On the Legacy of John Hunter, Neuroanatomy and Neurosurgery: there and back again

It should be remembered nothing in Nature stands alone; but that every art and science has a relation to some other art or science, and that it requires a knowledge of these others, as far as this connexion takes place, to enable us to become perfect in that which engages our particular attention

John Hunter, in *Observations on Digestion* (1837)

The inaugural *Hunterian Oration* was held in 1813 and delivered by Sir Everard Home in what was to be the first of a great tradition (Chaplin, 2013). Two hundred and thirteen years have passed since and many notable speakers have presented the legacy and story of John Hunter (1728-1793) in their own words. Thankfully, records exist for many of the orations given, not least in the *Annals of the Royal College of Surgeons*, thus bestowing contemporaneous and invaluable records of our shared craft through time, delivered in the light of Hunter's esteemed image.

Despite the *Oration's* becoming a biennial event in 1853, there existed a challenge to the speaker of successfully presenting novel and varied insights into the man and his enduring influence on the surgical practice (and medicine!) of the day, given so many previous iterations (Cade, 1963). It was no less James Palmer, who edited *The Works of John Hunter* through 1835-1837, who remarked:

"*It may be worthy of consideration whether it would not be better that these orations should occur less frequently. It is a hopeless task to seek for something new every year on so limited a subject*" (quoted by Cohen, 1956:645).

This sentiment has persisted in some quarters since. Indeed, a cursory look through the subjects of previous orations through the last two centuries identifies several recurring themes, not least Hunter's influence on military surgery and wounds of war (Tai, 2025).

Intriguingly, an account of Hunter's influence on the modern neurosurgeon appears to remain virgin ground, with seemingly the only clear dedication that of N.C MacNamara's (1901) oration on *The Human Skull in Relation to Brain growth*. Of course, for much of this time, the *Orations* have existed when neurosurgery has not. Yet "nothing in nature stands alone" and little effort is required to see the myriad connections that have transcended time between Hunter and both the defining period and modern practice of Neurosurgery.

This essay, therefore, seeks to present John Hunter and Hunterian principles through the lens of Neurosurgery. By doing so, it reveals a shared philosophy and reflects on several of his lesser-known achievements. In the end, it becomes clear how even now our pursuit of greater anatomical knowledge and, ultimately, safer neurosurgical intervention, remains contingent on his original, essential methods: *there and back again* indeed.

Hunter and His Influence on the Origins of Neurosurgery:

Hunter is regarded as the founder of *scientific surgery*, a man who:

> *…brought to the study of medicine not only an unrivalled knowledge of anatomy and physiology, and an unmatched industry and zest in unmasking Nature's secrets, but a supreme intellect and creative imagination yoked to the scientific method of reflective inquiry* (Cohen, 1956:650).

His methods of induction and the diligent testing of hypotheses no doubt laid the foundations for what is now the consensus for robust, empirical methodology (Cohen, 1956). It is surprising then that beyond the eponymous museums, societies and orations that remain today, there is little in the way of commemorative clinical or research institutions - an exception being the *John Hunter* (sexual health) *Clinic* at Chelsea and Westminster Hospital, implicit to which is his (believed) infamous self-inoculation and *Treatise On Venereal Disease* (Hunter, 1837; Brain, 1952; Moore, 2009).

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Such oversight cannot be attributed to our colleagues across the Atlantic where the *Hunterian Neurosurgical Laboratory* of the Johns Hopkins Hospital, Baltimore can be found. These halls have conveyed the so-called 'fathers' of the neurosurgical discipline, who in turn emerged from disparate beginnings: from Halsted to Cushing to Dandy and so on. Of course, Halsted was not a neurosurgeon, but he oversaw the rise of Harvey Cushing who was undoubtedly a giant, if not the "only true genius American medicine has produced" (Awad, 1995). He followed in the mould of Hunter as the laboratory's Director in 1904, overseeing wide-ranging research founded on three core principles: student education, veterinary surgery that stressed surgical techniques, and meticulous surgical and laboratory record-keeping (Sampath, 2000). As such, he perpetuated the essence of Hunter, the man. The birth of Neurosurgery and the ethos of the laboratory evolved stepwise through the early 20th Century and what followed were seminal investigations into essential neurosurgical and pathological concepts: cerebral oedema; hydrocephalus and cerebrospinal fluid dynamics; and improved surgical techniques (Halstedian principles) (Sampath, 2000). Today, the laboratory is renowned for its translational research in each of the sub-disciplines of neurosurgery, and for fostering successful 'surgical scientists' of the future (Tyler, 2016): after all, *why think? Why not try the experiment?*

Cushing's own dedication and renown as "clinician-scientist" gave birth not only to Neurosurgery as a highly regarded specialism, but also that of Endocrinology, in which his work on the function and dysfunction of the pituitary gland was most central (Awad, 1995). Cushing's research delineated the clinical importance of both hypopituitarism and hypercortisolaemia (Cushing's Disease), whilst later popularising transsphenoidal hypophysectomy in place of more morbid transcranial approaches to the pituitary fossa and sellar region (Pendleton, 2013). Together with Halsted, Cushing propagated Hunter's legacy by establishing a modern paradigm for academic medicine throughout the world (Awad, 1995).

Working at the same time in the UK was Britain's first appointed specialist "Brain Surgeon", Sir Victor Horsley. Much like Hunter, Horsley was a polymath and "social conscience" with not only surgical prowess and detailed anatomical knowledge, but

steadfast dedication to the allied subjects of pathology and microbiology (Powell, 2006). Again, the principles of Hunter's method were vociferously adhered to by this "archetypal surgeon scientist". In this nascent period of neurosurgical specialism, Cushing's and Horsley's achievements were totemic but they differed greatly as surgeons, with Horsley perhaps the more reminiscent of Hunter's 18th Century battlefields:

> *Cushing…was an extremely slow, methodical surgeon who obsessively chased every bleeding point. In 1900 Cushing accompanied Horsley to a private house, where Horsley both anaesthetised and operated on a patient's trigeminal ganglion, all within the hour. The astonished Cushing claimed to have seen nothing but blood and swabs and wrote that "there was nothing of modern neurosurgery that he could learn from Horsley." The two were chalk and cheese: it's hard to see the patrician teetotal, non-smoker Horsley getting on with the forceful, brash, chain smoking American* (Powell, 2006:1319).

Nonetheless, their relative gifts to modern neurosurgery remain revered to this day, serving as a conduit between Hunter and a modern philosophy of neurosurgery. Whilst at a rudimentary level this philosophy may be regarded as "dedication and hard work" (Awad, 1995), in truth, it centres on a time-honoured pursuit of knowledge and the adoption of an epistemological position that Hunter would have admired (Dutta, 2024).

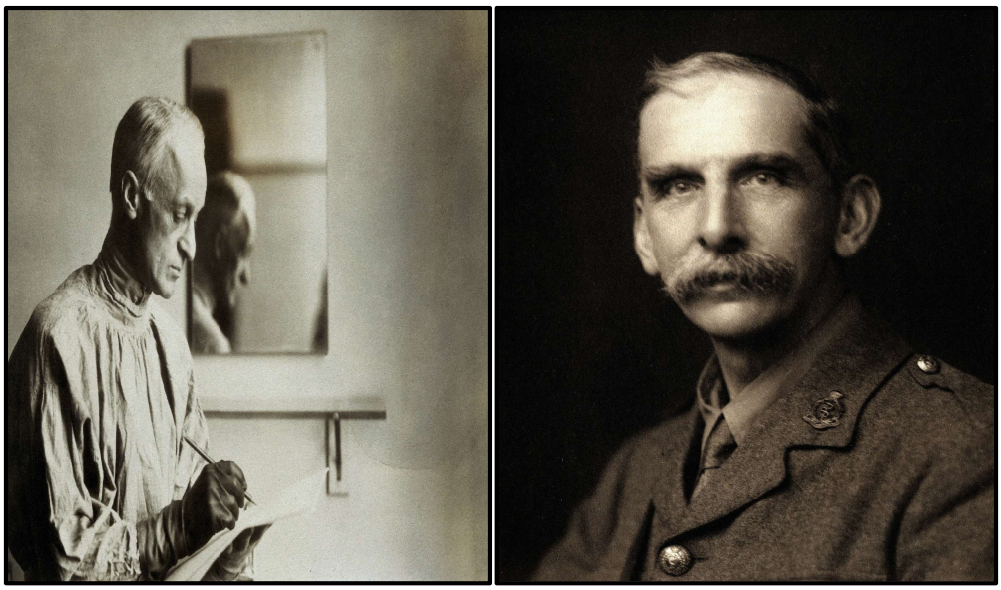

Figure 1: Harvey Cushing (left) and Sir Victor Horsley (right)

Hunter's Contributions to the Neurosciences:

Much like Cushing and Horsley, Hunter was never far away from professional conflict. The medical societies that "blossomed" in the late 18th Century were a hotbed for opinion and debate (Wade, 2005). Consequently, Hunter was known for his "volatile temperament", most often born out of frustration for antiquated approaches to clinical practice and knowledge (Wade, 2005) but culminating in his sudden death from cardiac disease at one such meeting (Perry, 1993). Some have debated the interplay between Hunter's organic disease and his state of mind, and whether this was a consequence of self-inoculated neurosyphilis (Brain, 1952; Perry, 1993). Yet Hunter's lived experience was undoubtedly in the confines of neurological disease, taking a form of sensory epilepsy and multifaceted hyperaesthesias (Brain, 1952). Altogether, this must have informed much of his academic curiosity in this domain, which centred on elements of neural transmission within the senses and peripheral nervous system (Dellon, 2025).

It is sometimes perceived that Hunter lacked interest in the "teaching of single systems or [the] narrow confines within the animal economy" (Stone, 2007), but this would surely be countered by his considerable efforts in comparative anatomy and his defining of disease processes within a multitude of organ systems (Hunter, 1837). Hunter contributed the first microscopic descriptions of the olfactory nerves and their relation to the nasal cavity and smell; described in detail characteristics of the variable forms of painful stimuli, as well as the phenomenon of referred - or "sympathetic" - pain (Stone, 2007; Dellon, 2025); and he pre-empted Müller's *Law of Specific Nerve Energies* (Cohen, 1956) - "a mechanical impression on the retina produces an impression of light; a blow on the ear a sensation of sound" (Hunter, 1837). In this vein, he asserted several of the founding principles of neurophysiology:

The nerves have but one mode of action, namely, that of conveying impressions [sensory nerves]; but this in two different directions: one from their extremities in the body towards the brain, conveying impressions made on them to the brain, in order to

excite actions suitable to these impressions; the other, from the brain to the extremities, conveying the mandates of the will [motor nerves] (Hunter, 1837).

The essence of Neurosurgery is to allow for the normal functioning of the nervous system. Most often this is achieved by decompression of the neural elements that are afflicted by physical disease, but increasingly we modulate (Functional Neurosurgery) the physiology of the nervous system through the very principles that Hunter so presciently observed and would surely now gleefully remark.

The Pursuit of Neuroanatomical Ground Truth:

Through his comparative studies, Hunter contributed significantly to our knowledge of neuroanatomy - his dissection of the *cauda equina* being especially impressive (Cade, 1963). It is, however, a misconception to assert that our anatomical knowledge is complete and confined to history. The human brain is a focus of renewed attention due to the many putative and transformational possibilities that lie within for the treatment of neurological disease. Recent years have seen exponential growth in our understanding of white matter connectivity, with implications for the safer treatment of numerous neurosurgical diseases and for harnessing the rehabilitative potential of neuroplasticity (Duffau, 2006). This enthusiasm has largely been accelerated by dedicated radiological techniques, namely *diffusion-tensor imaging* (tractography) (Catani, 2002).

There remains, however, the need for an anatomical *ground truth* with which to validate this new knowledge. As a result, dissection remains the foremost means by which the structural secrets of the human brain are revealed to us. Still, it is necessary to adapt to and overcome its limitations. For example, understanding the exact cortical connectivity of the cerebral white matter requires modification of classical, destructive techniques through so-called ‘inside-out’ dissection (Dannhoff, 2024). Hunter famously quipped to Astley Cooper the need to “grow wiser every year” (Cohen, 1956) and we must, notwithstanding the time that’s passed since his own essential dissections.

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Indeed, much remains unknown and is especially true regarding the brain's deep vascularisation (Smirnov, 2021) despite Hunter's own prominent descriptions of cerebral end-arteries (Shellshear, 1920). The brain is in fact replete with perforating vessels (Vogels, 2021), with obvious, deleterious implications to neurological function in disease. The more recent acquisition of microsurgical knowledge and technique has advanced our understanding of this important anatomy, yet we find we return to the illuminations of Hunter's most ardent principles and sheer dedication to the anatomical craft.

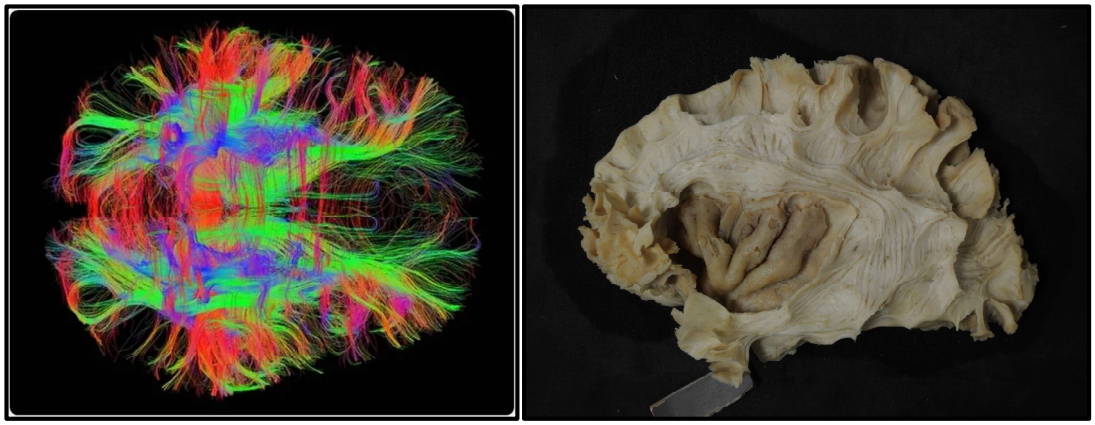

Figure 2: The human connectome: Diffusion-tensor Imaging versus white matter dissection.

Conclusion:

A hypothesis which becomes dispossessed by new facts dies an honourable death; and if it has already called up for examination those truths by which it was annihilated, it deserves a moment of gratitude

John Hunter (quoted by Cohen, 1956:649)

Neurosurgery owes its gratitude to John Hunter. It was founded on his unwavering principles yet scratch beneath the surface and we find a richer acknowledgement of

Hunter's legacy and a common philosophy. Neurosurgery is, therefore, an especially scientific and surgical discipline, just as Hunter would intend. This essay hopes simply to illuminate just some of Hunter's lasting legacy.

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Word Count: 1999

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