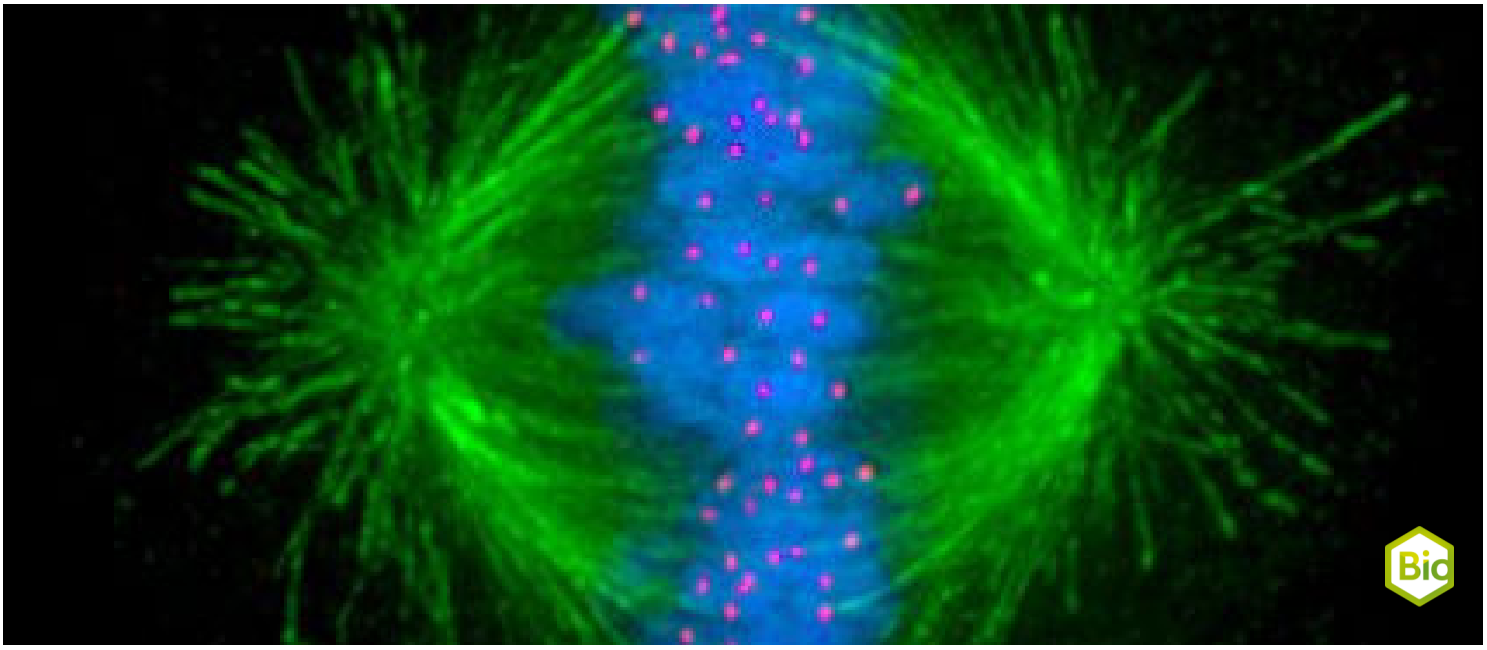
Nucleus and chromosomes - Mitosis



Biology	Microscopy / Cell Biology	Cell structure
Biology	Microscopy / Cell Biology	Heredity
Applied Science	Medicine	Histology & Medical Microbiology

Difficulty level	Group size	Preparation time	Execution time
easy	1	10 minutes	30 minutes

This content can also be found online at:

http://localhost:1337/c/615b022d3b0beb0003f80a83

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Teacher information

Application

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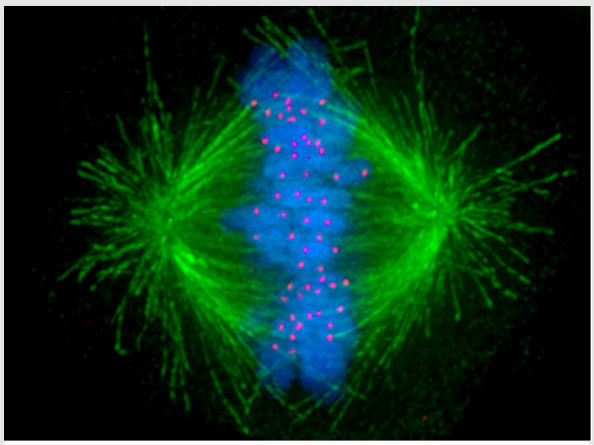

metaphase of mitosis

The cell nucleus can be seen as a round structure under the light microscope even without staining. It is the control centre of many processes in the cell and the carrier of genetic information. The nucleus contains fibrous structures, the chromatin, which appear as a uniform mass when stained. Cell division always begins with the division of the cell nucleus (mitosis). In preparation for this division process, the filaments contract, becoming shorter and thicker. The genetic information in them has doubled in the meantime. The membrane around the cell nucleus dissolves, the chromosomes first gather in the middle of the cell, then migrate along the spindle apparatus to the cell poles and form two new cell nuclei. Only then does the cell body divide and two daughter cells are formed.

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Other teacher information (1/5)

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Previous

Mitosis is described in detail in the biology books. The information on the student page is intended as an introduction to the experiment, but is not sufficient as preparation. The doubling of the number of chromosomes is also not discussed there. The students should therefore have been familiarised with the topic in class and should have seen the corresponding graphics. Films about the processes involved in mitosis also lend themselves to lesson planning. Only with good preparation can some phases of mitosis be identified.

Principle

The students should be familiar with the use of a microscope and the preparation. Furthermore, mitosis should be treated in theoretical form before the experiment.

Other teacher information (2/5)

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Learning objective

The reproduction of cells is based on the principle of cell division. Mitosis in itself describes only the cell nucleus division and not the cell division as a whole.

Tasks

Have students microscope plant cells during mitosis.

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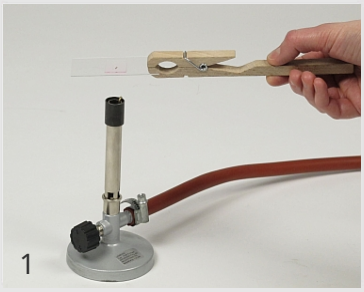
Other teacher information (3/5)

Preparation

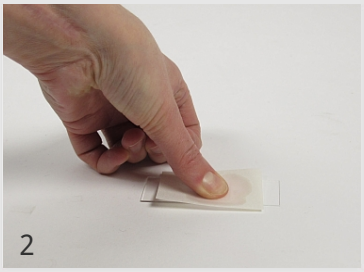
For the study of mitosis, formation tissue (meristem) is required, which is located, for example, in all root tips. If one uses vegetable onions, as described on the student information page, one must check in a preliminary experiment whether these also form roots. Some onions available in the supermarket are treated with germ-inhibiting substances. Onions from a specialist garden centre are certainly more suitable. Tulips, daffodils and hyacinth bulbs are also suitable. Alternatively, you can grow seedlings of various plants on damp blotting paper (garden cress, mustard, garden beans) and prepare their roots accordingly.

To prepare the roots, a special hyacinth jar, an egg cup or an Erlenmeyer flask can be used. The bulb can also be started 14 days before the beginning of the experiment. The removal of the root tips should then be done in the early morning hours. If this is not possible with the students, they can also be separated and fixed by the teacher (fixation: mixture of ethanol-96% and acetic acid-99%; 1:3).

Other teacher information (4/5)



1



2

Making the preparation

Repeated testing by the teacher is recommended. The students must work very carefully in this experiment, so that a detailed discussion of the experiment should precede it. Boiling (1) should be done on the lowest possible flame. Boiling or squeezing (2) usually causes the liquid to disappear, so some carminessetic acid or vinegar can be added if necessary. Squeezing (2) should be demonstrated: when squeezing, avoid lateral pressure, cover with blotting paper and press straight down evenly and firmly, this will preserve the cover glass.

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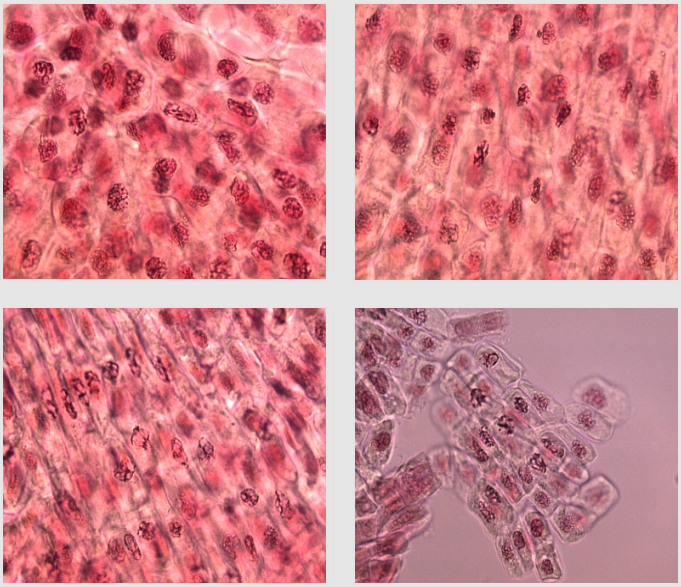
Other teacher information (5/5)

Microscopy

One should not raise expectations too high. The students can at least recognise the well-stained chromosomes. If they calmly look through their preparation, they will discover different division phases. If the preparation is too thick or if there are no division phases, the experiment should be repeated. Plenty of onion roots must therefore be available.

The illustrations on the right serve as examples of what can be seen under the microscope in a vegetable onion.



Safety instructions

- **Carminessetic acid is highly corrosive! Put on protective goggles!**

H and P phrases
H314 Causes severe skin burns and eye damage. eye damage.
P280 Protective gloves/ protective clothing/ eye protection/ face protectionWear
P260 Do not inhale vapour.
P301 + P330 + P331IF SWALLOWED: Rinse out mouth. Do NOT induce vomiting.
P302 + P352 ON CONTACT WITH THE SKIN: Wash with plenty of soap and water.
P305 + P351 + P338ON CONTACT WITH THE EYES: Rinse with water for a few minutesrinse. Remove existing contact lenses if possible.
P309 + P310AT Exposure: Immediately **POISON INFORMATION CENTER** or call a doctor.

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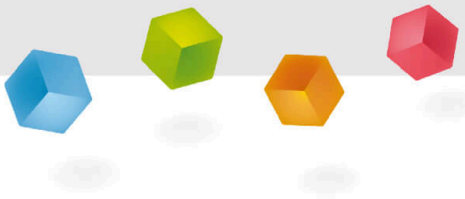

Student Information

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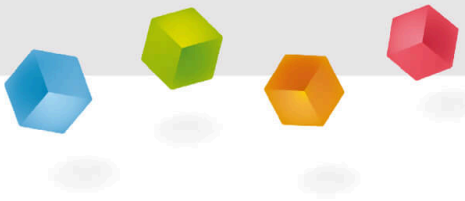

Student Information

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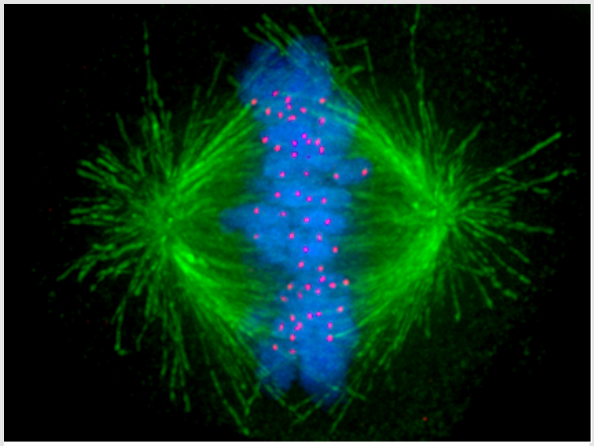
Motivation



metaphase of mitosis

The division of cells is a process that affects all life on earth. Realize that the images you see under the microscope are the foundation of all life and the basis of evolution. In addition, the principle of cell nuclear division is used in research for cancer treatments and other areas of research.

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Equipment

Position	Material	Item No.	Quantity
1	PHYWE Binocular student microscope, 1000x, mechanical stage	MIC-129A	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	Dropping pipette with bulb, 10pcs	47131-01	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	Test tube holder, up to d 22mm	38823-00	1
10	Carmine acetic acid sol. 250 ml	31469-25	1
11	Bunsen burner,natural gas, DIN	46917-05	1
12	Safety gas tubing, DVGW, sold by metre	39281-10	1
13	Hose clip, diam. 8-16 mm, 1 pc.	40996-02	2
14	Erlenmeyer flask, borosilicate, wide neck, 250 ml	46152-00	1

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Structure (1/2)

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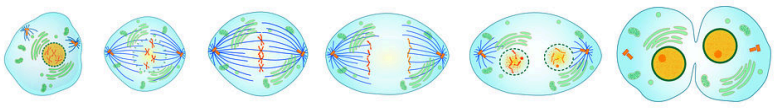
(1) Preparation - Theory

Find out about the process of mitosis.

Look at graphical representations of the division phases.



Sequence of mitosis

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Structure (2/2)

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Kitchen onion on glass

(2) Preparation - practical

Cell division processes take place particularly in formation tissues (meristems). This division-active tissue is found in the tips of roots. A kitchen onion is placed on a glass so that the onion slice just does not touch the water. After three to seven days, roots have formed whose tips are suitable for dissection.

Procedure (1/3)

PHYWE

(1/2) Prepare the preparation

- Cut off 3 mm of the root with the scissors (Fig. 1) and halve the root with the scalpel (Fig. 2).
- A drop of carmine acetic acid is placed on the slide (Fig. 3).
- The root piece is placed directly into the carmine acetic acid and covered with the coverslip (Fig. 4).

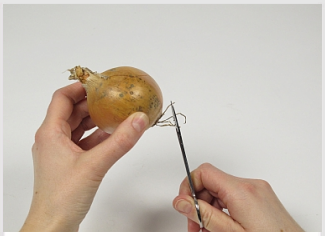

Fig. 1

Fig. 2

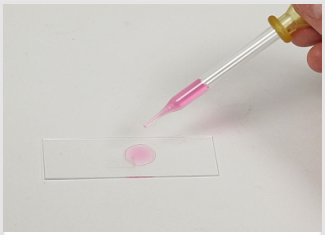

Fig. 3

Fig. 4

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Procedure (2/3)

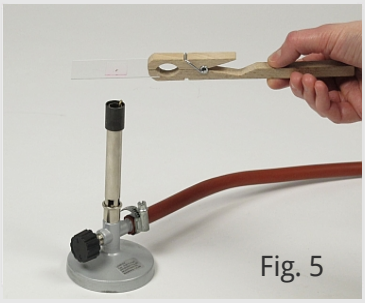

Fig. 5

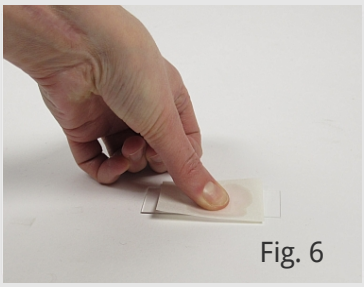

Fig. 6

(2/2) Making the preparation

The preparation should now be heated very carefully (Fig. 5) so that it just becomes soft but is still preserved. A squeeze preparation is to be made after boiling.

This is how you proceed: Gently swirl the slide through the small flame of the burner until small bubbles rise. The slide is placed on a smooth surface, covered with blotting paper and the root piece is crushed by pressing on the cover slip with the thumb (Fig. 6). This should produce a thin, transparent preparation and not destroy the cover glass.

Procedure (3/3)

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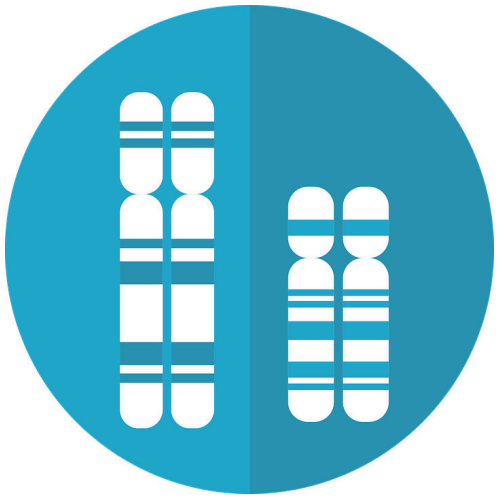

Search chromosomes

(3) Microscopy

Microscope up to the highest magnification.

Search cells in which chromosomes can be detected.

Try to assign the arrangement of chromosomes to individual division phases that you know from the preparation.

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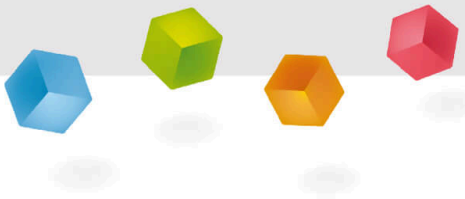

Report

Task 1

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Which of the following statements is true about mitosis?

- ☐ Mitosis is the division of the cell nucleus.
- ☐ Mitosis is the division of the cell.
- ☐ Mitosis is divided into 4-5 different phases.

Check

How many chromosomes or chromosome pairs does a human being have?

Chromosomes: ____

Chromosome pairs: ____

Check

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Task 2

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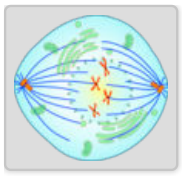
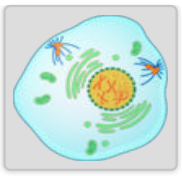
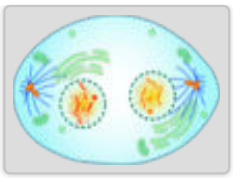
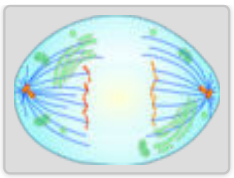
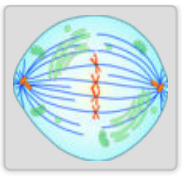
Put the pictures in chronological order

Check

Task 3

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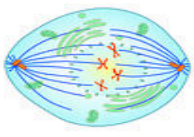
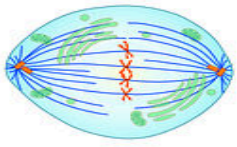
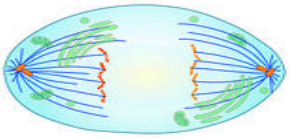
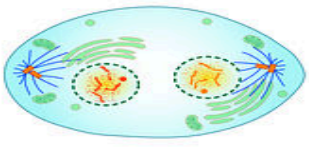
Match the phases to the pictures

Telophase | Anaphase | Late metaphase | Early metaphase | Prophase

Check

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