Bacteria (Item No.: P1444901)

Curricular Relevance

Area of Expertise: Biologie
Education Level: Klasse 7-10
Topic: Biologie der Zelle, Mikroskopie
Subtopic: Protisten und Prokaryonten
Experiment: Bakterien

Difficulty	Preparation Time	Execution Time	Recommended Group Size
Easy	10 Minutes	30 Minutes	1 Student

Additional Requirements:

- Hay infusion
- Yoghurt with live cultures

Experiment Variations:

- In this experiment the microscope with 1000x magnification cannot be replaced with one with less magnification power.

Keywords:

Task and equipment

Information for teachers

Information

Bacteria are real life artists: Some of the organisms belonging to this group find adequate life conditions everywhere on earth, in the depths of the oceans, on highest mountains, in hot springs, and in the Arctic. Bacteria can be compared with regard to various aspects, whether they are pathogens or of beneficial use, whether they can only survive or die in an atmosphere containing oxygen. Today you will learn to differentiate bacteria on account of their various shapes.

Information on obtaining materials

In this experiment it is important not to use any human pathogenic bacteria. A simple and rather safe way to breed many bacteria is provided by the hay infusion technique (how to make one, see Experiment P1444401 "Ciliates in a hay infusion"). Also beneficial bacteria which are exploited by mankind are to be examined. Various yoghurts and curdled milk drinks containing live cultures are available at supermarkets. Numerous bacteria are found in the supernatant clear liquid.
Another variant not described in the students' experiment is the possibility to examine one's own oral flora. Test specimens may be scraped off from teeth and then stained. However, such experiments might elicit a sense of disgust or revulsion. The maintenance of special hygienic conditions must be ascertained.

Information on hay infusions
See experiment "Ciliates in a hay infusion" (P1444401).

Information on yoghurt and probiotic cultures
Natural yoghurts usually contain *Streptococcus thermophilus*, *Lactobacillus bulgaricus*, or *Lactobacillus acidophilus*. Supermarkets increasingly sell very expensive probiotic food. They are supposed to produce positive changes in the intestinal flora if consumed in large amounts. In fact many of these foodstuffs do not contain the indicated amounts of these bacteria and the major proportion of them is destroyed by the stomach's hydrochloride acid. It is disputed whether the remaining bacteria really do substitute the unwanted or preferentially the regular intestinal flora. A long-term colonization of the cultures thus added does not take place.




Safety measures

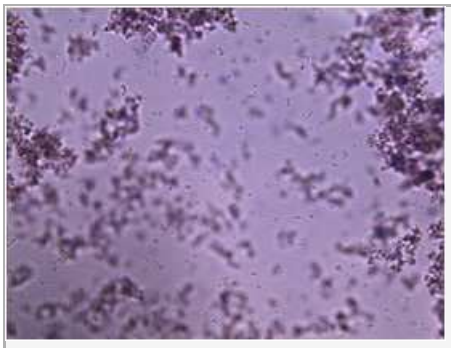
- Giemsa solution contains methanol. Avoid contact with skin!
- Wear protective glasses and gloves!

Hazard and Precautionary statements

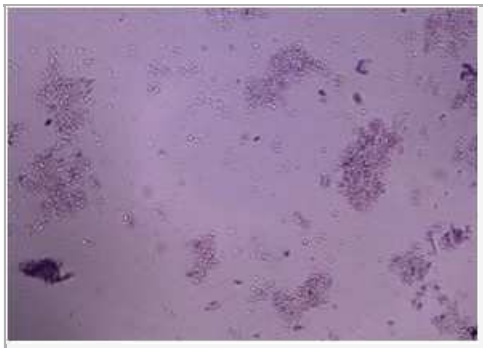
Giemsa solution:	
H301:	Toxic if swallowed.
H311:	Toxic in contact with skin.
H331:	Toxic if inhaled.
H370:	Causes damage to organs.
P260:	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P280:	Wear protective gloves/ protective clothing.
P301 + P310:	IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P311:	Call a POISON CENTER or doctor/ physician.

Information on how to proceed

1. Microscopy of yoghurt
First, the students are to notice the coagulated and dominate milk flakes only. Bacteria are much smaller than the specimens examined so far! Hence their attention should be drawn to the tiny bacteria which drift passively in the liquid phase. Care should be taken that only a very small amount of the staining solution is applied.



Yoghurt with bacilli and cocci, (400x) stained with azure II eosin Methylene Blue

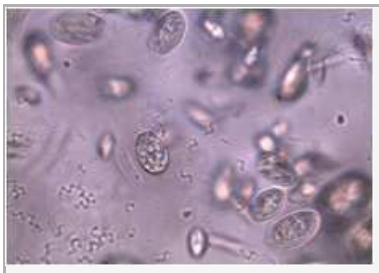


Yoghurt with bacilli and cocci, (400x) stained with azure II eosin Methylene Blue

2. Microscopy of a hay infusion
The microscopic examination should first proceed without a stain, for staining usually has lethal consequences for the organisms. After staining, the bacteria are less mobile, however, their shapes might be better recognizable.

Spirillae in a hay infusion, (400x) (stained with Lugol’s solution)

Spirillae and rotifers in a hay infusion, size comparison, (400x)



Size comparison of ciliates and spirillae, (400x)

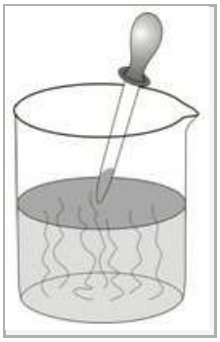
Spirillae in a hay infusion, (400x) (stained with Lugol’s solution)

Bacteria (Item No.: P1444901)

Task and equipment

Task

Describe the shape of bacteria in a hay infusion and in a yoghurt drink!



Equipment

Position No.	Material	Order No.	Quantity
1	SWIFT 132 microscope (M3702CB-4)	63022-99	1
2	Microscopic slides, 50 pcs	64691-00	1
3	Cover glasses 18x18 mm, 50 pcs.	64685-00	1
4	Beaker, low form, plastic, 100 ml	36011-01	1
5	Dropping pipette with bulb, 10pcs	47131-01	1
6	Chemicals set for TESS advanced Microscopy	13290-10	1

Set-up and procedure

Safety measures

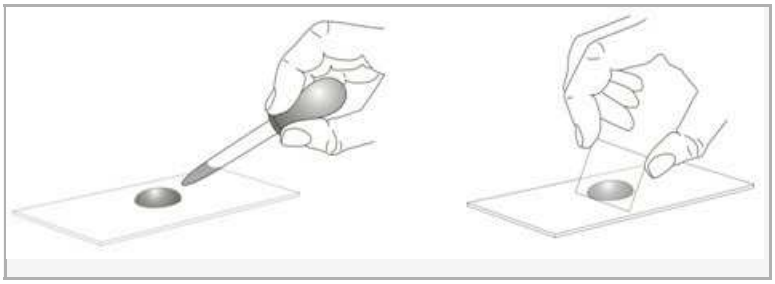
- Giemsa solution contains methanol. Avoid contact with skin!
- Wear protective glasses and gloves!

Information

Bacteria are real life artists: Some of the organisms belonging to this group find adequate life conditions everywhere on earth, in the depths of the oceans, on highest mountains, in hot springs, and in the Arctic. Bacteria can be compared with regard to various aspects, whether they are pathogens or of beneficial use, whether they can only survive or die in an atmosphere containing oxygen. Today you will learn to differentiate bacteria on account of their various shapes.

1. Microscopical examination of yoghurt
It is important for this experiment that you do not use a heat-exposed yoghurt but one that still contains live cultures!

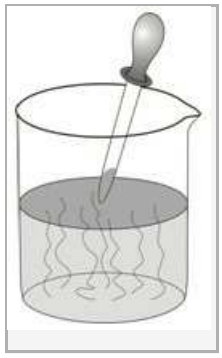
- Mix on a slide less than one drop of the staining solution with one drop of yoghurt.
- Disperse it in such a manner that you will obtain a transparent slide.
- View the stained sample under the microscope up to highest power.
- Note: You will notice very small particles swimming between flaky objects derived from the milk only at a 400-fold magnification. These particles are the bacteria!



What shapes do bacteria possess? Note your observations in the report.

2. Microscopy of a hay infusion
Surely you have already seen a hay infusion under the microscope when you were searching for paramecia. Today we want to find even smaller inhabitants, i.e. the bacteria which the ciliates feed on!

- Take a sample from the surface film, i.e. the upper whitish layer on top of the hay infusion.

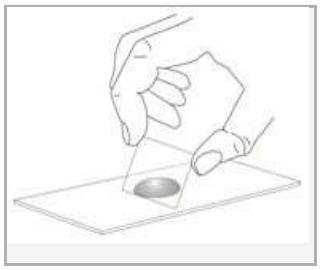


- View the specimens under the microscope, first without staining solution and up to highest power!
  What shapes do the bacteria have? Note your observations in the report.

Additional option:

- Mix on the slide less than one drop of the staining solution (either Lugol's solution or azure II eosin Methylene Blue solution) with one drop of the hay infusion.

- Disperse it in such a manner that you will obtain a transparent slide.
- View the stained sample under the microscope up to highest power.



3. Give your bacteria names!
You must know:

- bacteria displaying a round shape are referred to as: **cocci**
- rod-shaped bacteria are referred to as: **bacilli**
- corkscrew or spiral-shaped bacteria are referred to as: **spirillae or spirochaetes**

Report: Bacteria

Result - Observations 1

Note your observations to the yoghurt bacteria.

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Result - Observations 2

Note down your observations to the hay infusion bacteria.

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