

Book Review

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The Idea of the Brain: The Past and Future of Neuroscience.
Cobb, Matthew. Publisher: Basic Books. 2020. ISBN: 9781541646865.

In his captivating new book, author Matthew Cobb provides a refreshingly candid, accessible and insightful tour of the ups, downs, dead ends and future prospects of our endeavour to understand the most complex and fascinating entity in the known universe – the brain. The book is organised into past, present and future sections outlining the seminal experiments, researchers and technological advances on the path towards unravelling the mysteries of the brain and will be of great interest to mental health professionals and researchers alike.

While Hippocrates of Kos documented the central importance of the brain in 400 BCE, Cobb dates the birth of modern brain science to 1665, when thinkers such as the Danish anatomist Nicolaus Steno started to consistently prioritise the brain over the heart as the place of thought and when machine metaphors were introduced. The book outlines the evolution of these metaphors in shaping our understanding of the brain, from clocks to Descartes' hydraulics to telephone exchanges to the coding and wiring of computers.

Cobb surmises that the explanatory power of our most contemporary metaphor, the computer, like all preceding metaphors, fails to sufficiently capture the stunningly complex interconnected organic neural networks of the brain. Indeed, the 90 billion neurons and 100 trillion synapses of the human brain, with a speculated storage capacity of a zettabyte of information (1 trillion gigabytes), is not a digital device. Furthermore, the brain has been sculpted by over 500 million years of evolution under the influence of bidirectional information exchange processes with the environment, which it attempts to interpret and predict, while weaving a time-lagged sense-making narrative to reflect back on the process and, at least in part, shape future trajectories.

The book eloquently sketches some of the contentious rivalries and vigorous debates in neuroscience, notably between the soups and sparks (neuropharmacologists and electrophysiologists), the long running disputes between localised versus distributed brain function advocates, to the more contemporary theories of consciousness; from the less accepted quantum microtubule theory, to the clash between the global neuronal workspace theoreticians and those that prefer

the integrated information approach. As the author relays these stories, he illuminates the gradual painstaking and self-correcting process of the scientific method. He quotes Francis Crick, who after co-discovering the double-helix structure of DNA with James Watson in 1953, turned to consciousness research in the mid 1970s; "Listen to the questions that philosophers ask, but not to their answers".

While providing an insightful perspective on the trajectory of our understanding of the brain, and notwithstanding progress in certain areas, the author emphasises the extensive knowledge gaps, suggesting we may be at an impasse. It is now appreciated that the brain comprises both localised and distributed networks of complex dynamic configurations of neuronal firing, organised from the level of individual neurons to circuits under the influence of a multitude of molecular signalling systems and environmental inputs. But precisely how this astonishing level of material complexity results in subjective experience remains a major mystery. To highlight the extent of the knowledge gaps, Cobb points to the inability to precisely predict the tiny network of neurons and associated molecular signalling pathways that comprise the stomach of a lobster. Accordingly, the author takes a more measured approach to artificial intelligence researchers and their ambitions to supersede the organic constraints of biological wetware by uploading the brain into a computer. This *in silico* approach, Cobb points out, is dualism in another guise and he is not convinced it will happen any time soon.

As a Professor of Zoology, Cobb speculates that advances may be more likely to come from discrete and attainable projects that explore simpler systems of the small brain variety, such as Zebrafish larva, which contain 100,000 neurons. To contrast the differences in scale, a magnetic resonance imaging (MRI) voxel represents the surrogate activity of 100,000 neurons and thus, according to the author, can be a rather coarse tool that may struggle, in its current form, to advance our fundamental understanding of how the brain actually works. Cobb further lambasts the MRI phrenologists by referencing the infamous MRI study exploring the neural correlates of a dead Atlantic salmon.

On a more sober note, in contrast to the remarkable translational benefits in the field of robotics, where advances have given people the ability to control robotic limbs with their brain, Cobb laments the lack of recent translational treatments derived from neuroscience for those with mental health disorders. The author echoes the disappointment and frustration of Thomas Insel, the previous director of the National Institute of Mental Health, at the lack of any meaningful translational benefits from modern neuroscience, despite massive amounts of funding and accumulated

data. The author, recognising the negative impact of mental health disorders, not only on individuals but also on their families, accurately reflects – “It is hard to know what to say. We do not know how the healthy brain and mind work, so it is hardly surprising that we do not know how to fix things when problems arise”. Indeed, future prospects to ameliorate mental health problems are dependent on the incorporation of intrinsically linked socio-environmental factors into the neuroscientific endeavour.

Notwithstanding the conceptual impasse and lack of a cohesive unifying framework, Cobb retains optimism that the challenges of the explanatory gap or gaps, albeit enormous, are within the scope of future scientific understanding and may eventually be bridged by gradual incremental progress in brain

science. As we continue to enthusiastically explore, with humility and compassion, the boundaries of human understanding and the marvellous myriad mysteries of the brain, so too should we aim to translate potential advances into meaningful benefits for all people.

Conflict of interest

None.

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