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Book Review

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Handbook of Transcranial Magnetic Stimulation

Alvaro Pascual-Leone

Published by: Edward Arnold: 406 pp. ISBN 034 0720093 £110.00 (hardback)

Magnetic Stimulation of the Human Nervous System

KR Mills

Published by: Oxford University Press: 333 pp. ISBN 019 2629867 £69.50 (hardback)

Lewis Wolpert has written of the counter-intuitive nature of many things revealed by science, (*The Unnatural Nature of Science*, Faber, 1992). Magnetic stimulation of the nervous system must surely be one such example of the unexpected. Though this was first shown at the end of the end of the 19th century, its modern era began with Polson and Barker's work in Sheffield. Together with Merton they showed, in the mid-1980's, that movements could be produced painlessly by the discharge of a high voltage electrical current through a coil placed on the scalp (via production of a magnetic field within the brain which, in turn, lead to an electrical field sufficient to discharge neurones). In introducing the technique to North America in 1990 Cadwell felt it necessary to assure people that the technique was not magic.

The technique, transcranial motor stimulation (TMS), was initially used to determine the latencies of pyramidal tract conduction in healthy controls and those with MS and MND, in whom longer latencies were shown. (In these and other studies it should be remembered that TMS has been estimated to activate only the largest 4% of corticospinal neurones). But soon, as the potential of this new and powerful technique was realised, more complex aspects of physiology were explored. The thresholds for a TMS induced twitch were found to be elevated in some strokes, in migraine and with some anti-epileptic medication, whilst it was reduced in early ALS, suggesting alterations in the balance of cortical inhibition and facilitation. The learning of a motor skill, like piano playing, actually increased the area of the brain from which TMS motor activation was possible: here was short-term plastic change within the brain, written on the scalp. TMS during a visual task suppressed perception of stimuli, while if given during the preparation to move it delayed the actual movement or altered the perception of its timing. Repetitive TMS has even been used as an alternative to ECT in depression. Safe, accessible and relatively simple to use, TMS has become widespread in its use in the UK and enthusiastically take up by groups in the USA, Europe and the rest of the world. It has allowed fascinating new insights into both neurophysiology and cognition. And now, 17 years later, TMS has come of age with these two excellent books, each of which surveys the field widely and deeply.

Both are by people at the forefront of research in TMS. Pascual-Leone and his four co-editors of *The Handbook* have all made contributions in various areas of the field, while Mills was one of the first to do clinical research with TMS before concentrating on recording the effects of cortical TMS on single muscle cells.

It is inevitable that there are areas of overlap between books: Mills is even one author in Pascual-Leone *et al's* book. Thus, both cover motor mechanisms and the use of TMS in clinical neurology (though, arguably, TMS has excited physiologists more than clinicians as yet). There are also differences: Pascual-Leone *et al* cover a wider field, including psychiatry and cognitive function, whilst Mills focuses more in neurology.

Both cover work with TMS in spinal cord disease. Both Mills and Davey (in *The Handbook*), discuss the work of Gianutsos *et al* on the determination of completeness in acute syndromes and how some EMG activation of muscles below the level of the lesion may be shown with TMS (suggesting incompleteness). Both cite other papers disagreeing, though regrettably neither author discusses the possible reasons for this. Davey goes on to discuss the relation between TMS induced movement and prognosis, concluding it adds little, mapping studies of the areas of brain where TMS is effective in activating muscles above the cord level, and studies of the cortical inhibition after TMS as shown by the 'silent period'. His conclusions about the role of TMS in spinal cord injury seem more optimistic than Mills' brief synopsis implies.

Both of these books are splendid and both succeed in their aims. *The Handbook* is well presented and accessible, with good figures and excellent overviews and introductions to the various areas in which TMS has been used. It can be recommended to undergraduates and all those interested in TMS, whether medical or in allied professions. It contains some outstanding expositions; the chapters of Lemon and Amassian *et al* being a personal delight, amongst others, even though some shorter chapters were less successful and the absence of chapters by some of the editors is disappointing. Though possibly a little expensive for individuals, sales to libraries and departments should allow it deserved success.

Mills' work shows the advantages of a single author book. Remarkable for its clarity and sustained critical insight, it is a classical review of the neurology/neurophysiology of TMS at the turn of the century. It is, however, less accessible to students and so may find its natural home with specialists in clinical and academic neuroscience. Its price may, just, allow them to buy a copy themselves: if not then libraries should remain vigilant.

Lastly, it should not be forgotten that TMS has been performed mainly on man, allowing complexities of research on conscious co-operating human volunteers previously unheard of, not just in neurophysiology but in cognitive neurology and psychiatry. One of Pat Merton's lasting legacies has been to move man into the laboratory as a subject. One might speculate how much of this he foresaw: it is certainly fitting that he should have been the first to try TMS, on himself of course.

J Cole