

Chapter 1: A Brief History of Cognitive Neuroscience

MULTIPLE CHOICE

LEARNING OBJECTIVES

1. Explain the origins of the field of cognitive neuroscience
2. Describe the roots of the debate over localization of function
3. Explain the ways in which brain structure was studied
4. Understand the philosophical origins of cognitive psychology
5. Discuss behaviorism and its principal tenets
6. Explain how and why cognitive psychology came to the forefront of psychological fields
7. Identify the different methods that are used to measure brain function and structure

1. The case of Anne Green was remarkable in that after being falsely convicted of murdering her newborn child,
 - a. she survived an attempted electrocution.
 - b. she escaped and later married Thomas Willis, a famous neurologist.
 - c. she survived an attempted hanging.
 - d. she escaped and later became a famous neurologist.

ANS: C DIF: Easy REF: Historical Perspective
OBJ: LO 1 MSC: Remembering

2. Aside from saving Anne Green's life, Thomas Willis and Christopher Wren also
 - a. created very accurate drawings of the brain.
 - b. came up with the names of a number of brain structures.
 - c. took the first steps that led to cognitive neuroscience.
 - d. all of the above.

ANS: D DIF: Medium REF: Historical Perspective
OBJ: LO 1 MSC: Understanding

3. Which of the following is NOT one of the principal reasons that Willis is considered one of the early figures in cognitive neuroscience?
 - a. he named many brain parts.
 - b. he dissected the brains of criminals within 21 miles of Oxford.
 - c. he was among the first to link behavioral deficits to brain damage.
 - d. he created very accurate brain images.

ANS: B DIF: Difficult REF: Historical Perspective
OBJ: LO 1 MSC: Evaluating

4. A central issue of modern cognitive neuroscience is whether specific human cognitive abilities
 - a. can be localized to particular parts of the brain.
 - b. are determined by the shape and size of the human skull.
 - c. are best studied using introspection or the scientific method.
 - d. can be identified using the Golgi silver method of staining.

ANS: A DIF: Medium REF: The Brain Story
OBJ: LO 2 MSC: Understanding

5. The discipline of phrenology was founded by
- Broca and Wernicke.
 - Fritsch and Hitzig.
 - Ramón y Cajal and Sherrington.
 - Gall and Spurzheim.

ANS: D DIF: Easy REF: The Brain Story
OBJ: LO 2 MSC: Remembering

6. Phrenologists believed that the contour of the skull could provide valuable information about an individual's cognitive capacities and personality traits. This approach was based on the assumption that
- skull protrusions are caused by disproportionate development of the brain areas beneath them, which are responsible for different specific functions.
 - certain traits such as aggressiveness lead to life experiences and injuries that alter the shape of the skull in specific ways.
 - life experiences and injuries that alter the shape of the skull in specific ways lead to certain traits, such as aggressiveness.
 - the development of the skull bones directly influences the configuration of the soft brain areas beneath them, which are responsible for different specific functions.

ANS: A DIF: Difficult REF: The Brain Story
OBJ: LO 2 MSC: Evaluating

7. Localizationist is to _____ as holistic is to _____.
- Wernicke ; Gall
 - Gall ; Flourens
 - Flourens ; Broca
 - Broca ; Wernicke

ANS: B DIF: Medium REF: The Brain Story
OBJ: LO 2 MSC: Understanding

8. Gall's method for investigating phrenology was flawed because
- he used the wrong language to explain the characteristics he observed.
 - he did not tell Napoleon Bonaparte that he possessed noble characteristics.
 - he ought only to confirm, not disprove, the correlations he observed.
 - he used his own skull as the base model.

ANS: C DIF: Easy REF: The Brain Story
OBJ: LO 2 MSC: Remembering

9. The view known as *aggregate field theory*, which stated that the whole brain participates in behavior, is most associated with
- Broca.
 - Hughlings Jackson.
 - Brodmann.
 - Flourens.

ANS: D DIF: Easy REF: The Brain Story
OBJ: LO 2 MSC: Remembering

10. Willis is to _____ as _____ is to Broca.
- Flourens ; Spurzheim.
 - Spurzheim ; Flourens.
 - Gall ; Dax.
 - Dax ; Gall.

ANS: C DIF: Difficult REF: The Brain Story
OBJ: LO 2 MSC: Analyzing

11. In developing phrenology, Gall's main failure was that
- he did not seek disconfirming evidence.
 - he was not a scientist.
 - his method was correlational.
 - all of the above.

ANS: D DIF: Difficult REF: The Brain Story
OBJ: LO 2 MSC: Analyzing

12. Giovanni visits his local phrenologist. What is this person likely to tell him?
- You are a domineering person.
 - Your father was a very domineering person.
 - Your brother is a domineering person.
 - Your mother was a very domineering person.

ANS: A DIF: Medium REF: The Brain Story
OBJ: LO 2 MSC: Applying

13. The view developed by Marie-Jean-Pierre Flourens, based on the idea that processes like language and memory cannot be localized within circumscribed brain regions, was known as
- the neuron doctrine.
 - aggregate field theory.
 - rationalism.
 - the law of effect.

ANS: B DIF: Easy REF: The Brain Story
OBJ: LO 2 MSC: Remembering

14. John Hughlings Jackson proposed a _____ organization in the cerebral cortex, based on his work with people with _____.
- holistic ; aphasia
 - topographic ; aphasia
 - topographic ; epilepsy
 - holistic ; epilepsy

ANS: C DIF: Medium REF: The Brain Story
OBJ: LO 2 MSC: Understanding

15. _____ was one of the first brain scientists to realize that specific cognitive functions can be localized to specific parts of the brain and that many different functional regions can take part in a given behavior.
- Broca
 - Hughlings Jackson
 - Flourens
 - Brodmann

ANS: B DIF: Medium REF: The Brain Story
OBJ: LO 2 MSC: Remembering

16. Which nineteenth-century scientist suggested that the frontal lobe contributes to language and speech production?
- Flourens
 - Wernicke
 - Broca
 - Brodmann

ANS: C DIF: Medium REF: The Brain Story
OBJ: LO 2 MSC: Remembering

17. Paul Broca's first patient Leborgne was able to produce which of the following words?
- merci
 - tan
 - trois
 - Paris

ANS: B DIF: Easy REF: The Brain Story

OBJ: LO 2 MSC: Remembering

18. Which of the following things would have been the most difficult for the famous individual studied by Paul Broca, compared to before his stroke?
- a. listening to a piano recital
 - b. appreciating a painting
 - c. reading a book aloud
 - d. playing a game of cards

ANS: C DIF: Medium REF: The Brain Story
OBJ: LO 2 MSC: Applying

19. Which of the following things would have been the most difficult for the famous individual described by Carl Wernicke, compared to before his stroke?
- a. understanding a speech
 - b. painting a picture
 - c. singing a song
 - d. riding a horse

ANS: A DIF: Medium REF: The Brain Story
OBJ: LO 2 MSC: Applying

20. Wernicke was an early researcher who suggested that the _____ contributes to language comprehension.
- a. right frontotemporal area
 - b. left frontotemporal area
 - c. right temporoparietal area
 - d. left temporoparietal area

ANS: D DIF: Medium REF: The Brain Story
OBJ: LO 2 MSC: Applying

21. Wernicke is to _____ as Broca is to _____.
- a. understanding speech ; speaking
 - b. speaking ; understanding speech
 - c. aggregate field theory ; topographic organization
 - d. aggregate field theory ; aggregate field theory

ANS: A DIF: Easy REF: The Brain Story
OBJ: LO 2 MSC: Remembering

22. As a first approximation, individuals with damage to the left inferior frontal lobe tend to have more difficulty with _____, whereas individuals with damage to the left posterior temporal lobe tend to have more difficulty with _____.
- a. fine motor control ; the sense of touch
 - b. the sense of touch ; fine motor control
 - c. the production of language ; the perception of language
 - d. the perception of language ; the production of language

ANS: C DIF: Easy REF: The Brain Story
OBJ: LO 2 MSC: Remembering

23. One reason that early research on specific human cognitive capacities and the brain areas that are responsible for them developed rather slowly before the twentieth century is that
- a. most early investigators were limited to postmortem studies to localize lesions.
 - b. investigators did not know the brain was separated into two hemispheres until the twentieth century.
 - c. most early investigators focused on studying the brain–behavior relationship in animals rather than in humans.
 - d. there was little interest in this field until the twentieth century.

ANS: A DIF: Medium REF: The Brain Story

OBJ: LO 3 MSC: Understanding

24. Korbinian Brodmann used _____ techniques to document fifty-two regions of the brain that differed in _____.
- a. phrenological ; cytoarchitectonics
 - b. phrenological ; chronometrics
 - c. tissue staining ; cytoarchitectonics
 - d. tissue staining ; chronometrics

ANS: C DIF: Easy REF: The Brain Story
OBJ: LO 3 MSC: Remembering

25. Which of the following individuals was NOT associated with a major histological discovery in neuroscience?
- a. Edward L. Thorndike
 - b. Korbinian Brodmann
 - c. Camillo Golgi
 - d. Jan Evangelista Purkinje

ANS: A DIF: Medium REF: The Brain Story
OBJ: LO 3 MSC: Understanding

26. Researchers Fritsch and Hitzig found support for the idea that specific functions are localized to discrete parts of the cortex in an experiment using electrical stimulation of a dog's brain. More specifically, they found
- a. a systematic relationship between the portion of cortex stimulated and specific movements.
 - b. a systematic relationship between the portion of cortex stimulated and specific vocalizations.
 - c. no systematic relationship between the portion of cortex stimulated and specific movements.
 - d. no systematic relationship between the portion of cortex stimulated and specific vocalizations.

ANS: A DIF: Medium REF: The Brain Story
OBJ: LO 3 MSC: Understanding

27. Cytoarchitectonic maps distinguish different cortical regions by
- a. the structure of their surface convolutions.
 - b. their structure at the cellular level.
 - c. the complex functions they perform.
 - d. the basic functions they perform.

ANS: B DIF: Easy REF: The Brain Story
OBJ: LO 3 MSC: Remembering

28. Yvette wants to figure out whether cells in two different layers of the occipital lobe have different functions. What would she have done if she had been a scientist in the early twentieth century?
- a. look at a CAT scan
 - b. observe the tracts that connect each layer
 - c. look at patients with damage to those cells
 - d. look at the layers under a microscope

ANS: D DIF: Medium REF: The Brain Story
OBJ: LO 3 MSC: Applying

29. The neuroanatomist who described fifty-two distinct cortical areas based on cell structure and arrangement, and whose classification scheme is often used today, was
- a. Purkinje.
 - c. Brodmann.

b. Helmholtz. d. Hyde.

ANS: C DIF: Easy REF: The Brain Story
OBJ: LO 3 MSC: Remembering

30. Which of the following terms refers to the idea of a continuous mass of tissue that shares a common cytoplasm?

- a. synapse
- b. syncytium
- c. striatum
- d. claustrum

ANS: B DIF: Easy REF: The Brain Story
OBJ: LO 3 MSC: Remembering

31. *La reazione nera*, or “the black reaction,” refers to

- a. a cell stain developed by Golgi.
- b. a perceptual phenomenon described by the Gestalt psychologists.
- c. a ganglion preparation developed by Arvanitaki.
- d. a type of reinforcement-based learning described by the behaviorists.

ANS: A DIF: Easy REF: The Brain Story
OBJ: LO 3 MSC: Remembering

32. Which of the following scientists contributed to modern neuroscience in the nineteenth century?

- a. Paul Broca
- b. Sir Charles Sherrington
- c. Gustav Theodor Fritsch
- d. Santiago Ramón y Cajal

ANS: A DIF: Medium REF: The Brain Story
OBJ: LO 3 MSC: Remembering

33. Which of the following statements best describes the “neuron doctrine”?

- a. The nervous system consists of a fused network of interconnected fibers.
- b. The brain can be subdivided into regions that are distinct in cytoarchitectonics yet functionally interactive.
- c. The nervous system consists of physically distinct cells that are functionally interactive.
- d. The brain can be subdivided into functionally autonomous modules.

ANS: C DIF: Medium REF: The Brain Story
OBJ: LO 3 MSC: Understanding

34. The neuron doctrine is usually credited to _____, who used a staining technique pioneered by _____.

- a. Purkinje ; Brodmann
- b. Brodmann ; Purkinje
- c. Golgi ; Ramón y Cajal
- d. Ramón y Cajal ; Golgi

ANS: D DIF: Easy REF: The Brain Story
OBJ: LO 3 MSC: Remembering

35. The primary contribution of Golgi to the field of cognitive neuroscience was that he

- a. developed a staining technique that permitted full visualization of individual neurons.
- b. showed experimentally that the nervous system is composed of a net of physically interconnected neuronal units.
- c. discovered that cells in different regions of the cortex also differ in shape and size.
- d. demonstrated that nerves can release chemicals that have an activating effect on nearby muscle cells.

ANS: A DIF: Medium REF: The Brain Story

OBJ: LO 3 MSC: Understanding

36. The term *synapse*, coined by Sherrington, refers to the junction between
- a blood vessel and surrounding neurons.
 - two different cytoarchitectonic regions in the brain.
 - two adjacent neurons.
 - an axon and the cell body of a neuron.

ANS: C DIF: Easy REF: The Brain Story
OBJ: LO 3 MSC: Remembering

37. *Rationalism* is the philosophical position that knowledge
- originates from sensory experience.
 - must be experimentally tested.
 - must be deduced and justified through reason.
 - is globally distributed in the cortex.

ANS: C DIF: Easy REF: The Psychological Story
OBJ: LO 4 MSC: Remembering

38. *Empiricism* is the philosophical position that all knowledge
- must be deduced and justified through reason.
 - originates from sensory experience.
 - must be experimentally tested.
 - is globally distributed in the cortex.

ANS: B DIF: Easy REF: The Psychological Story
OBJ: LO 4 MSC: Remembering

39. Which of the following is NOT true of empiricism?
- It is primarily associated with the British philosophers Hobbes, Hume, and Mill.
 - It was a foundation for the associationist–behaviorist school of psychology.
 - It postulates a special role for reason and induction in human thought.
 - It emphasizes sensory experience in the development of knowledge.

ANS: C DIF: Medium REF: The Psychological Story
OBJ: LO 4 MSC: Understanding

40. Ebbinghaus, who is considered the father of modern memory research, was among the first to demonstrate that
- different types of brain lesions can produce different types of memory deficits.
 - in terms of cognition, the whole is greater than the sum of its parts.
 - behavior is best understood in terms of stimulus–response relationships.
 - internal mental processes can be measured in rigorous and reproducible ways.

ANS: D DIF: Difficult REF: The Psychological Story
OBJ: LO 4 MSC: Analyzing

41. All of the following are representative of the emergence of the field of cognitive science in the second half of the 20th century EXCEPT
- new developments in computer technology and artificial intelligence.
 - a philosophical shift in the field toward empiricism and associationism.
 - Chomsky’s work arguing that behaviorist theories cannot explain language acquisition.
 - Miller’s work showing that internal processes like short-term memory can be quantified.

ANS: B DIF: Difficult REF: The Psychological Story

OBJ: LO 4 MSC: Evaluating

42. Thorndike's law of effect
- stated that much knowledge is innately specified due to natural selection.
 - was written to oppose Darwin's theory of natural selection.
 - stated that a behavior that is followed by a reward is likely to occur again.
 - was written to oppose the behaviorists.

ANS: C DIF: Easy REF: The Psychological Story

OBJ: LO 5 MSC: Remembering

43. Empiricism is to _____ as rationalism is to _____.
- Locke and Hume ; Descartes and Kant
 - Locke and Descartes ; Hume and Kant
 - Descartes and Kant ; Locke and Hume
 - Hume and Kant ; Locke and Descartes

ANS: A DIF: Medium REF: The Psychological Story

OBJ: LO 5 MSC: Understanding

44. John Watson famously argued that newborn babies
- are incapable of forming memories.
 - have an intelligence comparable to our nearest primate cousins.
 - can be raised to become anything.
 - will develop different intellectual abilities according to innate differences.

ANS: C DIF: Difficult REF: The Psychological Story

OBJ: LO 5 MSC: Analyzing

45. According to associationist Herman Ebbinghaus, complex processes such as memory
- can be understood by combining different pieces of information.
 - are best understood in terms of a stimulus's emergent properties.
 - cannot be measured because they are not behaviors.
 - can be measured in an analytic fashion.

ANS: D DIF: Difficult REF: The Psychological Story

OBJ: LO 5 MSC: Evaluating

46. According to Edward Thorndike, which of the following is NOT true about rewards?
- They indicate which creatures have malleable structures in the brain.
 - They help to stamp things into the mind.
 - They lead to adaptive learning.
 - They are part of the law of effect.

ANS: A DIF: Difficult REF: The Psychological Story

OBJ: LO 5 MSC: Evaluating

47. "Cells that fire together, wire together" was first proposed by Donald Hebb as an explanation for
- epileptic seizures and their effects.
 - associations made by the law of effect.
 - the way in which the brain codes new learning.
 - amnesia caused by brain damage.

ANS: C DIF: Medium REF: The Psychological Story

OBJ: LO 5 MSC: Understanding

48. Noam Chomsky argued that the structure of human languages is _____, in contrast to B. F. Skinner's assertion that languages are _____.
- a. innate ; learned
 - b. learned ; universal
 - c. universal ; rational
 - d. rational ; innate

ANS: A DIF: Easy REF: The Psychological Story
OBJ: LO 6 MSC: Remembering

49. Which of the following people did NOT play a strong role in the theoretical shift in psychology in the latter part of the twentieth century?
- a. Noam Chomsky
 - b. Sir Charles Sherrington
 - c. George A. Miller
 - d. Claude Shannon

ANS: B DIF: Easy REF: The Psychological Story
OBJ: LO 6 MSC: Remembering

50. Which of the following people played the LEAST direct role in the development of the electroencephalogram?
- a. Hans Berger
 - b. Willem Einthoven
 - c. Richard Canton
 - d. Hermann von Helmholtz

ANS: D DIF: Difficult REF: Instruments of Neuroscience
OBJ: LO 7 MSC: Analyzing

51. You decide that you want to measure blood flow of the brain. Which of the following methods could you use?
- a. listen to the blood flow across veins
 - b. look at red blood cells under a microscope
 - c. measure the amount of iron in the blood
 - d. none of the above

ANS: D DIF: Medium REF: Instruments of Neuroscience
OBJ: LO 7 MSC: Applying

52. Computer axial tomography is to MRI as _____ is to _____.
- a. x-ray ; radio frequencies
 - b. structure ; function
 - c. blood oxygenation ; x-ray
 - d. radiation ; dipoles

ANS: C DIF: Medium REF: Instruments of Neuroscience
OBJ: LO 7 MSC: Analyzing

53. Which of the following methods measures the BOLD signal?
- a. magnetic resonance imaging
 - b. functional Magnetic resonance imaging
 - c. computerized axial tomography
 - d. electroencephalogram

ANS: B DIF: Medium REF: Instruments of Neuroscience
OBJ: LO 7 MSC: Understanding

SHORT ANSWER

1. Localizationists argued that higher cognitive functions were the product of brain activity in specific areas. Give evidence that they used to support their claims.

ANS:
Answers will vary

DIF: Easy REF: The Brain Story OBJ: LO 1
MSC: Remembering

2. Paul Broca and Carl Wernicke discovered two different forms of aphasia. Compare and contrast them.

ANS:
Answers will vary

DIF: Medium REF: The Brain Story OBJ: LO 2
MSC: Understanding

3. Describe the main tenets of the Neuron Doctrine.

ANS:
Answers will vary

DIF: Easy REF: The Brain Story OBJ: LO 2
MSC: Remembering

4. Marie-Jean-Pierre Flourens, an early neuroscientist, is believed to have been the first to make what claims about the brain?

ANS:
Answers will vary

DIF: Easy REF: The Brain Story OBJ: LO 2
MSC: Remembering

5. A major question in cognitive neuroscience is the extent to which regions of the brain are independent or integrated. Which of these two viewpoints is most valid? Present evidence to support your view.

ANS:
Answers will vary

DIF: Difficult REF: The Brain Story OBJ: LO 2
MSC: Evaluating

6. Associationism and empiricism are two main philosophical positions. Pick the one you think best describes how humans come to know things and explain why you think this.

ANS:
Answers will vary

DIF: Medium REF: The Psychological Story OBJ: LO 4
MSC: Remembering

7. Describe the transition from behaviorist to cognitive approaches in psychology.

ANS:
Answers will vary

DIF: Easy REF: The Psychological Story OBJ: LO 4
MSC: Understanding

8. Why is Noam Chomsky seen as having a major influence on cognitive psychology?

ANS:
Answers will vary

DIF: Medium REF: The Psychological Story OBJ: LO 4
MSC: Remembering

9. Describe two principal methods used to measure brain structure.

ANS:
Answers will vary

DIF: Easy REF: Instruments of Neuroscience OBJ: LO 7
MSC: Remembering

10. Describe how and why the term *cognitive neuroscience* was chosen for this field. Be sure to mention the two fields that combined to create this new field of study.

ANS:
Answers will vary

DIF: Easy REF: A Historical Perspective OBJ: LO 4
MSC: Remembering

11. You would like to understand at what point in time an event took place in the brain. What neuroimaging method would you choose? Explain why you would choose this method and what information you would be missing.

ANS:
Answers will vary

DIF: Easy REF: Instruments of Neuroscience OBJ: LO 7
MSC: Understanding