

DR RANJ
BRAIN
POWER

The title 'DR RANJ BRAIN POWER' is centered on the page. 'DR RANJ' is in a grey, blocky font. 'BRAIN' is in a large, dark grey, rounded font. 'POWER' is in a grey, blocky font with a lightning bolt symbol inside the 'P' and 'R'. Yellow lightning bolts are scattered around the text.

A TOOLKIT TO UNDERSTAND
AND TRAIN YOUR UNIQUE BRAIN

Illustrated by
DAVID O'CONNELL

wren
& rook





To my favourite little people . . .
Rohan, Sajjan, Veer, Oscar and Olivia.

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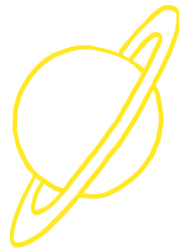


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BRAINS ARE BRILL!



Yes, they really are the bee's knees! Actually, brains and knees are very different parts of the body. And what do bees even have to do with anything, I hear you ask? Fair point. But trust me on this: brains are pretty cool.



WHY ARE BRAINS SO COOL?

THINK ABOUT IT.

That's pretty funny in itself, because you're using your brain to think about your brain. And you're using your brain to read this book, which is telling you to think about your brain, using your brain ... Oh dear, my brain hurts. I could go on, but I'll stop before I confuse us both!

Your brain is actually quite incredible. Did you know it's made of around **100 BILLION** cells? If you lined up

100 billion peas all in a row, the line would go around the planet 250 times! Those cells also make it the most powerful supercomputer in the world, but it only uses the same amount of power as a light bulb.

All that in a squishy lump of stuff sitting inside your head. That doesn't sound very cool, but its coolness lies in this: it is in charge of **ABSOLUTELY EVERYTHING** in your body. Things you see, hear, feel, smell and taste, as well as everything you do – including stuff you do without realising. While you've been reading this sentence, your brain has probably just told your mouth to swallow! There, you just did it, didn't you?

If we removed your brain, you would probably survive, but only doing the very basics. You'd be able to breathe and eat. However, you wouldn't be able to think about what you're going to do after school, or read your favourite stories, or play your favourite games, or feel like **YOU**. That's why your brain is so important. And it does all this 24 hours a day, 365 days a year. Amazing!

This also means that you have to look after it, because you can't replace it. Unlike some of the other organs in your body, you can't swap brains with anyone if it goes wrong. And we know that because people have tried!



In 1908, two doctors called Dr Alexis Carrel and Dr Charles Guthrie transplanted the head of one dog onto the neck of another. I know, proper Frankenstein stuff! Unfortunately, the ‘Frankendog’ experiment didn’t work and sadly the dog died soon after. But people didn’t learn their lesson there. In 1970, an American doctor called Dr Robert White tried a similar ‘head swap’ experiment with monkeys. Guess what? It didn’t work out too well for the monkeys either. Poor monkeys.

That doesn’t mean we’ll never be able to transplant a brain from one person to another, but it’s a long, long way off. So in the meantime, it’s best just to look after the brain you have.

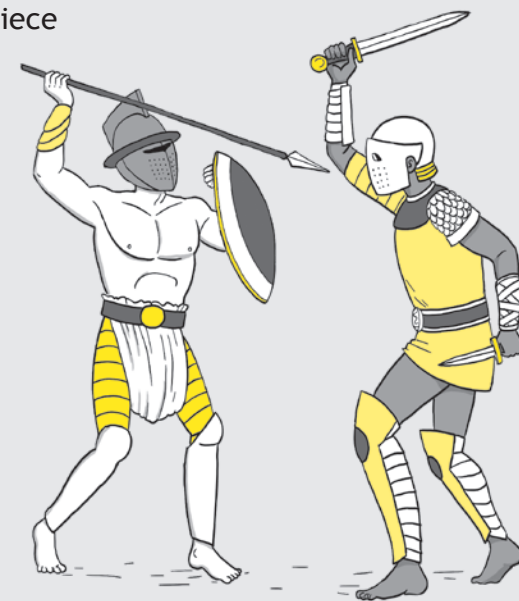
BRAINS HAVE FASCINATED US FOR THOUSANDS OF YEARS ...

The ancient Egyptians used to think that all your thoughts came from your heart. So when someone died, they would carefully mummify that person’s body (including their heart), preserving all the important bits. But,



oops – they sucked out the brain through a hole in the skull (**E W W W W**) and tossed it in the bin because they didn’t think it was anything special. Awkward.

However, an old Egyptian piece of papyrus (that’s like old-school paper) from 1700 BCE has details about the brain and nervous system, so some Egyptians must have realised its importance.



In 170 BCE, there was a Greek doctor called Galen who looked after all the Roman gladiators. He was one of the first people to say that your feelings and all the different functions of your body were controlled by your brain.

But it wasn’t until 1543 that the first book about ‘neuroscience’ (which means studying the brain) was written, by a doctor from the Netherlands called Andreas Vesalius. He cut open dead bodies and had a look inside to see how they were put together. Most people would call that messy, but clever people call it **ANATOMY**. His book contained really detailed

drawings and descriptions about the brain for the first time ever. He didn't get everything spot on though ... he also recommended removing people's blood from their bodies to cure their illnesses, which I do not recommend.

Luckily, we don't have to cut people up to learn about their brains any more.



We now have really powerful scanners (called CT and MRI scanners) that let us see inside your head and all the different parts of the brain without you feeling a thing. They look like giant doughnuts, but you can't eat them I'm afraid. The technicians would get a bit annoyed, and they don't taste very nice!

While scientists have spent centuries obsessing over what your brain does and how it works, other people have been trying to figure out how we're able to think and have feelings – in other words, where our minds come from.

In 1649, a French philosopher called René Descartes came up with the idea that while your brain controls your body, your mind is something separate. Not literally separate. He didn't mean it was hanging out of the back of your head! But he meant separate in the sense that your mind seems to be bigger than your brain – your mind somehow takes up your whole being.

BRAINS ARE THE FUTURE ...

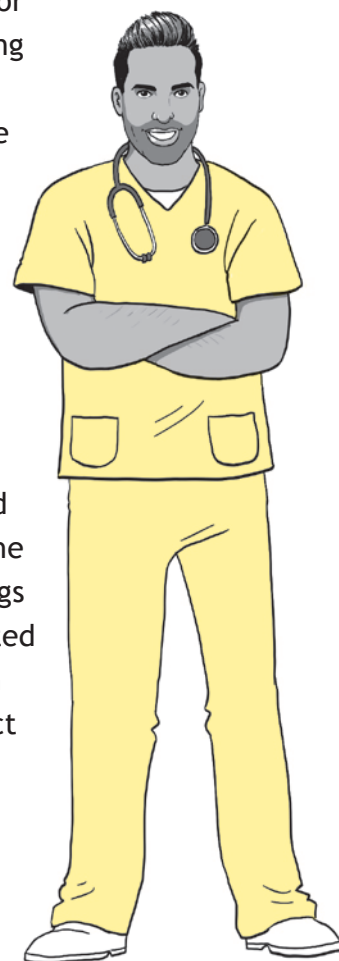
All of these discoveries have taught us about how amazing your brain (and mind) are. So much so that scientists have been trying to recreate what the human brain does in machine form. Have you heard of something called artificial intelligence, or AI?

Imagine it's the 1940s during the Second World War, when the Nazis of Germany were fighting against lots of other countries. The Nazis would communicate secretly using a special code made by a machine called Enigma. However, an amazing British mathematician called Alan Turing invented a computer which cracked that code, and that breakthrough helped win the war. Yes, Alan Turing is probably the most **AWESOME** Alan in history.

He changed history a second time when he wrote about the possibility of creating machines that think like humans, and his initial insights eventually led to the creation of artificial intelligence – computers that ‘think’ a bit like human brains do. But your brain is more complex and much more powerful than the world’s best supercomputer. No machine currently exists that can do everything your brain does. Artificial intelligence is getting more sophisticated every day though. If you’ve ever used Siri, Alexa or Google Assistant, then you’ve been using something that is based on artificial intelligence. Who knows what AI will be able to do in the future?

WHY AM I SO CLUED UP ABOUT BRAINS?

I’ve been a doctor for twenty years and that means I know a little about how the brain works and how to help when things don’t quite go to plan. However, I started learning about the brain properly when I went to university. I even did a project where I spent a lot of time cutting up rats’ brains. **YUCK!**



Now, as a doctor who treats children and young people, I look after people whose brains may be hurt or not working properly. I also care for people who are struggling with their mental health.

YOUR MENTAL WHAT?

We all know that being healthy and looking after your body is important for it to work properly. That’s what we call physical health. But what about your mind? Well, looking after your brain and mind is just as important so that they can work correctly and we can live happy lives. That’s what we mean by mental health. It’s about how you feel and deal with all the things in the world.

I’ve had times when my own mental health wasn’t great and I got through it. It wasn’t always easy, but I’m in a much better place now and I’m here to tell you all about it! I want you to remember that, however you feel or whatever is happening in your life, you’re never alone and there is always someone to help if you are finding things tough.

WHY SHOULD YOU KEEP READING THIS BOOK?

So we're all agreed: brains are cool, yes? Great: my job's done, you can stop reading!

WAIT, COME BACK! I'm only joking.

It's important you agree that all brains are cool because we're going to spend a lot of the rest of the book talking about how **YOUR** specific brain is completely and utterly brilliant. Even though they look similar, your brain is totally unique to you, just like your friend's brain is totally unique to them. Everyone's brain is a bit different, and works in its own special way to make them who they are. And brains are things of beauty to be proud of. So in this book, I want to show you just how incredible your brain is, how you can get to know it better and how you can help it be the best it can possibly be. That's

right, we're going to **TRAIN YOUR BRAIN!**

I'll even let you into a little secret: once you understand your brain and mind, you'll figure out more about

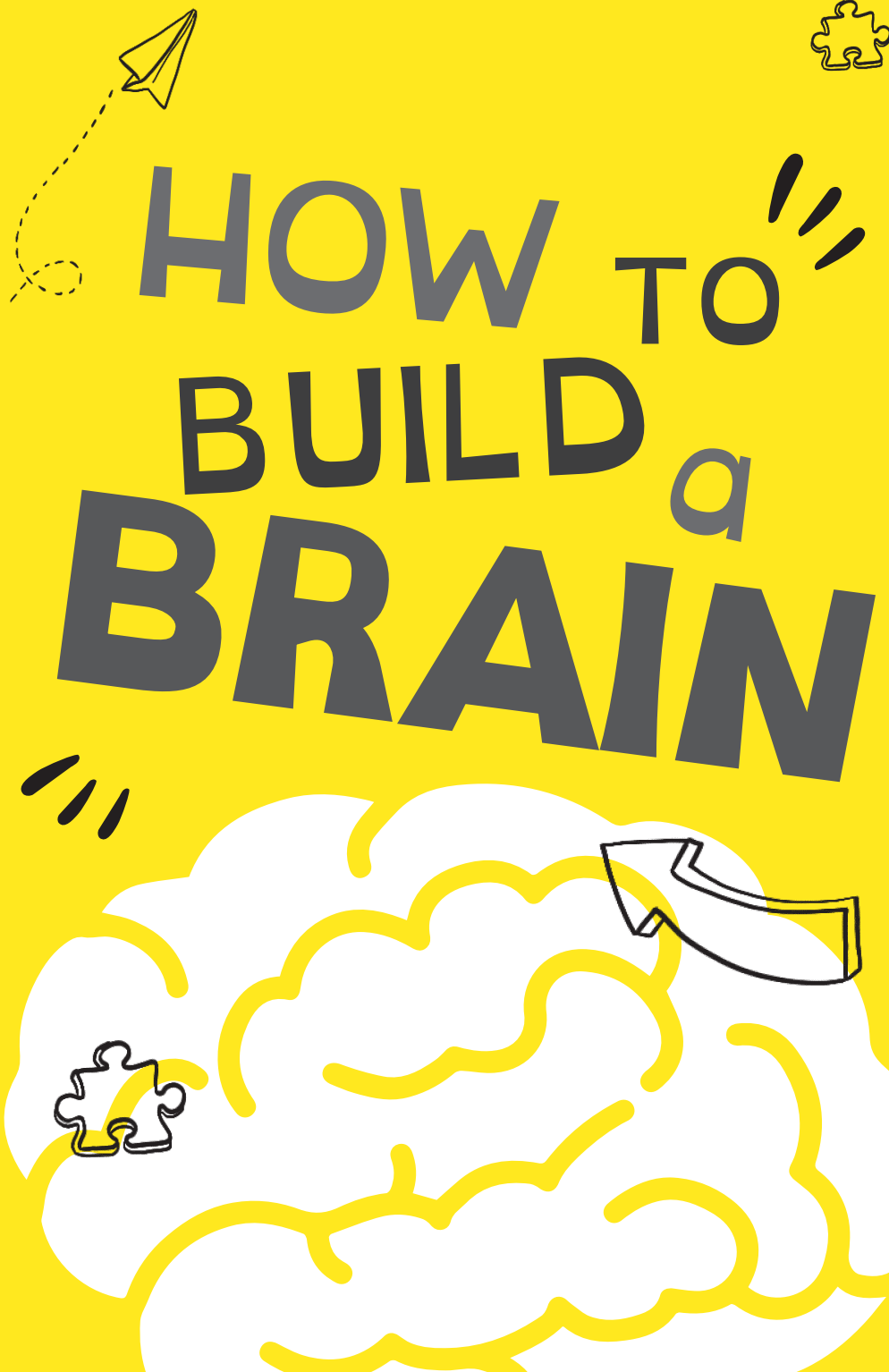
who you are – and how to get the most out of life. It'll help you feel supercharged with confidence. That's why this book is called **BRAIN POWER**. Because understanding your brain really can make you feel like a superhero.

BEFORE WE START ...

Let's find out what you know (or think you know) already. See if you can tell whether these five brain-busting facts are true or false. You'll get the answers at the end of the book, but try not to sneak a peek!

- 1) Your brain is mainly made of water.
- 2) Messages to or from your brain travel at 80 km per hour.
- 3) The animal with the biggest brain is the elephant.
- 4) Sleep is important because it's when your brain makes memories.
- 5) The left side of your brain controls the right side of your body (and vice versa).

Want to know the answers? Keep reading!



1

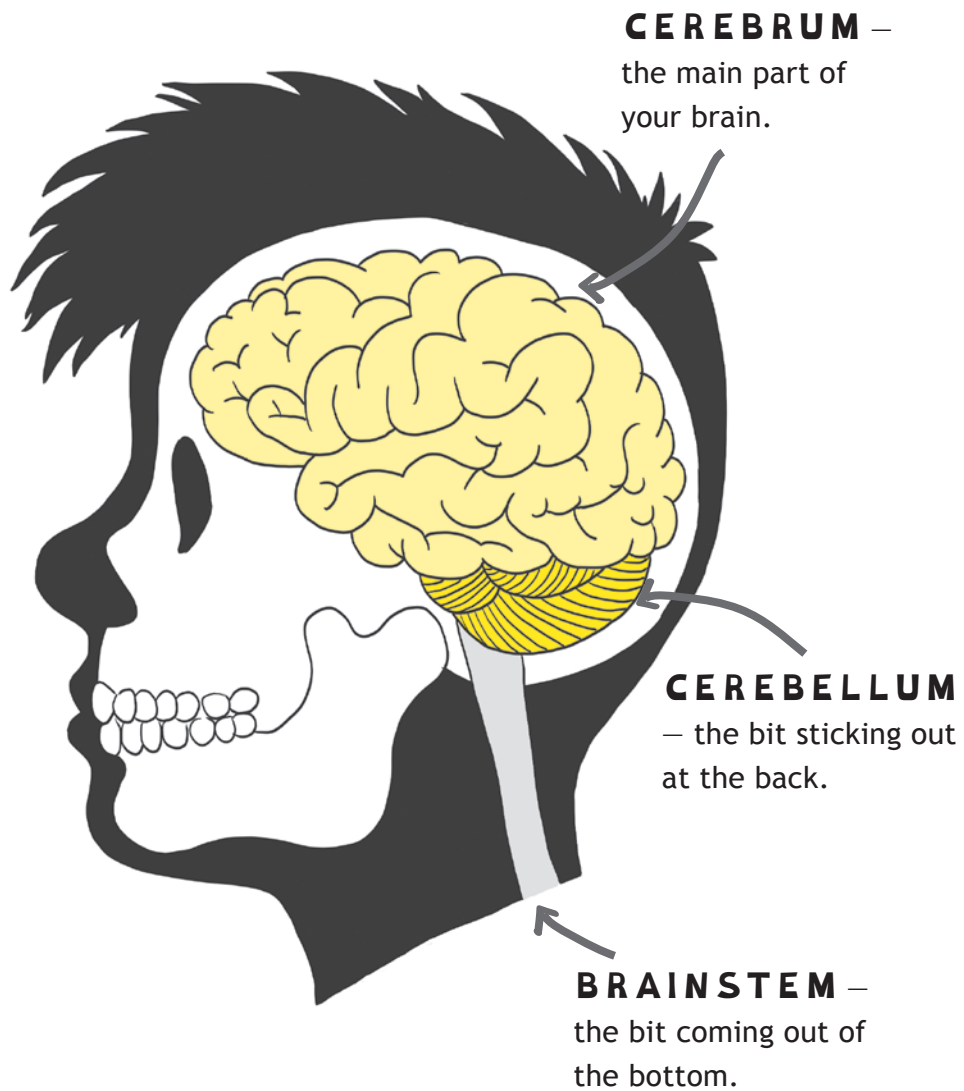
Your brain is responsible for everything you feel and do, and for making you, you. But how exactly does it do that?

If we're going to understand your brain properly, we'll need to learn how it's put together. We could try taking the top of your head off, scooping out your brain with a giant spoon, and then laying it out flat on the table to get a really good look. But the mess would be awful. So I'll just have to tell you about it instead.

YOUR 'BRAINSTRUCTION' MANUAL

This chapter is going to be like a brain instruction manual – or a 'brainstruction' manual (see what I did there?). And we're going to be learning lots of technical stuff, so you'll need to think like a scientist.

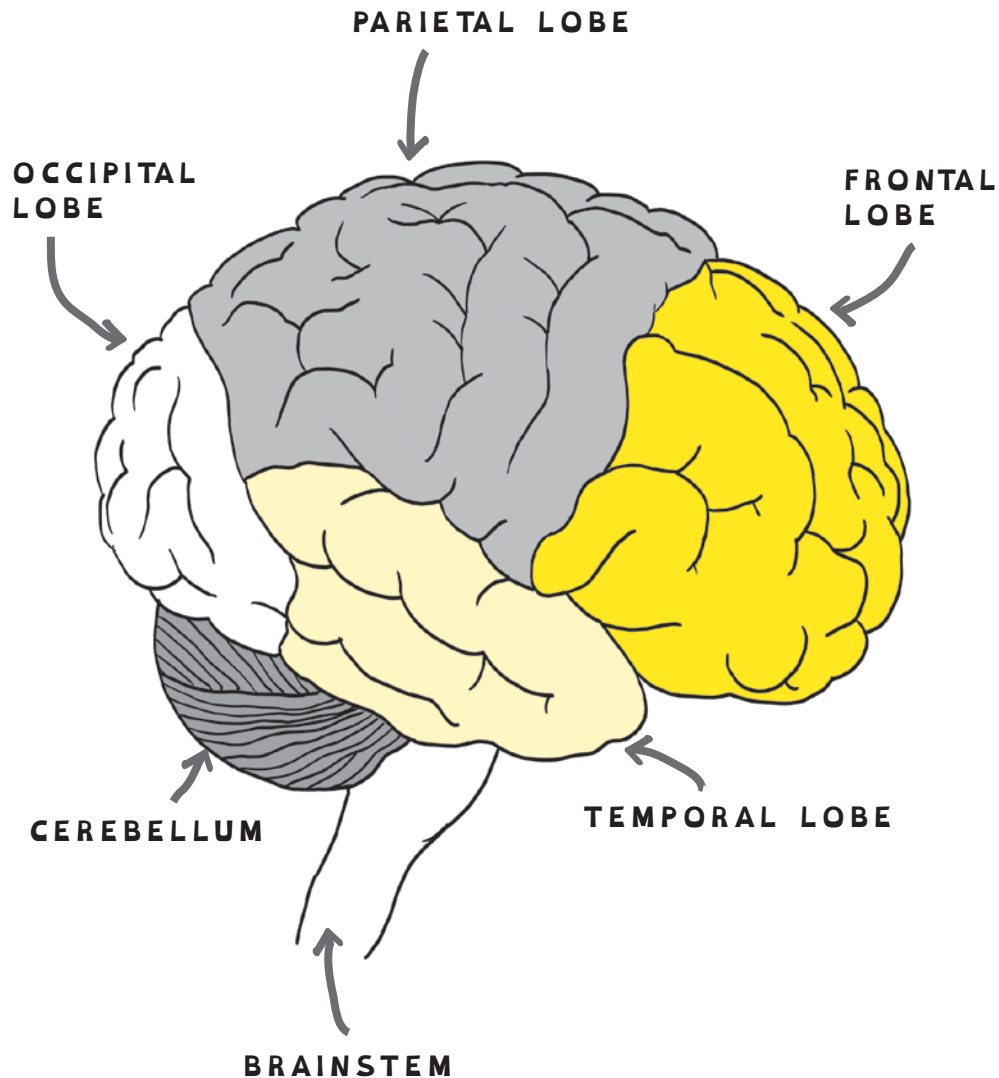
To start, here's a picture of what your brain looks like .
It has three main sections to it:



It kind of looks like a giant shrivelled-up prune inside your head. Why is it so wrinkly? Because it's folded up so you can fit as much brain as possible into a small space. If you unfolded and laid your brain out flat, it would be the size of a pillow (and be as flat as a pancake)! Some pictures of brains make them look pink, but the truth is that your brain is actually grey. It's also really squidgy because your brain is mainly made up of water, protein and fat – just like soup. But don't worry, your skull is not full of soup (though sometimes I do wonder about my brother's ...)!

Just like soup is made from lots of different ingredients, the food we eat contains all the ingredients our bodies need. This includes things like protein and fat, as well as the water we drink. All of these help make up the stuff inside our bodies, including our brains. Around three-quarters of your brain is made of water. So if you were to stop drinking for long enough, first you'd start to feel thirsty because your brain would tell you that you need to drink, and then eventually your brain would start to shrink and dry up! Unfortunately this would also mean it would stop working properly and you'd be really unwell. So do not try this at home! In fact, it's probably best just to listen to your parents and make sure you drink enough water, OK!? Please don't get me into trouble.

Your brain is cleverly organised into different parts. Each one does a specific job. Let's take a closer look:



FRONTAL LOBE

Where you do all your important thinking and decision-making. It also controls movement and speaking. That time you thought you were a superhero and decided it would be a good idea to jump from the fifth step, sprained your ankle and shouted OUCH! when you landed? You can thank your frontal lobe for all that.

PARIETAL LOBE

Where you experience the world around you, like when you touch something. So when you stub your toe on the corner of your desk and immediately jump up and down in pain, that's your parietal lobe kicking into action.

TEMPORAL LOBE

Deals with things like hearing, memory and emotions. Remember your favourite nursery rhyme from when you were a much smaller person? Well, that's sitting somewhere in here!

OCCIPITAL LOBE

In charge of what you see and uses information from your eyes to recognise objects and colours. It also helps you get an idea about how far away things are. You're using this part as you read this book right now.

CEREBELLUM

Helps control balance and movement. If you like dancing, you probably use this part of your brain quite a lot.

BRAINSTEM

Connects your brain to your spinal cord. The spinal cord is the bundle of nerves that comes out of the bottom of your skull and runs down your back. The brainstem also does things like make sure you breathe, that your heart keeps beating, and other things that you probably don't pay attention to.

HOW DO WE KNOW WHAT DOES WHAT?

Unlike the diagrams you've just seen, brains don't come ready-labelled inside the body. It's only because of experiments throughout history that we've managed to work out what each bit does. For example, it was a doctor called John Martyn Harlow in the 1800s who worked out that your frontal lobe does all the clever stuff and helps create your personality.

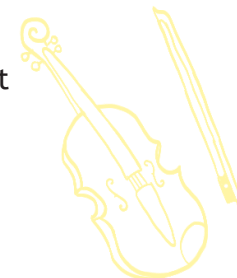
He realised this when one of his patients had a horrible accident and an iron rod went through his head. The person eventually recovered but his frontal lobe was



seriously damaged, and his behaviour changed. He went from being someone who was smart, level-headed and popular to someone who was immature, impatient and inconsiderate of others. It was like he was a different person, all because of an iron rod through the brain. I know what you're thinking: why does brain history have to be so gruesome all the time?!

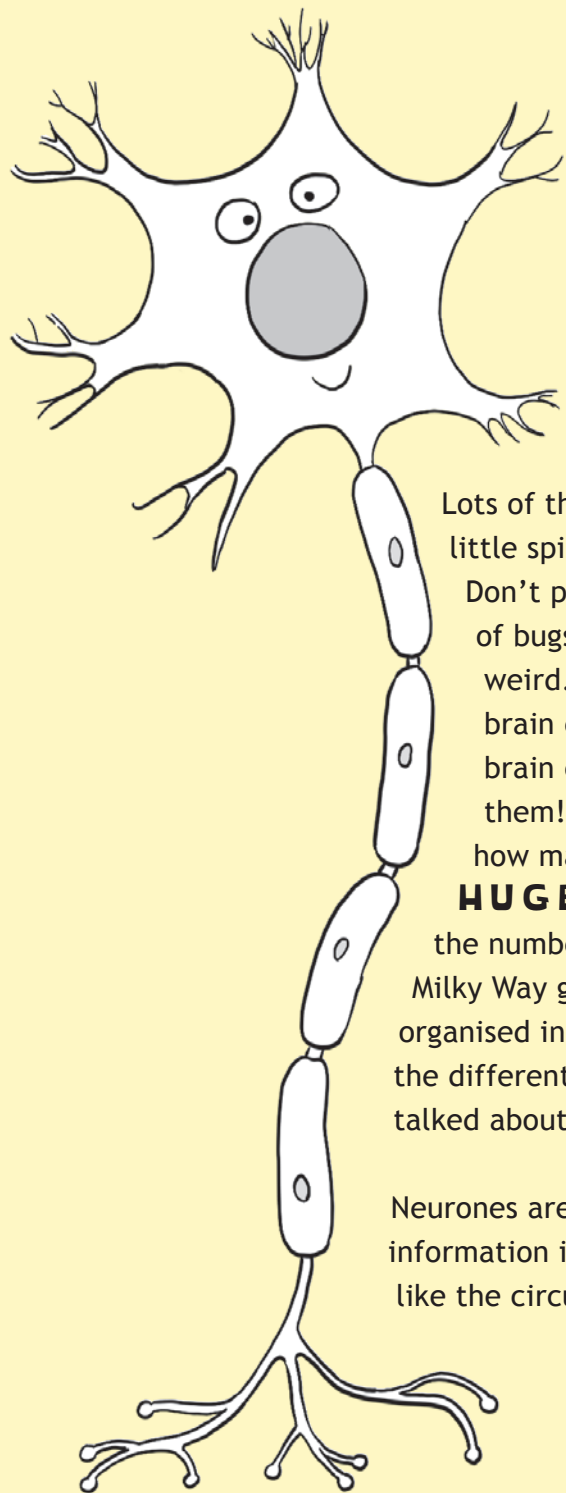
Luckily, these days we can do special brain scans called PET or fMRI scans, which show us which bits of the brain are being used when we do certain things. No iron rods required – phew!

And sometimes, we don't even need a fancy machine. In 2020, a lady called Dagmar Turner had an operation on a brain tumour at King's College Hospital, London. Dagmar played the violin while the surgeons were operating on her brain tumour so they could make sure they didn't damage any parts of the brain that controlled her hand movements. How incredible is that?!



UNDER THE MICROSCOPE

Let's get really scientific now. Imagine you're looking at the brain through a powerful microscope. What would you see?



Lots of things that look like tiny little spiders all holding hands! Don't panic, your brain is not full of bugs! That would be seriously weird. Those spidery things are brain cells, or neurones. Your brain contains over 100 billion of them! You might not appreciate how many that is, but that's a **HUGE** number – the same as the number of stars in the entire Milky Way galaxy. They are all organised into groups that make up the different parts of the brain we talked about earlier.

Neurones are what carry and store information inside your brain. Just like the circuits inside a computer,

neurones connect with each other and make tiny circuits. And they carry that information using electricity too. Did you know that these electrical signals travel at over 400 kilometres per hour? That's faster than a Formula 1 racing car!

BACK TO THE BEGINNING

Now that we know what your brain looks like and what it's made up of, let's go back and explore how it all started. So cast your mind back to before you were a baby.

OK, that's impossible because you won't remember any of that. So let me fill you in ...

Your brain starts developing long before you are born, while you are an embryo (that's what we call you when you are still inside your mum and really tiny – you've been in her tummy only for about two weeks at this point!). It starts off as a tiny tube, called the neural tube, which is a few millimetres long. This tube then grows and starts to fold up. Different parts of the tube go on to make different parts of the brain, and the last bit makes the spinal cord. So everything inside your head started off as a tiny straw!

Fortunately, our brains don't stay that small and they grow rapidly to become what you have today.

STAGES OF BRAIN DEVELOPMENT IN AN EMBRYO

29 DAYS



33 DAYS



52 DAYS



59 DAYS



70 DAYS



20 WEEKS



6 MONTHS



9 MONTHS

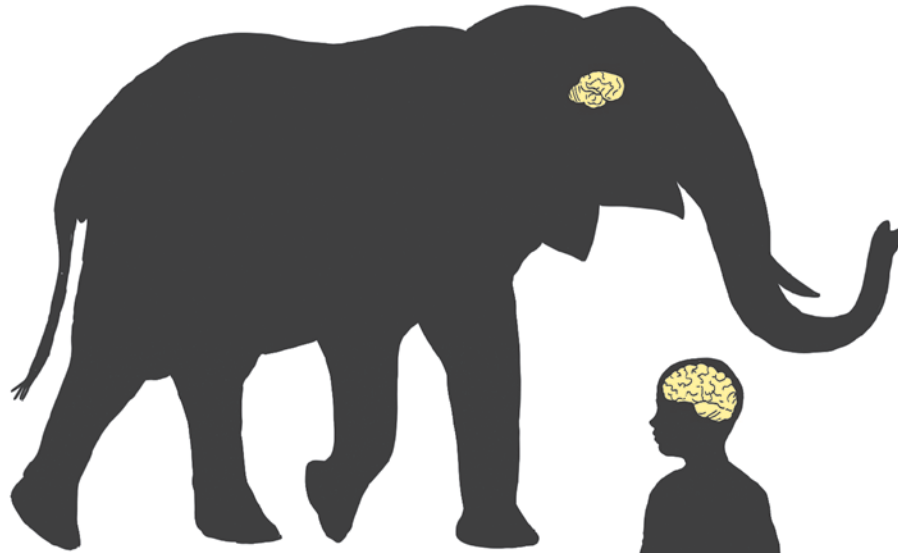


YOU'RE THE 'BRAINY' ONE!

You may not have realised it, but you are. By the age of six, your brain is already almost as big as it will be when you're a fully grown adult. Now I understand why everyone told me I had such a big head when I was a kid. It must have been because my brain was **ENORMOUS!** At least, that's what I tell myself.

But it's not just about the size of your brain by itself. The size of your brain compared to your body matters, as well as how developed it is. This is why humans are more clever than animals that are much bigger than us.

A sperm whale has the biggest brain of all among the animal kingdom, but it's not the most intelligent creature. That's partly because its brain is not as developed as ours is, but also because its brain is small compared to its body. And while humans are a lot smaller than whales, our brains are quite big in comparison to our bodies. Turn the page to see what I mean - a sperm whale's brain looks titchy when you see it inside its body. And are you surprised that a human brain is basically the same size as an elephant's?



CAT

HUMAN

ELEPHANT

SPERM WHALE



You may have heard some people say that we only use 10% of our brains. It's not true, but lots of people believe it. We know from brain scans that most of the brain is being used all the time – even when you are asleep.

However, there are lots of parts of the brain that do the same thing. This is what we call redundancy. We think our brains work this way just to make sure that if one bit stops working properly, another bit can take over. Always good to have a spare!

So the next time someone tells you to 'use your brain' – tell them that you are! Most of it!

ARE BOYS' AND GIRLS' BRAINS DIFFERENT?

We've all heard it before: boys are naturally better at things like sport, and girls are naturally better at art. And boys are noisy and rough while girls are gentle and quiet. Hmm, sounds a bit fishy to me.

For many years we believed that boys and girls liked or were good at different things because their brains were really different. However, it's not as simple as that. Boys' and girls' brains are actually quite similar, but children's brains can change depending on what happens to them. So the things you see and do when you're young, the way you are brought up, and what you do at school and home can all change your brain while it is growing. It's quite likely that the reason boys and girls seem different is because they were always

expected to do different things. For instance, boys have traditionally been encouraged to be more physical and sporty, whereas girls are often given more opportunities to do quieter activities like art.

Even though some people seem to be naturally good at certain things, we are all born with brains that are pretty much the same. As we grow up, our brains



start to become unique to each of us based on how we choose to spend our time.

So girls, you are more than welcome to go out and play football. Go and climb mountains. Drive racing cars and become world leaders. Boys, feel free to dance. Design and make cool clothes for the world to wear. Be kind and caring to those around you.

**WHATEVER YOU
WANT TO DO, YOUR
BRAIN IS READY
TO BE AMAZING AT
ANYTHING YOU SET
YOUR MIND TO!**

Don't believe me? Read on ...

YOU ARE BUILT TO LEARN

One thing I've realised as an adult is that I used to learn things much more quickly when I was younger. And that's because children's brains are turbo-wired to learn faster than adults. Right now, your brain is primed and ready to learn new skills better than any grown-up ever could!

Here's why ...

- 1)** Your brain is growing rapidly, and the neurones inside are making new connections faster than at any other time in life. Young brains are also more adaptable. That means they're able to change to do things better and faster.
- 2)** You don't have the same responsibilities that adults do (like earning money so you have somewhere to live), so your brain can use more of its power for learning cool new stuff. That's why so many grown-ups say that they would love to be children again, because they had less to worry about and could focus on the stuff they loved.
- 3)** Young people are braver and more keen to try new things out, so they learn fresh skills. Grown-ups are more likely to be worried about looking

silly and so decide to play it safe with what they already know.

- 4)** Children tend to sleep for longer than adults, and we know that sleep is important for learning and making memories (more on this in chapter 5).

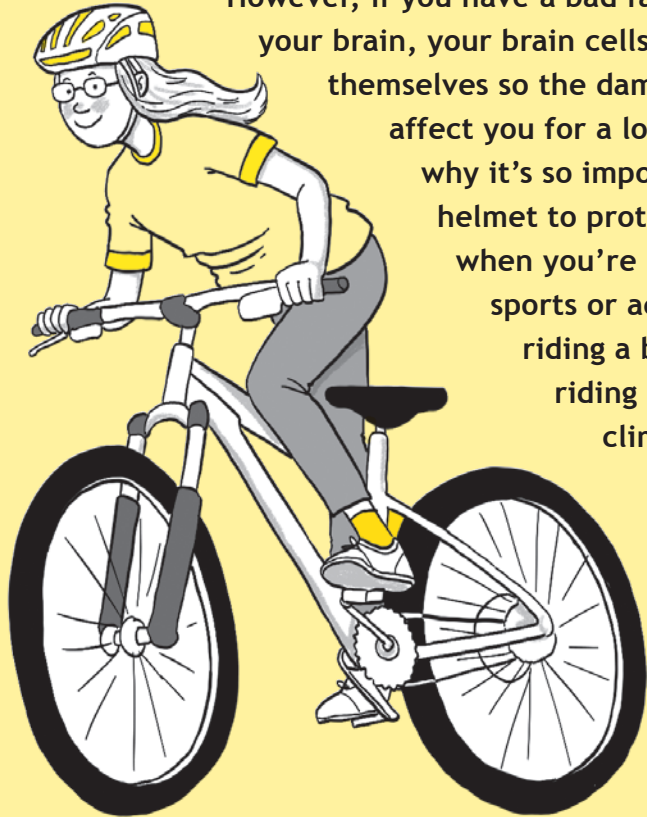
So if you want to learn a new language, to play an instrument, or find out how to do a hardflip on a skateboard, then now is the time! Just make sure you do it safely, OK? There are even ways we can **TRAIN** our **BRAINS** to get good at stuff – in chapter 4 we'll discover some brilliant brain-training exercises for you to try out.



BEWARE THE BUMPS

As amazing as your brain is, it cannot repair itself if it gets injured, unlike other parts of your body. For instance, if you fall and break your arm, it will heal because the bones in it repair themselves.

However, if you have a bad fall and hurt your brain, your brain cells can't repair themselves so the damage could affect you for a long time. That's why it's so important to wear a helmet to protect your head when you're doing certain sports or activities like riding a bike, horse riding or mountain climbing.



If you do take a knock to the head and you feel unwell afterwards, always tell a grown-up straight away. You may have something called concussion. This is where the electrical activity in your brain cells becomes disturbed, so they need a bit of time to recover. Some people experience it as headaches. Others feel really groggy and find it hard to concentrate, or they might feel really anxious all the time. This needs to be taken seriously as you may need to see a doctor and take some time out to rest.





BRAINS GROW OLD TOO

Our brains may be fantastic, but sadly they are not immortal ... As we get older, our brains get older too. They might become a little bit slower (so you can't whizz around on your scooter like you used to). They may not be as organised as they once were (and you might be a little forgetful at times).

You may have noticed some of these things in your grandparents or the nice old neighbour who lives a few doors down. However, there are things that we can all do to try to keep our brains in tip-top condition for as long as possible:

- 1) **EXERCISE YOUR BRAIN** – keeping our brains active for as long as possible helps them stay fit (just like our bodies). So doing things like puzzles, brain games and reading will keep your brain going strong.
- 2) **BRAIN FOOD** – specific 'brain food' isn't a real thing, since no food can make you more clever, I'm afraid. However, trying to eat more healthy food and drinking enough water will keep your body and brain in good shape.
- 3) **BE FRIENDLY** – being nice and doing things with other people not only helps you feel



happier, but is actually good for your brain too. See, when your mum told you to be nice to other people, she had a point!

- 4) **GET SOME REST** – your brain needs rest at the end of a long day, just like your body does. So go to bed when your parents tell you to!

There are more tips on looking after your brain in the chapters coming up.

