

PSYCH 260/BBH 203

Exam 4 Study Guide

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Prelude



Today's topics

- Review for Exam 4
 - Tuesday, May 3, 12:00 PM - 10:00 AM, Canvas
- Frontiers in neuroscience
- Careers in neuroscience
- The Cerebral Symphony

History

- Descartes thought _____ about the _____
- Fluid from the cerebral ventricles was once thought to _____

Methods

- Single unit recordings have _____ spatial and _____ temporal resolution.
- EEG has _____ spatial and _____ temporal resolution.
- Single unit recordings measure _____; EEG measures _____.

Anatomy

- Directional terms, slices
 - In the human forebrain _____ and superior overlap.
- Gross
 - The _____ means “little brain” in Latin; it’s located adjacent to _____.
 - The _____ and _____ in the midbrain release dopamine
 - The _____ controls endocrine and ANS activity.

- Gross anatomy
 - The insula is located deep inside the _____.
 - Forebrain/midbrain/hindbrain
 - ventricles/CSF, meninges, blood supply
 - Gyri/sulci
 - lobes, insula/insular cortex
 - gray/white matter

Cellular anatomy

- Neurons receive most of their input on the _____ and _____.
- Gray matter is made of _____; white matter is made of _____.

Neurophysiology

- Resting potential
 - In neuron at rest, _____ inside is greater than outside; What force(s) _____ push $[Na^+]$ inward?
- Ca^{++} influx is involved in _____, _____, and _____.
- EPSP/IPSPs are _____ than action potentials

- Nodes of Ranvier contain lots of _____-gated channels
- The *absolute refractory period* occurs when voltage-gated Na⁺ channels _____
- Action potential phases, causes, components
- Synaptic transmission
 - EPSPs, IPSPs
- Synaptic plasticity, LTP, NMDA receptors

Neurochemistry

- 'Big Three' – Glu, GABA, ACh
- Neuromodulators – DA, NE, 5-HT
- Hormones
 - Oxytocin, vasopressin are released from _____.
- Can we readily measure neurotransmitter levels in the brain?

Evolution and development

- There is a “mammalian” brain plan (True/False)

Emotion

- The _____ lobe contains the amygdala
- Pleasure/reward systems, key brain areas and neurotransmitter(s)
- Fear, stress in behavior and brain
 - Acute vs. chronic stress

Perception and Action

- Sensory fibers enter the (dorsal/ventral) spinal cord. Motor fibers exit from the (dorsal/ventral) spinal cord.
- Parietal lobe contains _____ cortex
- Photoreceptor cells release more neurotransmitter in (darkness/light)
- Can't see reddish-green because long ("red") and medium ("green") cones _____

- Areas of cortex devoted to moving fingers, tongue are (large/small)
- Most retinal ganglion cells project to the _____
- Sound direction is signaled by _____
- Minty flavors taste `cool' because...
- Topographic maps: somatosensation, audition, vision

- Perceiving what vs. where: vision, somatosensation
- Functional segregation: examples of
- Receptive fields: how size varies with perceptual sensitivity

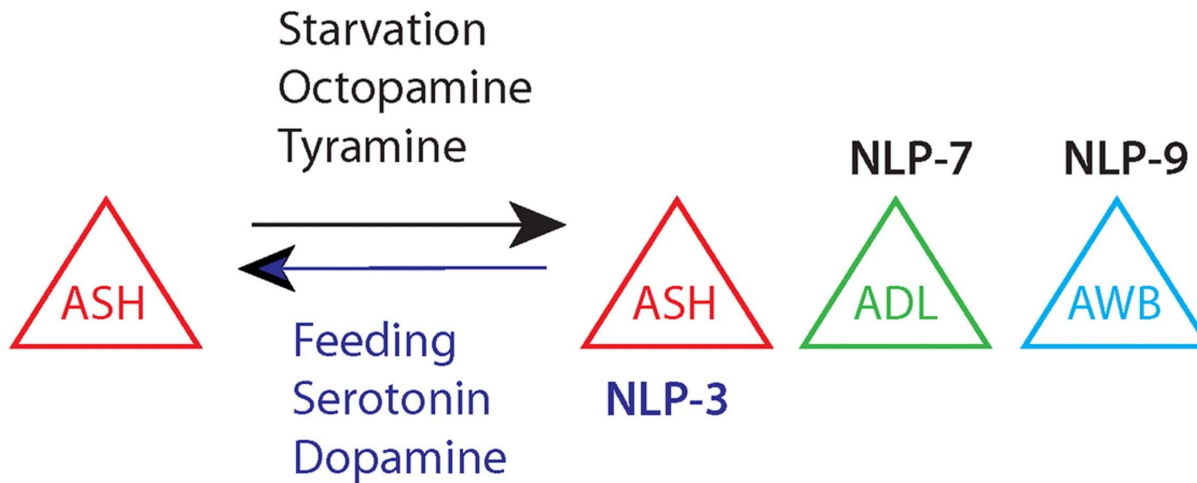
Memory

- Long-term Potentiation (LTP) involves neuron A's connection to neuron B _____
- NMDA receptor opens when sending cell _____ and receiving cell _____.
- Amnesia
 - _____ is impaired; _____ is spared.
- NMDA receptors and Hebbian learning

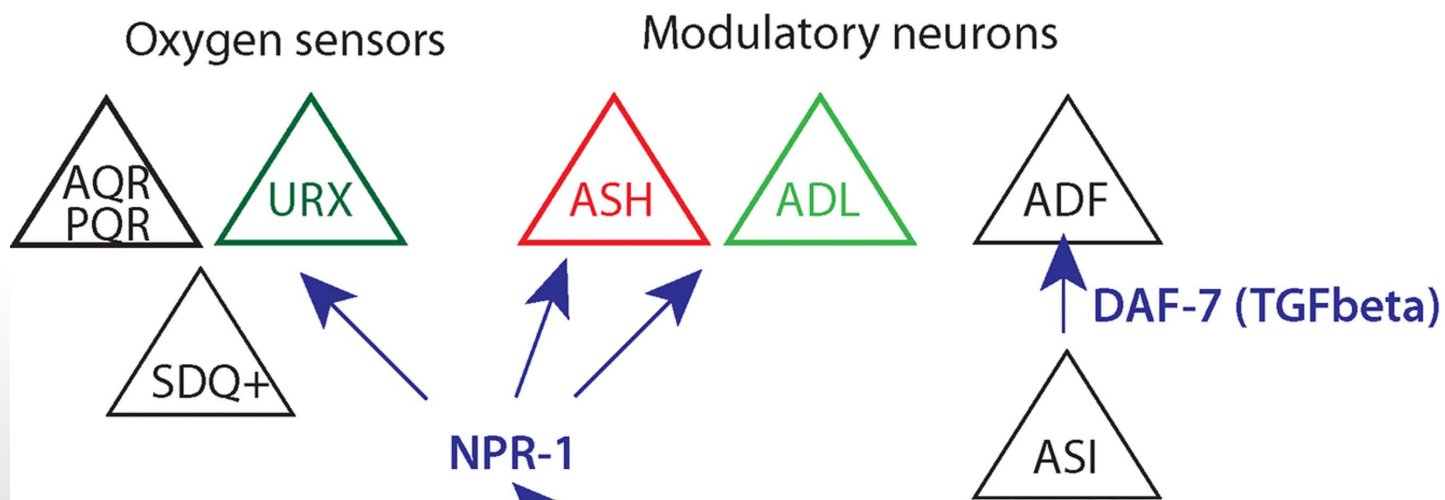
Frontiers in neuroscience

Beyond the connectome

A) Octanol avoidance

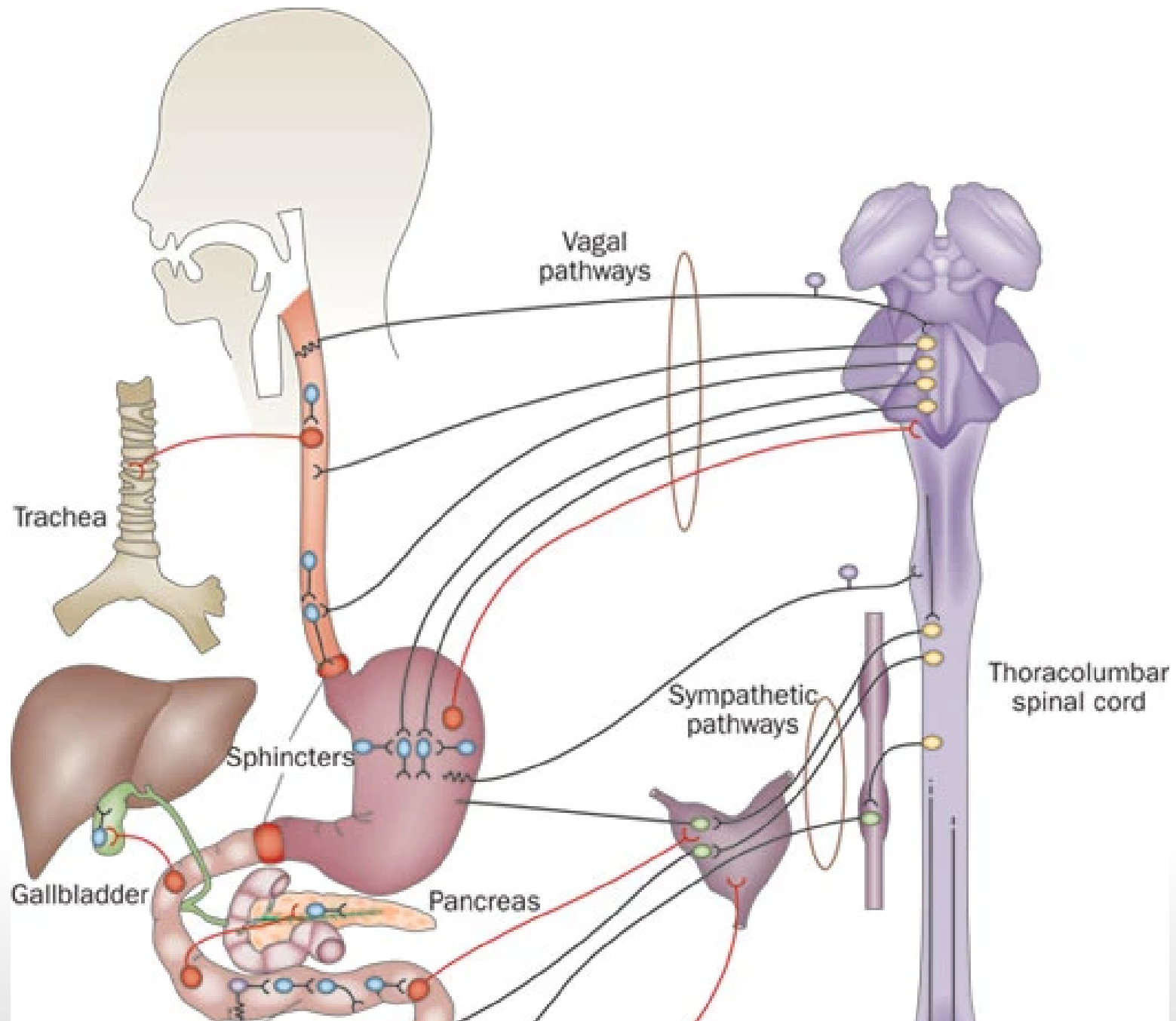


B) Aerotaxis

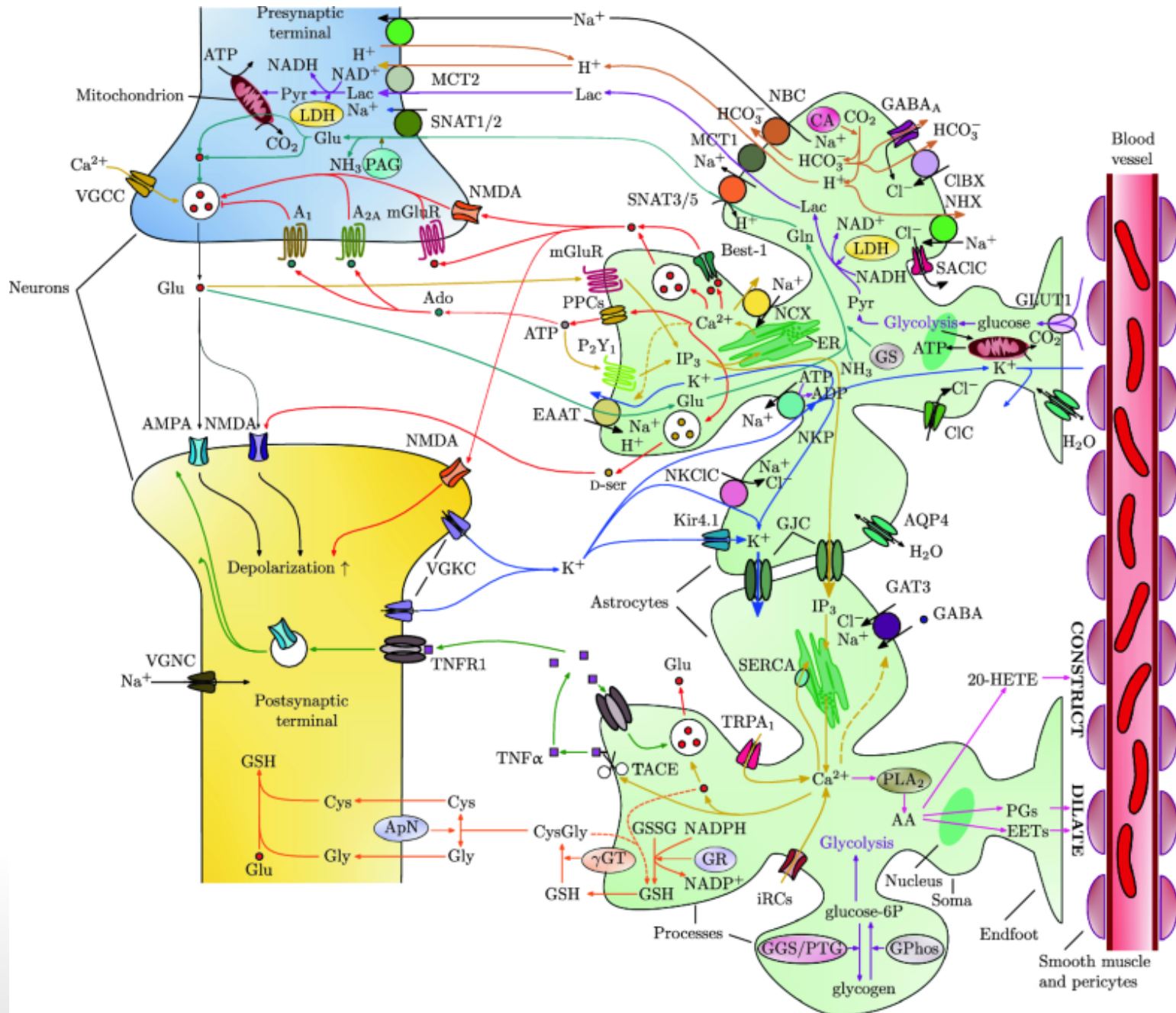


Brain dynamics

Brain/gut connection



Glia



Careers in neuroscience

Job prospects

“Employment in healthcare occupations is projected to grow 15 percent from 2019 to 2029, much faster than the average for all occupations, adding about 2.4 million new jobs. Healthcare occupations are projected to add more jobs than any of the other occupational groups. This projected growth is mainly due to an aging population, leading to greater demand for healthcare services.”

[U.S. Bureau of Labor Statistics](#)

- [Best jobs in health care](#)
- [Careers in neuroscience from indeed.com](#)
- B.A./B.S. vs. M.S. vs. Ph.D. vs. M.D.
- Job experience before grad school good
- Start networking, keep in touch

Interviewing

- Getting an interview
 - Show initiative & impact
- During interview
 - Come prepared – why this job? why this organization?
 - Dress professionally
 - Be engaged, ask questions

The Cerebral Symphony



References

- Bargmann, C. I. (2012). Beyond the connectome: How neuromodulators shape neural circuits. *BioEssays: News and Reviews in Molecular, Cellular and Developmental Biology*, 34(6), 458–465. <https://doi.org/10.1002/bies.201100185>
- Breakspear, M. (2017). Dynamic models of large-scale brain activity. *Nature Neuroscience*, 20(3), 340–352. <https://doi.org/10.1038/nn.4497>
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