

## BLOA - Notes

(Ethics and research methods questions can be asked of **red** topics)

Study

Definitions

Explanation

### The relationship between the brain and behaviour

#### Research methods

- Martinez and Kesner (1991)

- Definitions

- Lab experiment

- Explanation

#### Ethics

- Maguire et al. (2000)

- Definitions

- Explanation

- Anonymity

#### Techniques used to study the brain in relation to behaviour

- Maguire et al. (2000)

- Definitions

- Brain scan

- MRI

- Gray matter

- Hippocampus

- Explanation

- From autopsies to modern day technology: brain scans (non-invasive)

- MRI

- Magnetic resonance imaging

- A magnetic field and radio waves are used to map the activity of hydrogen molecules

- Hydrogen molecules are present in different brain tissues to a different degree

- Procedure: subject placed on table which slides into cylindrical apparatus

- No radiation exposure

- It produces a 3D image, but can also produce a 2D image of a 'slice' of the brain from any angle

- It is very detailed and can even spot small changes (spatial resolution: 1-2mm)

- It indicates structure, not function

#### Localization of function

- Maguire et al. (2000)

### - Definitions

- Localization of function
- MRI
- Gray matter
- Hippocampus
  - Posterior
  - Anterior

### - Explanation

- Define the theory.
- The theory relies on the idea that behaviour may be the product of brain structure
- There is a range in types of localization
  - Strict localisation - a clear connection between function and brain area
  - Weak localisation - a brain area may be responsible for a function
  - Widely distributed functions - functions that are not localised anywhere
  - But the argument of the theory is that every behaviour is associated with a specific brain region
- Autopsies, but more commonly brain scans can be used to identify areas of the brain responsible for specific functions.
  - This can be done by looking at the amount of gray matter in a specific area and by looking at the behaviour of scanned individuals

## Neuroplasticity

### - Maguire et al. (2000)

### - Definitions

- Neuroplasticity
- Synaptic plasticity
- Cortical remapping
- Dendritic branching
- Long term potentiation
- Hippocampus
  - Posterior
  - anterior

### - Explanation

- Neuroplasticity occurs as a result of one's environment (eg. behaviour or damage to the brain)
- When neurons fire continually as a result of stimulation in the environment, the neurons sprout new dendrites – known as dendritic branching.
  - This increases the number of synapses available for the behaviour.
- Explaining different levels of neuroplasticity (synaptic level, cortical remapping)
- Synapses become stronger through repeated use
- Neural pruning is also an example of neuroplasticity

## Neural networks

### - Maguire et al. (2000)

### - Definitions

- Neural network

- Neuroplasticity
- Dendritic branching
- Neuron
- Action potential
- Axon
- Long term potentiation

#### - Explanation

- The process by which neural networks are formed is called neuroplasticity
- When a neuron is stimulated, an action potential (an electrical charge) travels down the axon.
- Neural networks are created when a neuron or set of neurons are repeatedly stimulated.
- This repeated firing of the neurons, called long term potentiation, results in gene expression which causes the neurons to sprout new dendrites – known as dendritic branching.
- This increases the number of synapses available for the behaviour.
- The branching of neurons in the brain is called gray matter.

### Neural pruning

#### - Draganski et al. (2004)

#### - Definitions

- Neural network
- Neuron
- Neuroplasticity
- Dendritic branching
- Brain scan
  - MRI

#### - Explanation

- Neural pruning is an example of neuroplasticity, as connections between synapses are lost as a response to one's environment
- The connection between two dendrites is called a synapse and the connections between the synapses is how information travels around our brain
- Neural pruning occurs when these synaptic connections are lost, because they are not used
- This increases the effectiveness of commonly used neural networks
- Neural pruning occurs most in adolescence. It can occur in adulthood (eg. alzheimer's or environmental stimuli)
- Brain scans can be taken to observe neural pruning by looking at gray matter. The more grey matter, the more synaptic connections and neural networks.

### Neurotransmitters and their effects on behaviour

#### - Martinez and Kesner (1991)

#### - Definitions

- Neurotransmission
- Neurotransmitter
- Acetylcholine
- Neuron

- Antagonist
- Synapse

#### - Explanation

- Neurotransmission is the process by which neurons communicate with each other by sending and receiving neurotransmitters
- Acetylcholine seems to play a role in the encoding of spatial memories.
- The presynaptic neuron releases chemicals called neurotransmitters to cross the gap between two neurons called the synapse.
- These neurotransmitters then bind to specific receptor sites on the postsynaptic neuron creating an electrical signal called the action potential.
- If these receptor sites are blocked by another chemical the postsynaptic neuron will not be able to create an action potential, inhibiting the process of neurotransmission.
- Neurotransmitters return to the presynaptic neuron or are dissolved by enzymes
- The effect of neurotransmitters cannot be directly measured, thus they are often studied by blocking the receptor site of a specific neurotransmitter and studying results
- Link study to human behaviour

### Neuron

#### - Martinez and Kesner (1991)

#### - Definitions

- Synapse
- Neuron
- Neurotransmitter
- Neurotransmission
- Acetylcholine

#### - Explanation

- The nervous system is a system of neurons
- A neuron consists of three parts: body, dendrites and axon
- The process by which electrochemical messages are sent is called **neurotransmission**.
- The electrical impulse that travels along the body of the neuron is called an **action potential**.
- When an action potential travels down the body, or **axon**, of the neuron, it releases neurotransmitters that are stored in the neuron's terminal buttons.
- The neurotransmitters are then released into the gap between the neurons – called the **synapse**.
- Neurotransmitters are the body's natural chemical messengers that transmit information from one neuron to another.
- After crossing the synapse, the neurotransmitters fit into **receptor sites** on the post-synaptic membrane, like a key in a lock.
- Once the message is passed on, the neurotransmitters are either broken down by an enzyme or reabsorbed by the terminal buttons, in a process called **reuptake**.
- When explaining the process of neurotransmission, have a focus on neurons

### Synapse (how these relate to excitatory and inhibitory neurotransmitters)

#### - Martinez and Kesner (1991)

#### - Definitions

- Synapse
- Neuron
- Neurotransmitter