AMERICAN BOARD OF CLINICAL NEUROPHYSIOLOGY, INC.

Candidate Handbook

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GENERAL INFORMATION

The American Board of Clinical Neurophysiology, Inc. (formerly The American Board of Qualification in Electroencephalography, Inc.) was founded in 1946 by Herbert Jasper, M.D. It is the oldest free-standing Board for medical certification.

The purpose of the Board is to establish and improve standards of knowledge and proficiency in the professional practice of Clinical Neurophysiology. This is accomplished by examinations in the field of Clinical Neurophysiology of the Central Nervous System, including Electroencephalography (EEG), Evoked Potentials (EP), Polysomnography (PSG), Epilepsy Monitoring, and Neurologic Intraoperative Monitoring (NIOM). The Board issues a certificate to eligible candidates who have satisfactorily completed both Parts I and II of the examination. The Board also grants one or more specialty or subspecialty designations (upon successful of the Part II examination) in the areas of: General Clinical Neurophysiology, Epilepsy Monitoring, or Neurologic Intraoperative Monitoring.

TRAINING REQUIREMENTS

The ABCN is an American Medical Subspecialty board. Therefore, all candidates for Diplomate status must be physicians (MD, DO, MBBS, or equivalent) who have completed primary board certification in Neurology, or a related American Board of Medical Specialties – sponsored board certification (as below).

An applicant who wishes to be examined by the Board must be a physician who has successfully completed residency training in Neurology (including Pediatric Neurology) or a related field such as Neurosurgery, Psychiatry, or a critical care specialty such as Anesthesia or Critical Care, in an ACGME, UCNS or RCPSC-accredited program, and has obtained Primary Board Certification in that specialty.

In addition, an applicant must have completed (or will complete within three months) training for a minimum of 12 months (full time, or full-time-equivalent if during a longer period of part time training), as supervised by a senior clinical neurophysiologist, in a Clinical Neurophysiology fellowship program. At least nine months of this training must have been devoted to full time (or FTE) Clinical Neurophysiology training following completion of residency.

The Board expects that training in EEG and Clinical Neurophysiology will include broad exposure to the scientific basis of clinical neurophysiology, as well as relevant aspects of technique and instrumentation. Additional knowledge of sleep, intraoperative monitoring, EEG telemetry, and evoked potentials is required depending on the track chosen. All candidates are expected to have extensive experience interpreting EEGs, in all age groups and in a wide range of clinical disorders.

The ABCN also offers examination and certification for candidates (usually international physicians who are clinical neurophysiologists) who are not eligible for primary (US) board certification. These candidates may submit an application to take the ABCN examination. Upon successful completion of the examination, they will be issued ABCN “International Certificates” of having passed the examination, along with recognition in the subspecialties of General Clinical Neurophysiology, Epilepsy Monitoring, or Neurologic Intraoperative Monitoring. [If subsequent Primary US Board certification is submitted, ABCN Diplomate status may also be awarded.]
APPLICATION PROCEDURE

Application forms may be obtained from the Executive Office and on-line at the American Board of Clinical Neurophysiology website, www.abcn.org. The application process is complete only when the application fee, the application form, and the required supporting documents have been received by the Executive Office. Candidates who have trained in more than one location must send documentation from each program director. Because the Board asks the individual responsible for training to certify that the applicant has satisfactorily completed the program and is capable of independent record interpretation, endorsement should not be requested until near the end of training.

A candidate may apply to take the examination within the last two months of fellowship. Upon successful taking of the examinations AND notification from the Clinical Neurophysiology that the candidate has competed the fellowship, the Diplomate certificate will be sent.

Candidates with primary (US) board certification, completing Clinical Neurophysiology training programs should submit:
1. A completed ABCN application.
2. Copy of a valid, current, license to practice medicine.
3. Evidence of primary US board certification, e.g. in Neurology from the ABPN, or other related field, as above.
4. Documentation from the Clinical Neurophysiology fellowship program director stating that the candidate “has (or will have within two months) completed 12 months of formal training in Clinical Neurophysiology and is competent to interpret EEGs and other Clinical Neurophysiology studies independently.”
5. The application fee.

Candidates (often international physicians) who have not completed primary (US) board certification, completing Clinical Neurophysiology training programs should submit:
1. A completed ABCN application.
2. Copy of a valid, current, license to practice medicine.
3. Documentation from a Clinical Neurophysiology program director stating that the candidate “has completed 12 months of formal training in Clinical Neurophysiology and is competent to interpret EEGs and other Clinical Neurophysiology studies independently.”
4. The application fee.

It is the responsibility of the applicant to obtain the necessary supporting documentation from the fellowship director, using the forms provided with the application materials. Program directors should send completed forms directly to the Executive Office. The Executive Director will notify the candidate when the application is complete. Application must be completed no later than two months preceding the date of the written examination.

Approval of the applicant for examination is determined on an individual basis by the Board upon review of the information submitted. Once an individual’s application is approved by the Board, the applicant is considered an eligible candidate and must take the examination within 3 years after notification of eligibility.

Candidates may take both Parts I and II of the ABCN exam within the same two week testing period if they wish.

Special testing arrangements may be made for special needs individuals submitting an application, examination fee, and a letter describing the nature of the disability and the special accommodations needed for testing. Requests for special testing for special needs must be received at least EIGHT weeks before both the written and oral examinations.

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THE EXAMINATION

The ABCN examination is intended to test the knowledge of the candidate in Clinical Neurophysiology of the central nervous system, as it relates to disorders of the nervous system and to medicine in general. In addition, the Board will expect the candidate to demonstrate knowledge of basic neurologic science pertinent to an understanding of Clinical Neurophysiology and disorders of the nervous system.

THE BOARD

The Board consists of practicing physicians with expertise in central Clinical Neurophysiology and intraoperative monitoring.

LENGTH OF ELIGIBILITY

It is expected that both Part I and Part II examinations must be satisfactorily completed within five years after notification of approval of the application. Failure to do so requires that a new application and fee be submitted. A candidate who fails either Part must be reexamined and complete the exam process within five years. Candidates are strongly advised to seek further education before re-examination. There is no limit to the number of times a candidate may attempt the examination within the five year period.

NOTIFICATION OF RESULTS

ABCN will release results only to the candidate. Notification is done by mail. Certificates are sent to successful candidates within two months of the examination. Names of new Diplomates and Certificates are announced on the ABCN website and shared with the American Society of Clinical Neurophysiology. Occasionally the ABCN database may be published. Contact information will not be included.

CERTIFICATION AND RECERTIFICATION

Candidates will be certified by the Board when they have passed both Part I and Part II examinations. Those successfully completing the Epilepsy Monitoring Track will be certified in Central Clinical Neurophysiology “with special competency in Epilepsy Monitoring.” Those successfully completing the Intraoperative Monitoring Track will be certified “with special competency in Intraoperative Monitoring”. Those successfully completing the General Clinical Neurophysiology Track will be certified in “Central Clinical Neurophysiology.” Certificates are time-limited and certificants and diplomates are subject to recertification by written examination at the end of ten years. Diplomate status is offered to successful candidates who have provided documentation of primary certification in Neurology by the American Board of Psychiatry and Neurology or the American Osteopathic Board of Neurology and Psychiatry.

Any certificate issued by the Board shall be subject to revocation any time the Board shall determine in its sole discretion that the diplomate to whom the certificate was issued either was not properly qualified to receive it or has since become disqualified because the medical license of the diplomate is withdrawn or suspended for cause. Individuals whose certificate has been revoked by the Board will be entitled to appeal the Board’s action by submitting new evidence to the Board. Any such appeal process must be initiated in writing by the diplomate. If this is done, the Board will consider the new evidence and then take final action. Once this procedure is completed, the Board’s decision will be final and not contestable. Upon reinstatement of the license, certification will be reinstated upon petition by the physician.

It is the responsibility of the diplomate to keep the Executive Office informed of changes in name and address and licensure status as soon as the change is made.
VERIFICATION OF CREDENTIALS

A database of ABCN Diplomates and Certificates is maintained in the ABCN Executive Office. Requests to verify credentials should be directed to the Office. Verbal and written verifications are provided upon request.

The American Board of Clinical Neurophysiology, Inc. does not discriminate on the basis of age, sex, race, religion, national origin, marital status, or handicapping condition.

AMERICAN BOARD OF CLINICAL NEUROPHYSIOLOGY

PART I EXAMINATION INFORMATION

The three-hour examination will be administered during an established two-week testing period at PSI Computer Testing, Inc. The examination consists of 120 objective, multiple-choice questions. Admission to the examination requires submission of the application and application fee. Once accepted, the examination fee of $450 is due to ABCN.

PSI has many computer-based testing sites in the United States. Scheduling is done on a first-come, first-service basis. Please note that hours and days of availability vary at different centers. You will not be able to schedule your examination appointment until you have received an Eligibility Notice from PTC.

If you do not receive an Eligibility Notice or other correspondence at least three weeks before the beginning of the two-week testing period, contact the Professional Testing Corporation by telephone at 212-356-0660.

If you need to cancel your examination appointment or reschedule to a different date within the testing period you must contact PSI at 800-211-2754 no later than noon, Easter Standard Time of the second business day PRIOR to your scheduled appointment. There are no refunds for this examination. If you fail to arrive for your appointment or cancel without giving the required notice, you will forfeit your testing fee.

A candidate who fails the Part I examination may repeat the test within two years without filing a new application by advising the Executive Director and submitting a second examination fee no later than six weeks before the examination. If the candidate does not pass the examination within five years, a new application, application fee, and examination fee must be filed with the Board. Eligibility requirements will be those in place at the time of the new application.
Part I Content Outline

I. Physiology and Instrumentation

A. Physiology
   1. Anatomy of neural generation
   2. Mechanisms of EEG and evoked potential generation
   3. Pathophysiology of abnormal waveforms
   4. Basic mechanisms of epileptogenesis

B. Instrumentation and Acquisition Procedures
   1. Basic electricity and electronics
   2. Amplifiers and their characteristics
   3. Calibration
   4. Filters
   5. Localization and polarity
   6. Artifacts
   7. Electrical safety
   8. Computers and principles of averaging
   9. Electrodes and their application
   10. Techniques of ECS determination
   11. Statistics
   12. Long term monitoring
   13. Instrumentation and safety in the operating room
   14. Principles of EEG digitalization

II. Clinical EEG

A. Basic EEG Patterns From Prematurity to Senescence
   1. Maturational changes
      a. Neonatal
      b. Other age related changes
   2. Normal adult patterns-wake
   3. Normal variants
   4. Activation procedures

B. Clinical Correlation
   1. Seizures
   2. Other paroxysmal and transient conditions
   3. Focal lesions
   4. Diffuse and multifocal encephalopathies
   5. Coma
   6. Brain death
   7. Drug and other treatment effects
   8. Patterns of uncertain significance
   9. Disorders affecting sleep patterns
   10. Periodic patterns
   11. Neonatal disorders
   12. Extended monitoring

C. Sleep
   1. Physiology
   2. Instrumentation
   3. Clinical

III. Clinical Evoked Potentials

A. Visual
   1. Stimulus and recording techniques
   2. Physiological parameters
   3. Standard parameters of stimulation and recording
4. Criteria of abnormality
5. Clinical correlation

B. Auditory
1. Stimulus and recording techniques
2. Physiological parameters
3. Standard parameters of stimulation and recording
4. Criteria of abnormality
5. Clinical correlation

C. Somatosensory
1. Stimulus and recording
2. Physiological parameters
3. Standard parameters of stimulation and recording
4. Criteria of abnormality
5. Clinical correlation

D. Event related
1. Stimulus and recording techniques
2. Physiological parameters
3. Standard parameters of stimulation and recording
4. Criteria of abnormality
5. Clinical correlation

IV. Sleep

A. Technical, polysomnography
1. Selection of appropriate recorded variables
   a. Neonates and children
   b. Adults
2. Recording parameters for different variables
3. Recording respiration
4. Artifacts

B. Physiology
1. Sleep stage criteria
   a. Neonates and children
   b. Adults
2. Patterns of drowsiness and sleep
   a. Neonates
   b. Children, adults, elderly
3. Sleep indices criteria
4. Normal sleep architecture
5. Normal EEG patterns of drowsiness in children, adults and elderly
6. Circadian rhythms and sleep
7. Neural and neurochemical control of sleep patterns
8. Effects of sleep deprivation, sleep needs

C. Clinical aspects
1. Effect on epileptiform activity and seizures
   a. Neonates and children
   b. Adults
2. Common parasomnias
3. Effects of drugs on sleep architecture
4. Criteria of abnormal sleep architecture
5. Disorders of excessive somnolence
   a. Polysomnographic testing in diagnosis
   b. Multiple sleep latency testing in diagnosis
6. Disorders of initiation and maintenance of sleep
7. Abnormalities of sleep in CNS disease
8. Indications for sleep monitoring

V. Intraoperative Monitoring
A. SEP monitoring for spinal cord, brainstem and cerebral surgery
B. BAEP monitoring techniques for eighth nerve and brainstem surgery
C. EEG monitoring for cerebral surgery
D. Motor evoked potential monitoring for spinal cord surgery
E. Cranial nerve monitoring
F. Criteria for decision making
G. Influence of anesthetic agents

VI. Epilepsy
   A. Applications and limitations of ambulatory EEG monitoring
   B. Applications and limitations of video/EEG monitoring
   C. Recognition of ictal patterns
   D. Correlation of EEG patterns with clinical syndromes
   E. Intracranial recording

REFERENCES

The latest editions of the following references may be of some help in preparing for the ABCN examination. This list does not attempt to include all acceptable references, nor is it suggested that the exam is necessarily based on these references.


AMERICAN BOARD OF CLINICAL NEUROPHYSIOLOGY

PART II EXAMINATION

The Part II three-hour examination will be administered during an established two-week testing period at PSI Computer Testing, Inc.

The examination consists of approximately 100 objective, multiple-choice questions. Candidates will have three hours to complete the track selected. Acceptance to the examination requires submission of a Part II application and $450 exam fee per track.

The candidate must select at least one of three tracks for the completion of Part II. These three tracks include Epilepsy Monitoring, Neurophysiologic Intraoperative Monitoring and General Clinical Neurophysiology.

Epilepsy Monitoring Track

Content Outline

The Epilepsy Monitoring Track will contain more case-based items and will incorporate video segments.

A. Correlation of interictal EEG with seizure type
   1. Partial onset
   2. Secondarily generalized
   3. Primary generalized
      a. Convulsive
      b. Nonconvulsive

B. Identification of various patterns of ictal onset, propagation, and resolution along with their localizing significance in scalp recordings
   1. Focal onset seizure
   2. Generalized convulsive seizure
   3. Generalized nonconvulsive seizure
   4. Syndromes
      a. Hypsarrhythmia – electrodecremental seizures
      b. Lennox Gastaut syndrome
      c. Electrical SE during slow sleep
      d. Landau-Kleffner syndrome
   5. Recognition of non-ictal events & patterns
      a. Artifacts
      b. Nonepileptic paroxysmal patterns
   6. Technical aspects
      a. Appropriate recording montages
      b. Activation techniques


c. Other approaches that may assist in event interpretation

C. Recognition of clinical manifestations of various seizure types, and their appropriate classification
   1. Simple partial
   2. Complex partial
      a. Automatisms
      b. Lateralizing signs
      c. Localizing signs
   3. Secondarily generalized
      a. Lateralizing signs
      b. Localizing signs
   4. Primary generalized
      a. Convulsive
      b. Absence
   5. Myoclonic
   6. Atonic

D. Identification and localization of neonatal seizures
   1. Interictal EEG patterns
   2. Ictal EEG patterns
      a. Focal
      b. Multifocal
   3. Clinical manifestations

E. Recognition of behavioral features suggestive of non-epileptic events
   1. Psychogenic
   2. Arrhythmia
   3. Parasomnia
   4. Other

F. Planning and Interpretation of Intracranial Monitoring
   1. Indications for intracranial monitoring
   2. Choice of intracranial electrodes
      a. Subdural strips
      b. Grids
      c. Depth electrodes
   3. Interictal epileptiform activity
   4. Ictal activity
      a. Identification of seizure onset
      b. Localization

G. Evaluation of patients for epilepsy surgery
   1. EEG findings leading to
      a. Temporal lobectomy
      b. Corpus callosotomy
      c. Multiple subpial transection
   2. EEG and the intracarotid amobarbital test (Wada)
   3. Intraoperative electrocorticography
      a. Uses
      b. Limitations

Neurophysiologic Intraoperative Monitoring Track
Content Outline

The NIOM Track will contain more complex multiple-choice questions focused on all aspects of Neurophysiologic Monitoring. Candidates will have three hours to complete 120 items.

A. Basic NIOM techniques 25%
   1. SEP
   2. MEP
   3. BAEP
   4. EEG
   5. ECoG
   6. EMG/NCS
   7. VEP
   8. Others

B. Anatomy and physiology 15%
   1. Cerebral cortex
   2. Subcortical structures
   3. Brainstem and cerebellum
   4. Ascending and descending pathways
   5. Cranial nerves
   6. Spinal cord
   7. Peripheral nerves, neuromuscular junction, muscles
   8. Vascular anatomy
   9. Head and neck
   10. Spine and other bones
   11. Cellular physiology
   12. Others

C. Surgical procedures and NIOM (to include surgical technique and NIOM questions) 25%
   1. Vertebral column surgery
   2. Spinal cord surgery
   3. Lumbosacral surgery
   4. Tethered cord surgery
   5. Peripheral nerve surgery
   6. CPA surgery
   7. Vascular surgery
   8. Cardiac and aortic surgery
   9. Epilepsy surgery
   10. Brain tumor surgery
   11. Posterior fossa decompression surgery
   12. Selective dorsal rhizotomy
   13. Pain surgery
   14. Movement disorders surgery
   15. Cranial nerve surgery
   16. Pelvic floor surgery
   17. Hip surgery
   18. ENT surgery
   19. Other surgery

D. Anesthetic considerations 15%
   1. SEP
   2. MEP
3. BAEP
4. EEG
5. ECoG
6. EMG/NCS
7. VEP
8. Anesthesia not modality related
9. Others

E. Operating room procedures 5%
1. Sterilization techniques
2. OR equipment
3. Anesthesia equipment
4. Aseptic techniques/sterile field
5. Imaging
6. Communication

F. Equipment/Networking issues 10%
1. Electrodes
2. NIOM machines (incl. amplifiers, filters, averaging, electrical issues, etc)
3. Networking, remote access
4. Other/Ancillary equipment

G. Ethical and medicolegal issues 5%
1. ACNS guidelines
2. AANEM guidelines
3. AAN guidelines
4. Medicare rules for interpretation
5. Real time review issues
6. Other

Generalist Track Content Outline

The Generalist Track will include short segments of neurophysiologic studies (EEG, evoked potentials, etc.), with one or more multiple-choice questions for each sample. Additional multiple choice questions will cover technical aspects of recording and clinical correlation.

A. Electrocencephalography 45%
1. Physiology of normal and abnormal waveforms
2. Instrumentation and acquisition procedures (include quantitative EEG)
3. Normal patterns of various ages in wake, drowsy, and sleep states
4. Neonatal normal and abnormal patterns
5. Activating procedures (hyperventilation, photic stimulation)
6. Drug effects
7. Focal abnormalities
8. Diffuse abnormalities
9. Coma and brain death
10. Epileptiform abnormalities
11. Benign EEG variants and patterns of unknown significance
12. Artifacts

B. Epilepsy Monitoring 15%
1. Correlate interictal EEG with seizure type / epilepsy syndrome
2. Localization and propagation of epileptogenic foci (children, adults)
3. Correlation of behavioral and electrographic changes
4. Identify and localize neonatal seizures
5. Nonepileptic events (physiologic and psychogenic)
6. Plan and interpret intracranial monitoring
7. Evaluate patients for epilepsy surgery

C. Evoked Potentials 15%
1. Visual evoked potentials (pattern reversal)
2. Brain stem auditory evoked potentials
3. Short latency somatosensory evoked potentials
   a. Stimulus and recording techniques
   b. Criteria for identification of major waveform components
   c. Criteria for normal and abnormal evoked potentials for adults and children
   d. Presumed generator sources of major waveform components
   e. Clinical significance of various evoked potential abnormalities
   f. Technical and non-pathologic factors that influence evoked potentials and affect interpretation

D. Sleep 15%
1. Recognition of sleep stages
2. Identification of examples showing the effects of age, physiological and environmental variables, and disease on sleep architecture
3. Interpretation of multiple sleep latency studies
4. Identification of polysomnographic findings in sleep-related disorders
5. Montages, special instrumentation and other technological aspects of sleep studies

E. Intraoperative Monitoring 10%
1. SEP monitoring for spinal cord, brainstem and cerebral surgery
2. BAEP monitoring techniques for eighth nerve and brainstem surgery
3. EEG monitoring for cerebral surgery
4. Motor evoked potential monitoring for spinal cord surgery
5. Cranial nerve monitoring
6. Criteria for decision making