

Neuroscience lecture notes

What are the different divisions of the peripheral nervous system? What are their different functions?
What are the different forms of protection offered to the central nervous system?

What are the two branches of the autonomic nervous system, and how can we characterise their functions?

How and why do drugs used to treat psychological conditions, such as depression, cause side-effects in the body? **

What are the 3 membranes of the meninges and how do they differ?

What happens at the level of the spinal cord?

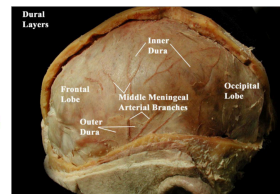
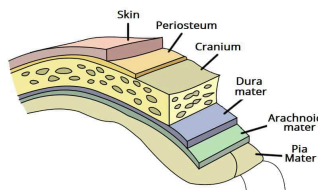
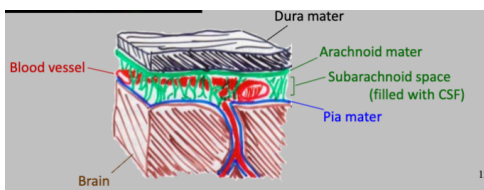
LINK: <https://www.brainfacts.org/> → more on neuroscience

Nervous system is throughout the body - 2 major divisions:

1. Central Nervous System - contain around 86 billion neurons

Consists of the Brain and spinal cord

- Brain and spinal cord are protected by 1. Bone, 2. Meninges, 3. Blood brain barrier
- **Meninges:** Flexible sheet between brain/spinal cord and bone, made up of 3 membranes (1. Dura mater, 2. arachnoid mater (blood vessels travel within the subarachnoid space) 3. pia mater)
 - ◆ *Dura mater (outermost layer)*
 - Thick, tough, and relatively inflexible - Name means “hard mother” in Latin
 - Provides strong physical protection for the brain and spinal cord
 - ◆ *Arachnoid mater (middle layer)*
 - Named for “spider” in Greek because of its web-like structure
 - Contains cerebrospinal fluid (CSF) in the sub-arachnoid space, acting as shock absorption
 - Large blood vessels supplying the brain travel through this layer
 - Damage to these vessels can cause bleeding under the dura mater (subdural hematoma)
 - ◆ *Pia mater (innermost layer)*
 - Very thin and delicate - follows all the contours and folds of the brain
 - Adheres directly to the surface of the brain and spinal cord
 - Provides a protective coating while allowing nutrient exchange between CSF and nervous tissue
 - Sit around brain + spinal cord → protects brain from injury inside the skull when it moves



→ **Blood brain barrier**

- ◆ Brain has high energy demands - blood vessels supplying blood to CNS have special walls, restricting entry of many chemicals/toxins into CNS
 - E.g if antihistamines go into brain - makes us drowsy → the drug has been modified to not be able to cross the blood brain barrier

Spinal Cord: A cable of neural fibres with “roots” branching off → it connects the brain to the PNS

- Some reflexes are controlled by spinal cord (quicker reactions than if mediated by brain) e.g. touch something hot and pull hand away is spinal mediated

2. Peripheral Nervous System (sensory neurons convey sensory information to the CNS - motor neurons come from the CNS and cause muscle contraction in response to sensory information)

Autonomic Nervous system

- Controls non-voluntary bodily functions - “The 4 F’s” (fight, flight, feeding, sex)
- 2 Branches: Sympathetic (blood vessels constrict) vs Parasympathetic (blood vessels contract)

- Have opposite effects - controlled by the brain
- Uses neurotransmitters (acetylcholine (primarily parasympathetic) and noradrenaline (primarily sympathetic))

Enteric Nervous System → able to operate on its own without the brain

- Located in walls of gastrointestinal tract
- Controls digestive activity (peristalsis (muscular contractions that move food down oesophagus/intestine etc.) and secretion of enzymes) and senses physical and chemical conditions of the gut
- Interacts with the brain but can also function independently
- Uses neurotransmitters, including dopamine and serotonin

LEC2

What are the fluid-filled cavities in our brain and why are they there?

What does the brainstem do? What can happen to it after a head injury and why is that dangerous?

Where is the cerebellum and what does it do?

What structures sit at the very centre of the brain, at the top of the brain stem? What are their functions?

What parts of the brain make up the limbic system and the basal ganglia? What aspects of behaviour do they contribute to?

Why is your cortex so wrinkled? What are the different lobes, and what different functions are they specialised for?

What connects your two hemispheres?

How has the brain changed during the course of evolution?

The ventricles

Ventricles: Cavities filled with cerebrospinal fluid (CSF)

Ventricles → function as the sewerage system of the brain - blockage causes hydrocephalus (inflates ventricles, squashing brain, pressure on brain)

Major subdivision of the brain

1. Brainstem - controls/ is critical for life-supporting functions e.g. walking, maintaining breathing, HR etc.

Damage following head injury leads to coma and death → treatment for head injuries causing pressure in brain = drilling a hole into skull relieves pressure

2. Cerebellum (“small brain”) → ‘what signals need to be sent to the muscles in order to produce a certain coordinated movement

Control of precision movements (including learned ones) → allows us to be able to make coordinated movements e.g. hitting a tennis ball in a precisely

Densely packed with neurons (contains 70% of neurons in brain)

3. Thalamus & Hypothalamus (Together known as the diencephalon)

Thalamus (*At the very centre of the brain, sitting on top of the brain stem*): sensory relay to cortex (and more)

→ brain’s sensory relay and control hub, filtering and directing incoming information to the cortex while regulating attention and sleep

Hypothalamus (*Directly below the thalamus, above the brain stem*): Involved in hormonal regulation and motivational control (feeding and sex) → connected with pituitary gland, which secretes hormones

4. Limbic system: Control of emotion and memory → regulates emotion and memory, helping you recognise, feel, and remember experiences that are emotionally significant