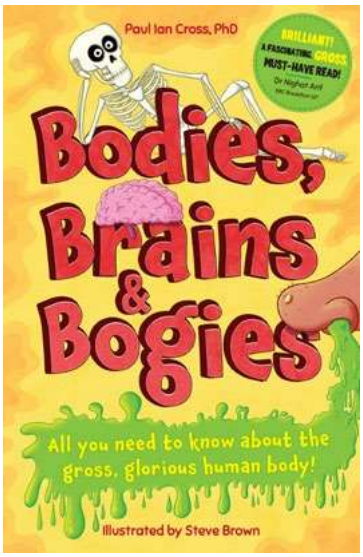
BODIES, BRAINS AND BOGIES

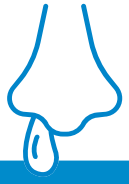
Pupil activity sheet

CENTRE *for* INDUSTRY EDUCATION COLLABORATION

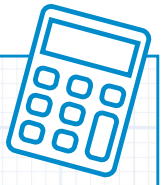
This is one of a series of six activity sheets to use alongside the books which have been shortlisted for the Royal Society Young People's Book Prize 2023.



This book celebrates everything that is weird and wonderful about our bodies from brain biology to toenail trivia. Fascinating facts, informative illustrations, and detailed diagrams; a fun and accessible way to learn all about our brilliant bodies in *Bodies, Brains & Bogies* written by Paul Ian Cross PhD, and illustrated by Steve Brown.



> "Even though our bodies are weird and gross, they're also unique. There's no one else like you in the entire world. As a matter of fact, there's no one like you in the ENTIRE UNIVERSE."
>
> ***Bodies, Brains & Bogies***

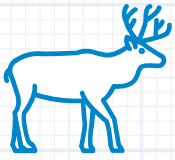


Mathematics challenge

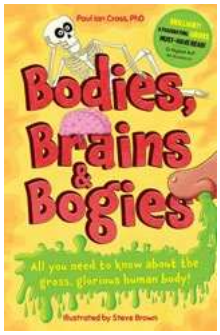
Humans belong to a class of animals called vertebrates meaning we have a backbone. Animals with bones inside their body (known as an endoskeleton) make up just 3% of all the animals on Earth. The other 97% are invertebrates, like insects, which have a tough outer shell called an exoskeleton.

Limb structure varies greatly in shape, size, and function across the animal kingdom. Use books and online research to find out how many bones are in the top or front limbs and bone structures of different vertebrates. Here are some UK vertebrates to get you started:

Once you have collected your animal bone data, can you put the animals in order based on the number of bones they have? Do you notice any patterns? Does the size of the animal make a difference to how many bones they have? How do land animals compare to animals that live in the water, or animals that fly? Did you discover anything surprising?



Roe deer leg	Pipistrelle bat wing	Basking shark pectoral fin
Sparrow wing	Harbour seal pectoral flipper	Red squirrel arm
Orca whale pectoral fin	Common frog leg	European otter arm



BODIES, BRAINS AND BOGIES

Pupil activity sheet (continued)

Thumb dexterity

You have been challenged to investigate whose thumbs are better adapted to text typing by taking part in a speed trial. Ask your friends and family members to get involved. The more data you collect, the better your results will be.

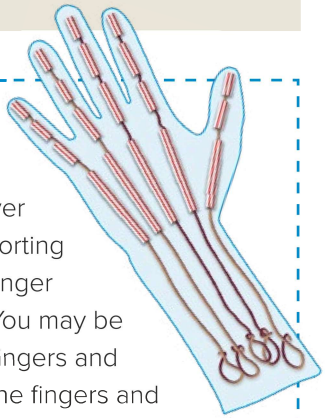
Use the same short sentence then time how long people take to type it into a text message using a phone. Make sure you test people of different ages and across different generations, like siblings, parents, and grandparents.

Alternatively, you could set up your own investigation and give people one minute of typing time to see how many times they can write your 10-word sentence and calculate their words per minute. Compare your results with another round of testing, this time asking your test subject to type the words out on a desktop or laptop keyboard. How do the generations perform differently?

Wings and things

We use our hands and fingers to help with lots of daily tasks but there are plenty of animals that get by in life without the benefit of these body parts. Where we have arms and hands, other creatures have wings, fins, flippers, extra legs, or tentacles. Use library books and internet research to find out about the many different limb arrangements and bone structures in the animal kingdom and how they are used.

Helpful hands



Have you ever taken a moment to consider how human hands work? Underneath the protective layer of skin is a network of veins and arteries for transporting blood and a structure of 27 bones: 14 phalanges (finger bones) and 8 metacarpals (the palm of the hand). You may be shocked to find that the muscles which move the fingers and thumb are in the forearm. They are connected to the fingers and thumb by stretchy tendons. You can have a go at making a moving hand model which shows how the tendons control the movement of fingers. There are plenty of online tutorials you can look for.

Scientist profile

Meet Dr Paul Ian Cross. He is a scientist, a science communicator, and a writer who enjoys making science, technology, engineering, and maths (STEM) accessible and interesting for pupils and adults.

In his work as a scientist, Paul is a medical researcher specialising in vaccine development. In addition to his work in the lab, he shares science facts on social media where he communicates his passion for biology, health, medicine, and nature.

Paul's scientific curiosity doesn't end there, he's also interested in technology, environmental sustainability, climate change, and the exploration of the universe, all of which find their way into his science fiction stories.

A scientist first, then a successful author; who says you can only have one passion in life?

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Teacher activity sheet

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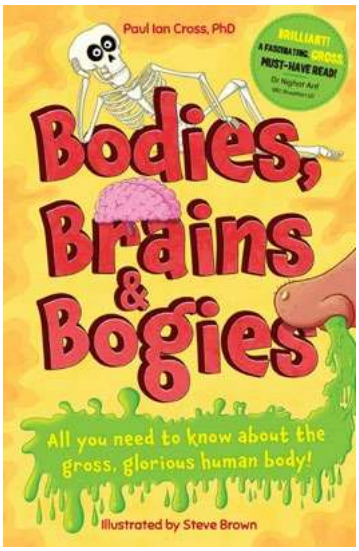


Each activity sheet contains ideas for experiments to do with your pupils, provides information relating to careers, and has a maths focus to help pupils understand the importance of mathematics education across the curriculum.

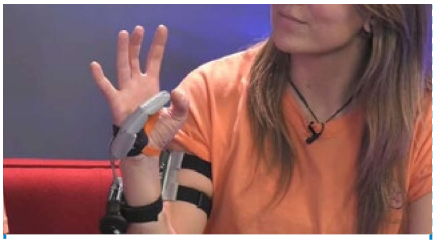
These investigations can be done as standalone activities or carried out as an in-depth sequence to develop pupils' disciplinary and substantive knowledge. The pupils' deeper learning and their science capital development would be more memorable if they were able to collaborate with a scientist such as an anatomist or physiotherapist. If you work with a scientist in this way you could also consider applying for a Royal Society Partnership Grant of up to £3,000. For more information and to apply, visit: **royalsociety.org/partnership**

How useful are our limbs?

Ask your class what they've used their hands for in the last 24 hours. No doubt a surprising array of activities like brushing teeth, texting, tying shoelaces, and online gaming; but do they know the backs of their hands as well as the old idiom would suggest?

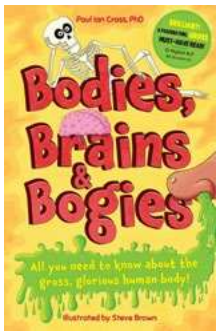
Placing their non-dominant hand palm-down beneath a desk, and a piece of paper on the desk above the hand, pupils draw ten dots to show where they think their fingertips end and where the knuckles are. Connecting the five knuckle dots and drawing lines connecting each knuckle to the fingertip, ask pupils to compare this drawing to their own hand. Is it accurate?

It is likely very different from their hand. People often draw their hands much wider and fingers much shorter, showing that our brains are interpreting our bodies differently to how they actually are. This is important to remember when it comes to how we feel about our bodies. The 'Body Beautiful' chapter has some great tips for understanding our differences and staying body positive.



Scan the QR code to find out about limb research by watching this two minute video segment (starting at 1:44:52), from the Royal Society Summer Exhibition 2022.

Find out more about the research team involved.



BODIES, BRAINS & BOGIES

Teacher activity sheet (continued)

How useful is my thumb?

In the Awesome Anatomy chapter, we learn just how important thumbs are to the evolutionary success story of humans, but how much of a difference do they make?

Challenge pupils to pick as many items up (eg beads) with one hand as possible using their whole hand. Repeat the task, this time without using their thumb. Pupils can make predictions about what they think might happen. Our thumbs have two bones whilst our fingers have three. Does this information alter pupils' predictions? Can you pick up the same number of items? Why? Were different strategies needed?

Consider repeating this activity isolating the pinkie finger or index finger. Do they have different effects? Do you see the same results comparing dominant and non-dominant hands?

Thumb dexterity

Over many generations, humans have evolved to use their thumbs for gripping and using tools, developing hand-eye coordination, and fine tuning our problem-solving skills, all of which have strengthened our thumb muscles helping to make us the dominant species we are today.

Hand-held devices like smart phones, tablet PCs, and gaming controls are fairly recent inventions and us humans, and our thumbs, have embraced these new technologies for gaming, messaging, and more. Scientists have noticed that younger generations who have grown up with smart phones seem to use their thumbs to type, whereas older generations, who have adapted to hand-held devices tend to type with their fingers. So do pupils have more flexible thumbs?

Challenge pupils to find out if their thumbs are well adapted to text typing by challenging them to a speed trial. Agree on a sentence about 10 words long and time how long it takes them to type it into a text message using a hand-held device. Could pupils involve children in other year groups and the adults in school to increase their data set and compare across a larger age-range? Pupils can record the results and use them to create a graph to show patterns and trends.

Career links

- **Biologists**
  study living things like plants and animals. An anatomist is a special type of biologist who studies humans and other animals to learn about the structures of our bodies and how our organs are organised inside us.
- **Neuroscientists**
  work to understand how our brains and nervous system work and develop over time. They study how we form ideas and make decisions, and how to fix our brains if things go wrong.
- **Physiotherapists**
  help people affected by physical injury, illness or disability through movement and exercise. They can teach us more about how our muscles and bones work together and give us advice on how we sit and stand, and how we can prepare for and recover from sports and exercise. Some physiotherapists work in healthcare and others work with athletes and sports people to keep them in peak physical condition for their jobs.