



# The Biofeedback Certification International Alliance

## Blueprint of Knowledge Statements for Board Certification in Biofeedback

The provider certified in Biofeedback will demonstrate entry-level mastery of: **Yellow highlights are important for Techs**

### I. ORIENTATION TO BIOFEEDBACK – 2 hours

#### A. Definition of biofeedback

1. Summarize the AAPB definition of biofeedback  
*Biofeedback is a process that enables an individual to learn how to change physiological activity for the purposes of improving health and performance. Precise instruments measure physiological activity such as brainwaves, heart function, breathing, muscle activity, and skin temperature. These instruments rapidly and accurately "feed back" information to the user. The presentation of this information — often in conjunction with changes in thinking, emotions, and behavior — supports desired physiological changes. Over time, these changes can endure without continued use of an instrument.*
2. Provide an overview of the modalities commonly used in biofeedback, including blood volume pulse (BVP), electrodermal (EDR), electroencephalographic (EEG), heart rate (HR), heart rate variability (HRV), respiratory (RESP), surface electromyographic (SEMG), and temperature (TEMP) biofeedback.

#### B. History and development of biofeedback

1. Identify the pioneers in biofeedback and their main contributions (e.g., Basmajian, Budzynski, Gevirtz, Green, Kamiya, Lehrer, Lubar, Miller and DiCara, Peper, and Serman).
2. Summarize the findings of seminal studies in the development of biofeedback (e.g., Miller & DiCara, 1967; Taub & School, 1978; Green, Green, & Norris, 1979).

#### C. Overview of principles of human learning as they apply to biofeedback.

1. Summarize the major concepts of classical and operant conditioning.
2. Explain the relevance of learning principles to biofeedback training (e.g., shaping and fading, and generalization).

#### D. Assumptions underlying biofeedback

1. Explain how biofeedback training utilizes feedback and feed-forward.
2. Discuss the concept of self-regulation and describe specific self-regulation skills.
3. Explain the roles of passive and active volition in self-regulation training.

### II. STRESS, COPING, AND ILLNESS – 3 hours

#### A. Summarize these models of stress and illness:

1. Biopsychosocial
2. Transactional
3. Allostatic load
4. Dysponesis

#### B. Explain psychophysiological reactions to stressful events.

##### 1. Acute stress

- a. Fight-or-flight or freeze response
  - i. Sympathetic-adrenomedullary activation
  - ii. Relationship to panic disorder and somatization
- b. Parasympathetic responses:
  - i. Polyvagal theory (e.g., fainting, freezing, tend-and-befriend)
- c. Respiratory responses
  - i. Overbreathing
  - ii. Apnea
  - iii. Gasps and sighs

##### acute stressor effects (change and time until change) on blood volume pulse and temperature

##### 2. Chronic Stress

- a. Hypothalamic-pituitary-adrenocortical activation
- b. Health consequences of chronic stress
  - i. Psychoneuroimmunology (PNI) and its implications for immune-related illness
  - ii. Effects on HRV and its implications for illness and death

#### C. Discuss psychosocial mediators of stress

1. Cognitive appraisal of stressors, conditions in which the stress response can be beneficial or harmful, and coping resources.
2. Affect (e.g., anger, anxiety, hostility, compassion, depression, gratitude, and hopelessness).
3. Personality dispositions
  - a. Self-efficacy
  - b. Resilience
  - c. Optimism
  - d. Big 5 personality traits
  - e. Type D personality
4. Social support

### III. PSYCHOPHYSIOLOGICAL RECORDING – 8 hours

- A. Describe the most commonly employed biofeedback modalities: blood volume pulse (HR and HRV), capnometer, electrocardiograph (HR and HRV), electrodermograph (skin conductance and potential), electromyography (EMG), oximeter, respirometer, and thermograph.
  1. Discuss sensors and typical placements
    - a. Explain when professionals should use wide and narrow SEMG placements (know where to place active and reference electrodes), the phenomenon of volume conduction, (add effect of subcutaneous fat on EMG measurements) and how these placements affect measurements and vulnerability to artifacts.
    - b. Discuss when professionals should use larger or smaller diameter electrodes and the rationale for each choice. discuss the advantages of disposable electrodes
  2. Explain the physiological mechanisms that generate these signals.
  3. Explain how to prepare the skin.
  4. Describe characteristic signals:
    - a. Units of measurement
    - b. Typical amplitude and frequency ranges
  5. Summarize common artifacts, their appearance in a raw signal, and strategies for their control.
- B. Explain the purpose of a tracking test and how to perform it for each biofeedback modality.
- C. Explain how to measure and achieve acceptable skin-electrode impedance in SEMG recording.
- D. Summarize how you can check electrode cables for breaks.

E. Explain how to prevent shock hazards (e.g., optical isolation, and telemetry).

- F. Explain how the following electronic concepts apply to biofeedback. Where they measure instrument performance, recognize acceptable values:
  1. Conduction and insulation
  2. Voltage (E)
  3. Current (I)
  4. Resistance (R)
  5. Ohm's Law ( $E=IR$ )
  6. Power
  7. Impedance (Z)
  8. Signal-to-noise ratio and sensitivity
  9. Differential amplifiers
  10. Common mode rejection
  11. Frequency
  12. Low-pass, high-pass, and notch filters
  13. Bandpass and bandwidth: explain the effect of narrow and wide bandpasses on EMG amplitude and vulnerability to artifacts
  14. Power spectrum and Fast-Fourier analysis
  15. Time constant
  16. Resolution

G. Describe aseptic techniques to prevent transmission of infection.

1. Explain how to disinfect clinic surfaces, including furniture.
2. Describe how to disinfect sensors and cables.
3. Discuss how disposable sensors reduce infection risk.
4. Understand how personal reusable sensors (e.g., rectal or vaginal) reduce infection risk.

### IV. RESEARCH METHODOLOGY - 2 hours

- A. Understand the difference between experimental and non-experimental designs, as well as the use of randomly controlled and non-randomized designs, and the conclusions that can be drawn from each.
- B. Explain the importance of internal and external validity, reliability, and power in evaluating research findings.
- C. Understand basic descriptive and inferential statistics.
- D. Explain how meta-analyses help professionals evaluate treatment efficacy.
- E. Summarize evidence-based practice efficacy criteria as outlined in the *Template for Developing Guidelines for the Evaluation of Clinical Efficacy of*

- F. Review and summarize key research studies that have established current efficacy levels of major applications of biofeedback (e.g., asthma, headache, and hypertension).

## V. SURFACE EMG (SEMG) APPLICATIONS – 6 hours

- A. Understand skeletal muscle anatomy and physiology
1. Explain the concept of a motor unit and functions of small and large motor units.
  2. Describe the EMG frequency distributions seen in relaxed, strongly contracted, and fatigued muscles.
- B. Identify the location and functions of major muscle groups trained in biofeedback.
- C. Describe common muscle actions (e.g., flexion and extension).
- D. Understand the anatomy and physiology involved in the following disorders:
1. Low back pain
  2. Tension-type headache
  3. TMJD
- E. For chronic musculoskeletal pain, explain:
1. Ascending and descending pain pathways
  2. Gate control theory
  3. Trigger point mechanisms
  4. Allodynia
- F. Explain the following treatment strategies
1. SEMG assessment
    - a. Static versus dynamic assessment
    - b. The clinical significance of SEMG asymmetry and sustained muscle contraction
  2. SEMG tension recognition and discrimination training
  3. SEMG down-training and up-training
- G. Identify target muscles, typical electrode placements, SEMG treatment protocols, and their efficacy for the following conditions:
1. Tension-type headache
  2. TMJD
  3. Posterior neck and upper back pain

4. Low back pain
5. Pain due to poor workplace ergonomics

## VI. AUTONOMIC NERVOUS SYSTEM (ANS) APPLICATIONS – 8 hours

- A. Understand the anatomy and physiology of the autonomic nervous system.
1. Describe the sympathetic, parasympathetic, and enteric branches in terms of their location, innervation of major organs, and actions.
  2. Anatomy and autonomic innervation of the cardiovascular, electrodermal, GI, and respiratory systems.
  3. The mechanisms that contribute to heart rate variability (HRV).
- B. Explain the following psychophysiological concepts:
1. Tonic, phasic, and spontaneous activity
  2. Orienting and defensive responses
  3. Arousal/activation
  4. Adaptation and habituation
  5. Homeostasis and the boundary model
  6. Individual response stereotype
  7. Situational specificity of physiological response
  8. Placebo and nocebo effects
- C. Explain ANS assessment strategies
1. Psychophysiological stress and relaxation profiles
  2. Resonance frequency breathing rate determination
- D. Describe ANS training strategies
1. Biofeedback-assisted relaxation
  2. HRV biofeedback
  3. Peripheral blood flow (BVP and temperature) biofeedback
  4. Skin conductance/potential biofeedback
- E. Explain the pathophysiology, treatment protocols, and their efficacy for the following disorders:
1. Anxiety
  2. Depression
  3. Hypertension
  4. Irritable bowel syndrome
  5. Migraine headache
  6. PTSD
  7. Raynaud's disease
  8. Recurrent abdominal pain

## VII. RESPIRATORY APPLICATIONS – 3 hours

- A. Describe respiratory anatomy and physiology, including the muscles used in inhalation and exhalation.
- B. Explain the physiological mechanisms that generate end-tidal CO<sub>2</sub> and regulate oxygen distribution to tissues.
  - 1. Explain the importance of pH in respiratory physiology
  - 2. Explain the importance of the Bohr effect the effect of slowing breathing on oxygen delivery to tissues
  - 3. Recognize healthy end-tidal CO<sub>2</sub> and oxygen saturation values
- C. Describe the following breathing patterns:
  - 1. Effortless breathing
  - 2. Overbreathing and hyperventilation
  - 3. Clavicular breathing
  - 4. Thoracic breathing
  - 5. Reverse breathing
  - 6. Apnea
- D. Describe breathing assessment and training techniques
  - 1. How to assess overbreathing
  - 2. How to teach healthy breathing
    - a. Explain the importance of effortless breathing
    - b. Describe how to teach abdominal breathing
    - c. Summarize strategies to correct dysfunctional breathing patterns (e.g., overbreathing)
- E. Explain the pathophysiology, treatment protocols, and their efficacy for the following disorders:
  - 1. Asthma
  - 2. COPD
  - 3. Panic disorder

## VIII. INTERVENTION STRATEGIES – 8 hours

- A. Intake procedures
  - 1. Explain how to assess the presenting problem
    - a. Measure the frequency, intensity, and duration of symptoms
    - b. Identify what exacerbates and alleviates the symptoms
    - c. Document prior treatment for the presenting problem, including medication, medical and mental health histories
- B. Treatment Planning

Explain how to use empirical evidence and individual assessment results to choose appropriate biofeedback training methods.

- C. Education
  - 1. Explain biofeedback and the individual's role in this learning process
  - 2. Identify the psychophysiology underlying the individual's concern(s)
  - 3. Explain how biofeedback can address the individual's concern(s)
  - 4. Discuss how to adjust your client's expectations
  - 5. Explain the importance of practice to biofeedback training success
- D. Training
  - 1. Explain how to:
    - a. establish a baseline and compare client progress within and across sessions
    - b. structure a biofeedback training session
    - c. select and evaluate appropriate biofeedback displays
    - d. adjust display speed and resolution
    - e. utilize shaping and reinforcement in biofeedback training
    - f. provide verbal feedback during biofeedback training
    - g. set short-term and long-term training goals
    - h. assign home practice and promote client accountability
    - i. use symptom and practice logs in biofeedback training
    - j. schedule training to promote transfer of training and reduce the risk of relapse
  - 2. Summarize strategies to prepare a client for graduation
  - 3. Describe how to evaluate training success
- E. Training resources
  - 1. Summarize strategies to increase mindfulness
  - 2. Explain how to integrate autogenic training, progressive muscle relaxation, visualization and imagery, and effortless breathing into biofeedback

## IX. PROFESSIONAL CONDUCT – 2 hours

- A. Certification
  - 1. Understand the difference between certification and licensure
  - 2. Explain how the voluntary surrender or revocation of a license affects BCIA certification
  - 3. Recognize the importance of continuing education and advanced training

4. Describe how BCIA responds to complains regarding the ethical conduct of its certificants
- B. Responsibility and competence
1. Understand one's responsibility and liability in provision of services
  2. Demonstrate competence in all aspects of service provided
  3. Explain why professionals must limit the scope of practice to areas of expertise and to services permitted by the relevant practice act.
  4. Understand the difference between experimental versus experimentally-validated treatments, and how to explain this to prospective patients
  5. Identify contraindications to treatment
  6. Understand the ethical principles of one's primary profession and the challenges of complying with competing ethical guidelines
  7. Discuss how to ethically advertise, market services, and make public statements
- C. Client rights
1. Explain how to ensure privacy, confidentiality, and secure privileged communication
  2. Describe how to obtain informed consent for assessment and treatment
  3. Summarize procedures for accepting clients, avoiding abandonment, and making appropriate referral
  4. Explain how to protect client privacy, rights, feelings, and sensitivities when attaching biofeedback sensors
  5. Discuss universal precautions in biofeedback
  6. Explain how to ensure equal access to health care
- D. Supervision and consultation
1. Discuss appropriate consultation and supervision in biofeedback
2. Understand the requirement that BCIA-certified technicians operate under BCIA-certified supervisors.
  3. Explain the purposes of consultation and supervision
  4. Describe the process of supervision
  5. Outline the guidelines for seeking supervision
- E. Professional relationships
1. Explain the issue of multiple relationships (dual relationships)
  2. Discuss how to avoid conflicts of interest and exploitation of clients
  3. Describe how to communicate client progress with a referring physician.
  4. Discuss consultation, referral, and relationships with other professionals
  5. Explain how to monitor health and medication
  6. Describe procedures for dealing with unethical behavior of colleagues
- F. Record keeping
1. Discuss how to maintain technical and legal records
  2. Identify legally-required records and applicable requirements for their retention
  3. Explain how to document a client's medical history
  4. Describe how to maintain records security to ensure confidentiality

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