Name _____KEY_____

Nsci2001: Human Neuroanatomy
2019 Final Examination

Write your name on this page! On your bubble answer sheet, enter your name (last name, space, first name), internet ID (X.500 name) and student number. Please do it now!!!

Questions in blue are recycled from previous quizzes and exams.

Lecture 3 development

1. Which of the following structures develops from the embryonic hindbrain?

→ A. cerebellum
B. retina
C. thalamus
D. basal ganglia
E. cerebral cortex

Lecture 4 ventricles, CSF & meninges

2. Cerebrospinal fluid (CSF) drains from the 4th ventricle immediately into …

→ A. the subarachnoid space.
B. the 5th ventricle.
C. the dural venous sinuses.
D. the falx cerebri.
E. the cerebral aqueduct.

3. With the head in an upright position, such as when you are sitting in a chair, the occipital lobe of the cerebral cortex is supported by the …

A. base (lowest part) of the skull.
B. falx cerebri.
→ C. tentorium cerebelli.
D. foramen magnum.
E. pituitary gland

Lecture 5 blood supply

4. Approximately how much blood flows through the brain in a minute?

A. 25-100 ml
B. 450-800 ml
→ C. 750-1000 ml
D. 1000-1500 ml
E. 6000-7000 ml

5. What vessel returns deoxygenated blood directly into the heart?

→ A. inferior vena cava
B. aorta
C. pulmonary artery
D. pulmonary vein
E. More than one of the above are correct.

Lecture 6 cells

6. The synthesis of mRNA takes place in what cell organelle?
   → A. nucleus
   B. ribosome
   C. endoplasmic reticulum
   D. golgi apparatus
   E. mitochondria

Lecture 7 electrical properties

7. Neurons have a higher concentration of which ion inside the cell?
   A. Calcium
   B. Sodium
   → C. Potassium
   D. Magnesium

8. What happens in a neuron immediately after it reaches threshold?
   A. The lipid bilayer flips.
   → B. Voltage-gated sodium channels open to generate an action potential.
   C. Voltage-gated calcium channels close to generate an action potential.
   D. Voltage-gated sodium channels are inactivated causing a refractory period.
   E. Potassium channels repolarize the membrane.

Lecture 8 synaptic communication

9. What is the effect of tetanus toxin on certain neurons?
   A. degrades neurotransmitter receptors
   B. degrades synaptic vesicles so neurotransmitter is released inside the axon terminal
   C. increases neurotransmitter release into the synaptic cleft
   → D. prevents neurotransmitter release into the synaptic cleft

10. What is the function of SNARE proteins?
   A. depolarize the axon at the start of an action potential
   → B. facilitate fusion of synaptic vesicles to the plasma membrane at a synapse
   C. clear neurotransmitter from the synaptic cleft
   D. bind to neurotransmitter at a synapse and activate G-proteins

Lecture 9 spinal cord

11. Which of the following structures is NOT normally found in an intervertebral foramen?
   → A. spinal cord
   B. sensory ganglion
   C. ventral root
   D. dorsal root

Everyone received credit for #12. B and C are correct.

12. What structure contains axons that carry sensory information from the body into the spinal cord?
   A. ventral root
   → B. dorsal root
   C. dorsal column
   D. lateral funiculus
   E. trigeminal nerve

Lecture 12 brainstem

13. Which of the following is NOT visible on the ventral surface of the intact adult human brain?
    A. hypothalamus
    B. pons
    C. optic chiasm
→ D. basal ganglia

14. Which of the following is a landmark of the upper medulla?
    A. superior colliculi
→ B. pyramids
    C. cerebral peduncles
    D. pineal gland
    E. mammillary bodies

Lecture 13 forebrain

15. How many layers of cells is the neocortex described as having?
    A. three (3)
    B. four (4)
    C. five (5)
→ D. six (6)
    E. seven (7)

16. Axons in the corpus callosum connect …
    A. thalamus to cortex.
    B. cortex to spinal cord.
    C. multiple parts of the central nervous system to cerebellum.
→ D. the two hemispheres of the cerebral cortex to one another.

Lecture 14 cranial nerves

17. Preganglionic parasympathetic axons for control of the heart, lungs and a portion of the gut run in the …
    A. facial nerve (CN VII).
    B. glossopharyngeal nerve (CN IX).
→ C. vagus nerve (CN X).
    D. spinal nerves from cervical spinal cord.
    E. spinal nerves from thoracic spinal cord.

18. Cranial nerves can have one or more major functions. Which of the following is NOT a function of any cranial nerve?
    A. general motor
    B. general sensory
    C. special sensory
→ D. sympathetic motor
    E. parasympathetic motor

Lecture 15 & 16 somatosensory system

19. Which of the following statements regarding the dorsal column pathway and spinothalamic pathway is TRUE?
    - A. These two pathways use different thalamic nuclei.
    - B. Axons in these two pathways travel together in the spinal cord.
    - → C. The information carried by these two pathways goes to the same cortical region.
    - D. Axons in these two pathways cross the midline of the nervous system at the same place.
    - E. More than one of the above are true.

20. Axons in the right dorsal column of the spinal cord carry primarily what information?
    - A. motor control information from the left cortex
    - → B. proprioception and touch information from the right side of the body
    - C. pain, temperature and touch information from the right side of the body
    - D. pain, temperature and touch information from the left side of the body
    - E. motor control information from the left cortex and certain somatosensory information from the right side of the body

Lecture 17 & 18 vision

21. In dark conditions, photoreceptors …
    - → A. depolarize and release glutamate.
    - B. hyperpolarize and release GABA.
    - C. hyperpolarize and release glutamate.
    - D. depolarize and release GABA.

22. Visual cortex is organized into functional units called columns. Which is NOT a visual property used for columnar organization?
    - A. orientation
    - B. ocular dominance
    - → C. shade (black vs. white)
    - D. color

Lecture 19 hearing & vestibular

23. The medial geniculate nucleus is a relay nucleus passing information from the _____ to the _____ . (fill in the blanks)
    - → A. inferior colliculus, auditory cortex
    - B. hypothalamus, cingulate cortex
    - C. retina, visual cortex
    - D. basal ganglia, motor cortex
    - E. hippocampus, cingulate cortex

24. Hair cells in the cochlea are receptors for …
    - A. linear movement.
    - B. angular acceleration.
    - C. gravity.
    - → D. sound.
    - E. More than one of the above are correct.

Lecture 20 chemical senses

25. Which of the following is the first cortical area to process taste sensory information?
    - A. parietal cortex
    - → B. insular cortex
    - C. orbitofrontal cortex
    - D. piriform cortex
    - E. cingulate gyrus

26. Which of the following statements is true regarding the olfactory system?
    - → A. The olfactory bulb sends axons that synapse in the amygdala and piriform cortex.
    - B. The primary olfactory cortex is part of the orbitofrontal cortex.
    - C. The primary olfactory cortex has six cell layers.
    - D. Axons from the olfactory bulb to cortex continually die and regenerate.
    - E. The olfactory system detects only five basic odors.

Lecture 24 motor system

27. The axons that run in the ventral roots attached to the cervical spinal cord arise from what type of neuron and synapse where?
    - A. arise from preganglionic sympathetic neurons and synapse in sympathetic ganglia
    - B. arise from postganglionic sympathetic neurons and synapse in the spinal cord
    - → C. arise from spinal motor neurons and synapse with skeletal muscle
    - D. arise from somatosensory neurons and synapse in the spinal cord
    - E. More than one of the above are correct.

28. What motor proteins are used in the myofibers of striated (skeletal) muscle?
    - → A. actin & myosin
    - B. myosin & dynamin
    - C. dynein & actin
    - D. kinesin & dynein
    - E. actin & ubiquitin

Lecture 25 basal ganglia

29. Which of the following is NOT a part of the striatum?
    - A. nucleus accumbens
    - B. caudate nucleus
    - → C. globus pallidus
    - D. putamen

30. The subthalamus has a major role in …
    - A. identifying objects and faces using vision.
    - → B. regulating the motor system.
    - C. releasing hormones.
    - D. regulating the flow of sensory information to the cerebral cortex.
    - E. regulating circadian rhythms.

Lecture 26 cerebellum

31. Which of the following statements is true regarding inputs to the cerebellum?
    - A. Axons from motor cortex synapse in the medial region of the cerebellar cortex.
    - B. Axons from motor cortex synapse in the lateral region of the cerebellar cortex.
    - → C. Axons from motor cortex synapse in the pontine nuclei, and neurons in the pontine nuclei synapse in the cerebellar cortex.
    - D. Axons from motor cortex synapse in the red nucleus, and neurons in the red nucleus synapse in the cerebellar cortex.

32. The spinocerebellum (vermis and intermediate portions of the hemispheres) is responsible for what function?
    - A. planning and learning movements
    - B. terminating movements
    - → C. coordination and correction of movements
    - D. balance

Lecture 27 autonomic nervous system

33. Where are the somas located for preganglionic sympathetic neurons?
    - A. brainstem
    - B. cervical spinal cord
    - → C. thoracic spinal cord
    - D. sacral spinal cord
    - E. More than one of the above are correct.

Lecture 28 eye movements

34. Which of the following is NOT considered to be a conjugate eye movement?
    - → A. vergence
    - B. optokinetic nystagmus
    - C. smooth pursuit
    - D. saccade

35. What level of the brainstem contains motor neurons whose axons innervate the extraocular (eye) muscles?
    - A. pons
    - B. midbrain
    - C. medulla
    - D. thalamus
    - →AB E. More than one of the above are correct.

Lecture 29 reticular formation & sleep

36. Which two nuclei are required for wakefulness?
    - A. lateral geniculate nucleus and locus coeruleus
    - B. raphe nucleus and solitary nucleus
    - → C. raphe nucleus and locus coeruleus
    - D. nucleus accumbens and raphe nucleus
    - E. nucleus accumbens and locus coeruleus

37. Which sleep stage exhibits EEG activity most similar to the awake stage?
    A. Stage 1
    B. Stage 2
    C. Stage 3
    D. Stage 4
→ E. REM

Lecture 30 hypothalamus

38. Imagine that McDonald's asked you to develop a chemical that they could add to their food to make customers who eat their food want to order more. What properties should your chemical have to be most attractive to McDonald's?
    A. It should have properties similar to leptin.
    B. It should block the actions of orexin.
→ C. It should mimic the actions of ghrelin.
    D. It should block the actions of thyrotropin-releasing hormone.
    E. More than one of the above are correct.

Lecture 31 limbic system

39. Psychopathy is associated with a deficit in connectivity from what brain region to the rest of the brain?
    A. hippocampus
    B. nucleus accumbens
→ C. cingulate gyrus
    D. amygdala
    E. septal nuclei

40. Which of the following statements regarding the hippocampus is NOT true?
    A. The hippocampus has an important role in remembering events and places.
    B. The hippocampus is a phylogenetically old part of cerebral cortex.
    C. The hippocampus is described as having three layers.
→ D. The hippocampus is a major structure of the basal ganglia.

Lecture 34 cerebral cortex I (from Dr. Heilbronner)

41. The frontal lobe is separated from the parietal lobe by the …
    A. lateral fissure.
    B. parieto-occipital sulcus.
→ C. central sulcus.
    D. collateral fissure.
    E. internal capsule.

42. In which lobe of the brain is the primary motor cortex located?
→ A. frontal
    B. parietal
    C. occipital
    D. temporal
    E. limbic

43. Which layer of neocortex sits adjacent to the white matter of the cortex?
    A. I
    B. III
    C. V
→ D. VI
    E. VII

44. Which white matter bundle connects the frontal and temporal lobes to each other?
    A. corpus callosum
→ B. uncinate fasciculus
    C. anterior commissure
    D. internal capsule
    E. cingulum bundle

45. Which of the following statements is true regarding columns and layers in the cerebral cortex?
    A. Columns lie parallel to the surface of the cortex, while layers are perpendicular to the surface.
→ B. Columns lie perpendicular to the surface of the cortex, while layers are parallel to the surface.
    C. Only neocortex contains layers, not allocortex. Both types contain columns.
    D. Only allocortex contains columns, not neocortex. Both types contain layers.
    E. Each column is a different brain area, whereas each brain area can have multiple layers.

Lecture 35 cerebral cortex II (from Dr. Heilbronner)

46. Diffusion tensor imaging measures the diffusion of what substance in the brain?
    A. blood
→ B. water
    C. neurons
    D. glia
    E. radioactive tracer

47. The blood-oxygenation level dependent signal changes over the course of _____, while action potentials occur on the order of_____. Fill in the blanks.
    A. hours; seconds
→ B. seconds; milliseconds
    C. milliseconds; seconds
    D. minutes; seconds
    E. seconds; minutes

48. Which of the following is NOT part of association cortex?
    A. fusiform face area
    B. premotor cortex
    C. dorsolateral prefrontal cortex
→ D. primary auditory cortex
    E. cingulate cortex

49. Which of the following would NOT be considered evidence for modularity in the cerebral cortex?
    A. The fusiform face area responds exclusively to images of faces.
    B. The parahippocampal place area only responds to images of places.
→ C. Many areas of the cortex respond to visual stimuli.
    D. Phineas Gage had selective deficits to decision-making following a lesion that covered parts of his frontal and limbic association cortices.
    E. If you lesion a specific region of extrastriate cortex (called MT), you will be unable to perceive motion in visual stimuli.

50. Damage to the right parietal association cortex will lead to _____, and damage to the left parietal association cortex will lead to _____. Fill in the blanks.
    A. left visual field neglect; right visual field neglect
    B. right visual field neglect; left visual field neglect
    C. right visual field neglect; no neglect symptoms
→ D. left visual field neglect; no neglect symptoms
    E. problems naming things; visual neglect

Lecture 36 language in the brain (from Dr. Heilbronner)

51. What are the three major sources of blood supply to the cerebral cortex?
    A. anterior tibial artery, femoral artery and subclavian artery
    B. femoral artery, common carotid artery and external carotid artery
    C. left cerebral artery, right cerebral artery and medial cerebral artery
    D. dorsal cerebral artery, middle cerebral artery and ventral cerebral artery
→ E. anterior cerebral artery, middle cerebral artery and posterior cerebral artery

52. Where is Broca's area located?
    A. dorsal posterior frontal lobe
→ B. ventral posterior frontal lobe
    C. posterior superior temporal lobe
    D. anterior superior temporal lobe
    E. right parietal lobe

53. Where is Wernicke's area located?
    A. dorsal posterior frontal lobe
    B. ventral posterior frontal lobe
→ C. posterior superior temporal lobe
    D. anterior superior temporal lobe
    E. right parietal lobe

54. A patient who has great difficulty producing words, but is able to comprehend them well, likely has a lesion in the …
    A. right Wernicke's area.
    B. left parietal lobe.
    C. right parietal lobe.
→ D. left Broca's area.
    E. left dorsolateral prefrontal cortex.

55. Which of the following statements is FALSE regarding language acquisition?
→ A. We are born with a propensity to learn a specific language.
B. Infants are sensitive to many phonemes, even those outside of their native language.
C. Exposure to language during early life is critical for developing fluency.
D. Second-language acquisition is easier at early ages.

Lecture 37 drug abuse & addiction

56. The primary neurotransmitter that promotes the feeling of reward is …
A. acetylcholine.
B. serotonin.
C. glutamate.
→ D. dopamine.
E. norepinephrine.

57. Which brain region is part of the reward circuitry?
A. hypothalamus
B. ventral tegmental area (VTA)
C. hippocampus
D. nucleus accumbens
→BD E. More than one of the above are correct.

58. Which type of laboratory experiment can be used as a model of drug addiction?
A. drug self-administration by lever pressing
B. contextual fear conditioning
C. conditioned place preference (cpp)
D. maze learning
→AC E. More than one of the above are correct.

59. Cocaine works by. . .
A. increasing dopamine release.
B. reducing the breakdown of acetylcholine in the synaptic cleft.
→ C. blocking reuptake of dopamine by transporters.
D. increasing receptor binding of dopamine in the nucleus.
E. reducing the binding of dopamine to receptors in the nucleus.

60. Drug exposure/addiction is associated with what type of neuronal structural change?
A. longer, more branched axons
→ B. more dendritic spines
C. fewer dendritic spines
D. fewer dendritic branches

Lecture 38 injury & regeneration

61. Wallerian (anterograde) degeneration includes which of the following processes?
A. swelling of the axon
B. fragmentation of the cell membrane
C. fragmentation of myelin
D. phagocytosis of cellular debris
→all E. More than one of the above are correct.

62. Nogo is a protein that promotes axon regeneration. True or false?
    A. true
→ B. false

63. What happens during the process of chromatolysis?
→ A. The rough endoplasmic reticulum (rER) in neurons breaks down.
  B. The nucleus in neurons breaks down.
  C. It is the process of neuronal death.
  D. Neurons shed their axons.
  E. Schwann cells proliferate.

64. There is evidence that the failure of injured axons to regenerate in the mature central nervous system (CNS) is due to …
  A. a glial scar.
  B. myelin inhibitory molecules.
  C. the intrinsic inability of mature CNS neurons to grow axons.
→all D. More than one of the above are correct.
  E. None of the above are correct.

65. Glial scars in the central nervous system (CNS) are formed mainly by what cell type?
→ A. astrocytes
  B. oligodendrocytes
  C. schwann cells
  D. interneurons

Lecture 39 neurodegenerative diseases

66. What is the greatest risk factor for neurodegenerative diseases?
  A. genetics
  B. lifestyle
→ C. age
  D. exposure to mutagens
  E. familial history of a neurodegenerative disease

67. Which of the following is NOT a neurodegenerative disease that directly affects a person's motor system?
  A. spinocerebellar ataxia
  B. amyotrophic lateral sclerosis (ALS)
  C. Huntington's disease
  D. Parkinson's disease
→ E. retinitis pigmentosa

68. Amyotrophic lateral sclerosis (ALS) is caused by degeneration of which neurons?
  A. neurons in the dorsal horn of the spinal cord
  B. medium spiny neurons in the striatum
  C. dopaminergic neurons in the substantia nigra
→ D. upper and/or lower motor neurons
  E. cholinergic neurons in the raphe nucleus

69. What part of the nervous system is most affected in Alzheimer's disease?
→ A. cerebral cortex
B. striatum
C. brainstem
D. cerebellum
E. spinal cord

70. What type of neuron typically degenerates in Huntington's disease?
→ A. medium spiny neurons in the striatum
B. pyramidal neurons in premotor and motor cortex
C. thalamic neurons in the reticular nucleus
D. medium spiny neurons in the hippocampus
E. dopaminergic neurons in the midbrain

Lecture 40 adult neurogenesis & stem cells

71. What brain areas have been definitively identified as being sites of neurogenesis in the adult mammalian brain?
A. subventricular zone of the medulla
B. subvascular zone of the midbrain
→ C. subgranular zone of the hippocampus
D. floor plate of the spinal cord
E. ciliary zone of the retina

72. Which of the following is known to <u>reduce</u> neurogenesis in the adult mammalian brain?
→ A. drinking alcoholic drinks
B. exercise
C. taking certain antidepressants
D. having consensual sex.
E. More than one of the above are correct.

73. The antidepressant, Fluoxetine, increases neurogenesis in certain regions of the adult brain. True or false?
→ A. true
B. false

74. What types of neurons are produced by the adult subventricular zone of the mammalian forebrain?
A. hippocampal neurons
B. thalamic interneurons
→ C. olfactory bulb interneurons
D. olfactory receptor neurons
E. midbrain interneurons

75. Which of the following are uses for stem cells?
A. experiments to study development
B. therapeutic cell replacement
C. cell lines for studying various diseases
D. drug development
→all E. More than one of the above are correct.

Lecture 41 learning & decision making

76. Rapid, pre-programmed responses to specific stimuli are called …
→ A. reflexes.
B. conscious actions.
C. startle responses.
D. side effects.
E. reflections.

77. Decision-making often relies on …
A. potential outcomes.
B. past experience.
C. perception of the present situation.
→ D. More than one of the above are correct.

78. Long-term potentiation (LTP) is a cellular change that results in …
A. reduced synaptic strength.
B. loss of synaptic contacts.
C. increased dendritic spine density.
→ D. increased synaptic strength.
E. cellular immortality.

79. What category of decision-making is based on skills and habits, and which brain area is involved in that category?
A. procedural; hippocampus
B. emotional; amygdala
→ C. procedural; striatum and cerebellum
D. emotional; spinal cord

80. Vicarious trial and error (VTE) experiments are used to assess what type of decision-making?
A. reflexes
B. pavlovian/emotional
→ C. deliberation
D. procedural

The End!

Please <u>turn in this exam and your bubble sheet</u> in the box at the front of the room.
Double check that your name is on both.

Have a wonderful and safe summer!