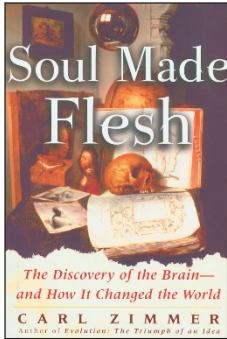


Finding the mind in the brain



Soul Made Flesh: The Discovery of the Brain—and How it Changed the World

by Carl Zimmer

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Reviewed by Lawrence Kruger

Carl Zimmer's provocatively titled new book, *Soul Made Flesh: The Discovery of the Brain—and How it Changed the World*, is an ambitious attempt to provide a history of neuroscience for a general audience, written with the readable and entertaining slant of an erudite and able journalist. It is largely an account of the life and times of Thomas Willis (1621–1675), which encompasses a world of cadaver dissections, vivisection and transfusion experiments, and is laced with brief tastes of the turbulent parliamentary revolt in England and of philosophical thought from antiquity to Descartes and beyond.

Touting the material substance of the 'soul' as being the 'flesh' of the brain is a deceptive gambit, but attributing the discovery of the brain to Willis acknowledges that the first book specifically devoted to brain anatomy and function was his landmark *Cerebri Anatome* in 1664. With this monograph, Willis brought together in a substantial text some of the limited information of the time, combined with some exceptionally handsome and accurate illustrations.

Willis, physician to the embattled Charles I and Sedleian Professor of Natural History at Oxford, used his prestige and wealth to assemble the beginnings of a lab team that included Richard Lower, who performed experiments injecting alcoholic beverages and dyes into the bloodstream of dogs, and the brilliant Christopher Wren, who employed the then-new mezzotint engraving technique. A very busy practitioner, Willis was unaware (as apparently is Zimmer) that the celebrated eponymous 'Circle of Willis' had been depicted earlier by Giulio Casserio (1552–1616), although not as handsomely and accurately as by Wren. Willis' impact derived largely from his clinical experience with neurological disease and its treatment—despite the unkind conjecture of Charles II that Willis, in his practice of 'physick', probably killed more people in Oxfordshire than the anti-royalist armies.

Zimmer skips from the anatomy of Andreas Vesalius (1514–1564) to the era of Willis, thereby implying that Willis worked almost in a

vacuum that led to his 'discovery' of the brain. But just as Watson and Crick's discovery of the structure of DNA was a product of prepared minds learning about nucleotide base pairs and getting a surreptitious peek at X-ray diffraction data (thus leading them to construct a model and grasp its implications), Willis synthesized selected information derived from the zeitgeist of the period. Envisioning what he called 'neurology', in a radical departure from the ideas of his predecessors, Willis and his team attempted to construct a mechanistic anatomy of the brain.

Rather than elaborating on preceding anatomical work, Zimmer's account is peppered with amusing anecdotes about the principal philosophers who struggled with the nature of the 'sensitive' and 'rational' soul. This was an age when theology, and the classical languages upon which it is based, dominated university education in England, but also the period when William Harvey (much influenced by anatomical study in Padua) developed an empirical methodology that established the circulation of the blood and launched the scientific revolution. Unlike Willis, many English physicians who grappled with the material 'soul' went abroad for part of their medical education and were aware of the contemporary state of anatomy, but they are omitted from the assemblage in Zimmer's paean to Willis.

Both Willis and his biographer prove rather oblivious to the ferment raised in natural history and systematics by the encyclopedists of the academies in Paris and Rome. Even within the Royal Society, Edward Tyson, who was struck by Willis's account of the brain of a 'changeling' (a retarded person, in modern parlance) whose cerebral cortex was less convoluted than normal, depicted the brain of an African Moor as similarly less convoluted. But Tyson was also surprised to find the porpoise brain more convoluted than the human brain. By the end of the century, the scale of gradation among animals included comparisons between primates, but the concept of evolution was still far off, and the 'soul', derived from God uniquely for Man, could not be found in the substance of the brain when there was so little distinctive difference between human and chimpanzee.

Original observations on brain correlates of cognitive capacity failed to gain persuasive footing in the ensuing centuries. Thus, to find later investigations of the 'soul', Zimmer jumps quickly from this relatively neglected area in the history of brain science to the present by exploring functional magnetic resonance imaging (fMRI) and contemplating the rational mind through the explosion of current research dealing with the neurobiology of cognition. Visiting a 'neuroethicist', Zimmer is understandably seduced by the wonders of correlating fMRI data with a model of ethical decision-making. But a rapid, oddly selected survey of recent research in neurobiology based on reading and interviewing some active scientists is hardly an apt postscript to the seventeenth century. Perhaps discoveries about the brain shall change the world, but for the neurobiologist who may aspire to change the world, the glass might seem half-empty until more significant strides are made in reversing the irreparable ravages of neurological disease, deciphering the mechanism of memory storage and retrieval, or understanding the penchant for violence in our species. ■

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