Liver cells (hepatocytes) (Item No.: P1443301)

Curricular Relevance

Area of Expertise: Biologie

Education Level: Klasse 7-10

Topic: Biologie der Zelle, Mikroskopie

Subtopic: Spezialisierte Zellen, Gewebe und Organe

Experiment: Leberzellen

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

Additional Requirements:

- Liver
- Sugar, 1 to 2 table spoons or 3 sugar cubes
- Blue ink

Experiment Variations:

Keywords:

Task and equipment

Information for teachers

Information on obtaining materials

The study material can be easily obtained at a butcher’s shop. Since only little material is needed, the liver of a smaller mammal (e.g. rabbit) will also be adequate. The material can be deep-frozen without any difficulty long before it is used and then be thawed whenever needed.
For staining, the ink cartridge of a single student will suffice for the whole class, as it can be diluted. Alternatively, the pure dye Methylene Blue (article no. 31567-04) can also be applied.

Information on the liver

Since the liver is a significant metabolic organ which is also predominant in the abdominal cavity as far as its size is concerned, it should receive due attention in biology class. It may be presented as a subject, for example, in the scope of blood sugar regulation. In this context, it is reasonable to demonstrate the position and size of liver and pancreas in the abdominal cavity using a model (torso).
Microscopy of liver cells may stand in connection with the discussion of metabolism, but it is also suited in the context of an exemplary comparison between plant and animal cells. In this regard, it is conditional that the students are familiar with the fundamental structures of the plant cell (compare with the oral mucosa experiment).

Safety measures

- Attention! Count the number of scalpel blades at the end of lessons in order to prevent accidents that also might occur afterwards!
- Carmine acetic acid is highly corrosive!
- Put on protective glasses!

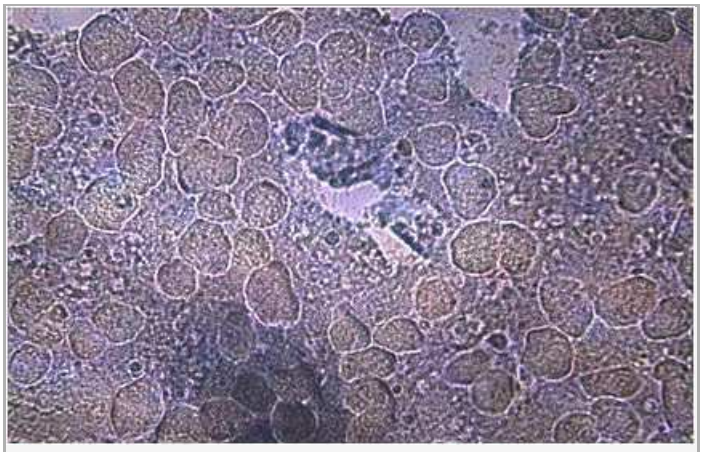
Hazard- and Precautionary statements

Carmine acetic acid:	
H314:	Causes severe skin burns and eye damage.
P280:	Wear protective gloves/protective clothing/eye protection/face protection.
P260:	Do not breath vapour.
P301 + P330 + P331:	IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P302 + P352:	IF ON SKIN: Wash with plenty of soap and water.
P305 + P351 + P338:	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P309 + P310:	IF exposed or if you feel unwell: Immediately call a POISON CENTER or doctor/physician.

Information on practical performances

ad 1: Dabbed preparation of liver cells

This method is less cumbersome than the method including the sugar solution. However, it also harbors the risk that an insufficient number of liver cells might adhere to the slide. The teacher should ascertain that a fresh liver cut is made and also make sure to test this method in advance.

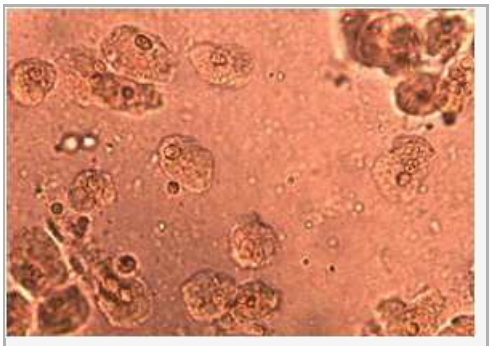


Dabbed preparation of liver cells 400x, stained with Methylene Blue

ad 2: Liver in sugar solution

Isolated cells are obtained with great certainty when this method is applied:

Staining with carmine acetic acid presents an alternative. The nuclei are well displayed, the contours are clearly visible:



Liver cells 400x, stained with carmine acetic acid

ad 3: Drawing

Drawing a liver cell will be easy even for students without much practice. It should be observed that the outline of the cell body

is continuous and not broken. The students are to draw the nucleus in its central position in accordance with their own observations.

ad 4: Comparison with the plant cell

Even if a student may not have achieved in making a good slide, the students still have the opportunity of seeing the typical image of a liver cell by comparing their specimens. The following characteristics of an animal cell are to be elaborated:

- Animal cells do not possess a cell wall (consequently, a rather smooth and round shape is seen), instead, they are surrounded only by a membrane.
- Animal cells do not possess chloroplasts and are therefore not green.
- Animal cells do not possess any vacuoles. In plants, vacuoles occupy a large space and displace cytoplasm and nucleus into a marginal zone. The central position of the nucleus is indicative of the absent vacuole.

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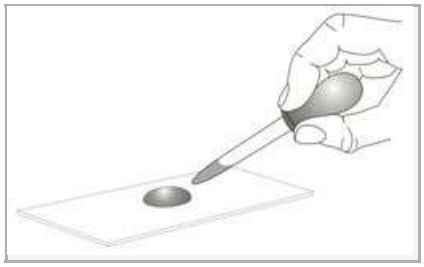
Liver cells (hepatocytes) (Item No.: P1443301)

Task and equipment

Task

Examine the shape of individual liver cells and compare their structure with a plant cell.



Equipment

Position No.	Material	Order No.	Quantity
1	Euromex BioBlue BB.4250 microscope	EUR-BB-4250	1
2	Microscopic slides, 50 pcs	64691-00	1
3	Cover glasses 18x18 mm, 50 pcs.	64685-00	1
4	Scissors,straight,pointed,l 110mm	64623-00	1
5	Beaker, low form, plastic, 100 ml	36011-01	1
6	Tweezers,straight,pointed,120mm	64607-00	1
7	Scalpel holder	64615-00	1
8	Scalpel blades,rounded tip,10 off	64615-02	1
9	Glass rod,boro 3.3,l=200mm, d=5mm	40485-03	1
10	Chemicals set for TESS advanced Microscopy	13290-10	1

Set-up and procedure

Hazards

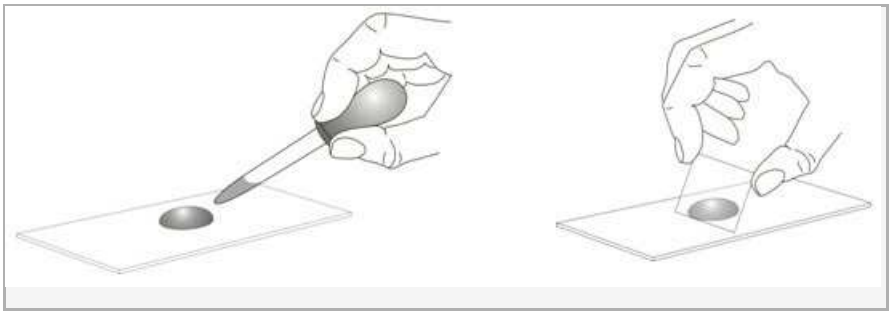
- The blades of the scalpel are very sharp! Their removal from the aluminum foil and the sections made with them must proceed with great caution.
- Carmine acetic acid is highly corrosive!
- Put on protective glasses!


Information
The liver is the central organ of human and animal metabolism. It influences, for example, the blood sugar level, synthesizes various blood proteins, and decomposes toxic metabolic products and other toxicants taken up with the food. The bile which the liver produces accumulates in the gallbladder and is discharged into the intestines when needed. It emulsifies dietary fat.
The human liver is a very large organ weighing approx. 1,500g and lies on the right side of the abdomen, directly under the diaphragm.

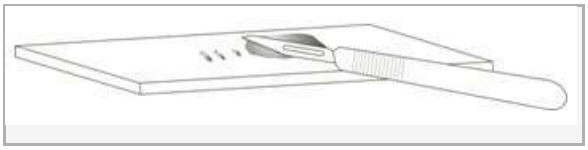
Methods and observations

There are two ways that are appropriate to examine liver cells. Decide with your neighbor who shall test which variant! In either case you will be able to apply your regular fountain-pen ink or a cartridge for staining. Ink contains the dye Methylene Blue which enhances the contrasts of cellular components.
First variant

1. Make a fresh cut through a piece of liver and dab the cut surface with determination on the slide. The specimen should be given 5 minutes to dry.
2. Now add 2 to 3 drops of ink from your cartridge. Dilute with water after 2 minutes and view the result under the microscope.



Second variant
1. The cells are detached from the tissue in a sugar solution. A small piece of liver is dissected and crushed.



2. The tissue slurry is stirred in the sugar solution.

3. A drop of ink and a drop of the liver – sugar solution is applied to the slide, mixed, and viewed under the microscope.

Drawing of a liver cell isolated by applying your variant method in the report.

Report: Liver cells (hepatocytes)

Result - Observations

Draw a cell which is clearly visible.

Evaluation - Question 1

Also take a look at the microscopic image your neighbor has drawn to answer this question. Which components of a plant cell cannot be found in a liver cell?

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