TRANSITION GUIDE TO

Neuroscience
Exploring the Brain
FIFTH EDITION

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This transition guide serves to outline the updates and new content found in ***Neuroscience: Exploring the Brain, Fifth Edition.***

OUTSTANDING FEATURES

- Content is written in a way that is accessible to both science and nonscience students alike, enriched by full-color illustrations to further highlight core material.
- *Path of Discovery* boxes, written by leading famous experts in the field (including Nobel laureates Robert Lefkowitz, Eric Kandel, and Roderick MacKinnon), showcase actual research experiences, illuminating real-life paths to scientific discovery.
- *Neuroscience and Medicine* boxes, which highlight the health significance of material covered in each chapter and connect neuroscience to its many medical applications.
- *Brain Byte* and *Brain Food* boxes dig deeper into select topics of interest to satisfy or stimulate students' curiosity further.
- *Review Questions* found at the end of each chapter provoke thought and help students integrate the material.

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REVISION UPDATES

- Content has been updated to reflect new discoveries and trends in the field. Significant new technologies, such as CRISPR/gene editing, brain stimulation methods, microscopy, functional imaging, connectomics, stem cells, computational modeling, and more have been described where appropriate.
- Learning Objectives were added to each chapter
- All existing boxed features have been revised, updated and refreshed.
- *Neuroscience and Medicine* boxes are new to this edition and highlight and expand upon medically relevant material.
- *Path of Discovery* boxes continue to be authored by leading experts in the field, bringing new faces into the fold.

APPLICABLE COURSES

- Neuroscience
- Neurobiology
- Physiological Psychology
- Biological Psychology (or Biopsychology)
- Brain and Cognitive Science

INSTRUCTOR RESOURCES

- Test Bank (LMS compatible), PowerPoint Slides, Student Assignments and Activities, Lesson Plans, Image Bank

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NEW AND UPDATED IN THIS EDITION

Please note that the order of chapters and general topics covered in each one has not changed in the *Fifth Edition.*

CHAPTER 2. Neurons and Glia

- Glial cell types and functions
- Advances in microscopy
- Gene editing technology, including CRISPR
- Dendrites, spines, and synapses reconstructed from electron micrographs
- Criteria for classifying neurons

CHAPTER 3. The Neuronal Membrane at Rest

- How protein structures are revealed
- Regulation of potassium

CHAPTER 4. The Action Potential

- Refractory periods
- Mechanisms of local anesthetics and neurotoxins

CHAPTER 5. Synaptic Transmission

- Short-term synaptic plasticity

CHAPTER 6. Neurotransmitter Systems

- Neurosteroids and their therapeutic relevance
- Beta-arrestin and G-protein signaling

CHAPTER 7. The Structure of the Nervous System

- Chronic traumatic encephalopathy
- The glymphatic system
- Connectomics

CHAPTER 8. The Chemical Senses: Taste and Smell

- Classic and newly discovered types of taste
- Molecular mechanisms of taste transduction
- Labeled-line and population coding schemes in sensory systems
- Evolution of taste receptors in bats, cats, whales, birds, and humans

CHAPTER 9. The Eye

- Color vision abnormalities
- Lateral inhibition and receptive field structure
- Ganglion cell edge detection

Chapter 10. The Central Visual System

- Sensory and motor nuclei of the thalamus
- Segregation and integration of processing streams in area V1
- Blindsight, Charles Bonnet syndrome, and visual hallucinations

CHAPTER 11. The Auditory and Vestibular Systems: Hearing and Balancing

- Molecular mechanisms of hair cell transduction
- The cochlear amplifier
- Auditory disorders and genetics of deafness
- Cochlear implants
- Sound localization mechanisms

CHAPTER 12. The Somatic Sensory System: Touch, Pain, and Itch

- Structure and function of mechanosensitive ion channels, including PIEZO2
- Mechanosensation and sex
- Somatic sensory maps in females and males
- Ion channels critical for nociception, temperature sensing, and itch

CHAPTER 13. Muscles and the Spinal Control of Movement

- Spinal reflex circuits
- Mechanisms of proprioception
- Degenerative disorders, including ALS and Duchenne muscular dystrophy

CHAPTER 14. Brain Control of Movement

- Motor structures and pathways in the brain
- Functional organization of the human motor cortex
- Mechanisms of Parkinson's disease and Huntington's disease

CHAPTER 15. Chemical Control of Brain and Behavior

- Enteroception
- Long COVID and the brain
- Empathogens

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CHAPTER 16 Motivation

- Glucagon-like peptide-1 and appetite
- Motivation to socialize

CHAPTER 17. Sex and the Brain

- Sex vs gender
- Male and female brain anatomy and connectivity
- Sexual orientation, gender identity and the brain
- Sex as a factor in neurological disease

CHAPTER 18. Brain Mechanisms of Emotion

- Human emotional expression
- Interoception, insular cortex. and the experience and expression of emotion
- Constructed emotion theory

CHAPTER 19. Sleep, Circadian Clocks, and Brain Rhythms

- Methods of neural recording in humans (EEG, ECoG, LFP, MEG)
- Sleep definitions, phenomenology, and functions
- Neural structures, circuits, and neurotransmitters of sleep regulation
- Mechanisms of circadian rhythms

CHAPTER 20. Language

- Classification of aphasia
- Braille and sign language
- Language networks and parallel streams

CHAPTER 21. The Resting Brain, Attention, and Consciousness

- Functions of the default mode network
- Default mode subnetworks
- Attention and selection history
- Dorsal and ventral attention networks
- Classification of normal and abnormal consciousness
- Theories of consciousness

CHAPTER 22. Mental Illness

- Endozepines
- MDMA-assisted therapy
- Seasonal affective disorder
- Rapidly acting antidepressant treatments
- NMDA receptor autoimmune encephalitis

CHAPTER 23. Wiring the Brain

- Axon guidance through local protein synthesis
- Releasing the brakes on plasticity

CHAPTER 24. Memory Systems

- Working memory mechanisms
- Spatial memory and specialized neurons in the hippocampal system
- Indexing theory and memory retrieval
- Sleep and memory consolidation

CHAPTER 25. Molecular Mechanisms of Learning and Memory

- Behavioral time scale plasticity
- Homeostatic plasticity
- Molecular switch hypotheses
- Synaptic tagging and capture

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