# Section on Clinical Electrophysiology

Curriculum Content Guidelines for

**Electrophysiologic Evaluation**

**Introduction**

For the purpose of this document, electrophysiologic evaluation is defined as encompassing the observation, recording, analysis, and interpretation of bioelectric muscle and nerve potentials, detected by means of surface or needle electrodes, for the purpose of evaluating the integrity of the neuromuscular system.

Electrophysiologic evaluations include but are not limited to clinical electromyography, motor and sensory nerve conduction studies, and other evoked potential procedures. The following are sugggested guidelines for entry-level curricula content in the area of electrophysiologic evaluation.

**I. Terminal Behavioral Objectives**

Upon completion of academic and clinical experiences, entry level graduate physical therapists will be expected to:

1. **Describe** the neuromuscular anatomy and **explain** physiologic basis for electrical testing.
2. **Explain** electrophysiologic principles such as strength duration curves and characteristics of waveforms including amplitude, duration, frequency and rate of rise and decay.
3. **Identify and describe** common pathologic conditions for which ENMG evaluation is indicated and recognize the need for referral for testing.
4. **Identify** the applications and limitations for ENMG tests.
5. **Describe** the basic procedures for nerve conduction studies (NCS) and **Identify** the peripheral and cranial nerves that may be examined with these studies
6. **Perform** motor and sensory NCS in a safe and effective manner.
7. **Measure** parameters such as latencies, amplitude, duration.
8. **Calculate** segmental conduction velocities
9. **Recognize** normal and abnormal NCS values and correlate resu1ts of NCS with clinical findings,
10. **Document** the findings of a nerve conduction study.
11. **Observe** and **explain** the basic procedure of EMG examination.
12. **Describe** how an EMG needle examination is performed.
13. **Recognize** the general characteristics of normal and abnormal potentials.

14. **Explain** the significance of normal and abnormal EMG findings.

15. **Identify and explain** sources of error in electrophysiologic testing.

16. **Correlate** data from NCV and EMG test reports with pathologic conditions associated with those findings.

17. **Integrate** the electrophysiologic findings into the formulation or modification of a Physical Therapy evaluation and plan of care.

18. **Describe** the principles, indications and interpretation for repetitive stimulation tests, Braistem auditory evoked potential testing (BAER)" Visual evoked response (VER0, Somatosensory evoked potentials (SSEP), H-reflex testing and F-wave testing.

19. **Identify** contraindications for NCS and EMG.

20. **Explain** electrical safety procedures as related to electrophysiologic procedures.

21. **Describe** infection control procedures as related to electrophysiologic procedures.

22. **Describe** the state laws governing the practice of ENMG by Physical Therapists in state(s) where students receive their formal academic and clinical education.

## II. Prerequisite and/or Concurrent Information

### Gross Anatomy:

Knowledge of the muscular system of the body with emphasis on structural and cross-sectional relationships. This knowledge should include, but not be restricted to myotomes. as well as, normal and common anomalous innervation patterns. The representative muscles for each segment level of the spinal cord should be recognized as a basis for establishing a pattern for electrophysiologic evaluation.

The pattern and location of neuromuscular tissues, vital areas, and bony and other landmarks should be readily located for electrode placement guidance.

### Neuroanatomy

The organization and functional features of the central and peripheral nervous system should be understood. Of specific concern are the relationships between suprasegmental control and the motor unit, as well as the organization and role of the motor unit itself. Knowledge of the course of peripheral nerves between the spinal cord and their distal distributions is required for accurate signal sensing, evoked potential measurement, and identification of innervation anomilies.

### Nerve and Muscle Physiology

The genesis of bioelectric currents in excitable membranes, their waveforms and conduction characteristics over peripheral motor and sensory nerves is basic to successful performance of electrophysiologic evaluation. The function of the myoneural junction and the impulse transmission to depolarize the muscle membrane must be understood to differentiate junctional signals from those of nerve or muscle.

The properties of excitation-contraction coupling and the response of muscle to evoked or endogenous signals permit recognition of normal or abnormal temporal characteristics of muscle excitability. Understanding the properties of spinal segmental ref1exes contributes to improved description and analysis of the bioelectric activity of muscle and nerves. Bioelectric properties of

muscle and nerves can be altered by underlying metabolic changes or by drugs, thus requiring a degree of comprehension proficiency of such effects.

**Clinical examination**

**Client history and observation**
**Clinical Test and Measures**
Neuromuscular (Muscle Strength and Endurance, Cranial nerve function)
Sensory Perception Testing (pain, temperature, touch, pressure, cognitive)
Reflex Testing
Cardiovascular System (Heart Rate, Blood Pressure)
and Peripheral Circulatory System
Edema
Musculoskeletal System
Active & Passive Motion
Basic Postural Assessment
Basic gait analysis

**Physical Sciences relevant to Electrophysiologic Evaluation**

## III. Electrophysiologic Evaluation Content

The knowledge base of the physical therapist performing electrophysiologic evaluation should include the following areas, based on the Position on Electrophysiologic Evaluation HOD 06-85-37-63.

Knowledge and skill in the procedures involved in a clarifying evaluation are necessary to the entry-level graduate to have an understanding of and appreciation for electrophysiologic evaluation. These procedures include appropriate chart review, and acquisition of pertinent information of the patient's personal and family history. A clinical work-up of the patient includes testing of muscular strength joint range of motion, sensory distribution, and individual physical and psychological variations of patients which may affect the outcome of the evaluation.

Knowledge of how the bioelectric signals are obtained, processed, displayed and recorded is needed along with knowledge of instrumentation used to perform NCV and EMG evaluation. Knowledge of basic characteristics of recording and stimulating electrodes is also necessary, and should be included.

The entry-level graduate should be able to explain the tests. Knowledge of safety procedures is necessary so that appropriate safety measures are strictly followed.

Knowledge of the appropriate procedures for performing electrophysiologic evaluation is essential. These procedures include proper electrode selection, placement, and e1ectrophysiologic s1gnal sampling techniques.

The ability to recognize the various norma1 and abnormal bioelectric responses observed during examination and/or stated in a report based on their amplitude, duration, waveform, frequency of occurrence, and recruitment pattern is essential. Proper reporting of the results of the electrophysiologic evaluation is essential. The ability to review a report of NCS and EMG test results and draw appropriate clinical correlations (which may include referral) identifying relevance of findings to formulating a physical therapy assessment and p1an of care are also essential.

Entry level physical therapists will have laboratory practice in performance of basic nerve conduction studies. Demonstrations of EMG exams will be observed and discussed.