Handbook of Transcranial Magnetic Stimulation. Pascual-Leone A, Davey NJ, Rothwell J, Wasserman EM, Puri BK, editors. London (UK): Arnold; 2002. 406 pp with index. ISBN 0-340-72009-3 (cloth). CDN$157.95.

Transcranial magnetic stimulation (TMS) is a technology that was developed to noninvasively activate nerve cells through the scalp. TMS is not a new idea. In 1896, D'Arsonval applied TMS over the retina and induced phosphenes. In 1910, Polleneck filed a patent to use magnetic stimulation for the treatment of depression. However, it wasn't until the 1990s that the technology was developed sufficiently to induce electromagnetic fields that cause cortical neuron depolarization. Unique aspects of TMS include its relative safety, ease of application and the awake and interactive state of the subject being stimulated.

Although some applications, such as the potential use of repetitive TMS (rTMS) to treat depression, have been widely publicized, TMS has been used for a much longer time as a neuroscientific tool to study brain localization, brain connectivity and cortical excitability. TMS has also been used as a neurophysiologic diagnostic tool, a cognitive probe and a potential therapy for some neuropsychiatric conditions. *The Handbook of Transcranial Magnetic Stimulation* responds to this growing interest, although it appears mostly geared toward neurophysiologists and neurologists.

Surveying TMS is a daunting task when one considers the rate of new publications in this field. A PubMed search using "transcranial magnetic stimulation" as a keyword on Aug. 19, 2003, came up with 2063 citations! As the field continues to expand, it may become necessary to reserve a separate "handbook" for the 3 main sections (clinical, cognitive and neuropsychiatric); however, for now it seems appropriate for the reader to get a fair overview of all the different TMS modalities.

This book stresses the need to learn the basics to be able to interpret accurately any generated data and their limitations. It is divided into 5 sections. The chapters are succinct, making it easy to browse through and focus on a particular topic of interest, whether it be the physics of magnetic stimulation, neurophysiology, clinical neurology or neuropsychiatric research.

The handbook starts off by explaining the physics behind TMS and how it works. Although the basic principles of TMS seem simple, the mechanisms by which it works are not. The first chapters in part 1 are dense. They do a wonderful job of providing many details but sometimes risk losing the novice reader. The sequence of events is as follows: the TMS capacitor discharges high amplitude electric current in the TMS coil and in turn generates a magnetic field up to 20 000 times the strength of the earth's magnetic field that passes unimpeded through the scalp or tissue. The magnetic field gets converted to electrochemical energy that directly depolarizes superficial neurons (at a maximum depth of 2 mm) and indirectly influences pathways to which these neurons connect. Currently, TMS coils have 2 basic designs: they can be round and generate a diffuse ring of magnetic field, or they can be a figure 8 coil in which the summation of the 2 round coils is greatest at the centre. The latter design allows for more focal stimulation. rTMS carries the risk of an unwanted seizure. This risk increases when faster and more intense stimulations are delivered with longer trains and shorter inter-train intervals. Such considerations led researchers to develop a set of safety guidelines in an effort to identify who should undergo this procedure and when. Since their publication in 1998, these guidelines have been quite successful in limiting the number of major adverse effects. As the field continues to mature, ethical and risk–benefit ratio considerations of each individual subjected to TMS should be kept in mind. Some of the suggested considerations in chapter 5 don't appear to be warranted, however. Continuous monitoring with electromyography or electroencephalography is no longer standard considering that such measures rarely detect and prevent a seizure. Careful study of children and pregnant women may also yield valuable contributions and should be considered when appropriate.

To paraphrase one of the editors John Rothwell, the ease of applying TMS does not correlate

with our understanding of its effects on underlying neurons. In part 2 of the handbook, several authors explain the postulated mechanisms of action. If a single TMS pulse is applied over the "thumb area" of the motor cortex, it will induce a movement in the contralateral thumb. Thus, motor studies and electromyographic recordings have been the most widely used method for studying TMS, although various imaging modalities — interleaved modalities such as positron emission tomography, functional magnetic resonance imaging and quantitative electroencephalography — are making it possible to focus on areas other than the motor cortex to better understand what is occurring with each pulse. Single TMS pulses can produce isolated excitatory and inhibitory events in nerve pathways such as the corticospinal system. TMS pulses can also be delivered in pairs, a few milliseconds apart (paired-pulse TMS), to probe cortical excitability by examining the influence of a first pulse on the effect of a second pulse on motor evoked potentials. Finally, rTMS is postulated to modulate the neuronal activity at the site of stimulation and distally.

So far, animal models have been limited — the ratio of TMS coils to brain is different than in humans (see chapter 8) — and interpretation of data should be considered preliminary. The reader is encouraged to review the work from Germany by Keck and Post (not referenced in the handbook), in which they have successfully modelled the TMS fields coupled to brain morphology to simulate similar conditions in which focal TMS is applied in humans. They largely replicated earlier non-focal TMS animal studies.

Section 3 covers a wide range of neurological conditions in fair detail. Chapter 16 serves as a good reference as it lists all the different indications where TMS may be used as a diagnostic tool. The largest section of the handbook is to follow, making it particularly interesting for neurophysiologists and neurologists. TMS adds to conventional electrophysiological studies the possibility of assessing the complete motor pathway of different nerves. It also has the advantage of avoiding uncomfortable electrical stimulation. Yet the biggest problem in peripheral nerve magnetic stimulation is determining the accurate site of initial depolarization. Anesthesia presents different limitations for intraoperative monitoring of spinal cord put at risk by various surgical procedures (chapter 18). It is interesting to learn the degree of estimated diagnostic value of TMS in multiple sclerosis, facial nerve palsy and hysterical paresis and fascinating to read about the potential for TMS-induced plasticity (chapter 19). The promise is that someday a more in-depth knowledge of the parameters of use may allow neuro-rehabilitation centres to augment their current regimens with TMS to enhance and possibly consolidate recovery.

Since Neisser's *Cognitive Psychology* in 1967, the term "cognition" has come to include all mental information processing, everything from low-level perception to the organization of action. In part 4, the editors cover language, memory and learning, the visual system, mood and emotion and neuroplasticity. Repeated stimulation may affect the activity of underlying neurons, whether in the short term (such as in speech arrests [chapter 27] and memory disruptions [chapter 28]) or longer (chapter 33). This re-introduces a very important concept — that one can use targeted non-invasive stimulation to modulate a neuronal circuit and have lasting effects. TMS can now be considered not just as a diagnostic or a mapping tool but as a potential enhancer of a cognitive process. This section does not put forth in much detail the notion of intricate neuronal networks to provide the frame for such putative modulation. TMS, with its limited penetration and only direct access to the cortex, may use the targeted area as a node of entry to much larger distributed interconnected regions. This is touched upon in part 5, where another important theoretical framework is introduced — namely, that repeated stimulation may lead to long-term changes similar to the ones observed with electrical stimulation (long-term potentiation and long-term depression) and are dependent on use parameters.

One of the most immediate promises for rTMS's therapeutic utility is in depression. Because both TMS and ECT use electricity to induce electric currents in the brain, it has been tempting to compare them. The authors propose not to rush to compare clinical efficacy, given that ECT is still one of psychiatry's most powerful antidepressant tools. There are now 3 published reports that show equal efficacy for these

techniques in the non-psychotic depressed population. Since the book was published, there have been 5 independent meta-analyses with different statistical methods investigating the acute antidepressant effect of rTMS. Three found a moderate effect size and clear significant differences from sham treatment, and one using the Cochrane method concluded otherwise, despite also noticing a positive effect of 2-week fast left and slow right prefrontal TMS. rTMS is now approved for treatment of depression in Canada, and a multicentre clinical trial geared toward obtaining a similar indication from the US Food and Drug Administration is currently being conducted in the United States.

Few rTMS studies have focused on schizophrenia. Slow and fast prefrontal rTMS has been tested for treatment of positive, negative and mood symptoms with mixed results. Obsessive–compulsive disorder and Parkinson's disease involve fairly well defined functional neurocircuitry, and this makes the use of TMS theoretically quite promising. Yet, to date, TMS therapeutic investigations have yielded limited and preliminary results. Post-traumatic stress disorder and Tourette syndrome also warrant further research. All clinical investigations will benefit from improved sham applications. The final clinical role played by TMS in psychiatry is yet to be fully determined.

Because of the non-invasive nature of TMS and its wide range of potential applications, there will likely be more and more researchers and clinicians using it. This handbook is geared more toward serious practitioners than casual readers in a field that is rapidly evolving.

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Foundations in Social Neuroscience. Cacioppo JT, Berntson GG, Adolphs R, Carter CS, Davidson RJ, McClintock MK, McEwen BS, Meaney MJ, Schacter DL, Sternberg EM, Suomi SS, Taylor SE, editors. Cambridge (MA): MIT Press; 2002. 1345 pp with index. ISBN 0-262-53195-X (paper). US$55.

There are several techniques for summarizing a field of research in a book. The most common is to arrange a meeting in a suitably popular location and induce the participants to submit a chapter. This book uses a less common tactic — collecting published papers. Although little information is given on the process of assembling the book, presumably the 12 editors, all distinguished researchers, were responsible for choosing the 82 articles that, together with a brief introductory chapter, make up the 1345 pages of this book. Most of the original articles would be easily available at any university library — *Science* and *Nature* feature prominently — and only one is a chapter from another book, so the merit of this book comes from the compilation of articles from a wide range of disciplines that, broadly construed, form a foundation for a social neuroscience.

The articles are divided into 5 main sections entitled Multilevel integrative analyses of social behaviour; Social cognition and the brain; Social neuroscience of motivation, emotion and attitudes; Biology of social relationships and interpersonal processes; and Social influences on biology and health. The articles include reviews and original research studies on both experimental animals and humans. Several broad themes, which are well represented, include:

- Neuroanatomical aspects of cognitions and behaviours more or less related to social interaction, which includes studies on patients or experimental animals with brain lesions, as well as studies on normal subjects or patients, using various techniques for neuroanatomical localization (e.g., electroencephalography and positron emission tomography). The brain outputs that these studies attempt to localize include general behaviours such as aggression, fear, anxiety (social, but also other types), motivation, affect, face recognition, voice perception, gambling and even conscious experience.
- The relation between neurochemicals and social behaviour. This theme focuses mainly on low serotonin levels and aggression and other types of socially inappropriate behaviour, mainly in monkeys but also to some extent in humans, and the role of oxytocin and vasopressin in social behaviour in prairie voles (a line of research pioneered by the recently appointed director of the National Institute of Mental Health in the United States, Dr. Thomas Insel).
- The interrelation of the hypo-