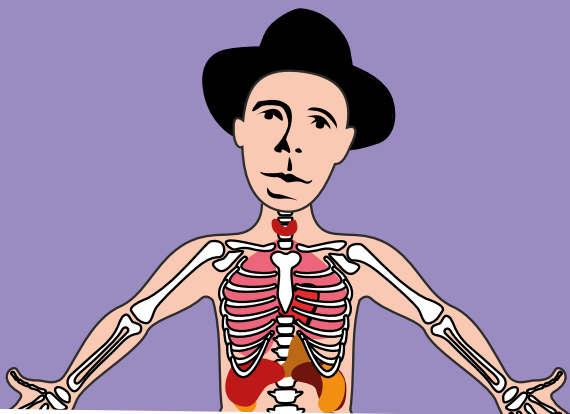


Gunther von Hagens'

# BODY WORLDS

The Original Exhibition



DOCTOR JUNIOR

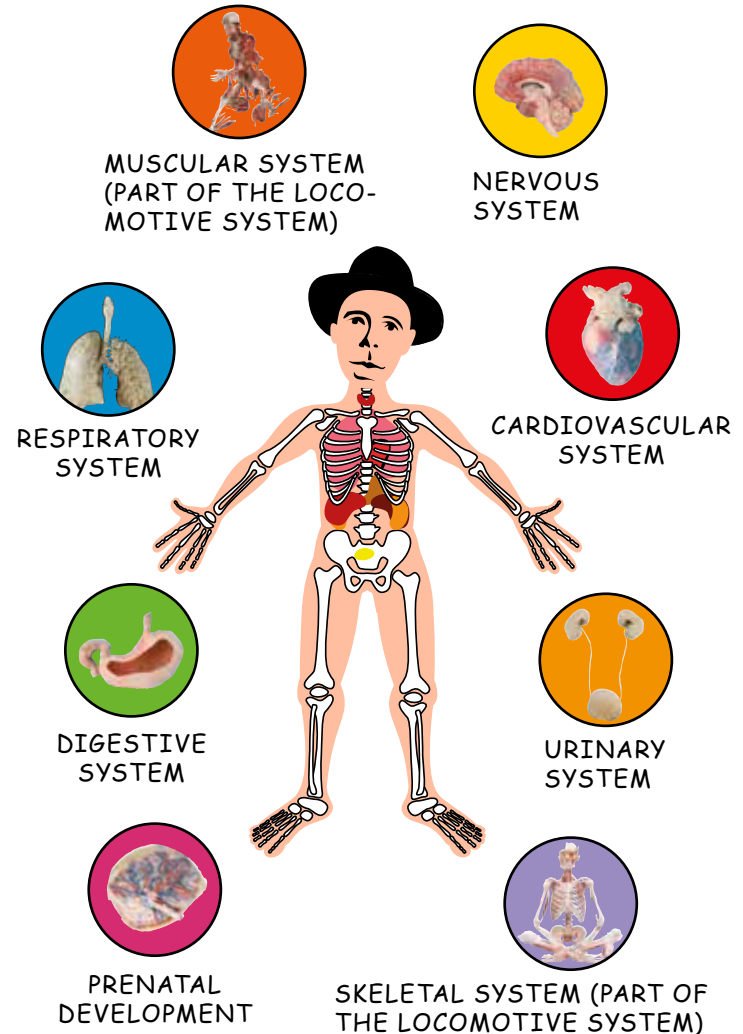


## ENJOY THE QUIZ!

Your body has many organs that work together in a perfect way. You probably know most of them. They have a certain shape and a particular place in your body. For example, the heart, the lungs, the brain and the kidneys, are commonly known organs, but our skin and blood vessels are organs too.

When organs work together in a certain way, it is called a 'system'. All of those individual systems are dependent of each other and allow your body to function smoothly. If something in one of the systems breaks down, an illness may be the result and can then affect different organs.

This BODY WORLDS Anatomy Quiz guides you through all of the important body systems. You will learn a lot about the functionality, particularities and illnesses related to the systems of your body.



# SKELETAL SYSTEM

The skeleton is the internal framework of the body. It provides stability, carries its weight and protects delicate organs. The centre of the skeleton is the spinal column. It makes sure that you walk upright.



The human hand has the same number of bones and muscles.



a ☐ True

b ☐ False

Where is the tiniest bone of your body located?

a ☐ In the nose.

c ☐ In the ear.

b ☐ In the fingers.

d ☐ In the toes.



How many vertebrae make up the the spine?



a ☐ 13

c ☐ 24

b ☐ 33

d ☐ 34

# MUSCULAR SYSTEM

We need our muscles to move. Muscles even work when we only move a little or are completely still. Otherwise we would not be able to stand upright or raise our hand.

Our heart is also a muscle that works day and night.



What kind of muscles exist?



- a ☐ Skeletal muscles
- b ☐ Cardiac muscles
- c ☐ Smooth muscles

What is the role of tendons?



- a ☐ Tendons connect bones together.
- b ☐ Tendons reduce friction and lubricate the joints.
- c ☐ Tendons connect muscles to bones.

Which of the following activities do not need the help of muscles?

- a ☐ Breathing
- b ☐ Seeing
- c ☐ Moving
- d ☐ Thinking



# NERVOUS SYSTEM

The nervous system regulates hundreds of activities simultaneously. From head to toe, there is an extraordinarily delicate network of nerve fibres, which monitor and control almost all bodily processes.



The brain, spinal cord and nerves form the ...



- a ☐ nervous system.
- b ☐ cardiovascular system.
- c ☐ respiratory system.

What is controlled in the brain stem?



- a ☐ Heart frequency and blood pressure.
- b ☐ Respiration, digestion and sleep.
- c ☐ Concentration.

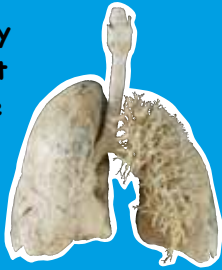
Nerve signals can travel at up to ...

- a ☐ 8 km/h (5 mph).
- b ☐ 80 km/h (50 mph).
- c ☐ 400 km/h (250 mph).
- d ☐ 800 km/h (500 mph).



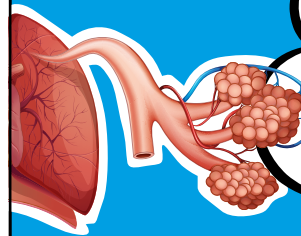
# RESPIRATORY ORGANS

Your body requires a continuous supply of oxygen to keep the body functioning. Inhalation means that the lungs absorb oxygen from the air and pass it on to the blood. Blood distributes oxygen into the whole body. Exhalation means that carbon dioxide is released out of the body.



How much air reaches the lungs per breath?

- a ☐ 2 litres (4 pints)
- b ☐ 1/2 litre (2-4 pints)
- c ☐ 5 litres (11 pints)
- d ☐ 10 litres (21 pints)



Respiration means that oxygen is taken in and carbon dioxide is released. Where does this gas exchange take place?

- a ☐ In tiny air sacs.
- b ☐ In the bronchi.
- c ☐ In the air passages.

What is the role of the mucous membranes in the respiratory tract?



- a ☐ They heat up the inhaled air.
- b ☐ They filter dust and bacteria out of the inhaled air.
- c ☐ They dry up the inhaled air.

# HUMAN BODY SYSTEMS

## Nervous system

The nervous system is comprised of a delicate network of nerve cells, stretched from head to toe, which monitor and control all bodily processes.

## Respiratory organs

The respiratory organs take care of the gas exchange in the lungs. Essential oxygen is absorbed from the air and carbon dioxide is released.

## Cardiovascular system

Our respiratory organs are our most important internal transport system and distribute nutrients and oxygen into the different body parts. Additionally, they collect deposits, which are not supposed to remain in the body.

## Digestive System

The organs of the digestive system break down the food in a way that allows the nutrients to pass into the blood and provide the organism with the energy that it requires.

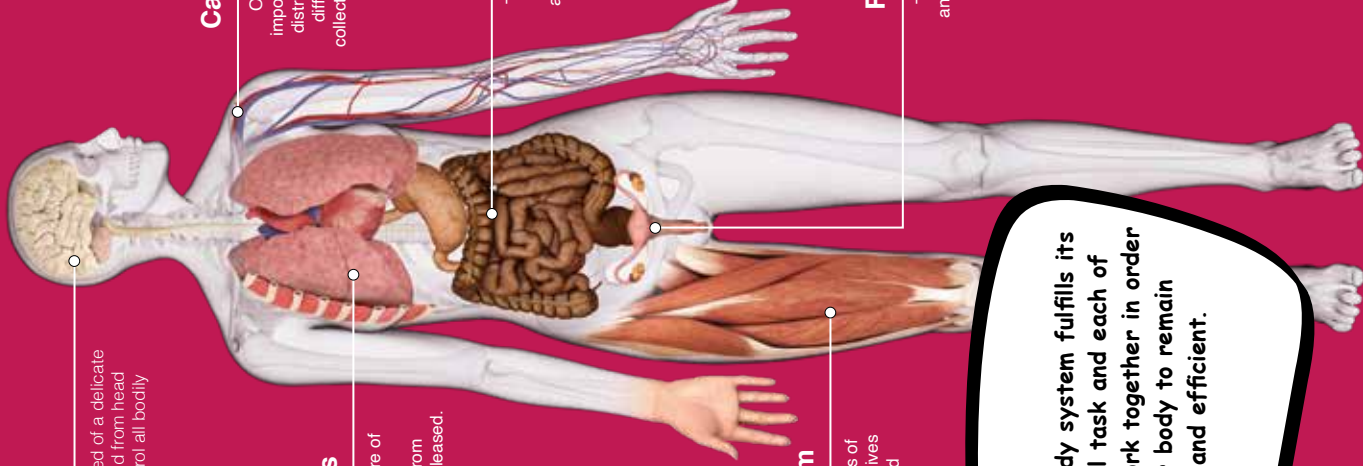
## Locomotive System

The locomotive system consists of bones, muscles, and joints. It gives us shape, provides stability, and allows mobility.

## Reproductive Organs

The reproductive organs of women and men are fundamentally different. They consist of the external and internal sexual organs.

Each body system fulfills its essential task and each of them work together in order for your body to remain healthy and efficient.



# CARDIOVASCULAR SYSTEM

The cardiovascular system consists of the heart and a dense network of blood vessels. This network provides the body with important nutrients and oxygen.



The size of the heart is roughly that of our fist and weighs approximately ...

- a ☐ 60 grams (2 ounces). c ☐ 300 grams (11 ounces).  
b ☐ 150 grams (5 ounces). d ☐ 600 grams (21 ounces).



Laid end to end, what length would the dense network of arteries, veins, and capillaries have?

- a ☐ 96,500 cm (0.6 miles)  
b ☐ 96,500 metres (60 miles)  
c ☐ 96,500 km (60,000 miles)



Which of the following statements about the heart is not correct?

- a ☐ It beats about 70 times per minute.  
b ☐ It is the largest organ in our body.  
c ☐ It pumps about 75 ml of blood per beat.

# DIGESTIVE SYSTEM

In the digestive system, food is processed and turned into energy. Digesting means that nutrients and waste products are separated. Nutrients are passed into the blood, where they can be transported to each individual cell.



Our stomach is able to expand. It is capable of holding at least ...

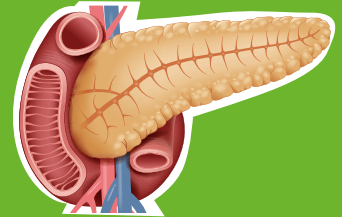


- a ☐ 0.5 to 1 litre (1 to 2 pints)
- b ☐ 1.5 litres (3 pints)
- c ☐ more than 5 litres (more than 11 pints)



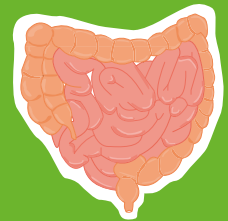
What is produced by the pancreas?

- a ☐ Gland liquid
- b ☐ Saliva
- c ☐ Pancreatic juice



What surface could be compared to the small intestine if you laid it out flat, and what size would it be?

- a ☐ About the size of a Ping-Pong table (4 m<sup>2</sup> / 43 ft<sup>2</sup>).
- b ☐ About the size of a half badminton court (30 to 40 m<sup>2</sup> / 323 to 430 ft<sup>2</sup>).
- c ☐ About the size of a football table (1 m<sup>2</sup> / 11 ft<sup>2</sup>).



# URINARY SYSTEM

Three-fourths of our body is made up of water. Water serves as transportation for all the substances which our body needs: minerals, hormones and parts of food. We need about 33 to 67 ounces / 0.3-0.5 gallons / 2 to 4 pints to replace the water which the body loses every day, through sweating, exhaling and using the bathroom.



What organs shape the urinary tract?

- a ☐ Only the kidneys.
- b ☐ The heart, kidneys and lungs.
- c ☐ The kidneys, ureter and bladder.

How many litres of blood do the kidneys filter per day?



- a ☐ 1 litre (2 pints)
- b ☐ 10 litres (21 pints)
- c ☐ 100 millilitres (0.2 pints)
- d ☐ 100 litres (211 pints)

Kidneys are shaped like a ...

- a ☐ bean.
- b ☐ pea.
- c ☐ pickle.
- d ☐ onion.



# PRENATAL DEVELOPMENT

The first period of human life takes place invisibly in the mother's body. A single cell, or zygote, is formed when the father's sperm fertilises the mother's egg.



From what point is the mother able to feel the movements of the growing child?

- a ☐ From the very beginning.
- b ☐ Only at the end by giving birth.
- c ☐ Approximately starting at the 5th month of pregnancy.

Twins can be ...

- a ☐ only girls.
- b ☐ both girls, both boys or a girl and a boy.
- c ☐ only boys.

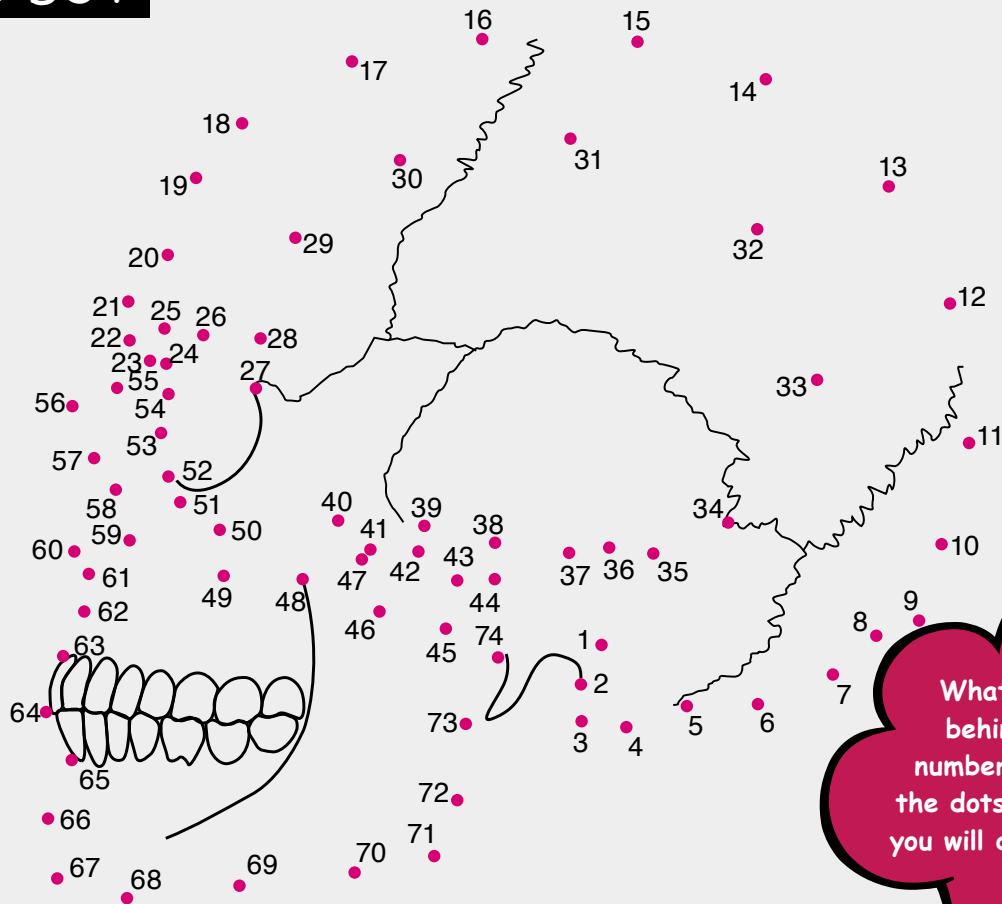


What does the growing child receive through the umbilical cord connected to its mother?

- a ☐ Nutrients
- b ☐ Milk
- c ☐ Oxygen



# DOT TO DOT



What image is hiding behind the dots and numbers? If you connect the dots in the right order, you will discover the answer.

## SKELETAL SYSTEM

Where can you find the tiniest bone of your body?

 **c: In the ear.**

Hammer (malleus), anvil (incus) and stirrup (stapes) are the names of the three hearing bones in our ears. All three bones are less than an inch long, approximately 2.5mm long and weigh 2 to 4 milligrams (0.03 – 0.06 g), the stapes are the smallest of them. Additionally, they received their names because they are shaped like a hammer, an anvil and a stirrup.

The human hand has the same number of bones and muscles.

 **b: Wrong**

The hand is a complicated structure, containing 27 bones, eight carpals, five metacarpals and 14 bones in the fingers, which are connected by ligaments and joints. The majority of the 33 muscles are in your forearm.


How many vertebrae does the spine contain?

 **c: 24. Vertebrae.**

The spinal column keeps head and torso straight and makes it possible for the body to move or to bend. The spinal column is the main backing/support and also protects the spinal cord.

## MUSCULAR SYSTEM

What kind of muscles exist?

 **a, b and c.**

There are three kinds of muscles in the body: skeletal muscles, cardiac muscles and smooth muscles. Cardiac muscles contract rhythmically and can only be found in the heart. Smooth muscles exist in the hollow organs, for example in the bladder. The skeletal muscles perform voluntary movements, for example when moving arms and legs.

What role do tendons play in your body?

 **c: Tendons connect muscles to bones.**

They strongly tighten skeleton muscles to the bones.

Muscles and bones work together and provide the power which the body needs. A human body has more than 700 muscles and all of them look totally different. Looking at the shape of the muscle, you can tell how strong it is.

Which of the following activities do not need the help of muscles?

 **d: Thinking**

When you breathe, you use the muscles which make you inhale and exhale. You need the eye musculature for seeing. Also when you participate in athletic activities, many muscles are needed. Only for thinking, no muscles are necessary. But the brain gives the muscles orders, so they work. Nerve cells connect each muscle fibre with the brain. Therefore, the brain is always informed about how every muscle is functioning. For example it knows if the muscles are tired, well rested, stressed or unstressed.


## NERVOUS SYSTEM

The brain, the spinal cord and the nerves form ...

 **a: The nervous system.**

Nerves constantly collect information about the organs of perception and forward them to the spinal cord, which forwards them to the brain.

What is controlled in the brainstem?

 **a: Heart frequency and blood pressure**  
**b: Respiratory/breathing, digestion and sleep**  
**c: Concentration**

The brain is the body's command centre. It contains three main parts: the cerebrum, cerebellum and brain stem. They all have different functions/duties, but also work together. The cerebrum regulates thinking and acting and puts all information together to a meaningful connection/relationship. The cerebellum is in charge of balance and coordination of movement. The brain stem regulates essential functions, such as breathing, digestion and further vital functions.

Nerve signals are forwarded at the speed of ...

 **c: 400 km/h (250 mph)**

Each nerve contains thousands of nerve cells, which can have "arms" as long as 1 m (3.2 feet). Information is sent to the brain, similarly to an electric cable, to let it know what's going on in each part of the body.

## RESPIRATORY SYSTEM

How much air reaches the lungs per breath?

 **b: 1/2 litre (2-4 pints).**


With every breath, about 2-4 pints are absorbed, at times of effort even up to ten times as much. Your body cannot store oxygen, therefore you have to breathe day and night. This happens automatically. Your brain determines how many times you breathe.

While breathing, you will inhale oxygen and exhale carbon dioxide. Where does this gas exchange take place?

 **a: In the tiny air sacs (alveoli).**

The gas exchange, the absorption of the inhaled air and the release of the used air, takes place in the septum of the tiny air sacs in the lung. This process is also called 'exterior respiration'.

What role do the mucous membranes play in the respiratory passage?

 **a: They heat the inhaled air.**  
**b: They filter dust and bacteria out of the inhaled air.**

This coating, which is similar to mucous, moistens the passing air. Furthermore, deposits such as dust or pathogenic germs stick on it. The inhaled air is also heated. At the nasal concha there is a tight net of tiny blood vessels. The colder the inhaled air, the stronger the mucous membrane is supplied, which leads to the heating of air.

## CARDIOVASCULAR SYSTEM

The size of the heart is roughly that of our fist and weighs approximately ...

 **c: 300 Grams (11 ounces)**

A human heart weighs a little more than two sticks of butter 250 g (8.8 oz). It beats more than 100,000 times a day and moves the approximately 1.3 gallons of blood, in every human body, the blood circulates the body around 1,500 times per day.

Laid end to end, what length would the dense network of arteries, veins, and capillaries have?

 **c: 96,500 kilometres (60,000 miles)**

Laid end to end, the cardiovascular network of an average adult would wrap around the earth more than twice. Some of your blood vessels are as thick as a felt tip pen, others as thin as a single hair.


Which of the following statements about the heart is false?

 **b: It is the largest organ in our body.**

Not the heart, but the skin is our largest organ. It weighs more than any other organ and it grows with us. It is able to let hair grow, it keeps us warm or cold and it is even able to feel. For humans, the skin is 8 mm thick. However, your eyelid is only as thick as a piece of paper.

## DIGESTIVE SYSTEM

Our stomach is able to expand. It is capable of holding ... litres of food.

 **b: At least 1.5 litres (3 pints) of food fit in our stomach.**


There, the food is processed and mushed in about three hours. Salt acid/hydrochloric acid kills bacteria, acids and enzymes help to dissolve the nutrients. The food pulp is slowly passed into the small intestine, the main site of digestion, where nutrient molecules are absorbed into the bloodstream.

What is produced by the pancreas?

 **c: Pancreatic juice.**

The pancreas is located across the back of the abdomen, behind the stomach. It produces a digestive fluid, the pancreatic juice. In this juice, there are many substances which digest nutrients.

What size could the surface of the small intestine be compared with if you laid it out?

 **b: About the size of a half badminton court (30 to 40 m<sup>2</sup> / 323 to 430 ft<sup>2</sup>).**

In the small intestine, nutrients are chemically broken down and led into the bloodstream. To increase the area for absorbing nutrients, the small intestine has ring-shaped folds and a dense network of finger shaped villi.

## URINARY SYSTEM

### What organs shape the urinary tract?

#### **c: Kidneys, ureter and bladder.**

The kidneys filter water-soluble waste products from the blood and expel them in the urine. The urine first collects in the renal pelvis which is a part of the ureter in the kidney. As soon as your body alerts you that the bladder is full, you have the urge to go to the bathroom.

### How many litres of blood do the kidneys filter per minute?

#### **a: 1 litre (2 pints).**

The kidneys filter about 1 litre (2 pints) of blood every minute. But only one per-cent of it is released by urine. The rest of it is taken back to the blood for circulation. Without the essential work of the kidneys, the body would be poisoned from inside.

### Kidneys are shaped like a ...

#### **a: Bean.**

Every human being usually has two kidneys. You can find them underneath the last rib on the left and the right of your spine. One kidney is about 10-12 centimetres long (4-5 inches) and about 2.5 centimetres (1 inch) wide. Overall they look like a large red-brown bean.

## PRENATAL DEVELOPMENT

### Twins can be ...

#### **b: Both girls, both boys or a girl and a boy.**

You can separate between Monocygotic and dizygotic twins. Monocygotic twins are made, when the egg is separated, after being fertilised. The twins look closely alike because they originated from only one fertilised egg. Dizygotic twins are made when two ova are fertilised by two sperm. Therefore, twins can also be girls, boys or a girl and boy.

### From what point is the mother able to feel the movements of the growing child?

#### **c: Approximately from the 5th month of pregnancy.**

Most mothers are able to feel movements of the baby starting from the 5th month of pregnancy. This does not mean that the baby has not moved before. Contrary, starting at the 8th week the baby is a real performer. At this point it is too small for the movements to be felt through the abdominal wall.

### What does the growing child receive through the umbilical cord connected to its mother?

#### **a: Nutrients c: Oxygen**

The umbilical cord is about 55 cm long and 2 cm thick. It provides the baby with all important nutrients, which it needs to grow. It also passes along oxygen from the mother.

## DID YOU KNOW... ?

When you laugh, 15 facial muscles contract, when you frown, it's 43!

The muscles of the esophagus help to transport the food to the stomach, even when you are doing a headstand.

Blood vessels, that pump the blood away from your heart are called arteries. Blood vessels, that pump the blood towards the heart are called veins.

The brain is as smooth as butter. Therefore, it needs the hard skull for protection.

Your eye muscles are the most active muscles because they are constantly needed for seeing.

Teeth are stronger than bones.

Each hair root has a small muscle which is able to erect when it is cold or when you are afraid of something. It is called getting 'goosebumps.'

Undigested parts of food stay in the colon about 6 to 20 hours.

There are body parts that do not contain blood, these include hair and nails, the cornea of the eye and dental enamel.

When your arms fall asleep, it means that a nerve is pinched, not that blood is not rushing through.

Muscles look red because they are very well supplied with blood.

The hand is the most flexible part of the body.

It is possible to survive 40 days without food but only six days without water.

The body cannot save oxygen which means that a person has to breathe day and night. This happens automatically.

The heart is not heart-shaped but instead it's mostly round.

Urine flows into your bladder, even when you are doing a handstand.

The heart of an embryo starts beating between the 18th and the 24th day after fertilisation.

Humans and horses have the same amount of bones.

# WORD SEARCH

Every word that is listed below is hidden horizontally, vertically, diagonally, but also backwards within the scrambled letters. Can you find them?

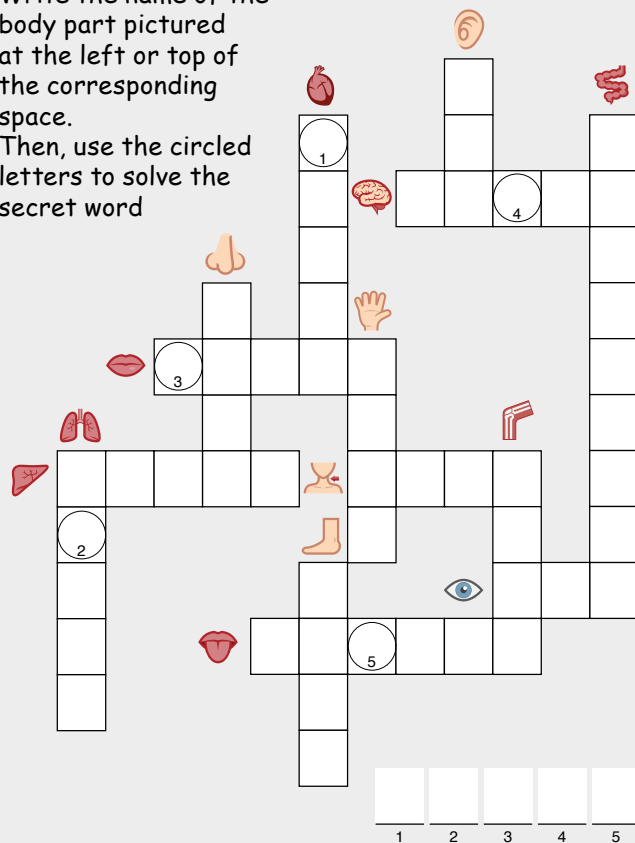
R	K	E	L	N	K	P	T	X	E	E	B	B	T	L
B	E	E	L	I	E	N	G	I	A	E	L	E	E	L
O	G	S	D	C	E	C	T	D	R	N	O	L	N	A
F	R	N	P	M	S	R	K	N	L	K	O	L	D	G
B	E	G	E	I	A	U	I	E	S	I	D	Y	O	J
Y	I	V	A	E	R	D	M	P	V	W	V	C	N	A
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M	D	E	R	M	I	S	T	A	E	Q	I	T	R	N
U	X	G	W	Z	X	R	R	I	Q	V	E	N	E	S
D	I	G	E	S	T	I	O	N	O	R	O	E	E	M
A	R	B	E	T	R	E	V	B	I	N	L	V	N	O
S	T	O	M	A	C	H	R	E	E	P	R	R	A	T
F	T	Q	Y	X	G	A	S	N	S	E	R	A	M	H
A	R	M	N	I	I	T	O	D	N	P	C	C	U	E
T	M	K	A	N	C	B	N	R	Q	K	E	S	H	R

Appendix	Dermis	Knee	Organ	Throat
Arm	Digestion	Leg	Respiration	Vein
Arteries	Ear	Liver	Rib	Vertebra
Belly	Gall	Mother	Scar	
Blood	Heart	Movement	Spleen	
Bone	Human	Muscle	Stomach	
Brain	Kidney	Nerves	Tendon	

# CROSSWORD PUZZLE

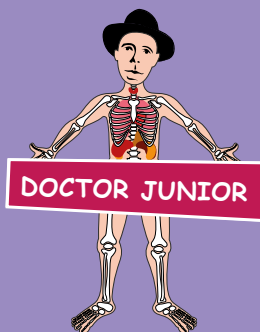
Write the name of the body part pictured at the left or top of the corresponding space.

Then, use the circled letters to solve the secret word



1 2 3 4 5

[www.bodyworlds.com](http://www.bodyworlds.com)



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