
Preface

Many of our modern investigations into the nervous system are possible because of the pioneering work from Ludwig's Institute in the late 1800s (1, 2). From this single site came many of the techniques and discoveries that still provide information on the work being conducted today. Nevertheless, activation, inhibition or destruction of the nervous system or its component parts as a vital tool for the investigation of function has undergone remarkable development in the past 150 years. More recently, new approaches have been developed that allow for activation, inhibition or destruction of parts of the nervous system as therapeutic tools. Methods for activating or inhibiting parts of the nervous system have developed considerably since Borison and Wang's (3) initial experiments with Radon lesions in the medulla oblongata of dogs 60 years ago (Fig. 4 of (3)).

The objective of this book is to provide an overview of modern methods for generating lesions as well as for stimulating and inhibiting neural pathways. Most physiological studies require activation or inhibition of pathways in order to gain a mechanistic understanding of sensory inputs, integration and efferent pathways. Currently available approaches provide sensitivity and specificity that were unheard of at the time of Borison and Wang (3). An overview of the progress in the use of the neurotransmitter glutamate as a chemical excitant is provided. This method has its roots in the seminal work of many investigators in the 1970s (4). Since that time, investigations into the role of amino acid neurotransmitters increased dramatically as it became clear that they are responsible for the largest component of fast neurotransmission in the brain and spinal cord, as well as exerting effects on slowly acting metabotropic receptors and being required for other cellular activities.

A number of different approaches for activating and inhibiting neurons, nuclei and nerves are assayed. Many new techniques such as optogenetics and the use of the *in situ* perfused preparation are examined. In other sections, the use and validity of more well-known approaches are reassessed. The use of local anaesthesia to achieve reversible denervation in physiological studies—an approach that is common in clinical medicine—is examined in the context of baroreceptor denervation. Less invasive methods of examining baroreceptor function using heart rate variability and baroreflex sensitivity are also considered. At the intracellular level, cellular and integrative functions resulting from the activation or inhibition of neuronal G protein systems are assayed. Current approaches to antidromic activation are then assessed, as is the technique of dye labelling by electroporation of Neurobiotin. Activation and inhibition of single neurons during intracellular recording as well as using multibarrel electrodes extracellularly in the vicinity of an intracellular electrode are described. Analysis of sympathetic nerve activity in the periphery is a topic that has created considerable discussion for many years, and this is also examined. Another approach that is commonly used in neurophysiology is the compound action potential. Examination of the compound action potential in relation to vision and estimation of motor units in mice is

described. Changes in peripheral nerve function following nerve injury and subsequent neuropathic pain is an important area of study and is discussed in relation to two models. Finally, a method for improving motor function in humans following stroke is described.

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References

1. Fye WB (1986) Carl Ludwig and the Leipzig Physiological Institute: 'a factory of new knowledge'. *Circulation* 74(5): 920–928
2. Ludwig C, Cyon dE (1866) Die Reflexe eines der sensiblen Nerven des Herzens auf die motorischen Nerven der Blutgefäße. *Ber der Sächs Ges der Wissenschaften* 18: 307–328
3. Borison HL, Wang SC (1951) Quantitative effects of radon implanted in the medulla oblongata: a technique for producing discrete lesions. *J Comp Neurol* 94: 35–55
4. Watkins JC, Curtis DR, Felix D (1971) Effect of intracellular injection of pyridine nucleotides on electrical responses of cat spinal motoneurons. *Brain Res* 35(2): 570–572

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