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Sir Charles Bell

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Abstract

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This was the dream of a man of great vision and genius, who, retiring to sleep, awakes once more with his dominant thought, an idea matured by the coalescence of inspiration and protracted study.

There can be no doubt that Charles Bell had intellectual brilliance in great measure; during his lifetime he was surgeon, anatomist, physiologist, artist and philosopher. In fact his critics have said of him that his academic life was too highly faceted, and that had his work been steered along a more homogeneous pathway, his reputation might have been all the greater.

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SIR CHARLES BELL

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It is told that one restless night, being struck by a sudden idea, Sir Charles Bell awoke his wife exclaiming, "Eureka! I pray God not to have sent me an empty dream, or to suffer me in the morning to recover the thread of this nocturnal vision. If I see with my waking eyes what I have caught a glimpse of in slumber I shall assuredly leave behind me an immortal name."

This was the dream of a man of great vision and genius, who, retiring to sleep, awakes once more with his dominant thought, an idea matured by the coalescence of inspiration and protracted study.

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Charles Bell was born in the Fountainbridge suburb of Edinburgh in 1774. His father was an Episcopalian clergyman, the Reverend William Bell, who had four sons—Robert, John, George and Charles—Charles being the youngest. In spite of his meagre income the priest had managed to give his three eldest sons a good education; these three were destined to become men of great eminence; Robert became the Professor of Conveyancing to the Society of Writers to the Signet; John was to become one of Edinburgh's most celebrated surgeons and George was to occupy the Chair of Scots Law in this University. It was, however, the youngest son who would immortalise the family name. Charles was unfortunate in that when he was yet only five years old his father died, and the financial circumstances of the family became even more precarious than they had previously been.

At the age of ten, Charles did attend school—the High School in Edinburgh—where he remained for four years. Speaking about it later in life he said, somewhat derisively "The education at the High School was to me torture and humiliation. Adams, loved by all good scholars, was to me a stupid tyrant. Anything mechanical or tending to natural philosophy I comprehended better than my companions, but the memory of verse or Latin rules without intellectual comprehension of some principles, I was almost incapable of. Memory

should be cultivated, it bestows great advantages. Mine was ever deficient. I could not and cannot venture on a quotation either in conversation or in public discourse."

While still quite young, he began to assist in his brother John's anatomy school, and at the same time attended lectures in the University. During the following years he became very expert in anatomical drawings, and while still a student published a work called "*A System of Dissections*" which was illustrated by his own drawings.

Eventually Charles came to practise surgery but, mainly due to the fierce disagreements between the University and his brother John, he realised that such success as he might achieve would not be accomplished in Edinburgh. And so it was with mixed feelings that he decided to take the long road to London.



Fig. 1.—Charles Bell in 1804.

Courtesy Messrs. E. & S. Livingstone, Ltd.; from Gordon-Taylor and Walls, "*Sir Charles Bell—His Life and Times*," Edinburgh, 1958.

At the time Lord Jeffrey wrote to another Scot who had taken the inevitable path to the English Capital: "All the world migrates towards London. My good friend Charles Bell is about to follow your bad example; he has almost determined to fly and establish himself in the great asylum. I have a warm regard for him; I can also assure you that you will find him extremely unassuming, intelligent, honourable, grateful"

He went South not completely unarmed for he had achieved some fame in his published account of the "*Nervous System and Special Senses*" and in the "*Anatomy of the Human Body*," which he had written with his brother. Also with John he had stressed the importance of a sound basis of anatomy for the proper practice of surgery. In fact the two brothers had virtually created the subject of surgical anatomy.

In addition, he had to his credit two other works—the beautifully illustrated

"System of Dissections" and "Engravings of the Arteries, of the Nerves and of the Brain"; and to this period also belongs his first great work, the celebrated "Anatomy and Philosophy of Expression".

In the "Anatomy of Expression", tracing the causes of movements in the countenance and in the body frame under the influence of emotion and physical change, Bell concerned himself with the course, origin and destination of nerves. Even in his earliest edition he shows his great interest in the nervous system saying, "If we had a perfect knowledge of the function of the nerves, they might, on all occasions inform us of the causes of those actions which appear to us inexplicable". Similarly, his early discussions of the functions of the nerves of the face foreshadow much of what was later to flow from his prolific pen. Certainly this creditable contribution to the understanding of human and comparative anatomy did much to build up and enhance Bell's reputation in this country and on the Continent.



Fig. 2.—The Nerve of Bell, with writing referring to his concept of a Respiratory System of Nerves.

Courtesy Messrs. E. & S. Livingstone, Ltd.; from Gordon-Taylor and Walls, "Sir Charles Bell—His Life and Times," Edinburgh, 1958.

It was some time before Bell received any financial success in London; at first, his income was based on the number of pupils attending his anatomy courses. He did have a number of surgeons at his school, but it was not until a few years later—when he began his own private practice and became consultant surgeon to the Middlesex Hospital—that he reaped any substantial monetary reward.

Later, in 1812, and encouraged by his wife, he took over ownership and became principal teacher in the Windmill St. School of Anatomy, which the Hunter brothers had made so famous. Here Bell taught and dissected and continued to brood upon the functions of the nervous system.

What was Bell like as a surgeon? We are certainly told that he had great manual dexterity, and it is also known that many operations caused him much anxiety. As Bell has said—"When a surgeon first takes the knife in his hand, and is preparing with oppressive feelings to perform an operation, which may terminate the life of his patient, he is not always aware of what is the most difficult to be accomplished. His ideas are vague, his mind not settled to what he is to expect; the circumstances which ought chiefly to engage him are not distinctly before him; and no man has ever performed this painful duty without feelings that it is in the very course of the operation that he learns what is most necessary for him to know and practise."

The Napoleonic Wars which ensued at this time gave Bell much opportunity for the treatment of gunshot wounds. In 1815 the great Battle of Waterloo was raging, and it did not take Bell long to decide that he must go to help as best he could the wounded of that campaign. He arrived some eleven days after the fighting had finished and found around him a wretched picture of human misery. He worked for days together leaving himself little time for food or sleep. As he says he "operated until his clothes were stiff with blood, and his arms powerless with using the knife."

Some two and a half weeks after the battle Bell visited that historic theatre of war, and he described the scene in his diary—"... Already silence dwells here; for although it is mid-day, and the sun bright and all shining in gladness, yet there is a mournful silence contrasted with the scene which has been so recently acting. No living thing is here—no kites, no birds of any kind; nothing but a few wretched women and old men, scattered on heights and at a distance, and who are employed in gathering cannon-balls."

* * *

Of all Bell's contributions to the arts and sciences his discoveries and work on the nervous system will ensure for him everlasting fame. He had been preoccupied with the nervous system of the human body from a very early age. This is reflected in a passage from his "*Anatomy and Physiology of the Human Body*," which Bell wrote with his brother John. He said, "On the subject of nerves my reader will find an account of that system which I have delivered in my lectures for the ten years past. That I have been so long in placing my views in a systematic work will only prove my respect for the received opinion, but, the manner in which so many of my professional brethren have allowed themselves to be assailed by new and fantastic doctrines, shewing little respect for the old, makes me hesitate less in substituting opinions different from these hitherto admitted."

The ideas on the function of the nervous system before Bell's time were essentially "Galenical" in outlook. Von Haller in the middle eighteenth century had considered the nerves to be hollow for the transmission of "nervous fluid" from the brain to the periphery and vice versa. He also suggested that there might be two varieties of nervous fluid—one for sensation and one for movement—both being present in any one nerve.

* * *

As early as 1807 he wrote to his brother George in **Edinburgh**, saying, "My new '*Anatomy of the Brain*' is a thing which occupies my head almost entirely. I hinted to you formerly that I was burning, or on the eve of a grand discovery. I consider the organs of the outward senses as forming a distinct class of nerves from the others. I trace them to corresponding parts of the

brain totally distinct from the others; I take five tubercles within the brain as the internal senses. I trace the nerves of the nose, ear, eye and tongue to these. Here I see established connexions. Then the great mass of brain receives processes from these central tubercles. Again the greater mass of the cerebrum sends down processes or crura, which give off all the common nerves of voluntary motion, etc. I establish thus, a kind of circulation as it were. In this enquiry I describe many new connexions. The whole opens up in a new and simple light; the nerves take a simple arrangement; the parts have appropriate nerves and the whole accords with the phenomena of the pathology and is supported by interesting views."

Bell entertained the idea that the parts of the brain were distinct in function. It occurred to him that there were four divisions of the spinal marrow—first a lateral division, then a division into the back and fore-part. It also occurred to him that the spinal nerves had within the sheath of the spinal marrow two roots—one from the back part and another from before. These are the thoughts which led him to perform his classic experiments.



Fig. 3.—The autonomic nervous system, the cervical and brachial plexuses, the facial and trigeminal nerves.

Courtesy Messrs. E. & S. Livingstone, Ltd.; from Gordon-Taylor and Wails. "Sir Charles Bell—His Life and Times," Edinburgh, 1958.

In the first he opened the spine of an animal and injured the posterior filaments of the nerves—no motion of the muscles followed—then he touched the anterior division and immediately the parts were convulsed. In his second

experiment he destroyed the posterior part of the spinal marrow by the point of a needle—no convulsive movement followed; when he injured the anterior part the animal was convulsed. Thus had Bell demonstrated a separation of function between the anterior and posterior nerve roots.

The following year, in 1811, Bell published his famous "*Idea of a New Anatomy of the Brain*," which explained his views on the structure and functions of the nervous system. In it he states that the cerebrum and cerebellum have different functions and that diverse roles are incorporated in the varying parts of the cerebrum. "The nerves," he says, "are composed of filaments which, though distinct in office, are united for convenience of distribution." This would solve the question of how a nerve might lose one property and retain another. On the basis of gross anatomy, Bell wrongly believed that there were exclusive connections between the posterior roots and the posterior columns and the cerebellum; and that in a like manner the cerebrum was connected with the anterior columns and the anterior spinal nerve roots. Throughout the entire paper there is no direct reference to the anterior roots being motor and the posterior roots being sensory in function. Whether he had intended to convey such a view is not altogether clear—but even in his letter to his brother George, a year earlier, he had talked of the part of the spinal marrow "having sensibility," and the "posterior and insensible part of the spinal marrow." Probably had Bell carried out more animal experiments, which in these pre-anaesthetic days he had an utter distaste for, he might have been able to give a clearer picture of the function of the nerves. But, his ideas and experiments on the spinal nerves and the trigeminal and facial nerves sowed such seeds of interest in the mind of the Frenchman, Magendie, that this scientist was able, after doing repeated experiments along essentially similar lines to those done earlier by Bell, to state clearly the functions of the nerve roots—namely that the posterior nerve roots were sensory and the anterior nerve roots were motor. (This is nowadays known as the Bell-Magendie Law). Bell always disputed the fact that Magendie had discovered the function of the nerves, and for many years a bitter controversy raged between these two great neurologists. Probably in the final analysis it would be fair to say that Bell had demonstrated the functions of the spinal nerves, but that he had left it to Magendie to confirm and interpret accurately his results. In spite of Bell's wranglings with this French scientist, he had a great reputation on the Continent—greater it is said than that of Harvey—and the story is told that when he visited Paris one time Professor Roux introduced Charles Bell to his class and in the same breath dismissed them, saying "*C'est assez messieurs, vous avez vu Charles Bell.*"

* * *

These are not the only important contributions which Bell made to neurology. He was, as has been pointed out, greatly interested in the nerves of the face. At this time it was customary to divide the facial nerve in the treatment of *tic douloureux*. It was Bell who pointed out the fallacy of performing this operation, which merely resulted in facial paralysis, showing that it was the facial nerve which supplied the motor nerves to the facial muscles of expression, and that the trigeminal nerve was both sensory and motor.

Bell's doctrines and his excellent clinical teachings won for him a large clinical practice in London, and in conditions involving the facial nerve he was certainly second to none. His medical classic "*The Nervous System of the Human Body*," which was published in 1830, and which is surely the first text-book of modern neurology, contains, in addition to all his experimental and clinical observations, a number of case histories of his patients—many suffering from Facial Palsy—or as it was later to be known "Bell's Palsy."

In 1835 the Chair of Surgery in the University of Edinburgh became vacant, and Bell was offered the post. The position was certainly inviting, for Edinburgh was pre-eminent among the medical schools of Europe, and Bell would have a chance to see his family again, and as he remarked "London is a place to live in, not to die in." So, at the age of sixty-two, he returned north to his birthplace. But he was by now in the autumn of his existence and in the year of 1842 Bell died.

* * *

In the death of Charles Bell, the world lost not only a master anatomist and surgeon, but also one whose skill as a painter was quite superb. Together with his talented brush was coupled an eloquence of expression which added so much to his more philosophical works. Perhaps indeed his pursuits were too numerous to enable him to complete his "New Idea" of the nervous system, the great ambition of his life. Yet, without Bell's work, for how much longer would the nervous system have remained in such obscurity? Even if Charles Bell were denied his crowning glory, it was certainly he who shone the light of understanding on the hitherto inextricable confusion of the nervous system and pointed a path to the further elucidation of its hidden mysteries.

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