THE PREFRONTAL CORTEX—EXECUTIVE AND COGNITIVE FUNCTIONS.

The function of the prefrontal cortex is as fascinating as it is elusive. Whilst damage to more posterior regions produces fairly blatant deficits of function, the effect of frontal brain lesions has proved far more difficult to characterize, although no less devastating to the lives of patients. Early reports told of individuals with no apparent loss of intellectual function, yet whose behaviour changed so drastically that they were never able to resume the lives that they had led before. Part of the problem has undoubtedly been that the cognitive processes underlying abilities which are impaired by prefrontal damage, such as planning, reasoning and problem solving, have not been well understood. A strong theoretical framework within which to interpret the effects of frontal lesions has therefore been lacking. This situation has now changed considerably and the chapters in The Prefrontal Cortex—Executive and Cognitive Functions reflect the ever-increasing degree of theoretical, and technical, sophistication that has been brought to bear on this area of study.

The book consists of 15 chapters based on contributions to a discussion meeting of the Royal Society of London. As one would expect from a meeting of this calibre, the contributions are from some of the most prominent researchers in the field. An introduction by A. C. Roberts sets the scene for the reader by highlighting some of the questions that are to be addressed in the chapters that follow. The chapters do vary in the complexity of the ideas put forward, and also in the firmness of conclusions drawn, but the book does at least tackle some issues that not so long ago may only have been mentioned in passing. For example, there are three chapters that deal with the role of prefrontal dysfunction in schizophrenia. Although the frontal lobes have long been implicated in schizophrenia, it seems that attempts at an explanation of exactly how have been tackled only relatively recently. Another chapter that I particularly liked was Damasio’s account of the ‘somatic marker hypothesis’, which attempts to explain some behavioural problems of patients with ventromedial lesions in terms of their failing to experience appropriate emotional responses, which in turn impairs their decision making ability. The domains of cognition and emotion are often treated as non-overlapping entities, and it is refreshing to see an account of how an impairment in one type of processing could affect the other. The chapter by Rolls on the orbitofrontal cortex also delves into this territory, and comes up with conclusions that differ slightly from those of Damasio. Whilst these chapters, along with most of the others in the book, convey the immense progress in our understanding that has been made, the authors are careful not to give a false impression regarding how much further there is still to go. Adele Diamond’s chapter also delves into an area that I have not seen tackled very
often, reviewing evidence for an impairment of dopamine-based prefrontal functions in phenylketonuria. The neuropsychology associated with learning difficulties has long been acknowledged as an under-researched area, something that may be starting to change.

Along with these, a number of more familiar themes are addressed, such as the effects of prefrontal lesions on executive function and memory. Several chapters address the effects of frontal lesions on aspects of working memory. In Baddeley’s extremely influential model, this consists of two slave systems co-ordinated by the activity of a ‘central executive’. The function of the central executive has become closely associated with frontal lobe function, hence a tendency has developed to refer to the effects of frontal lobe damage as ‘dysexecutive syndrome’. Baddeley and Della Sala describe difficulties experienced in dual-tasking—a paradigm involving simultaneous performance of two cognitive tasks—by patients with dysexecutive syndrome. However most of the data they cite is from patients with dementia rather than patients with frontal lobe lesions, although they do stress that they define the syndrome in functional rather than anatomical terms. The importance of this distinction is also pointed out in Robbins’ chapter on executive functions, which also draws upon experimental lesion studies in non-human primates. The dual-task paradigm is also used in Passingham’s chapter on ‘attention to action’. In fact, explaining exactly how the central executive operates has remained a challenge. Shallice and Burgess describe their model of supervisory processes and frontal lobe function and Goldman-Rakic describes a central executive consisting of a number of different processing domains, rather than one central processor.

Another area which has proved difficult to characterize has been the role of the frontal lobes in memory. Unlike damage to the temporal lobes, where the resultant amnesia is quite apparent, frontal lobe damage affects memory in a more subtle manner. Petrides’ chapter draws a distinction between strategic and automatic retrieval, the latter being unaffected by frontal damage. Many standardized tests of memory tap only this automatic function which is subserved by the temporal and parietal lobes. A lot of the distinctions drawn between frontal and posterior functions are based on a distinction between automatic and controlled processes, which has a long tradition in the literature. But whereas previously this may have been thought sufficient, there is now a greater demand to specify what these terms actually mean.

The great strength of this book is the way it draws together divergent sources of evidence to create an overall picture of the role played by this area of the brain. Studies based on experimental lesions in non-human primates converge with human data from neurological patients. The traditional neuropsychological approach of looking at impairments in the cognitive abilities of patients with prefrontal damage is complemented with studies of functional imaging of cognitive tasks performed by healthy individuals. There is also the inclusion of data drawn from connectionist modelling. I feel the book does have a weakness though, and that is the accessibility of the style in which it is written. Probably as a result of each author having to summarize a body of fairly complicated research in a limited space, the style of each chapter is quite condensed, which does not make for easy reading. I suspect that someone with little background knowledge of neuropsychology, who wants an introduction to the area would find this book hard work and possibly quite off-putting. Consequently I doubt that it will find much favour with students.

However, this may reflect an underestimation on my part of the ability and thirst for knowledge of a modern undergraduate. Where I do see the book being very useful is to the researcher or clinician who is already familiar with some current aspects of research into prefrontal cortex function, but who wishes to expand their knowledge of the aspects they are not researching themselves. Alternatively, this book would probably be of great value to someone who has some background knowledge of the field, but has fallen behind with the latest developments. Reading this book would probably be an efficient way to bring yourself up-to-date.

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