CHAPTER 49 : Nervous Systems

49.2 The vertebrate brain is regionally specialized

I. Arousal and Sleep

- brainstem/cerebrum control alertness
- brain is active in sleep
- sleep: consolidating learning & memory
- reticular formation - diffuse network of neurons in the core of brainstem
  - → determines which info reaches cerebrum
  - → more received info = more alert/awake
- sleep/wake cycles in all birds & mammals
- Melatonin made in pineal gland
  - → important role in sleepiness
- dolphins sleep while swimming (one eye open)

II. Biological Clock Regulation

- bio. clock - molecular mechanism directing periodic gene expression & cellular activity
  - → usually linked to light/dark
- suprachiasmatic nucleus (SCN)
  - group of neurons in hypothalamus
  - coordinate circadian rhythms
  - determines rhythm of whole animal

III. Emotions

- depend on many brain structures
  - → amygdala, hippocampus, thalamus (& more)
  - → grouped as *limbic system* (border the brainstem)
- laughing/crying also involve other areas
- emotion attaches to basic survival functions

- emotional experience stored as memory
- amygdala - clusters of neurons near base of the cerebrum that has an important role in storing emotional memory
- autonomic arousal: increased heart rate and sweating after experiencing unpleasant event repeatedly

IV. Organization of the Human Brain

- embryo develops forebrain, midbrain and hindbrain
  - ↓ cerebrum
  - ↓ brainstem
  - ↓ cerebellum

Cerebrum

- skeletal muscle contraction, learning, emotion, memory, perception
- cerebral hemispheres - right and left
- cerebral cortex - vital for perception, voluntary movement, learning
  - → also divided into right and left
  - → left side of brain controls right & vice versa
- corpus callosum - thick band of axons
  - → enables left ↔ right communication

Cerebellum

- coordinates movement & balance; motor skills
- monitors motor commands
- hand-eye coordination
- receives info about sensory stuff
  - → & about position of joints, lengths of muscles, & auditory/visual stuff

Diencephalon

- gives rise to thalamus, hypothalamus, and epithalamus
- thalamus - main input center for sensory info going to cerebrum
  - → info sent to appropriate place for processing
- hypothalamus - smaller; contains body's thermostat & central biological clock
  - → control of pituitary gland
  - → hunger, thirst, mating/sexual behavior, fight-or-flight response
  - → hormones as well
- epithalamus: pineal gland, source of melatonin

Brainstem

- consists of midbrain, pons, medulla oblongata
- midbrain gets & integrates sensory info
  - → sends it to forebrain
  - → coordinates visual reflexes
- pons and medulla
  - → transfer info between PNS, mid- & forebrain
  - → coordinate large-scale body movement
- medulla
  - → breathing, heart/blood vessel activity, swallowing, vomiting, digestion