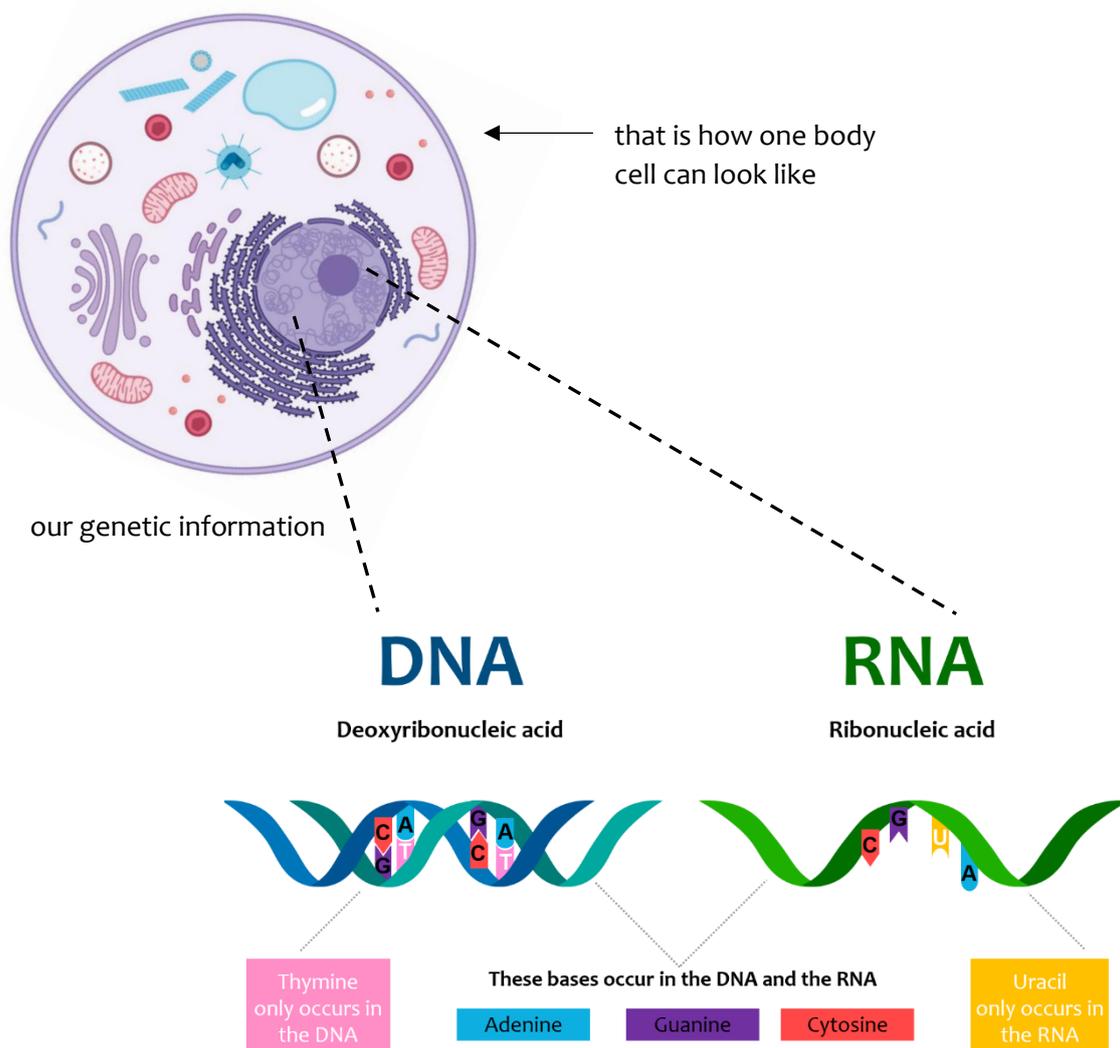


The building blocks of life

In this week's Pop-Up Science edition, we are dealing with DNA, the carrier of our genetic material, and how we can read its information.

The DNA is a very long and thin thread that is constructed like a twisted rope ladder, which is called a double helix. If you pulled this “ladder” apart, the thread would have a length of about one meter and eighty centimeters! And this thread fits into every single cell of our body!

This is possible because the DNA is incredibly thin. Its diameter is only 2 billionths of a meter, that is 0.00000002 meters (or 25,000 thinner than a single hair)! In the cell's nucleus, this thin thread is packed up like a very dense ball of wool.



A. Read the following text and underline the most important pieces of information!

DNA is short for deoxyribonucleic acid. Regardless of whether it is a muscle, heart or brain cell, each cell of our body contains DNA which carries our entire genetic information, our genes. In human cells, the DNA is packed into 23 pairs of chromosomes. This means, that humans have a total of 46 chromosomes in most body cells. Fruit flies, however, only have 8 chromosomes, and so do champignons (yes, of course mushrooms – as well as plants – have cells and DNA, too!).

Every human has unique genetic material. This is because everyone receives different parts of genetic information from their mother and father. Thus, the parents' chromosomes are mixed differently in every child. But 99 % of the genetic information is the same in every person!

You can imagine the shape of the DNA as a twisted rope ladder. The DNA consists of a material called deoxyribose. This deoxyribose forms the strands of the DNA—the rope of the rope ladder. The deoxyribose holds nucleic bases. Two opposite bases always bind to each other and form base pairs—the runs of the rope ladder. The bases are called adenine (A), thymine (T), guanine (G), and cytosine (C). You can imagine our genetic code as analphabet soup of the letters A, T, G, and C.

A gene is a section of DNA and the template for the construction of proteins. Proteins help, for example, with blood formation, muscle development, but are also important for any other process in the human body. To be able to use the information of the DNA, the genes on the DNA are translated to RNA language. RNA is the single-stranded "little sister" of DNA. Its task is to "read" DNA and pass on information. The RNA language is then again rewritten into protein language. This language decides in which order different amino acids, the building blocks of proteins, are bound to one another.

In brief, a certain sequence of base pairs on the DNA and then RNA results in a certain sequence of amino acids and thus a certain protein. And all this happens in just one single cell – pretty complicated, right?.

B. Try to answer the following questions.

Check the correct answers.

1. How many chromosomes do most cells of the human body have?

23

46

8

2. What is the name of the material that DNA is made of?

saccharose

ribose

deoxyribose

3. What are the four nucleic acids called that make up DNA?

adenine, threonine, guanine and cytosine

adenine, thymine, guanine and cytosine

adenine, uracil, guanine, cytosine

4. A gene is a section of ...

RNA

DNA

a protein

5. The RNA is double-stranded and passes on information which is needed for the formation of proteins.

true

false

6. What is the correct order of protein production in the human body?

RNA – DNA – protein

protein – DNA – RNA

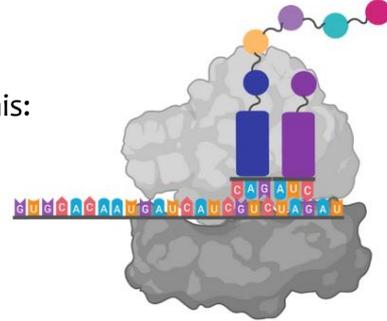
DNA – RNA – protein

C. Do you speak the language of proteins?

DNA is translated to RNA. RNA defines in which order the amino acids must be linked to form a protein. Like DNA, RNA contains the nucleic bases adenine, guanine and cytosine. However, thymine is replaced with uracil (U).

Once all amino acids have been linked correctly, the protein is complete!

The machine that the cell needs for this is called ribosome and looks like this:



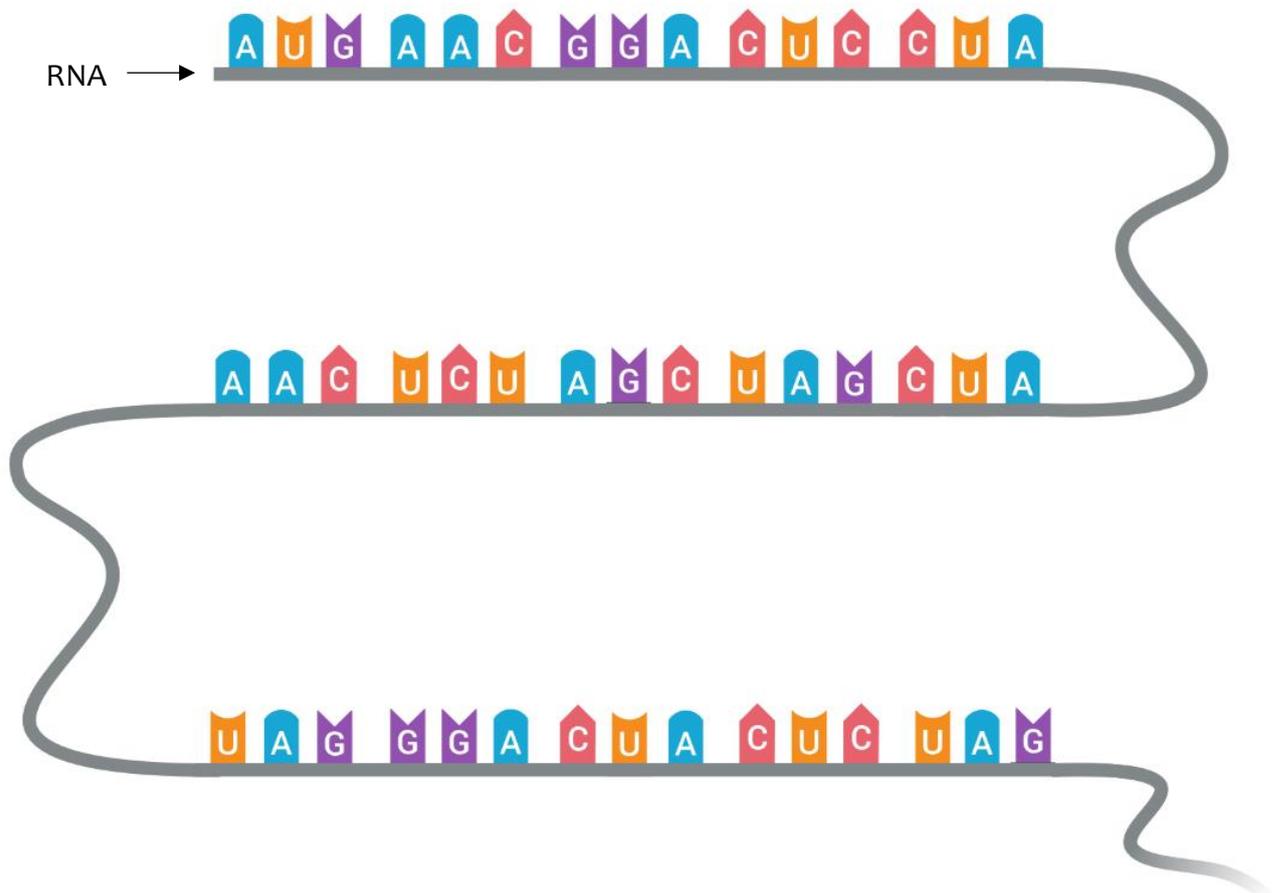
Can you build the protein in the correct order?

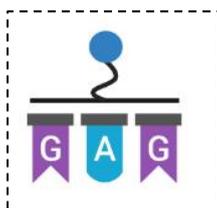
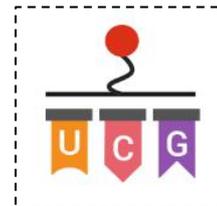
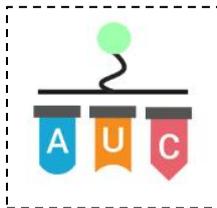
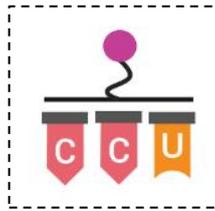
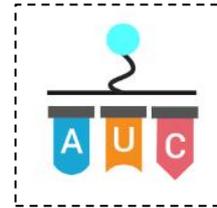
There are two important rules in RNA language:

- **uracil (U)** only binds to **adenine (A)**
- **cytosine (C)** only binds to **guanine (G)**



Cut out the individual amino acid building blocks and place them on the RNA strand in the right order. You'll find the building blocks on the next page.





D. Word search

Can you discover all the hidden words in our word search this time?

CHROMOSOMES

ADENINE

GENETIC MATERIAL

SUGAR

THYMINE

NUCLEIC ACID

DEOXYRIBOSE

CYTOSINE

PROTEINS

AMINO ACID

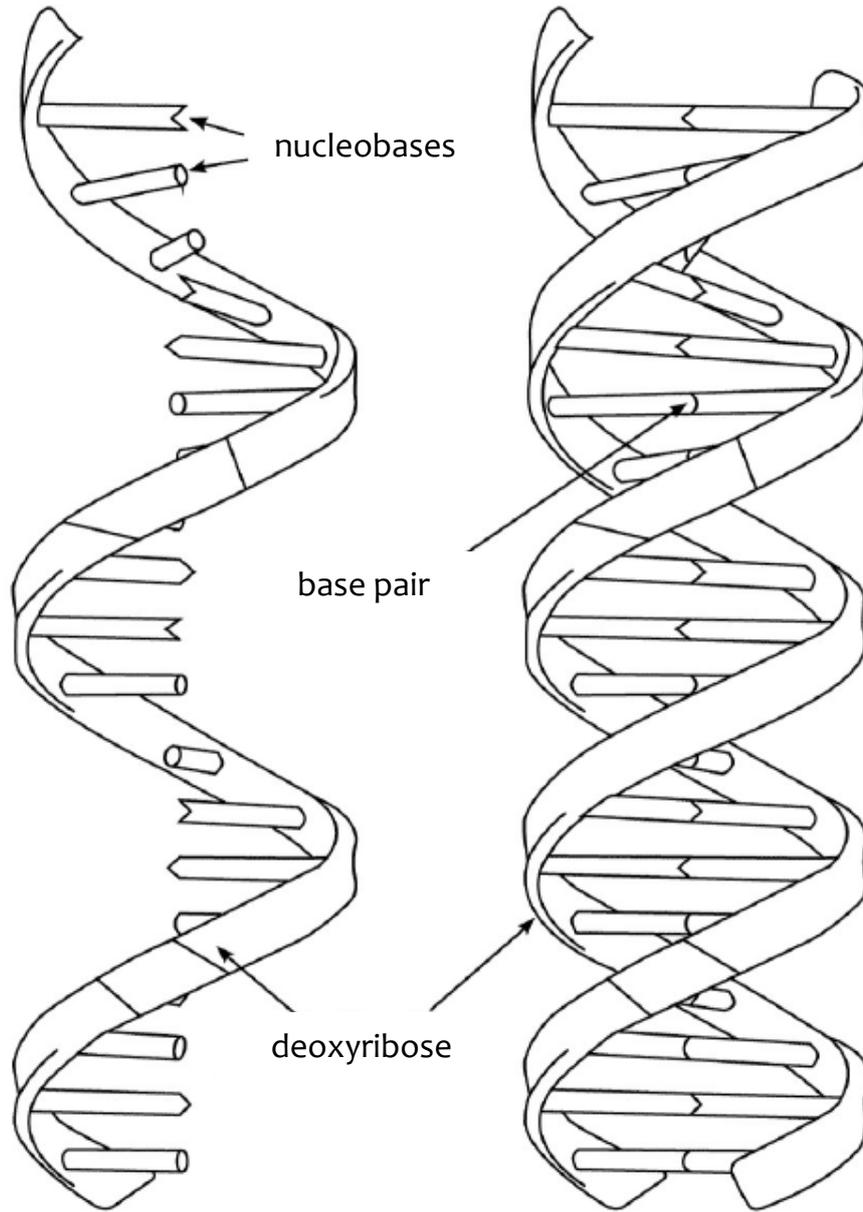
GUANINE

RIBONUCLEIC ACID

Circle each word. Good luck!

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

**E. Color the single-stranded RNA and the double-stranded DNA.
Have fun!**



RNA

Ribonucleic acid

DNA

Deoxyribonucleic acid