KING'S College LONDON

INSTITUTE OF PSYCHIATRY,
PSYCHOLOGY & NEUROSCIENCE

Module:
Biological foundations of mental health

Week 2:
Building blocks of the brain

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Topic 1
Neuron-glial interactions and mental health

Part 1b of 2

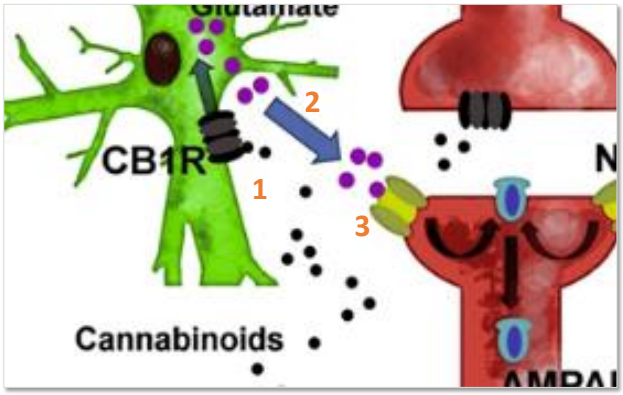
Consequences of gliotransmission

- What are the consequences of astrocyte modulation at the tripartite synapse for brain function and behaviour?

- There is some evidence for a possible role in **memory** and **sleep regulation**.

Evidence for a role of astrocytes in memory

1. Cannabinoids bind to all CB1R (in black)
2. Astrocytes release glutamate (purple)
3. Glutamate binds to NMDAR
4. AMPAR is internalised
5. LTD is induced
6. The mouse is lost



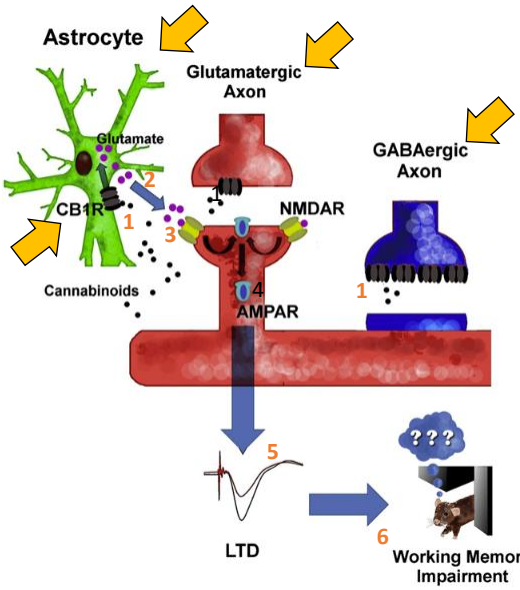


Figure 6: Working Memory Impairment following cannabinoids exposure

Evidence for a role on sleep regulation

Adenosine acts to suppress synaptic transmission, and its release would be linked to the regulation of sleep.

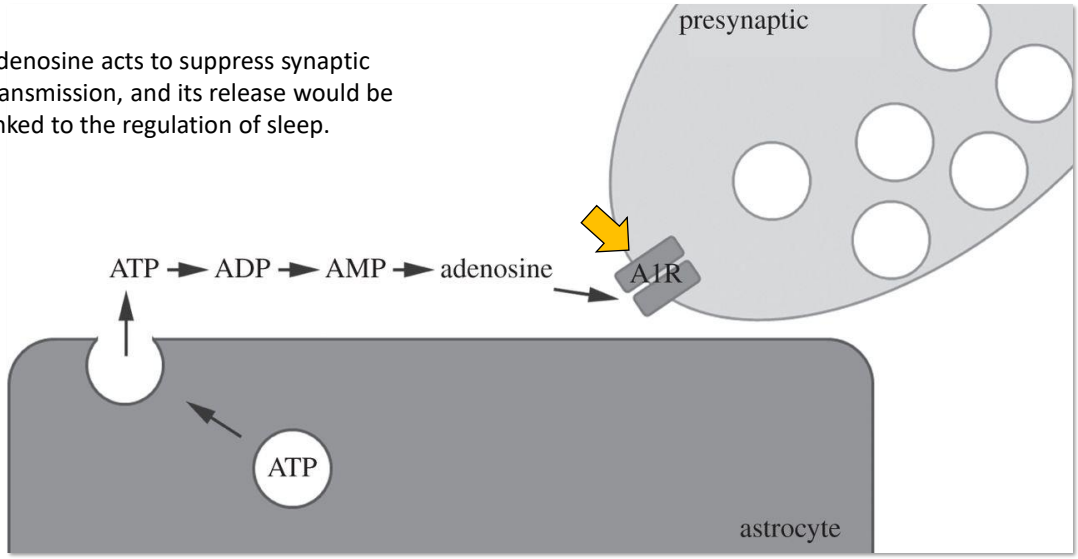


Figure 7: ATP signalling via exocytotic release from astrocytes

Co-morbidities

Many mental health disorders affect cognition and exhibit sleep co-morbidities.

Astrocyte networks

Gap junctions interconnect astrocytes in networks

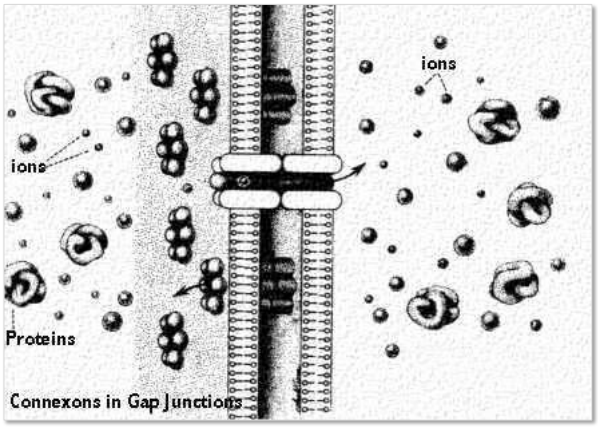


Figure 8: Drawing of a gap junction

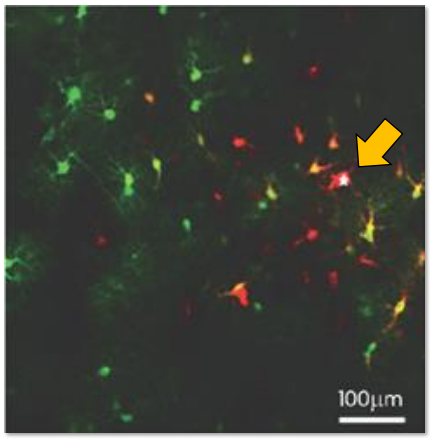
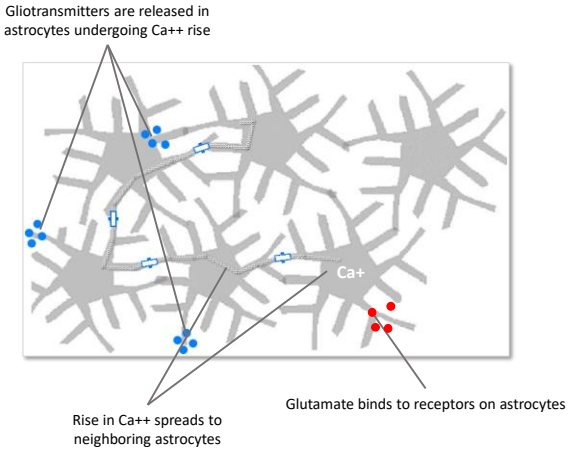
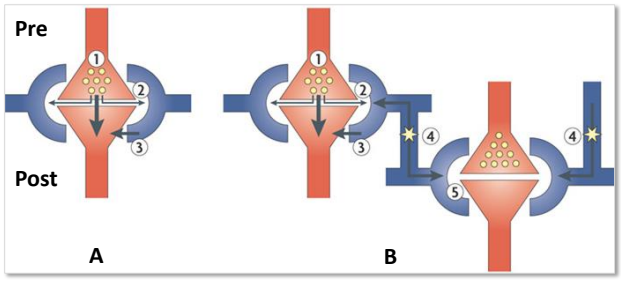


Figure 9: Astrocytes can be directly coupled with neighbouring astrocytes via gap junctions

Astrocytic networks and neuronal





1: Release of neurotransmitter
2: Neurotransmitter interacts with receptors on astrocytes
3: Release of gliotransmitters that influence neuronal activity
4: Glutamate and glutamine diffuse through astrocyte gap junctions
5: Release of gliotransmitters at a remote synapse

Figure 10: Calcium waves in astrocyte networks

What can astrocytic networks do?

- Regulate the generation of a rhythmic firing pattern in neurons, necessary for several vital functions, such as respiration and mastication
  Eg. Rhett syndrome

- Act as a hub for integrating signals from different brain areas

In part 2, the potential involvement of astrocytic network dysfunction in depression will be illustrated.