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A Review of: “Neurofeedback and Neuromodulation: Techniques and Applications. Robert Coben and James R. Evans (Eds.).”

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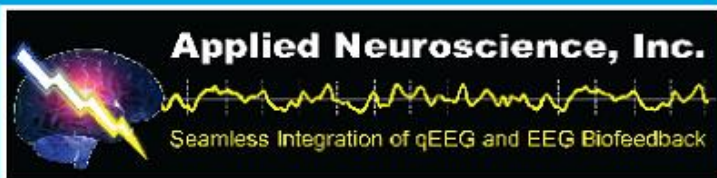
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BOOK REVIEW

NEUROFEEDBACK AND NEUROMODULATION: TECHNIQUES AND APPLICATIONS. Robert Coben and James R. Evans (Eds.). *Academic Press, London, United Kingdom, 2011, 450 pages, ISBN: 978-0-12-382235-2.*

Most book reviews lead the reader through a content review of the text, waiting until the last paragraph to summarize and leaving the reader to wait for a recommendation from the reviewer. So to break the trend, here it is: Put this book in your library. This text offers the latest research and summaries of “hot topics” in the field of neuromodulation and analysis of brain function. The best analogy is of reading through a listserv discussion with leaders in the field, whom you’ve always wanted to pull off to the side at a conference and have a good chat.

The text is divided into four sections: The first section covers neuromodulation analysis techniques, the second section covers endogenous neuromodulation strategies, the third section explores exogenous neuromodulation strategies such as repetitive transcranial magnetic stimulation (rTMS) and Transcranial Direct Current Stimulation, and the fourth section explores evidence of change mechanisms and long-term consolidation.

The most intriguing attribute of the book in the reviewer’s opinion is that the topics covered aren’t always the standard, accepted theories in the field but are proposals with scientific backing for the reader to become educated about and utilize when thinking about clients but not necessarily for clinicians to put into action, as many may not have the training for all applications examined in the text. For example, the first chapter, by Jack Johnstone and Joy Lunt, discusses qEEG and many applications from neurofeedback

protocol efficacy to using EEG to guide TMS, and qEEG/event-related potential (ERP) to guide medication management.

The book includes what we think we know about brain function, but better, where we may be going in terms of thinking about brain function. An example of this is Chapter 2, which discusses Blind Source Separation. Most of us are probably familiar with EEG source analysis methods based on a head model and the inverse solution but may not be as familiar with BSS. Marco Congedo and Leslie Sherlin do an excellent job of trying to simplify the concept for those practitioners who may not be mathematically inclined; however, the reading is still challenging for the uninitiated. Nonetheless, the reader will leave the chapter much better educated about, and have a greater appreciation for, data recorded from scalp electrodes.

Chapter 3 addresses brain function in terms of specific events related to stimuli, or ERPs. With authors Juri Kropotov, Andreas Mueller, and Valery Ponomarev explaining ERP origins, analysis, and practical applications, the reader will have an understanding of the functional importance of ERPs in psychological applications, diagnosis, and defining effects of TDS and neurofeedback.

Martijn Arns, Jay Gunkelman, Sebastian Olbrich, Christian Sander, and Ulrich Hegerl explain EEG vigilance and phenotypes in neuropsychiatry in Chapter 4. The authors point out the argument that “something is wrong with our definitions of psychiatric disorders and hence the *DSM-IV*” and the importance of understanding the current status of brain function when making a diagnosis or designing treatment. Their approach is defined by the concept of biomarkers and how that may be defined by the EEG. In addition, the vigilance model is

employed to help explain possible contradictions in EEG activity on an individual basis.

Chapter 5 begins Part 2, Endogenous Neuromodulation Strategies, with Roger deBeus and David Kaiser reviewing the results of a randomized, double-blind, placebo-controlled study of neurofeedback and children with attention deficit/hyperactivity disorder (ADHD). These investigators used a cross-over design and identified “learners” and “nonlearners.” They included both parent and teacher ratings and thorough assessments with outcomes that will help guide future studies of ADHD and neurofeedback.

Rob Coben and Lori Wagner discuss empirical evidence in connectivity-guided neurofeedback for autistic disorders. They include currently accepted treatments, neurofeedback, and qEEG evaluation for autism spectrum disorders (ASDs). The chapter does a wonderful job of summarizing current literature, giving the reader a working knowledge of the options for treatment but more specifically pointing out the efficacy and limitations of current research in the field. Dr. Coben summarizes his well-designed studies that point to neurofeedback as “possibly efficacious with potential.”

Neurofeedback and epilepsy is the topic of the chapter by Gabriel Tan, D. Corydon Hammond, Jonathan Walker, Ellen Broelz, and Ute Strehl. The authors summarize the latest research and clinical protocols and supplement with wonderful case studies that the reader may find valuable in putting theory into practice. The authors also introduce LENS (the Low Energy Neurofeedback System) as treatment for epilepsy and headaches and seem to advocate for several possibilities for symptom relief which nicely incorporates neurofeedback, LENS, and qEEG.

The topic of Chapter 8 is feedback of slow cortical potentials (SCP) by Sarah Wyckoff and Ute Strehl. The authors explain that SCPs are a type of ERP that is time-locked to a specific event, whether the event is a stimuli or a cognitive/emotional process. This chapter reviews concepts that, as the authors point out, are not widely investigated outside of the European neurofeedback community.

Technical and training requirements are explained and differences pointed out between traditional neurofeedback and SCP feedback, which make the technique very clear to the reader. The chapter includes the method for diagnosis and evaluation as well as evidence and indications.

Chapter 9 gives the reader an overview of the history and principles of fMRI and reviews the development of rtFMRI. Ranganatha Sitaram, Sangkyun Lee, Sergio Ruiz, and Niels Birbaumer discuss the fMRI-BCI system and studies that have been conducted on healthy subjects as well as study attempts at addressing clinical populations. The authors report findings in the areas of regulation of emotion, behavioral modification, motor and auditory regulation, and language processing. Clinical populations treated include pain management, tinnitus, stroke, psychopathy, and schizophrenia. Limitations are also addressed.

Part 3, Exogenous Neuromodulation Strategies, begins with a chapter by Desirée Spronk, Martijn Arns, and Paul Fitzgerald that addresses in detail the utility of rTMS in depression. Protocols and recent developments are introduced after the reader is given a thorough introduction to TMS. Possible physiological mechanisms are explored using methodologies such as neuroimaging, neurochemical, neurotrophin, and genetic effects in terms of the antidepressant properties of rTMS.

The authors of Chapter 11 are Berthold Langguth and Dirk de Ridder, who discuss Transcranial Magnetic Stimulation for tinnitus. This chapter offers a great overview of brain function relative to tinnitus. Treatment effects are explored between single session TMS and repeated session TMS, and even in a maintenance model. According to the authors, TMS can have clinical implications for investigating pathophysiology, and may be used as a diagnostic tool as well.

In Chapter 12, Jay Reidler, Soroush Zaghi, and Felipe Fregni address the neurophysiological effects of Transcranial Direct Current Stimulation (tDCS). The chapter provides an in-depth review of the possible neurophysiological effects of tDCS, including how

low-amplitude current applied at the scalp can penetrate to the level of the cortex. They also do an eloquent job of explaining how electrical fields, when applied to brain tissue, effect cellular properties in a predictable fashion and the implications for the differences between anodal and cathodal tDCS.

Part 4 begins with Chapter 13, written by Johanne Lévesque and Mario Beauregard, who review the biological basis of ADHD but then explain results from their fMRI study that measured effects of neurofeedback in 20 ADHD children on neural substrates relative to that diagnosis as well as results from other measures such as the Digit Span and IVA.

Tomas Ros and John Gruzelier coauthored Chapter 14, "The Immediate Effects of EEG Neurofeedback on Cortical Excitability and Synchronization" (p. 399). The chapter is statistics-heavy but well worth the effort in terms of the author's findings. They state that their results "provide a first basis for the 'missing link' between the historical long-term training effects of neurofeedback and direct validation of direct neuroplastic change after an individual session of training."

The final chapter is written by Rob Coben, Martijn Arns, and Mirjam Kouijzer. The authors discuss both neurofeedback as a treatment for children with ADHD and ASD and the long-term behavioral and neuropsychological effects of training in both diagnoses. The authors found benefit across all experiments reviewed and further state that neurofeedback is both effective and can lead to long-lasting changes in these populations.

This book is a must read for clinicians and researchers who want to keep up to date with the latest thinking and research in our field, written by some of the best thinkers and researchers in our field. As a wise professor once told me, it's not getting to an answer that matters, but asking the questions that provoke ongoing discussion, and this book does just that. Each chapter reflects the diverse interests and experiences of its author(s) and will draw the learner into each topic. Summary: strongly recommend!

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