A ST. ANDREWS PHYSIOLOGIST OF THE PAST.[1]

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(Plate VI.)

The history of Scotland can boast a greater number of names of those who have enriched her intellectually than perhaps any other country of the same size. Nor are these names chiefly those of her aristocracy, famous as "they of the blood" have indeed made their little mountain-land. No doubt the Argylls, the Abercrombies, the Alisons, the Cochranes, Clerk-Maxwell, Duncan of Camperdown, Dundas of Arniston, Fletcher of Saltoun, Sir William Hamilton, Law of Lauriston, Montrose, Sir John Moore, Napier of Merchiston, Lady Nairne, the Outrams, the Stairs, the Tweeddales, have by gallant feats of arms, by statesmanship, in letters, or by legal learning, conferred undying honour upon the national records; but to the solid mass of Scottish intellectuality and world renown, it is the sons of her soil that have most conspicuously contributed. In almost every department of human activity, those of her humbler ranks have shown themselves not only capable of achieving greatness but of being pioneers. Joseph Black, Henry Bell, Burns, Colin Campbell, Carlyle, Chalmers, the two Hunters, the Monros, the Nasymths, Thomas Reid, Simpson, Tannahill, Watt, and many more rose, as it is said, "from the ranks," but rose to the intellectual leadership of men.

John Reid, M.D., who at the time of his death was Chandos Professor of Anatomy and Medicine in the United College of St. Salvator and St. Leonard in the University of St. Andrews, was born on the 9th of April 1809 in the little town of Bathgate, in Linlithgowshire. His father was Henry Reid, a small farmer and cattle-dealer; his mother's maiden name was Jean Orr; John was their sixth child. Several great men were born in 1809. John Reid was two years older than James Young Simpson, his school companion and friend, born at Bathgate in June 1811; and it is at least interesting that from this obscure place, within a couple of years of each other, two great intellects in the profession of medicine should have arisen,—the son of the baker to become, in his day, the most sought-after practitioner in Great Britain, a brilliant professor of gynæcology, an antiquary of no mean attainments, and the patron of culture and all that was best in Edinburgh for the last twenty-five years of his life; while the other, the son of the farmer, could be truly said to have been at the time of his death one of the finest anatomists, and certainly the most prescient physiologist in Scotland.

[1] The opening lecture in the class of Physiology, in the United College, University of St. Andrews, October 10, 1900.

Young Reid, while in no sense an infant prodigy, very early showed that he was not cast in the same mould of characterless rusticity as the boys around him. Love of books very soon made itself manifest in the docile, quiet, heavy-looking, but obedient and affectionate child. From the dame's school, John passed to the village school, where a worn-out old man tried to teach the boys Latin and Greek before they knew almost anything of their own language. At the age of 14, in 1823, he was sent to attend the Arts Classes in the University of Edinburgh. His parents, with that honourable ambition so frequently met with amongst the Scottish peasantry, had intended their son to prepare for the ministry of the National Church, but it is not clear that Reid himself ever embraced this idea with any degree of cordiality; whether he did so or not, by 1825 he had commenced the study of medicine.

Through the courtesy of the Registrar, Matriculation Office, University of Edinburgh, I have seen some of John Reid's signatures in the albums. In 1823 he signed as No. 588 on matriculation, as "John Reid, Bathgate," in a very open boyish hand; one of his fellow-students that year in the Faculty of Arts —or "Literature," as it was then called—was Horatius Bonar, later the sweetest singer of the Free Church. In 1824 he signs No. 576, entering for the Humanity and Greek classes; No. 273 this year is "Richard Owen, Lancaster," one day to be the great palæontologist. In 1825 he is No. 298, "John Reid, Linlithgowshire," and enters for chemistry, a medical class, there being no Faculty of Science for many a day later. In 1827, "James Simpson, Linlithgowshire," enters himself, so that, as he was two years younger than Reid, he entered medicine two years after him.

Those occupying the medical chairs at this date were—In Botany, Robert Graham, Professor from 1820 to 1845; in Materia Medica, Andrew Duncan (secundus), from 1821 to 1832, when Christison was appointed; in Natural History, Robert Jameson, from 1804 to 1854; in Chemistry, Thomas Charles Hope, from 1795 to 1844; in Midwifery, James Hamilton, from 1800 to 1840; in Clinical Surgery, James Russell, from 1803 to 1833, when Syme was appointed; in Anatomy, Alexander Monro, from 1798 to 1846, when Goodsir was appointed; in Physiology, or "The Institutes of Medicine," William Pulteney Alison (born 1790, died 1859), who was professor from 1821 to 1842, when he was transferred to the Chair of the Practice of Medicine, in which in 1855 he was followed by Laycock. Dr. Alison was uncle to a no doubt more widely known man, Sir Archibald Alison, of Crimean and Indian Mutiny fame. The Chair of Pathology was not established until 1831.

Of all these teachers, John Reid seems to have received most inspiration from Professor Alison, who appears to have

been peculiarly fitted to introduce his young hearers to the problems and contending theories of the science of animal functions.

Early in his studies Reid showed a preference for the two ground-sciences of medicine—anatomy and physiology—which is hardly surprising when we reflect how very empirical was the therapeutics, and how septic the surgery of the first three decades of this century. The far more exact science of descriptive anatomy, with its younger sister physiology, inasmuch as it constituted a direct looking into the face of animate nature, and an honest endeavour to interpret what was there seen, could not fail to have attractions for the logical, solid-minded Scottish youth.

Probably the professor from whom Reid received least was Alexander Monro (tertius), the occupant for forty-eight years of the Chair of Anatomy. He was son of the well-known Professor Alexander Monro (secundus), after whom a foramen in the vertebrate brain is named, and grandson of Alexander Monro (primus), a distinguished anatomist and surgeon, who held his chair for thirty-four years. Altogether the Chair of Anatomy had been in the Monro family for 126 years, until in Edinburgh "Monro" came to be regarded as a synonym for "Anatomy."

As a teacher the third Monro was a failure; his weakness was the chief cause of the growth in popularity of the Extra-Academical School of Medicine at Surgeons' Hall, in which, at the time of Reid's studentship, the subject of anatomy was being taught with conspicuous ability by the famous, and, a year or two later, notorious, Dr. Robert Knox. Knox would have been considered a "born" lecturer, even though Professor Monro's dulness had not sent the students by scores, with Reid among them, from the University to the Surgeons' Hall, but, as things were, Knox's popularity so overcrowded his dissecting-rooms that the supply of subjects was hardly equal to the demand.

Thus it was that the "resurrectionists" were encouraged in their gruesome work, and that the villains Burke and Hare entered upon their series of sixteen horrible murders in Tanner's Close, West Port, to supply bodies for dissection both at the University and at the Extramural School. The older burying-grounds of Edinburgh—Greyfriars, Calton, Canongate—contain many graves covered over with massive iron gratings or cages, to prevent this purely physical and ante-dated resurrection.

There seems no doubt that these miscreants received from £7, 10s. to £10 for each corpse supplied, and equally clear that Knox and his assistants asked no awkward questions as to the vital antecedents of the "subjects" brought before them. Possibly no set of crimes ever gave rise to the same amount of popular indignation as did the West Port murders. Knox, on leaving the witness-box at the trial, was within a very little of being lynched;

and it is believed that the execution, by hanging, of William Burke, at eight in the morning of January 28, 1829, at the head of Liberton's Wynd, High Street, was witnessed by 40,000 people.

Burke's body, by order of the Town Council, was handed over to Professor Monro to be dissected, this being the last case of the custom; and, on the day after the execution, the public were allowed to view the corpse, amongst those admitted being the metaphysician, Sir William Hamilton, and the phrenologist, George Combe, who had come to inspect the brain exposed for the day's lecture.

John Reid continued to dissect all through his course, recognising, as he explicitly states in some of his letters, the paramount importance of human practical anatomy. In several of these letters, written between December 1827 and December 1828, he speaks of his constant attendance at the dissecting-rooms, and so it amounts to a certainty that Reid's hands helped to dismember at least some of the victims of this most awful series of crimes, extending as they did from December 1827 to December 1828. Who knows but that perhaps young Reid was one of the horrified group who recognised "Daft Jimie's" body as that of the half-witted lad they had so often seen followed by his crowd of tormentors in the College Wynd and Adam Street, for it appears that Reid, Simpson, and a student M'Arthur were all lodging at this time "in a flat at the top of a tall house in Adam Street."

John Reid graduated as M.D. on August 1, 1830, his diploma being dated July 12, and his graduation thesis, written in Latin, being entitled "De aneurismate."

There was at this date no degree of Bachelor of Medicine, and only one examination at the close of the curriculum. This was, more truly, the first and the last rather than "the final," for it corresponded not to our final—a strictly medical or professional examination—but to a combination of all the professionals, and included everything from botany upwards. This is, no doubt, one explanation why Reid dissected throughout his whole course, he had to pass in anatomy at the very end.

In the graduand's album for 1830, he signs as No. 18, "Joannes Reid": the 104th in the list being Allen Thomson, long a light in the world of anatomy.

From a letter to his father, it appears that Reid had thoughts of attempting to obtain a surgeonship in the Royal Navy, but we hear no more of it, for by November 1830 we find him acting as clinical clerk to his old professor, Dr. Alison, who had wards in the Royal Infirmary, for at that time, and until the death of Hughes Bennett, the Professor of Physiology was also a practising physician.

In the autumn of 1831, after a year's residence in the hospital, Dr. Reid set out for Paris, in order at that famous medical school

to study still further the subjects of anatomy, medicine, and surgery, the last mentioned under the masters of their art, Lisfranc and Dupuytren, the valuable surgical museum collected by the latter still existing.

Reid lodged at 187 Rue St. Jacques with a family, so that he might learn French. He evidently found the time spent at the École de Médecine very profitably occupied, the Parisians always providing by means of their suicides plenty material for his work. His later letters from Paris describe the ravages of a terrible epidemic of cholera, which carried off thousands of persons in a few weeks. In his last letter from Paris, April 17, 1832, he says that even the published lists acknowledge a thousand fresh cases in the twenty-four hours, but that that was short of the truth. "You sometimes meet," he writes, "carts piled up with coffins even to the number of fifty upon one cart."

Reid was not so wholly engrossed in matters pertaining to his profession, that he neglected to visit some of the world-renowned places of interest in the capital Dr. George Wilson, in his "Life of Reid,"[1] relates that on his first visit to the Louvre, he was so overwhelmed by that gorgeous gallery that his emotion rendered him for a time unable to answer the questions of his travelling companion.

On quitting Paris, Reid passed through Savoy, Switzerland, Germany, and the Netherlands on his way home. He crossed to Dover from Ostend by steamer, surely one of the first that ever performed that crossing, and by the summer of 1832 he was once more under his father's roof in Bathgate. Before the autumn of 1832 was past, cholera had broken out in this country, and the scourge was particularly malignant at Dumfries, to which town Dr. Reid and three other Edinburgh physicians were despatched. Reid, notwithstanding an attack of peritonitis, courageously stuck to his post, and found his Parisian experiences of the plague very valuable. In a letter to his father, he alludes to "my old friend the inflammation," from which we may, with our latter-day diagnosis, suggest that Reid, like so many young men, had suffered from attacks of intermittent appendicitis; he was just 23, and, in spite of being bled and leeched, he recovered.

Early in 1833 he received an invitation from Dr. Knox to "come over and help" him, so large had Knox's class grown; but although Reid was offered a share in the income from the fees, his parents and relatives plainly showed him that they would have preferred his settling in Polmont to succeed a Dr. Scrymgeour, lately there deceased. Reid writes to his father, distinctly setting forth that, though he may not think it, a demonstratorship under Knox is considered in Edinburgh quite as respectable as a country surgeonship, and he points out that in the former situation he will have three months' holiday. He

[1] Edinburgh, 1852.

carried out his views, and accepted the post at Surgeons' Hall, no doubt amid much head-shaking on the part of the good old people at Bathgate over the wilfulness of the young men of the day.

As demonstrator under Knox, Reid was an unqualified success. In anatomy, above all things, to teach others is to teach oneself, and as his hours were 9 to 4 for nine months of the year, for three years, it can be quite well understood that, when he resigned the post in 1836, the human body was to him, what in the apocalyptic vision the sea was to St. John, "as it were transparent glass." Reid, though not fluent, was a clear expositor. George Wilson doubts whether the teacher can be said to be, like the poet, "born"—I have no doubt of it whatever; the faculty of imparting knowledge is as much born with a man as a musical gift or a tendency to gout.

During the years of demonstratorship to Knox, Reid was unconsciously preparing himself to discharge the duties of a lecturer by attending the meetings of some of those student societies for which Edinburgh University has so long been justly famous. The Royal Medical, the Royal Physical, and the Anatomical and Physiological were those Reid attended. The first named is by far the oldest, having had an existence without change of title since 1737, and having received its Royal Charter in 1778. There can be no doubt whatever that Reid, like so many young men since, derived much benefit from taking part in these debates, which are, practically, public speaking.

He was one of the presidents of the Royal Medical Society for the Session 1835–36. This has always been considered the "Blue Ribbon" of the medical societies, but Reid's post was not that of a "splendid isolation," since he had his life-friend, J. Y. Simpson, beside him as a colleague.

The cause of Reid's resigning his demonstratorship was a particularly gratifying one, having almost no analogy in this our day of scramble for places in an over-filled profession. Reid was actually *invited* to succeed Dr. Fletcher as extra-academical lecturer on physiology. His biographer says "it was a rare compliment": it was.

Men usually have to struggle for their advancement, but Reid was presented with a requisition signed by eighty-six gentlemen, one being later the well-known Dr. W. B. Carpenter of London University, that he would agree to accept the vacant lectureship, and "by so doing," they say, . . . "increase the reputation of this city as a school of medicine, the zeal and success with which you have hitherto prosecuted physiological investigations being already well known to the public." He answered in very modest terms that the idea of lecturing on physiology had never crossed his mind, but that, being so flatteringly invited, he would do his best. Let us note that by 1836, physiological work of his was already well known to his professional brethren.

His reply to them is dated from 31 Buccleuch Place, where he was living with a widowed sister. There was apparently but one person to be consulted about this new move, and that was his old teacher, Professor Alison, who not only corroborated all that the others had said, but in order to qualify Reid to lecture at Surgeons' Hall, and so become Alison's rival, he proposed him as a candidate for the Fellowship of the Royal College of Physicians of Edinburgh, to which learned body he was admitted on October 4, 1836. In the following month he began his first course of lectures, with the aid of the late Dr. Fletcher's diagrams. Dr. George Wilson attended his opening lecture, and said he got on very well indeed, but I will not take you behind the scenes and tell you how many of that session's lectures were ready when the first had been delivered.

It was during the next two years, while he was a young lecturer—only 27—that Dr. Reid carried out the most important of his experimental researches, namely, those into the functions of what was then known as the Eighth Pair of Nerves. We shall say something later on as to the importance of this investigation, when discussing Reid's place in physiology; suffice it here to say that the work necessary to elucidate the functions of the three great nerves, IX., X., XI., as we now call them, was of no easy or elementary nature, but required accurate anatomical knowledge, the highest operative skill, and the possession of that faculty, indispensable to the experimenter, of so planning a particular interference with nature that from its result, whether positive or negative, conclusions which will add something to previous knowledge may be directly drawn.

But it must not be in any way imagined that at the time of Reid's appointment he had no technical qualifications for such a post. By January 1835 he had published a paper on "Obliteration of the Vena Cava Superior at its Entrance into the Heart";[1] papers on "Phlebolithes," "Peculiarities of the Fœtal Circulation," and on "Mesenteric Glands in the Whale";[2] and in 1836 papers on "Monsters," the "Transposition of Abdominal Viscera," "Venesection relieving the Heart," and on the "Anatomy and Physiology of the Heart." In fact, while busy in Knox's rooms, he had noted anything interesting or unusual, and these early papers gave abundant evidence of his acquaintanceship with the older and the contemporary French, German, and Italian biological literature.

During the first two years, 1836 to 1838, Hughes Bennett tells us that Reid performed upwards of 100 experiments, the first on living animals ever performed in Edinburgh, to unravel the functions of these nerves, according to the difficult task he had set himself. I may say at once that these were experiments on living

[1] *Edin. Med. and Surg. Journ.*, January 1835.
[2] *Ibid.*, January and April 1835.

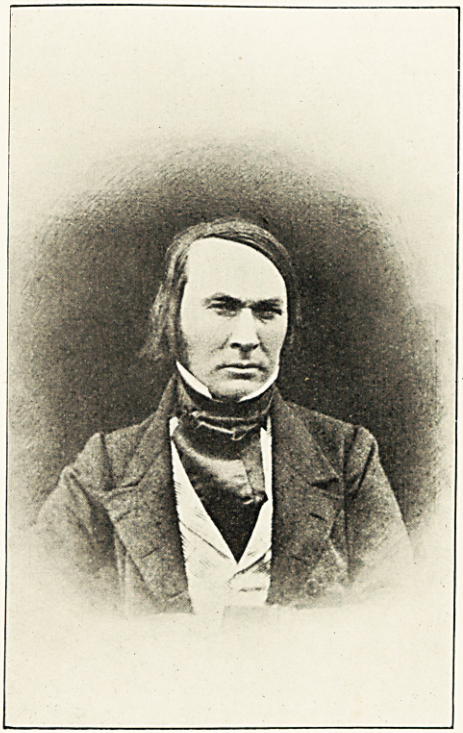
animals, for Reid's science was that of life—the discovery of the functions of *living* organs and tissues—and necessarily he investigated living nature at first hand. He would have been by many good people of to-day branded as an inhuman wretch. I will give you his own words: "It may appear to some that I have repeated many of these experiments with unnecessary frequency and a wanton sacrifice of animals. But I naturally felt diffidence and distrust in the accuracy of the results I obtained when opposed to those of more experienced observers, and it was only after repeated and careful examination of the phenomena that I could feel myself justified in calling these in question.

"It is also sufficiently obvious that nothing is more injurious to the progress of science than hasty and partial observations, and I was anxious to avoid, as far as I possibly could, adding to that mass of conflicting evidence which there is already so much reason to deplore. Besides, as every false observation requires additional experiments for its refutation, I felt that, with less extended opportunities of witnessing the phenomena under observation, I must incur a greater risk, not only of throwing obstacles in the way of the progress of truth, but also of occasioning a useless infliction of animal pain."

In effect, he said, if we are going to go into this business, let us do it properly to prevent its having to be done over again, and more animals killed. Such results as Reid obtained could never have been got from any mere dissection of dead animals; as well might you ask a man to discover how a spinning-machine or an electric dynamo works, without allowing him to see "the machinery in motion." But experiments such as these cannot be performed alone: the chemist, geologist, and physicist may do a great deal of valuable work alone, but the physiologist must have help. One man cannot procure an animal, prevent it injuring him, secure it, give it chloroform, operate upon it, tie its arteries, attend to instruments, observe phenomena, and record what he sees. There must be division of labour; hence several men are reported as having assisted Reid, notably Professor Alison, Sharpey (later Professor of Physiology at University College, London), Dr. J. Duncan, Mr. Spence, a Mr. Kemp, and a Mr. Percy. "It is obvious," writes Reid in the paper on this work, "that without the aid of active and intelligent assistants it would have been perfectly impossible to have proceeded with such an investigation."

We are not, however, at all surprised to learn, from a lecture by Hughes Bennett, that such experiments on animals as Reid ventured to show his class were not a success. His words are: "They did not prove attractive, and gradually he ceased to perform them."

The experiments of physiology are, for the most part, unfitted for demonstration to large classes seated some distance away from



the lecturer. It is not, as in chemistry or physics, a matter of explosions, flames, fumes, and movements; many of the phenomena to be demonstrated are not in themselves striking or sensational; some of the facts of profoundest import are evanescent, difficult to observe, difficult to show to another—a pulse, a thrill, a murmur, a quiver, a twitch—and the phenomenon has come and gone before the uninitiated knows precisely what is to happen. Physiological experiment is very much a matter of patient individual observing, and save in the department of the senses there is little that can with advantage be made spectacular. Again, some results are to be exhibited only after a lapse of time—days, weeks, months—but the progress of them—the really important thing about them—can rarely be shown to classes. It is one thing to discover functions; it is quite another thing to "make a show of them openly."

Although Dr. Reid's inclinations led him away from the life of a practising physician, yet he well knew the value to a physiologist of keeping himself in close touch with medicine and pathology; hence we are not surprised to find that in the spring of 1838 he accepted the post of pathologist to the Royal Infirmary, and a year later the additional very important one of superintendent. These appointments he held until September 1841, and it was while in the Royal Infirmary that he began the custom, still in vogue and long since become a matter of routine, of weighing the organs removed from the body during the post-mortem examination. From data accumulated in this way, Dr. Reid compiled his "Tables of the Weights of some of the Most Important Organs of the Body at Different Periods of Life," not published until 1843, when he clearly saw that, settled in St. Andrews, he would have no more opportunities to add to his columns of figures.

We shall immediately see that in 1841, Dr. Reid became Chandos Professor in St. Andrews, but this was not the first chair for which he had been a candidate. As early as 1839, Dr. Reid became candidate for the Chair of Medicine in King's College, Aberdeen. This chair, having been changed to one of chemistry, was given to Dr. William Gregory, no doubt an excellent appointment. In the same year Reid entered for the Chair of Anatomy in Marischal College, Aberdeen; it was gained by his friend Allen Thomson, later professor at Glasgow. Reid apparently took what might be called disappointments with what is often called philosophical resignation; in all probability, being perfectly happy amidst his teaching and researches in Edinburgh, he entered for these chairs more from a sense that it was the proper thing for an extramural teacher to do, than because he wished to change his state. Early in 1841 the Chandos Chair was rendered vacant by the death of Professor Robert Briggs, and Dr. John Reid was "apparently" appointed in March to the professorship. The force

of the "apparently" will be manifest from the following letter to his father:—

"Royal Infirmary, *March* 29, 1841.

"My Dear Father,—I believe that I may now look upon myself as one of the professors of St. Andrews. I was elected on Saturday last—all the members of the University voting for me except three, and even these were not opposed to me, but were anxious for delay, to ascertain the possibility of converting the chair into one of natural history. I can scarcely think that anything is likely now to occur which could deprive me of it, but one is never sure of a thing until he is in actual possession of it."

There is an almost familiar air about this letter, a feeling that there is something doubtful, a feeling of impending possible change, an indefinable suspicion of insecurity; the same "spirit that breathed o'er" (the) "Eden" of St. Andrews in 1841 is still suffering from laboured respiration in the ancient halls of learning by that classic stream.

But Reid's friends would not let him leave Edinburgh until they had testified in corporate fashion, through the time-honoured instrumentality of a public dinner, how highly they esteemed him; Professor Alison took the chair, the croupier was the newly elected Professor Simpson.

The Chandos Professorship to which John Reid was now elected at the age of 32, is a survival from a day when anatomy and medicine practically embraced all that could be taught in matters medical. But as matters medical, having emerged from their primitive state of astrological and alchemical mysticism, and having passed through the stage of an unenlightened empiricism, were coming about this time to be placed on a rational basis, it was perfectly clear that they could not be taught to junior students who had had no previous instruction in anatomy and physiology. Hence, in carrying out the duties of the chair, the idea of teaching medicine was, under the circumstances, very wisely dropped, and instruction in anatomy and physiology substituted. During the session 1841–42, Professor Reid gave a junior course to students on human anatomy, and, of his own free will, a course of comparative anatomy and general physiology open to members of the University and the public alike. This latter seems to have been very much appreciated, for at the close of the first session a presentation was made to Professor Reid at a very largely attended public breakfast. His speech on this occasion contains one sentence which embodies a truth almost more overlooked in our day than in his: "I entertain a strong conviction that several of the doctrines which physiology embraces are well worthy of the attention of the general student, and might be rendered more available in the course of general education than has yet been done." Indeed, since Reid's time, there has been a distinct retro-

gression in this respect, for the all-important science of how our own wonderfully constructed frames "live and move and have their being"—physiology—has been taken out of the Arts Faculty, and the subject made no part of the degree that closes the otherwise liberal education of a Master of Arts.

We may here try to estimate Reid as a lecturer. It appears, in the first place, that he had no natural gift of speaking extempore, and therefore read his lectures. The Rev. Mr. Lothian of the Congregational Church, St Andrews, who attended the first series, says his style was elegant and clear, his voice musical and pleasant to listen to. But there was nothing in Reid, according to his biographer, Professor Wilson, of that compound of prophet, priest, and play-actor which Carlyle says constitutes the popular lecturer: in our own phrase, there was no "playing to the gallery." Science was science; it might be explained to suit a junior student or a layman, but it was not to be made an amusement, far less parodied beyond recognition.

Reid in fact possessed these excellent qualities which we are accustomed to conceive of as going to make up the Scottish character. We know the type so well—commonsense, caution, shrewdness (often with a dry humour), no love of display, no affectation, a high sense of duty, faithfulness in positions of trust, a certain degree of self-denial, patience, perseverance, self-reliance, or at any rate a wholesome abhorrence of dependence on others, far less parasitism,—all these, along with transparent honesty, a great love of truth, albeit with much kindliness, sympathy, and indulgence to intellectual error, were the components of the character of John Reid.

According to Hughes Bennett, who knew him very well, Reid's character was made up of earnestness in whatever he undertook, perfect rectitude, a love of truth, and kindness of heart. He considered he had the genius for interrogating Nature.

Bennett remarks, what we are not surprised to know when we remember Reid's training, that he owed nothing of his success to social accomplishments or to "elegancies of manner."

Professor Wilson describes his person thus: "Tall, with a strong figure, diminished in height by a stoop acquired by so much bending over books, dissections, and microscopes; his complexion fresh and even ruddy, his forehead expansive, his eyes small but of a bright black; his hair, which matched his eyes, was worn long."

Reid at first evidently found the change to St. Andrews, if not exactly uncongenial, then rather trying, from the complete severance from his accustomed stimulations to activity. Though very kindly received by his brother professors, he felt it strange to have no hospital in which to study cases, and very difficult to procure subjects for dissection. Seeing that his course was on

human anatomy, this savoured somewhat of the play of Hamlet without Hamlet.

In October 1844, John Reid was married to Miss Ann Blyth of Edinburgh. Two of their sons died quite young, and are buried in their father's grave. The mural tablet of white marble on the eastern wall dividing the garden of the Priory from the old burying-ground is inscribed as follows:

SACRED TO THE MEMORY OF JOHN REID, M.D.,
Professor of Anatomy and Physiology in the University of St. Andrews,
Who Died 30th July 1849, aged 40 Years;
ALSO OF HIS TWO INFANT SONS.

He felt the death of his elder boy, Henry, very acutely, occurring as it did at a time when he was struggling with his own mortal malady. His two daughters survived him, but both died before attaining their 25th year; his widow is still in life.

Reid had practically finished his physiological work when he came to St. Andrews in 1841; all the work that made him famous had already been done in Edinburgh. He wrote papers at St. Andrews, notably two long ones on epidemic fever in Edinburgh in 1836, but from lack of skilled assistance, and on account of the breakdown in his health, he did no more work on animal functions. By the aid of a Chevalier microscope from Paris, he studied certain marine forms, easily accessible in St. Andrews Bay—Polypes, Mollusca, and Medusæ, embodying his observations in three papers communicated to the Philosophical Society of St. Andrews on November 30, 1844, May 4, 1846, and April 5, 1847. It is on record that Dr. Reid occasionally played golf, but to what order his game belonged I can find no reference.

As an anatomist, pathologist, zoologist, and physician, Reid was quite equal to any Scotsman of his time, but I venture to think that his place in physiology has not yet been properly assigned him: or, if he has a niche in the temple of fame, it is apt to be overlooked by the visitor whose eye catches the great statues but misses the busts.

John Reid's claim to an honourable place in the Physiological Valhalla rests more especially on the work done in researches whose results were embodied in the following papers:—

1. "On the Relation between Muscular Contraction and the Nervous System." 1841.[1]
2. "An Experimental Investigation into the Function of the Eighth Pair of Nerves." 1838 and 1839.
3. "On the Effect of Lesion of the Trunk of the Ganglionic System of Nerves in the Neck upon the Eyeball." 1839.
4. "On the Anatomical Relations of the Blood Vessels of the Mother to those of the Fœtus in the Human Species." 1841.

[1] This had been the subject of a note to the British Association at Edinburgh in 1834, and again to that body at Glasgow in 1840.

In the first-mentioned paper, Reid attacked a historic problem, which had engendered in Europe about as much acrimony as any other debatable point in biological science. His work virtually settled the subject in dispute, which was—Is the irritability of muscle an inherent property, or is it conferred upon muscles by their connection with the nervous system?

That muscular irritability was inherent was the belief of the Hallerians, so named as being the followers of Albrecht von Haller, the great Swiss biologist (1708 to 1777), while those who held the latter view—championed by Müller—were known as the neurologists.

The mere statement of the essence of the subject, which was still a controversy as late as 1840, is in itself sufficient to show us how very different to-day is our standpoint as regards living matter.

Protoplasm—though the word was not coined till 1846 by Hugo von Mohl—in virtue of its being alive has the power of performing functions, and the most obvious function of muscular protoplasm is to "contract," as it is technically called, or redistribute itself in space, in response to what we know as a "stimulus," *i.e.* some change—usually an exhibition of energy—in the environment. The power or potentiality of responding to a stimulus is called irritability or affectability, and the response itself is the performance of the particular function or functions for which the living matter has been differentiated.

Similarly, the protoplasm of nerve fibres distributed to muscles is affectable, and its most obvious response to stimulus, *i.e.* function, is the transmission of impulses, which impulses, in normal conditions, are themselves the stimuli which rouse muscles to activity. Such is, in modern terms, a partial statement of the relations of the nervous system to muscle, and this is virtually what a Hallerian believed, in contradistinction to the neurologists' more mystic conception, of some kind of influence which was conveyed out of the nervous system by the nerves to the muscles—"animal spirits," in short, which "vitalised" the muscles and endowed them with contractility. This was the view of non-inherent irritability.

Reid argued as follows:—Let us sever the nerve connection between the central nervous system and a muscle in one animal, and leave it intact in another animal—the "control experiment"; by electrical stimulation of the nerves exhaust both muscles; wait for a time, and once again stimulate each muscle, when, if the muscle whose nerve is cut contracts, we may conclude its irritability is in itself, and is not conveyed to it from the nervous system now severed from it by a gap in its nerve.

On stimulating under those conditions, Reid found that the contractility had "returned as quickly and strongly in one limb as in the other." The neurologists had never gone so far as to

imagine that the nervous system could confer this property across the space between the two severed ends of the cut nerve.

Reid further showed that a muscle with nerve severed, if left inactive, would waste, become fatty, and ultimately inexcitable; *whereas* if "daily exercised," as he called it, "by galvanism," it would retain its irritability *ad infinitum*. Here the power of retaining contractility depended, not on any connection with the nervous system, for there was none, but on the muscle being made to use the contractility it possessed, *i.e.* to perform its functions. It was not a question of receiving some mystical endowment from the nervous system, but, through being active, of preventing that atrophy which invariably accompanies inactivity. This is only a particular case of a great law in the intellectual, emotional, and moral worlds, as well as in the physical; it is by activity that we keep ourselves alive; we "work out our own" metabolic "salvation" almost entirely by a kind of muscular "trembling"; and by using the gift that we have we contrive to retain it, for "if the light that is in thee be darkness, how great is that darkness."

The nervous system, then, conveys no power of contractility; it merely originates and issues impulses tending to awake the contractility which the muscle possesses on its own account, and in virtue of its own life; whether these impulses be voluntary and originated as a result of a conscious state, or be "reflex," *i.e.* produced apart from consciousness, they bring about in both cases the same result on arriving at the muscle—exhibition of function, contractions great or small involving tensions great or small. The nervous system, in other words, not only conveys impulses to muscles, but keeps up streams of them, which induce nutritional changes in the tissue. Muscle is of itself alive—has a life independent of all other tissues, just as blood cells, brain cells, or bone cells have; but by means of the nervous system, its life, its power of performing function, is *correlated* with other, and it may be distantly situated, tissues: in the body human as in the body social "no one liveth to himself." The nervous system emits and conveys orders to act; it imparts no power for carrying them out.

The nervous system is the totality of the officers, the muscles are the well-fed rank and file; the officers issue commands to act, they confer no physical power for action; the neurologists thought that the officers not only gave commands, but supplied the commissariat out of their own pockets.

These researches of Reid were not only of importance as solving a definite problem in physiology, but they showed that Reid did not shrink from attacking an almost classic controversy on a point involving the philosophy of biology.

For although to cure an attack of indigestion or to reduce a dislocation need not involve a correct understanding of the relations of the nervous to the muscular system, nevertheless the true physiologist must not remain immersed in the multitude of

details of empirical research, but ever and anon move from the laboratory to the library to ponder on what these facts mean, to try to comprehend under some one or two principles of wide application the relations and interdependence between tissues and tissues, organs and organs, systems and systems in the body. In the case in point, life of a tissue does not depend on the possession of nerves, but life is only life in its highest sense, in its most efficiently co-ordinated subservience to the life of the whole body, when that tissue is in connection with nerves.

Reid by no means overlooked the therapeutic, the practically useful aspect of the subject, for in a note added to the paper in 1848 he remarks that in cases where muscles have become paralysed—*i.e.* removed from voluntary control by interruption, functional or anatomical, between them and the nervous system—galvanic stimulation of them will cause contractions, so that through their artificially induced activity their nutrition will not be allowed to suffer, and they will therefore not become wasted. Reid, at 30 years of age, solved this problem by the experimental method, and so virtually closed a famous controversy.

Claude Bernard, in 1852, corroborated the truth of what Reid proved, by discovering that curare paralysed the motor nerve endings in muscle, so that a muscle which would no longer contract when stimulated through its nerve, contracted with its former vigour when its own tissue was stimulated directly.

The most elaborate of Reid's researches was that already alluded to, into the functions of the great cranial nerves; it lasted for two years, and entailed more than 100 experiments. He read a kind of preliminary note on this work at the meeting of the British Association at Liverpool in 1837.

To appreciate fully the magnitude of this research, we must remember the labour it necessitated, the great number of post-mortem examinations it needed, the tedious dissections, the careful scrutiny of fleeting phenomena, and, above all, that it was carried out as early as 1836. This was previous to the introduction into physiology of the method so familiar to us now of electrical stimulation of tissues. It was du Bois-Reymond and the German school who taught us how to employ the *interrupted* current—a method of great convenience in stimulating tissues, and one capable of much delicacy of gradation.

In order to stimulate a nerve, Reid had either to pinch it with forceps or to apply a chemical irritant to it, which, compared with faradic stimulation, is about as delicate as opening your front door with a crowbar instead of with a latch-key. Remembering, therefore, how crude were Reid's means of eliciting nervous phenomena, we are quite astonished at his discovering as much as he did about the great nerves of the head, neck, and body.[1]

[1] He sometimes used the *constant* current, but, compared with the interrupted, it is a very clumsy stimulus.

Reid only just missed discovering that the cardiac branches of the X or vagus nerve depress—inhibit—the heart's activity; it was reserved for Weber, the German physiologist, to do so in 1845. But ten years previously Reid had written: "It would appear that the influences of causes acting on the central organs of the nervous system may be transmitted to the heart by two channels, namely, by the par vagum and by the sympathetic system."

Reid recognised the double nerve supply of the heart, which very circumstance was the cause of his not being able to clearly demonstrate the whole function of either nerve independently. The action of the vagus is to slow, that of the sympathetic to accelerate, the heart. When, therefore, he cut the vagi, the heart, being influenced by the "sympathetic" fibres alone, seemed to have its action accelerated, but after cutting the sympathetic, Reid had no means of continuously stimulating the X, and so bringing out its specific slowing action. By very careful observations, after section of both accelerators, he might have noticed the cardiac action slowed, even without stimulation of the X, but this experiment he does not seem to have performed.

In the appendix to the paper written in 1848, he shows that he had read the then just published work of the brothers Weber, and of Budge and Waller, who electrically stimulated the tenth nerves and obtained complete arrest of the heart. On the functions of the pulmonary, œsophageal, and gastric branches of the vagus, his observations are very careful, and his conclusions far-seeing.

Reid did not possess sufficiently delicate methods to investigate all that he had set before him; he worked a few years too early to benefit by the German instruments, but he had all the experimental acumen and unwarped methods of attacking Nature, which were less fruitful than they otherwise would have been, owing to his having to cease working "in the rich dawn of an ampler day." He is the last great Scottish pre-instrumental physiologist.

Lastly, in the matter of Reflex Action, Reid was greatly in advance of the teaching of his time When he wrote his paper "On Sensational and Emotional Reflex Actions," embodying what he had previously taught in Edinburgh, the very idea of reflex action was in its infancy. Marshall Hall, who wrote on the subject between 1832 and 1837, and who gave physiology the first systematic account of the vastly important phenomena comprised under the term "reflex action," was a contemporary of Reid, whom he outlived by eighteen years.

While thus the very notion of reflex action was only just beginning to be understood, Reid had seized its import and extended its connotation to include unwilled actions resulting from *conscious* states, especially emotions—another example of that prescient attitude of his mind which ever took comprehensive surveys over large fields of inquiry.

By the cruelty of a matchless irony, that most dreaded of all diseases, cancer, fixing upon his tongue, invaded with a steady and well-named malignant progress the areas of distribution of the very nerves whose functions in mouth and throat he had spent two long years in discovering. With the transient hysteria born of acute bodily anguish, he exclaimed in the Scottish formula: "This is a judgment on me for my experiments on animals." It was certainly curious that the regions of those very nerves he had so minutely studied should be those to become involved in the cancerous ulcer.

On August 31, 1848, at Professor Simpson's, 52 Queen Street, he underwent an operation at the hands of his friend Mr. (later, Sir) William Fergusson, assisted by Goodsir, Duncan, and Hughes Bennett, who removed one-third of the tongue. By lymphatic dissemination the disease advanced to the glands of the neck, where another operation was necessary; this left an external wound. The second operation was performed at Professor Goodsir's, 55 George Square, by James Duncan, assisted by Spence and Goodsir, on November 29, 1848. Yet a third time, 1st January 1849, did poor Reid submit to the horrors of the surgeon's knife; but it was a hopeless case. He knew so well what they were going to do to him, and he warned them about letting air into the veins: years before, he had written on "Death by Admission of Air into the Venous System."

Reid was doomed at 40. Having visited Keswick and Innerleithen, he returned to his house in St. Andrews, in North Bell Street, now Greyfriars Garden, for the last time. It was practically on his deathbed that he edited a collection of nearly all his published papers, arranging them in a large octavo of 659 pages, entitled "Physiological, Pathological, and Anatomical Researches." But his calm courage never gave way. In the spring of 1849 he actually reviewed a work by Hughes Bennett on "Cancer," critically discussing the symptoms and issue of the very disease whose death-grip was at that moment upon his throat. He requested Bennett to examine his body after death.

He died in unspeakable agony, assuaged only by morphia and the recently discovered chloroform, on July 30, 1849. His last words were, "The world is behind": he was not thinking of all his honours, his fame, his discoveries, but of that unrevealed state of blessedness for which, in the last months of suffering, he had prepared himself with a resignation higher and fairer than the stoic's —the Christian's.

His biographer, Dr. George Wilson, attended the funeral on the 2nd of August, which was, he tells us, a "singularly bright and beautiful day." We who know this ancient place can so well picture the scene—the beautiful day, for when it *is* beautiful in August, by the calm of the eastern sea, it can indeed be beautiful; the matchless blue of the sun-flooded sapphire of the sky, stretched above the little grey city and the great greyer ruins of the noblest

of Scottish cathedrals, as the sad and slow procession wound from the Old Town Kirk to the place of burial, a stone's-throw from the tall, silent, guardian tower of the town; and there they lowered from the sight of their weeping eyes what alone was mortal of John Reid, to rest in that most sacred of sepulchres, filled with the music of the murmur of the everlasting sea as it moans through these "roofless fanes."

When referring to Reid's experiments on animals as the earliest in Edinburgh, I overlooked the fact that Robert Whytt carried out certain experimental researches on frogs in connection with his investigations on the nervous system.

A CONTRIBUTION TO THE MECHANISM OF ARTICULATE SPEECH.

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(*Concluded from page* 353.)

ANTERIOR LINGUO-PALATALS.—1. *Voiced fricative* (Zh).—This is the French *j*; it occurs in English chiefly in association with D as the soft *g*, or the English *j*; but it is also found alone, *e.g.* the *si* of *occasion*, the *z* of *azure*.

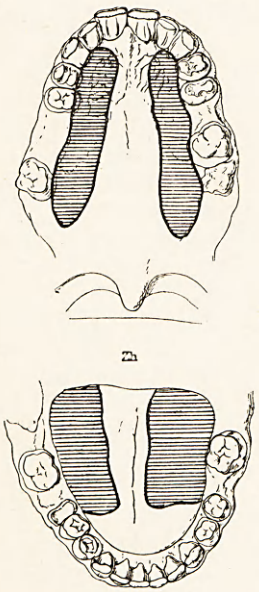

FIG. 35.

It is acoustically more nearly related to Z than to Y, as is indicated by the fact that it is represented by *si* and *z* in English. Yet the position of the organs shown in the diagrams has a greater re semblance to Y than to Z, for the strait is a long and marked one, terminating some distance behind the front of the mouth as in Y, not a short anterior one as in Z. The difference between the contact-areas in Zh (Fig. 35) and Y is not great, but the acoustic difference is considerable, though the one sound is sometimes substituted for the other, as in the dialectic pronunciation of the German *ja*—ZhA^3, instead of YA^3. The similarity between the diagrams is due to the deficiency already referred to in the contact method of experiment; it shows merely actual contact, giving no indication of areas where the organs are very closely approximated. In Y the area anterior to that of actual contact is moderately wide, and does not apparently contribute directly to the adventitious friction sound which gives the phone its character; but in Zh this anterior area,