

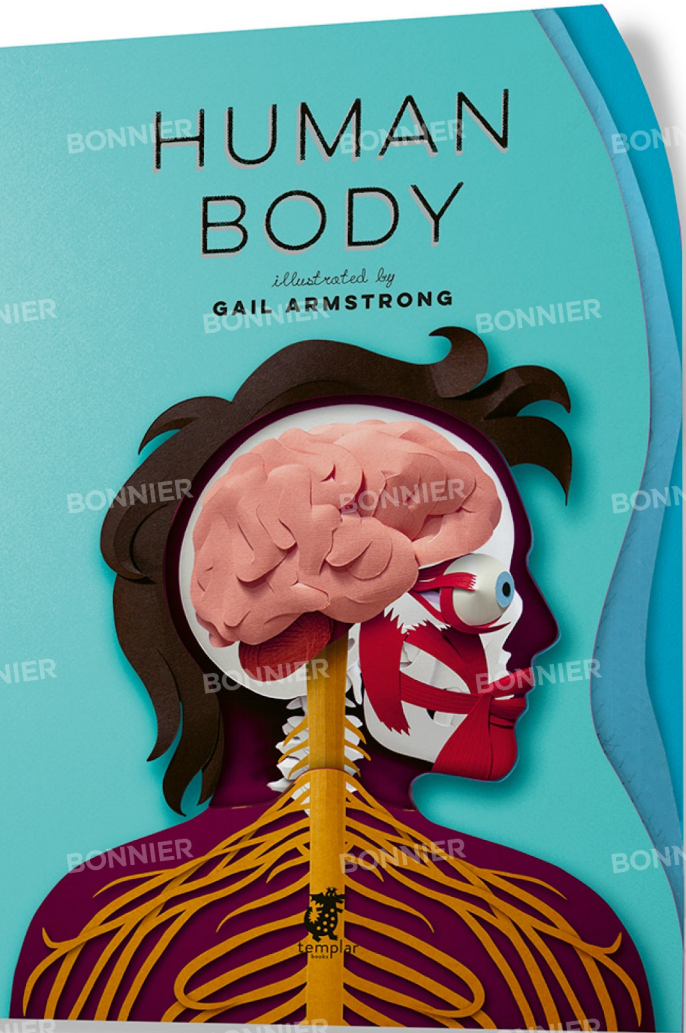
PAPER WORLD

# HUMAN BODY

Take a  
closer look at  
the body – with  
40 flaps to  
lift!



*illustrated by*  
**GAIL ARMSTRONG**



# HUMAN BODY

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Your body is incredible. It works right round the clock to keep you going. Even when you're fast asleep, your body is busy growing, breathing, pumping blood and finishing off that last meal you ate.

Inside this book you can turn the pages and lift the flaps to explore all the organs of the human body, revealing layer after layer of incredible facts.



# ORGANS & SYSTEMS

The human body is made up of many different parts, all working together to keep you moving, breathing and thinking. At any point during the day or night, it has dozens of jobs to perform. Each job is operated by a different system: a group of body parts linked up like parts of a production line.

**Water everywhere**  
About 70 per cent of the human body is water. That's why it's so important that you drink plenty of water to keep hydrated!

**What is an organ?**  
An organ is part of the body that does a particular job. For example, your heart pumps blood around the body.

The very smallest parts of the body are cells – these are the basic building blocks of all living things. Cells of a similar type group together to make tissues, such as muscle tissue. And tissues group together to form organs, such as the heart, lungs and brain. A system is made of tissues and organs linked together.

**Biggest organ**  
Incredibly, the largest organ in the body is the skin. An adult's skin weighs about 3.5kg and would be more than 2 square metres if you spread it out.

**How many systems?**  
There are many different systems in the body – just open the paper chain to see! Each one is made up of organs and tissues. For example, the nervous system consists of nerves (tissues) all linking up to the brain (an organ).

**Cells**  
Every part of your body is made up of tiny building blocks called cells. They are too small to see with the naked eye. But if you were to look at one under the microscope, you would see they all have different shapes, depending on the job they do. Here is a typical human cell, along with its most important parts.



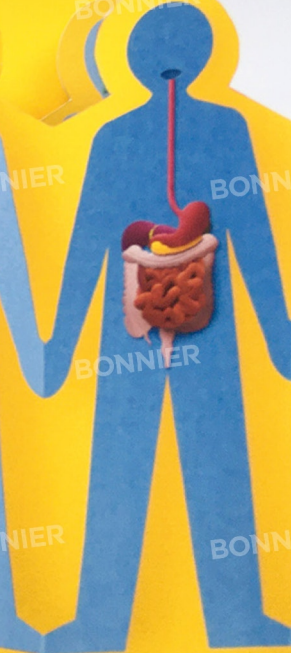
**A unique wonder!**  
We all have the same basic body parts, but every person on this planet is totally unique inside and out! That's because everyone has a unique set of genes (except for identical twins). And every individual has their own very different experiences as they grow up.



Nervous System



Endocrine System



Digestive System

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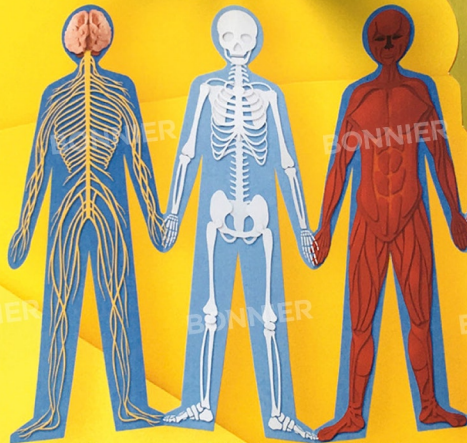
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Nervous System

Skeletal System

Muscular System

Circulatory System

Respiratory System

Endocrine System

Digestive System

# SKELETON & MUSCLES

Your skeleton holds your body up, gives it shape and allows you to perform all kinds of movements – from throwing a ball, to ice skating. It also protects the body's soft internal organs, such as the heart and brain.

Important as it is, your skeleton couldn't make you move without the help of your muscles. In fact, you can't move a single part of your body – from your tongue to your toes – without using at least one muscle. Some muscles move without you thinking about it (like the muscles that churn food in your stomach) but others require thought (like moving your legs to walk). All work by contracting (getting shorter and fatter) and then relaxing. The muscles that make you walk, jump and run are called skeletal muscles. There are about 650 in the body, and they make up about half of an adult's weight!

## Biggest muscle

The gluteus maximus or buttock is the largest muscle in the body! It controls the movement of the hips, for tasks like climbing the stairs.

**Skull**  
The skull is made of 22 bones – all but one are fused together to make a hard, hollow-like covering for the brain.

## Smile

Even smiling is controlled by muscles. Did you know it takes more muscles to frown than to smile?

## Smooth muscle

Smooth muscle makes things move in the body. It pushes food through the digestive system, contracts the bladder and...

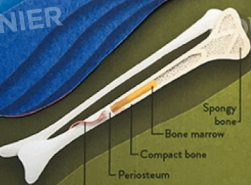
## Muscle fibres

If you looked at your muscles under a microscope, you would see bundles of long, stretchy ropes called muscle fibres.

The muscles that move your skeleton look like this up close (right) but there are other types of muscle around the body.

## Cartilage

Cartilage is a tough, flexible substance that covers the ends of bones, so that they glide past each other as the body moves. It also makes up the shape of the ears and nose!



## Bone layers

The bones in your legs and arms are strong but light because they have a honeycomb texture, full of tiny air pockets. In the middle of the bone is a jelly-like substance called bone marrow, where new blood cells are grown.

## Cartilage

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## How many bones?

There are 206 bones in the adult body. Babies are born with more, but they gradually merge, or fuse, together as they grow older.

# HEART & LUNGS

Protected within the bones of the ribcage are some of the most important organs in the body – the organs of the cardiovascular system. These are actually two systems working closely together: the respiratory system, which keeps you breathing, and the circulatory system, that pumps blood around the body.

The lungs are two spongy air-filled sacs, whose job is to bring air in and out of the body. The air that you breathe in is full of a gas called oxygen, which every living thing needs to stay alive. As the body uses oxygen, it makes a waste gas called carbon dioxide, which the lungs then remove. This in-out process is repeated 22,000 times a day!

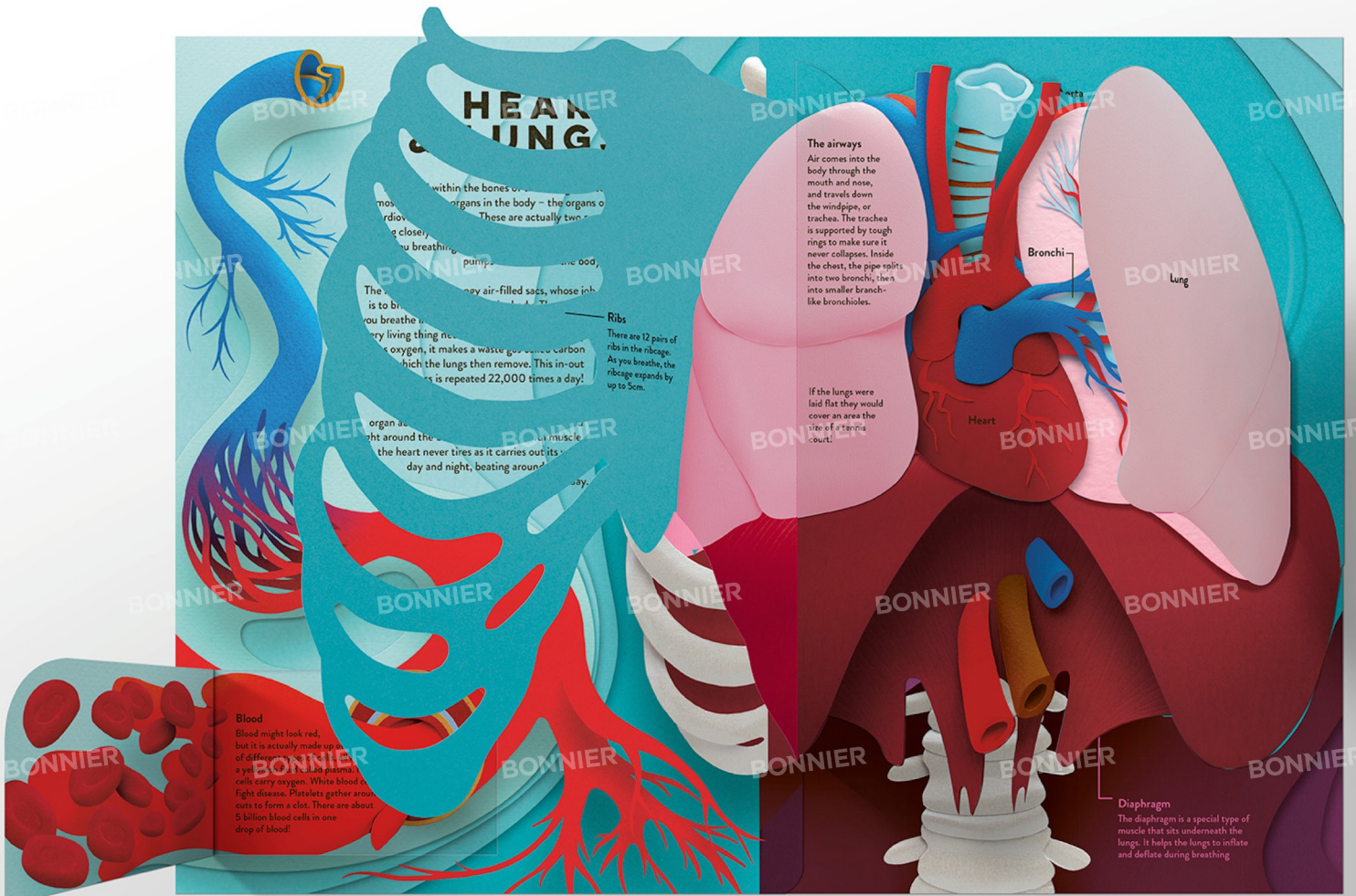
Tucked just beside the lungs is the heart, an organ about the size of a fist that pumps blood right around the body. Made of powerful muscle, the heart never tires as it carries out its work, day and night, beating around 115,000 times a day.

## Blood

Blood is usually made up of lots of different types of cells, all floating in a yellowish fluid called plasma. Red blood cells carry oxygen. White blood cells fight disease. Platelets gather around cuts to form a clot. There are about 5 billion blood cells in one drop of blood!

## Diaphragm

The diaphragm is a special type of muscle that sits underneath the lungs. It helps the lungs to inflate and deflate during breathing.



# HEART & LUNG.

within the bones of the ribcage. Most of the organs in the body – the organs of the digestive system, for example – are actually two-sided. These are actually two-sided organs. You breathe in through the nose and out through the mouth. The heart pumps the blood, and the lungs take in oxygen. They are air-filled sacs, whose job is to breathe in oxygen. Every living thing needs oxygen, it makes a waste gas called carbon dioxide which the lungs then remove. This in-out cycle is repeated 22,000 times a day!

**Ribs**  
There are 12 pairs of ribs in the ribcage. As you breathe, the ribcage expands by up to 5cm.

**The airways**  
Air comes into the body through the mouth and nose, and travels down the windpipe, or trachea. The trachea is supported by tough rings to make sure it never collapses. Inside the chest, the pipe splits into two bronchi, then into smaller bronchial-like bronchioles.

If the lungs were laid flat they would cover an area the size of a tennis court!

**Blood**  
Blood might look red, but it is actually made up of different types of cells. Red blood cells carry oxygen. White blood cells fight disease. Platelets gather around cuts to form a clot. There are about 5 billion blood cells in one drop of blood!

Bronchi

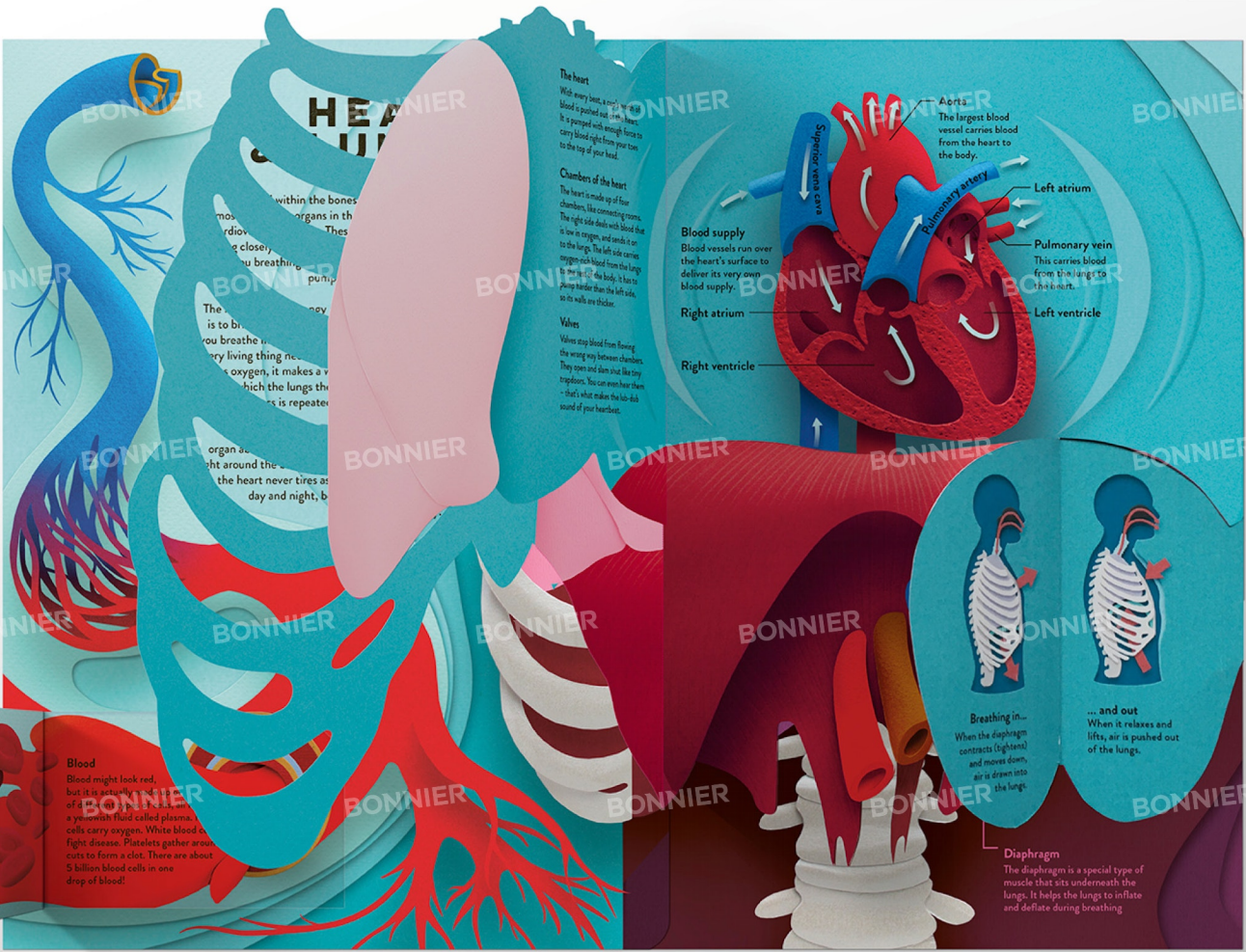
Lung

Heart

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The diaphragm is a special type of muscle that sits underneath the lungs. It helps the lungs to inflate and deflate during breathing.





# HEART

**The heart**  
With every beat, a tiny wave of blood is pushed out of the heart. It is pumped with enough force to carry blood right from your toes to the top of your head.

**Chambers of the heart**  
The heart is made up of four chambers, like connecting rooms. The right side deals with blood that is low in oxygen, and sends it on to the lungs. The left side carries oxygenated blood from the lungs to the rest of the body. It has to pump harder than the right side, so its walls are thicker.

**Valves**  
Valves stop blood from flowing the wrong way between chambers. They open and slam shut like tiny trapdoors. You can hear them — that's what makes the lub-dub sound of your heartbeat.

**Aorta**  
The largest blood vessel carries blood from the heart to the body.

**Left atrium**

**Pulmonary vein**  
This carries blood from the lungs to the heart.

**Left ventricle**

**Blood supply**  
Blood vessels run over the heart's surface to deliver its very own blood supply.

**Right atrium**

**Right ventricle**

**Blood**  
Blood might look red, but it's actually made up of a mix of red blood cells and a yellowish fluid called plasma. Red blood cells carry oxygen. White blood cells fight disease. Platelets gather around cuts to form a clot. There are about 5 billion blood cells in one drop of blood!

**Breathing in...**  
When the diaphragm contracts (tightens) and moves down, air is drawn into the lungs.

**... and out**  
When it relaxes and lifts, air is pushed out of the lungs.

**Diaphragm**  
The diaphragm is a special type of muscle that sits underneath the lungs. It helps the lungs to inflate and deflate during breathing.

# DIGESTIVE SYSTEM

**The crown**  
The crown of the tooth is the part you can see above the gums.

Food provides the body with all the energy it needs to live as fit and healthy. But first it has to be broken down into parts that can be absorbed into the blood stream. This process takes place in the tubes and organs that make up the digestive system.

All food begins its journey in the mouth. Here, it is bitten and crushed by the teeth, coated in slimy saliva, and pushed towards the back of the mouth. Then it enters the digestive tract and begins its descent towards the stomach.

**Dentin**  
This hard, yellowish layer makes up most of the tooth.

**Gums**  
The pink gums make a seal around the teeth.

**The root**  
The root of each tooth goes down into the gum line.

**Nerves**  
Nerves and blood vessels flow in and out of each tooth like cables.

**A long journey**  
Food can take up to three days to travel through the entire digestive system.

**Canines**  
Fang-like canines are long and pointed, for gripping and tearing food.

**Oropharynx**  
Also known as the throat, this is the part of the digestive system where the food is broken down into smaller pieces.

**Tongue**  
The tongue is a flexible muscle that pushes food against the teeth and around the mouth.

**Molars**  
These big teeth at the back of the mouth are for crushing and grinding.  
**Premolars**  
These wide teeth sit between the canines and the molars, and help grind up food.

**Incisors**  
The front teeth, or incisors, are flat and sharp, for slicing through food.

**Open wide**  
A normal adult mouth has 32 teeth.

# DIGESTIVE ORGANS

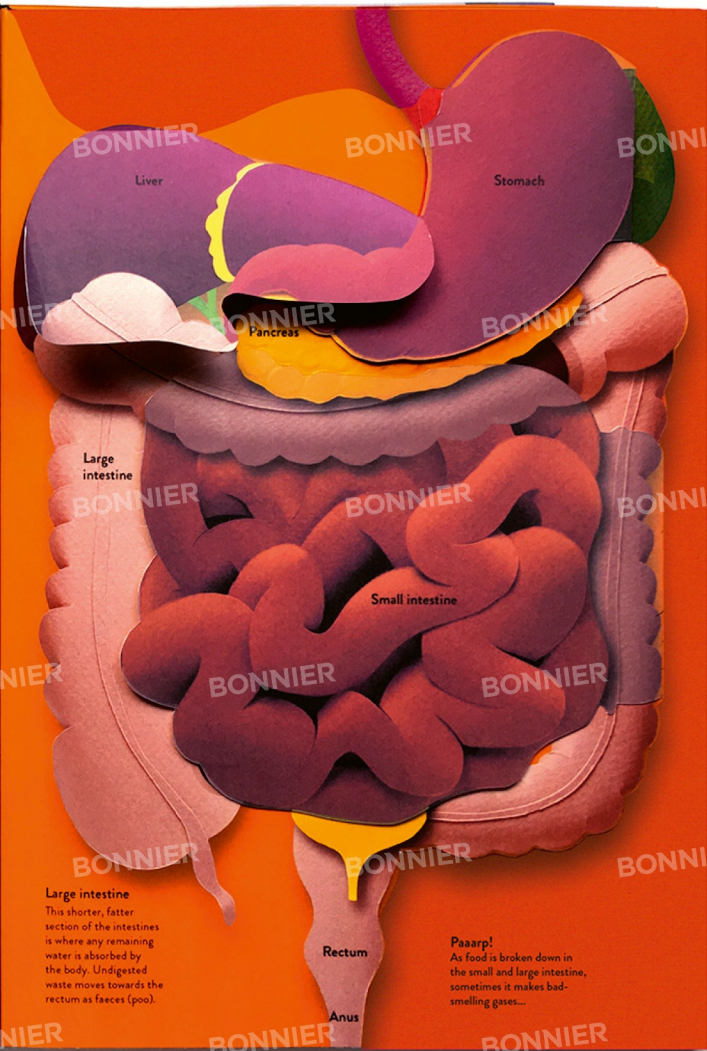
Most of the digestive organs are held in the abdomen, or belly – all folded to fit beside each other. Some organs break food down physically, by squashing and mixing it like a blender. Others produce special chemicals called enzymes, which break down food chemically.

Together they turn the meal you ate into a soupy mixture of water and tiny molecules that the body can absorb into its bloodstream. Most of these are absorbed in the small intestine, where around 90% of absorption takes place. Any waste or toxins not absorbed then pass through the body to become faeces (poo).



How long?

Stretch out the digestive organs and they are almost 9 metres long. That's about the length of a bus!



**Large intestine**

This shorter, fatter section of the intestines is where any remaining water is absorbed by the body. Undigested waste moves towards the rectum as faeces (poo).

**Paaarp!**

As food is broken down in the small and large intestine, sometimes it makes bad-smelling gases...

# BONNIER DIGESTIVE ORGANS

Most of the digestive organs are held in the abdomen, or belly – all folded to fit beside each other. Some organs break food down physically, by squashing and mixing it like a blender. Others produce special chemicals called enzymes, which help to break down food chemically.

How they work: The meal you ate into a soupy mixture. The tiny molecules that the body can absorb into its bloodstream. Most of these are absorbed in the small intestine, where around 90 per cent of digestion takes place. Any waste or toxins not absorbed then pass through the body to become faeces (poo).



**How long?**  
Stretch out the digestive organs and they are almost 9 metres long. That's about the length of a bus!



**Liver**  
The liver processes nutrients, filtering toxins (poisons) from the blood. It also makes a yellowish-green liquid called bile, which helps to break down fats, proteins, carbohydrates and fats in our food.

**Gall bladder**  
The gall bladder stores bile made in the liver and releases it into the small intestine when it is required.

**Gall bladder**

**Large intestine**

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This shorter, fatter section of the intestines absorbs any remaining water absorbed by the body. Undigested waste moves towards the rectum as faeces (poo).

**Pancreas**

**Kidneys**  
Once digestion has taken place, all the amino acids and sugars filter the blood, removing wastes and extra water and turning them into urine. They also produce important chemicals called hormones. Urine is stored in the bladder before being expelled from the body. The kidneys are part of the urinary system.

**Bladder**

**Rectum**

**Anus**

**Stomach**  
The stomach is a stretchy, muscular bag where food is munched and churned. It contains a mix of bacteria and enzymes, which break food down. Layers of muscles in the stomach's walls work in different directions to ensure food is thoroughly mixed. The stomach's wall is stretchy enough to expand if you eat a big meal!

**Pancreas**  
This organ makes enzymes, which break down sugars and fats so they can pass into the bloodstream.

**Small intestine**  
After it has left the stomach, food enters the small intestine. Despite its name, it is actually formed of around 6 metres of narrow, looping tubes.

Tiny finger-like projections called 'villi' make the intestine's surface area even larger. Nutrients and water pass through the villi's lining to blood vessels that then carry them away.





## THE SENSES

Senses are the body's way of understanding what's happening in the world around us. They mean you can smell a beautiful flower, taste a delicious meal, hear music, see where you're walking and tell whether something is hard or soft. More importantly, the senses keep us safe. If you hear or see danger, you know to run away from it. If you touch something sharp, you can pull your hand away before it cuts you. And if you smell bad food, you know not to eat it!

The five main senses are sight, hearing, touch, taste and smell. The sensory organs of the eyes, ears, nose, tongue and skin send a constant flow of information to the brain for processing. But amazingly, around two-thirds of the information processed by the brain comes from the eyes alone!

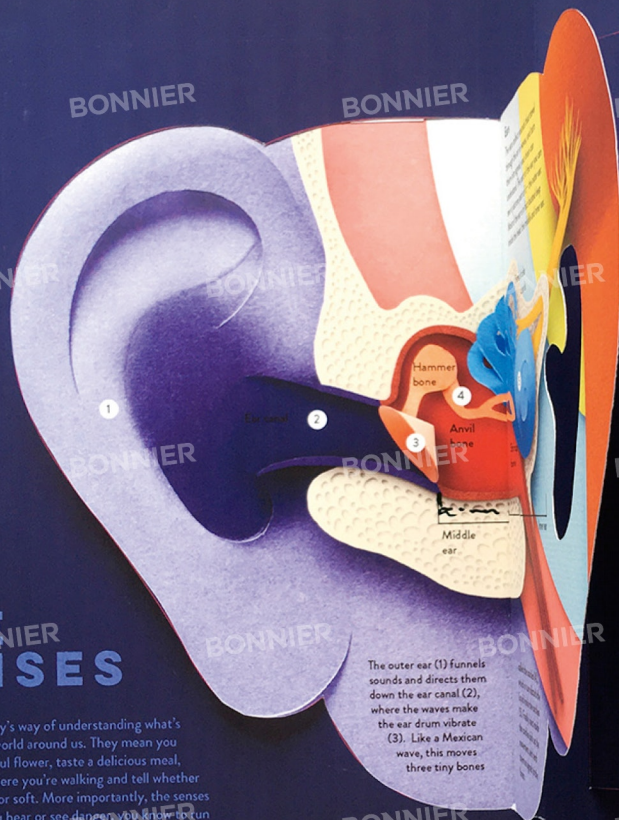
### Touch

The skin all over your body contains tiny receptors, which detect touch and send signals to the brain. They can tell if something is hot, cold, soft, hard or painful. Some parts of the body – such as the fingertips – are more sensitive because they have more receptor cells.

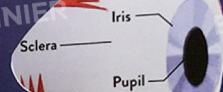
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The outer ear (1) funnels sounds and directs them down the ear canal (2), where the waves make the ear drum vibrate (3). Like a Mexican wave, this moves three tiny bones



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## Eyes

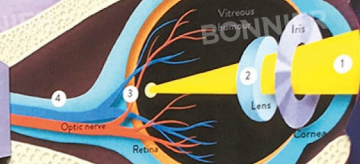
At the front of the eye are the parts you can see if you look in a mirror: the white sclera, the coloured iris and the dark pupil. A transparent dome called the cornea sits over the iris and pupil and focuses light as it enters the eye.

## How we see

Light passes into eye through the pupil (1). The lens focuses it (2) and projects an upside-down image onto the retina at the back of the eye (3). Light-detecting cells send messages down the optic nerve (4) to the brain, and the brain flips the image back to the right way around.

## Extraocular muscles

Seven muscles attach to the eye and eyelid. They control their movement, swivelling your eyes up and down and side to side. Your eye lids blink to keep the eye clean and moist and protect it from bright light.



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**Smell**

Smells are chemicals released into the air. They enter the nose as tiny particles floating in the air. Special cells in the lining of the nose then detect the molecules and send messages to the brain.

Brain

**Thalamus**  
This part of the brain processes signals from the sensory organs and helps with movement.

Olfactory bulb

Nerve branches

Odour particles

Tongue

**Smells good – tastes good!**

Your sense of taste is closely connected to your sense of smell. In fact, about 80 per cent of what we think we taste, is actually smell. Just taste it out by eating something while holding your nose.

See how  
he can  
hear  
see  
food

The five  
The sense  
send a code  
But amazing  
by the brain



# THE BRAIN

The brain is the control centre for the whole human body. It works round the clock, receiving signals and sending messages, and is responsible for every single thing you do, from walking and talking, down to digesting food and making the heart pump. The largest part of the brain is the wrinkled cerebrum, where all thoughts take place. It is divided into different areas, which control different functions.

Messages from the brain are sent to the rest of the body via the nervous system – a vast network that stretches through the body like electric cables. Billions of messages travel through the system every second, moving as tiny pulses of electricity.

## Cerebrum

The large wrinkly part of the brain is where all conscious thoughts take place about movement, speaking, and feelings. It is wrinkled so that your big brain can fit inside your small skull. If you laid it out, it would be as big as a newspaper!

## Spinal cord

The spinal cord is like a telephone wire that messages travel along between the brain and the rest of the body. It runs all the way down the back, protected by the bones of the spine. Together the brain and spinal cord form the central nervous system. This part of the brain controls the movement of your muscles.

## Brainstem

## Spinal cord

**Frontal lobe**  
This area is where you plan, make decisions, and control your emotions.

**Temporal lobe**  
It helps like the ear to hear, and helps you understand what you hear.

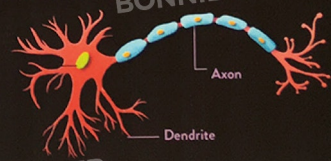
Frontal lobe

## Nerves

The nervous system is made up of billions of nerve cells, called neurons. They look a bit like an octopus, with one long 'arm' called the axon that carries outgoing signals, and several smaller arms called dendrites, that carry incoming signals. Each neuron can carry about 500 signals a second.

## Brainstem

This links the brain to the spinal cord. It controls automatic processes, including breathing and digestion, which the body does without you having to think about them.



Axon

Dendrite

# REPRODUCTIVE SYSTEM

The reproductive system is responsible for the task of making a baby. Men and women each have different reproductive organs. For new life to begin, a male cell, called a sperm, must join with a female cell, called an egg. The sperm fertilizes the egg and then a baby starts to grow. It takes nine months for a baby to grow inside its mother.

The sex organs start to work at the ages of about 11-14 in girls and 13-16 in boys. Boys grow taller and more muscular and their voices drop; girls grow curvier and develop breasts; both sexes grow more hair around their pubic areas. This time of change is known as puberty.



## Oviduct

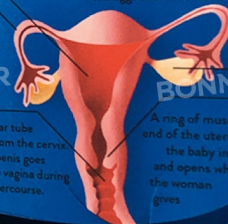
Two thin tubes called oviducts or fallopian tubes connect the ovaries to the uterus. Every month, an egg is released from an ovary down the oviduct.

## Uterus

Also known as the womb, this is a muscular organ where a baby develops.

## Ovary

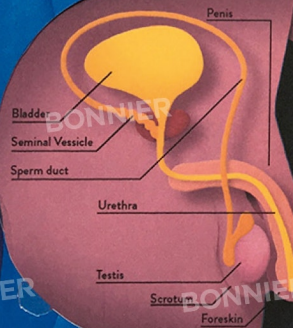
Women have two ovaries that contain hundreds of eggs (female sex cells). When a baby girl is born, she already has all the eggs she will ever have!



## Vagina

A muscular tube leading from the cervix. A man's penis goes inside the vagina during sexual intercourse.

A ring of muscle at the end of the uterus, keeps the baby in place and opens when the woman gives birth.



During sex, soft, slippery cells called sperm travel along the sperm duct, into the testis and pass out of the body.

Once inside the female's vagina, millions of sperm swim towards the egg. Usually only one sperm will win. The egg is fertilized, the fallopian tube and moves around 5 days.

Men produce new sperm throughout their lives.

## FACTS about puberty

### Boys

#### Breasts

Breasts start to develop. Girls may want to wear a bra now.

#### First period

Most girls have their first period 2 years after starting puberty.

#### Changing body

The body shape changes as the hips become wider.

#### Hair

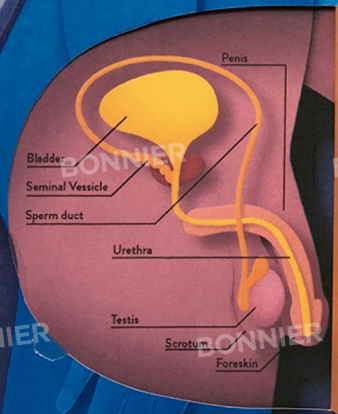
Underarm and pubic hair grows.



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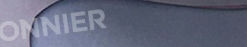
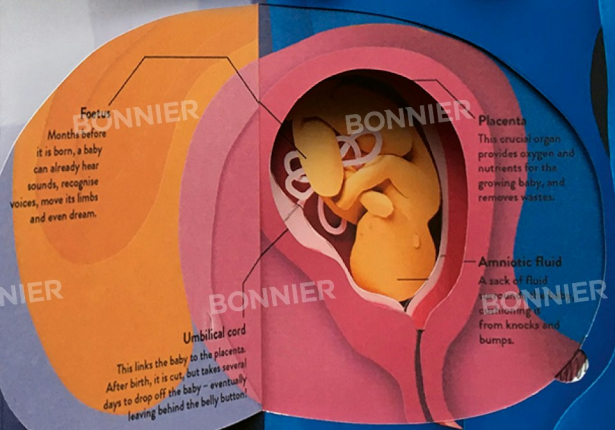
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During puberty, shaped cells called sperm travel along the sperm duct, into the testis and pass out of the body.

Cells made that travel on sperm, millions of sperm swim towards the egg but only one can win it. The egg is fertilised and changes into and moves around to the uterus - a journey of several days.

One problem is sperm can't travel through the skin.



# GROWTH OF A BABY

**The fertilised egg**  
Every single human life starts as one egg joined with one sperm. Once the egg is fertilized, a protective barrier stops any other sperm getting through.

Eggs and sperm contain all the information needed to grow a whole new life. The joined cells divide over and over again to make a ball-shaped clump, which fixes itself to the walls of the womb. The growing baby is now known as an embryo. By the time it is eight weeks old, it has all of its main body parts and looks like a tiny person. For the next seven months, it grows quickly and is known as a foetus.

A growing baby takes everything it needs from its mother, receiving nutrients and oxygen through the placenta. After 40 weeks of pregnancy, the mother gives birth. The walls of the uterus contract and the baby is pushed out. It is entirely dependent on its mother for warmth, food and care.

**Divide and conquer**  
The cell then rapidly divides, again and again. Then the berry-like cluster of cells called a blastocyst attaches to the lining of the uterus.

1 week

4 weeks

8 weeks

20 weeks

30 weeks

37 weeks

40 weeks

**Checking in**  
After about 6 weeks, a heartbeat can usually be detected. Doctors and midwives regularly check the heartbeat to monitor the health of the baby.

**Trimesters**  
Pregnancy usually lasts for 9 months, sometimes divided into three periods called 'trimesters'. The first trimester is when all of the baby's main organs and limbs grow.

**Growing up**  
A human grows more in the first year of life than at any other time. Newborn babies are dependent on their parents for everything. They can only eat milk, and only communicate by crying.

**On the move**  
By the time they are 6-9 months, most babies can crawl or roll. They will start to eat some solids. They will also be making some noises to communicate, and will recognise different adults.

**First steps**  
By a year, some babies will be taking their first steps. They will be able to say words like 'mama' and 'dada' and use simple gestures, such as waving goodbye.

**Fully grown**  
From 37 weeks, the baby is 'full-term' or 'fully-grown' and ready to be born.

**Pregnancy**  
A woman's body goes through many changes during pregnancy. Her breasts will swell, in preparation for feeding the baby with milk after birth. Her hips will slightly relax and widen to allow the passage of the baby during birth. She may also find things smell or taste different. Some women experience cravings for unusual foods!

**Embryo**  
The tiny baby is called an embryo until it is around 8 weeks old.

8 weeks

8 weeks



# GLOSSARY

## Artery

A blood vessel that takes blood away from the heart.

## Carbon dioxide

A waste gas made by the body as a result of respiration.

## Cartilage

A strong, flexible tissue that covers the end of bones and makes up some body parts, such as the nose.

## Cell

The basic building-block of all life. Cells make up all the tissues in the body.

## Gene

A set of instructions which tell each cell how they should be built. Genes are passed down from parents to children, and determine some characteristics, such as eye and hair colour.

## Gland

An organ that makes a substance the body needs, such as sweat or tears.

## Hormone

A chemical messenger carried in the blood.

## Ligament

A strong, flexible band that connects two bones together at a joint.

## Neuron

An individual nerve cell. A bundle of neurons is known as a nerve.

## Organ

A working part such as the heart, brain or lungs, made up of different tissues all working to perform one task in the body. Groups of organs are called systems.

## Oxygen

A gas present in the air, and vital to human life.

## Pulse

The rhythmic throbbing of blood vessels as blood from the heart is pushed through them.

## Respiration

The process of bringing oxygen into the body and releasing carbon dioxide.

## Saliva

A watery liquid made by glands in the mouth. It makes food easier to swallow and starts the process of digestion.

## Tendon

A strong cord attaching a muscle to a bone.

## Valve

A door-like mechanism inside the heart and in larger veins, which shuts to stop blood flowing backwards.

## Vein

A blood vessel that carries blood towards the heart.

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