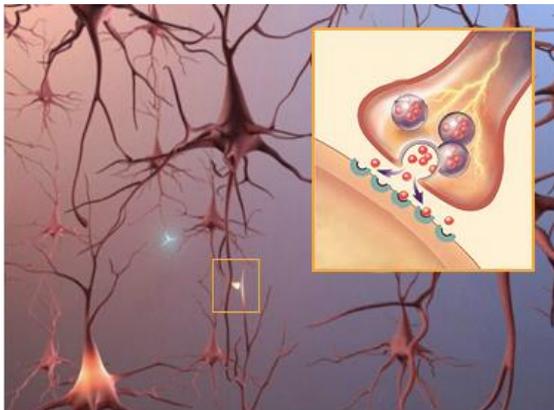
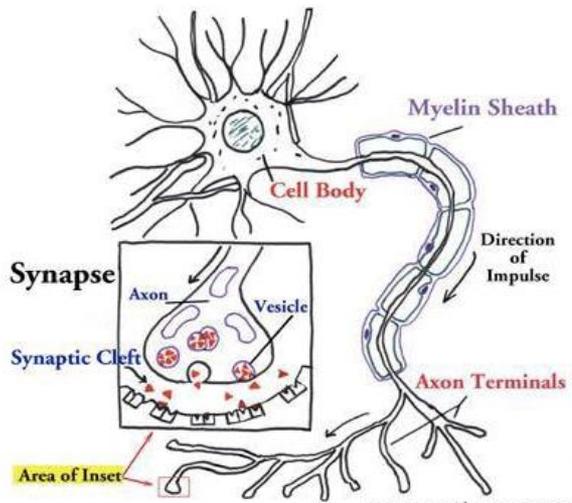


# 1Neuron\*



- Neurons form networks through which nerve impulses travel- about 250 km /hour
- Dendrites, cell bodies, axon, myelin, conduction & synapses. Synaptic gap/time
- 100 billion neurons in your brain
- 1,000 to 10,000 synapses for each neuron in your brain
- Neurotransmitters-
- Modification with experience/disuse- plasticity

## <sup>2</sup>Grey and white matter in the brain\*

The 'grey' matter is composed of the neuron's cell bodies and dense network of dendrites. It includes centre of spinal cord and outer layer of cerebral hemispheres known as cortex.

The parts of the CNS that contain grey matter (composed of neuronal cell bodies) are often called nuclei or ganglia.

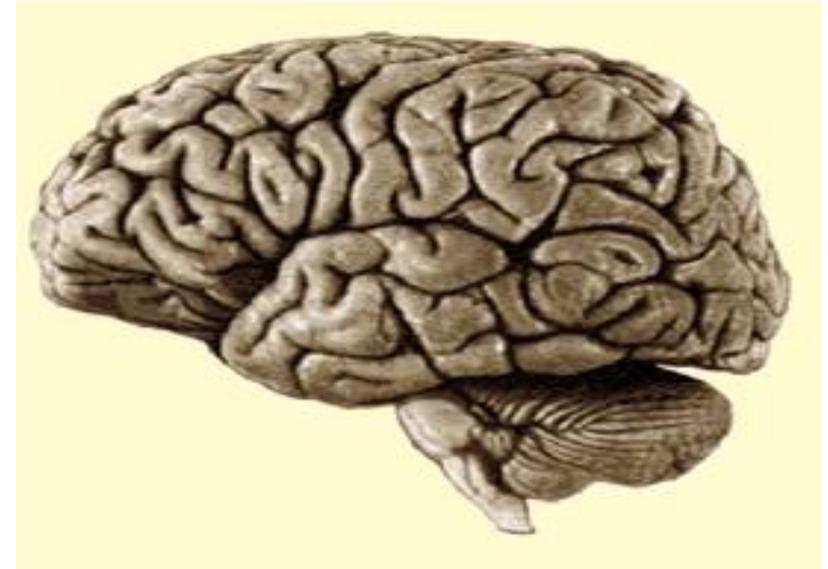
'White' matter consists of myelin sheathing that covers the axons. Certain groups of axons found in the brain's white matter are called pathways, nerves or bundles.

# <sup>3</sup>Interneurons\*

- The role that interneurons have in homeostatic like regulation is to make sure that the signals reaching other neurons are at the optimal level and come at the optimal time so that they neither overwhelm nor understimulate the other neurons.
- If a signal coming into a sensory neuron is too low to be detected, neighbouring interneurons will excite the neuron- make it more sensitive- so it is able to fire more easily.
- On the other hand, if the signal to the sensory neuron is too high, the interneurons can inhibit (raise its firing threshold) the sensory neuron from firing making it less sensitive to the signal.

# 4 NeoCortex\*

- About 75% of the 100 billion neurons in the brain are located in the few millimetres of grey matter of the cortex. In proportion to body weight-largest cortex of any vertebrate
- The neocortex is the part of the brain that functions to make human beings unique.
- Distinctly human traits including higher thought, language and human consciousness as well as the ability to think, reason and imagine all originate in the cortex.



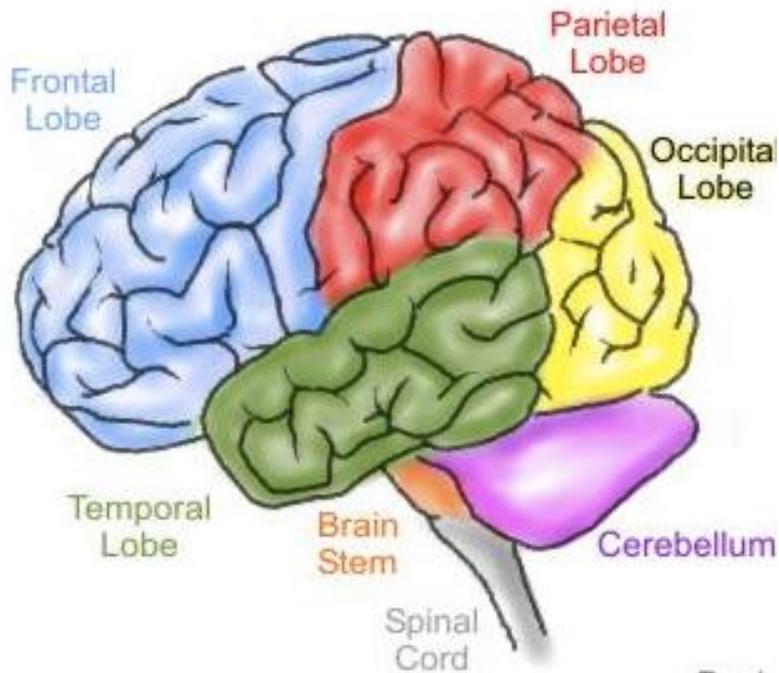
# <sup>5</sup>Neocortex\*

- It is the outermost portion that can be divided into the four lobes of the brain.



# 6 Frontal Lobes\*

Regions of the Human Brain



- The focus of the next six weeks
- Most anterior-right under the forehead
- Makes up about one third of the neocortex

# <sup>7</sup>Prefrontal cortex\*

- In phylogeny as in ontogeny, the association cortex of the frontal lobe, also known as the prefrontal cortex, is a late-developing region of the neocortex.
- It is also one of the cortical regions to undergo the greatest expansion in the course of both evolution and individual maturation.
- In the human adult, the prefrontal cortex constitutes as much as nearly one-third of the totality of the neocortex.

# 8 Prefrontal cortex\*

- The protracted, relatively large, development of the prefrontal cortex is manifest in gross morphology as well as fine structure.
- In the developing individual, its late maturation is made most apparent by the late myelination of its axonal connections.
- This and other indices of morphological development of the prefrontal cortex correlate with the development of cognitive functions
- It is these cognitive functions that we will be talking about during the upcoming weeks.
- Incidentally, these facts are of importance in the current marijuana legalization process

## <sup>9</sup>Executive Functions- moving away from the metaphor\*

- The frontal lobes control the processes called "mentalizing" upon which our socialization is based; this is the ability to understand another's mental processes.
- Spontaneity of facial expression and of interaction with others is also controlled by the frontal lobes

# <sup>10</sup>More Executive Functions\*

- Functioning of sequencing events, which is the ability to plan a series of movements needed to perform a multi-step task, like making a sandwich.
- Flexibility in thinking processes, for example, being able to conceive of and choose between complex alternatives in a social environment. The problematic opposite of this flexibility is perseveration, which is the fixed persistence of a single thought.
- Both attentiveness of focus on a single task and resistance to emotional lability, which is commonly referred to as mood changes or mood swings, are controlled by the frontal lobes.

# <sup>11</sup>More Executive Functions\*

- The ability to solve problems, which often depends on flexible thinking, and the ability to correctly express language are both controlled by the frontal lobes
- They also control emotional impulsivity, working memory, aspects of attention, and judgment.

# <sup>12</sup>Two ways these processes operate\*

- Deliberately
- e.g. when a mature adult forgoes a short term pleasure in pursuit of a long-term goal (can children do this - more on this topic to follow)
- Automatically
- e.g. when one maintains a topic in conversation despite the many diverse thoughts that move through one's consciousness

# 13 Executive Functioning which is largely under the control of Prefrontal Lobes Involves\*

- Planning for the future/decision making
- Self monitoring/error correction/flexibility/budgeting of time
- Working Memory- Integration of past and new information
- Control over dominant responses
- Attention allowing control of interference
- the frontal lobes -- commands action and reaction and integrates our attention with short- and long-term goals.
- The Prefrontal lobes allow us to respond  
-not simply react

# <sup>14</sup>Poor Executive Function\*

- A dysregulation of goal directed behaviour
- not attributable to a more basic deficit in perception, memory, or language comprehension
- Occurs across tasks varying in content & surface characteristics
- Despite understanding goal of task, prefrontal dysfunction results in impaired performance (intrusions of task irrelevant behaviour, perseveration, lack of initiative etc.)

# 15 Summing up\*

- The frontal lobes are of paramount significance in determining our daily capabilities, personality manifestations, social interactions and judgments and decisions.
- They command action and reaction and integrate our attention with short- and long-term goals.
- One of the great achievements of the prefrontal cortex is their inhibitory action on other brain regions allowing impulse control, delay of gratification, ability to mentally try out different solutions etc. – it makes us human!!
- The frontal lobes are indeed **the seat of our essence and nature.**