Make a neuron and build a brain.
Teacher help sheet

Aims:
Understand that the brain is made of neurons (they are the 'building blocks')
Neurons connect to make pathways through the brain
Pathways are strengthened and weakened by experiences

Equipment:
Slide deck showing pictures of neurons.
Selection of junk or craft materials to make a model (see table below).
Scissors and tape.
Long piece of string or chalk to mark the outline of a brain.

Feature of the neuron	Suggested items	Modelling material needs
Cell body	Plasticene, pipe cleaner (folded into a ball), big beads, cut up egg box or other junk.	To be able to attach to the cell axon easily
Cell axon	Pipe cleaner, straw, wire, lollipop sticks, strips of card.	Long and thin, ideally bendy, but not essential.
Dendrites	Wool, pipecleaners	Thin and long, bendy
(advanced: myelin sheath)	Foam packaging material, insulation material, beads, foam or felt (to wrap around axon).	Be able to wrap around the around (or thread axon through it).

Steps:

1) Explain that the class is going to make a brain. Ask them what the brain is made up of? Listen to their responses. Explain that all biological material is made up of cells (these are the building blocks, like lego!), that combine to make tissues and organs. The brain is the organ that controls our bodies and our interactions with the external environment.

2) Ask if anybody knows the name of the cells that make up the brain. (If children are familiar with Nina and the neurons" on CBeebies – if it has been shown recently - then you may want to hum the tune to give them a hint!). Explain that they are all going to make a model of a neuron.

3) Show some pictures of neurons (see slide deck). *Optional activity – ask students to research neurones or nerve cells and find out what they look like and what parts they are made up of, before making their model.*

4) Show them the equipment they will have to make it and the amount of time you want to give them. Note – the simplest neurone can be made by bending one pipe-cleaner into a ball as the cell body. Attaching a second as the axon, and shorter bits to make dendrites.

5) Once everybody has made a neurone, make a shape on a desk or the floor to represent an outline of the brain (using string or chalk). Make it large enough so everybody can see it, or gather around it.

6) Place all the models inside the brain and ask students to guess how many neurones there are in the brain. Listen to their guesses. There are approximately 100 billion (estimates are about 80-120 billion).

7) Explain that the neurons form networks, by connecting between the axon terminals of one neuron and the dendrites of the next. Show them using 2 or 3 model neurons – lining them up in the brain. There is a small gap between the neurons (called a synapse). *You could explain that messages travel along a neuron by electrical impulse and across the gap by chemical messenger.*

8) Explain that this is called a pathway – 2 or more neurons joined together. The brain is made up of a **network** of pathways. You could make a few connected pathways through your model brain.

9) So what decides neuron connects to which? You could show this with different neurons (does this one connect with … this one? Or that one?). **Experiences** decide which connect. Each time you hear something, say something, meet somebody, do an activity, learn something… a message passes along a pathway. The more you do something (or behave in a particular way) the more the pathway gets used and the stronger it gets (it gets better at sending the message).

   Neuroscientists say that "neurons that fire together, wire together". The more he message passes, the more fixed the pathway becomes. "If you don't use it, you lose it" reflects the fact that pathways that don't often have messages passing along them will weaken and be broken down. You can use the metaphor of a pathway through a jungle – the more it is used the bigger it gets and is easy to travel down. The less it is used then the more likely that the jungle will grow back again and the pathway disappears.

   This explanation describes neuroplasticity – the ability of the brain to change structure in response to experiences. The brain is particularly fast growing and plastic during the first years of life (and again in teenage years) and therefore very sensitive to experiences during this time.

Helpful hints:

- Pipe cleaners work better than string for the axons as pipe cleaners hold their shape.
- Make as many as possible (the brain actually has about 85 billion neurons (estimates vary!)
- Different lengths and shapes are fine as there are many types of neurons in the brain (some are much shorter than others for instance).