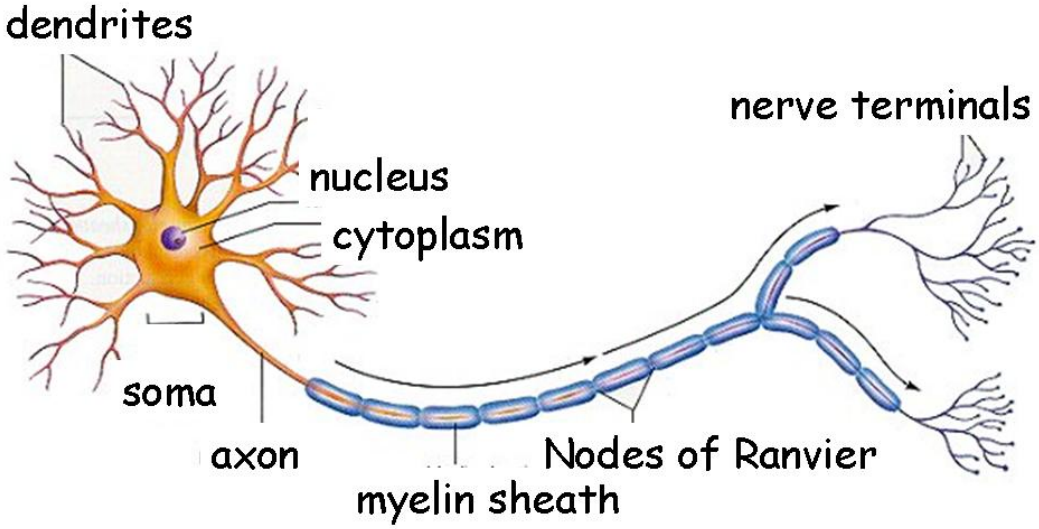
BRAIN QUIZ

1. The picture below represents a single nerve cell (which is also called a neurone). Label the important parts of this cell.

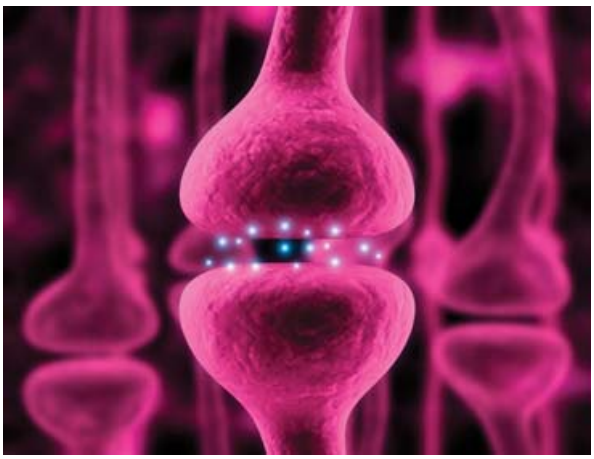


2. Which type of cell in your body has the longest axon? *The neurons which control voluntary movements. The upper motor neurons are in the brain and they connect with the lower motor neurons which are located in the spinal cord. These neurons have very long axons. In very tall people they can be 4 feet long.* **http://pathology.mc.duke.edu/neuropath/nawr/motor-systems.html**

3. The 'soma' is the nerve cell body. Typically, what is the diameter of a nerve cell body? *About 10 microns (μm; or one-hundredth of a millimetre)*

4. What is the junction between two nerve cells called? *The synapse.*

5. Nerve cells communicate by releasing a chemical which diffuses across the synapse between the two cells and activates 'receptors' on the next nerve cell. Name one of the chemicals that are used by the brain for this neurotransmission.



The first neurotransmitter discovered was acetylcholine

$CH_3COOCH_2CH_2N^+(CH_3)_3$

Since then many different neurotransmitters have been discovered . Some drugs act by 'impersonating' neurotransmitters i.e. they bind to the seceptors and copy the way in which they act. An example is morphine which acts on recptors that control nerves important in pain. **http://faculty.washington.edu/chudler/chnt1.html).**

6. Name a famous male neuroscientist. What was/is he famous for? *Ramon y Cajal is often referred to as the 'Father of Neuroscience. He provided careful and beautiful dawings of neurons in many regions of the brain. These had the precision of an archyects drawing and provided descriptions of the neurons in the brain and fundamental insight into their organisation.*

7. Name a famous female neuroscientist. What was/is she famous for? *Rita Levi-Montalcini; she discovered nerve growth factor a soluble factor released from nerve cells swhich timulates their growth. This is important in understanding how the brain grows in development and has led to a whole new field of research that hopes to find ways to repair the brain following injury or in disease.*
http://www.nature.com/news/2009/090401/full/458564a.html

8. How many Nobel prizes have been won by scientists who have used *C. elegans* as their experimental model? *Three;* **http://130.15.90.245/c__elegans.htm**

9. What is the chemical formula of ethanol? C_2H_5OH

10. Which part of the brain is particularly important in memory? *The hippocampus*

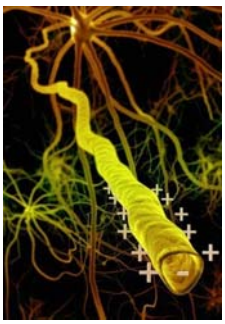
11. How long can *C. elegans* live for? *About 3 weeks. But there are long lived C.elegans which can live more than 5 times longer, equivalent to a human living for 500 years! These long-lived C.elegans are mutants , that is, it is changes in their DNA that affects the biology of how they age. C. elegans and mutants with different rates of ageing are being used to try to understand what makes an animal, including humans, age*
http://www.ucl.ac.uk/~ucbtdag/.

12. Name two different techniques that can be used to image the human brain.
Positron emission tomography (PET) scans have a number of uses in neuroscience . One common use is to measure how many receptors there are in the brains of patients. A good example of this comes from the lab of Nora Volkow at the National Institute of Drug Abuse (USA). She has imaged the brains people suffering from the disease of drug addiction . This shows a decrease in the numbers of receptors for a particular class of transmitter, dopamine,.This is important because it shows how chronic drug use can affect the brain and lead to addiction.

Functional magnetic resonance imaging (fMRI) can provide a measure of how active different regions of the brain are when a patient performs a

particular task and therefore gives an insight into what role particular parts of the brain play in behaviour. In psychiatry this has also been very useful as it gives an indication of which parts of the brain might be functioning abnormally. For example, in patients with schizophrenia the frontal lobes are underactive, and this provides an explanation for the decrease in intelligence that occurs in patients who have suffered from the disease for a long time.

13. What are the electrical signals that travel along an axon called?



An 'action potential'. It is a spike of electrical activity that is actively generated so that it can travel within milliseconds from one end of an axon to another, (imagine what happens when a trail of gunpowder is lit). It does this because of the very rapid movement of ions Na^+ and K^+, across the axonal membrane. A motor neuron conducts at a velocity of 120 m sec^{-1} (more than 200 miles per hour).

14. Name a genetic disorder of the nervous system.
Hungtinton's disease is a hereditary condition caused by a mutation in the protein Huntingtin. It causes loss of (reduced) motor coordination and cognitive decline . This is due to the death of neurons in the basal ganglia of the brain, a region that is very important in motor control. Although the cause of the disease is known, neuroscientists are still trying to find out precisely why the neurons die and how this might be prevented.

With Huntington's disease the genetic basis of the disorder is unequivocal. It is an autosomal dominant genetic disorder and the child of a parent with the disease has a 50% chance of developing it. However for most of the diseases of the nervous system the situation is less clear; there seems to be a genetic component (as evidenced by the propensity for the disease to run in families) and also an environmental component. A good example of this are the psychiatric conditions e.g. depression, drug addiction, alcoholism and schizophrenia.

15. What type of cell in the brain has a name that means 'glue'? *The 'glia' - but in fact we now know they do a lot more than just stick the brain together.*

16. What are endorphins? *The brain's natural painkillers. They are chemicals released by neurons that act just like morphine to relieve pain. They also elevate mood and make you feel good.*

17. How many people in the UK have dementia? *700,000 people in the UK have dementia. It is largely a disease of the elderly and it is estimated that as people live longer the incidence of dementia will increase so that by 2050 nearly 2 million people will be affected. Understanding the progression of the disease is clearly very important. Ultimately this will lead to medical treatments that will slow the disease down and enable elderly people with dementia to live a better quality of life for longer.*

18. What might happen to an individual that suffered damage to the temporal lobe of the brain? *The temporal lobes process auditory information, perception, language and memory therefore the symptoms would depend on how extensive the damage was to this region. The damage might give rise to anterograde amnesia, the inability to form new memories, as the temporal lobe harbours the hippocampus, a region in the brain that performs this function. A person with anterograde amnesia would have problems following a conversation as they wouldn't be able to remember what was said a few minutes previously.*

19. Which cells of the eye enable you to see at night? *The rods. They respond to low light levels. They work when the light is dim, in bright light they are switched off. They respond best to blue light and not to red. The rods don't work in daylight (they desensitise) and this is why when you go from bright light straight into a dimly lit room it takes a while to see anything- your rods have to recover from the bright light in order for you to be able to see - this chemical process in the rods takes a few seconds. If you want to see at night, it is a good idea to use a red torchlight; the rods aren't 'swtiched off' by red light and so when you switch the torch off you can go straight back to star-gazing.*

20. Have you learnt anything while you were doing this quiz? How do you think this knowledge is stored in your brain? *Hopefully you have! But how your brain stores this knowledge is probably one of the biggest questions neuroscience is still trying to answer. We know the brain can change it properties and that learning has something to do with altering the signalling at synapses and also their number. Studies on animal models e.g. Aplysia and Drosophila, have provided insight into some of the molecules and signalling pathways that might bring about these changes at the synapses. But how these synaptic changes make a human memory is still a puzzle for neuroscience to solve.*