COGS 107B

TA: Alexander Johnson
abj009@ucsd.edu

Office Hours: Fridays Before Section 10am - 11:50
Mandeville Coffee Cart
Week 3

Have covered so far (all on midterm):
   Neuron Doctrine & System Basics
   Somatosensory
   Proprioceptive
   Vestibular
   Visual
   Auditory

Questions on material thus far?

Midterm 1 is 2/1/2018 (1 week!)

Slides will be on the website dnitz.com under the (teaching - 107b) resources tab.
Question for you:
Can you sort the following receptors by:

- Transient v Persistent
- Small receptive fields v big receptive fields
- Modality

- Meissner’s Corpuscles
- Pacinian Corpuscles
- Merkels Discs
- Hair Receptor (NOT Aud./Vest. hair cell)

- Golgi Tendon Organ
- Muscle Spindle Cell

- Otolith Organs (Utricle/Sacule)
- Semicircular Canals

- Parvocellular Ganglia Cells
- Magnocellular Ganglia Cells

- Hair Cell (auditory / on Basilar Membrane)
- Octopus Cell
- Spherical Bushy Cell
Hair cells rely on $[K+]$ for their generator potential.
Question for you:

What happens when you spin in a counterclockwise motion? (Semicircular canals)

What happens when you are on the tower-drop ride? What part of your vestibular system is needed?
Can you explain gaze-tracking?
Question for you:

Can you explain dead reckoning (path integration) knowing what you know about the vestibular system and ‘head direction’?
Question for you:

What are & how does the vestibular system provide postural reflexes?

Vestibular Projection Pathways
Question for you:

What are the 4 egocentric ‘frames of reference’ (information pathways) we get?
Question for you:

What are the 4 types of ganglion cells which provide all non-color information?
What receptor types are contributing to each?
Question for you:

How does the LGN preserve retinotopy & hemispheric source information?
Question for you:
How can receptive fields go from center-surround (ganglion cells) to bar shaped (V1)
Question for you:

Can you draw the visual field from retina to cortex?
How is magnification of sensory homunculus with regard to merkel disc density similar to something we have in the visual system?
Question for you:

How are the receptive fields sensitive to edge, object, and location on object?
How is the population code used to create this?
Question for you:

How do we describe sound?

- **Wavelength** (λ): Distance between identical points on consecutive waves.

- **Amplitude**: Distance between origin and crest (or trough).

- **Frequency** (ν): Number of waves that pass a point per unit time.

- **Speed**: = wavelength x frequency
Question for you:

How does the ear turn air pressure into water pressure?
Question for you:
What are the features of the base and apex of the cochlea which let it detect different frequencies?

What moves? What type of receptors detect it?
Where else do we see these receptor cells?
Question for you:
What is auditory space? What is an auditory object?
Cochlear Nucleus

- Complex
- Transient
- Complex
- Complex
- Persistent

Auditory nerve fiber

Primary-like PST

Tone burst

Pyramidal cell

Octopus cell

Globular bushy cell

Multipolar cell

Spherical bushy cell

Pauser PST

Onset PST

Primary-like with notch PST

Chopper PST

Primary-like PST
Question for you:

How do we localize sound? 3 ways.
True / False - The action potential and synaptic potential are actually special cases of the membrane potential

Name 5 properties of ion channels: (Ion) Selectivity, State, Kinetics, Gating, Distribution

The 'Pinocchio Effect' involves a resolution of contradictory information supplied by which two sensory systems of the brain? **Somatosensory (holding nose) & Proprioceptive (tricking the muscle spindle)**

(circle the appropriate word) Generator potentials are analogous to [synaptic] / [action] potentials.

True / False - Hats sometimes push on and hold hairs of the head in particular positions. The 'hair' type of touch receptor provides the brain with a steady indication of these positions. **Transient responses to change**

'Microslip' events are best detected by the **Pacinian Corpuscle** touch receptor.

(circle the appropriate word) Recordings of neurons along [oblique] / [vertical] trajectories through visual cortex yield neurons with different directional tuning preferences. **Cortical columns (arranged vertically) share responsiveness**

Ganglion cells of which type have responses to light that are analogous to Pacinian corpuscle responses to touch? **Magnocellular (Y) has transient responses to visual stimuli which helps detect motion.**

On an otherwise dark field of view, light in the form of a plus sign in the upper-left field of view will excite neurons in the:

A. right-upper V1
B. right-lower V1
C. left-upper V1
D. left-lower V1
Inter-aural level differences are registered by neurons of the:
A. lateral superior olivary nucleus
B. primary auditory cortex
C. medial geniculate body
D. medial superior olivary nucleus

True / False - The responses of cochlear nucleus neurons to pure tones are homogenous and like those of cochlear ganglion cells

Low-frequency tones produce the most oscillation at this part of the basilar membrane which is:
A. base, narrow and floppy
B. base, wide and floppy
C. apex, narrow and stiff
D. apex, wide and floppy
E. apex, narrow and floppy

Neuron A responds to an isolated 10 KHz tone by firing 3 action potentials per second. However, if preceded by a 5 KHz tone, the same neuron’s response to the 10 KHz tone is to fire 20 action potentials per second. This is a good example of Volley Principle/ population coding