welcome to

COGS 17 !

section A02

guiding questions

hi

- i’m andrea (ann-dree-uh)
- cognitive science spec. neuroscience (minor: computational social science)
- i work in a neuroscience lab studying astrocytes in tripartite synapses
    - you’ll learn about astrocytes soon!

A02 section: 6:00 PM monday @ CSB 004
OH: 10 AM wednesday @ CSB 114
contact: anh045@ucsd.edu

reminders

online exams (open book, one shot)

- midterm 1: 4/22
- midterm 2: 5/15
- midterm 3 & final (cumulative): 6/9

homework (unlimited attempts, no late work accepted)

- due every wednesday 11:59 PM (except HW 3 due monday 4/21)
- homework 1 has been published. due **THIS WEDNESDAY** 4/9 11:59 PM

always check the syllabus! come to OH if you have any questions!

do YOU □ want to slay the class

you probably already know this already

- listen to class
- do your homework (extra credit!)
- ask questions or come to any section/OH if you don't understand any concepts
  - note: section slides will not be uploaded to canvas; if you want them please email me
- there are LOTS of resources available for you in the modules. use them to your advantage
  - lecture notes
  - practice homeworks
  - slides
- let me know what kind of support you want during section

be PROACTIVE, this class is INFO HEAVY

kahoot

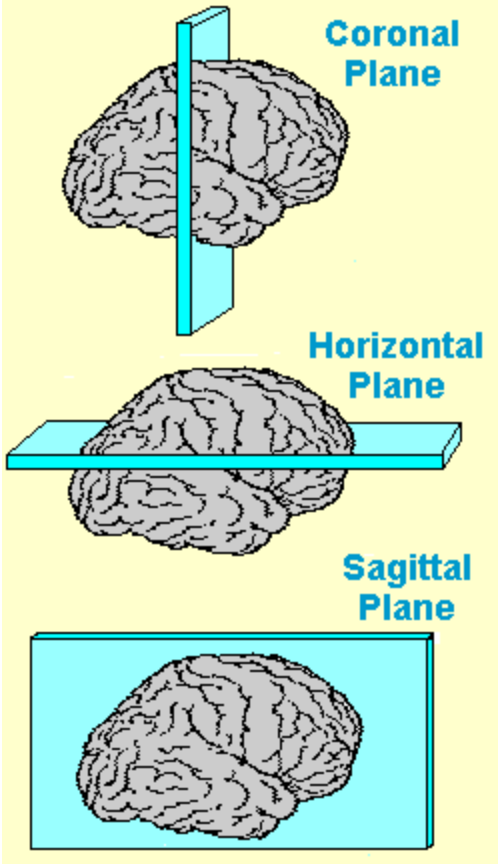
https://play.kahoot.it/v2/?quizId=a29461d8-6143-404c-aa85-8de8bb04ff7b&hostId=0889db3c-c5d4-454b-b692-99e48772950b

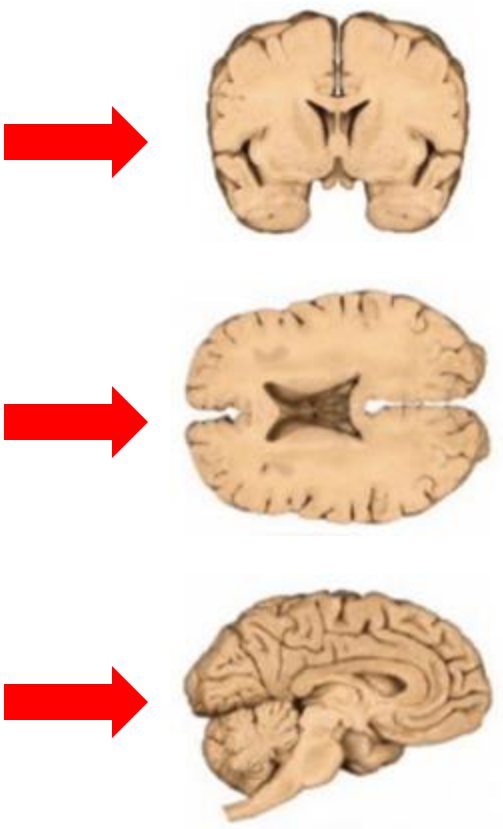
viewing planes

vertical planes

- **coronal**: seen from front
- **sagittal**: seen from side

horizontal plane: seen from above





anatomical orientations

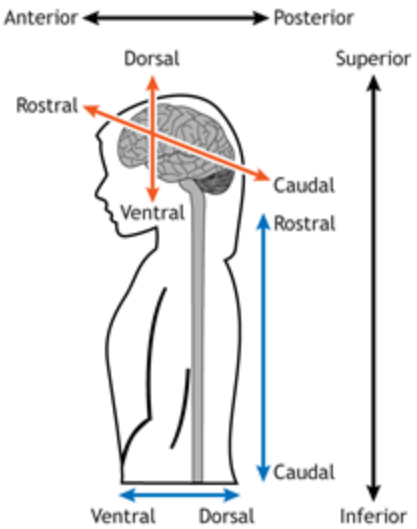
lateral: away from midline
medial: toward midline

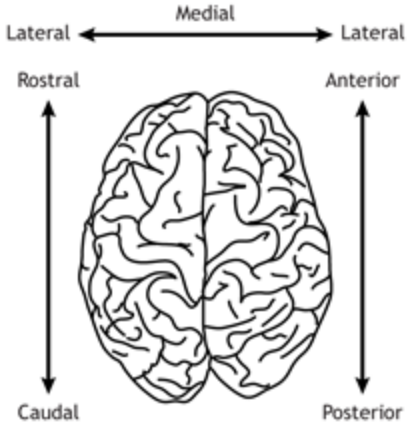
anterior (rostral): toward front
posterior (caudal): toward back

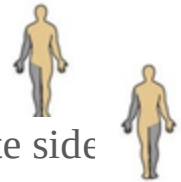
superior: above
inferior: below

dorsal: toward back of body and top of brain
ventral: toward stomach and underside of brain

ipsilateral: connecting to the same side
contralateral: connecting to the opposite side







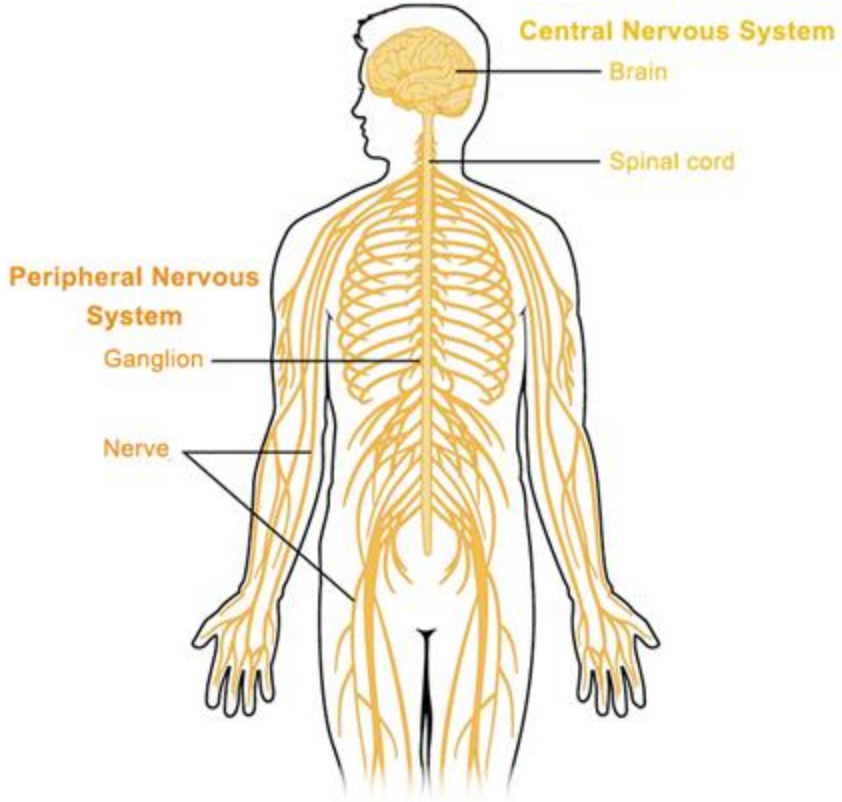
division of the nervous system

central nervous system (CNS)

- brain and spinal cord
- surrounded by bone and meninges

peripheral nervous system (PNS)

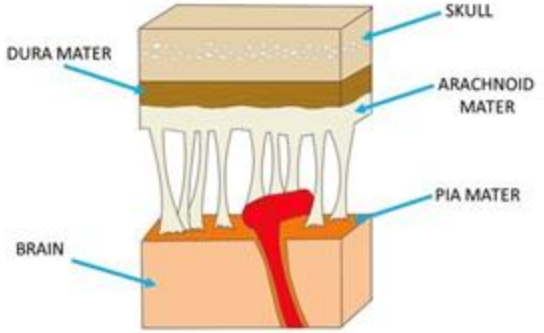
- all other nerves that extend from CNS
- somatic nervous system: interact with external environment (sensory/motor)
- autonomic nervous system: regulates internal environment (internal organs)



support structures

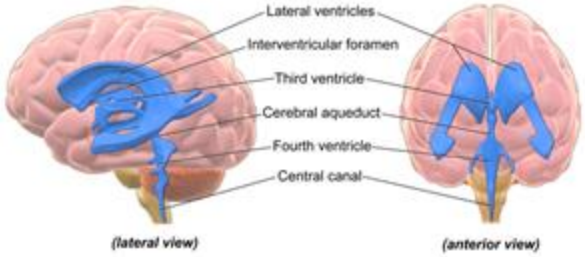
meninges

- membranes that surround and protect the CNS → **PAD**ding
- 3 layers: from inner to outer –
  - **P**ia mater: thin and flexible inner layer
  - **A**rachnoid space: spider-like spongy matrix filled with cerebrospinal fluid (CSF)
    - shock absorber
  - **D**ura mater: thick and tough outer layer



ventricles

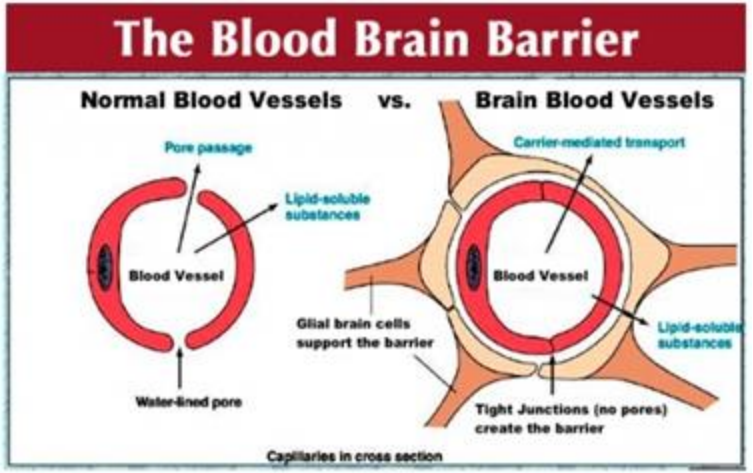
- hollow chambers in the brain that produce CSF
- CSF circulates through ventricles, subarachnoid space, and central canal
  - takes out waste to veins
  - ventricle blockage can lead to hydrocephalus
  - cushions and supports CNS



support structures

blood vessels

- web of incoming arteries and outgoing veins
- feeding (glucose) and cleansing brain (used CSF)
- use *a lot* of blood (20%) compared to their weight (< 2%)



blood brain barrier (BBB)

- semi-permeable membrane
  - protects brain from infections
  - allows essential nutrients to enter
    - passive transport: small fat-soluble or uncharged molecules (CO_2, O_2); active transport: glucose
- consist of capillaries with tightly shut walls
  - prevent leakage
  - unlike in rest of body
- supported by astrocytes

hindbrain

medulla oblongata

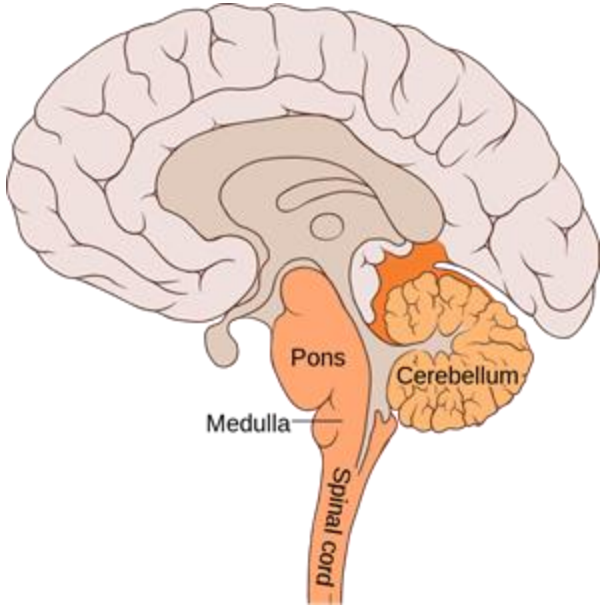
- vital reflexes (heart rate, breathing, vomiting)

pons (‘bridge’)

- superior to medulla
- relays info between cortex & cerebellum; brain & spinal cord
- reticular formation (arousal) & raphe system (sleep)

cerebellum – *not in brain stem!*

- motor programs with real-time sensory coordination and motor feedback
- don’t command muscle movement, only organizes sensory input to guide/modify movement



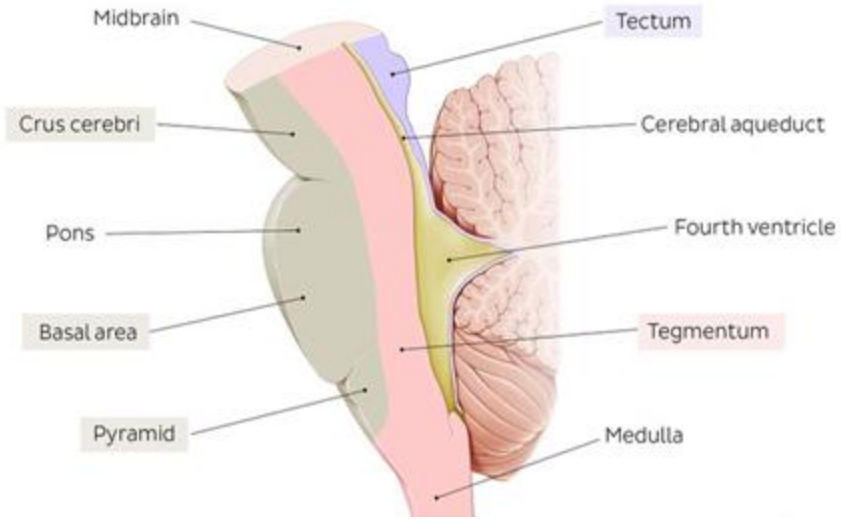
midbrain

tectum

- sensory part
- superior colluli (2): visual motion
    - blindsight: detect+respond to visual stimuli despite no direct visual awareness
- inferior colliculi (2): auditory motion
    - track sound & contact with superior colliculus to direct eyes to sound source

tegmentum (inferior to tectum)

- motor pathways & some cranial nerves
- red nucleus and substantia nigra
- cranial nerves for eye movement control



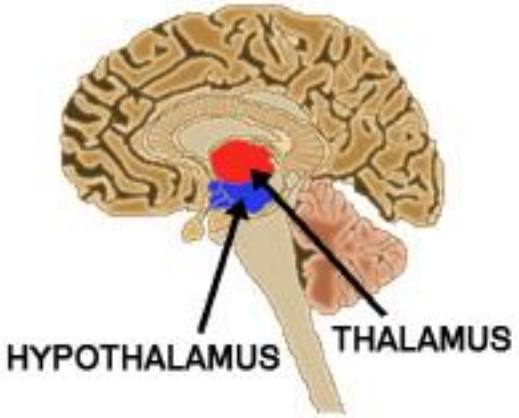
forebrain – diencephalon (part of brainstem)

thalamus

- primary source of input to cerebral cortex
  - most sensory (except olfaction) & motor info converge on nuclei here
- cortical arousal

hypo(below)thalamus

- nervous (brain) and endocrine (hormone) system interface
- communicates with pituitary (master) gland
  - maintain homeostasis– signal pituitary gland to trigger hormonal response
  - 4Fs: feeding, fleeing, fighting, sex



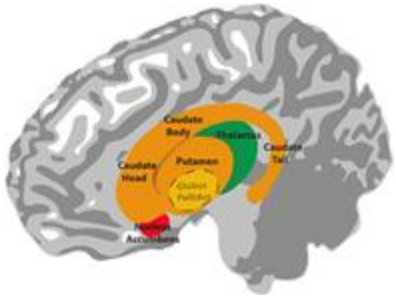
forebrain – tele(beyond)ncephalon (not part of brainstem)

limbic system – motivation

- **hippocampus:** forming new memories & spatial mapping
- **amygdala:** emotional expression and interpretation in others
- **cingulate gyrus:** re-entrant system, assess 👍/👎
- **olfactory bulb:** exchange olfactory info with rest of limbic system

basal ganglia

- control movement esp. planned sequential behaviors
  - task-setting, organizing goals and subgoals
- re-entrant system
- parkinson's disease



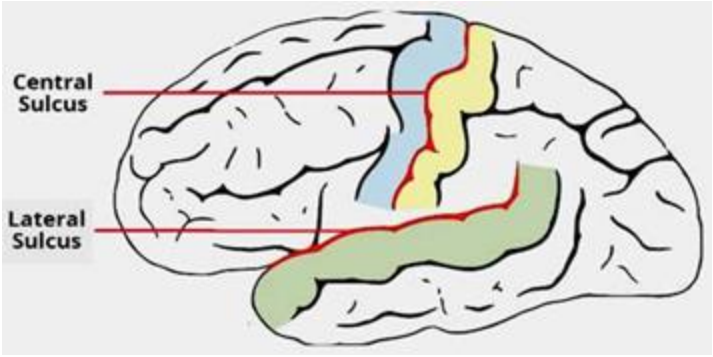
basal forebrain

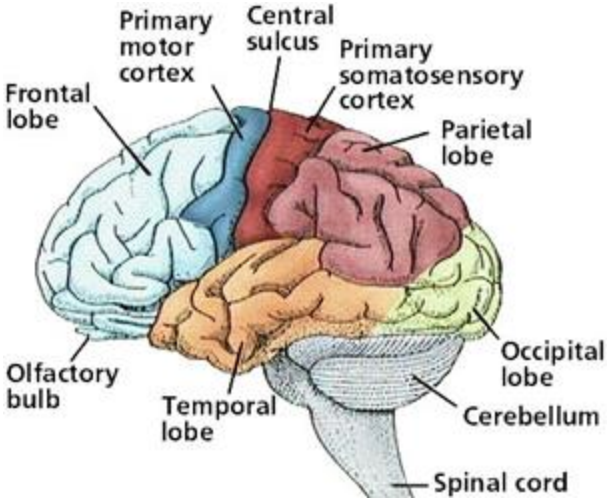
- cortical arousal and attention; receives from raphe & reticular formation
  - main source of Ach (arousal), GABA (de-arousal)

note: hindbrain (besides cerebellum) + midbrain + forebrain
diencephalon = BRAIN STEM

cerebral cortex

- 6 layer organization of cells, information projected on layer 4
- bulge = **gyrus** (pl. gyri)
- fold = **sulcus** (pl. slci)
  - **central sulcus**: divides *parietal* from *frontal* lobe
  - **lateral fissure**: divides *temporal* from rest of brain
- lobes of the brain





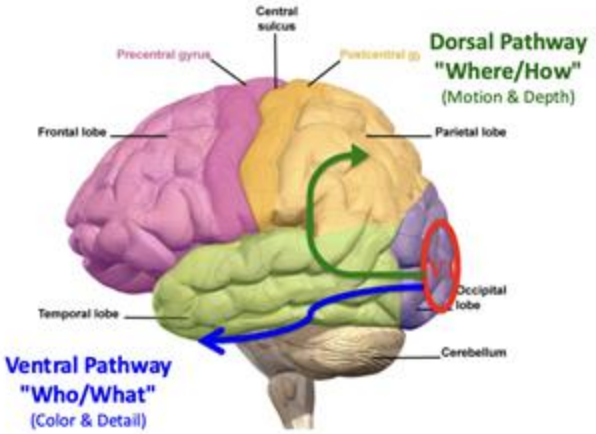
cerebral cortex – lobes

occipital lobe

- primary visual processing: V1 projects from LGN
- separate pathways for color, details, motion, depth that project to other lobes

temporal lobe

- audition
  - primary auditory processing: A1 projects from MGN
  - higher auditory: eg. wernicke's area
- higher visual
  - medial temporal (MT) – direction-sensitive motion detection (dorsal *where/how*)
  - inferior temporal (IT) – facial recognition (ventral *who/what*)
- emotional interpretation (anterior)



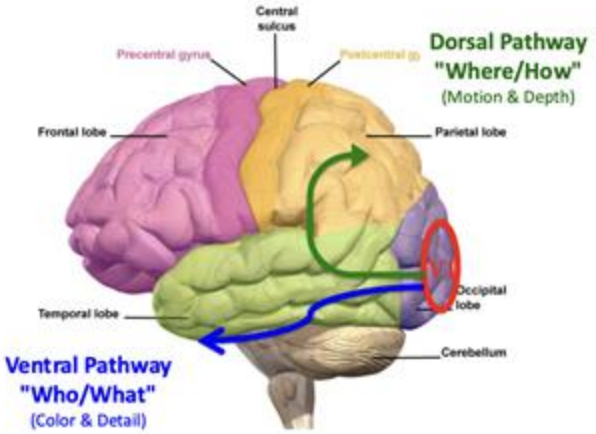
cerebral cortex –

parietal lobe

- primary somatosensory processing: S1 projects from VPN
- higher visual & spatial mapping on *where/how* pathway
  - canonical cells – affordances
  - mirror cells – imitation

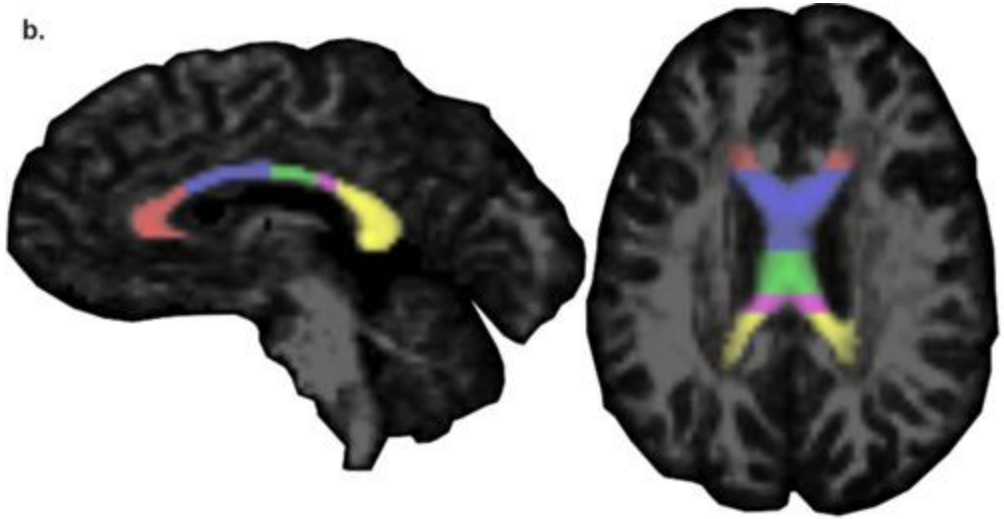
frontal lobe

- motor movements, language production, strategy
- primary motor cortex in precentral gyrus – voluntary action
- premotor areas – *preparing* to act, planning
  - mirror cells
  - broca's area
- prefrontal cortex – self control (higher cognitive, decision making)
  - orbitofrontal cortex – social evaluation, theory of mind



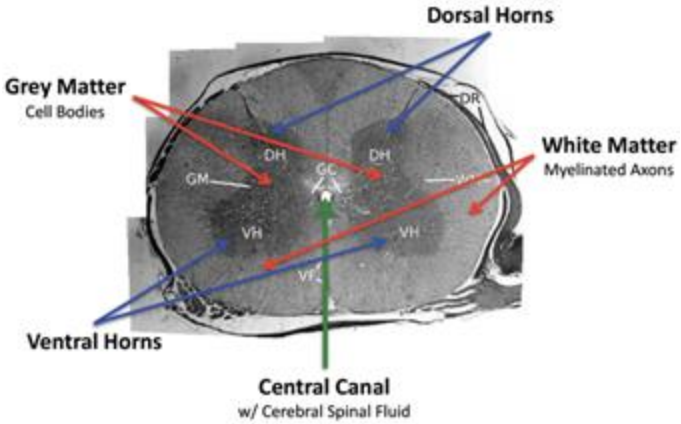
corpus callosum

- large axonal fibers connecting the two hemispheres
- part of the “white matter” of the brain; consists of mainly myelinated axons



spinal cord

- 31 segments, encased in bone & meninges
- each segment has a pair of of
  - **afferent dorsal root nerves**
    - sensory info from body to brain
  - **efferent ventral root nerves**
    - motor info from cord to muscles and glands
- **bell-magendie law**
  - sensory info enters CNS via dorsal roots and exits via ventral roots



**unlike other structures in the CNS, the central canal is the is not duplicated on the right and left!*

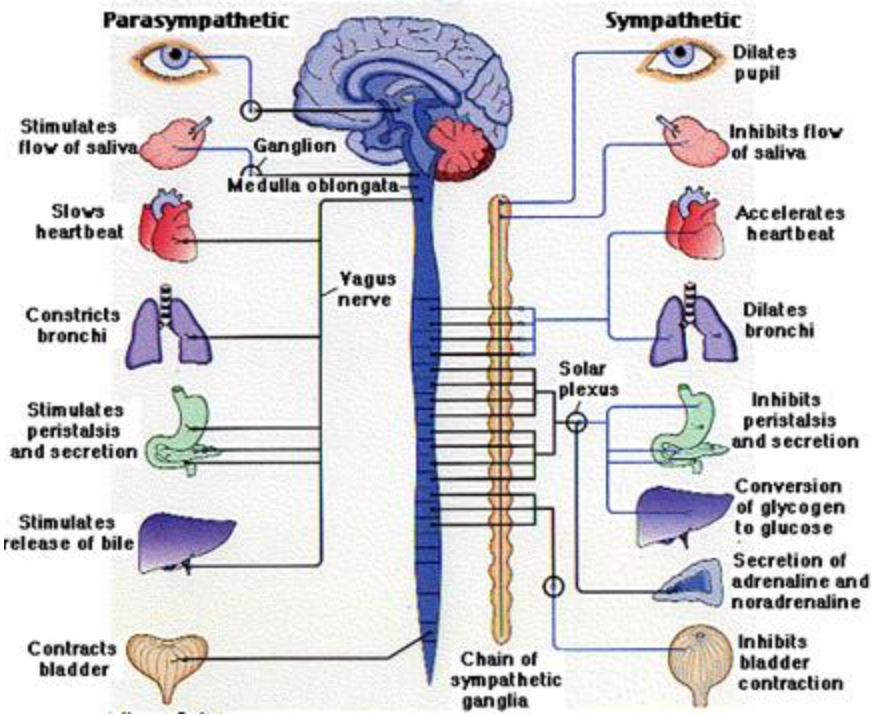
peripheral nervous system

somatic

- interaction with external environment
- 31 pairs of spinal nerves: sensory info from body → feedback and motor output to and from skeletal muscles
- 12 cranial nerves: sensory and organ feedback, motor control of eye movements, facial expressions

autonomic

- regulates internal state
- sympathetic: fight or flight
  - extreme reaction → parasympathetic rebound
- parasympathetic: rest and digest



		Sympathetic vs.	**Parasympathetic**
Effect on:	Eyes	dilate, inhibit tears	constrict pupils, produce tears
	Heart	pump fast	pump slow
	Bronchi (lungs)	open	constrict
	Salivary glands	inhibit salivation	stimulate salivation
	Stomach, Intestines	halt activity	motility & secretion
	Bladder	hold	empty
	Genitals	hinder sexual arousal (altho req'd for orgasm)	facilitate sexual arousal (erect, lubricate)

that’s it. be free children!

rmb your hw