tion be instituted by the local authority, it is quite within the competence of the justices to refuse to make the order asked for, if they think fit. I would, therefore, most earnestly deprecate the sanction of this Committee being given to any such change in the law as Mr. Dodson would propose. The very large majority of defaulters are persons who are indolent and apathetic on the subject of vaccination; and these, sooner than take the trouble to bring their children for vaccination, will pay the bribe for being excused from it which Mr. Dodson's Bill would appoint. I trust, therefore, that the Committee, which was so successful in 1871 in securing the rejection of a similar clause, will use its influence against this proposed crippling of the law, which has been not improperly described as "the practical abolition of compulsory vaccination".

June 24th, 1880.

AN ILLUSTRATION OF THE SPECIFIC ASPECT OF PNEUMONIA.

By JAMES RUSSELL, M.D., F.R.C.P.,
Physician to the General Hospital, Birmingham, etc.

"PNEUMONIA", justly observes Dr. Sturges, "occupies a middle place between the specific fevers, so-called, and the local inflammations, and has something in common with both." The following particulars, simple in themselves, given to us by a very intelligent wife, whose husband was attended for fatal pneumonia by my friend Mr. Wilders and myself, together with the subsequent history, emphasise that part of the analogy which connects the disease with the specific fevers, in a manner which is probably more frequently accessible, were the introductory stages as carefully observed.

The case occurred in the person of a gentleman aged 70, of large build and vigorous constitution, but somewhat emphysematous. During the week preceding his illness, my friend had been attending him for an unimportant digestive disorder. On the Wednesday, he was thrown into a state of intense excitement by a very unpleasant business transaction, and was found by his servant in a state of extreme agitation and tremor. On Friday afternoon, he was somewhat exposed to the very cold east wind lately prevailing, and a little again on Saturday. On that afternoon, his wife, on her return from an absence from town of some days' duration, found her husband sitting in his greatcoat over a large fire—this, however, was his custom when he thought himself to have taken cold. She thought him pale and rather pinched. He passed a good night, but on the following morning (Sunday) she determined not to go to chapel, as she thought him unwell. He, however, denied being ill, and persuaded her to leave him; but he did not take his usual dinner, and immediately the meal was ended left the table, refusing dessert. Soon afterwards, however, he asked for an orange to allay his thirst. During the afternoon, he was very thirsty, drinking repeatedly and through a great part of the night was getting up, sometimes every hour, to drink milk or water. In the morning of Monday, he readily acceded to his wife's suggestion that he should put off receiving some friends till he was better. On the same morning, the only abnormal condition which Mr. Wilders could discover was some pain in the left haunch, which soon disappeared. The chest was even unusually free from morbid sounds; the pulse was 74. In the afternoon, being called upon to write a letter, he found himself unequal to the undertaking, and had to hand it over to his wife, only appending his signature; and having to enclose a second letter in the same envelope he became confused, and she had to give him help.

During the night, he became more confused; was getting out of bed continually to pass urine, and on one occasion forgot his purpose and returned to bed, having again to get out in a few minutes. As morning broke, the confusion had passed into mild delirium; and at 10 a.m. (Tuesday), Mr. Wilders found his temperature 104.5, pulse 136, with mental confusion, and scanty but very characteristic rusty expectoration. The urine was free from albumen. He died at 11 p.m. of the next day from failure of the heart, the pulse exceeding 200 in the minute, and the intellect being very confused. The temperature, which had fallen in the morning to 102.4, had risen above 105. The expectoration continued scanty; the urine was copious. He afforded remarkable attestation to the fact that high pyrexia does not necessarily destroy digestion, inasmuch as, with his high temperature, he relished solid food to the last; he ate the breast of a chicken on the day preceding his death; and on his last day ate a chicken sandwich more than once, my colleague most judiciously following the lead of his patient's desire. The tongue was moist throughout. There was a commencing herpetic eruption on the lip. Respiration was 30-36. The single physical examination we were able to make discovered dulness with crepitation quite at the base of the left lung.

THE HARVEIAN ORATION, DELIVERED AT THE ROYAL COLLEGE OF PHYSICIANS, Friday, June 25th, 1880.

By JOHN W. OGLE, M.D., F.R.C.P.,
Consulting Physician to St. George's Hospital.

MR. PRESIDENT, FELLOWS, COURTEOUS AND LEARNED VISITORS,—This is the great feast of our medical year, as it were our Asclepieia, formerly observed by us on the day sacred to St. Luke of our Gospels—the "beloved physician"—October 18th, but now kept on the anniversary of the opening of the building in which we are now assembled.*

We are here congregated amidst the effigies, the books, the relics, and memorials of our ancestors, "kindred spirits who rule us even from the tomb", in obedience to the will of one whose name is, and ever will remain, a household word, not only with those of our profession, but with all men of true science, and with all in the world who have at heart the welfare of the great body of humanity. We meet, each and all, to add a leaf to the laurel chaplet on the bust of the venerable and illustrious Harvey—the chief honour and ornament of our College, as Dr. Ent calls him—to cast incense upon his altar-fire, to do hearty homage to his undying memory, and to the grand work and method which for all time he has set before us his descendants as biologists and as practical physicians—"engaging in the sacred things of Apollo", to quote from Harvey. We this day spare a short hour from the absorbing current of our daily life, and strive to call to our recollection the character and aims and labours of Harvey, who has earned the eternal gratitude of mankind and of all in this College who followed in his wake, and to gather hence inspiration, guidance, and encouragement.

When I acceded, Mr. President, to your flattering desire that I should occupy the place in which I now stand, I did so out of unfeigned regard to yourself (*cui multum debeo*) and your distinguished office; out of staunch loyalty and allegiance to the College, of whose ancient dignity we must needs all be proud; and out of respect to the existing Fellows, Members, and Licentiates. But it was not without much hesitation; nor was my diffidence diminished when I came to review the efforts of my predecessors in this place, whether I regard the substance and intrinsic value of their productions, the propriety of their style, or their *curiosa felicitas* of expression; and when, penetrated with a sense of my own incompetence, I considered how difficult they had made the task for those who were to succeed them in their office.

Whilst reviewing the scope and purport of the various former Oration, I found that of late years the plan which for the most part had been adopted in earlier times had been departed from, in that the work of our ancestors has of late received but inadequate notice and a somewhat too faint acknowledgment. No doubt there are some whose tendencies are ever to depreciate the present, and, *laudatores temporis acti*, to see good only in times gone by. But, engrossed by the rapid strides and the real progress which are being made in all branches of natural science, and by the marvellous assistance which the practice of our art is receiving from collateral and dependent studies, we are chiefly tempted, as I think, to be too narrow and unsympathising in our retrospect, and too regardless of the beneficent influence of tradition, and of those who laid the deep and solid foundation on which we have built and are yet building. We are a little unmindful of the tedious paths which have been trodden in the attainment of our present position. Basking in the glorious splendour of modern science, and with a future so full of possibilities, we somewhat ungratefully forget the gloomy night and obscure dawn through which the good and true workers of times past have painfully toiled.

I propose, therefore, in the first place, and by your permission, to draw attention in a cursory manner to our forerunners and earlier benefactors; remembering how honourable and useful an observance it is to pay tribute to the memory of those illustrious dead who in their generation have handed down to us the torch by which we are illumined, trusting that our example may in turn benefit those who come into our inheritance.

Aristotle has said, "If Timotheus had not existed, we should have lost much music. Yet if Phrynis had not been we should have had no

* By the President, Sir Henry Halford, June 25th, 1825.

Timotheus. For we have received some opinions from certain philosophers, yet were there others to whom these owed their existence."

Anyone approaching this room in which we are assembled may have seen on the wall above, and at the head of the first flight of stairs, the emblazoned arms borne by our College. The arms were presented by Christopher Barker, Garter King of Arms, September 20th, 1546, twenty-eight years after the College was founded by Henry VIII, and, as all our Fellows know, appear at the upper part of the letters by which we are bidden to our committee meetings. Therein are depicted a hand feeling the pulse, an outstretched arm, and beneath, the pomegranate fruit, both most fitting emblems of our craft. The hand and pulse typify that which is the central truth of all in our profession that we know and act upon, viz., *the circulation of the blood*. The pomegranate, gaping that the included fruit may find an exit,* no doubt typifies the mysterious powers of what we call Nature.

May we suppose that the form of the human head which also appears in our letters of invitation above-mentioned, surrounded by emanating rays of light, is that of Apollo or the Sun, whose beams carry so many beneficent influences?

Familiar in some degree with the history of medicine in times gone by, and reflecting how all knowledge is gradually evolved and has its roots firmly and deeply implanted in the past, that no science, as Harvey says, "can flow save from pre-existing knowledge of more obvious things," permit me, passing over the most ancient epochs, to give a glance, of necessity sketchy and superficial, at the general history of our art, as regards such of its particulars as bear on the subject which I have chiefly in hand, viz., the works and method of Harvey.

Referring to the teaching of the Greeks in provinces of knowledge cognate to the medicine of the present, let us dwell for a short time on the glimpses which the sightless Homer gives us into the rough-and-ready method of the time when disease and death were in a great measure referred directly to the anger and interposition of the gods, and the modes of their prevention traced to a celestial origin.

Homer must be acknowledged to have been, as well by necessity as by choice, an attentive and curious watcher of Nature and her operations. His works show that the ancient Greeks had their physicians, in addition to their soothsayers and magicians, and he speaks of the art of medicine as well as of chariot-driving, prophecy, and navigation; and both the *Iliad* and the later *Odyssey* indicate that in the times to which they refer mankind had decided notions respecting the functions of the blood and of the action of the atmosphere. They had theories as to certain principles of animal and vegetable life; considerable knowledge of the character, treatment, and varied consequences of different kinds of wounds, and of the process of embalming the dead—knowledge gathered, no doubt, from observation in the sacred temples, in their schools of medicine and gymnasia.

It is of much interest to note that Homer records the arterial jet observed in wounds. He was also doubtless aware of the dependence of fevers upon the influence of the hot sun on marshland, as exemplified in his allegory of the action of Apollo's cruel darts on the Grecian soldiery; and he mentions the salutary use of sulphur as a disinfectant in epidemic disease. We are told that venesection was first resorted to among the Greeks in the Trojan war.†

Passing over a period of four hundred years, in the literature of which time are to be found imbedded in the fanciful cosmogony of philosophers, poets, and dramatists, allusions to theory and practice connected with our art, but in which, although medical schools of renown, as well as sacred temples to which the sick resorted, had been established in Greece, nothing of any real significance was written—we have the celebrated multifarious collection of medical writings with which the name of Hippocrates, that "divine old man" to whom the same honours as to Hercules were accorded, was especially associated.

Hippocrates, living at a period of unprecedented intellectual and ideal development, contemporary with Pericles, Thucydides, Sophocles, Æschylus, Democritus, Plato, and Socrates, and coming of a family connected with the study and practice of medicine, appears to have accumulated all that had been written by his ancestors on the subject. He seems to have striven to detach medicine from theology, and to base

his general views and principles upon what appeared to be well ascertained and established facts, in what people often call the true Baconian spirit. Without seeking to explain phenomena, he specially directed his mind to the investigation of what we now term the natural history of disease. Hence it was that he was able to say that the medical art consisted entirely in observation, and hence it was that he was led to consider pathology as merely perverted and degraded pathology. To quote from an admirer, Dr. Daremberg, "Hippocrates cast such a splendour on medicine that it was immediately exalted into the rank of a positive and independent science, of an art liberal and submitted to precise rules". Our own practical Sydenham had called him "the Romulus of medicine, whose heaven was the empyrean of the art".

Being unable to gain information by dissection of man, though he had some knowledge of comparative anatomy—forasmuch as, like the pupils of Pythagoras, who preceded him, he was in the habit of examining the bodies of lower animals—it was impossible that he should have more than a slender and imperfect acquaintance with human anatomy. He thought the arteries, being found empty after death, contained only air during life; that the heart was the seat of the soul and the source of the heat of the body, and was kept cool by the action of the surrounding lungs. He observed sudden death to follow a wound of the heart. He considered the veins to be vessels carrying the nourishing blood to the body; and that the right ventricle of the heart and what we call the pulmonary artery supplied blood to the lungs solely for their nourishment. He was ignorant of the use of the nerves, and did not attribute to the brain any other function than that of a spongy gland.

Hippocrates recognised what is often termed a vital principle, and, though he has various meanings for it in his writings, he uses the word which we interpret Nature as indicating a power, or being, or intelligent action which superintends and regulates, and, so to say, co-ordinates the various functions of the organs, whether healthy and natural, or disturbed and altered.

Though he admitted and adopted many fanciful conceits and hypotheses, and ascribed diseases to alteration of the fundamental humours of the body (in which he was partly correct), he was a most studious and careful observer and historian of morbid processes; and this, co-operating with the influences of the Pythagorean doctrine of numbers, guided him to the recognition of crises and critical days, and to the use of fires for the prevention of the spread of epidemics. In addition to the use of remedies, many of which we ourselves now use,* Hippocrates laid great stress on bodily exercise, dietetics, and what we call hygienic treatment, using various forms of blood-letting freely, and cauterising with the moxa in cases of gout.

I will close this short notice of Hippocrates by quoting the following summary of his work and manner.

Dr. Daremberg observes: "No one since Hippocrates has had a higher idea of the dignity of medicine; no one has shown more respect for the sick, and more care for their cure—or, at the least, for their comfort and consolation. No one has shown more admiration for useful discoveries, more care to complete them; more deference for conscientious physicians who apply their intelligence to every part of the art, however insignificant it may be; more indulgence for the errors inseparable from all science and art—inasmuch as a consummate skill is seldom seen, and even in the case of good physicians resemblances cause mistakes and embarrassments; more aversion for such physicians as, altogether occupied by their fortune and reputation, make display of their learning, fondle the prejudices of the vulgar, and govern their conduct by the profit that they can draw from them; no one, in fine, who has given proof of so much experience and good judgment in the daily relations which the medical profession establishes between the physician, the patient, and the rest of the world."

Passing to the immediate followers of Hippocrates, I will only allude to the writings of the mighty thinker and naturalist Aristotle, the disciple of Plato, whose power of procuring all kinds of objects of interest through the means placed at his disposal by his royal master was almost illimitable. He made remarkable advances in comparative anatomy, and it was he who first gave the name of aorta to the large vessel which we know by that name. He also first described the large vessels as arising from the heart, but did not see the distinction between veins and pulsating arteries, as did his contemporary Praxagoras, who was the first to use the word pulse, but who, however, thought, as did Hippocrates, that the arteries only contained air, partly because after death they were empty, and partly because in the lungs they were thought to communicate with the bronchi.

Aristotle had clearer notions about the use of the nerves than his predecessors, but supposed that they had their origin from the heart, which organ he considered to be the seat of the affections of the mind.

* From him we inherit the use of the poppy-juice, henbane, hemlock, hellebore, scammony, colocynth, elaterium.

* Harvey has this expression when speaking of the loosening of the ossa pubis and the enlargement of the whole hypogastric region, which occurs, as he says, "in a most miraculous manner", during labour.

† It may be noticed that he describes a case of lesion to the brain followed by a remarkable tendency to rolling around the arena shown by the injured person—a phenomenon connected with certain forms of cerebral mischief, which, I need hardly say to this audience, has of late years attracted much attention. It appears, also, that he was acquainted with hydrophobia. All his readers will remember that he mentions the Papaver somniferum, and probably the Cannabis Indica, under the name of Nepenthe. We must also not forget that many of the anatomical words and designations which we meet with in the Homeric Hymns are in use amongst us at the present day, and in connection with this fact the story of Achilles with his vulnerable heel will not be forgotten.

The brain was, in his opinion, for the purpose of control and regulation of the heat of the heart. He held that during waking and sleeping there was a flux and reflux of blood like that of the sea, the Euripus. His erroneous hypothesis guided all the views of physiologists, and was the source of incalculable mischief until the time of Harvey.

In the school of Alexandria, the famous library of which was superintended by Aristotle (alluded to by Livy as "*Elegantia regum curaque egregium opus*"), anatomy made great advances, human dissection being encouraged by the Ptolemies; and the discoveries of Herophilus and Erasistratus, who belonged to it, were manifold and most important. The former of these two observers described with wonderful accuracy and ingenuity many parts of the brain; and the latter in a great degree recognised the difference between motor and sensory nerves, tracing the nerves up to their connection with the brain and spinal cord, and recognising to some extent the dependence of the action of muscle upon the integrity of nerve; and both noticed the lacteal vessels, though they were unacquainted with their use. They carefully described the valves of the heart, but still, like others before them, they looked on the arteries when in a healthy state as conveying only air, and they considered the veins to arise from the liver—ideas which, no doubt, as has been said, retarded for centuries the discovery of the circulation of the blood.

From Herophilus we have the name "trachea," and from him arose the false idea that the air (which in the philosophy of the time was looked on as the origin of life, the "spirits") which it conveyed was carried by the pulmonary veins to the left side of the heart, and thence by the aorta through the entire body. He also thought the arterial pulse was transmitted from the heart by the walls of that vessel.

The medical school of Alexandria considerably departed, however, from the teaching of the great Hippocrates, though it inculcated his theories of the "humours"; but it was a noted school for surgery, and some have tried to show that the operation of lithotomy was practised there.

Leaving now the consideration of what we can gather in connection with the matter I have in hand from the teaching of the Greeks, I will pass to the introduction of the cultus of Æsculapius into Rome. The inhabitants of this city, overwhelmed by pestilence, sought advice, as we are told, at the temple of this divinity at Epidaurus, in the Peloponnese. One of the sacred snakes, it appears, was sent from the temple, and on its journey to Rome escaped and found its way to an island in the Tiber; and on this island a temple was erected, in which the god was in future worshipped. That serpent, as we know, became henceforth the symbol of our art.

Italy having been colonised by the Greeks, Greek physicians and their practices were introduced into Rome, a distinct physician being allotted to each part of the body. Subsequently, as we read, the Romans, in accordance with their habits of personifying the phenomena of external nature, worshipped various deities consecrated to Health, Fever, Malaria, Midwifery, and to the various viscera of the body, and also to the bones; and the various votaries of medicine were divided into numerous controversial sects, wrangling with each other as to points of unattainable character, such as hidden and final causes, *a priori* reasoning, and other philosophical and metaphysical questions.

In course of time, the study of human anatomy was greatly advanced by comparative anatomy, and notably by the dissection of apes; and the nervous system was considerably studied.

Aretæus, who flourished in the time of Nero, like Hippocrates, thought that the heart contained the essence of the soul and life of man, and was the immediate cause of the breathing in animals, by reason of its action on the lungs; and also taught that the portal system in the substance of the liver anastomosed with the branches of the vena cava.

We now come to the time of the learned and astute and ingenious Galen, who lived in the first century of our era, the friend of Marcus Aurelius, of whom in England we have heard so much of late,* whose philosophico-medical system prevailed, notwithstanding the discovery of the circulation of the blood, until the middle of the eighteenth century.

Galen was a close observer of material objects and operations, the first to practise reliable experiments, and for the most part an ardent supporter and expounder of the doctrines of Hippocrates, though greatly mixed up with the fantastic and hypothetical systems of medicine (so called) founded on the philosophy of Plato and Aristotle.

He adopted the theories as to humours and the four elements, and believed in the three kinds of spirits—the vital, the animal, and the natural—all flowing from one great cause, Nature. With him, heat is the potent principle which everywhere operates; and he studied comparative anatomy to a considerable extent, and also certain departments of experimental physiology.

Some assert that he would have dissected the baboon, had he not thought the comparison with man might provoke opposition to such a procedure (an objection which certainly would not be offered in the present day); whilst others declare that he studied the internal anatomy of man, having opportunities of dissecting the bodies of criminals; victims of war, gladiators, and exposed children. At any rate, whether as a result of human necropsy or of analogy from the study of the lower animals, he advanced anatomy in a remarkable way, especially as regards osteology, the nervous system, the functions of nerves and spine and of the vascular systems; and he has bequeathed to us a good proportion of our anatomical nomenclature. Much of his physiology was, of course, mistaken. Thus, for example, whilst he was correct in considering the faculty of sensation and motion to be connected with the brain, he attributed this connection to the presence of an ethereal vital spirit, which he supposed to reside in that organ, and to be transmitted thence along the nerves.

Respecting Galen's views on the nature and circulation of the blood, he looked on this fluid as being elaborated and produced by the liver, the veins of which he considered to be the roots, so to say, of the general venous system. The heart, the seat of the greatest heat, and, as he terms it, the acropolis of the body, was recognised by him as being muscular and not under the dominion of the will, and as unprovided with nerves. He saw, by opening the thorax of living animals, and of those killed in sacrifice, that the auricles and ventricles contracted and dilated alternately, but he did not perceive that the blood was propelled by this contraction. He knew that the contact of cold water with an exposed heart would arrest its movements. He had had the opportunity of seeing the contraction of the heart in the case of a boy, who, by means of an accident at a gymnasium, had lost a portion of the sternum—an opportunity also enjoyed, as we know, by Harvey.

He thought that the blood, which was the origin of all the tissues of the body, was sucked in by the heart at its disastole, just as the air is by a pair of bellows, or as steel, as he said, is drawn by the magnet; and that the blood was distributed to the various parts of the body by a kind of attraction or selection acting upon it. He demonstrated pretty accurately the mechanical arrangements and use of the valves of the heart, and described the foramen ovale—known subsequently as Botalli's duct—as also its closure after birth, and was conversant with the "ductus arteriosus."

He knew experimentally that the arteries contained blood, for, as he said, if we ligature a portion of an artery of any animal in two places, and open it between the two threads, blood is found in the vessel; and he is said to have practised arteriotomy for the relief of pain.

It was his opinion that the vena cava and pulmonary artery were for the purpose of carrying the blood, containing a limited amount of a rare and subtle spirit, which it obtained from the left ventricle by means of small openings through the septum of the ventricles to the mass of the body and the abdominal viscera; but that it was the province of the pulmonary veins and of the aorta to transmit a large portion of this spirit with a limited amount of blood to the more important organs of the lungs and brain. He was thus the first to appreciate a difference between arterial and venous blood, the one being for the purpose of development and nutrition, the other for vital warmth. The passage of the spirit above mentioned to the lungs by the pulmonary veins, he thought, was permitted by the condition of the valves on the left side of the heart. He failed to discriminate 'twixt respiration and the pulse. Looking upon the heart as an organ of respiration, he thought that the thinner portions of the blood passed from the right to the left ventricles, through the orifices in the septum above mentioned, by virtue of the forcible dilatation of the latter, although he confessed he had never actually seen these apertures in the dead and rigid human body.

He determined also that, as the pulmonary artery carries by far more blood to the lungs than these organs require for their nutrition, the overplus, so to say, must find its way to the left side of the heart by way of the pulmonary veins. He considered that a species of anastomosis existed between the arteries and veins of the body. He combated the idea of Erasistratus, that the inhaled atmospheric air as such passed from the lungs to the pulmonary veins and the left side of the heart, and supposed that its only use was for cooling the blood.

The view above mentioned as to the passage of the spirit and blood through the septum of the ventricles may, I would suggest, have possibly originated from, or at any rate been supported by, the examination of the hearts of certain lower animals, in which foramina in the septa of the ventricles may have existed. For example, I find that my friend, the late Dr. John Davy, in his *Physiological Researches* (1863), page 534, describes the heart of an alligator from Ceylon, in which several small openings were found in the ventricular septum, some of which would admit a probe.

Dr. Bell Pettigrew has described the existence of an opening between

* From the lips of M. Reñan.

the ventricles in some of the snakes, and has figured it in a paper "On the Valves of the Vascular System" (see *Trans. Royal Soc. of Edinburgh*, 1864); and Professor Owen informs me that the Chelonian reptiles are instances of intercommunicating foramina, or passages in the substance of the ventricles of a four-cavitated heart. This structure is figured in Owen's *Anat. of Vertebrates*, vol. i, page 510, fig. 337.*

Again, in the Museum of the Royal College of Surgeons is a preparation of the heart of a serpent (*Python tigris*), showing the incomplete character of the wall dividing the aortic from the pulmonary chamber of the ventricle, which also intercommunicate by several apertures of different sizes near the apex of the ventricle.†

Galen's therapeutical and anatomical views held sway through the middle ages, amidst all the conflicting teaching of the different schools of medicine and philosophy, and through all the social and national fluctuations which the world experienced (and in spite of the fact that, at the end of the thirteenth century, human dissection was permitted), until the time of the restorer of descriptive anatomy, Vesalius, and of Servetus, in the middle of the sixteenth century. In the meantime, however, it may be mentioned that the word "*capillaries*" had been applied to the small vessels of the liver by a teacher of the famous school of Salerno, the "*civitas Hippocratica*", and the valves of different veins had been noticed by Cannanus, Sylvius, and St. Estienne.

Sylvius, born towards the end of the fifteenth century, was the first to use injections for the purpose of demonstrating the course of the bloodvessels, and he observed the part played by the foramen ovale in the fetal circulation.

Following him, must be mentioned Winter of Andernach, the master of Vesalius and of Servetus. He asserted that the air inhaled by the lungs became altered within them, an idea which no doubt had its fruit in the course of time.

Vesalius, eventually physician to Charles V and Philip II, breaking from authoritative teaching, differed greatly from Galen in many points of anatomy, but followed him pretty closely regarding his erroneous views of the physiology of the lungs and heart; considering, for example, that the heart was the origin of the heat of the body, and the dwelling-place of the affections of the mind. He recognised the valves of the veins as well as of the heart, but failed, as respects the veins, to see that they prevent the reflux of blood towards the heart; and, as did Galen, he thought the veins as well as the arteries carried blood from the heart. He pointed out that intercommunicating openings do not exist in the septum of the two ventricles of the heart; and the establishment of this fact was, no doubt, the first very decided step towards the grand discovery of the general circulation of the blood.

Vesalius was aware of the influence of artificial respiration. He recognised that Aristotle was wrong in supposing that the nerves took their origin from the heart.

We now come to a name that had the greatest possible influence on the true and proper theory of the blood's circulation, Michael Servetus, the impulsive, vain, sceptical, versatile, and metaphysical Spaniard. Endowed with a large measure of that imaginative faculty which now and then is so useful in science, by means of vivisections and varied experimental research, he made great advances in the physiology of the circulation and respiration, though the subject was in his hands entirely subsidiary to his views as to the function of a vital spirit, and explanatory of certain metaphysical and transcendental speculations. In fact, Servetus may be considered, as he has been termed, the inaugurator of practical physiology. Reflecting on the size of the pulmonary artery, he showed that the quantity of blood contained in this vessel was too much for the mere purpose of nourishing the lungs, and he recognised the fact that, in the foetus, although the lungs required nourishment, no blood whatever is sent to them through this vessel before birth. Considering these facts, and seeing, as did Vesalius, that blood did not pass through the septum of the ventricles, he concluded that the blood must pass beyond the lungs, so to say, and must find its way from the right to the left ventricle through the lungs, mixing in its transit with air, and, by virtue of the expiration, freeing itself from what he terms fuliginous vapours. In this way, it became adapted as the dwelling-place of the vital spirit which was formed by a union of the inspired air with the most subtle part of the blood, and was substantially composed of water, air, and fire.

In fact, from the structure of the organs, Servetus inferred the mechanism of the smaller or pulmonary circulation as we hold it at the present day.

* On the same page is a figure of the heart of a more active, though cold-blooded, reptile, the crocodile, in which, though the septum ventriculorum is imperfect, that between the beginnings of the aorta and pulmonary artery is perforated, allowing circulation of mixed blood when the animal chooses to remain submerged. Professor Owen observes of it, "When actually respiring air, the semilunar valves are so disposed as temporarily to close the interarterial orifice, and the crocodile has the advantage of the cardiac character of the mammal".

† Preparation described in catalogue as 917 B.

Servetus also taught that the blood underwent a change of character, acquiring a crimson colour and a "fiery potency", whilst passing across the lungs, and that, so changed, it found its way by the pulmonary veins to the left ventricle. He also taught that it was the mesentery which gave rise to the veins of the body.

The above views were committed to writing, but remained unpublished, owing to circumstances,* until about one hundred and fifty years after the time that he was shockingly and cruelly murdered by being burnt alive at the hands of the protestant Calvin.

Servetus clearly and incontestably saw and accurately described the smaller or pulmonary circulation, and in this way contributed a most important link to the chain of evidence of the general circulation. This was about the year 1553. Still, for him, as it had been for his predecessors, the movement of the blood in the general arteries and veins remained of a to-and-fro, a flux-and-reflux, and not of a circular character. The arteries were the sea of a double—an oscillating—current. The systemic or larger circulation was unrecognised.

Like others, Servetus thought that the venous blood originating in the liver was for the purpose of nourishment, and the arterial blood for the production of heat and for other special purposes.

Dr. Willis points out that Servetus does not speak of an intermediate system of vessels between arteries and veins of the body. Still, he may have had an intimation of the systemic circulation, as he speaks of "the natural spirits being communicated from the arteries to the veins by their anastomoses", but he did not think out his thought. When he speaks of the cerebral arteries ending in the cerebral membranes, or communicating the vital spirit with the tubes of the nerves, we may suppose that he had no accurate knowledge of the connection between the arteries and veins of the body by means of capillaries.

About the same period as Servetus, Columbus of Padua, relying on the results of vivisection, even more substantially established the same position.

Cæsalpinus of Arezzo followed. He was the first to use the word "circulation"; but of necessity he failed to see the communication between the arteries and veins of the body by means of the capillaries, and he saw in the pulmonary veins a double current of blood—the one for the passage of air and blood to the left side of the heart, the other for the escape of fuliginosities from the left side of the heart. He, however, proved by the anatomy of the veins, and by the effects of the ligature on them, that the blood did not flow along them in a direction from the heart. This was, of course, a most significant fact in the history of the circulation theory.

Cæsalpinus describes also the blood as being carried to the heart as to a heat-manufactory, and then propelled along the arteries to the entire body. He, however, traced the nerves, as well as the veins, to the heart, as did some of his ancestors.

The learned and excellent pupil of Fallopius, Fabricius, the master and friend of Harvey, at Padua, in 1574, gave a most complete and accurate demonstration of the structure, position, and uses of the valves of the veins.

[To be continued.]

THE DIAGNOSIS OF RÖTHELN.

FROM the correspondence in the BRITISH MEDICAL JOURNAL, it would seem that there is a difference of opinion on the question of whether rötheln be a distinct disease, or a hybrid of measles and scarlatina. During the past autumn, we have had here a severe epidemic of measles and scarlatina; severe, because, in the village where the greatest fatality existed, the unsanitary conditions were simply frightful. Several cases of both diseases were typical, and, as rötheln was also prevalent, I had many opportunities of distinguishing between them. I found that an attack of rötheln afforded no protection from either of the others. Within twenty-four hours of the initial shivering and lassitude the rash appeared; it was quite distinct from that of scarlatina, but partook slightly of the character of that observed in measles. The throat was always affected, but never beyond what was just sufficient to cause the patient a little discomfort. In only one case was the temperature above 102°. There was no catarrh; always by the third day the patient was about well. There was then invariably a little branny desquamation, but never to the extent observed in scarlatina.

The late Dr. Tanner, in the earlier edition of his *Practice of Medicine*, seemed to think it was a compound of measles and scarlatina; however, in his last edition he has come to believe it a distinct disease; as from its invariable mildness it scarcely seems reasonable to think it a hybrid of two generally severe diseases.

Wansford, 26th June.

FERGUS M. BROWN, L.R.C.P. Ed.

* See the interesting work by Dr. Willis.