

Book review

Unveiling the Mystery of the Brain. Neurophysiological Investigation of the Brain Function

ISBN: 0-444-51780-4. Tsuji S, Tobimatsu S, Kakigi R, Uozumi T, Akamatsu N.

This book is a selection of a series of neurophysiological studies presented at the 8th International Evoked Potentials Symposium (IEPS8, Fukuoka, Japan, from October 5th to 8th, 2004). The authors approach the task in an interesting way, combining studies using different techniques and from different theoretical and clinical backgrounds in order to provide an extensive survey of the field. In its present form, this book offers a clear picture of the state of the art of the field in a variety of topics.

The book is divided into fourteen sections plus a small preface. These sections are about the right length and some of the studies reported are very interesting (some of them have already appeared as regular articles in journals). However, the sections lack a brief introduction to each topic highlighting the most important findings or reports in each section. Sometimes the classification is not very clear and some reports should have been included in different sections. I will briefly mention some of the interesting reports in each section that deserve special attention.

The first three sections of the book are related to the assessment of sensory evoked potentials. The first section, (i) auditory function and evoked potentials, contains eight articles on aspects of auditory processing: the impact of gaps in white noise on the N1/P2 auditory evoked potentials (AEP) components, factors affecting the N1m (magnetoencephalography, MEG), beta band event related desynchronization (ERD) in a verbal fluency task and the event-related pattern observed in musical rhythms and emotional prosody in voices. The next section, (ii) visual function and evoked potentials, comprises 10 studies. Two clinical studies investigate the integrity of the visual pathway after paclitaxel administration in cancer patients (which induces sensory neuropathy) and long-term antiepilepsy drug intake (vigabatrin). The other two clinical studies report new methods to detect multiple sclerosis using multifocal visual evoked potentials and the comparison between Parkinson and Alzheimer's disease patients. Two more studies analyse face perception properties and the processing of face expressions (using the N170 face-specific component). The third section, (iii) somatosensory evoked potentials, contains six studies. Interestingly, one of the clinical reports

suggests that the N10 somatosensory evoked potential (SEP) component after wrist stimulation is present in amyotrophic lateral sclerosis (ALS) patients and therefore challenges the view that it is elicited by motor axons. Facial skin magnetic SEPs are also investigated, plus the optimal stimulus intensity for the elicitation of median nerve SEPs. Finally, the P15 SEP component is studied using a bipolar configuration and its relation with thalamocortical fibers and the usefulness of SEPs in the diagnosis of Bickerstaff's brainstem encephalitis.

The fourth and fifth sections are '*evoked potentials in monitoring*' and '*mapping of evoked potentials and event-related potentials*' (eight studies). The issues investigated are: (i) the influence of stimulus repetitions on the non-target and target ERP components (N1 and P3); (ii) the importance of preoperative mapping (somatosensory-evoked magnetic field) and intraoperative monitoring (SEP and motor evoked potential, MEP) on the surgery of a tumour near the sensorimotor region; (iii) an interesting method for localizing brain neural generators, proposing first the use of a blind source separation algorithm (e.g. the SOBI algorithm) to separate discrete signals generated from various brain and artefacts and then the application of a distributed source model (e.g. minimum norm solutions), which could account for more spatially and extended sources. The authors consider that the combination of discrete and distributed source modelling may increase the power of source localization in EEG/ERP. Finally, four more studies report the patterns of ERD/ERS in simple finger movement, the processing of Latin vs. kanji characters, the specificity of the N170 component to familiar and non-familiar face processing and the ERP components affected in a Simon task (spatial interference).

The next section, (vi) *multi-sensory integration, multi-modal evoked potentials*, includes seven studies devoted to the study of the integration of multi-sensory inputs. Several issues were investigated in relation to multi-sensory integration: auditory-visual inputs at different intervals, auditory-visual-somatosensory effects on reaction time facilitation and the P300 (showing no benefits for visual-somatosensory presentations), the evoked pattern by somatic (electrical stimulation)-auditory stimulation, and an interesting study in which voice presentation (male or female) clearly affects the processing of a face in a gender discrimination task. A large study on multimodal evoked potentials (SEP, VEP and BAEPs, brain stem auditory brain potentials) is also reported assessing 111 patients with

probable multiple sclerosis (MS). The results show that tibial nerve SEPs had the greatest diagnostic value (followed by median nerve SEPs and VEPs). The seventh section (*Neuroimaging*) includes eight reports. Of particular interest is a study of the integrity of the corticospinal and corticobulbar tracts using diffusion tensor tractography after region of interest specification in ALS patients (with bulbar or limb onset symptoms). A laser evoked potential (and its magnetic counterpart) study is also reported on the brain correlates of C-fiber burning pain stimulation with laser and its relation to different attentional conditions. An fMRI study is also reported on pain processing using virtual visual stimulation in allodynia patients (neuropathic pain caused by noxious stimulation).

The eighth section entitled '*neuromagnetic fields*' contains 12 studies addressing multiple issues: for example, stimulus repetition effects on the visual evoked field, analysis of the AEP and auditory evoked fields (N1m), the analysis of somatosensory evoked fields in newborns, face perception integration, within category phonetic discriminations using the mismatch magnetic field and a go/noGo study. The next section, (ix) '*magnetic stimulation*', is the largest, with 12 studies in which magnetic stimulation (TMS) is normally used to elicit MEPs. Several studies evaluate the effect of low frequency repetitive TMS on SEP in rats and normal volunteers, the evaluation of corticospinal tract in spinocerebellar ataxia (SCA6), the combined effect of rTMS over the primary motor cortex and peripheral motor point stimulation which induced changes in the excitability of the motor cortex in hemiparetic stroke patients, the ERP N100 component elicited after TMS, differences between monophasic and biphasic rTMS, and finally the null effect of interventional paired associative stimulation on motor cortex excitability in Parkinson's disease (PD), which highlights the involvement of dopamine in motor cortex plasticity.

The section on '*clinical application of evoked potentials*' evaluates cognitive functioning using ERPs

on different subgroups of patients, for example, PD patients, drug-naïve schizophrenics (medicated with atypical antipsychotics), patients with higher brain injury and sleep apnea syndrome. Spinal cord evoked magnetic fields are also investigated in two studies. The following section, (xi) '*higher-brain function, evoked potentials reflecting functional anatomy*', includes 10 studies, focusing on a range of interesting research topics, for example: (a) the effects on the feedback related negativity after gains and losses in a 'rock-paper-scissors' game, (b) the impact of emotional processing on the stimulus preceding negative ERP component, (c) language functional connectivity in the dominant hemisphere investigated using cortico-cortical evoked potentials in eight epilepsy patients, (d) the influence of auditory attention on the visual mismatch negativity.

The last sections, (xii) '*epilepsy and sleep*', (xiii) '*new measurement and analysis techniques*' and (xiv) '*electromyography and others*', include nine reports. Interesting methodological proposals in these sections include single-trial event-related potential analysis using wavelet denoising methods and the use of wavelet-crosscorrelation analysis on electrocorticography recording in epilepsy.

Summarizing, Tsuji et al.'s book is an important contribution to the neuroimaging field and to the application of these tools to clinical diagnosis. The integration of neurophysiologic measures into clinical practice deserves special attention in this field. This may in fact be one of the volume's most important contributions. It should be borne in mind that many of the studies in the book may not be accessible to non-specialists.

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