

Thomas Laycock and the romantic genesis of the cerebral reflex

Thomas Laycock (1812-1876) graduated from University College London in 1835, received his MD from Göttingen in Germany *summa cum laude* in 1839 and became the first Englishman to occupy the chair of Professor of the Practice of Medicine at the University of Edinburgh in 1855. He was the first person to apply the concept of reflex action to the brain, and was also the first to argue that the anatomical division of the central nervous system in humans is on a continuum with that found in other animals. Although he wrote on these topics fifteen years before Darwin's *The Origin of Species*, and his conclusions are compatible with currently held principles regarding the structure and function of the nervous system, he remains an obscure historical figure.

The ideological struggle over the principles that govern methodological practice in the biological sciences today occurred throughout the nineteenth century.^{1,2} It would be overly simplistic to state that this struggle was a simple fight between proponents of romantic biology on one side and those of scientific reductionism on the other, however, Laycock was clearly aligned to the former camp.³ In the first half of the nineteenth century the cerebrum was widely held to be a special part of the nervous system; the seat of the will, consciousness, and what it was to be human, it was considered to be above and beyond the laws that mediated function in the lower divisions of the nervous system. In 1833 Marshall Hall (1790-1857) published on the reflex arc in the spinal cord, arguing that reflex acts were also mediated by matter contained in the brainstem but specifically excluded the cerebrum.⁴

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Laycock did not agree, stating, “It will be easy to show that the excito-motor phenomena of Dr Hall, confined by him to the spinal cord, have their analogues in the cerebral hemispheres”.⁵ He most clearly states his hypotheses in his paper of 1845 entitled ‘On the reflex function of the brain’:

Four years have elapsed since I published my opinion, supported by such arguments as I could then state, that the brain, although the organ of consciousness, was subject to the laws of reflex action, and that in this respect it did not differ from the other ganglia of the nervous system. I was led to this opinion by the general principle, that the ganglia within the cranium being a continuation of the spinal cord, must necessarily be regulated as to their reaction on external agencies by laws identical with those governing the functions of the spinal ganglia and their analogues in the lower animals.⁶

Cerebral reflexes are ‘centric’ in origin, patients are ‘physically unable to restrain or modify’ them, and conscious experience is coincident to, rather than the cause of these reflexes. Included in his examples are the blink reflex in response to visual threat and pathological laughter and crying in a patient with a cerebral tumor and secondary epilepsy. However, his favorite example is the hydrophobic gasp of the rabid patient. He notes that exposing the patient to the touch, sight, sound or even the

idea of water can generate this response. He spends little time discussing animal work in his paper, but does pause to consider the influential negative experiments of Marie Jean Pierre Flourens (1794-1867), who found no evidence for the discrete cerebral localisation of brain functions in his experiments, predominantly on birds, concluding that cerebral functions were spread diffusely throughout the cerebrum.⁷ Laycock notes:

Dr Marshall Hall has relied mainly upon the experiments of Professor Flourens in support of his opinion that the brain is inexcitator, but it will be seen that these experiments consisted simply in irritating the brain by picking and tearing...Such irritations differ altogether from even the tactile sensations received by the general surface. As every nerve has its proper endowments, and requires the irritant peculiar to itself, to develop the reflex phenomena indicative of design, so the sensory gray matter in which the sensual nerves end must have its proper endowments and peculiar stimuli.

Laycock's views on the reflex sprang from his belief in both the unity of nature and its inherent purposefulness. He was part of a loosely defined movement (romantic science) which was not a self-organised club, but rather consisted of individuals who viewed biological phenomena as somehow different from the inorganic world. Although some have considered this movement a retarding force on the progress of biological science, in more recent times



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evidence has emerged that many of the ‘great’ names of the time were influenced by romantic philosophy.¹ There were many differing and contradictory shades of romantic thought at that time.⁸ Lenoir argues that between the extremes of vitalism (biological forms and forces are subject to their own rules, distinct and not dependant on those governing the inorganic world) and reductionism (all biological phenomena can be explained by physical laws and forces), many scientists chose a doctrine that took the middle road, allowing for both the separation and interaction of the biological and physical worlds. These scientists worked within a philosophy of biology outlined by Immanuel Kant (1724-1804). In his *Critique of Judgement* published in 1790, Kant argues that the concept of cause and effect can and should be used when studying events that take place in the inorganic world, as consequences tend to follow one another in a linear sequence. Problems arise when applying this view to the organic world as cause and effect are linked. A tree causes leaves to grow on it yet the leaves also cause the tree to grow; in Kant's words, “An organised natural product is one in which every part is reciprocally both ends and means”.⁹ In order to escape this paradox, he suggests that when studying events in nature one must assume that natural phenomena have an innate purposefulness. This assumption however, must remain just that, an assumption to help guide enquiry, and one must be careful not to make the logically inconsistent leap that nature really is purposeful. For Kant the paradox of investigating biolog-

ical phenomena arises not from the phenomena themselves, but from the innate limitations in our ability to interrogate the biological world:

In the unknown inner ground of nature, the physico-mechanical connexion of things and the organic connexion of their organic ends, may be united in one principle; we only say that our reason is unable to unite them.¹⁰

This teleological view of nature pervades all of Laycock's writings. For him, although the reflex is grounded in matter 'vesicular neurine', this matter is specially organised by nature to produce a function, i.e. reflex acts are directed towards some end and are thus properly defined as reflex functions. So even though he later goes on to argue that instinctive behaviours, emotional acts and some acts of intelligence (inspiration) may be due to cerebral reflexes, he does not regard himself in any way as a reductionist. The inbuilt purposefulness of the reflex lifts it above the inorganic world where events unfold without intention.

His viewpoint was out of kilter with the majority of British scientists at the time, and this served to partly camouflage his ideas. His large textbook of 1860, the title says it all, *Mind and Brain: or the Correlations of Consciousness and Organisation; with their Applications to Philosophy, Zoology, Physiology, Mental Pathology and the Practice of Medicine*, was not uniformly well received:

Anticipating from the title, a work of much practical character we were disappointed that theory lay at the root of the whole matter. This theory is a sort of combination of the philosophy of Plato with the physiology of Stahl.¹¹



Thomas Laycock (1812-1876) was the first person to apply the concept of reflex action to the brain. Picture courtesy of Royal College of Physicians of Edinburgh.

He felt that authorship of his concept of the cerebral reflex was stolen from him by William Carpenter (1813-1885) who wrote a famous and much-read textbook *Principles of human physiology*.¹² Carpenter, like Marshall Hall, argued that there was a strict cut-off at the cerebrum above which reflex action did not occur, only later changing his mind and giving himself primacy for this idea up to and including the fifth edition of his textbook published in 1855. Although he wrote to Laycock retracting this statement, the textbook passed out of his editorship and a formal corrigendum was never appended. Laycock continued to feel stung, writing articles attempting to correct this error into the year of his death.^{13,14}

It was to be left to others to 'modernise' Laycock's main conclusions by re-phrasing them in more acceptable theoretical garb. John Hughlings Jackson (1835-1911) was a medical student for three years at York when Laycock taught there. Although he makes little reference to Laycock in his published works, it has been argued that Laycock was an early and important influence on Jackson who incorporated some of Laycock's views on the reflex.^{15,16} Jackson recast the concept of continuity of the nervous system in animals within the acceptable paradigm of evolutionary theory, not, as Laycock did, around a belief in the unity of nature; proving that, in history as elsewhere, it is not enough to be right, you have to be right for the right reasons.

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