



SKELETON & RADIOLOGY

All the answers to your questions



Explore the structure of your body with Ray and Emma. Discover the skeleton, understand how it works, and learn all about radiology techniques — from their invention to how they function and are used today.



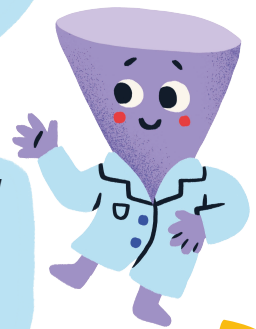
Emma



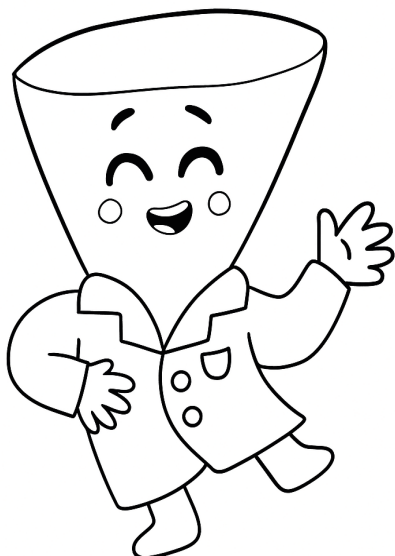
**Hello,
I'm Emma,
I'm 10 years old
and this is Ray!**

I'm preparing a presentation for my class on the human body. I've chosen to talk about **the skeleton** because it's what allows us to stand up straight... without being as soft as **marshmallows**.

However, apart from knowing that we have bones - and quite a few of them - I don't really know much else. **Ray**, the bone expert, is going to help me. Let's take a closer look - from the outside and the inside!



Ray



What is the skeleton?



Ray, I looked it up in the dictionary.

SKELETON = THE BONY FRAMEWORK OF THE HUMAN AND ANIMAL BODY.

Synonym: bone structure.

So it really is all about bones!



It is even a collection of bones!

They are articulated to enable the body to move. The skeleton's primary function is to enable you to stand upright!

Each bone is therefore very strong. It owes its strength to its outer 'bark', which is made up of a special mineral called

CALCIUM

This mineral salt is the most abundant in the human body. It is found mainly in bones and teeth, but it is also present in all the body's cells as it enables them to function properly.



The body naturally contains it at birth, but it is important to continue to obtain it through our diet.

Do you know where it can be found?



Yes! In milk and dairy products! It is often written on packaging or in advertisements. My parents always tell me, «Drink milk or eat cheese to grow up strong, darling!»



They're right, that's where you'll find it. The cheeses richest in calcium are Gruyère, Comté and Parmesan.

However, calcium can also be found elsewhere, though in smaller quantities. And if you don't like or can't digest dairy products, these alternatives can be very useful.

You can find it in:



BEANS
GREEN



SARDINES



TOFU



APRICOTS



ALMONDS



SPINACH



KIWIS



ORANGES



BLACKBERRIES



THYME



CLEMENTINES



SOME WATER
BOTTLES!

Take a closer look at the labels on the bottles!





What is the skeleton?

Emma's summary

- ✎ The skeleton allows us to stand upright.
- ✎ It is like a scaffold made of lots of bones.
- ✎ Every bone owes its strength to calcium and phosphorus.
- ✎ To ensure healthy growth and strong bones, it is important to eat a balanced diet, avoid too much salt, choose foods rich in calcium and vitamin D (as this helps the body absorb calcium), stay hydrated, and get plenty of exercise!



Let's play!

Circle the foodsthat help strengthen your bones.



BANANAS



TOFU



EGGS



ALMONDS



THYME



KIWIS



HONEY



CLEMENTINES



SARDINES



SPINACH



BLACKBERRIES



BREAD



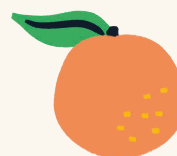
GREEN BEANS



APRICOTS



COURGETTES



ORANGES



YOGHURTS

The skeleton: a highly technical mechanism



Wow! That's a lot of bones!

At birth, the baby has around 270 bones.

As the body grows, the number decreases, because some bones fuse together.



The adult body has approximately 213 bones, but this number can vary.

Bone is a living tissue that renews itself approximately every ten years.

The longest and strongest bone: the femur (30 to 35 cm)



More than half of all bones are found in the hands and feet — 54 in the hands, fingers, and wrists, and 26 in each foot.



The smallest bone: the stapes

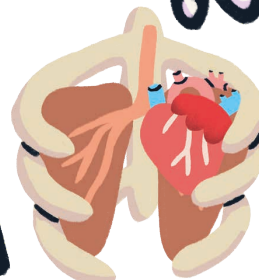
It is located in the ear with the incus and malleus. It vibrates when sound passes through and transmits it to the inner ear.



It is smaller than a grain of rice

Bones protect organs.

The rib cage protects the heart and lungs.



Rib cage



The skeleton tells us who we are



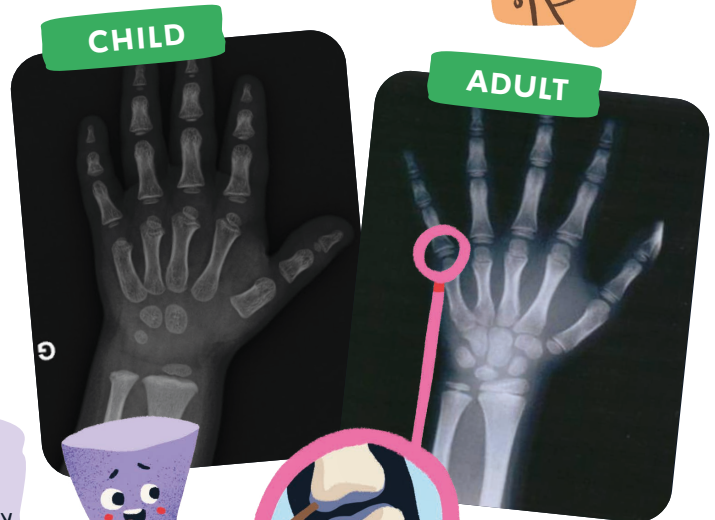
In history class, the teacher told us something crazy! Apparently, archaeologists can determine the age of people whose bones and skeletons are discovered, simply by analysing them. Is that true?



EXACTLY!

Much like detectives, they search for clues.
Look at these two images:

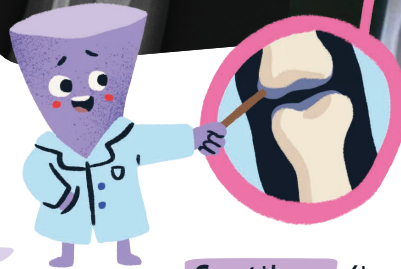
The one on the left shows a hand. It belongs to a young child. The black spaces between the white parts are mainly cartilage.



The larger the spaces, the younger the skeleton.

As the body grows, the cartilage gradually turns into bone, the small bones will fuse together, they will lengthen and take on a precise and definitive shape.

On the right, you have his hand... as an adult! Can you see the differences? The same applies to this example of a leg.



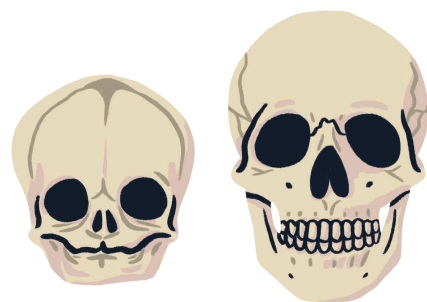
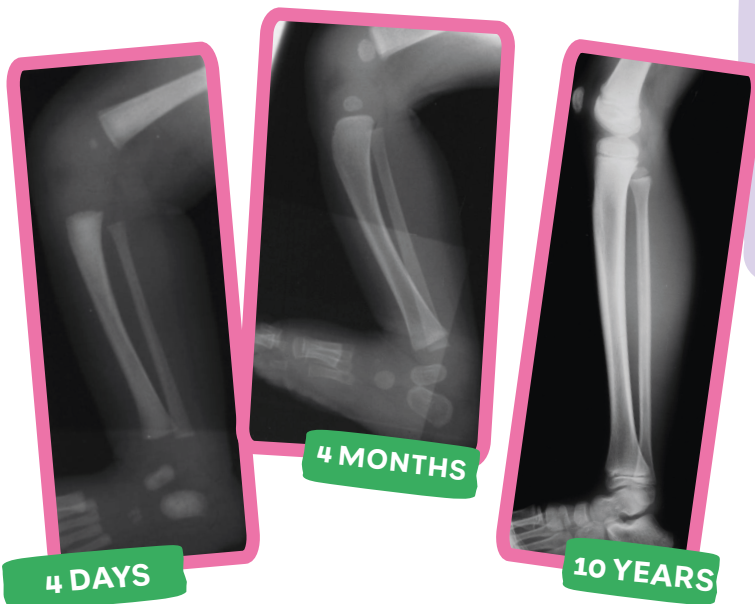
The black space between the bones is called **synovial fluid**.

Cartilage (in grey) is a flexible material that covers the ends of bones to protect them.

Same thing on this leg example.

Newborns' skulls are **flexible** at birth. The different parts begin to fuse together from the age of 2 months.

As with the rest of the skeleton, The bones of the skull **harden** and grow over time. Then, as we age, they become **more fragile**, and the body gradually shrinks a little.



BABY

ADULT



So, mine is changing right now?

Yes, there are quite a few changes during puberty (between the ages of 10 and 15). So if you sometimes experience minor knee pain, this may be partly due to that.



After that, growth stops, and you have to take care of your bones. And as we get older, little by little, bones become porous* and break more easily.

And you can also tell whether the skeleton belongs to a girl or a boy?



Yes, men's bones are larger, and their joint ends are thicker.

The pelvic bone is also slightly different. Men have a narrow pelvis that is positioned high up. Women have a wider pelvis (This helps the baby pass more easily during childbirth).



The skeleton tells us who we are

Emma's summary

So, observing the skeleton can reveal:

- ✓ the person's age,
- ✓ gender
- ✓ and even signs of injuries.



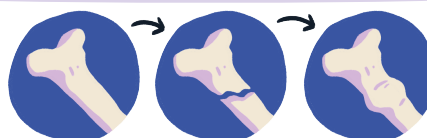
man



woman

And that's not all!

The skeleton also keeps traces of fractures. It's a bit like skin with scars when you cut yourself badly or have an operation. This is called a bone callus.



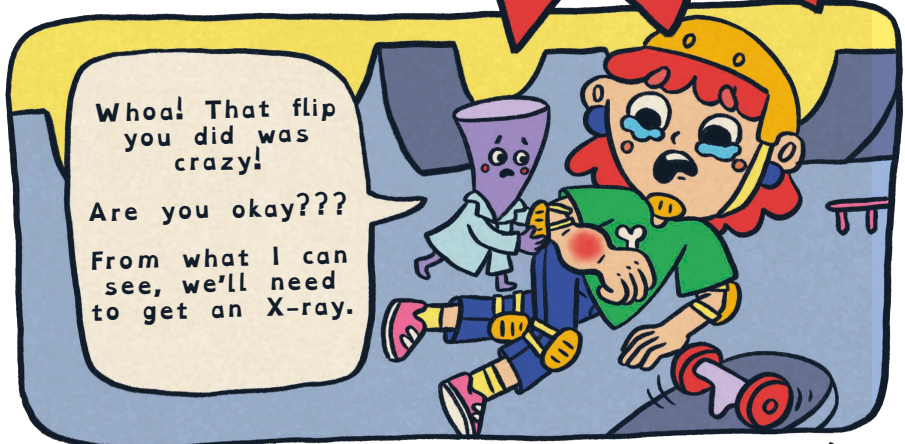
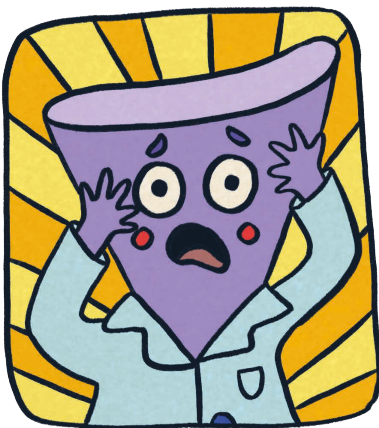
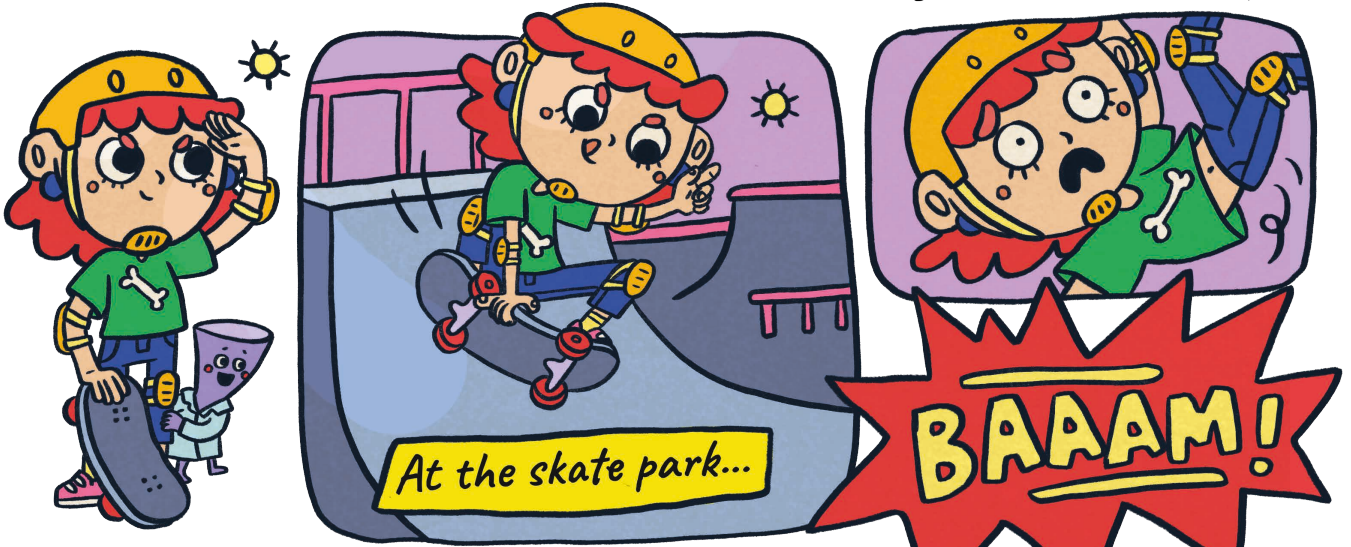
Let the game begin!

Put the skeleton X-rays in order, from youngest to oldest.

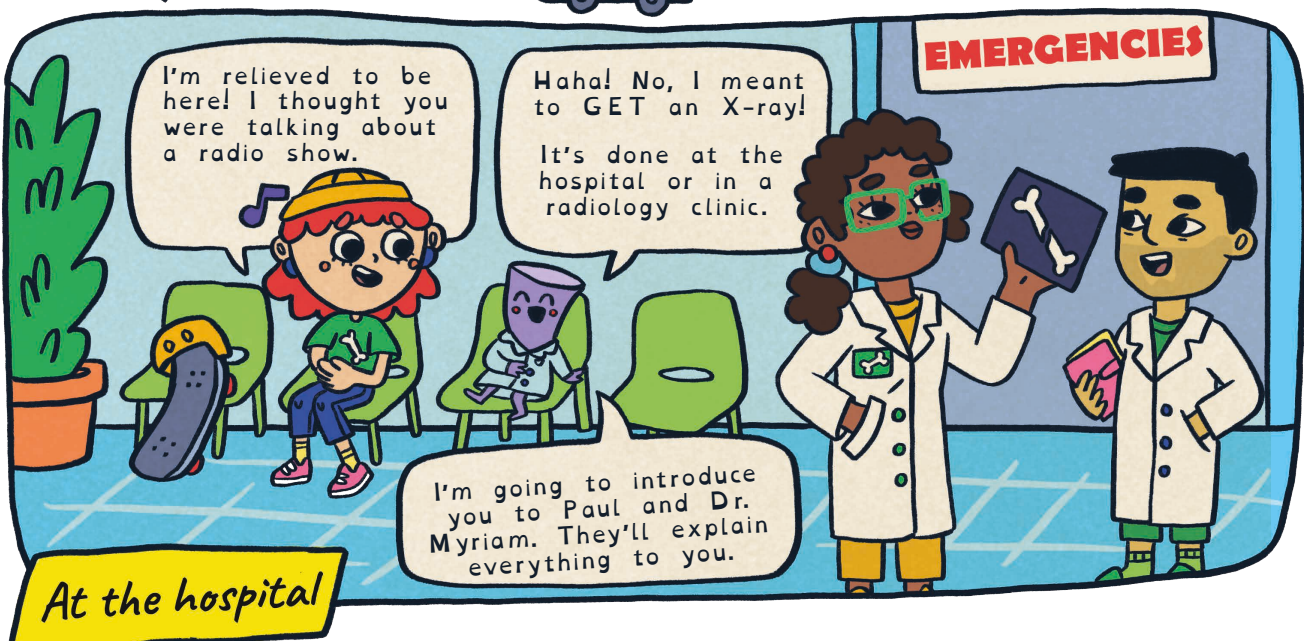


The accident

Emma and Ray at the skate park



PINN NN PONNNN!!



Radiology



Hello Emma, my name is Paul,
I am a radiology technician.

My job involves working with highly technical machines. Thanks to these machines, I can produce images of the inside of your body. There are different models that produce different types of images:



X-ray



CT scan



ultrasound



MRI

Ray will explain it to you in more detail later.

Artificial intelligence acts like an assistant that helps analyse the images more quickly. But it is always the radiologist, with their medical expertise, who makes the important decisions!

The radiologist you met when you arrived decides which imaging technique to use, depending on what needs to be examined more closely. Your Radiology request* indicates that Paul should give you an X-ray, a radiograph!

In my job, you have to be very careful with patients* and with the machines because it's very expensive technology! Your arm is sore, so I'll be careful not to hurt you. At the same time, I need to position it properly on the plate and adjust the device to get images that are as clear and useful as possible.

Isn't it just like taking a selfie? Say "Skeleton" and it's done?

It's a little more complex than that, but it won't take long. You'll just need to stay as still as possible.

In the meantime, why doesn't Ray explain why we call him "Ray"?

Come on, follow me, I'll show you!

X-ray



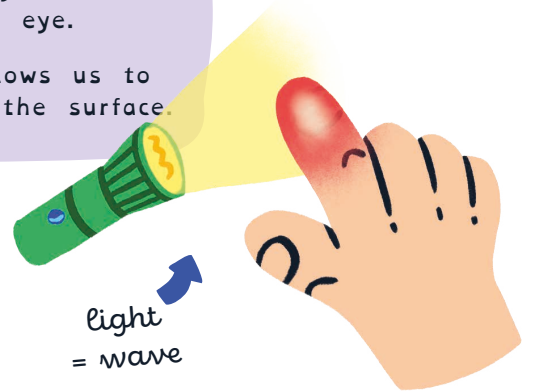
When you look at your body in daylight or with a lamp, you only see the skin.



However, if you shine a flashlight behind your fingertips, the light "passes through," and you can almost see them glowing red. In fact, it is the blood in your body that you can see through.

You perceive things that you couldn't see with the naked eye.

Light is a wave that allows us to reveal what lies beneath the surface.



Radiology works in a similar way, but it uses waves that are much stronger than visible light. And «ray» in French is pronounced «rayon»!



RAYON

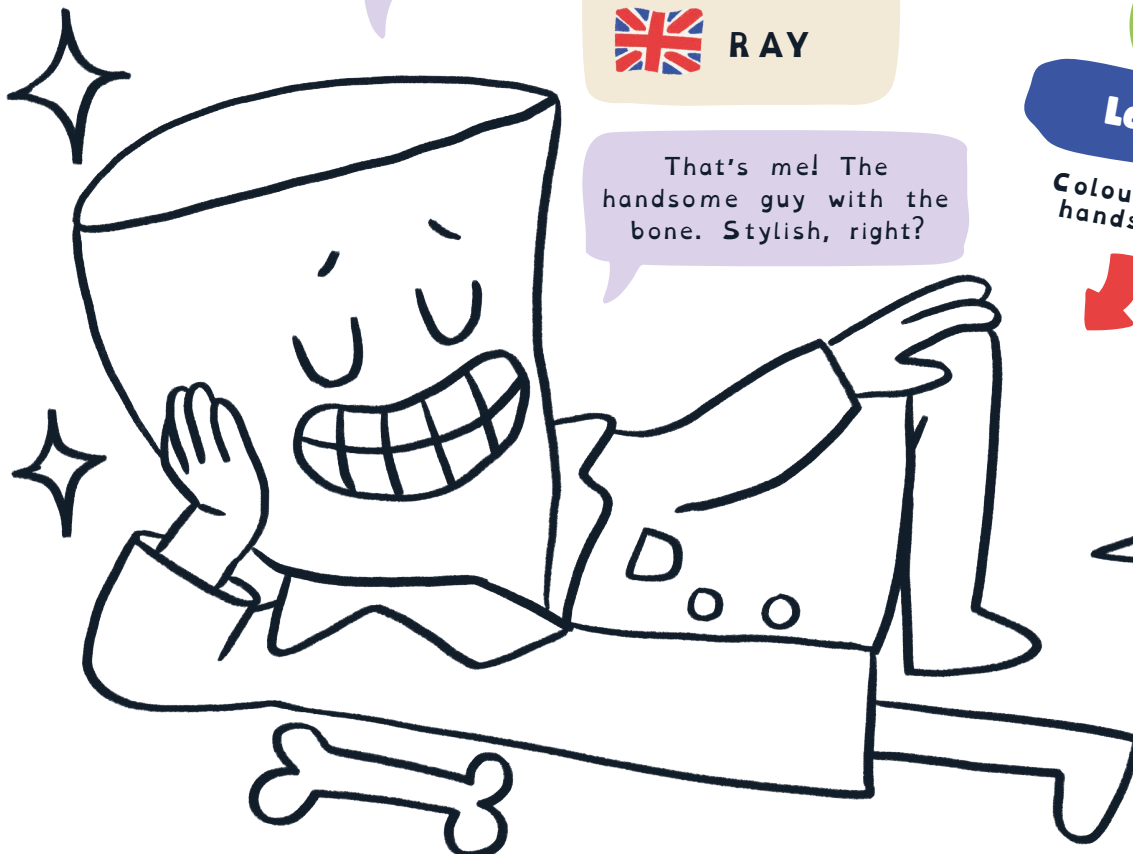
RAY

That's me! The handsome guy with the bone. Stylish, right?



Let's play

Colour Ray, the handsome guy.





X-ray



X-rays use radiation discovered in 1895 by Professor Röntgen, a physicist.

He named them X-rays because they were unknown at the time: X-rays.



First X-ray:
the hand of his wife Bertha



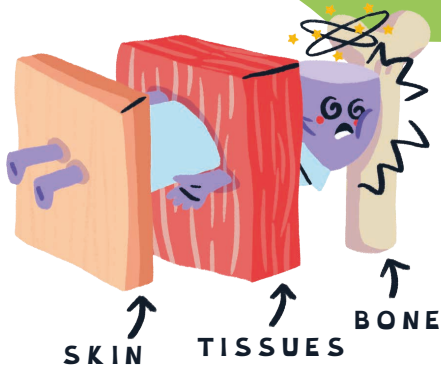
But it was mainly doctors such as the Frenchman Antoine Bécère who believed that these X-rays could be used to see inside the body.

Thanks to this idea, radiography became an essential tool for observing bones, detecting fractures and identifying certain diseases.



It was also soon discovered that X-rays could be used to treat certain illnesses. This led to the development of radiotherapy, which is still used today to treat diseases such as cancer.

X-ray



X-rays are special:

They can pass through the skin and soft tissues of the human body. However, when they encounter something hard and dense - like bone or metal - they stop.

To visualise this on an image: when the X-ray is blocked, a white area appears.

So, on X-rays, what appears white is hard, it's bone; the rest is black.



WHITE = BONE

BLACK = THE REST

Wow!!! So if you take an X-ray of my head... will we see my skull with my braces and my earrings?



Let's play!

Among all these photos, find Emma's X-ray.



Yes! You can see everything - even the fillings in your teeth! That's why the dentist asks patients to remove anything from their mouth.

The medical team therefore asks the patient to remove anything that might interfere with the analysis of the images.

Your earrings, for example.

The patient must also answer very specific questions about their health.

Click-clack !

Well done, Emma, you didn't move! Everything has been sent to Dr. Myriam. She is waiting for you for the diagnosis*.

It was lovely to meet you, Emma! Good luck with your presentation!





X-ray



Hello Emma. I'm Dr Myriam. Paul gave me the X-rays of your arm. Thanks to them, I can better understand your problem. My role is to make a diagnosis and suggest treatment so that you can heal as quickly as possible. It looks like you had quite a fall!

Yes, a skateboarding trick went wrong and...

CRAC!



Yes, that's what I see.

Let's look at the images Paul has given us. Here we can see the ulna in your right arm, which is one of the longest bones in the upper limb.

If you look closely, you can see a small crack in the middle. Your fall caused a fracture, so my diagnosis is clear.

YOU HAVE A FRACTURE OF THE RIGHT ULNA

If you wanted to go back to skateboarding right away, yes, but otherwise, not at all! You'll have to give your bone time to heal, to sort of «stick it back together».



Is it serious?

To help it heal, we're going to put your forearm in a cast. This will stop it from moving and allow the bone to heal properly. And we'll let nature take its course. With rest and patience, it'll only take a few weeks!



Like my friend Lucille! She had her leg in a cast. We signed it and everything! It was so COOL!



Hey! Would you like to decorate my plaster cast?





Let's play!

Decorate Emma's
plaster cast.



The X-ray

Emma's summary

- ✎ An X-ray is a two-dimensional (2D) image that lets us see inside the body.
- ✎ X-rays were developed in the 19th century by doctors to see inside the body.
- ✎ The technique works by using X-rays.
- ✎ It reveals bones, organs, and even metal objects!



**DOES THAT
REASSURE YOU?
SO, LET'S CONTINUE.**



CT SCAN



Paul mentioned three other possible imaging techniques: here we have the **CT SCAN**.

It's a large machine that works on the same principle as an **X-ray**, but it sends the rays all around the body.

This produces «slices» or «cross-sections». By combining all these slices, we can reconstruct your body as a **3D digital image** - a sort of avatar.

This means that the inside of your body can be observed in... This reveals the **bones, organs, and other tissues**.

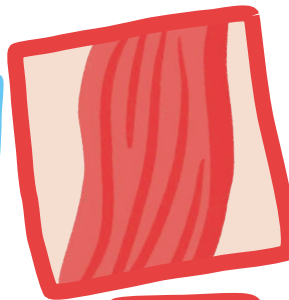
3D



BONES



ORGANS



TISSUES



That sounds like a lot of radiation. Is it dangerous?



Radiation is our ally when it is controlled. For a scan or X-ray, the patient must be alone when the machine is running.

You probably noticed that Paul was in the next room behind a glass screen, and that I was wearing a lead apron for protection during Emma and Ray's examination.

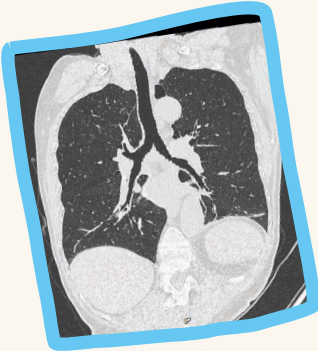


CT SCAN



Let's play!

Connect each CT scan image to the correct body part.



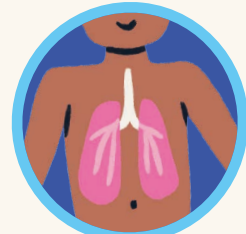
HAND



SKULL



FOOT



LUNGS

INFO +

The sun emits the same type of radiation.

If an astronaut ever travels to Mars - which is very far away - they too will have to protect themselves!



CT SCAN

Emma's Summary

- The CT scan provides a 3D representation.
- It produces 3D images of organs, bones, and other tissues.
- This is the same technique as X-rays.
- X-rays are harmless* when used in very small doses.

Ultrasound



Now let's move on to ultrasound.



I know!

It's to find out whether a mother is going to have a girl or a boy.



When a mother is expecting a baby, X-rays are avoided because the baby is very small and fragile.



It is true that we talk about ultrasound scans to see the baby in its mother's womb.

This technology uses a completely different type of wave and is safe for both mother and baby.

And you'll like this... it's the technique dolphins use to communicate: **ultrasound!**

These are high-frequency sound vibrations that cannot be heard but enable the detection and location of obstacles in front of you.

So, for the inside of the body, this creates a slightly three-dimensional image - like an ultrasound of a pregnant woman.



INFO +



Submarines also use ultrasound waves with their sonar.*

ultrasound of a pregnant woman



Ultrasound

Emma's summary

- ✎ The ultrasound scan provides a 3D image, like a map of the interior of the body
- ✎ It uses high-frequency sound waves called ultrasound
- ✎ This type of wave is completely harmless.
- ✎ We observe the organs, the inside of the body, like the mother's womb.



Place to play!

Connect the dots from 1 to 27 to reveal the baby on the ultrasound image.





MRI



And finally, let's talk about MRI.



MAGNETIC, like magnets, such as fridge magnets?



Almost. The word **MAGNETIC** indicates that the device contains a large magnet.



The word **RESONANCE** explains that it uses radiofrequency waves, similar to those from mobile phones, to make certain elements in the body's tissues vibrate and thus produce images.



**MAGNETIC
RESONANCE
IMAGING**



This advanced technology was developed about 40 years ago. It is still relatively new, and the machines are very expensive.



An MRI scan is an examination that is only used when very precise images of the inside of the body are required.

It is not used all the time, only in certain special cases.



That's a enormous machine!

Like with the CT scanner, do you have to go into the tunnel?

You mustn't be **CLAUSTROPHOBIC**!

You lie down and the table you're lying on slides into the tunnel. As it's noisy, you're given headphones with music; this reduces the noise and allows the technician to talk to you.

You must not wear anything metallic because of the strong magnet, and you must remain perfectly still during the MRI.





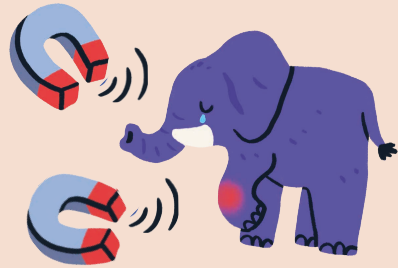
MRI

Emma's summary

- ✎ MRI uses a powerful magnetic field that behaves like a giant magnet.
- ✎ It acts like a magnet.
- ✎ It produces detailed images of organs, bones, and other tissues.
- ✎ It is a relatively recent technology, offering unrivalled precision.

INFO +

There are also XXL MRI machines for large animals such as tigers and horses.



Time to play!

Cross out the items you must not carry with you during an MRI.





Quiz



Our journey through the extraordinary world of bones and medical imaging has come to an end.

Are you ready to take on the challenges set by Paul and Doctor Myriam?

NO PROBLEM!
No problem! I'm an expert now!



Let's play!

Check the correct answer.

1 The skeleton is made of calcium.

TRUE FALSE

2 You need to eat chips to strengthen it.

TRUE FALSE

3 The smallest bone is called the femur

TRUE FALSE

4 Everyone has exactly the same number of number of bones.

TRUE FALSE

5 Some bones are soft at birth.

TRUE FALSE

6 Our bones bear the marks of our accidents.

TRUE FALSE

7 To take an X-ray, you need to wear headphones.

TRUE FALSE

8 Radiology technicians only take X-rays.

TRUE FALSE

9 X-rays are invisible to the naked eye.

TRUE FALSE

10 The first X-ray ever taken was of a foot.

TRUE FALSE

11 MRI stands for Magnetic Resonance Imaging.

TRUE FALSE

12 Ultrasound uses ultrasound technology.

TRUE FALSE

13 Radiologists repair radiology equipment.

TRUE FALSE

14 It is possible to take an X-ray of the lungs.

TRUE FALSE

15 The technique of radiology dates back to the 14th century.

TRUE FALSE

16 CT scans provide 3D images.

TRUE FALSE

17 Between bones, there are joints.

TRUE FALSE

18 It is the patient who chooses between an MRI or a CT scan.

TRUE FALSE

19 You can keep your keys in your pocket during an MRI scan.

TRUE FALSE

20 The skeletons of men and women are identical.

TRUE FALSE



Dictionary



attenuat

To reduce the force, effect, or value of something.

claustrophobic

Someone who is afraid of being confined or in very small spaces.

colossal

Enormous, very large

CT scan

(Also called computed tomography - a medical imaging technique that uses X-rays

diagnosis

Identifying a medical problem using its symptoms

harmless

Safe

incognito

Without being seen

MRI

Magnetic Resonance Imaging is a medical imaging technique that uses the effect of a magnetic field on the water molecules in the body.

a patient

Name designating people who consult healthcare professionals

porous

Having small holes or pores

radiology

A set of diagnostic and therapeutic techniques using X-rays and other radiation.

Radiology request

A document provided by a doctor detailing a patient's treatment

sonar

A device that uses sound waves to detect objects underwater

tissue

A group of similar cells of the same origin (e.g., skin is a tissue)

ultrasound

A medical imaging technique that uses vibrations similar to sound waves but imperceptible to the human ear.

x-rays

Invisible radiation capable of passing through the human body

Au Revoir! Bye! Adios!

So many discoveries! It was technical, but not as complicated as I thought
Thanks, **Ray** ! Thanks to you, Paul, and Dr. Myriam, I'm now an expert on the skeleton and radiology.

Visit us at the Museum of Radiology.

www.radiologie.fr/musee-radiologie

You'll see there, in real life, the very first radio!

ANSWERS:

PAGE 5 : he odd one out are bananas, zucchini, bread, honey, and eggs.

PAGE 8 : 3, 4, 2, 1

PAGE 13 : Third picture in the middle row.

PAGE 17 : 1-D, 2-A, 3-B, 4-C

PAGE 20 : The hair clip, the watch, the belt, the necklace, the 3 coins, the key, the fork, and the glasses.

PAGE 21 : 1. True / 2. False, dairy products / 3. False, it's the stirrup / 4. False, it can vary / 5. True / 6. True / 7. False, it's for the CT scan and/or MRI / 8. False, he also does MRIs and CT scans / 9. True / 10. False, it was Bertha Röntgen's hand / 11. False, Magnetic Resonance Imaging / 12. True / 13. False, a radiologist is a doctor who analyzes medical images / 14. True / 15. False, it dates from the 19th century / 16. True / 17. True / 18. False, it's the doctor who decides and writes a prescription / 19. False, any metallic object must be removed / 20. The pelvic bone (the pelvis) is different.

Musée de la Radiologie
75013 Paris



Are you coming to visit Paris? Sign up for a tour with your family or class!



SOCIÉTÉ FRANÇAISE
DE RADIOLOGIE
& D'IMAGERIE MÉDICALE

Ekole

This kit is offered to you by the French Society of Radiology and Ekole.

Project manager:
Jennifer Le Nourichel

Scientific advice:
Pr Alain Luciani, UPEC,
CHU Henri-Mondor, AP-HP

Design & Writing:
Marion Gallavardin

Illustration & Graphic Design:
Lila Le Minh

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Notes

