

Neurobiology of Human Behaviour

Lecture 5

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Learning Objectives – Lecture 5

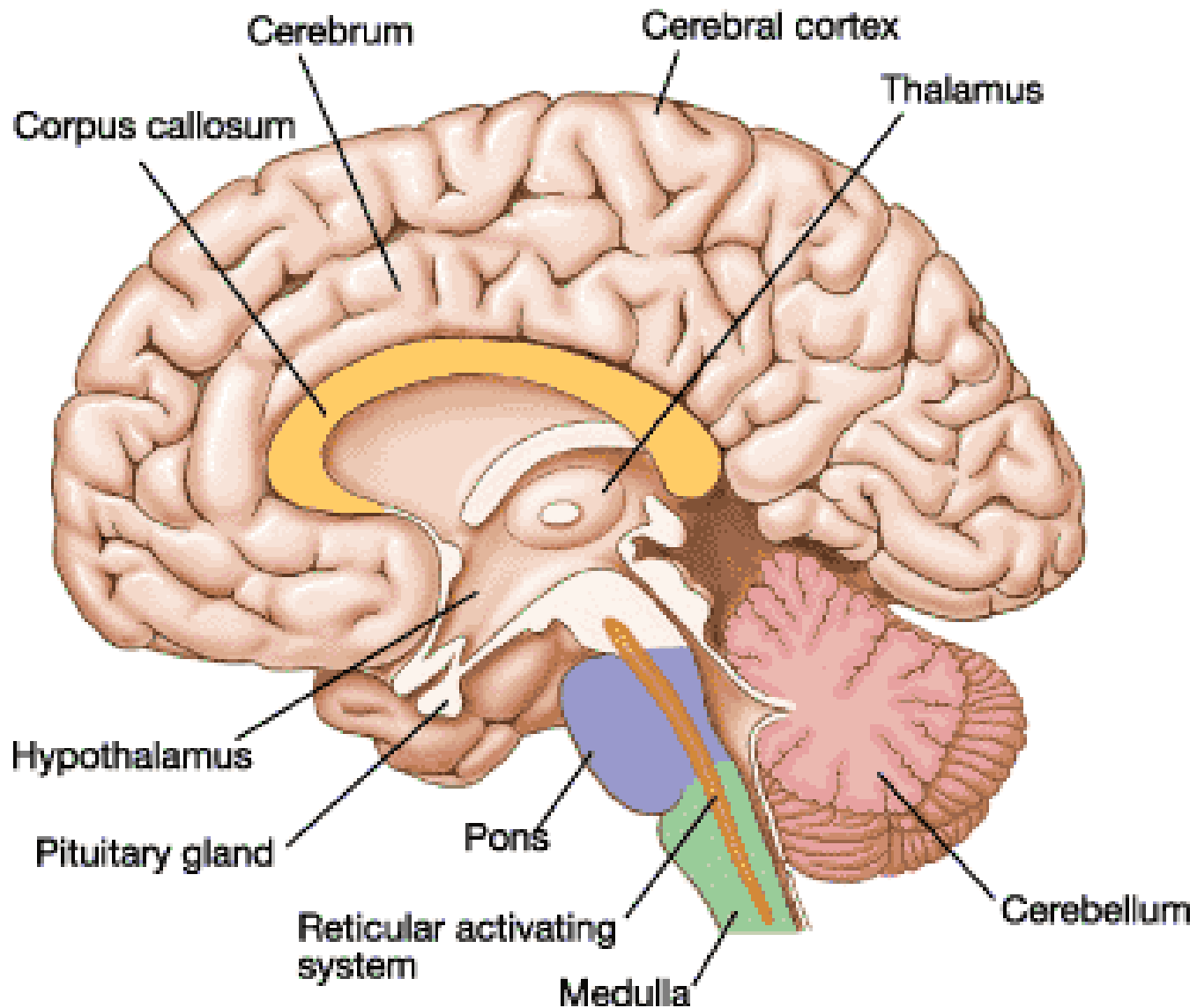
By the end of the lesson the learner should be able to:

- identify the different parts of the nervous system; and
- recognise processes responsible for the cognitive, affective and behavioural dimensions of the psyche.

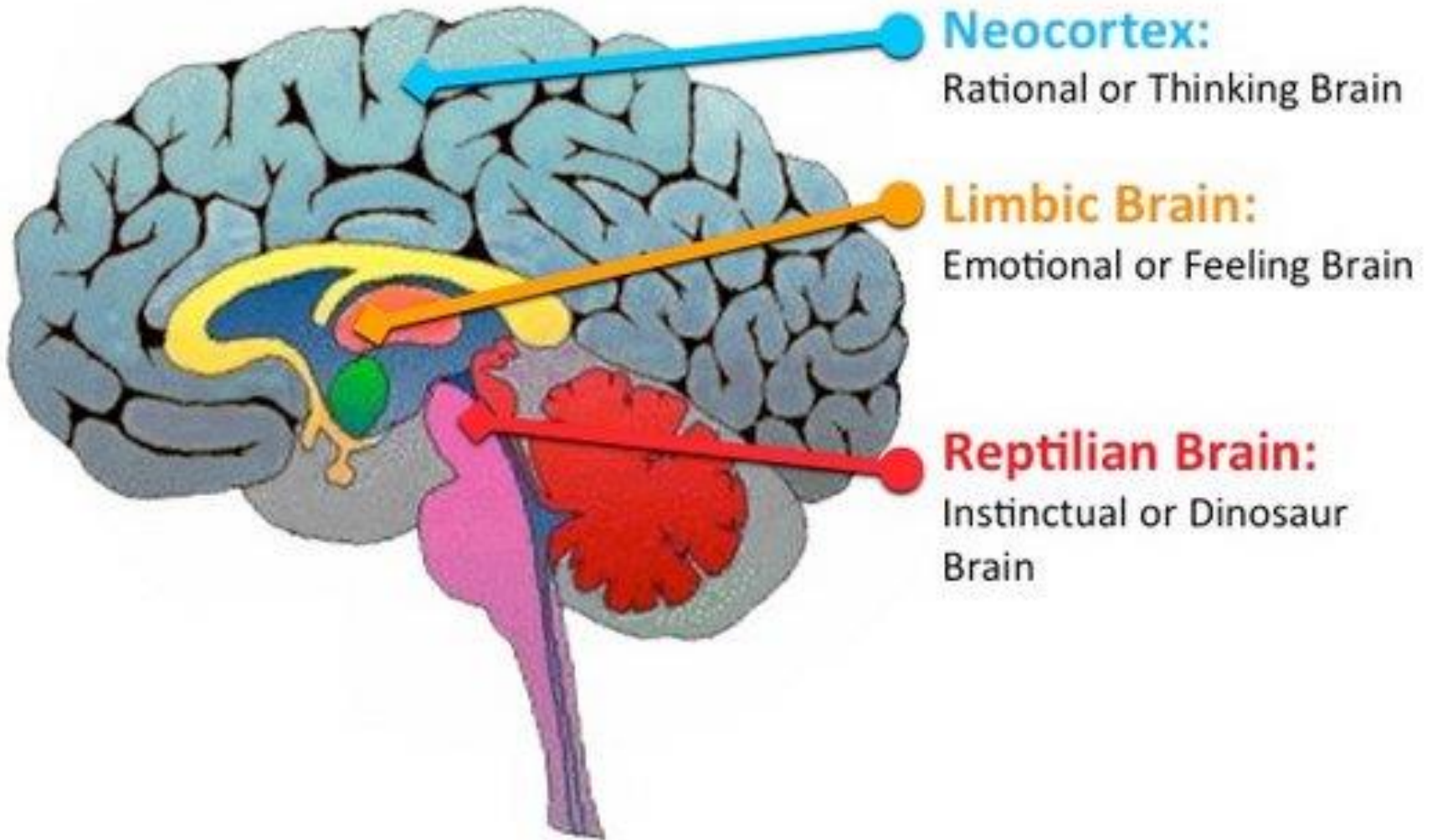
Some facts about the brain

- The average human brain weighs about 1300-1400 gms. Your brain uses 20% of your body's energy, but it makes up only 2% of your body's weight.
- At birth, the human brain weighs about 350-400 gms.
- There are about 100 billion neurons in the brain.
- A typical neuron can create about 1,000 to 10,000 synapses (that is, it can communicate with 1,000-10,000 other neurons, muscle cells, glands, etc.).
- The total length of the "wiring" between the neurons is about 100,000 kilometres.

Major Parts of the Brain



Human Brain: Three Brains in One



Neocortex:

Rational or Thinking Brain

Limbic Brain:

Emotional or Feeling Brain

Reptilian Brain:

Instinctual or Dinosaur Brain

Hand-Model of the Brain

- Watch Video:

<http://www.youtube.com/watch?v=DD-IfP1FBFk>



Reptilian Brain

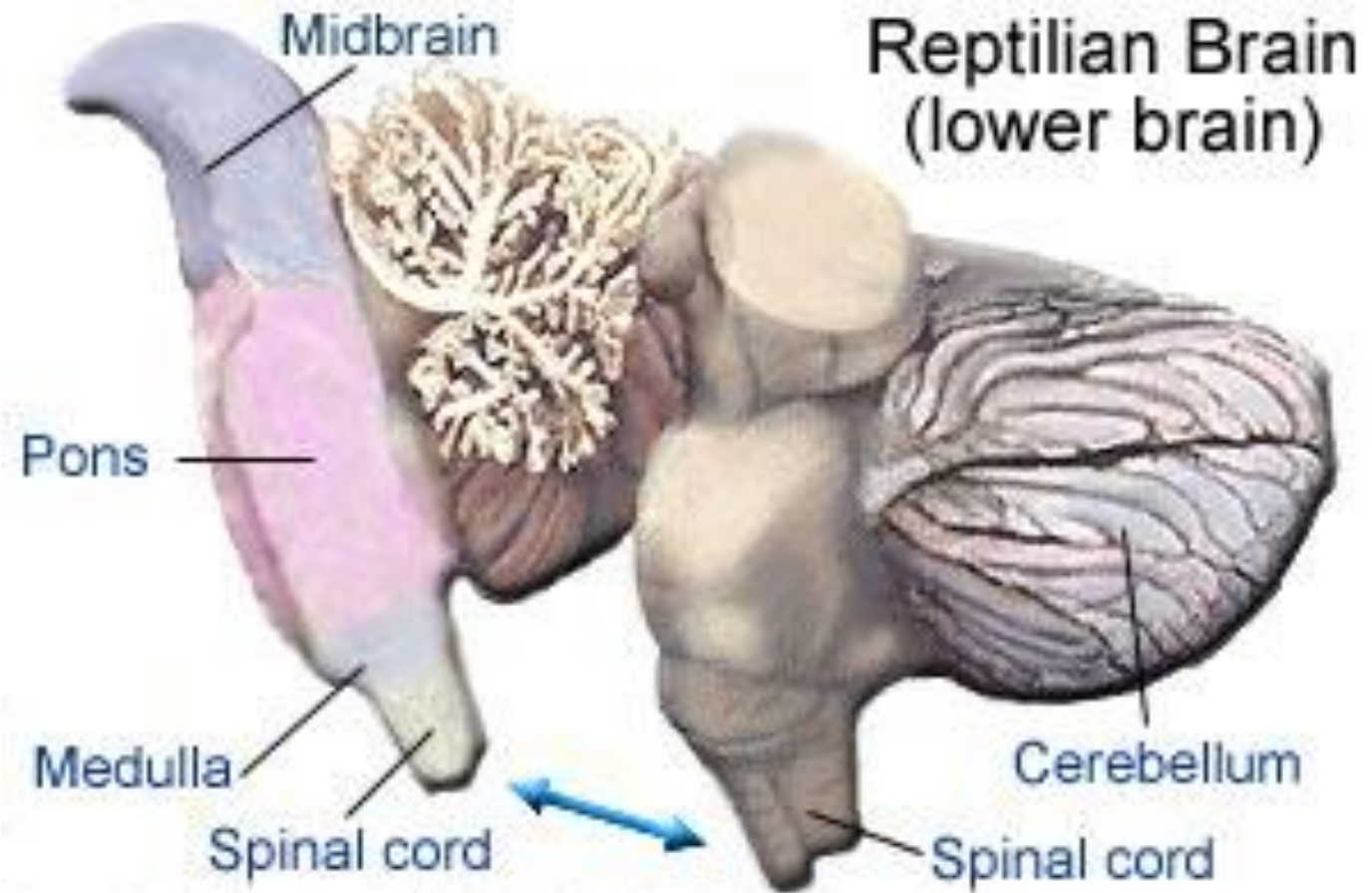
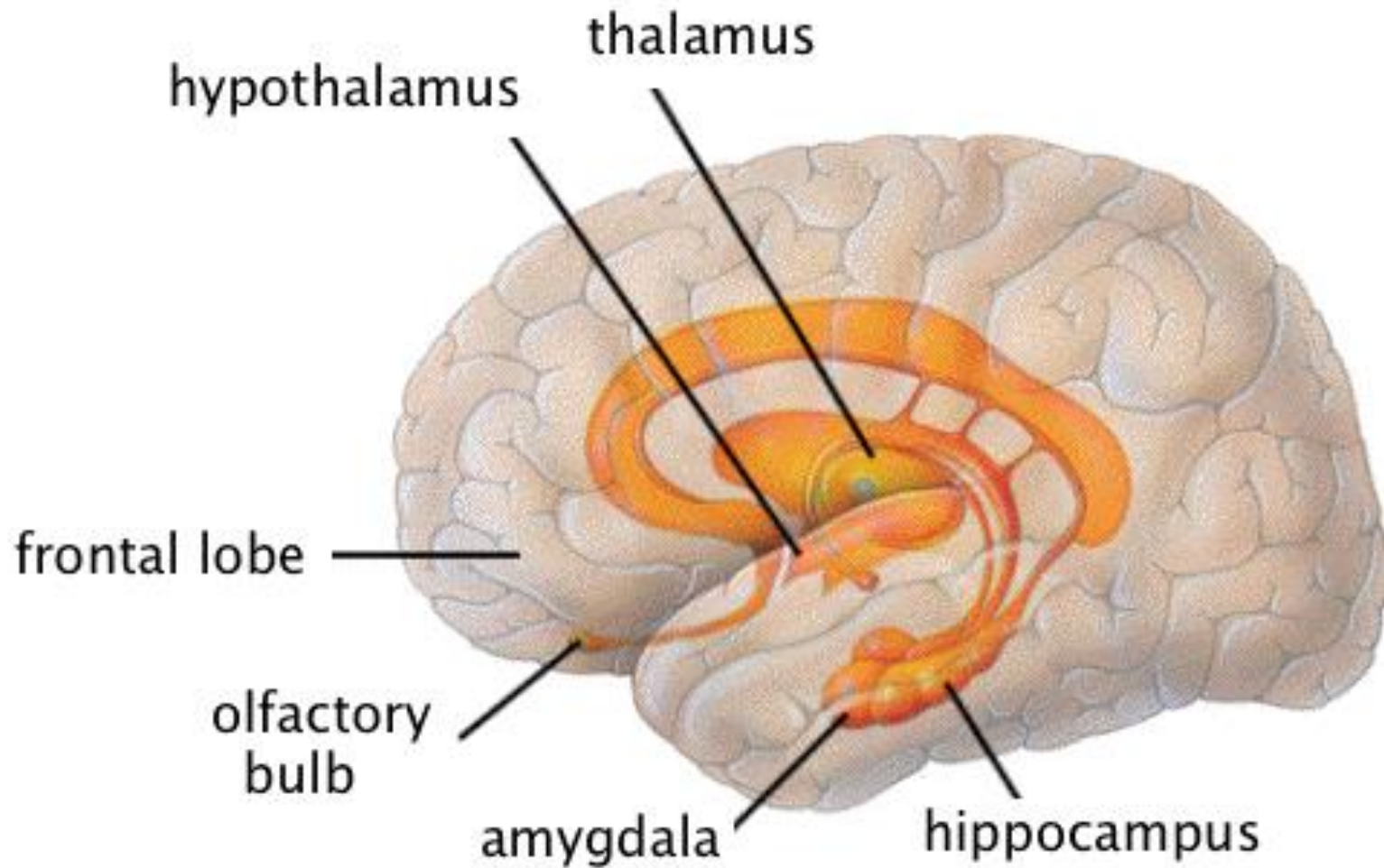


Illustration Courtesy of "Mapping the Mind"

Functions of the Reptilian Brain

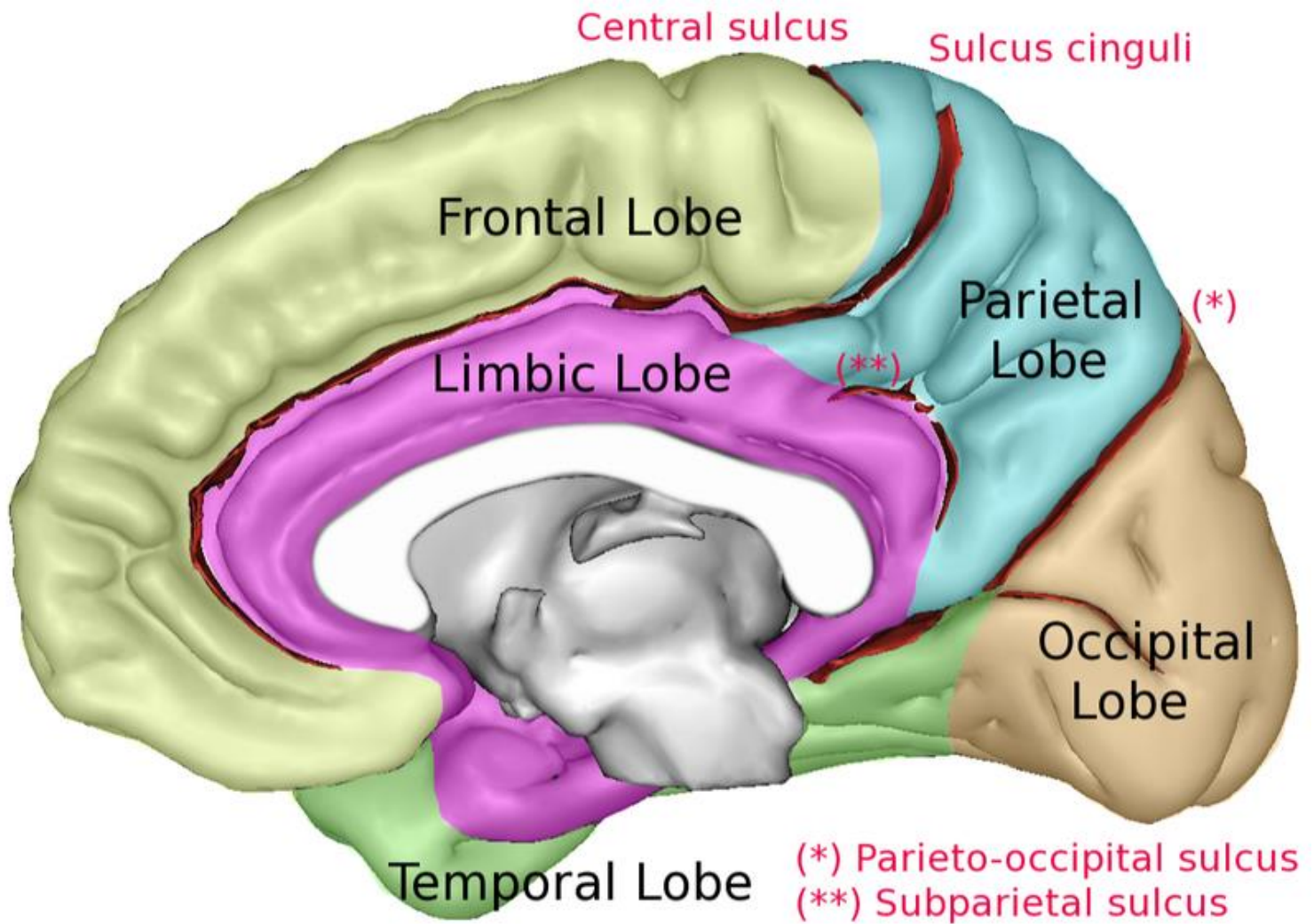
- Our reptilian brain includes the main structures found in a reptile's brain: the brainstem and the cerebellum.
- Controls the body's vital functions such as heart rate, breathing, body temperature and balance – autonomous functions.
- Responsible for survival. Flight, fight, freeze responses.
- The reptilian brain is reliable but tends to be somewhat rigid and compulsive.

Limbic System



Functions of the Limbic System

- It can record memories of behaviours that produced agreeable and disagreeable experiences, so it is responsible for what are called emotions in human beings.
- It is responsible for bonding, empathy...
- The limbic brain is the seat of the value judgments that we make, often unconsciously, that exert such a strong influence on our behaviour.

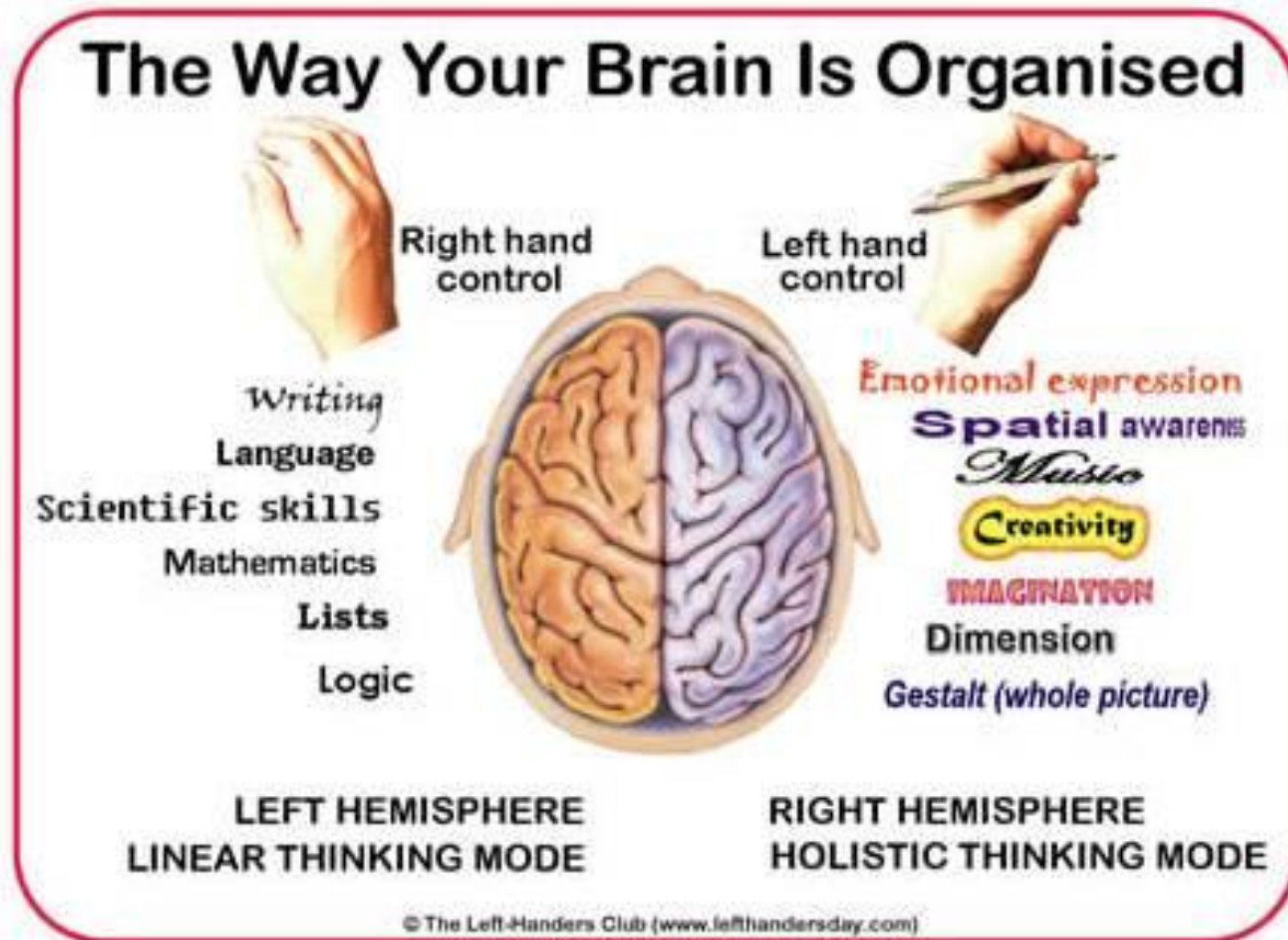


Functions of the Neo-cortex

- Major part of the cortex is found in primates.
- In humans it is more complex. These hemispheres have been responsible for the development of human language, abstract thought, imagination, and consciousness.
- Prefrontal cortex – found only in humans is responsible for rational choice – it is capable of monitoring the activity of the reptilian brain and the limbic system.

Cerebral hemispheres: Left-Right Brain

A postulation!



Left brain expression (Academic)

detail oriented
(Looks at parts)
Logical
Sequential
Rational
math and science
can comprehend
Analytical
Objective
uses logic
facts rule
words and language
present and past
knowing
acknowledges
knows object name
reality based
forms strategies
order/pattern perception
practical/planned
safe
cautious



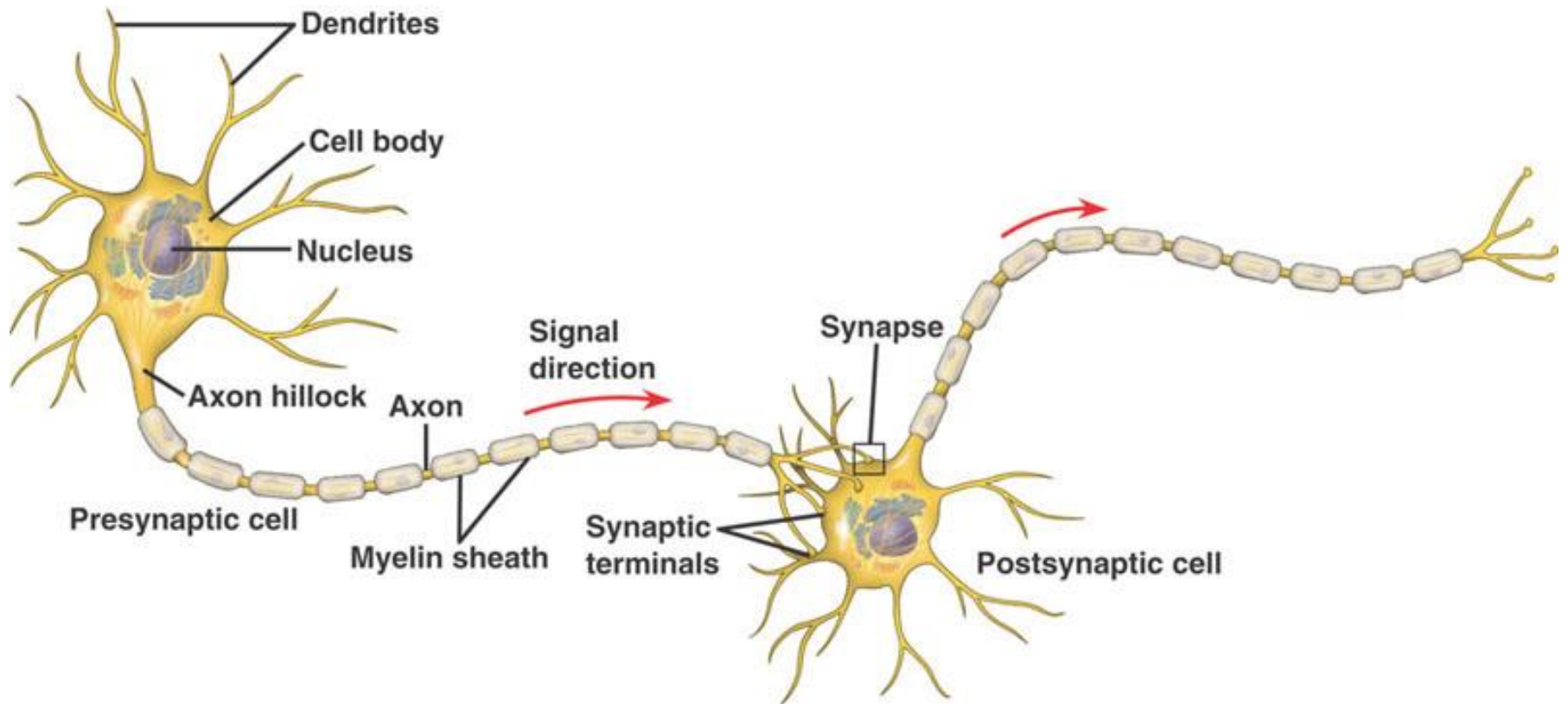
Right brain expression (Creative)

'big picture' oriented
(Looks at wholes)
Random
Intuitive
Holistic
philosophy & spiritualism
can 'get it' (the meaning)
Synthesizing
Subjective
uses feeling
imagination rules
symbols and images
present and future
believes
appreciates
knows object function
fantasy based
presents possibilities
spatial perception
impetuous/spontaneous
adventurous
carefree/risk taking

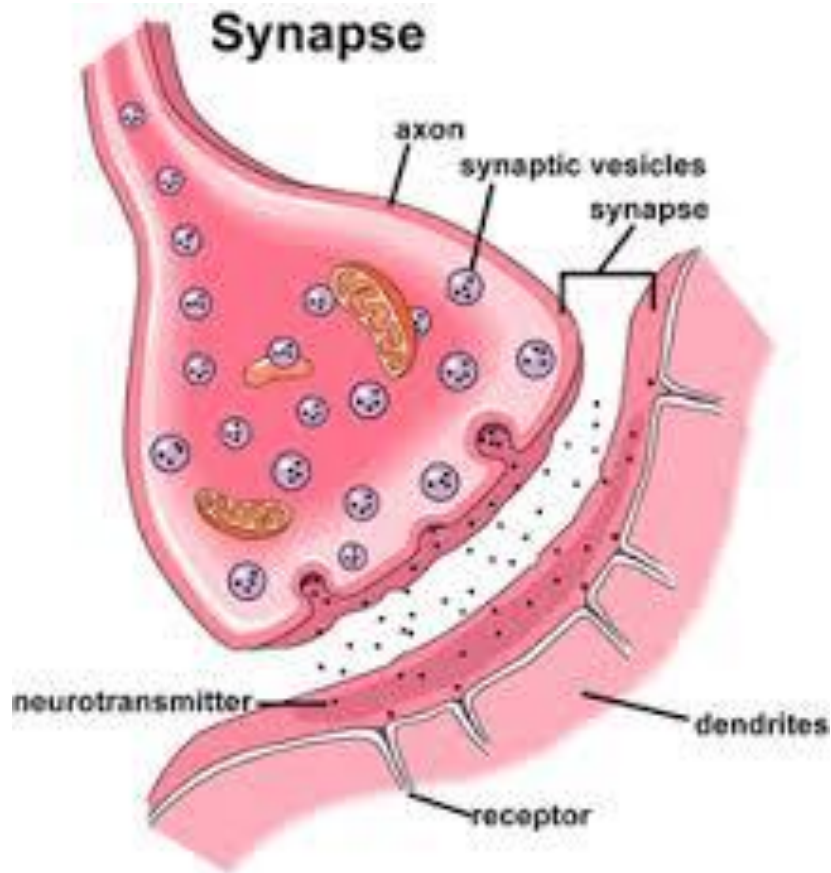
A critique of Left Brain-Right Brain

- While a distinction may exist in what is grouped as left-brain and right-brain activity, and while individuals might have a preferred style in their functioning, there may not be a biological basis for this.
- The biological basis was postulated from the a supposition that left-handed people are more creative!
- Any mental activity involves several parts of the brain; more complex the activity more part is involved; hence we can only talk of whole-brain activity;
- Left-brain and right-brain might be a way of referring to a set of personality traits.

Structure of the Neuron



Synapses



- In the nervous system, a **synapse** is a structure that permits a neuron (or nerve cell) to pass an electrical or chemical signal to another cell (neural or otherwise).
- Every time a new skill or knowledge is learnt, there are new set of synapses formed.

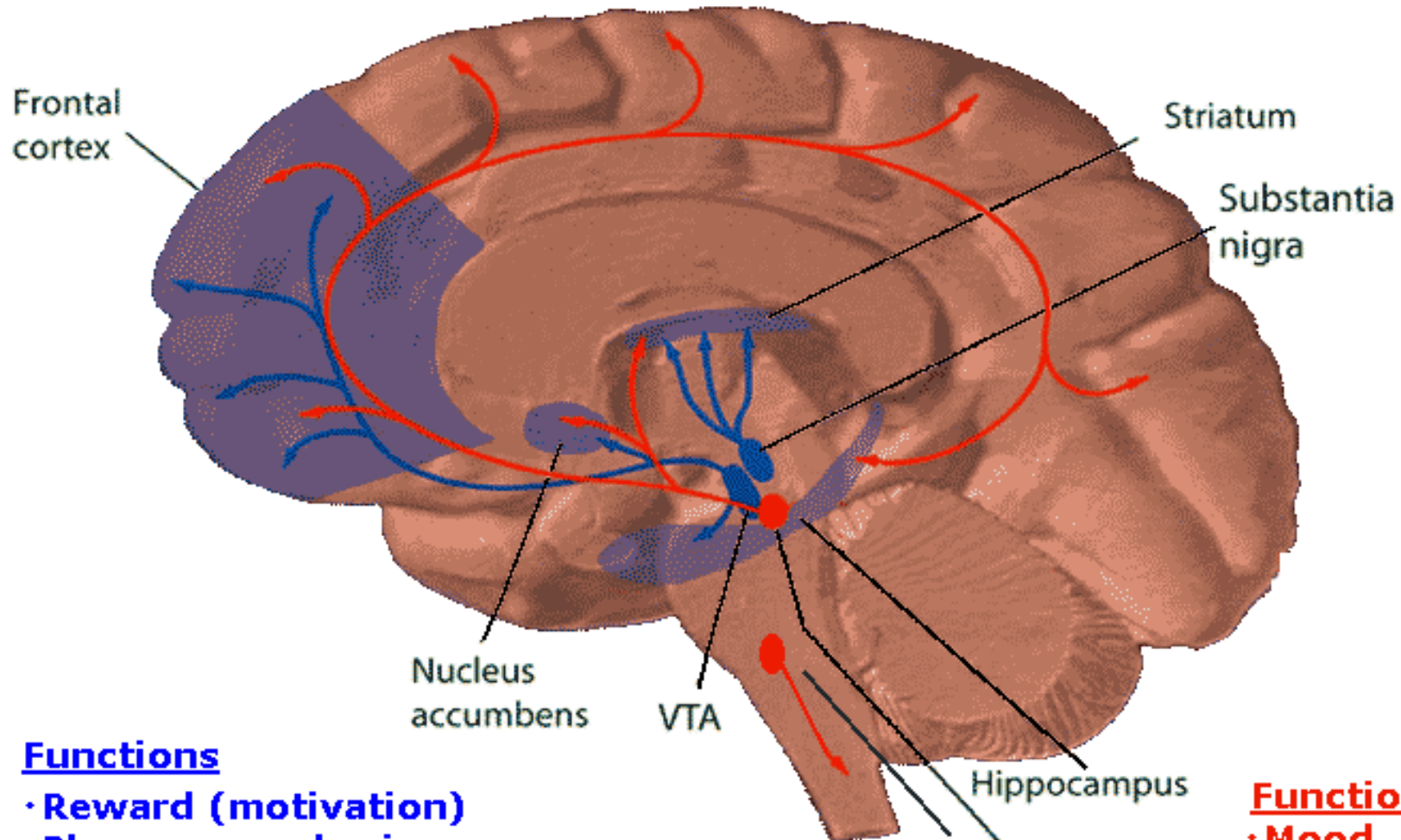
Neurotransmitters: What are they?

- How do neurons communicate with each other?
- Until the 20th Century, it was believed that they communicated through electric waves.
- Ramón y Cajal (1852–1934), discovered a 20 to 40 nm gap between neurons, known today as the synaptic cleft. The presence of such a gap suggested communication via chemical messengers traversing the synaptic cleft.
- In 1921 German pharmacologist Otto Loewi (1873–1961) confirmed that neurons can communicate by releasing chemicals.
- These chemicals are called, 'neurotransmitters'.

Some neurotransmitters

- **Dopamine:** has many pathways in the brain - one of which plays a major role in reward-motivated behavior. Most types of reward increase the level of dopamine in the brain, and a variety of addictive drugs increase dopamine neuronal activity.
- **Serotonin:** (also a hormone) related to moods including and depression. They also affect appetite and sleep.
- **Adrenaline** (also a hormone) related to excitement experienced in activities that require courage – adventure.
- **Endorphines:** intended to mean "a morphine-like substance originating from within the body; they are active during euphoria, they restrict pain.
- **Oxytocin:** Produced by hypothalamus... noticed when there is an experience of bonding/love!

Dopamine Pathways



Functions

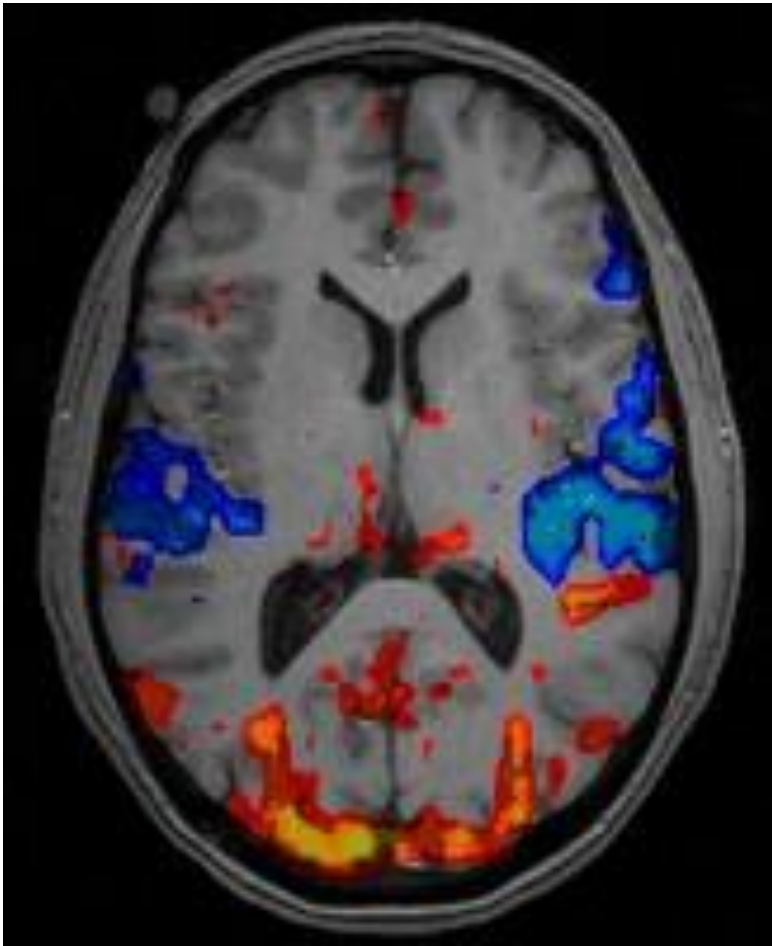
- Reward (motivation)
- Pleasure, euphoria
- Motor function (fine tuning)
- Compulsion
- Perseveration

Serotonin Pathways

Functions

- Mood
- Memory processing
- Sleep
- Cognition

fMRI in Psychology



- It is a type of brain-scan
- fMRI = Functional Magnetic Resonance Imaging. Used since 1990s.
- Image left is from a subject who watched a screen which alternated between showing a visual stimulus and being dark every 30 second.

Use of fMRI in Psychology

- It helps us trace which part of the brain is active when a certain mental/affective activity is carried out.
- It works by detecting the changes in blood oxygenation and flow that occur in response to neural activity.