Name _____KEY_____

Nsci2100: Human Neuroanatomy
2017 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 exams.

Lecture 3 development

1. Which of the following normally develops from cells of the neural crest?
   - A. retina
   - B. cerebellum
   - C. dorsal horn of the spinal cord
   - → D. sensory neurons of the dorsal root ganglia
   - E. More than one of the above are correct.

2. Neurons will develop from cells in what part of the gastrula stage embryo?
   - A. notochord
   - B. mesoderm
   - C. endoderm
   - → D. ectoderm
   - E. primitive streak

Lecture 4 ventricles, CSF & meninges

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.

Lecture 5 blood supply

4. Blood from the brain just returning to the heart first enters what chamber of the heart?
   - → A. right atrium
   - B. left atrium
   - C. right ventricle
   - D. left ventricle
   - E. right aorta

Lecture 6 cells

5. The cell membrane …
   - A. is hydrophilic and allows the free movement of water into and out of the cell.
   - B. is formed by two layers of water molecules held in place by outer and inner layers of lipids.
   - C. covers the soma and largest parts of the dendrites in neurons, but not the axon or smallest dendrites.
   - D. is where most proteins are synthesized in the cell.
   - → E. None of the above is correct.

6. A neuron can receive synapses on its …
   - A. axon
   - B. dendrite
   - C. soma
   - D. nucleus
   - → E. More than one of the above are correct.

Lecture 7 electrical properties

7. The sodium-potassium pump in neurons …
   - → A. is important for maintaining the resting membrane potential.
   - B. is activated by depolarization of the cell to generate and propagate an action potential.
   - C. pumps sodium ions (Na^+) into the cell and potassium ions (K^+) out of the cell.
   - D. is activated by excitatory synapses.
   - E. generates energy in the form of ATP for the neuron.

Lecture 8 synaptic communication

8. SNARE proteins in a synaptic terminal are activated by an …
   - A. outflow of sodium ions (Na^+) from the terminal.
   - B. outflow of calcium ions (Ca^{++}) from the terminal.
   - → C. inflow of calcium ions (Ca^{++}) into the terminal.
   - D. inflow of potassium ions (K^+) into the terminal.
   - E. inflow of neurotransmitter into the terminal.

9. Cocaine functions by …
   - A. promoting release of certain neurotransmitters at synapses in the brain.
   - B. blocking voltage-gated sodium (Na^+) channels in certain axons.
   - C. blocking voltage-gated calcium (Ca^{++}) channels in certain synapses.
   - → D. blocking transporters of certain neurotransmitters in synaptic terminals in the brain.
   - E. blocking certain neurotransmitter receptors at synapses in the brain.

Lecture 9 spinal cord

10. Axons carrying sensory information typically enter the spinal cord via a …
    - A. spinal nerve.
    - B. ventral root.
    - → C. dorsal root.
    - D. lateral root.
    - E. medial root.

Lecture 12 brainstem

11. Where is the red nucleus?
    - A. internal capsule
    - B. diencephalon
    - C. medulla
    - → D. midbrain
    - E. spinal cord

Lecture 13 forebrain

12. Which of the following statements regarding the thalamus is NOT true?
    - A. Neurons in more posterior regions of the thalamus have axons that synapse in more posterior regions of the cerebral cortex.
    - → B. Proprioceptive information is relayed from a nucleus in the anterior division of the thalamus to the cerebellum.
    - C. Neurons in the reticular nucleus of the thalamus have axons that synapse in other regions of the thalamus.
    - D. The anterior nucleus of the thalamus deals mainly with the limbic system.
    - E. All of the statements above are true.

Lecture 14 cranial nerves

13. 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 somatosensory system I

14. A stroke in the right ventral posterior lateral (VPL) nucleus of the thalamus is likely to result in an inability to detect what sensory modality where?
    - A. pain on the left side and proprioception on the right side
    - B. pain on the right side and proprioception on the left side
    - C. pain on the right side and proprioception on the right side
    - → D. pain on the left side and proprioception on the left side

15. What sensory modality is carried by axons in the fasciculus gracillis and fasciculus cuneatus of the spinal cord?
    - A. thermoception
    - B. hearing
    - C. nociception
    - → D. proprioception
    - E. vision

Lecture 16 somatosensory II (from Dr. Honda)

16. Hyperalgesia is …
    - A. a tingling sensation.
    - B. a lack of temperature sensation.
    - C. all the events that occur after detection of a noxious event by sensory neurons.
    - → D. increased sensitivity to pain.

Lecture 17 & 18 vision

There are two correct answers for question 17.

17. In humans, which retinal axons cross the midline of the brain in the optic chiasm?
    - A. all retinal axons
    - B. only retinal axons carrying information from the central visual field
    - → C. only retinal axons carrying information from the peripheral visual fields
    - → D. only retinal axons coming from the nasal sides of the retinas
    - E. only retinal axons coming from the temporal sides of the retinas

18. Which of the following statements best describes the visual information routed into parietal cortex?
→ A. This information is first relayed to the brain by axons of M-type ganglion cells.
B. This information is critical for recognizing your mother by sight.
C. Color information is processed here.
D. More than one of the above are correct.

19. The optic nerve head is the region of the retina specialized for high acuity vision. True or false?
A. true
→ B. false

20. Which of the following nuclei is particularly important for the pupillary light reflex?
A. superior colliculus
B. inferior colliculus
C. lateral geniculate nucleus
→ D. pretectal nucleus
E. suprachiasmatic nucleus

Lecture 19 hearing & vestibular

21. Normal hearing requires three small bones that are in the …
A. external auditory meatus (ear canal).
→ B. middle ear.
C. lateral ear.
D. inner ear.
E. eustachian tube.

22. Receptor cells activated by angular acceleration are present in the …
A. spiral ganglion.
B. vestibulocochlear ganglion.
C. organ of corti.
→ D. semicircular canals.
E. cochlear nucleus.

Lecture 20 chemical senses

23. Sensory information detected on one side of the body is typically relayed to the contralateral (opposite) side of cerebral cortex or to both sides. Which of the following sensory systems is sent only to the ipsilateral (same) side of cerebral cortex?
A. vision
B. hearing
→ C. olfaction
D. somatosensory
E. More than one of the above are correct.

24. Most of the cell bodies of the olfactory receptor neurons are in the …
→ A. nose.
B. tongue.
C. olfactory bulb.
D. frontal cortex.
E. sensory ganglia of cranial nerves.

Lecture 23 motor system

25. 80-90% of the corticospinal axons cross the midline in the …
    - A. diencephalon.
    - B. midbrain.
    - C. internal capsule.
    - D. pons.
    - → E. medulla.

26. Which of the following does NOT have neurons whose axons synapse in primary motor cortex?
    - A. ventral lateral nucleus of the thalamus
    - B. premotor cortex
    - C. somatosensory cortex
    - → D. globus pallidus

Lecture 24 basal ganglia

27. Which of the following axon tracts run through the striatum?
    - → A. internal capsule
    - B. dorsal columns
    - C. spinocerebellar tract
    - D. medial lemniscus
    - E. More than one of the above are correct.

28. The subthalamic nucleus is part of the …
    - A. telencephalon.
    - B. pons.
    - → C. diencephalon.
    - D. midbrain.
    - E. medulla.

Lecture 25 cerebellum

29. A stroke in which of the following is most likely to directly result in a significant movement problem on the right side of the body?
    - A. right primary motor cortex
    - B. right ventral anterior nucleus of the thalamus
    - C. right cerebral peduncle
    - → D. right cerebellar hemisphere
    - E. More than one of the above is correct.

30. Which of the following statements is NOT true regarding the flocculonodular lobe?
    - A. A major input to the flocculonodular lobe is from the vestibular nuclei.
    - B. A major output of the flocculonodular lobe is to the fastigial nuclei.
    - C. A major output of the flocculonodular lobe is to the vestibular nuclei.
    - D. The flocculonodular lobe has an important role in maintaining balance of the body.
    - → E. All of the above are true.

Lecture 26 eye movements (from Dr. L. McLoon)

31. Which of the following eye movements is NOT used when reading a book?
    - A. saccades
    - B. fixation
    - → C. smooth pursuit
    - D. vergence

32. Which of the following is NOT true about the vestibulo-ocular reflex?
    A. It is a 3-neuron pathway.
    B. It is activated by angular acceleration of the head.
    C. It does not require vision.
    D. It allows the world to look stationary when the head is moving.
→ E. All of the above are true.

Lecture 27 autonomic nervous system

33. Which of the following levels of the spinal cord has preganglionic sympathetic neuron cell bodies?
    A. fourth cervical (C4)
    B. fourth lumbar (L4)
→ C. fourth thoracic (T4)
    D. fourth sacral (S4)
    E. All of the above have preganglionic sympathetic neuron cell bodies.

34. 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.

Lecture 28 reticular formation & sleep (from Dr. Riedl)

35. Which statement best describes the EEG pattern as one progresses through stages I-IV of the sleep cycle?
→ A. There is decreasing frequency and increasing amplitude of cortical activity.
    B. There is increasing frequency and decreasing amplitude of cortical activity.
    C. There is increasing frequency and increasing amplitude of cortical activity.
    D. There is decreasing frequency and decreasing amplitude of cortical activity.

36. Which of the following brain structures sends an output to the brainstem reticular formation?
    A. cerebral cortex
    B. cerebellum
    C. spinal cord
    D. thalamus
→all E. More than one of the above correct.

Lecture 29 hypothalamus (from Dr. Wessendorf)

37. Which of the following helps regulate water balance by DECREASING urination?
    A. oxytocin
    B. thyrotropin-releasing hormone
    C. thyroid hormone
→ D. vasopressin
    E. follicle-stimulating hormone

38. The hypothalamus is divided into medial and lateral regions by what structure?
    A. lamina terminalis
→ B. fornix
    C. posterior commissure
    D. hypothalamic sulcus
    E. medial lemniscus

Lecture 30 limbic system (from Dr. Wessendorf)

39. Which of the following is NOT considered part of the limbic system?
    A. hippocampus
    B. amygdala
    C. anterior nucleus of the thalamus
    D. cingulate gyrus
→ E. None of the above is correct. All are parts of the limbic system.

40. Which of the following regions is most involved in the reinforcing aspects of addiction?
    A. septal nuclei
    B. anterior nucleus of thalamus
    C. insular cortex
    D. hippocampus
→ E. nucleus accumbens

Lecture 33 cerebral cortex I (from Dr. Nakagawa)

41. Which of the following statements is true about brain organization?
    A. The turtle brain has a six-layered neocortex.
    B. The substantia nigra is part of the ventral telencephalon.
→ C. The hippocampus is part of the cerebral cortex.
    D. The prosencephalon includes the forebrain and midbrain.
    E. None of the above is true.

42. Which of the following statements is NOT true about the lobes of the cerebral cortex?
    A. The temporal lobe includes the primary auditory area.
    B. The parietal lobe is bordered rostrally by the central sulcus.
    C. The limbic lobe is not visible on the lateral surface of the cerebral cortex.
    D. The frontal lobe includes the premotor area.
→ E. All of the above are true.

43. Which of the following brain regions does NOT receive robust and direct axonal projections from pyramidal neurons in layer 5 of the primary motor cortex?
    A. spinal cord
    B. thalamus
→ C. cerebellum
    D. brainstem
    E. All of the above receive robust and direct axonal projections from the pyramidal neurons in layer 5 of the primary motor cortex.

Lecture 34 cerebral cortex II (from Dr. Nakagawa)

44. Which of the following statements is true about association cortex?
    A. It occupies a larger portion of the brain in monkeys than in humans.
→ B. Each of the five lobes (frontal, parietal, temporal, occipital, limbic) in the human brain includes association areas.
    C. Prefrontal cortex is considered as a unimodal association area.
    D. Association cortex does not exist in the mouse brain.

45. Which of the following statements is NOT a major symptom caused by a lesion in the posterior parietal cortex?
→ A. difficulty in distinguishing familiar faces
    B. difficulty in reaching for an object
    C. neglecting objects in half of the visual space
    D. denying functional loss of one half of the body
    E. All of the above are major symptoms that are caused by a lesion in the posterior parietal cortex.

46. Which of the following statements is true about functional magnetic resonance imaging (fMRI)?
    A. It requires injection of radioisotopes.
    B. Its main use is for mapping axon tracts in living human brain.
    C. It has lower spatial and temporal resolution compared to positron emission tomography (PET).
→ D. It measures blood oxygen levels.
    E. None of the above is true.

47. The prefrontal cortex has extensive connections with other association areas but has no connections with subcortical structures. True or false?
    A. true
→ B. false

Lecture 35 cerebral cortex III (from Dr. Nakagawa)

48. Which of the following is typically classified as a language disorder?
→ A. dyslexia
    B. lisp
    C. stuttering
    D. dysarthria

49. Which of the following statements is true about functional and structural asymmetry of the cerebral cortex?
    A. It is unique to the human brain.
    B. Spatial attention is typically carried out by the left side of posterior parietal cortex instead of the right side.
→ C. Brain asymmetry is first detected in the human cerebral cortex before birth.
    D. Genetic mechanisms for asymmetry of the human brain are the same as the mechanisms for asymmetry of visceral organs like the heart and intestine.
    E. None of the above is true.

50. Which of the following types of aphasia cannot be caused by the occlusion of a branch or branches of the middle cerebral artery?
    A. Broca's aphasia
    B. Wernicke's aphasia
→ C. Both of the above can be caused by the occlusion of a branch or branches of the middle cerebral artery.

Lecture 36 drug abuse & addiction (from Dr. Thomas)

51. In pioneering studies, researchers who formed the initial maps of brain regions that we now refer to as the "reward circuit" relied heavily on …
→ A. electrical brain stimulation.
    B. molecular genetics.
    C. chemical sampling.
    D. functional magnetic resonance imaging (fMRI).
    E. detecting neuronal activity using electrophysiological methods.

52. The mammalian reward circuit has which of the following attributes?
    A. It adapts in response to differing environmental conditions.
    B. An important subset of neurons in the ventral tegmental area sends axonal projections to the nucleus accumbens.
    C. Stimuli associated with the availability of food elicit activity in this circuit.
→ D. More than one of the above are correct.

53. Extracellular dopamine levels in the brain show the greatest change in response to a…
    A. natural reward.
→ B. high dose of amphetamine.
    C. low dose of amphetamine.
    D. painful stimulus.

54. Repeated administration of cocaine or amphetamines is known to produce …
    A. widespread neuronal cell death.
    B. widespread neuronal proliferation.
→ C. an increased number of dendritic spines on medium spiny neurons.
    D. demyelination of peripheral nerves.
    E. axonal retraction.

Lecture 37 learning & memory (from Dr. Redish)

55. In the Memory and Decision-Making lectures, it was noted that there is a correspondence between memory and decision-making. This correspondence occurs because …
    A. they both involve imagination (in all decision-making systems).
→ B. the purpose of memory is to make better decisions.
    C. the purpose of decisions is to have better memories.

56. The hippocampus is the seat of memory, and if you lost the hippocampus, you would lose most of your memories. True or false?
    A. true
→ B. false

57. Memory is stored in the connections between neurons. True or false?
→ A. true
    B. false

Lecture 38 decision making (from Dr. Redish)

58. Imagine the first time you drive to work. Generally, you have to plan, thinking about what roads to take and which turns to make when. With experience, you no longer have to think about the route you take, and might accidentally drive your friend to your office instead of the airport because you got distracted. This is a transfer of control from …
    A. reflexes to deliberative.
→ B. deliberative to procedural.
    C. emotional to procedural.
    D. emotional to reflexes.
    E. deliberative to emotional.

Everyone received credit for #59.

59. Which decision system drives behavior in the ultimatum game?
→ A. Emotions and the Pavlovian action-selection system
    B. Episodic memory and Deliberation.
    C. Motor memory and Procedural learning.
    D. Imagination and Reflexes.

60. Decisions depend on …
    A. past experience.
    B. perception.
    C. needs and desires.
→ D. More than one of the above are correct.

61. What brain structure(s) are involved in the Pavlovian action-selection system?
→ A. amygdala and periaqueductal gray
    B. spinal cord
    C. prefrontal cortex and hippocampus
    D. cerebellum, basal ganglia, and motor cortex

Lecture 39 neurodegenerative diseases (from Dr. Lesne)

62. Huntington's disease is due to an abnormal number of repeats of three nucleotides in the gene for the Huntington protein. True or false?
→ A. true
    B. false

63. What neuropathological feature is characteristic of Alzheimer's disease?
→ A. neurofibrillary tangles
    B. lewy bodies
    C. TDP43 inclusions
    D. prion plaques and brain vacuolization
    E. ataxin-1 inclusions

64. What is the greatest single risk factor for acquiring Alzheimer's disease?
    A. genetics
    B. smoking
→ C. aging
    D. polluted drinking water and contaminated food

65. Deep brain stimulation is a recently developed method used with some success to treat what neurodegenerative disease?
    A. Alzheimer's disease
    B. multiple sclerosis (MS)
    C. amyotrophic lateral sclerosis (ALS)
→ D. Parkinson's disease
    E. spinocerebellar ataxia

Lecture 40 injury & regeneration

66. Which of the following would result in the most rapid and severe atrophy of the left hamstring muscles in the back of a person's thigh? (The main part of the hamstring muscles is innervated by the sciatic nerve, which comes off the lower lumbar and upper sacral spinal cord.)
    A. a complete mid-thoracic spinal cord transection
→ B. a complete left sciatic nerve transection just distal to its origin from the spinal cord
    C. a complete right sciatic nerve transection just distal to its origin from the spinal cord
    D. being confined to bed for an extended period of time

67. When a neuron's axon is cut, a conspicuous change in the soma of the neuron is a loss of what organelle?
    A. mitochondria
    B. Golgi apparatus
→ C. rough endoplasmic reticulum (rER)
    D. nucleolus
    E. nucleus

68. Imagine that you were hit by a car while walking across University Ave. The car bumper crushed your common peroneal nerve at the level of the knee. The nerve normally innervates muscles in the leg about 15cm below the injury. Approximately, how long after the accident would you expect to regain the use of these leg muscles?
    A. 10 days
    B. 30 days
    C. 60 days
→ D. 100 days
    E. 300 days

69. Immediately following axotomy, …
→ A. action potentials may be generated because sodium (Na^+) leaks into the damaged portion of the axon.
    B. action potentials may be generated because potassium (K^+) leaks into the damaged portion of the axon.
    C. the damaged axon is incapable of generating an action potential, and is described as refractory.
    D. calcium (Ca^{++}) is released from storage inside the damaged axon, and it causes a continuous stream of action potentials, which stimulates regeneration.

70. Wallerian degeneration refers to …
    A. neurons that die because they lose their main synaptic input.
    B. the changes in the soma of a neuron when its axon has been cut.
    C. the death of oligodendrocytes following axotomy.
→   D. the degeneration of the part of an axon that has been separated from the part of the neuron with the soma.

Lecture 41 adult neurogenesis & stem cells

71. It is well established that new neurons are normally generated in a portion of what part of the adult human brain?
    A. cerebellum
    B. striatum
→   C. hippocampus
    D. cerebral cortex
    E. substantia nigra

72. Neuroblasts in the subventricular zone of the adult mammalian forebrain …
    A. will undergo cell division.
    B. will migrate into the granule cell layer of the dentate gyrus.
→   C. will migrate into the olfactory bulb.
    D. line the ventricle in this region.
    E. are wrapped around the capillaries and small arteries in this region.

Everyone received credit for #73.

73. What type of neuron is normally generated in the adult mammalian olfactory system?
    A. interneurons in the olfactory bulb, which have short axons that synapse in the olfactory bulb
    B. projection neurons in the olfactory bulb, which have long axons that synapse in the olfactory cortex
    C. receptor neurons in the nasal cavity, which have long axons that synapse in the olfactory bulb
    D. receptor neurons in the olfactory bulb, which have long axons that sense olfactory information in the nasal cavity
→AC E. More than one of the above are correct.

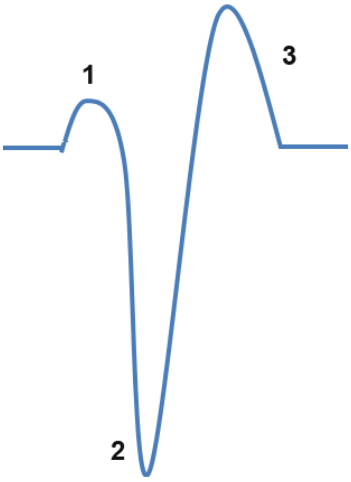
74. Which of the following activities is most likely to reduce neurogenesis in your brain?
    A. taking Prozac
    B. sleeping
    C. exercising
→   D. taking this exam
    E. having sex with someone to whom you are attracted

75. Formation of new myelin following division of oligodendrocyte precursor cells (OPCs) has been linked to a certain type of learning in mice. True or false?
→   A. true
    B. false

76. Fibroblasts harvested from the skin are often used to make what type of stem cell?
    A. neural stem cells (NSCs)
    B. embryonic stem cells (ESCs)
→   C. induced pluripotent stem cells (IPSCs)
    D. epidermal stem cells (EPSCs)

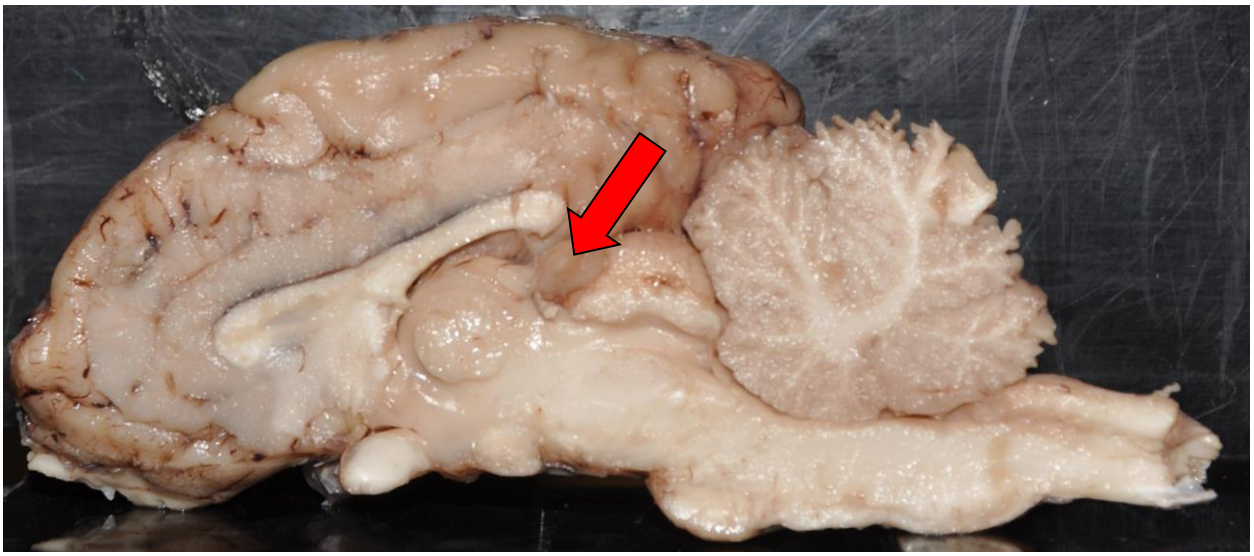
Labs (from Dr. Riedl)

77. Below is a waveform that you might have recorded from a cockroach leg in lab 10. Which of the following statements regarding this waveform is true?



A. This represents an intracellular recording of an action potential.
B. This represents an extracellular recording of an action potential.
C. Depolarization of the axon would be occurring at time '1'.
D. Hyperpolarization of the axon would be occurring at time '1'.
→BC E. More than one of the above are correct.

78. Below is a photograph of a sheep brain. What is the structure at the tip of the arrow?



A. thalamus
B. pituitary
→ C. pineal gland
D. superior colliculus
E. inferior colliculus

79. Below is a photograph of a sheep brain. What cranial nerve is at the tip of the arrow?

A. Optic, CN II
B. Abducens, CN VI
C. Trigeminal, CN V
D. Facial, CN VII
→ E. Oculomotor, CN III

80. Below is a photograph of a cast of the ventricular system in a human brain. What part of the ventricular system is at the tip of the arrow?

A. Lateral ventricle
→ B. Third ventricle
C. Cerebral aqueduct
D. Fourth ventricle
E. Central canal

The End!

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

Have a wonderful and safe holiday!
…HO, HO, HO!