Instructions: Complete the following 99 questions to the best of your ability. Time will be called at 50 minutes, and clarifying questions may be directed to the proctors. Unless otherwise specified, each blank constitutes one point. You may remove the staples on the exam, but all sheets must be put in order, stapled and returned in full at the end of the timing period. Good luck!
Questions 1-8 : Identify the following regions of the nervous system.

1. ____________________      2. _______________________
3. ____________________      4. _______________________
5. ____________________      6. _______________________
7. ____________________      8. _______________________

1. **Substantia nigra**
2. **Broca’s Area**
3. **Wernicke’s Area**
4. **(Posterior) Cingulate Cortex/Gyrus**
5. **Central Sulcus**
6. **Lateral Ventricles**
7. **4th Ventricle**
8. **Amygdala**

\( (x/8) \)
Question 9: What is the purpose of the spiky structure shown in the image to the right:

Transfer CSF (to venous system)

+1

Question 10: White matter shown in the picture above contains which of the following: Neuronal cell bodies, neuronal axons, Schwann Cells, Oligodendrocytes, Astrocytes, Satellite Cells, Microglia?

Neuronal cell bodies, Schwann Cells, Oligodendrocytes, Astrocytes, Satellite Cells, Microglia

+4 for correct, -1 for incorrect

Question 11: List three infratentorial brain structures and three supratentorial brain structures.

Infratentorial: Anything not in the cerebrum

Supratentorial: Anything in the cerebrum

+2

Question 12: Describe the structure and location of denticulate ligaments.

toothed/serrate/any synonym, support spinal cord

+2

Question 13: What specific structure attaches the cerebellum to the brainstem?

Peduncles

+1

(\times {10})
Questions 14-17: Identify the EEG from each stage of sleep

14. beta
15. alpha
16. theta
17. delta

Questions 18-21: Name the correct pathology from each imaging study.

18. Alzheimer’s disease
19. Glaucoma
Question 22: A patient comes into the ER with a traumatic injury to the spine. He cannot move his legs, however, he is able to breathe independently. Below which vertebra must this patient have suffered a spinal injury? _______________  

C3 (accept C2/C4)

Question 23: A patient visits their general physician suffering from numbness in the hand. The GP localizes loss of sensation to the pinkie and ring finger. In which anatomical region is the ulnar nerve being compressed? _______________  

Cubital tunnel (do not accept "elbow")

Question 24: What are the two types of ganglia in the enteric nervous system?  

Meissner's Plexus, Auerbach's plexus

Question 25: What is the primary inhibitory neurotransmitter, and the most abundant excitatory neurotransmitter?  

GABA, Acetylcholine
Question 26: What are two voluntary actions of the autonomic nervous system?

Urination, Defecation

Question 27: What is unique about the ganglia of the tenth cranial nerve?

Outside the head

Question 28: What membrane protein type is involved in the reception of nicotinic signals?

Ligand-gated ion channels

Questions 29-32: Below is an image of an experimental setup in which a giant squid’s neuron, up to 1 mm in diameter, very long, and visible on a macroscopic scale, is isolated and connected to electrodes.

29. What is the likely initial reading on the current monitor?

-70 mV (±15 mV)

30. Suppose a strongly saline solution was introduced around the cell. How would the reading change?

decrease/more polarized

31. How would the conduction velocity change if the neuron were twice as wide and twice as long?

Increase (accept specific numbers)

32. The giant squid neuron is unmyelinated. What type of signal conduction is NOT present in this experiment?

Saltatory (conduction)

(x/8)
Question 33: For two points, describe the longest human neuron:
from sacral plexus to big toe, over 1 meter long

Question 34: What pathogen causes shingles and where in the body does it reside?
Pathogen: Varicella (Zoster)  Location: trigeminal (ganglion)

Question 35: Deep Brain Stimulation is used to treat Parkinson’s disease.

Question 36: What are two histological findings of Alzheimer’s disease?
tangles, plaques

Question 37: What are three COMMON bacterial pathogens that cause conjunctivitis?
Haemophilus, Staphlococcus, Streptococcus
Chlamydia, Gonorrhoea, Pseudomonas, Moraxella

Question 38: A patient comes in with nonspecific neurological symptoms. You suspect the may have MS. For up to ten points, briefly outline how you would approach this case. Be sure to touch on symptoms, diagnostic tests, specific treatment modalities, and how you would counsel the patient about prognosis for full credit.

Symptoms: loss of sensitivity, ataxia, vision loss, muscle spasms, chronic pain, unstable mood, depression, pins and needles, numbness, speech problems, incontinence

Diagnosis: Spinal tap for antibodies, imaging studies like CT/MRI for lesions, MacDonald criteria, Scuamacher, Poser Criteria, neuro exam

Treatment: Corticosteroids, Interferons, mitoxantrone, fingolimod, dimethy fumarate, alemtuzumab, teriflunomide, cannabis

Counseling: Progressive or relapsing remitting (x/18)
Questions 39-44: Each of the numbered red bars indicates a lesion along the optic tract. For each lesion, shade in areas of visual defect in each eye, using the circles provided as visual fields.

39. Lesion 1: [Shaded area]

40. Lesion 2: [Shaded area]

41. Lesion 3: [Shaded area]

42. Lesion 4: [Shaded area]

43. Lesion 5: [Shaded area]

44. Lesion 6: [Shaded area]

Question 45: As light hits the retina, which four types of cells does it pass through as it is transmitted into electrical impulses?

Light \(\rightarrow\) [Cells: ganglion \(\rightarrow\) amacrine \(\rightarrow\) bipolar \(\rightarrow\) horizontal \(\rightarrow\) rods/cones \(\rightarrow\) pigment epithelium]

(any 4, in correct order) S- cone +1

Question 46: Which cell type detects the highest frequency of light? ____________

S-cone +2

Question 47: The photoreceptive pigment in rod cells contains within it which prosthetic group, and where does this group come from? ____________

Retinal, Vitamin A

(x/19)
Question 48: A gentleman finds that he is having trouble concentrating on his morning newspaper, and he is struggling with his favorite hobby, making fly fishing lures. He spends an increasing amount of time outside, playing catch with his grandchildren and driving on scenic routes. What visual defect might he be suffering from? 

___Prysibopia___

Question 49: What are three potential underlying causes for Nyctalopia? Additional correct answers will receive up to two bonus points.

___Retinitis Pigmentosa___, ___Retinal Detachment___, ___Medications___, ___Vitamin A deficiency___, ___Oguchi disease___, ___Pathological Myopia___, ___Cataract___, ___LASIK/Surgery___, ___Macular Degeneration___, ___Choroideremia___

Question 50: A patient is looking through the blinds on her window, and has difficulty reading the billboard across the street. When the blinds are open, she has no problem with this. Which visual pathology could she have? ___Astigmatism___

Questions 51-54 refer to the image below.

51. What is the scientific name of the visual defect shown here? ___Hyperopia___

52. What type of lens would be prescribed to correct this defect? ___Convex___

53. What is the scientific name of the visual defect shown here? ___Myopia___

54. What type of lens would be prescribed to correct this defect? ___Concave___
**Question 55:** A student is in class listening to his teacher lecture with a loudness of 40 dB. Later that night, he goes to a concert by his favorite band and the intensity of sound is 10,000 times that of the classroom. What is the loudness of the concert in decibels? 80 dB

**Question 56:** You are able to distinguish the difference in brightness between a 100W lightbulb and a 108W lightbulb. What is the minimum intensity that can be distinguished from a 200W lightbulb? 216 W

**Questions 57-59:** Name these structures in the ear that are necessary for sensing position and acceleration.

57. Semicircular Canals  58. Utricle  59. Saccule

\[ \times / 5 \]
**Question 60:** Label on this schematic of the basilar membrane where high frequency sounds and low frequency sounds would cause vibration.

**Questions 61-63:** Identify these structures found in the skin.

61. **Pacinii's Corpuscle** +1

62. **Meissners Corpuscle** +1

63. **Ruffini's endings** +1

**Question 64:** What is the name of the secreted protein that activates itch-sensing nerve fibers? **histamine** +1 (x/5)
Question 65: Name one of the modalities that nociceptors can respond to.

Temperature, touch, chemical

Question 66: A decreased threshold of pain in response to injury is called

Hyperalgesia

Question 67: You place your hand on the handle of a hot frying pan and immediately withdraw your hand without having to think about it. This is called a

Withdrawal Reflex and involves signals from your temperature receptors relayed to the Spinal Cord.

Question 68: Odorants are detected by receptors cells located in the

Olfactory epithelium and are relayed by axons to the Olfactory bulb of the forebrain.

Question 69: What is the type of molecular receptor that detects odorant molecules?

G-Protein

Question 70: What are the five tastes able to be detected by the tongue?

Sweet, Sour, bitter, Salty, Umami
Question 71: The surface of the tongue contains numerous bumps called ___________.

Questions 72-81: Match each hormone with its description.

72. Aldosterone    E  A. Responsible for long-term stress response.
73. TSH    J  B. Promotes water reabsorption in the kidneys to produce less urine.
74. Vasopressin    B  C. Secreted by the atria in response to high blood pressure.
75. Oxytocin    H  D. Promotes ovulation.
76. TH    F  E. Stimulates the kidney to reabsorb Na\(^+\) and secrete K\(^+\).
77. Cortisol    A  F. Increases metabolic rate and temperature of the body.
78. LH   D  G. Produced by the anterior pituitary to stimulate the thyroid gland.
79. Erythropoietin  I  H. Promotes uterus contraction during labor.
80. Somatostatin   J  I. Stimulates the production of red blood cells.
81. ANF   C  J. Secreted by D cells in the stomach to inhibit digestive processes.

Question 82: Goiter is a swelling of the thyroid gland caused by a deficiency in ___________.

Question 83: The girl in the left of the picture is older than her sister but has shown little growth and deficiency in bone and muscle mass. What hormone deficiency might she be suffering from? ___________
Question 84: A patient comes to the clinic with symptoms of hyperactivity and restlessness, increased heart rate, and diarrhea. What hormonal disorder is this? **Hyperthyroidism**

Question 85: A 40-year-old diabetic man who has been taking high doses of insulin experiences shakiness, sweating, and blurred vision before passing out. What side effect of his medication could have caused these symptoms? **Hypoglycemia**

Question 86: **Type I** diabetes is an inherited condition where the body destroys the insulin-producing cells in the pancreas. **Type II** diabetes is an acquired condition where the body loses its ability to respond to insulin.

Question 87: A diabetic patient arrives in the hospital with symptoms of thirst, fruity-scented breath, weakness, and confusion. Her blood pH is most likely **low** (low, high, normal) because she is experiencing ketoacidosis.

Question 88: The hormone **insulin** is released in response to high blood sugar and causes **increase** (increase, decrease, no change) in glucose uptake into cells. The hormone **glucagon** is released in response to low blood sugar and causes (increase, decrease, no change) in glucose uptake into cells.

Question 89: What is the name of the cells in the pancreas that produce insulin? **Beta cells**
Questions 88-91: Identify the letter of the structure that fits the description.

90. Produces the hormone responsible for secondary sex characteristics.  
   ____

91. Produces the hormone that causes the fight-or-flight response.  
   ____

92. T-cells mature in this gland.  
   ____

93. The posterior portion of this gland secretes oxytocin and ADH.  
   ____

(4/4)