

## LEARNING OBJECTIVES:

### FOUNDATIONS:

- **understand the scales and levels of biological organisation**
  - atoms → molecules → organelle → cell → tissue → organ → organ system → organism
- **understand and appreciate a brief history of neuroscience**
  - evidence of prehistoric brain surgery
  - Galen: one of the first to undergo dissection of a sheep's brain; first to discover hollow cavity for fluid (for homeostatic balance) in the brain
  - Descartes: believed the mind was separate from the brain, where the brain was the central 'hub' for other activities
- **describe the major components of the nervous (central/peripheral/autonomic)**
  - **CNS:** is responsible for integrating, processing, and coordinating sensory data and motor commands
    - brain: centre of NS; thought/emotion/coordination occurs here
    - spinal cord: sends signals to and from the brain and other limbs
  - **PNS:** connects CNS to the limbs and organs // includes all the neural tissue outside the CNS
    - somatic nervous system (**SNS**): controls skeletal muscle contractions
      - skeletal muscle
    - autonomic nervous system (**ANS**): provides automatic regulation of smooth muscle, cardiac muscle, glands and adipose tissue // controls homeostasis and functions beyond voluntary control
      - smooth muscle
      - cardiac muscle
      - glands
      - adipose tissue
    - parasympathetic division: rest and digest
    - sympathetic division: fight or flight
- **describe the major functional structures in the CNS**
  - the spinal cord connects the brain with the PNS – runs through the hollow column that is inside the spinal column
    - central gray matter – cell bodies
    - peripheral white matter – myelinated axons
    - sensory neurons:
      - cell bodies in dorsal root ganglion
      - axons enter via dorsal root
      - synapse in dorsal horn
    - motor neurons:
      - cell bodies in ventral horn
      - axons exit via ventral root
      - synapse on muscle fibres

- brain stem (medulla, pons and midbrain)
  - medulla:
    - autonomic functions
    - cardiac, respiratory, vasomotor, some reflexes
  - pons:
    - relay signals from cerebrum to cerebellum
    - sleep, respiration, bladder control, balance, posture, some sensation and eye movements
  - midbrain:
    - basic visual and auditory orienting responses
    - sleep / wake cycles and arousal
    - temperature regulation
    - continuous with spinal cord
    - regulates many autonomic and subconscious functions
    - provides sensory and motor innervation of the face/neck
- **describe the structure and function of the meninges, ventricles and CSF**
  - meninges: three membranes that cover the surface of the central nervous system: the dura mater, arachnoid membrane & pia mater
    - protect the CNS
  - ventricles: 4 ventricles make up the ventricular system
    - CSF is produced here
    - within each choroid plexus, a network of ependymal cells are involved in the production of CSF
    - ventricular system – continuous with the central canal of the spinal cord
  - CSF (cerebrospinal fluid): in the central nervous system, the fluid produced by the choroid plexus, in the ventricles of the cerebral hemispheres, that flows through the ventricular system to the subarachnoid space by small openings, located near where the cerebellum attaches to the brain stem
    - function – to cushion the brain within the skull and serve as a shock absorber for the CNS
      - also circulates nutrients
- **describe the role of the blood-brain barrier**
  - the blood-brain barrier is a complex that surrounds most of the blood vessels in the brain
  - acts as a barrier b/w bloodstream and the extracellular space of the brain
    - water
    - oxygen
    - small lipid-soluble substances
    - glucose
    - prevents toxins, pathogens and other dangerous substances from circulatory system into brain
  - made up by tight junctions of endothelial cells
    - fused together tightly
  - astrocytes are supporting cells → regulate blood flow
  - blood flow: heart → aorta → circle of willis (network of blood vessels)

