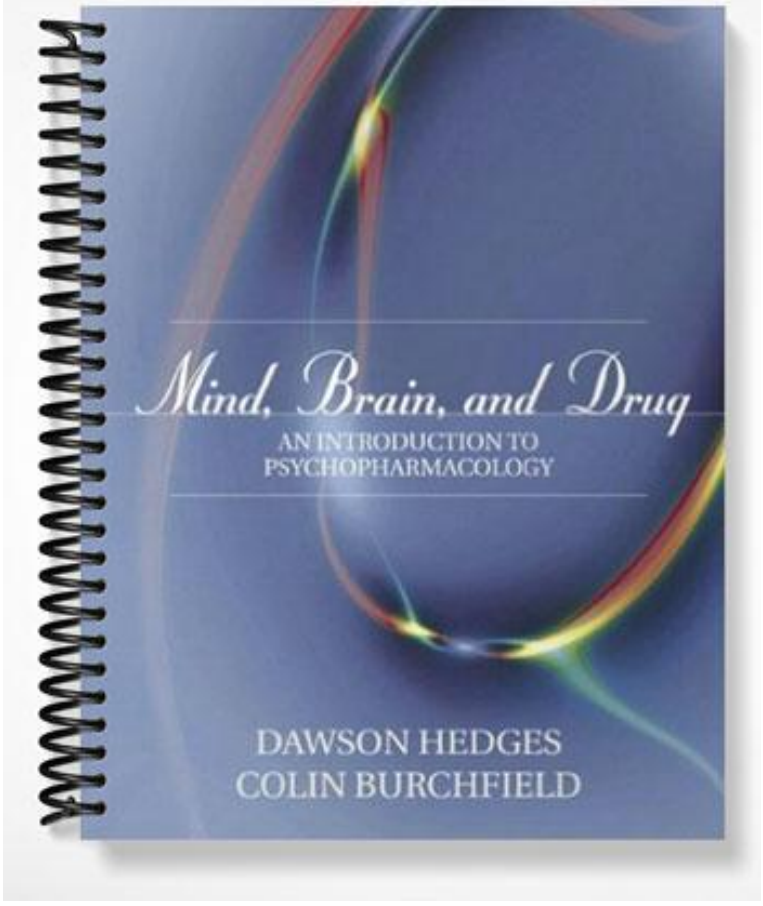
TEST BANK


Mind, Brain, and Drug
AN INTRODUCTION TO
PSYCHOPHARMACOLOGY
DAWSON HEDGES
COLIN BURCHFIELD

Instructor's Manual and Test Bank

for

Mind, Brain, and Drug
An Introduction to Psychopharmacology

prepared by

Dawson Hedges
Brigham Young University

Colin Burchfield
Columbus Air Force Base

Boston New York San Francisco
Mexico City Montreal Toronto London Madrid Munich Paris
Hong Kong Singapore Tokyo Cape Town Sydney

ISBN 0-205-47321-0

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1 09 08 07 06 05

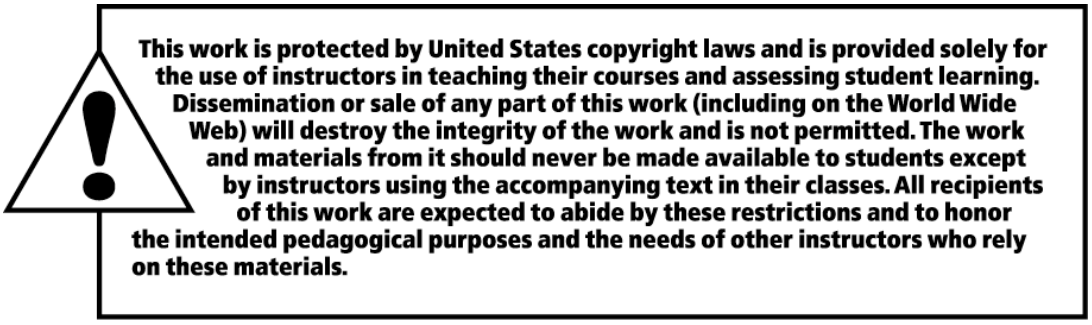


Table of Contents

Section One: The Neurobiological Basis of Psychotropic Drug Action

Section Two: The Psychotropic Drugs: Their Pharmacology, Metabolism, Interactions, Adverse Effects, and Therapeutic Uses

SECTION ONE: THE NEUROBIOLOGICAL BASIS OF PSYCHOTROPIC DRUG ACTION

Chapter 1. Neurons, Synapses, and the Brain: A Brief Introduction to Neuroscience

Chapter 1 Summary

In order to facilitate an understanding of psychopharmacology, it is helpful to have a basic understanding of the organization of the nervous system. To begin with, the fundamental unit of the brain is the neuron. Although neurons have many features in common with other cells in the body, they are also highly specialized for their primary roles of transmitting and processing information. For example, neurons have dendrites, specialized regions that receive information for other neurons, and axons, cellular processes extending from the neurons that transmit information to other neurons. Information travels through a neuron as an electrochemical wave known as an action potential.

Bounded by the membranes of the in-coming neuron and the out-going neurons, the synapse is the area at which inter-neuronal communication occurs. Intra-neuronal communication occurs by means of a wave of depolarization known as an action potential, which can cause a neuron to release chemical messengers called neurotransmitters into the synapse, where the neurotransmitter diffuses across the synaptic space to interact with the next neuron. This interaction may result in yet another action potential being generated in the down-stream neuron.

The brain itself is organized into an incredible variety of regions, each having a role in overall brain function. The brainstem, located just above the spinal cord, contains areas involved in heart and respiratory function. Near the brainstem is the cerebellum, which is important in the coordination of movement, as well as for some types of memory and conditioned learning. The hypothalamus controls much of the response to stress, hormonal function, and regulation of temperature, blood volume, and appetite. Nearby is the thalamus, where information flowing from the brain to the rest of the body and from the body to the brain passes and to some extent is processed. The cerebral cortex is that part of the brain most visible when grossly inspected. Highly convoluted, to increase surface area and mass, the cortex contains many areas of specialization. Parts of the cortex receive in-coming information from all sensory modalities. Other regions of the cortex further integrate and process this information. Notable for its size in humans in relation to other areas of the brain is the frontal cortex, which is thought to bet the neurobiological basis for planning, judgment, insight, and emotional control.

Chapter 1 Contents

Thalamus

Limbic Structures

- amygdala
- hippocampus

Basal Ganglia

Cerebral Cortex

- temporal lobe
- parietal cortex
- visual cortex
- frontal cortex
- association cortex

Summary

Suggested Readings

Sweatt JD (2005): Hippocampal function in cognition. Psychopharmacology 174: 99-110.

After reviewing the anatomy of the hippocampus, this article summarizes the function of the hippocampus in cognition, including its role in memory consolidation, spatial cognition, and sensory integration.

Chklovskii DB, Mel BW, Svoboda K (2004): Cortical rewiring and information Storage. Nature 431: 782-788

After briefly reviewing the hypothesis that memory may be stored by changing the strength between synaptic connections, the authors explore notion that cortical memory storage might involve actual changes in neuronal connections, joining previously unconnected parts of the brain.

Constantinidis C, Procyk E (2004): The primate working memory networks. Cognitive, Affective & Behavioral Neuroscience 4: 444-465

The authors review the anatomy of working memory, including the prefrontal cortex, other cortical areas, and the medialdorsal thalamus and the basal ganglia.

Murray EA, Wise SP (2004): What, if anything, is the medial temporal lobe, and how can the amygdala be part of it if there is no such thing? Neurobiology of Learning and Memory 82: 178-198

The authors discuss the anatomy of the medial temporal lobe, arguing that the different regions of the medial temporal lobe have unique functions, an argument that is contrast to the generally accepted understanding that the medial temporal lobe structures share similar functions.

Kolb B, Gibb R, Robinson TE (2003): Brain Plasticity and Behavior. Current Directions in Psychological Science 12: 1-5

In this succinct article, the authors review what is known about brain plasticity, emphasizing the ability of the brain to reorganize itself and some of the putative factors involved in brain plasticity. In so doing, they point out that brain plasticity casts the nurture-nature debate in new terms, as nurture appears to affect nature.

Multiple-Choice Questions

1. The number of neurons in the human brain is estimated to range from
    a. Twenty-five million to 50 million.
    b. Fifty million to 100 million.
    c. Twenty billion to 100 Billion.
    d. Twenty Trillion to 100 Trillion.

2. The estimated number of connections between neurons is approximately
    a. Thousands.
    b. Millions.
    c. Billions.
    d. Trillions.

3. Which one of the following is found within the neuronal cell body?
    a. Dendrites.
    b. Axons.
    c. *En passant* terminals.
    d. Mitochondria.

4. The diameter of a dendrite
    a. Increases with increasing distance from the cell body.
    b. Decreases with increasing distance from the cell body.
    c. Does not change with the distance from the cell body.
    d. Varies erratically with no relationship to the distance from the cell body.

5. Dendritic spines
    a. Are specialized areas of the dendrite where excitatory input is received from other neurons.
    b. Serve to protect the dendrite from oligodendrocytes.
    c. Merge one synapse with another to homogenize excitatory input.
    d. Are specialized areas of the dendrite where inhibitory input is received from other neurons.

6. Axons leave the cell body from
    a. The axon hillock.
    b. Dendritic spines.
    c. The nucleus.
    d. Oligodendrocytes.

7. Ionic pumps maintain
    a. Equal resting concentrations of sodium ions both inside and outside of the neuron.
    b. Higher resting concentrations of sodium ions inside the neuron than outside of the neuron.
    c. Higher resting concentrations of sodium ions outside of the neuron than inside the neuron.
    d. Higher concentrations of sodium ions in the interior of the neuron compared to sodium ion concentration in the synapse.

8. The action potential can be best viewed as
    a. A wave of hyperpolarization.
    b. A wave of depolarization.
    c. A spreading wave of enzyme activity.
    d. A wave of neurotransmitter release.

9. Nuclei are
    a. The points at which an axon contacts a dendrite.
    b. Clusters of neurotransmitter molecules.
    c. The point from which an action potential is generated.
    d. Groups of neurons.

10. An autosynapse occurs at the junction between
    a. An axon and a dendrite from a different neuron.
    b. An axon and its own cell body.
    c. An axon and a cell body from a different neuron.
    d. A dendrite and a cell body from a different neuron.

11. For neurotransmitter release a presynaptic neuron to occur
    a. The vesicular membrane must fuse with the pre-synaptic membrane.
    b. Neurotransmitter must first be released into the cytoplasm before reaching the synapse.
    c. The vesicle containing the neurotransmitter must be released into the synapse, whereupon the vesicle then ruptures, spilling the neurotransmitter into the synapse.
    d. Calcium ions bind to the neurotransmitter molecules stored in the vesicle, transporting them into the synapse.

12. Reuptake receptors
    a. Prevent the transportation of neurotransmitters into the post-synaptic neuron, thus maintaining a steady concentration of synaptic neurotransmitter.
    b. Enable neurotransmitter to be transported into the neuron from whence it was released.
    c. Enable neurotransmitter to be transported into the post-synaptic neuron, where it can initiate additional chemical events in the neuron.
    d. Reabsorb the vesicular remnants formed after neurotransmitter release.

13. Oligodendrocytes
    a. Produce the vesicles that store neurotransmitter.
    b. Compose much of the blood-brain barrier.
    c. Are integrally involved in the brain's immune response.
    d. Form myelin.

14. The volume of the human brain is approximately
    a. 500 cubic centimeters.
    b. 900 cubic centimeters.
    c. 1400 cubic centimeters.
    d. 2200 cubic centimeters.

15. Oxytocin and vasopressin are released from the
    a. Midbrain.
    b. Posterior pituitary.
    c. Anterior pituitary.
    d. Kidney.

16. Parkinson's disease is associated with neuronal degeneration in the
    a. Amygdala.
    b. Thalamus.
    c. Hypothalamus.
    d. Nigrostriatal pathway.

17. Cortisol-releasing hormone directly releases
    a. Cortisol.
    b. Adrenocorticotropic hormone.
    c. Thyroid hormone.
    d. Oxytocin.

18. All of the following are functions of the hippocampus except
    a. Regulation of the hypothalamic-pituitary-adrenal axis
    b. Explicit memory.
    c. Cortisol-releasing hormone secretion.
    d. Spatial memory.

19. All of the following are part of the basal ganglia except
    a. The hippocampus.
    b. The globus pallidus.
    c. The putamen.
    d. The caudate.

20. Among other things, the cerebellum
    a. Coordinates movement.
    b. Regulates the autonomic nervous system.
    c. Processes visual stimuli, allowing for color vision.
    d. Secretes oxytocin and vasopressin.

Answers to Multiple-Choice Questions

1. c
2. d
3. d
4. b
5. a
6. a
7. c
8. b
9. d
10. d
11. a
12. b
13. d
14. c
15. b
16. d
17. b
18. c
19. a
20. a

True-False Questions

1. The resting potential of a neuron is more positive in the interior of the neuron than outside of the neuron.
    a. True.
    b. False.

2. Ionic pumps in the neuron maintain higher resting concentrations of chloride ions inside the neuron than outside of the neuron.
    a. True.
    b. False.

3. There appear to be no more than 100 million neurons in the human brain.
    a. True.
    b. False.

4. Axons protrude from the cell body from the dendritic spines.
    a. True.
    b. False.

5. The action potential is an all-or-none phenomenon.
    a. True.
    b. False.

6. Excitatory input decreases the chances of a neuron generating an action potential.
    a. True.
    b. False.

7. Because an action potential is an all-or-none phenomenon, there is little additional information transmitted by the rate at which action potential formation occurs.
    a. True.
    b. False.

8. Synapses are only found between an incoming axon and an outgoing axon.
    a. True.
    b. False.

9. Symmetric synapses are associated with inhibitory transmission.
    a. True.
    b. False.

10. Monoamine oxidase can terminate the action of certain neurotransmitters.
    a. True.
    b. False.

11. Neurons outnumber glial cells by approximately 10 to one.
    a. True.
    b. False.

12. Astrocytes produce myelin.
    a. True.
    b. False.

13. The parasympathetic nervous system is part of the autonomic nervous system.
    a. True.
    b. False.

14. Hippocampal abnormalities have been associated with major depression, schizophrenia, posttraumatic stress disorder, and Alzheimer's disease.
    a. True.
    b. False.

15. Antipsychotic drugs can cause a drug-induced Parkinson's disease.
    a. True.
    b. False.

Answers to True-False Questions

1. False
2. True
3. False
4. False
5. True
6. False
7. False
8. False
9. True
10. True
11. False
12. False
13. True
14. True
15. True

Short Answer/Essay Questions

1. Describe the possible fates of a neurotransmitter after it is released into the synapse.

2. What is the function of calcium in neurotransmitter release?

3. What is the role of the hypothalamus in the stress response?

4. Discuss action potential propagation.

5. What changes in electrical potential would an observer positioned inside a neuron see as an action potential was formed?

6. Describe the organization of the nervous system.

7. How are axons and dendrites similar?

8. How do axons and dendrites differ?
9. How does a neuron conduct information?
10. How might drugs cause a movement disorder?