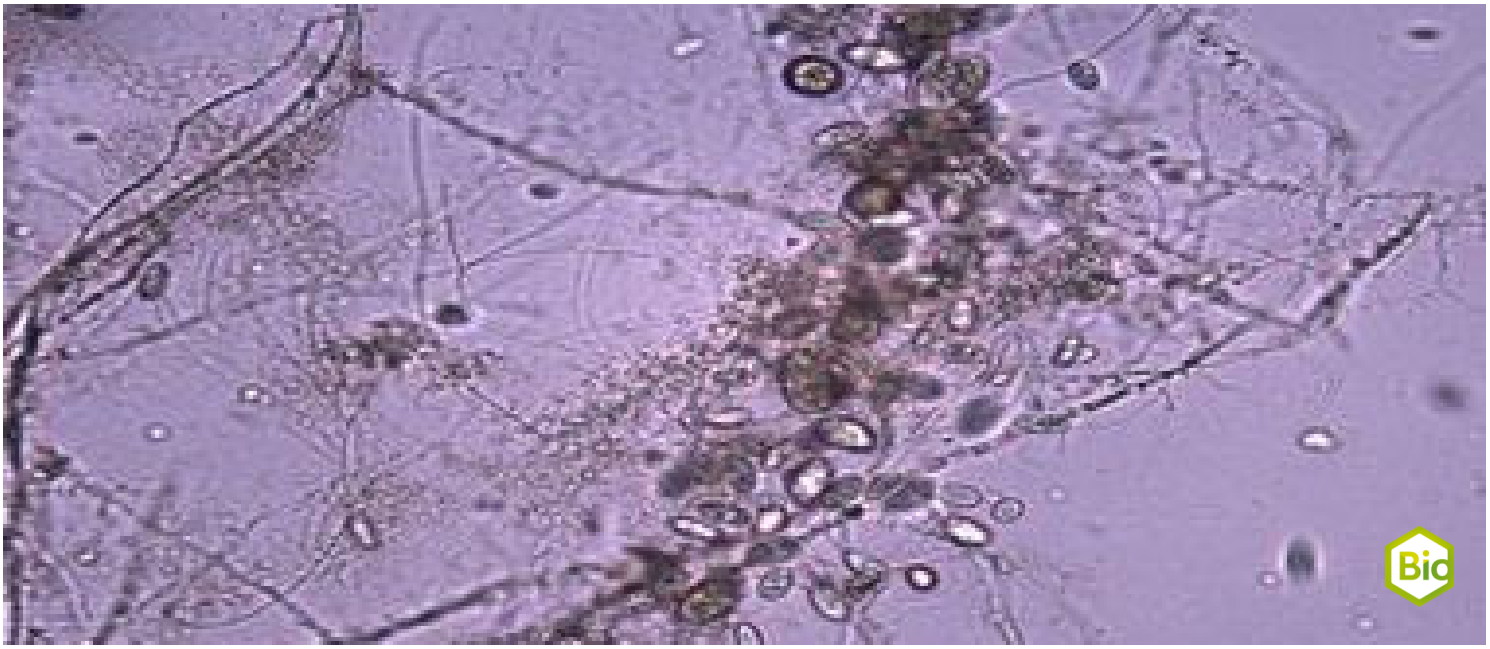
Shoot axis of the dicotyledonous plant identification of xylem, phloem and cambium



Biology	Microscopy / Cell Biology	Plants & Fungi
Biology	Microscopy / Cell Biology	Cell structure
Biology	Plant Physiology / Botany	Physiology of plants

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/6128a73e4839a1000394db4d

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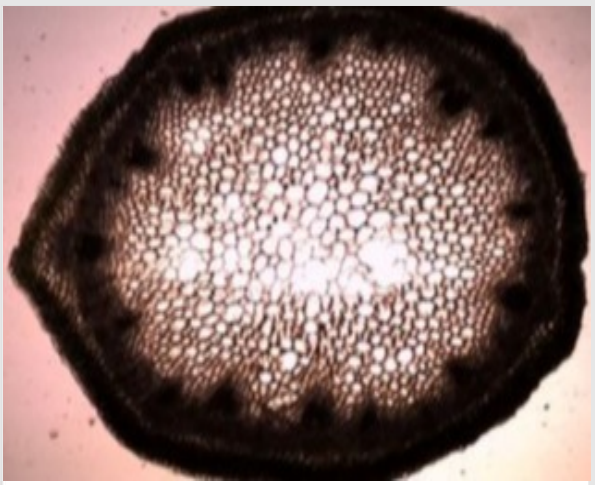
Teacher information

Application



Arugula (40x)

The shoot axis of plants has to perform a variety of tasks: it carries the leaves, the lateral branches and the flowers. The strengthening tissue provides the necessary stability and elasticity. Have you ever thought about how a 20-metre-high tree can transport water from the root to the treetop? And how it is possible for assimilates from the leaves to reach the roots? We want to explore the transport pathway. There is a one-way system for this in all plants. The vascular bundles contain vessels for the transport of water from the bottom to the top and sieve tubes for the transport of assimilates from the top to the bottom. The arrangement of the vascular bundles in dicotyledonous plants differs significantly from the arrangement in monocotyledonous plants.

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Other teacher information (1/5)

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Prior knowledge

Students should be familiar with basic terms and schematic illustrations before proceeding to the preparation. They should also be familiar with the preparation of a fresh specimen and microscopy.

Scientific Principle

Using cross-sections, students explore the shoot axis of the dicotyledonous plant.

Other teacher information (2/5)

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Learning objective

Students should be able to identify and name the structure of the shoot axis of a dicotyledonous plant.

Tasks

Students should make a preparation of the shoot axis of a dicotyledonous plant and look at it under the microscope.

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Other teacher information (3/5)

Notes on material procurement

The suitable material is the decisive prerequisite for the success of the pupils. The teacher must look for shoot axes that are a maximum of 3 mm thick, have a consistency that is not too soft (the daisy, Bellis perennis, is therefore not suitable) and are not yet too woody and hardened. Suitable potted plants include Tradescantia virginica, Impatiens and Solenostemon. From the flower and vegetable garden are recommended, for example: Nasturtium (Tropaeolum), Rocket (Eruca sativa), Cucurbita spec., Ranunculus spec. Labiates (Laminaceae) such as Deadnettle (Lamium spec.), Lavender, Sage. In the case of woody plants (sage, lavender), only the annual shoot part at the top should be used.

Other teacher information (4/5)

Information on the shoot axis

Shoot axes are the link between the roots and the leaves. They are divided longitudinally into nodes (nodes), from which the leaves and lateral branches branch off, and the intermediate pieces (internodes). Sections should be made in the area of the internodes. In dicotyledonous plants (dicots), the vascular bundles are arranged in a ring. They are usually surrounded by sclerenchyma and therefore clearly visible. The area from the vascular bundles to the center of the plant is called the pith, the area to the outside is called the bark. In the bark area we find strengthening tissue in species-typical expression. In the labiates (Laminaceae), for example, the stems are square-edged and there is a strong strengthening tissue (collenchyma) in these edges.

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Other teacher information (5/5)

Notes on implementation

PreparationTo introduce the concepts, the pupils should preferably see a germinating grain (with one cotyledon) and a germinating bean (with two cotyledons). Visualization makes the concepts easier to remember. The distinction of leaves should also be demonstrated (mostly parallel-nerved in monocotyledonous plants and mostly reticulate in dicotyledonous plants). The distinction of rooting types can be omitted as these are usually not visible to the students. Examples of dicotyledonous plants should come from the students' immediate environment and be familiar to them.

Prepare the specimen and microscope it: Depending on the tension of the tissue, the hand cut technique should be used with or without aids, or the cut should be made on the firm support. For naming the parts phloem, cambium, xylem should be ready illustrations.

Safety instructions (1/2)

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- Working with microscopes for too long can lead to physical discomfort (fatigue, headache, nausea), especially when students are untrained.
- To avoid accidents, scalpels should be checked for completeness at the beginning and end of the experiment.
- Microscopes are sensitive. During transport and handling, care should be taken to ensure that everything is done carefully and without rushing.
- Ethanol is highly flammable, keep away from open flames!
- Put on protective goggles!
- The general instructions for safe experimentation in science lessons to be applied to this experiment.

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Safety instructions (2/2)

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H and P phrases Ethanol

H225: Highly flammable liquid and vapor.

P210: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. Do not smoke.

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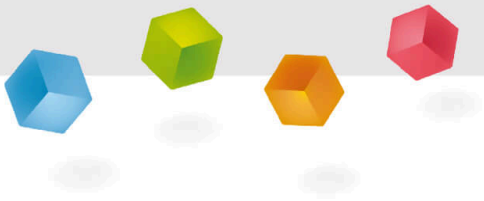

Student Information

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Motivation

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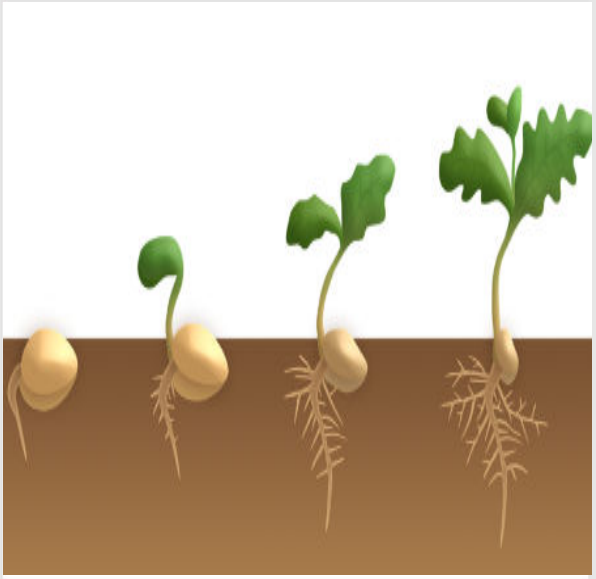

The shoot axis of plants has to perform a variety of tasks: it carries the leaves, the lateral branches and the flowers. The strengthening tissue provides the necessary stability and elasticity. Have you ever thought about how a 20-metre-high tree can transport water from the root to the treetop? And how it is possible for assimilates from the leaves to reach the roots? We want to explore the transport pathway. There is a one-way system for this in all plants. The vascular bundles contain vessels for the transport of water from the bottom to the top and sieve tubes for the transport of assimilates from the top to the bottom. The arrangement of the vascular bundles in dicotyledonous plants differs significantly from the arrangement in monocotyledonous plants.

Tasks

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Tropaeolum (40x)

1. Preparation
2. Making the preparation
3. Microscopy

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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	Beaker, 100 ml, plastic (PP)	36011-01	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	Chemicals set for TESS advanced Microscopy	13290-10	1

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Procedure (1/3)

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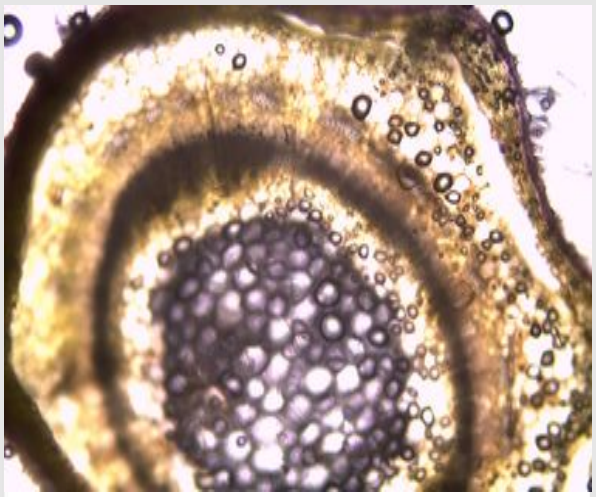
Preparation

- Find out about the terms: monocotyledonous and dicotyledonous in the biology book.
- Look at the illustration of a vascular bundle. Memorize the appearance of the wood part with vessels (xylem), the formation tissue (cambium) and the sieve part (phloem) (see also figure on the right).



Salvia (100x)

Procedure (2/3)

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Making the preparation

- Prepare the microscopy liquid: Add a few drops of ethanol to the water. This will slightly displace the air in the shoot axis. Prepare the microscope slide.
- Disturbing leaves are removed. Find a suitable place between the nodes.
- In the direction of the body, cut as thinly as possible. If this does not work, you can also cut on the slide.
- Use the forceps to place the thin sections directly into the drop on the slide.

Make the thinnest possible cuts

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Procedure (3/3)

Microscopy

- Examinate at lowest magnification and describe the arrangement of the vascular bundles:
- Observe at medium magnification. Look at a vascular bundle. The vessels (tracheae) for water transport are very large. Try to distinguish the xylem, the cambium and the phloem.
- Draw the cross-section of the shoot axis. It should be clear how the vascular bundles are arranged and at which points the shoot axis has particularly thick-walled cells. These are lignified and provide stability.

Report

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Task 1

PHYWE

Drag and drop the correct words into the spaces provided

Shoot axes are the link between the _____ and the leaves. They are _____ divided into _____ (nodes), from which the leaves and lateral branches branch, and the intermediate pieces (_____). The area from the vascular bundles to the centre of the plant is called the _____, the area towards the outside is called the _____.

interodes
longitudinally
roots
nodes
bark
marrow

Check

Task 2 + 3

PHYWE

Dicotyledonous plants are called dicots, monocots monocots.

○ True ○ Incorrect

Check

In dicotyledonous plants, the vascular bundles are arranged in a ring.

○ True ○ Incorrect

Check

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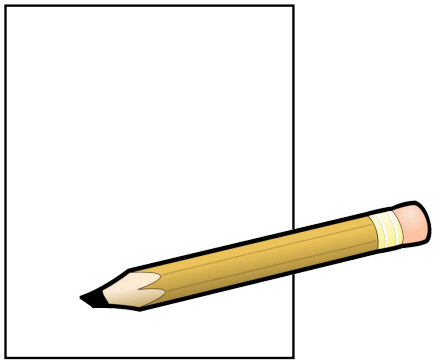
Task 4

PHYWE

Make a drawing of a shoot axis and label phloem and xylem. It should be clear how the vascular bundles are arranged and where the shoot axis has particularly thick-walled cells. These are lignified and provide stability.



Slide	Score / Total
Slide 18: Untitled Drag Text	0/6
Slide 19: Multiple tasks	0/2

Total 0 / 8

Solutions Repeat

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