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## **Science, Religion and the Mind-Brain Problem – The Case of Thomas Willis (1621-1675)**

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*Thomas Willis, the seventeenth-century physician and churchman, lived at the confluence of powerful cultural forces, especially related to tectonic shifts in science and religion. Because of his prominence as a neuroscientist, his case serves to demonstrate that, at the onset of modernity, science and faith did not meet one another as self-contained, hermetically sealed entities. Rather, science had been formed through religious assumptions, just as religion had been formed through scientific assumptions. In particular, Christian perspectives on body-soul dualism had been built up on the foundations of classical science. Consequently, the conflict alleged between science and Christian belief regarding human nature might better be cast as a clash between rival scientific accounts – the one having achieved powerful ecclesiastical sanction, the other an emerging newcomer to the ‘new science’.*

**Keywords:** Thomas Willis, anthropology, body-soul dualism, monism, neuroscience.

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Significant advances in our understanding of the brain in the last three decades might lead one to the conclusion that the science-religion interface is troublesome today to an unprecedented degree, at least with regard to the nature of the human person. As Thomas Metzinger observes, ‘Implicit in all these new data on the genetic, evolutionary, or neurocomputational roots of conscious human existence is a radically new understanding of what it *means* to be human’ – and, he avers, this emerging account of the human person is ‘strictly incompatible with the Christian image of man’.<sup>1</sup> Presumably, this is because the neuroscientific tightening of the mind-brain link renders increasingly improbable the need for the soul as an ontologically separable entity. We would be mistaken to imagine that our era is *sui generis* at least in this respect, however. In fact, these issues surfaced already in seventeenth-century England, where the ‘new science,’ with its materialist focus and empirical emphasis, seemed destined for a head-on collision with traditional theology. This constellation of issues comes into focus in an illuminating way in the work of

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1 Metzinger, T. ‘Introduction: Consciousness Research at the End of the Twentieth Century’, In Metzinger, T. (ed.) *Neural Correlates of Consciousness: Empirical and Conceptual Questions*, Cambridge, Massachusetts: MIT Press (2000) pp. 1-12 (p. 6).

Thomas Willis, who lived at the juncture of competing interests and commitments, especially concerning epistemology and changing models in the biological sciences and, by extension, with regard to the intersection of science and Christian doctrine. What is the basis of knowledge in the natural sciences? How ought one to explain evidence from the clinic, laboratory and post-mortem examination with regard to biological function and the nature of the human creature? These questions ought to be pressing for someone like Willis, an orthodox and pious Anglican *and* pioneer in the new science, with its evidentiary requirements.

Ours is not an examination motivated by antiquarian interest, however. With regard to contemporary views of the nature of human beings and philosophy of mind, Kevin Corcoran has recently concluded that ‘the mind-body problem remains wide open’.<sup>2</sup> This would come as a surprise to mid-twentieth-century readers of one of the earlier histories of neurology, wherein Walther Riese confidently asserts that the human soul, a stranger to the anatomical structures of the cerebrum, had been eliminated in the 1800s by philosophers, naturalists and physicians.<sup>3</sup> In the same way, Corcoran’s assessment complicates the confident assertion of Nobel laureate Francis Crick: “You,” your joys and your sorrows, your memories and your ambitions, your sense of personal identity and free will, are in fact no more than the behavior of a vast assembly of nerve cells and their associated molecules.<sup>4</sup> Nevertheless, standard textbooks on the philosophy of mind<sup>5</sup> continue to discuss a range of options for articulating the nature of the relationship of mind and brain, just as neurobiologists admit to the persistence of an ‘explanatory gap’ regarding how the physical correlates of a phenomenal state are related to our subjective feelings of that state.<sup>6</sup>

Ferment on this matter has generated a range of options in addition to the materialism championed by Crick and many others – substance dualism (Swinburne), naturalistic dualism (Chalmers), wholistic dualism (Cooper), emergent dualism (Hasker), two-aspect monism (Jeeves), constitutional materialism (Corcoran, Baker), emergent monism (Clayton), and nonreductive

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2 Corcoran, Kevin ‘Introduction’, In Corcoran, K. (ed.) *Soul, Body, and Survival: Essays on the Metaphysics of Human Persons*, Ithaca: Cornell University Press (2001), pp. 1-11 (p. 11).

3 Riese, W. *A History of Neurology*, New York: MD Publications (1959), pp. 19-48.

4 Crick, F. *The Astonishing Hypothesis: The Scientific Search for the Soul*, New York: Simon & Schuster (1994), p. 3.

5 e.g., Graham, G. *Philosophy of Mind: An Introduction*, 2nd ed., Introducing Philosophy, Oxford: Blackwell (1998), pp. 145-74; Heil, J. *Philosophy of Mind: An Introduction*, Routledge Contemporary Introductions to Philosophy, London: Routledge (1998).

6 Levine, J. ‘Materialism and Qualia: The Explanatory Gap’, *Pacific Philosophical Quarterly* (1983) 64, pp. 354-61; Greenfield, S. ‘Soul, Brain and Mind’, In Crabbe, M.J.C. (ed.) *From Soul to Self*, London: Routledge (1999), pp. 108-25; Metzinger, T. (ed.) *Neural Correlates of Consciousness*.

physicalism (Murphy), for example.<sup>7</sup> With this increase in philosophical attention, the debate has come full circle, since, in Western thought, its beginnings can be traced to the dualism of Plato (c.429-347 BC), the monism of Aristotle (384-322 BC), and the range of metaphysical permutations aligned along this continuum.<sup>8</sup> Even as early as the late fifth century BC, however, the most famous physician of classical antiquity, Hippocrates (and those treatises attributed to him), weighed in on the relation of *σώμα* (*soma*, 'body') and *ψυχή* (*psychē*, 'soul', 'self', 'personality'), and historically the terms of this debate have been correlated with anatomical and physiological factors, especially as these have been related to concerns of a religious sort. That is, the mind-body problem has been the gathering point for wide-ranging perspectives – philosophy, theology, the natural sciences and the psychological sciences, among the most prominent.

At one level in this essay, I will sketch the contribution of Dr Willis to medicine and, in particular, to the field of study now known as the neurosciences. This will necessarily involve us briefly in biography, especially in an exploration of the various paths that intersect and intermingle in his world and, thus, in his work – regarding *science*, and particularly the competing models of bodily organisation that vied for explanatory hegemony in the mid-seventeenth century; concerning *epistemology*, and especially changing attitudes and practices related to the propagation and adoption of knowledge in the natural sciences; and regarding *the relation of Christian theology to the 'new science'*. Willis' navigation of these entanglements was in some ways ingenious, allowing him continued, unfettered status in the church as well as notoriety in neuroanatomy and success as a physician. At the same time, we will see that Willis' solution could only be short-lived – not simply because he embraced a view of the 'soul' that was out of step with the theological tradition it sought to

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7 Swinburne, R. *The Evolution of the Soul*, rev. ed., Oxford: Clarendon (1997); Chalmers, D.J. *The Conscious Mind: In Search of a Fundamental Theory*, Oxford: Oxford University Press (1996); Cooper, J.W. *Body, Soul, and Life Everlasting: Biblical Anthropology and the Monism-Dualism Debate*, 2nd ed., Grand Rapids, Michigan: Wm.B. Eerdmans(2000); idem, 'Biblical Anthropology and the Body-Soul Problem', In Corcoran, K. (ed.) *Soul, Body, and Survival*, pp. 218-28; Hasker, W. *The Emergent Self*, Ithaca: Cornell University Press (1999); idem, 'Persons as Emergent Substances', In Corcoran, K. (ed.) *Soul, Body, and Survival*, pp. 107-19; Jeeves, M.A. *Human Nature at the Millennium: Reflections on the Integration of Psychology and Christianity*, Grand Rapids, Michigan: Baker (1997); Corcoran, K. 'Persons and bodies', *Faith & Philosophy* (1995) 12, pp. 324-39; idem, 'Physical Persons and Postmortem Survival without Temporal Gaps', In Corcoran, K. (ed.) *Soul, Body, and Survival*, pp. 201-17; Baker, L.R. 'Need a Christian Be a Mind/Body Dualist?', *Faith & Philosophy* (1995) 12, pp. 489-504; idem, *Persons and Bodies: A Constitution View*, Cambridge Studies in Philosophy, Cambridge: Cambridge University Press (2000); Clayton, P. 'Neuroscience, the Person, and God: An Emergentist Account', In Russell, J.R. et al. (eds.) *Neuroscience and the Person*, Scientific Perspectives on Divine Action, Vatican City State: Vatican Observatory (1999) pp. 181-214; Murphy, N. 'Nonreductive Physicalism: Philosophical Issues', In Warren S. Brown et al. (eds.) *Whatever Happened to the Soul? Scientific and Theological Portraits of Human Nature*, Theology and the Sciences, Minneapolis: Fortress (1998), pp. 127-48.

8 cf. Wright, J.P., and Potter, P. (eds.) *Psyche and Soma: Physicians and Metaphysicians on the Mind-Body Problem from Antiquity to Enlightenment*, Oxford: Oxford University Press (2000).

preserve, but above all since his work, especially in cerebral localisation, could not but undermine his metaphysical position vis-a-vis the 'soul'. Assessments of the relationship between science and religion in seventeenth-century England that tended toward a model of inherent conflict judged the outcome in different ways, with some maintaining that religion had a deleterious effect on science,<sup>9</sup> and others identifying religion as the loser.<sup>10</sup> To the contrary, I will argue that, although superficially a case of science-religion antagonism, the situation, exemplified in Willis, was characterised by mutual influence rather than conflict, with the one informing and patterning the other.<sup>11</sup>

### Thomas Willis, Founder of Neurology

In the West, at the turn of the twenty-first century, most people would locate both mind and human distinctiveness in relation to the brain, and human behaviour in relation to the central nervous system. This represents a rather startling series of innovations when compared to widely held views among people in the mid-seventeenth century. For many of them, the heart was just as central as the brain, if not more so, and both mental and physical qualities were determined by the liquid and ethereal substances ('humours') found in the 'caverns' or hollow spaces (and not the solid tissues) of the brain. Perhaps no one in the seventeenth century was more responsible for clearing this new path of understanding than Thomas Willis, who has been credited with 'practically refound[ing] the anatomy and physiology of the brain and nerves';<sup>12</sup> identified with Galen and Vesalius as 'the *Great Triumvirate* of neurology';<sup>13</sup> and hailed as 'the first inventor of the nervous system' and 'Father of Localisation'.<sup>14</sup>

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9 e.g., Brazier, M.A.B. *A History of Neurophysiology in the 17th and 18th Centuries: From Concept to Experiment*, New York: Raven (1984), pp. 63-66.

10 e.g., Shapiro, B.J. *Probability and Certainty in Seventeenth-Century England: A Study of the Relationship between Natural Science, Religion, History, Law, and Literature*, Princeton, New Jersey: Princeton University Press (1983), p. 74.

11 That the conflict metaphor for the historical relationship of science and faith requires significant nuance, particularly in the favour of our recognition of mutual relevance and influence, is increasingly acknowledged. For more nuanced perspectives on the historical and contemporary science-religion interaction, see, e.g., Russell, C.A. *Cross-Currents: Interactions between Science and Faith*, Grand Rapids, Michigan: Wm.B. Eerdmans (1985); Lindberg, D.C., and Numbers, R.L. (eds.) *God and Nature: Historical Essays on the Encounter between Christianity and Science*, Berkeley: University of California Press (1986); Brooke, J.H. *Science and Religion: Some Historical Perspectives*, The Cambridge History of Science Series, Cambridge: Cambridge University Press (1991); Alexander, D. *Rebuilding the Matrix: Science and Faith in the 21st Century*, Oxford: Lion (2002).

12 Sherrington, C.S. *Man on His Nature*, The Gifford Lectures 1937-38, 2nd ed., Cambridge: Cambridge University Press (1951), p. 194.

13 Spillane, J.D. *The Doctrine of the Nerves: Chapters in the History of Neurology*, Oxford: Oxford University Press (1981), p. 5.

14 Miller, W. 'Thomas Willis (1621-1675)', *Bulletin of the Society of Medical History of Chicago* (1923) 3, pp. 215-32 (p. 227).

According to his biographers, Willis considered a vocation in the church.<sup>15</sup> Indeed, his Oxford education, with Greek and Latin, logic and metaphysics, and mathematics at the core of the curriculum, could have launched him in the direction of any number of pursuits. Following his graduation with the BA in 1639 and MA in 1642, however, the unsettled state of the country turned his attention to medicine, a career he was to enter with only minimal formal training. Medical preparation at Oxford was typically a three-year affair, primarily under the tutelage of the Regius Professor of Physic and at the feet of the classics (among whom Galen and Aristotle would have figured most prominently), but Willis' training was cut short by a severe epidemic, which took his father as a casualty. Willis returned to the family farm, which he managed for a short period before the onset of his military service in the Royalist University Legion. There he remained until the surrender of Oxford to Fairfax in 1646, followed six months later by his graduation with the Bachelor of Medicine. He went on to add the 'doctor of physic' in 1660.

Willis was able to parlay his professorial appointment and his medical practice into an ever-expanding arena for medical inquiry. Eschewing the constraints of university regulations placed on his professorial appointment, that he read to an audience of undergraduates from Aristotle each Wednesday and Saturday morning, he focused instead on neurological and psychological disorders, as well as the chemical basis of medicine. He writes,

I determined with my self seriously to enter presently upon a new course, and to rely on this one thing, not to pin my faith on the received Opinions of others, nor on the suspicions and guesses of my own mind, but for the future to believe Nature and ocular demonstrations: Therefore thenceforward I betook my self wholly to the study of Anatomy: and as I did chiefly inquire into the offices and uses of the Brain and its nervous Appendix, I addicted my self to the opening of Heads...and so a firm and stable Basis might be laid, on which not only a more certain Physiologie than I had gained in the Schools, but what I had long thought upon, the Pathologie of the Brain and nervous stock, might be built.<sup>16</sup>

Thus did his academic post require that he develop a research programme, and this he did by gathering around himself a veritable team of talented sci-

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15 For biographical information, see Dewhurst, K. *Thomas Willis as a Physician*, Los Angeles: University of California Andrews Clark Memorial Library (1964); idem, 'Thomas Willis and the Foundations of British Neuroscience', In F.C. Rose and W.F. Bynum (eds.) *Historical Aspects of the Neurosciences: A Festschrift for Macdonald Critchley*, New York: Raven (1982), pp. 327-46; Feindel, W. 'The Origin and Significance of *Cerebri anatome*', In William Feindel (ed.) *The Anatomy of the Brain and Nerves*, by Thomas Willis, The Classics of Medicine Library, Birmingham: McGill-Queens University Press (1978), pp. 1-53; Finger, S. 2000. *Minds behind the Brain: A History of the Pioneers and Their Discoveries*. Oxford: Oxford University Press (2000); Hughes, J.T. 'Thomas Willis (1621-1675)', *Journal of Neurology* (2000) 247, pp. 151-52; Isler, H. *Thomas Willis (1621-1675): Doctor and Scientist*, New York: Hafner (1968); Miller 'Thomas Willis'.

16 Willis, T. *The Anatomy of the Brain and Nerves*, Pordage, S. (trans.), Feindel, W. (ed.), The Classics of Medicine Library, Birmingham: McGill-Queens University Press (1978 [1681]), preface.

entists.<sup>17</sup> In the years that followed, Willis and his team cultivated a wide range of research methods: the dissection of numerous animals, and of a wide variety, contributing to his reflections on *comparative anatomy*; human *necropsy*, especially of victims of the gallows; *physiological experimentation* – including experimental lesions and the injection of coloured fluids to trace the vasculature of the central nervous system; astute *history taking and clinical observation*;<sup>18</sup> and post-mortem investigation of some of his own patients, allowing for *clinicopathological correlations*. His multifarious approach allowed him to privilege actual observation over the time-honoured and authoritative statements of the classical medical texts.

Willis did not initially embark on a path leading to an emphasis on neurological research, but was compelled in this direction by circumstances both serendipitous and tragic. First, early on in his medical career, Willis was associated with the *Virtuosi*, a prodigious group of scientists, propagators of the ‘new science’, with only few exceptions men of Christian conviction who saw in the discoveries of natural science confirmation of their faith. This ‘Invisible College’ was the precursor to the Royal Society, to which Willis was elected in 1663 and, following an oversight, finally admitted as a Fellow in 1667. Committed empiricists, some of the *Virtuosi* possessed strong interest in neuroscience. Secondly, between 1657-1661 a series of outbreaks of neurologically significant epidemics troubled Oxford, meningococcal meningitis and encephalitis lethargica among them. Conducting autopsies on some of the dead, Willis recognised that current textbook descriptions of the human brain were woefully inaccurate. Thirdly, as we have seen, Willis’ approach to his academic post both required his devotion to research in the ‘doctrine of the nerves’ and gave him the wherewithal for doing so. Finally, Willis came onto the stage of biological inquiry at an opportune moment, when the stranglehold of ancient theories on current thinking and practices was being loosened.

With regard to this last point, the work of William Harvey (1578-1657) was crucial. Harvey demonstrated that blood flowed continuously and rapidly through the arteries and veins of the body. This indicated that the heart was nothing but a mechanical pump, not the centre of cognition or affect (for example), nor a source of one of the four humours. It is perhaps not too much to say that what Harvey did for the vasculatory system, Willis was to accomplish with reference to the nervous system, since he determined that the brain was the controller of involuntary mechanisms and (with reference especially to the cerebral cortex) the centre of vital human functions. After Willis, it would

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17 See the discussion in Feindel, ‘Origin and Significance’; idem, ‘The Beginning of Neurology: Thomas Willis and His Circle of Friends’, In Clifford, F.R. (ed.) *A Short History of Neurology: The British Contribution 1660-1910*, Oxford: Butterworth-Heinemann (1999), pp. 1-18.

18 Only recently has Willis’ skill in this area begun to be lauded – cf. Spillane, *Doctrine of the Nerves*, pp. 59-77; Williams, A.N. ‘Too Good to Be True? Thomas Willis – Neonatal Convulsions, Childhood Stroke and Infanticide in Seventeenth Century England’, *Seizure* (2001) 10, pp. 471-83; Williams, A.N., and Sunderland, R. ‘Thomas Willis: The First Paediatric Neurologist?’, *Archives of Disease in Childhood* (2001) 85, pp. 506-09.

become impossible to embrace the widely and long-held ventricular theory, which postulated that the ventricles of the brain functioned as the locus of the metaphysical attributes of the mind. In other words, the direction in which first Harvey and then Willis was moving would make it increasingly transparent that life was not something introduced to or imposed on the human body from the outside, but was in some sense a characteristic or property of the bodily systems themselves, or an emergent property of their interrelations. This required an intellectual shift of enormous proportions, since it indicated that the workings of the human body were subject to patently physiological explanation.

It was under Gilbert Sheldon's patronage that Willis had been appointed to the Sedleian Chair. Having served as Bishop of London before his election as Archbishop of Canterbury, Sheldon was a cleric of considerable influence. This was crucial above all because of the canopy of socioreligious security it provided Willis. Descartes had withheld publication of his *Traité de l'Homme* due to the watchful eye of the Catholic Church (the menacing shadow of Galileo's censure and trial fell on all scientists), and it was not uncommon in the sixteenth century for scientists to employ themselves at being well-connected so as to situate their scientific claims under the protective support of royalty, well-placed churchmen, academic societies, and the like.<sup>19</sup> It was at Sheldon's initiative that Willis moved to London around 1667/68, where Sheldon had made his residence, consummating the patron-client relationship, evident in Willis' attending Sheldon after his stroke and his dedicating his *Anatomy* to Sheldon.<sup>20</sup> This helps to clarify Willis' ongoing esteem in the church, even if his move did not significantly alter the trajectory of his research or his medical career. He kept his professorship until his death, from pneumonia, in late-1675, and, when relocating to London, quickly built up a successful practice.

Beginning in 1659 and continuing until the posthumous publication of the last of his work, Willis published seven books,<sup>21</sup> for our purposes the three most important of which were *Cerebri anatome: Cui accessit nervorum descriptio et usus*, published in 1664 in Latin, 'englished' by Samuel Pordage in 1681 as *The anatomy of the brain and nerves*; *Pathologiae cerebri et nervosi generis specimen in quo agitur de morbis convulsivis et scorbuto* (*Specimen of the pathology of the brain and nervous system*), published in 1671;<sup>22</sup> and *De anima brutorum*,

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19 cf. Dear, P. *Revolutionizing the Sciences: European Knowledge and Its Ambitions, 1600-1700*, Princeton, New Jersey: Princeton University Press (2001), pp. 109-23; Brazier, *History*, pp. 19, 64. 20 Westfall, R.S. 'Willis, Thomas', Galileo Project: Catalog of the Scientific Community, <http://es.rice.edu/ES/humsoc/Galileo/Catalog/Files/willis.html>; accessed 21 January 2002; Isler, *Thomas Willis*, pp. 154, 191-92.

21 For summaries, see Isler, *Thomas Willis*, pp. 45-185.

22 In addition to Willis, T. *Anatomy of the Brain and Nerves*; and, idem, *Two Discourses concerning the Soul of Brutes, Which Is That of the Vital and Sensitive of Man*, Pordage, S. (trans.), Gainesville, Florida: Scholars' Facsimiles and Reprints (1971 [1683]), English translations of selected texts from Willis are available in Clarke, E., and O'Malley, C.D. *The Human Brain and Spinal Cord: A Historical Study Illustrated by Writings from Antiquity to the Twentieth Century*, Berkeley: University of California Press (1968).

*quae hominis vitalis ac sensitiva est, exercitationes duae*, published in 1672, also translated by Pordage, in 1683, as *Two discourses concerning the soul of brutes, which is that of the vital and sensitive of man*. Here is found the primary evidence of Willis' expansive contribution to the beginnings of modern neuroscience, including the neologism with which he is most associated – the introduction in Willis' *Cerebri anatome* (1664) of the Greek νευρολογίας (from νευρον [*neuron*, first used of 'nerves' as 'organs of sensation' by Erasistratus (c.315-240 BC)] + λογος [*logos*, 'word' or 'principle'] in an otherwise Latin text, translated early on as 'doctrine of the nerves', but later simply transliterated as *neurology*. Here, too, we find such innovations as Willis' localisation of specific functions in precisely designated parts of the brain; his location of such 'soulful' attributes as imagination and memory in the substance of the brain; his argument, based in part on comparative anatomy, of a direct correlation between intelligence and convoluted complexity of the cerebrum; and his description of such conditions as epilepsy, paralysis and hysteria as maladies of the nervous system.

### **The Two Souls of Thomas Willis**

Two apparently competitive realities intersect in the work of Thomas Willis: (1) the kinship of the natural sciences, theology and philosophy in the sixteenth and seventeenth centuries; and (2) the implication of the work of such scientists as Harvey and Willis, that life was not something introduced to or imposed on the human body from the outside, but was in some sense a characteristic or property of the parts themselves, or an emergent property of their interrelations. From a perspective removed by some three-and-a-half centuries, the focal point of looming conflict was belief in the soul – or, to be more specific, the dualism of body and soul, mind and brain. After all, in Willis' work, 'the spirits of the life-soul were tending, literally, to "materialize"'.<sup>23</sup> In another sense, the science-religion conflict centred on epistemology; however, epistemological questions themselves came into focus above all in study of and reflection on the nature of the cosmos, and this was both epitomised and exemplified in questions concerning the nature of the human person. In this section, then, I will first explore the epistemological challenge represented in the new science, with its materialist point of departure. This will lead naturally into an examination of the relationship between scientific and theological anthropology. I hope to demonstrate how science and religion were organically related and mutually influential.

### **Epistemological Shifts**

The era into which Willis was born was characterised by an epistemic shift of mammoth proportions. 'Probability', 'belief' and 'credibility', once the almost

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<sup>23</sup> Sherrington, *Man on His Nature*, 194.

sole possessions of the theologian, were to become discursive categories for natural scientists as well, as unassailable authorities of the past, and the importance of philosophical coherence, gave way to empiricism and observation.<sup>24</sup> Even in embryonic form, this 'modernism' was characterised by its independence from the past, its recognition of the historical rootedness of all knowing, and therefore the import of carrying on inquiry apart from an *a priori* commitment to an informing tradition. As the crest of the Royal Society had it (citing Horace), *Nullius in verba* ('On the word of no one'). This revolution was in process during the time of Willis, and this helps to set his work into sharper relief.

Even if the hallowed authorities were passing into the shadows, so bright were their lights that their presence and power were still very much in evidence, both in intellectual circles and especially in popular practices. In the field of medicine, those authorities were, first, Galen, and then Aristotle.<sup>25</sup> The normal procedure for carrying on scientific 'research' is suggested by Andreas Vesalius (1514-1564), writing a century before Willis:

How much has been attributed to Galen, easily leader of the professors of dissection, by those physicians and anatomists who have followed him, and often against reason! In confirmation there is that blessed and wonderful *plexus reticularis* which that man everywhere inculcates in his books. There is nothing which physicians speak more often. They have never seen it (for it is almost non-existent in the human body), yet they describe it from Galen's teaching. Indeed, I myself cannot wonder enough at my own stupidity and too great trust in the writings of Galen and other anatomists; yes, I who so much laboured in my love for Galen that I never undertook to dissect a human head in public without that of a lamb or ox at hand, so as to supply what I could in no way find in that of man, and to impress it on the spectators, lest I be charged with failure to find that plexus so universally familiar by name. For the soperal [=internal carotid] arteries quite fail to produce such a 'plexus reticularis' as that which Galen recounts! (*On the Human Brain* 7.12)<sup>26</sup>

Even in these critical remarks, Vesalius acknowledged the potent convention of traversing the footpaths of the ancients, without question. Similarly, with reference to the neuroanatomy of Aristotle and his followers, Vesalius writes, 'Such are the inventions of those who never look into our Maker's ingenuity in the building of the human body!' (7.1). Again of Galen: 'In saying these things I admit that innumerable tenets of Galen contradict me; such as that of

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24 cf. Hooykaas, H. *Fact, Faith and Fiction in the Development of Science*, The Gifford Lectures 1976, Boston Studies in the Philosophy of Science 205, Dordrecht: Kluwer (1999); Shapiro, *Probability and Certainty*.

25 See Walsh, J.J. *Medieval Medicine*, Medical History Manuals, London: A. & C. Black (1920).

26 Translations of Vesalius are from Singer, C. *Vesalius on the Human Brain: Introduction, Translation of Text, Translation of Descriptions of Figures, Notes to the Translations, Figures*, London: Oxford (1952).

the anterior ventricles are the olfactory organs; that these ventricles, gradually increasing in softness, end by constriction into the visual nerves; yet more strangely that these front ventricles of the brain emit phlegm to the nose. *These and many other things of the kind are, I am convinced, learned rather from copious discussion than from dissection, for these things are so obvious that it is superfluous to warn against them those who dissect the brain themselves or watch others dissecting, and do not trust merely in books'* (7.5; emphasis added). We may recall Willis' words that preface his *Anatomy*, declaring his predilection for 'the opening of Heads' rather than placing his trust in 'the received Opinions of others'. However much this might seem natural to those of us weaned on critical thinking, the degree to which such thinking was out of step with the times is suggested not only by Vesalius' admission of his own gullibility but also by the brutal attack on Vesalius by his one-time mentor, Jacobus Sylvius (1478-1555), who in his defence of Galen ridiculed Vesalius as an incompetent madman.<sup>27</sup>

Actually, it is unclear in what way(s) Aristotle had real influence, at least as regards the importance of his writings for our present purposes. Even though his name was much spoken, by Willis and others, his thought seems not to have been well represented, and it is interesting that, to this day, neuroscientists can write, erroneously, of Aristotle's views of the nonmateriality of the soul and its location in the heart.<sup>28</sup> It is true that Aristotle privileged heart over head as the primary sense organ, and relegated the brain to service as a kind of radiator for the blood, but he was no dualist and any attempt to specify on Aristotle's behalf the 'seat of the soul' is misguided. Having devoted an entire treatise to the subject, he sketches a view of 'soul' (*ψυχή, psychē*) as that in virtue of which an organism is alive (*On the Soul* 2.1 §§412a-413a10), the form or essence of the living body that is a plant or animal or human being. Accordingly, 'soul' is no 'it' with an independent existence, nor a quality characteristic of humankind in contradistinction to other forms of life. Plants are alive and are therefore 'soulish' because they have and perform certain vital functions (such as growth and reproduction), yet they perform no functions that we might call cognitive or psychological. Not only is Aristotle a monist, then, but his position disallows reductionism of a living organism to the matter out of which it is made. Moreover, on the positive side of the ledger, Aristotle's conception urges a unified view of the human person, highlights the importance of human capacities, underscores the essential relatedness of humanity with other living beings, and emphasises, in the case of the human, especially social activity. For this reason, philosophers and psychologists at the turn of the twenty-first century might find themselves drawn to Aristotle's psychology for its potential in shaping present-day accounts of the human person. In Willis' time (and for many

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<sup>27</sup> cf. Finger, *Minds behind the Brain*, pp. 65-66.

<sup>28</sup> e.g., Peacock, A. 'The Relationship between the Soul and the Brain', In Rose, F.C., and Bynum, W.F. (eds.) *Historical Aspects of the Neurosciences*, pp. 55-81; Kolb, B., and Whishaw, I.Q. *An Introduction to Brain and Behavior*, New York: Worth (2001), p. 8.

since), however, Aristotle's position had been transformed, by Descartes, from theoretical psychology into epistemology, and thus from talk of 'soul' to the category of 'mind',<sup>29</sup> and it is often through Cartesian categories that Aristotle was to be accessed.

The influence of Galen (AD 129–?199/216) is another matter.<sup>30</sup> The persistence of his work can be attributed in large part to his efforts at developing an approach to medicine that embraced the whole of the field, and to the sheer volume of his writing. Particularly productive in the fields of physiology and anatomy, his pathology focused on the importance of physiological integration – especially the balance of the four humours that together comprised the human body, and the administration of the body throughout life via three centres: the brain, by means of nerves and muscles; the heart, by means of arteries; and the liver, by means of veins. Galen was deliberately noncommittal on the nature of the human soul, and he located mental processes in the substance of the brain. This was due to his essential materialism, manifest in his presumption that physicians did not require metaphysical clarity as long as they grasped the different influences of the humours on mental faculties.<sup>31</sup> Even among those who fully embraced his humoral theory, Galen would be regarded as suspect on account of his ambivalence regarding the human soul. In fact, among the seventeenth-century opponents of the new science, Galen was a powerful warning of the religious price to be paid when adopting a materialist approach. Nevertheless, Galenism, as a medical philosophy, colonised the world of medicine from the second into the seventeenth centuries, and continued its hegemony even after the rise of 'modern science' among persons remote from urban centres.

Galen claimed his allegiance to observation, and in this Vesalius and Willis were his heirs, but Galen's theories did not always live up to the scientific standards he set for himself. Thus, for example, his loyalty to Hippocrates led him to find anatomical features in the brain that actually were not present; likewise, his devotion to teleological reasoning (Given belief in Design, what function ought this organ to serve?) militated against physiological observation and conclusion (What function does this organ serve?). In Willis, we see points of contact with Galen, not least with regard to a materialist orientation that privileges the substance of the brain and a commitment to firsthand observation. Willis rejected Galen's humoral theory, however, as well as his teleological

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29 cf. Everson, S. 'Psychology', In Barnes, J. (ed.) *The Cambridge Companion to Aristotle*, Cambridge: Cambridge University Press (1995), pp. 168-94; Frede, M. 'On Aristotle's Conception of the Soul', In Nussbaum, M.C., and Rorty, A.O. (eds.) *Essays on Aristotle's De anima*, Oxford: Clarendon (1992), pp. 93-107; Wilkes, K.V. 'Psuch versus the Mind', In Nussbaum, M.C., and Rorty, A.O. (eds.) *Essays on Aristotle's De anima*, pp. 109-27.

30 See Temkin, O. *Galenism: Rise and Decline of a Medical Philosophy*, Ithaca: Cornell University Press (1973).

31 Siegel, R.E. *Galen on Psychology, Psychopathology, and Function and Diseases of the Nervous System: An Analysis of His Doctrines, Observations and Experiments*, Galen's System of Physiology and Medicine 3, Basel: S. Karger (1973), pp. 113-72.

approach, and adopted an alternative metaphysics that was more palatable to the church.

Two responses to Galen's work which predate Willis need to be noted. First, one of Galen's 'vital spirits' was the πνεῦμα ψυχικόν (*pneuma psychikon*, 'psychic spirit'), which was associated with psychic activity. It was the ψυχή (*psychē*) that traversed the nerves and, for Galen, was contained in the ventricles and functioned to activate brain function. From here, it was perhaps not a small step back to the theory of ventricular localisation. Herophilus of Chalcedon (c.330–260 BC) is usually regarded as the first person to propose that the soul resides in the 'caves of the brain', and already from the fourth century Galen's theory was being eclipsed by this earlier view, as Galen's medical views were synthesised with the theological commitments of such Christian Neo-Platonists as Augustine (AD 354–430) and Nemesius (4th–5th centuries).<sup>32</sup> The logic behind this preferred option is easy to grasp: Since the 'mind' is incorporeal, the ventricular chambers were a ready choice for their seat of operation, with the clear liquid (cerebral spinal fluid) its vehicle.

If the resuscitation of the theory of ventricular localisation represents a shift in Galen's functional anatomy, the alchemical views and iatrochemical movement associated with Paracelsus represent a frontal attack on Galenism. Born Philippus Aureolus Theophrastus Bombastus von Hohenheim (1493–1541), he took the name Paracelsus, perhaps as a way of claiming to have surpassed the Roman physician Cornelius Celsus (25 BC – AD 50), whose medical philosophy was rediscovered and valued in the Middle Ages. For Paracelsus, medical theory and practice grew out of a cosmology holding to the essential unity of nature and then from the macrocosm-microcosm analogy by which the human body was to be understood in relation to the cosmos and particular planets in the universe were correlated with particular minerals, these mystical correlates belonging to the fabric of creation itself.<sup>33</sup> Galen's humours, or vital spirits, were not the true basic elements, and Paracelsus required the body and its maladies to be described in chemical terms – hence, 'chemical medicine', or iatrochemistry.

In sixteenth and seventeenth-century England, medical alchemy was initially divorced from its metaphysical basis in speculative cosmology and, instead, tethered to an empiricism more at home in Galenism. That is, the preparation of 'medicaments' was emphasised, and, after scoring initial successes in the curing of diseases, iachemistry gained a solid footing on pragmatic grounds. By the mid-seventeenth century, however, with the Galenic system waning, a medicine based in experimental chemistry was required. Among the most influential iatrochemists of the late seventeenth century was Thomas

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32 Bruyn, G.W. 'The Seat of the Soul', In Rose, F.C., and Bynum, W.F. (eds.) *Historical Aspects of the Neurosciences*, pp. 55–81.

33 Debus, A.G. *The Chemical Philosophy: Paracelsian Science and Medicine in the Sixteenth and Seventeenth Centuries*, 2 vols., New York: Neale Watson (1977).

Willis, and his first publication, *De fermentatione* (1659), reflects this tradition.<sup>34</sup> Here and elsewhere in Willis, we see early reflection on metabolic processes; the clinical and experimental importance of chemical distillation; and the beginnings of the application of bioenergetics to neural function, with 'animal spirits' responsible for mediating neurotransmission and neurotrophic factors.<sup>35</sup> Perhaps most crucial for our purposes is how Willis' interest in chemical medicine cultivated his commitment to demonstrable science and his awareness of the chemical (and, thus, the material) basis of physiology in general and his views on the chemical basis of nerve function in particular. From here we see emerging Willis' view that psychological processes are dependent upon neural activity of a genuinely physical kind, with nerve impulses generating their effects by travelling along anatomically observable pathways.<sup>36</sup>

We come, finally, to the movement in the seventeenth century toward materialism in science and, thus, to a materialist understanding of the nervous system. If the 'truth' about the human person was decisively determined by Holy Scripture, what would happen when contravening evidence surfaced from extrabiblical sources, particularly from scientific observation? Twenty-first century hermeneuts will recognise the naivety of the question itself: 'What the Holy Scriptures teach' about the human person is always located in a hermeneutical circle (or spiral) with the presumptions brought by the interpreter to the theological enterprise. The issue is nonetheless a pressing one, since this is precisely the terms of the debate in historical perspective. In fact, for many, the mechanistic idea of nature and the scientific materialism of the seventeenth century mounted an offensive against the terms of the Christian faith. By the mid-seventeenth century, competing models of bodily organisation vied for eminence in the world of science (and philosophy of science), and these spread themselves across a continuum of compatibility with long, and widely held, beliefs.<sup>37</sup> Cartesian metaphysics championed not only a property dualism (mental and physical), but also a substance dualism that rendered the unextended, thinking, immaterial soul as unimportant to the mechanics of the extended, unthinking, material body, with the work of heart and nerve the consequence of hydraulic and pneumatic stimuli. The alchemical model, built on the ideas of Paracelsus, located an immaterial spiritual agency in the body's vessels. And Harveian physiology privileged the heart as the engine of blood circulation, limiting pneumatic agency to fermentation (i.e., to metabolic processes). But traditionally, and popularly, the real person, the authentic

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34 cf. Isler, *Thomas Willis*, pp. 47-64; Debus, *Chemical Philosophy*, vol. 1, pp. 519-26.

35 Eadie, M.J. 'The *Explosive Copula* of Thomas Willis', *Clinical and Experimental Neurology* (1993) 30, pp. 17-24.

36 Craneffeld, P.F. 'A Seventeenth Century View of Mental Deficiency and Schizophrenia: Thomas Willis on "Stupidity or Foolishness"', *Bulletin of the History of Medicine* (1961) 35, pp. 291-316 (p. 308).

37 Martensen, R. 'When the Brain Came out of the Skull: Thomas Willis (1621-1675), Anatomical Technique and the Formation of the 'Cerebral Body' in Seventeenth Century England', In Rose, F.C. (ed.) *Short History of Neurology*, pp. 19-35 (pp. 19-21).

'flame of life', was identified with the soul. In fact, the theory of death that pervaded England in this period – whether one was Protestant or Catholic, and of whatever social class – had it that '...body and soul became unhinged at the moment of death and went their separate ways. Kissed by God, the soul was the animating principle. The body was merely a vehicle or an encumbrance'.<sup>38</sup> If, as the new science was urging, 'life' was a characteristic property of a complex body, what was one to make of the soul? As Richard Westfall has observed, irrespective of the *direction* one takes in addressing this question, *the very presence of the question* signals the radical character of the intellectual shift emerging in the mid-1600s.<sup>39</sup>

### **At the Interface of Science and Religion**

Before commenting on how Willis himself navigated the treacherous terrain on the emerging borders of science and religion, two observations are needed. First, as I have earlier hinted, we are dealing with a reality that is *not* defined by the imposition of science on religion, or religion on science. Rather, science and religion participated in the same *Lebenswelt*. In fact, it is one of the characteristic features, and fallacies, of the 'modern' era, even at this early stage, that it supposed it could distance observation from prior interpretive matrices. 'Modernism' as a movement has been characterised by its indifference to the past – indeed, by a presumption of its detachment from history, its occupation of 'a new, autonomous cultural space'.<sup>40</sup> However, how the world works and the constraints of our finitude press for explanation, inevitably attracting the hermeneutical efforts of both natural science and spirituality, with these providing sometimes competing, sometimes complementary, always inextricably related and mutually informing perspectives on these points.<sup>41</sup> The mind-brain link is a case in point.

Though it is common to attribute body-soul dualism to the Christian Bible, this is not easily demonstrable and is widely rejected by biblical scholarship. Scholars of the Hebrew Bible are almost unanimous in their conclusion that the portrait of human nature found in the pages of what we call the Old Testament is of a psychosomatic unity.<sup>42</sup> To cite Genesis 2:7, the human being does

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38 Cressy, D. *Birth, Marriage, and Death: Ritual, Religion, and the Life-Cycle in Tudor and Stuart England*, Oxford: Oxford University Press (1997), p. 384.

39 Westfall, R.S. *Science and Religion in Seventeenth-Century England*, New Haven: Yale University Press (1958), pp. 2-3.

40 Schorske, C.E. *Thinking with History: Explorations in the Passage to Modernism*, Princeton, New Jersey: Princeton University Press (1998), p. 4.

41 Gleiser, M. *The Prophet and the Astronomer: A Scientific Journey to the End of Time*, New York: Norton (2002).

42 cf. Seebass, H. 'vpn', In Botterweck, G.J. et al. (eds.) *Theological Dictionary of the Old Testament*, vol. 9, Grand Rapids, Michigan: Wm.B. Eerdmans (1998), pp. 497-519; Childs, B.S. *Biblical Theology of the Old and New Testaments: Theological Reflection on the Christian Bible*, Minneapolis: Fortress (1992); Di Vito, R.A. 'Old Testament Anthropology and the Construction of Personal Identity', *Catholic Biblical Quarterly* (1999) 61, pp. 217-38.

not *have* a soul, but *is* a soul (that is, a living being [vpn, *nephesh*]). Although the New Testament evidence is more contested, it is nonetheless widely agreed that the Graeco-Roman world of the first century AD was capable of supporting both monist and various dualist anthropologies, and that the New Testament, whose primary theological influence was the LXX (i.e., the Septuagint, the Greek translation of the Hebrew Bible), comes down on the monist side of the continuum.<sup>43</sup> In other words, rather than arguing that religion, grounded in Scripture, was headed for a collision with the new science, it is more accurate to admit that, in the area of an essentialist anthropology, religion had already been shaped by science (and the philosophy of science), with the church now finding itself supporting through powerful ecclesiastical legitimation a scientific view of the human person that was not only at odds with its own primary and constitutive authority, its Scriptures, but also being questioned by science itself. Hence, when, for example, Félix Martí-Ibáez implicates Christian theology in ‘the gigantic conflict between dogmatic tradition and experimental observation’ focused on body-soul dualism, he has set his sights much too narrowly.<sup>44</sup> Without our needing to remove (or being justified in removing) Christian theology from the equation, it is simply the case that, behind body-soul dualism, looms not so much the claims of divine revelation in the Christian tradition, but the voices of earlier generations of scientists.

Admitting this does not detract from the potential of serious science-religion conflict in seventeenth-century England, but it does locate that conflict on a grander mural that rejects the science-religion dichotomy perpetuated subsequently in the history of neuroscience (and in some theological responses to neuroscience). In fact, there is plenty of evidence, not least in response to the dangers of the new science and its materialism, to suggest that the dichotomy was existentially urgent. We may simply note the length to which many new scientists went in order to situate their project theologically. Paracelsus had already spoken in terms of a two-book theory of divine revelation, the two ‘books’ being Holy Scripture and Nature, and this concept became a regular fixture in seventeenth-century English natural theology. Accordingly, science and religion were not antagonistic towards each other, for the new science was nothing more than a simple investigation into God’s creation. True, the mate-

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43 cf., e.g., Green, J.B. ‘Restoring the Human Person: New Testament Voices for a Wholistic and Social Anthropology’, In Russell, R.J. et al. (eds.) *Neuroscience and the Person*, pp. 3-22; idem, ‘Eschatology and the Nature of Humans: A Reconsideration of the Pertinent Biblical Evidence’, *Science & Christian Belief* (2002) 14, pp. 33-50; idem, ‘What Does It Mean to Be Human? Another Chapter in the Ongoing Interaction of Science and Scripture’, In Jeeves, M.A. (ed.) *From Cells to Souls: Changing Portraits of Human Nature*, Grand Rapids, Michigan: Wm.B. Eerdmans (2003) in press; Warne, G.J. *Hebrew Perspectives on the Human Person in the Hellenistic Era: Philo and Paul*, Mellen Biblical Press Series 35, Lewiston: Mellen Biblical Press (1995). Otherwise Gundry, R.H. *Sôma in Biblical Theology with Emphasis on Pauline Anthropology*, Society of New Testament Monograph Series 29, Cambridge: Cambridge University Press (1976); Cooper, *Body, Soul, and Life Everlasting*; idem, ‘Biblical Anthropology’.

44 Martí-Ibáez, F. ‘Foreword’, In Riese, W. *A History of Neurology*, New York: MD Publications (1959), p. 7.

rialistic focus of new science could marginalise the need for God, but, it was insisted, this was neither a necessary consequence of scientific investigation nor an appropriate use of science. First published in 1642, Thomas Browne's *Religio Medici* insisted that the physician was not doomed to atheism, for the physician's work leads to God; Scripture and the natural world formed a dual pathway to God.<sup>45</sup> Similarly, Richard Cumberland's *De legibus naturae* argued that mechanistic physics need not devolve into unorthodoxy in ethical theory nor into atheism; when atheism was the effect (as in the infamous case of Thomas Hobbes), impiety and not science was to blame.<sup>46</sup> Perhaps most famous is Boyle's *A free inquiry into the vulgarly received notion of nature*, which opposed the materialist infidels and insisted that the new, mechanistic science was religion's invincible ally.<sup>47</sup>

Clearly, the evolution of natural theology among members of the Royal Society evidences the need to address their vocal opponents convinced of the impiety of materialism and mechanism. Again, however, it is important to remember that these innovations in scientific inquiry were not alien intrusions into theological discourse. As a rule, the new scientists practised the Christian faith, and believed themselves compelled by their religious convictions to engage in natural science. Indeed, explicit motivation for natural theology came from at least two sources: from charges of atheism *and* from the felt need to repudiate anti-intellectual enthusiasm, with its basic appeal to the singular truth of private revelation.

What is more, Peter Harrison has argued that the sort of biblical interpretation championed by the Protestant Reformers, with its focus on 'literal interpretation', opened the possibility for new ways of viewing the order of nature.<sup>48</sup> According to the medieval encyclopedia, the universe was 'nothing other than an emanative outpouring from the unknowable and unnameable One down to the furthest ramifications of matter', with every being functioning as 'a synecdoche or metonymy of the One'.<sup>49</sup> If the entire sensible world is a book written by the hand of God, then all of nature serves metaphorically to reveal the Divine Author. Exegesis of the cosmos, then, proceeded along the lines of exegesis of the Bible, in accordance with the traditional theory of the four levels of interpretation: the literal, the allegorical, the moral, and the analogical. When

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45 Cunningham, A. 'Sir Thomas Browne and His *Religio Medici*: Reason, Nature and Religion', In Grell, O.P., and Cunningham, A. (ed.) *Religio medici: Medicine and Religion in Seventeenth-Century England*, Aldershot: Scolar (1996), pp. 12-61.

46 Parkin, J. *Science, Religion and Politics in Restoration England: Richard Cumberland's De legibus naturae*, Studies in History New Series, Woodbridge: Boydell (1999).

47 Boyle, R. *A Free Inquiry into the Vulgarly Received Notion of Nature*, Davis, E.B., and Hunter, M. (eds.), Cambridge Texts in the History of Philosophy, Cambridge: Cambridge University Press (1996 [1686]).

48 Harrison, P. *The Bible, Protestantism, and the Rise of Natural Science*, Cambridge: Cambridge University Press (1998).

49 Eco, U. *Semiotics and the Philosophy of Language*, Advances in Semiotics, Bloomington: University of Indiana Press (1984), p. 103.

Protestant interpretation countered this fourfold method of exegesis, in favour of the *sensus literalis*, it follows only naturally that nature, too, would be examined along different lines. 'Literalism means that only words refer; the things of nature do not. In this way the study of the natural world was liberated from the specifically religious concern of biblical interpretation, and the sphere of nature was opened up to new ordering principles'.<sup>50</sup> In effect, Harrison insists, it is not that the new science urged new interpretations of the Bible, but that new emphases in hermeneutics, worked out with reference to Holy Scripture, pressed for fresh conceptualisations of the world. Even if Harrison has too easily cast Protestant interpretation into a single mould and exaggerated the innovations of Protestant exegetes vis-a-vis their Catholic counterparts,<sup>51</sup> his study further underscores the significant degree to which biblical interpretation and science have interacted in ways that are mutually forming and informing.

Prior to addressing how Willis navigated the science-religion frontier on the metaphysics of the human person, a second observation is warranted – namely, that Willis manifestly *needed* a resolution to the problem generated by the juxtaposition of the soul-doctrine and anthropological materialism. Atheism was no option for Willis, the religiously conservative, pious, and charitable physician, who allocated his rooms in Christ Church to Anglican services, donated the fees earned on Sunday to the poor and funded evening services at St Martin-in-the-Fields even beyond his death. Rather, in such matters, Willis shows his hand unambiguously in his preface to *The Anatomy of the Brain*, likening his dissection table to 'the most holy Altar of Your Grace', Gilbert Sheldon, Archbishop of Canterbury, and referring to his work as an examination of

the Pandects of Nature, as into another Table of the Divine Word, and the greater Bible: For indeed, in either Volume there is no high point, which requires not the care, or refuses the industry of an Interpreter; there is no Page certainly which shews not the Author, and his Power, Goodness, Trust, and Wisdom.<sup>52</sup>

Experimentation thus parades in the guise of worship, sacrifice and spiritual meditation.

For Willis, the way forward had already been prepared by Pierre Gassendi (1592-1655), one of the writers read among the *Virtuosi*. Gassendi had claimed that animals must have souls since they apparently possessed a memory, a capacity for reason, and other traits typically associated with the soul. (Note incidentally that the 'souliness' of non-human animals is also found in Genesis [vpn, *nephesh*, 'soul' or 'life', is used of animals in 1:20, 21, 24, 30] and in Aris-

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50 Harrison, *Bible, Protestantism*, p. 4.

51 See Howell, K.J. *God's Two Books: Copernican Cosmology and Biblical Interpretation in Early Modern Science*, Notre Dame, Indiana: University of Notre Dame Press (2002).

52 Willis, *Anatomy of the Brain and Nerves*, pp. 51-52.

totle [see above].) But, if this is true, what distinguishes humanity from ‘the brutes’? Enter a second soul, the presence of which allows for a material soul, characteristic of both humans and non-human animals; and a further soul, immaterial and immortal, found in humans alone. Willis himself distinguishes between the Corporeal Soul (common to humans and ‘brutes’) and the Rational Soul (superior to the Corporeal Soul, found only in humans). Although Willis claims that ‘divers Authors both Ancient and Modern and both Philosophers and Theologists’ have observed the difference between these souls,<sup>53</sup> evidence for such a pervasive tradition is difficult to find and is altogether absent from the Bible. More probably, Willis either did not possess the categories of thought necessary to address the metaphysical ramifications of his work, or simply found in his distinction between two souls a ready means for avoiding a clash with ecclesiastical authority. Only rarely in his writings does Willis take up the role of the Rational Soul, and its chief *raison d’être* seems to be to superintend the Corporeal Soul. Instead, having acknowledged an immortal soul, he then devotes himself at length to the function and properties of the ‘animal soul’, enabling him to include psychical issues within the competence of medicine and to present a coherent psycho-physiological approach to human capacities and behaviours. As Cranefield summaries, ‘The soul of brutes, in the hands of Willis, really seems to be simply a handy name for the assemblage of anatomical and physiological mechanisms which underlie psychological processes’.<sup>54</sup>

Our difficulty in grasping what to make of the immaterial, Rational Soul is illustrated in Willis’ description of the brain:

The Brain is accounted the chief seat of the Rational Soul in a man, and of the sensitive [soul] in brute beasts, and indeed as the chief mover in the animal machine, it is the origine and fountain of all motions and conceptions. But some Functions do chiefly and more immediately belong to the substance of this, and others depend as it were mediately and less necessarily upon it. Among these, which of the former sort are accounted the chief, are the Imagination, Memory, and Appetite. For it seems, that the Imagination is a certain undulation or wavering of the animal Spirits, begun more inwardly in the middle of the Brain, and expanded or stretched out from thence on every side towards its circumference: on the contrary, the act of the Memory consists in the regurgitation or flowing back of the Spirits from the exterior compass of the Brain toward its middle. The Appetite is stirred up, for that the animal Spirits, being some-how moved about the middle of the Brain, tend from thence outwardly towards the nervous System. The rest of the Faculties of this Soul, as Sense and Motion, also the Passions and Instincts merely natural, though they depend in some measure upon the Brain, yet they are properly performed in the oblong Marrow [i.e., spinal cord] and Cerebel [cerebellum], or proceed from them.<sup>55</sup>

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53 Willis, *Two Discourses*, p. 38.

54 Cranefield, ‘Seventeenth Century View’, p. 306.

55 Willis, *Anatomy of the Brain and Nerves*, p. 91.

Here, Willis allows that the brain is the origin of all motions and conceptions, apparently of both Rational Soul and Corporeal (i.e., 'sensitive') Soul. Moreover, as here, throughout his writings on the central nervous system, Willis locates in the brain or spinal column not only reflexes and sensory and motor centres, but also cognition, imagination, volition, and affect. Thought he assigned to the cerebrum, voluntary movement to the cerebral hemispheres, perception to the corpora striata, imagination to the corpus callosum, memory to the cerebral cortex, instinct to the midbrain and involuntary regulation to the cerebellum.<sup>56</sup> In effect, Willis adopted a metaphysical solution to the problem of personhood that allowed him to proceed along an empiricist path, with matters of an ethereal sort partitioned off, outside the realm of experimentation or even consideration.

This solution could only be short-lived. Galen was maligned for his ambiguity on the immortality of the soul, yet in the work of Willis 'soul' was delimited in ways that left the doctrine shrivelled and languishing: What role any longer justifies its existence in our conception of the human person?<sup>57</sup> If the capacities constitutive of the human being traditionally allocated to the immaterial soul are identified with the substance of the brain, then the need underlying the attribution of an immaterial soul to the human being vanishes. In this case, what makes us singularly human is the complexity of our brain – or, better, the properties and capacities that have this complex brain as their anatomical basis.<sup>58</sup> If human identity is grounded in consistency of memory; if the differentiating marks of the human person are the development of consciousness, individuality within community, self-consciousness, the capacity to make decisions on the basis of self-deliberation, planning and action on the basis of that decision, and taking responsibility for these decisions and actions;<sup>59</sup> and if

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56 Willis, *Two Discourses*, pp. 22-27.

57 Some philosophers of mind might reply 'the exercise of libertarian free will', but this was not an issue for Willis, and even it has begun to be investigated by neuroscientists (e.g., Libet, B. et al. [eds.] *The Volitional Brain: Towards a Neuroscience of Free Will*, Thorverton: Imprint Academic [1999]) and philosophers influenced by neuroscience (e.g., Flanagan, O. *The Problem of the Soul: Two Visions of Mind and How to Reconcile Them*, New York: Basic [2002]; Wegner, D.M. *The Illusion of Conscious Will*, Cambridge, Massachusetts: MIT Press [2002]). Some philosophical theologians might reply that belief in the resurrection of the dead entails belief in the soul (so Cooper, *Body, Soul, and Life Everlasting*; idem, 'Biblical Anthropology'), but this too is arguable (Corcoran, 'Physical Persons'; Davis, S.T. 'Physicalism and Resurrection', In Corcoran, K. [ed.] *Soul, Body, and Survival*, pp. 229-48; Gutenson, C.E. 'Time, Eternity, and Personal Identity: The Implications of Trinitarian Theology', In Green, J.B. [ed.] *Losing Your Soul and Finding Yourself? Christian Perspectives on Being Fully Human*, Nashville: Abingdon [in press]; Green, J.B. 'Resurrection of the Body: New Testament Voices Concerning Personal Continuity and the Afterlife', In Green, J.B. [ed.] *Losing Your Soul and Finding Yourself* [in press]; Murphy, N. 'The Resurrection Body and Personal Identity: Possibilities and Limits of Eschatological Knowledge', In Peters, T. et al. [eds.] *Resurrection: Theological and Scientific Assessments*, Grand Rapids, Michigan: Wm.B. Eerdmans [2002] pp. 202-18).

58 Cordoso, S.H., and Sabbatini, R.M.E. 'What Makes Us Singularly Humans?', *Brain & Mind* (2000), [http://www.epub.org.br/cm/n10/editorial-n10\\_i.htm](http://www.epub.org.br/cm/n10/editorial-n10_i.htm); accessed on 21 January 2002.

59 Hefner, P. *The Human Factor: Evolution, Culture, and Religion*, Theology and the Sciences, Minneapolis: Fortress (1993), pp. 118-19.

these have a neural substrate, then the concept of 'soul', as traditionally understood in theology as a person's 'authentic self', may be redundant. And if, as we have noted, the perspectives of Christian Scripture and neurobiology merge on this aspect of our understanding of the human person, then it is not clear that the loss to the structure of traditional Christian theology of an ontologically distinct soul ought to be of great concern.

Of course, Willis is not himself responsible for all of this. However, given his legacy as the 'Father of Localisation', it is easy to see that Willis' work set neurobiology firmly on this path. This is true in spite of the facts that Willis himself deflected such metaphysical concerns and that, on so many points in his discussions of cerebral localisation, Willis' thoughts were often more speculative than data-based and, as it turned out, simply wrong.

## Conclusion

Whether his contributions are a consequence of Willis' particular genius or a result of his living at the fertile intersection of so many innovations in science and philosophy – or, as seems more likely, some combination of the two – it is nonetheless clear that Thomas Willis holds a pivotal position in the history of the neurosciences. He also inhabited a pivotal moment in the history of the interface of religion and science. In fact, in recounting the story of Willis, it is important to account as fully as possible for both of these historical narratives – the one oriented toward the development of the neurosciences, the other concerned with science and religion. This is because the one has so profoundly affected the other, with science to a significant degree already having set the terms of the discussion, with those terms now enjoying the powerful legitimation of the church and both popular and scholastic theologies, and with both theology and science unhappy with the consequence. In *A history of neuroscience*, Riese observed that localisation had implications that had not been recognised in Willis' century, nor fully exploited at the time of Riese's own writing in the mid-twentieth century.<sup>60</sup> If these are now being explored openly, it is crucial that Willis still be allowed his voice, since in his person and work we have evidence of a complexity of the interface of science and religion not often recognised today.

Those typologies describing the interaction of religion and science – conflict, independence, dialogue, and integration<sup>61</sup> – are not well-suited to describing the confluence of narratives in Willis. This is because such typologies for interaction of necessity start from the erroneous assumption that science and religion have lives separate from one another. Whether this is a possibility in the early twenty-first century, it was not in the first (when, e.g., Paul or Luke

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60 Riese, *History of Neurology*, p. 89.

61 Barbour, I. *When Science Meets Religion*, New York: Harper (2000).

breathed the air of the reigning scientific-philosophical paradigms, and in some cases made choices among the available options), nor in the seventeenth. Rather, in Willis, we find the two, science and theology, interacting in a more organic way, so that it becomes virtually impossible to extricate the one influence from the other, or to prioritise one vis-a-vis the other. Hermeneutics, especially centred in ecclesial turmoil and theological reform, helped to shape the semiotics of scientific investigation. Moreover, a commitment to the unitary character of truth, available for the exegete in the books of Scripture and of the cosmos, provided theological impetus for the 'new science' emerging in the early modern period. Conversely, central theological claims regarding the regnant portrait of human nature – namely, anthropological dualism – drew their *nourishment* especially from the work of Galen, woven together with the science-philosophy of Neoplatonism, via the theological discourses of Augustine of Hippo; and their *legitimation* from the overpowering and authoritative influence of Augustine, combined with contemporary ecclesiastical sanction, and popular religious expression. In other words, presumed hostile relations of science and religion circling the emerging debates on mind-brain, body-soul issues did not arise from biblical faith meeting secular science on the battleground. Instead, we have to do with the challenge of new science to old science, the latter now in theological dress.

If, in this arena, Willis' synthesis was doomed and his speculation on the function of the different parts of the brain often wide of the mark, these do not detract from the importance of his theory of localisation, which recast neuroscience in ways that continue to be developed and explored. Nor do these detract from the significance we find in the illustration of his work, and that of others around him, of a genuinely reflexive relationship involving science and religion.

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