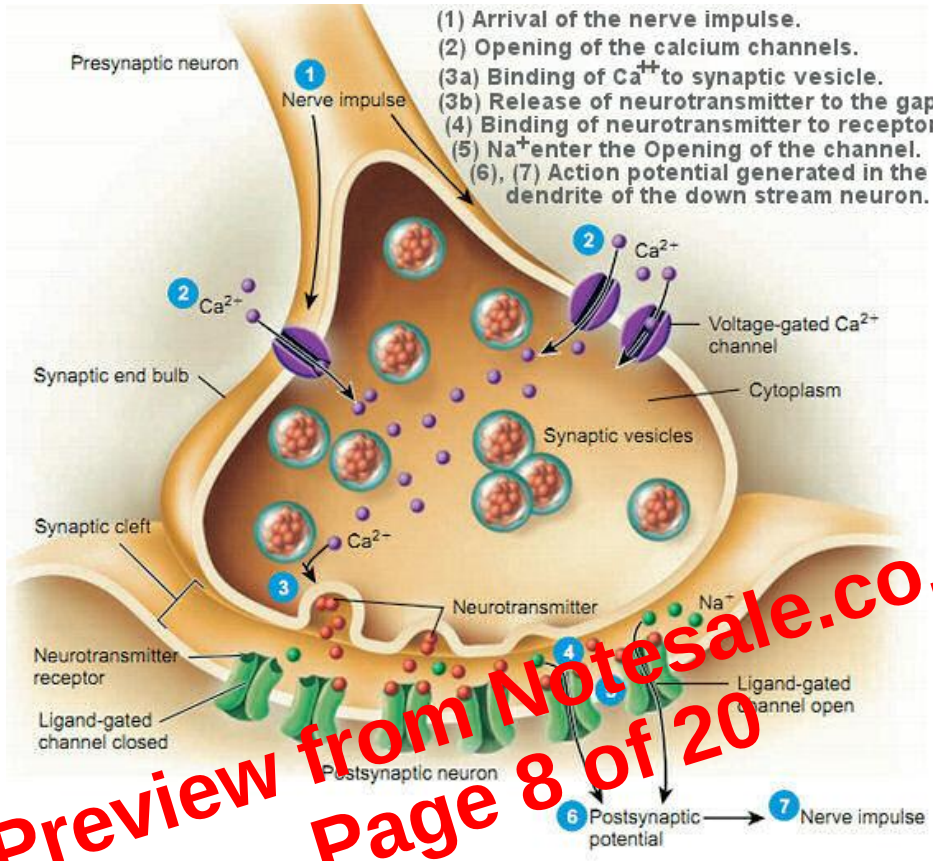
Synaptic communication

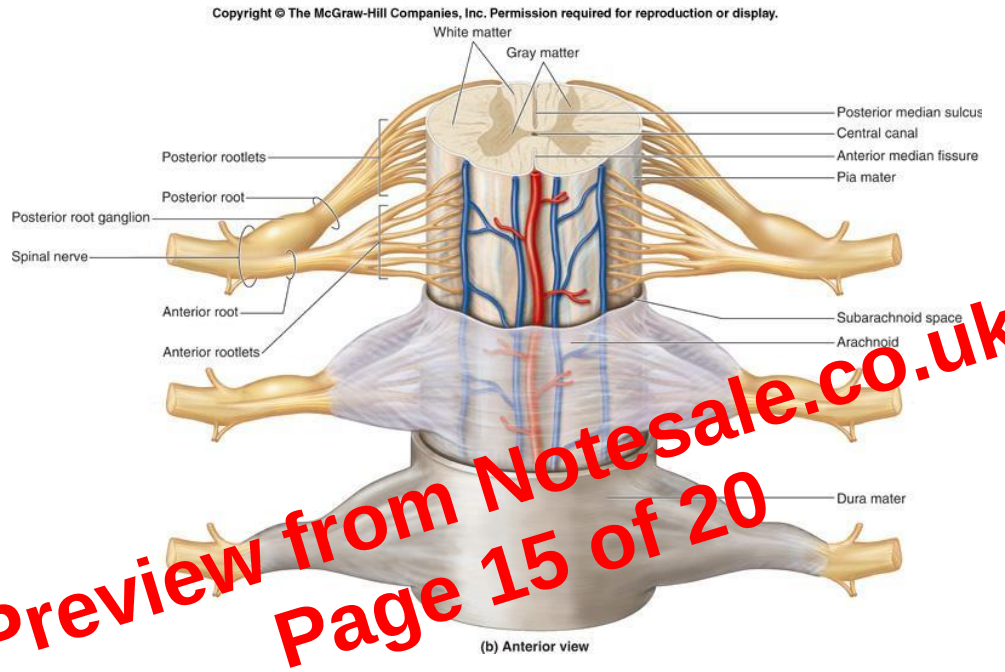
- Synapse transmits nerve impulse from neuron to another cell, and ensures unidirectional transport of the signal – functional contact
- Converts electrical signal from **presynaptic** cell into a chemical signal that affects the **postsynaptic** cell

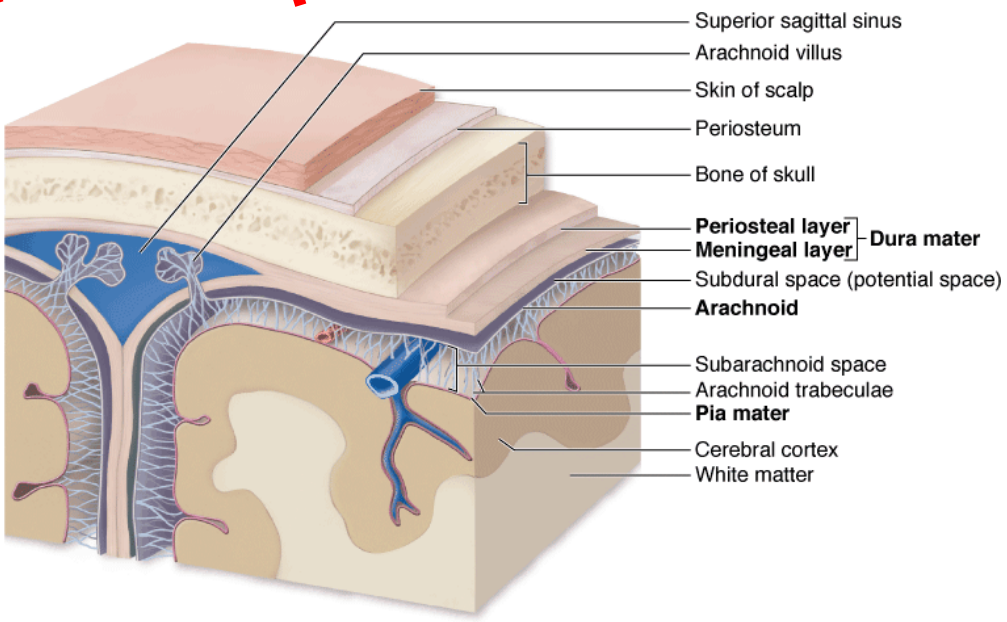


Taken from Antranic.org, Synaptic Transmission by Somatic Motorneurons, available at http://antranik.org/synaptic-transmission-by-somatic-motorneurons/

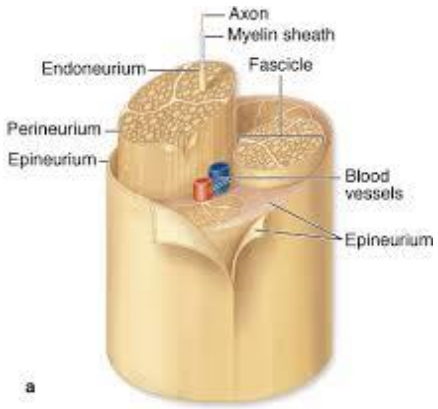
- **Neurotransmitter** bind to specific receptors that can either activate channels or second messenger cascades
- **Excitatory** – activity at synapse **promotes impulses** in postsynaptic membrane
- **Inhibitory** – neurotransmitter promotes **hyperpolarisation** of the postsynaptic membrane, making an AP less likely; IPSP – opens Cl- channels
- Neurotransmitters are removed from the cleft by **enzymes**, diffusion or endocytosis, preventing sustained stimulation
- Types of synapse
    - Axosomatic
    - Axondendritic
    - Axoaxonic (modulates signals from the two other synapse types)

    - **Arachnoid villi:** arachnoid penetrates dura mater and protrudes into blood filled venous sinuses; transports CSF from subarachnoid space to venous sinuses
- **Pia mater** is lined by flattened, mesenchymal-derived cells, closely applied to **entire surface of CNS tissue**
    - Between pia mater and neural elements is a **thin layer of astrocytic processes**; forms barrier between CNS and CSF
    - **Perivascular spaces:** tunnels covered by the pia mater where blood vessels penetrate the CNS





Taken from Mescher et al, Junquiera's Basic Histology: Text and Atlas, Twelfth Edition



Taken from Mescher, Junquiera's Basic Histology: Text and Atlas, Twelfth Edition

Ganglia

- Ovoid structures containing **neuronal cell bodies** and **glial cells** supported by **connective tissue**
- **Relay stations** to transmit nerve impulses; one nerve enters and one exits
- **Direction** of nerve impulse determines whether it is sensory or autonomic ganglion
- **Sensory ganglia:** receive **afferent impulses** that go to the CNS
    - Associated with **cranial nerves** and **dorsal root** of the spinal nerves.
    - The large neuronal cell bodies are associated with **satellite cells**
    - **Pseudounipolar** neuron
- **Autonomic ganglia**: **efferent impulses** from the CNS that effect activity of smooth muscle, secretion of some glands, cardiac rhythm and other involuntary activities involved in homeostasis
    - Small, bulbous dilatations in autonomic nerves
    - Some found in certain organs e.g. constitute **intramural ganglia** in digestive tract.
    - Usually **multipolar** neurons; fewer **satellite cells** than sensory ganglia
    - **Two neuron** circuit: preganglionic fibre is located in CNS, and its axon forms synapse with postganglionic fibres; chemical mediator in the synapses is **acetylcholine**
    - Autonomic nerves have two parts: **sympathetic and parasympathetic**
    - Neuronal cell bodies of **preganglionic sympathetic** nerves are in **thoracic and lumbar segments** of spinal cord, and **parasympathetic** are in **medulla and midbrain and in sacral portion** of the spinal cord