

The brain contains 100 Billion neurons and 50 Trillion synapses

Brain mass is 50/50 in glia and neurons

More intelligent animals are associated with higher number and more complex glia.

Glia release glial transmitters upon receiving NT, driven by intracellular Ca, e.g.: BDNF, TNF $\alpha$ , glutamate, ATP

Tripartite function: presynaptic, postsynaptic and glial involved in signal transmission.

- Astrocyte: envelope synapses, and blood vessels.

- Regulate transmission

- Cannabinoid receptor CB1R on glia bind to CB1, Ca signalling induce glutamate release, lateral NMDA receptor binding with glutamate lead to internalisation of AMPA receptor, weaker depolarisation amplitude, causes memory impairment.

- Regulate bloodflow/nutrient availability

- Astrocyte enveloping the synapse detect neuronal activity, processes around blood vessel release vasoactive substances e.g. prostaglandin, increase supply of O<sub>2</sub> and glucose to neurons

- ECM homeostasis

- Contain K<sup>+</sup> channels for ion buffering

- Synapse formation

- In neuron-glia cultures, synapses form steadily, less synapses form in neuron only cultures.

- Astrocytes secrete BDNF, TGF1

- Microglia: Immune cells migrated into CNS during development.

- Immune regulation

- Normally immobile surveillance mode with moving processes

- Activate transform into phagocytic mode when encountering foreign antigens.

- Synaptic pruning during development.

- General neurotrophic theory

- Hamburger 1930 amputation experiment shows degree of innervation is relative to the size of the limb.

- 1986 Nobel Prize awarded for the discovery of nerve growth factor (NGF)

- Neurotrophin (nerve survival signal) transported back to the soma via retrograde axonal transport by dynein.

- Ligation of axon leads to swelling on both sites of ligation.

- General neurotrophic theory states neuronal survival depend on availability of neurotrophins

- Contribute to synaptic pruning, excessive amount of neurons and synapse produced, later eliminated

- However 👉🧐, less neuron die from neurotrophin deficiency as the organism matures, more focus on intrinsic apoptosis pathways