

Documentation for the teaching material »Blood«

School:	Staatliche Regelschule »Martin Luther« Zella-Mehlis (grades 5 – 10)			
Grade:	8			
Subject:	Biology			
Authors:	Beatrix Mähler, Jörg Triebel			
Target:	Independent acquirement of competence to the topic »blood«; training of key qualifications, esp. reading skills, methodical competence; microscopy and outlining; structuring; textbook as important information source			
Organization form/time needed:	Pair work approx. 12 lessons (6 x 2 lessons in time block) + 1 lessons systematization/ZF + 1 lessons class work differentiation, for example, at station 9 possible by handing out a text with missing words as worksheet			
Evaluation of the students' performances:	Verbally during the development; gratification system (at exact reading, station 9) Grading after each working phase, so that every student has a grade at the end of the work station, test paper with sophisticated tasks according the Y-Model			
Material Requirements:	See material list; copied in color, laminated			
Methodical Indications:	Partner finding via partner cards; survey (entry by students), Teacher control of the students' routing slip; Helping principle on the blackboard: I need help/I can offer help; Bonus questions that can serve the differentiation; Diagnosis sheet for preparing the test (after station 13) see also material list			
Students' Materials:	File, textbook »Volk und Wissen Volume 2« (brown); routing slip with rules for »jumbled sentences«; worksheets »Blood Circulation« and »Heart«; microscopes + white paper			
Literature:	Suggestions from regional biology teacher education; »Erlebnis Biologie«/Schroedel/Bd. 2; articles from the daily press, pharmacy journals, »Unterrichtshilfe Bio 8«; »Zeitbild »Blut«			

Stations Cardiovascular System

Station/Theme	Material	Notes	
1. Function of the blood	text		
2. Components of the blood	microscope DP blood slide, drawing paper, pencil		
3. What does our blood consist of?	textbook page 64	survey	
4. Blood - more than a red fluid!			
5. Watch your blood flow!	fabric for stasis bandage		
6. How is your blood transported?	DP vein, artery, drawing paper	table colored and laminated as cards	
7. Does blood really flow in a circle?			
8. The heart - our engine	worksheets		
9. Which way does the blood take through your body?	text with missing words		
10. Our sealing system – the blood coagulation	textbook page 65	shaken sentences	
11. The blood types	textbook page 65/66 questionnaire	Z: rhesus factor	
12. Cardiovascular diseases	risk factors	3 hints	
13. AIDS	text questionnaire	textbook tasks 1, 2	
Facts and figures	textbook page 64	survey	
Extra: Why is blood red?			
Extra: Lymph			
Extra: Construction of a heart model			
Extra: Auto Diagnosis Sheet and term trainer			

Station Work to the topic »Blood – more than a red fluid«

To make learning at stations effective, you have to follow some rules. Unfortunately, the sentences are mixed up. Rearrange them into their correct order!

Shaken sentences	Rules
 into your file/carefully/ silently and write/Work 	
2. or with/work/You can/alone/ a partner	
 the material/handle/carefully/ tidiness and completeness/ care for/and. 	
4. given/time/Control/the	
5. the teacher/if necessary/Only/ask	
6. can get/that you/Keep in mind/ a mark.	
 we summarize/everything,/ of the station work/to be prepared At the end/for a test paper 	

You keep your own routing slip here. You have to work on 13 stations.

Simply mark off the list what you have done. Was it easy or hard? Mark it with a cross.

Note that every station has a number and a title.

If you finish the compulsory part very quickly, you can start with the additional stations.

Number/Topic in short form	completed	easy	difficult
Extra			

Station 1: Function of the blood

Imagine a house with its heating system: In the basement there is a furnace that burns oil, gas, or wood. The acquired energy heats the water of the heating system. Via different pumps, the heated water circulates to radiators in the house or to the floor heating. Blood moves, like the water in the heating system, through the veins to all organs, tissues and cells. It transports water, salts, nutrients, vitamins, hormones, carbon dioxide, oxygen and waste products of the metabolism. It is the main **transport vehicle** of the human body. Moreover, you clearly realize that your body is warm. The blood regulates your heat balance. The energy of your food is released in the numerous mitochondria of the cells through biological oxidation, just like the combustion of fuel oil in the heating furnace. The blood absorbs this energy to spread it in the body. Your heart is the pump which allows the blood to flow in a circuit. If you ever have fever, this mechanism runs at full speeds. Your metabolism is increased so that the white blood cells disarm the annoying germs. Your immune system increases the production of antibodies that get faster through the blood to the source of the disease. If you get injured, blood leaks out of the wound. This will prevent outside germs from getting into your body. At the same time the **blood coagulation** takes effect: a lot of the platelets decompose by the contact with air and form the scab.

Got that? Then solve the following tasks:

Read the text carefully. Make a word list as follows:

Draw a table with two columns.

Add into the table header

- left: the function of the blood
- right: information

Fill in the table.

Use the bold typed words and the corresponding information.

Blood in the language

blood brother, blood suckers, related by blood, blue blooded, the blood froze in his veins, bloodthirsty, hot-blooded

Facts and figures about blood

- A human has 4-6 liters of blood.
- In one mm³ blood there are 5 Mio. red and 5,000-10,000 white blood cells as well as approx. 300,000 platelets.
- In the bone marrow of your body there are 2 Mio red blood cells that form in a second.
- Each of them carries oxygen to the cells about 75,000 times.

Station 2: Components of the blood

- Examine the present blood slide via a microscope.
- Make a microscopic drawing.
- Therefore, use the available drawing paper. Draw with a pencil.
- Compare with the image or your textbook and mark the components.
- Glue your sketch carefully into your file.



Station 3: What does your blood consist of?

- Now you should gather information about the components of your blood. Use your textbook for it.
- Copy the flow chart and complete it.



blood fluid

Plasma consists of approx. 90 % water. Furthermore it contains glucose, fats, proteins, salts, hormones and waste products such as carbon-dioxide. Blood plasma without the coagulant fibrinogen is known as **blood serum**.



Station 4: Blood – More than just a red fluid!

You certainly know these »Wanted« posters that search for criminals. This time, the elements of blood are to be caught.

Gather information about the blood cells in your textbook (pages 64/65). Design a »Wanted« poster with a picture of the three types of blood cells.



Station 5: Watch your blood flow!

Copy the table. Note down the trial and your observation.

Test	Observation
T 1: back of the hand	
Τ 2:	
T 3:	
T. 4	
4:	

- T 1: Compare the color of the left and the right **backs of your hands**. Lift your right arm straight up and let the left arm hang down for about two minutes. Now watch the back of both hands.
- T 2: Uncover the right arm. Apply a **stasis bandage** with the help of a fabric not too tightly above the elbow. Hold the back of a chair firmly with your left hand for some time. Watch the inside of the **forearm**. Try to watch the swelling of the vein and the nodes (venous valves)!
- T 3: Run your thumb over the **swollen vein**!
- T 4: **Loosen** the thumb, write down your observations. In case of heavy bleeding it is advisable to slow down the flow of blood by pressing certain vessels. Find out with the textbook which vessels these are.

Station 6: How is your blood transported?

Your blood flows in a closed system through the body, similar to the water of water pipelines in a house. Instead of pipelines we have blood vessels. These are built differently and have several functions. Here you can find out everything about it.

- Examine the preparation of the two blood vessels.
- Make a sketch on the drawing paper. Glue it into your file.
- Put the cards in the right order. Transfer this order into your file.

blood vessel artery		vein	capillary	
build strong muscular annulus		less muscular annulus, venous valves	thin walled, small diameter	
function	transports blood off the heart	transports blood to the heart	serves the mass transport and mass exchange	

Station 7: Does the blood really flow in a circle?

Our blood flows through the body in blood vessels. The length of all blood vessels is 400 000 km. This is the distance between the earth and the moon. We distinguish between a **pulmonary circulation** and **systemic circulation**. Both circuits are connected with each other by the heart. It pumps blood (red) that is rich in oxygen, into the body and brings back blood rich in carbon dioxide (blue). Now this one is pumped into the lungs, the carbon dioxide is exhaled and oxygen is inhaled. The cycle »starts« again.

- Gather detailed information about the blood circulation in your textbook (pages 70/71). Take a worksheet and glue it in the middle of your file.
- Mark the components of the blood circulation left.
- Match the terms »pulmonary circulation« and »systemic circulation« to the boxes on the right.
- Sketch in the flow direction of the blood between pulmonary and systemic circulation Use: red for blood rich in oxygen and blue for blood rich in oxygen directed

blue for blood rich in carbon dioxide.



Station 8: The heart - our »engine«

	PROFILE
size:	approximately like a clenched fist
mass:	approx. 280 g (woman) to approx. 320 g (man)
build:	hollow muscle, divided into 2 halves by the cardiac septum each consisting of the main chamber and the atrium
wall thicknesses:	right ventricle 2-4 mm left ventricle 8-11 mm
beat rate:	70 beats a minute
beat volume:	70 ml each ventricle
pumping capacity/d	ay: 5,700 l through 9,600 km veins and arteries and 100,000 km capillaries

- Gather information in your textbook page 70. Note eight important facts into your file.
- Follow the path of the red blood cell from the heart through your body back to the heart with the help of the illustration.
- Take a worksheet and glue it into your file. Mark the most important components.
- Pick a study partner. Describe to each other the journey of the red blood cell with the help of the marked illustration.

The way of the red blood cells through heart and circulation:

From the left ventricle (1) it passes through the large aorta (2) into the systemic circulation. Back to the heart the trail leads through the vein (3), into the right atrium (4). Passing the heart valves it heads into the right ventricle (5). From there the route leads through the pulmonary artery (6) to the lungs. Following one of the pulmonary veins (7) the red blood cell reaches the heart again. It ends up in the left atrium (8). Now the cycle can start again.



Station 9: Which way does the blood take through your body?

Test yourself by filling in the missing words. Compare afterwards with your study partner.

- 1. The blood rich in o____ runs from the lungs through the pulmonary ____ into the ____ atrium.
- 2. This is filled with blood rich in _____ and contracts.
- 3. Due to the atrioventricular valves, the blood rich in oxygen flows from the _____ into the left _____.
- It is filled with blood and contracts. The blood is pumped into the ___y ___y (aorta).
 The semi-lunar valves prevent it from flowing back.
- 5. The _____ leads the blood rich in _____ from the heart back into the body.
- 6. There the _____, the _____ and the _____ are provided with oxygen via the _____.
- 7. This part is called »_____ circulation«.
- 8. The _____ from the blood containing ______ from the body into the heart.
- 9. The _____ is filled with blood containing _____ and contracts.
- Due to the atrioventricular valves, the carbon dioxide containing blood flows from the right _____ m
 into the right _____.
- This ventricle is filled with blood, contracts and pumps the blood into the pulmonary _____.
 The semi-lunar valves prevent it from flowing back.
- 12. The pulmonary _____ transports the carbon dioxide containing blood to the lungs. Inside the pulmonary alveoli, the gas exchange takes place. Therefore, the r __ blood cells are loaded with _ x _ _ _ and get back to the heart via the pulmonary _ _ _ (see 1).
- 13. This part is called »b _ _ _ circulation«.

Fill in the gaps. You can use the following terms: cells, body artery, artery, carbon dioxide, organs, right, capillaries, ventricle, pulmonary, veins, tissue, aorta, left, atrium, oxygen, vena cava, red, body.

You have made it! So if you have filled in the gaps properly, go to your teacher. You earn a little reward.

Extra: Transfer the table and complete it.

circulations	blood vessels	Transported gases	Provided with oxygen are:
-	towards the heart:	-	
-	off the heart:	-	

Station 10: Our sealing system – the blood coagulation

Did you know? There are about 5,000-8,000 white blood cells, 4-5 million red blood cells and 200,000-350,000 platelets in one mm³ blood of a healthy person.

But what happens when you hurt yourself?

Sure, it forms a scab. After it comes off, you have a scar. And after some time there is nothing there. A miracle? No! This is about the blood coagulation.

In your textbook page 65 you will find a short text. Read it carefully. Now explain the sketch regarding the »blood coagulation«.



You can use the word puzzle, but ... First you have to puzzle sentences 1–5 together. No pain, no gain ...

(Please cut the puzzle)

- 1. Blood gets in contact with air.
- 2. Platelets decompose and release an enzyme.
- 3. The enzyme lets the blood coagulation enzyme react.
- 4. The coagulation enzyme causes the formation of protein filaments.
- 5. A net of protein filaments contracts during the drying, the scab is formed.

Station 11: The human blood types

Does everyone have the same blood or are there differences? Read the text in the textbook page 65/66. Then answer the following questions:

- What blood types are there for humans?
- Who discovered them?
- Why do you always have to be aware of the patient's blood type before blood transfusions?
- What does the »Rhesus Factor« stand for?

Extra: What is the significance of the rhesus factor during pregnancy?

Frequency of blood types and rhesus properties



Station 12: Cardiovascular Diseases

Our organs do not always work as intended by nature. Pressure, stress, lack of physical activity, unbalanced diet, lack of sleep, alcohol and nicotine – in short, an unhealthy lifestyle makes us sick. A typical example is Otto Wahl.

> Two billion and thirteen times, the heart of Otto WahL was beating. Two billion and fourteen now But Otto doesn't care about it. the is sitting in the office, does not exercise, leaves the house only by car. the smokes, indulges in fatty food and totally forgot about his heart. This is just laboring to let the blood through the veins that are about to close. Beat number sixteen has made it but at number seventeen it broke off. So Otto WahL, though physically strong, died of a heart attack.« 1

- Calculate how old Otto Wahl was?
- Read the story carefully and assemble all the mentioned risk factors for a heart attack.
- What would the lifestyle be of a person who is in danger of having a heart attack? Formulate 3 recommendations.

From: Bay F., Schneider H.: NAT URA, 5. und 6. Schuljahr, Lehrerband, Band 1, Biologie f
ür Gymnasien,
 Auflage. Ernst Klett Verlag; Stuttgart, D
üsseldorf, Leipzig, 2000

Station 13: AIDS

You probably know the movie »Philadelphia«. It is about a man suffering from AIDS, whose life was suddenly changed by this disease. AIDS is the No. 1 civilization disease in the world. Studies repeatedly show new insights.

AIDS is still not curable. What should you know about AIDS?

Look for the following facts using the textbook page 68:

- a. AIDS means:
- b. year of discovery:
- c. pathogens (shape, size, proliferation, international name):
- d. mechanism of action:
- e. transmission:
- f. symptoms (characteristics of the disease):
- g. protection:

What personal question do you have about this topic? Write it anonymously on a card and enter it into the black box.

Extra: textbook page 68/tasks 1, 2 - What does HIV-positive mean?

How fit are you?

Test yourself! You know, that at the end of the station work a test paper is due. If you have worked carefully and completely on the stations, it won't be too difficult to match the most important information to the box with the terms. For the moment you can (and you should) use your records. Since you will write the test paper on your own, you should work on the term trainer alone. In only that way can you find out your strengths and weaknesses. Is there a better preparation for a test paper?

term trainer »blood and circulation«

The heart is a we and consists of the following components:	Circulation 2 sub circulations:	The aorta or body artery	How to protect yourself from AIDS:
Blood vessels	Transported gases in the blood:	3 risk factors for a heart attack	Arteries lead blood That's why they are
The blood has 4 functions:	Blood coagulation Which blood component does »seal« something?	Provided by oxygen are:	Symptoms of AIDS
Blood types (4) Discoverer	Cardiovascular diseases	Veins lead the blood That's why they are	Hemoglobin
Composition of the blood	AIDS/HIV-positive	Hints for maintaining health of heart and circulation:	Capillaries are That's why they supply

Auto Diagnosis Sheet

for preparing the test paper »blood and circulation system of the human«

Name:	Class:	Date:

Mark crosses to the subsequent issues of how safe you feel when answering. Be honest with yourself! This sheet is not graded. It should give you a survey of what you know and what you still need to practice.

The last column shows what you can do to be fit and »well supplied with blood«. Note: This is your individual learning time.

I've got what it takes!	sure	quite sure	insecure	very insecure	You can p read in th	ractise or e textbook:
1. I know the 4 functions of blood.					s 1	tb p. 64
2. I know the components of blood.					s 2, 3, 4	tb p. 64/65
3. I know the blood circulation of my body.					s 7, 9	tb p. 71
4. I know the blood vessels.					s 6	tb p. 69
5. I know the anatomy of the heart.					s 8	tb p. 70
6. I know about blood coagulation.					s 10	tb p. 65
7. I know the blood types.					s 11	tb p. 65/66
8. I know about heart attacks and prevention.					s 12	tb p. 70/71
9. I know about AIDS.					s 13	tb p. 68

(s = station)

Here you've got room for notes that you've looked up. Rewrite the most important facts. Pay particular attention to sketches, they stay best in your mind. Good luck.