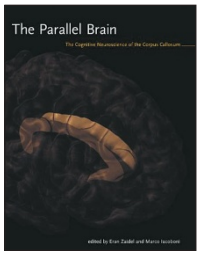
Parallel Universe



The Parallel Brain: The Cognitive Neuroscience of the Corpus Callosum

Editors: Eran Zaidel & Marco Iacoboni

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Reviewed by Anthony LaMantia

The MIT Press has published a new volume of reviews and commentaries on interhemispheric connections and lateralization. This compendium, *The Parallel Brain*, was initiated from the proceedings of a 1996 NATO (North Atlantic Treaty Organization) meeting. It offers some sparks of interest for those discovering the mysteries of hemispheric specialization, as well as a cogent update for those wondering what happened to a field that perhaps piqued their interest decades ago. Unfortunately, both novices and lapsed cognoscenti may feel entangled by detail and debate rather than enlightened by summary and synthesis when reading this useful, but ultimately disappointing, volume.

Neuroscientists and philosophers have long acknowledged the central importance of hemispheric lateralization and integration. The discovery (or re-discovery) of these phenomena in the 1950s and 1960s helped return neuroscience to sensible principles of functional localization and specificity of information transfer. A generation of neuroscientists-in-training from the 1950s through the 1980s read with great interest the landmark papers of Roger Sperry and others that described interhemispheric transfer of learned behaviors in cats and monkeys, as well as hemispheric specialization in 'split-brain' patients whose cerebral commissures had been surgically resected. What then seemed exciting remains: parallel representations of complex cognitive information restricted to specialized regions and circuits in one hemisphere or the other, integrated by neurons whose axons project between the hemispheres. What may be frustrating to a reader of *The Parallel Brain*, however, is a sense that subsequent lateralization research has been pursued with little attention to other dimensions of neuroscience.

For novices who wish to use *The Parallel Brain* as an introduction to lateralization, several strategies for selective reading might relieve the difficulty of penetrating its many chapters. For an orientation to the field, it might be wise to ignore the distracting unifying scheme: measurement of interhemispheric reaction time, originally described by the experimental psychologist A.T. Poffenberger around the turn of the century. To the uninitiated, this device primarily appears to justify theoretical constructs with confusing acronyms. Some particularly helpful chapters include R.W. Doty's comprehensive survey (Ch. 7) and Stephanie Clarke's concise and well-illustrated review of human callosal connections (Ch. 21).

For cognoscenti—lapsed or current—several additional issues may raise concern. First, there is a maddening conflation of the corpus callosum—the axon bundle that connects a great deal of the cortex in the two hemispheres—with broader (and fundamentally more interesting) issues of hemispheric specialization and integration. Cutting the callosum has proven valuable for analyzing distinct hemispheric functions. Nevertheless, hemispheric specialization is most likely an emergent property of integrated circuitry within and between hemispheres rather than a consequence of axonal interconnections via the callosum. This obvious conclusion is given little serious attention; instead, the callosum becomes an inappropriate proxy for laterality throughout *The Parallel Brain*. Second, several chapters resurrect data on associations between individual variation (*e.g.*, handedness, gender) or pathology (*e.g.*, schizophrenia) and cross-sectional area of the callosum. This approach, fashionable in the 1980s, has long since been challenged. A number of difficult methodological issues complicate this sort of gross morphometric analysis; accordingly, it has been impossible to replicate most relevant studies. The extensive, non-critical coverage given this material in *The Parallel Brain* reinforces one's sense that the field has moved faster than the co-authors and editors wish to acknowledge.

This sense of scientific time warp defines most dimensions of the parallel universe of the book. It is particularly surprising that a book on laterality published in 2002 has so little human functional imaging data. Some may argue that the temporal resolution of such approaches cannot detect the rapid transfer of information that the editors suggest as a central focus for the field. Nevertheless, lateralization is more than transfer, and functional imaging in normal as well as split-brain subjects offers the possibility of new insights. Furthermore, work in experimental animals, particularly primates, is cursorily described or ignored. Physiological techniques such as single-unit recording in awake, behaving monkeys are not featured, either as current means for studying lateralization or as future tools. Finally, in a volume that focuses heavily on development and organization of the corpus callosum, little mention is made of studies of the development of other commissural pathways. Surely lessons learned in these studies have some currency for analysis of the great cerebral commissure.

The scientific examination of hemispheric specialization and callosal connectivity has always been difficult, and those brave enough to tackle it have often been frustrated by the limited technologies available to study these complex phenomena. The authors and editors of this volume no doubt have faced this frustration, and many of the shortcomings in their account of this field likely reflect the difficulties of studying higher-order cognitive processes such as hemispheric lateralization. Nevertheless, the source and significance of specialization of our right and left cortices for distinctly human functions like language, spatial abilities and emotions remains a fundamental mystery. Despite its flaws, *The Parallel Brain* reminds us of this mystery, and perhaps may encourage novices as well as seasoned investigators to pursue a more direct trajectory to explore this universe of intriguing neuroscientific issues. ■

Anthony LaMantia is in the Department of Cell and Molecular Physiology and UNC Neuroscience Center, University of North Carolina School of Medicine, Campus Box 7545, Chapel Hill, North Carolina 27599, USA.
e-mail: anthony_lamantia@med.unc.edu