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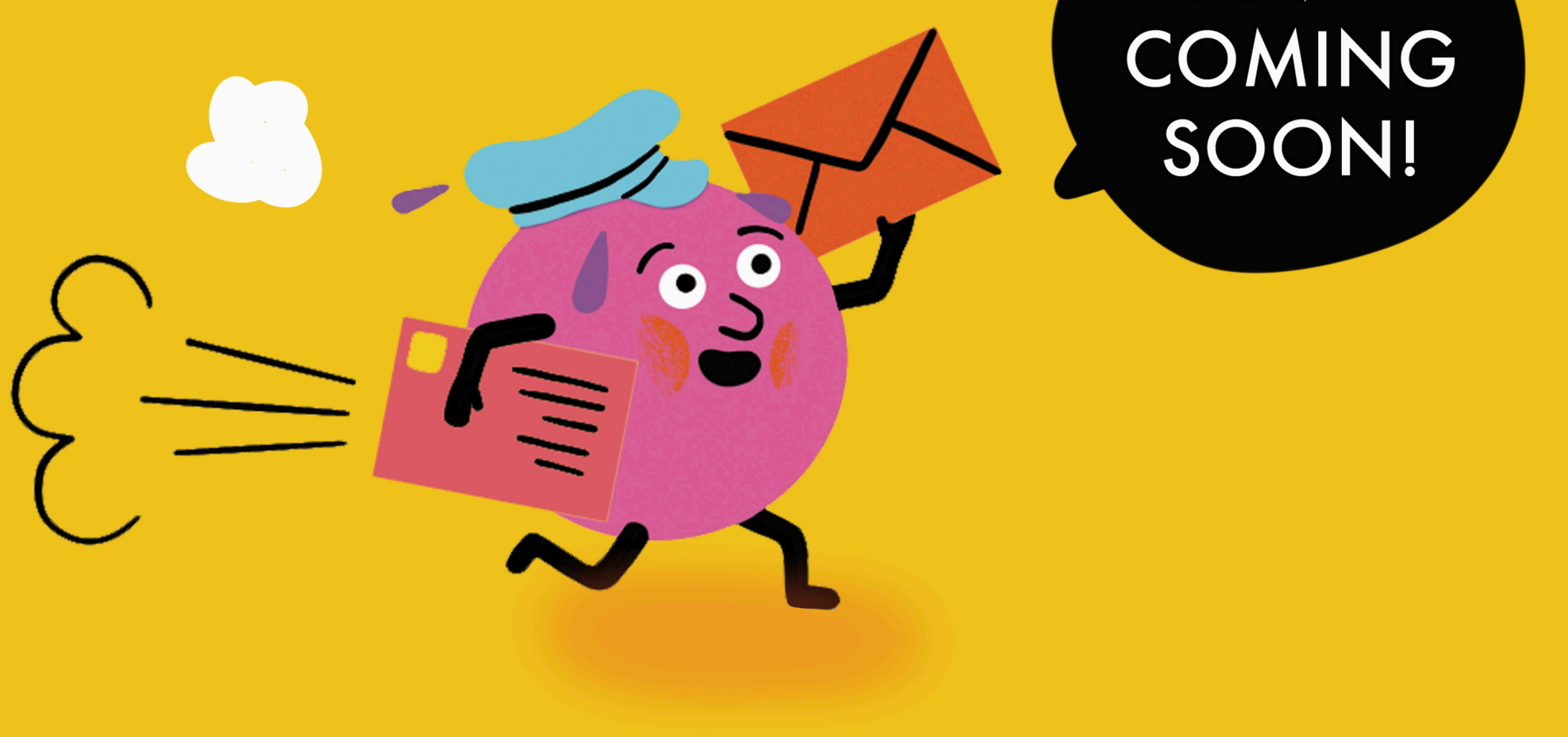
ALL IN THE MIND

A guide to the **AMAZING** brain

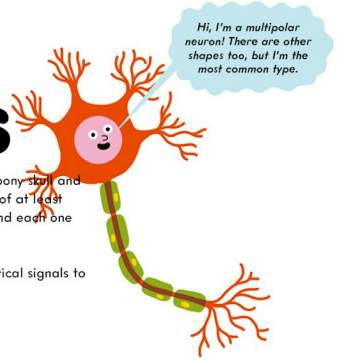


COVER COMING SOON!

COVER NOT FINAL

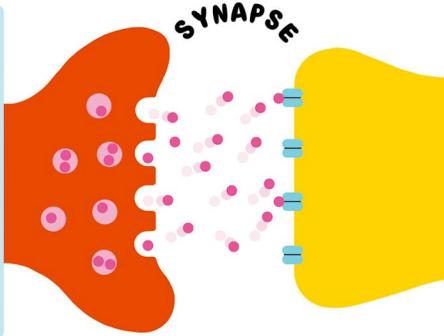
MEET YOUR BRAIN CELLS

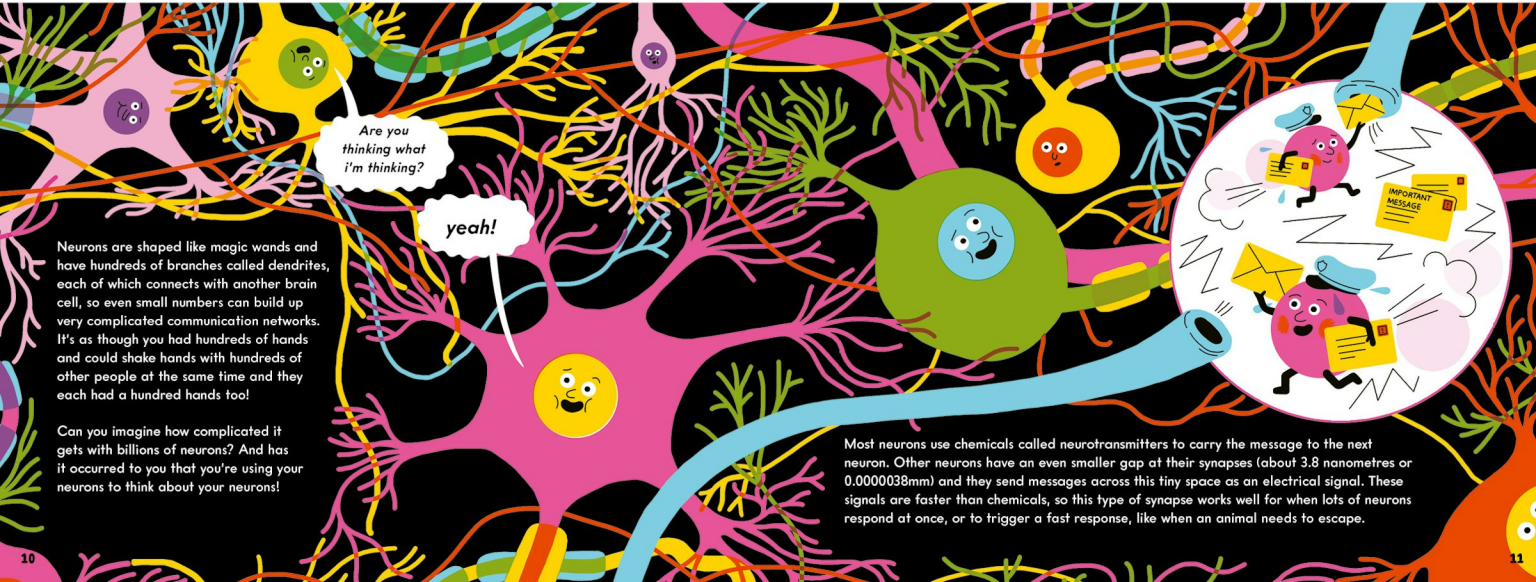
Your brain is a soft, squishy lump of tissue protected by the bony skull and three layers of tough membrane called meninges. It's made of at least 85 billion (that's 85,000,000,000) tiny cells called neurons, and each one communicates with around 100,000 other brain cells.
They don't do this by talking, of course, or it would be very noisy inside your head! They use chemicals or tiny electrical signals to 'speak' to each other. Let's meet some neurons . . .



HOW NEURONS TALK TO EACH OTHER

Messages pass through neurons as tiny chemical and electrical signals. They're very fast – in some neurons they can travel over 100m/s. The place where two neurons meet is called a synapse. The neurons don't actually touch each other at a synapse, althoughthe gap between them is very small (about 20 nanometres – that's 0.00002mm).





Neurons are shaped like magic wands and have hundreds of branches called dendrites, each of which connects with another brain cell, so even small numbers can build up very complicated communication networks. It's as though you had hundreds of hands and could shake hands with hundreds of other people at the same time and they each had a hundred hands too!

Can you imagine how complicated it gets with billions of neurons? And has it occurred to you that you're using your neurons to think about your neurons!

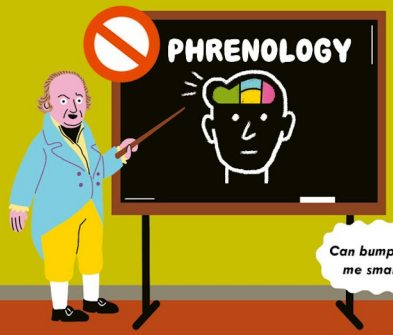
Most neurons use chemicals called neurotransmitters to carry the message to the next neuron. Other neurons have an even smaller gap at their synapses (about 3.8 nanometres or 0.0000038mm) and they send messages across this tiny space as an electrical signal. These signals are faster than chemicals, so this type of synapse works well for when lots of neurons respond at once, or to trigger a fast response, like when an animal needs to escape.

THE HISTORY OF BRAIN STUDIES

It's not easy to study the human brain. It's hard to get at and easy to damage. Early scientific studies of the brain looked at how brain injuries affected people.

Phineas Gage (1823-1860) was an American railroad worker who was injured in an explosion that drove a metre-long iron bar into his cheek, through the front of his brain and out of the top of his head. Amazingly, he survived although he lost an eye. His intelligence and memory seemed unaffected, but friends said the accident changed his personality.

Gage died twelve years after the explosion, possibly due to the long-term effects of his brain injury. But his story helped scientists investigate how the front of the brain might be connected to personality. His skull and the iron bar that caused his injury can still be seen in the Harvard Medical School Museum.



In the 1800s, German doctor Franz Joseph Gall claimed that the brain was made of muscles and the more each one was used, the larger it got, causing bulges in the skull. Gall believed that areas of the skull represented abilities and personality types and so that someone's skull would reveal their personality. This method is called phrenology. It's complete nonsense, but was popular for a while...

MODERN METHODS OF STUDY

Here are a few of the methods scientists use now to study the brain:

Sometimes scientists send a weak electric current through part of the brain to see what effect it has. One area might make someone's leg move suddenly; another might make them see a flash of colour! While this happens, electrical signals in the brain are recorded to give an Electro Encephalogram (EEG). This shows which parts of the brain are connected to certain actions or emotions.

Monitoring changes in brain blood flow are important in studying brain problems like dementia and strokes. A radioactive substance can be injected into the blood so its flow through the brain can be studied.

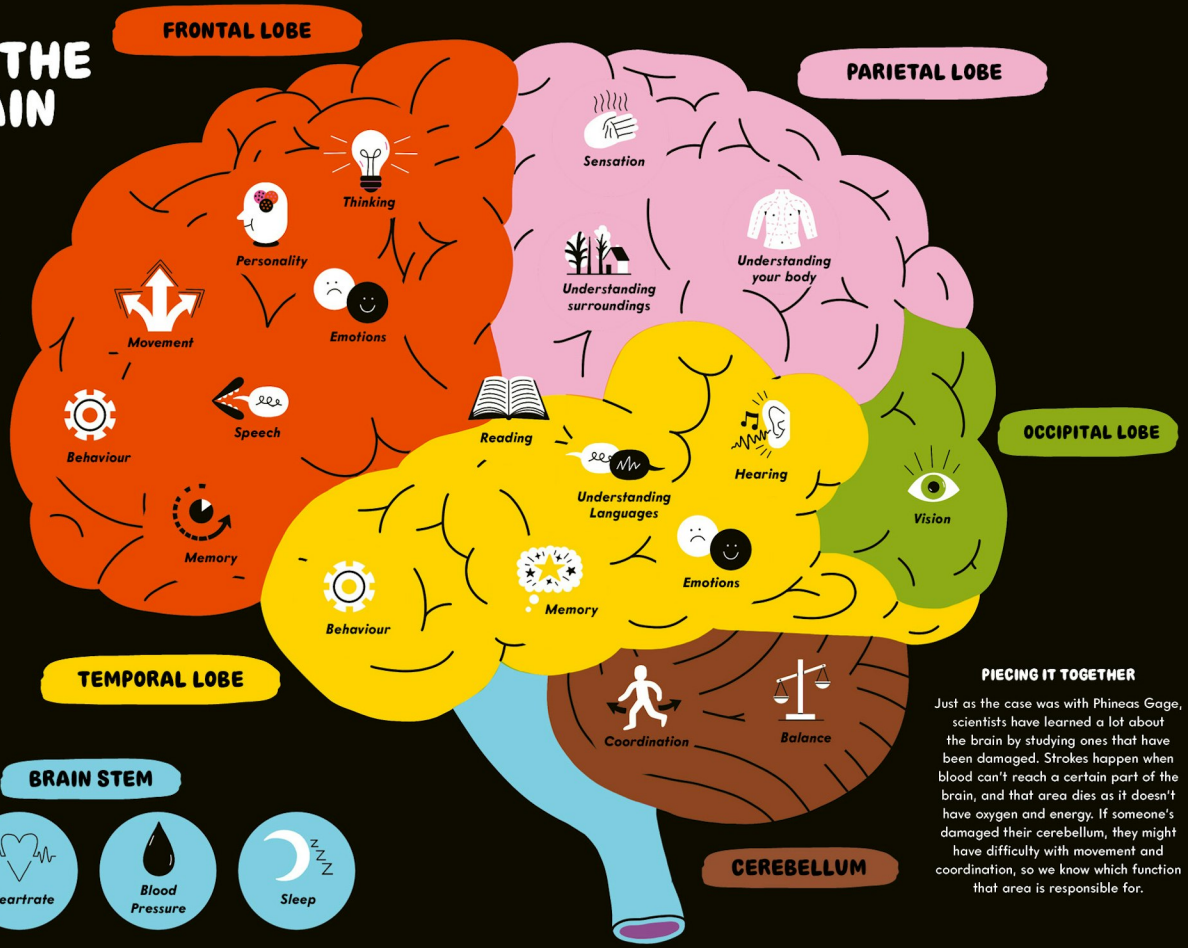
Magnetic Resonance Imaging (MRI) scans use powerful magnets to accurately show which parts of the brain are active when someone carries out a particular task.

A GUIDE TO THE HUMAN BRAIN

Your brain is an essential organ that defines your unique personality and helps your body to function. It can be divided into the cerebellum, brain stem and four lobes that make up the cerebrum. Over time, scientists who study the brain, called neuroscientists, have mapped it out and linked each part to different functions they are responsible for. Some functions use only one area, and others, like intelligence, use lots at once!

LEFT BRAIN RIGHT BRAIN

Originally it was thought that each function was carried out by one side of the brain. People believed that the right side controlled creativity and the left side was responsible for more logical tasks. Today we know that this isn't true – both sides of the brain are involved in most functions. But there are still differences: the left brain specialises in language and problem-solving, and the right brain solely handles activities that need spatial awareness, like parking a car or reading a map!



PIECING IT TOGETHER

Just as the case was with Phineas Gage, scientists have learned a lot about the brain by studying ones that have been damaged. Strokes happen when blood can't reach a certain part of the brain, and that area dies as it doesn't have oxygen and energy. If someone's damaged their cerebellum, they might have difficulty with movement and coordination, so we know which function that area is responsible for.