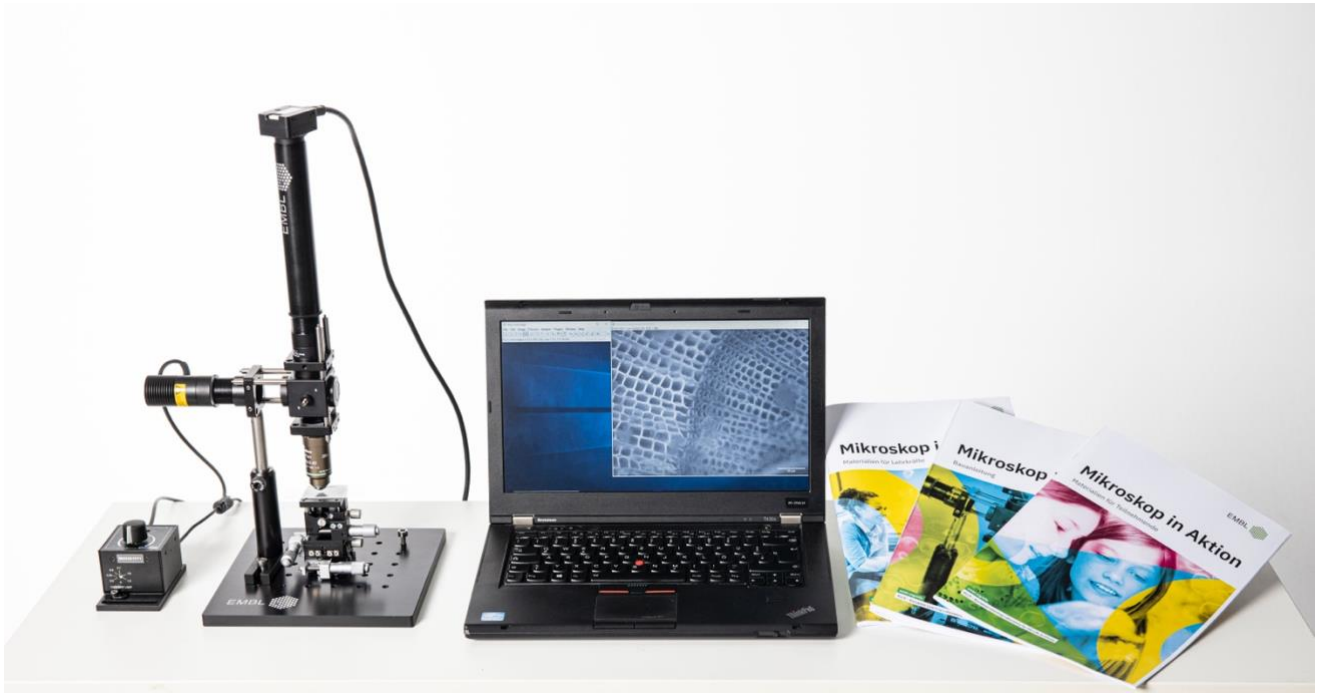
Microscope in Action educational kit

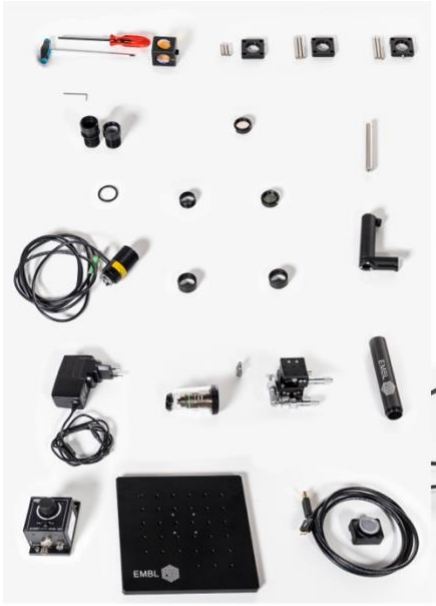
The kit includes:

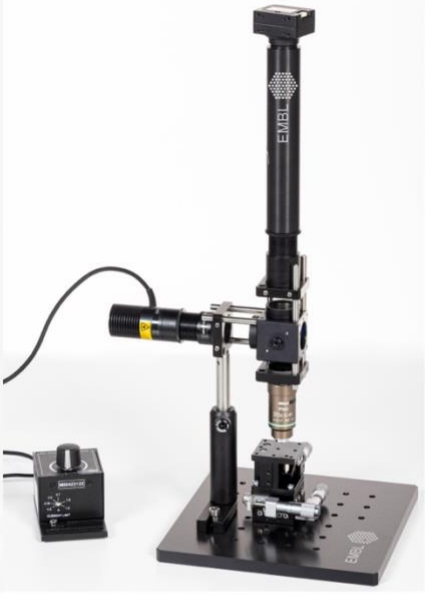
1. Portable Fluorescence Learning Microscope
2. Laptop
3. Experiment box
4. Teaching and learning materials.

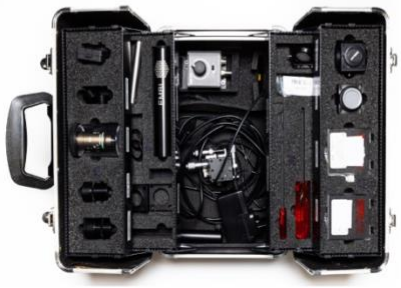


Fluorescence Learning Microscope

The Fluorescence Learning Microscope (FLM) designed and developed by EMBL scientific and educational experts, is a research-grade portable, easy-to-use fluorescence microscope building kit. Each microscope is fitted into a compact and easy-to-transport durable case. The microscopes are safe, made of high quality, durable materials suitable for repetitive use by novice users.







Technical specs of microscope

- 20x Objective lens
- Nominal wavelength = 470 nm (blue)
- Bandwidth of filters – filter set for GFP
- LED: 470 nm, 760 mW (Min) Mounted LED, 1000 mA
- LED driver up to 1200 mA15 V, 2.4 A Power Supply Unit
- Camera: CMOS, 2048 × 1536, monochrome, USB connection

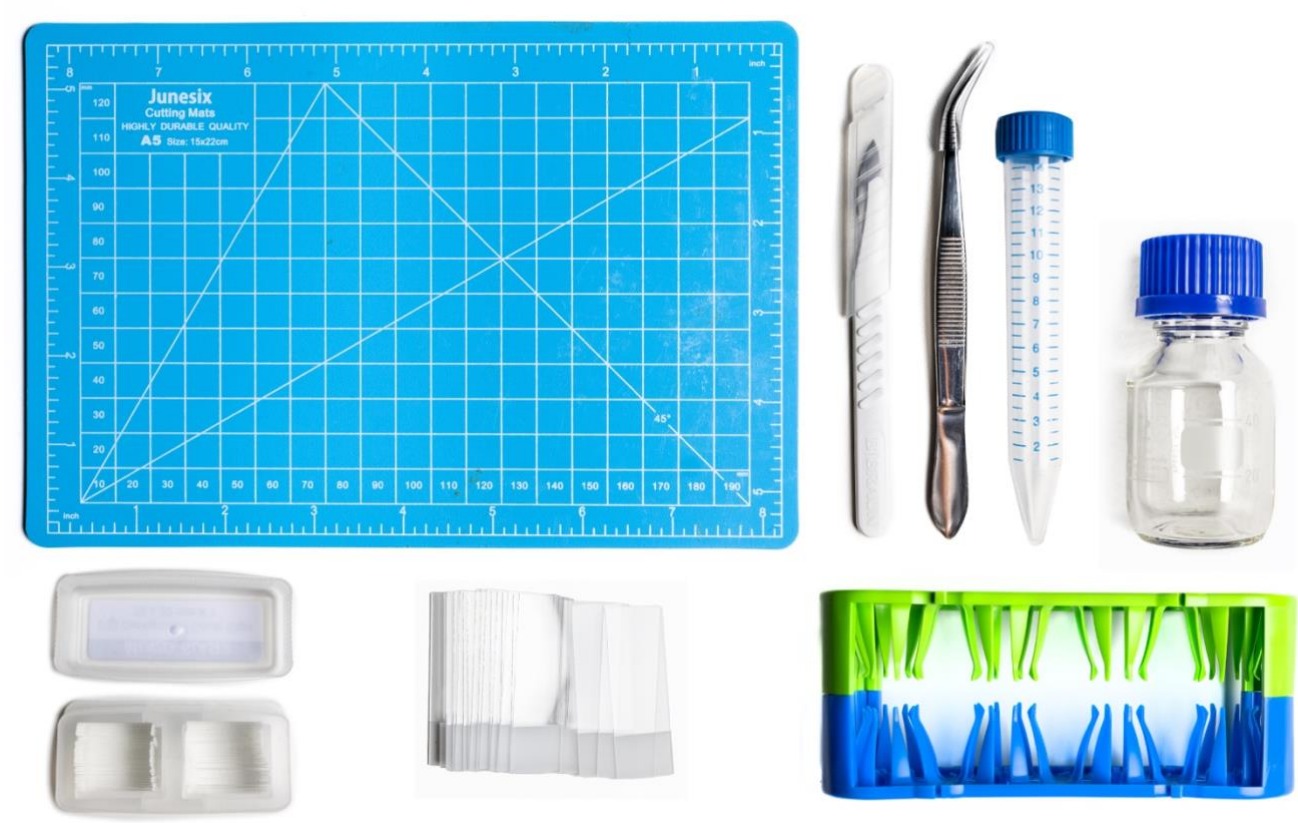
Additional items in case:

- Prepared sample slide set with 3 slides
- Calibration grid

MiA experiment box (Optional item)

MiA includes sample preparation protocols which require simple materials available in basic school laboratories or found easily in markets or homes. If you do not have access to these materials, you can lease the MiA experiment box from us. This experiment box includes the listed materials in quantities sufficient to run a workshop with up to 24 participants.

- Cutting boards
- Coverslips
- Glass Slides
- Glass bottle (50ml)
- 15ml Falcon tubes
- Rack for falcons
- Tweezers and
- Scalpels



Laptop (Optional item)
We optionally offer laptops as part of the lease scheme but so it is not necessary to lease the laptops with the FLMs, you are free to use your own computers/laptops. The laptops we offer are preloaded with the necessary open access software for camera and image analysis. Most computers can be used with the microscopes, they need a USB port and the following software.

NOTE: We do not sell the laptops. If you buy a fluorescence learning microscope from us please note that you will need to have a computer with a USB connection and the following open access software to use it.

- Camera: Point Grey Flycapture2 SDK- compatible with Windows and Linux. It can be downloaded here: https://www.flir.de/products/flycapture-sdk/
- ImageJ: used to open, manipulate, and analyze images. It can be downloaded here https://imagej.nih.gov/ij/download.html
- Alternatively users can use the open-source software µManager. It can be downloaded here: https://github.com/micro-manager

Teaching and learning Materials

The following digital materials complement the "Microscope in Action" experience. We hope the provided material will help streamline your teaching and provide your students with an immersive and comprehensive learning experience. The materials can also be used to enhance other lesson plans.

The complete list of materials available in the package is found below and the full package of digital resources can be downloaded HERE. All resources are available in English and some are additionally available in German. Language options are indicated with a for German and for English.

Here you can read a short description about each resource and find links to download individual resources.

1. **Videos**
   a. Microscope Assembly video (LINK)
      In this video an EMBL scientific expert demonstrates, step-by-step, how to assemble the microscope from its individual parts.
      Duration: 17 min

   b. Introduction to Fluorescence microscopy (LINK | LINK)
      In this video an EMBL scientific expert gives an introduction the basics of light and fluorescence and the components of our learning FM along with a brief overview of the physics behind its construction:
      Duration: 16 min

   c. Advanced fluorescence microscopy (| LINK)
      In this video an EMBL scientific expert talks about the limitations of imaging and how they have been overcome with the development of advanced fluorescent microscopy.
      Duration:

   d. How to prepare sample slide (|)- COMING SOON
      This video demonstrates how to prepare a simple sample slide using pollen from flowers and carrots.
      Duration:

   e. Scientific talks (EN)
      1. Expansion Microscopy- LINK

An EMBl scientist talks about a technique used to overcome the resolution limit

2. Fluorescence Research in Action - LINK

An EMBl scientist gives an overview of how they use fluorescent microscopy in their research

2. **Slide Decks**
   a. Educators ppt (Info guide for educators and ready to use slides for classroom) (LINK | Coming soon)
   Includes salient aspects with graphics of topics covered in an MiA workshop which can aid educators to understand the scope of the workshop and give them access to ready to use slides/visuals

   b. Microscope Assembly slide deck (LINK | LINK)
   Provides slides which can be used to facilitate the assembly of the microscope with a group of participants in workshop or classroom settings

3. **Handbooks and activity sheets***
   a. Educators' handbook (LINK | LINK)
   b. Student's handbook (LINK | LINK)
   c. Assembly Guide (LINK | LINK)
   d. Additional activity worksheets COMING SOON

4. Microscopy images LINK

5. Info on provided sample slides LINK

*The Educators/Students handbook includes several activities for each MiA module. Here you can get an overview of the activities, their duration and target age groups.

The highlighted activities can also be carried out without the MiA kit.

Sample preparation Module (🇬🇧 & 🇩🇪)

1. The Micropipette - Hands-on activity to introduce the micropipette 12+ | 15 minutes
2. Dilutions- Learn to do dilution calculations and prepare dilutions using coloured water 12+ | 30 minutes
3. Sample preparation- #1 Fluorescent beads 12+ | 5 minutes
4. Sample preparation- #2 Lily pollen 12+ | 15 minutes
5. Sample preparation- #3 Fresh plant materials 14+ | 45 minutes
6. Sample preparation- #4 Staining with a non-toxic stain 14+ | 30-60 minutes

Imaging and Image analysis module (🇬🇧 & 🇩🇪)

1. Imaging a test sample 14+ | 15 minutes
2. Acquiring a calibration image and setting the scale 14+ | 15minutes
3. Comparing images with and without filters 14+ | 10 minutes
4. Widen your field of view by combining photos 14+ | 15 minutes
5. Measuring fluorescent intensity 14+ | 15 minutes
6. Everyday objects that are fluorescent 12+ | 10 minutes
7. Fluorescent highlighter fun with everyday specimens 12+ | 10 minutes
8. Adding colours to greyscale images 12+ | 45 minutes

Experiments (🇬🇧 & 🇩🇪)

1. The scientific method 14+ | 120 minutes
2. Extracting and analysing data from images 12+ | 10 minutes
3. Autofluorescence in plants 13+ | 45 Minutes
4. Different staining methods 13+ | 60 minutes
    a. Specific fluorescent staining of cell organelles 14+| 10 minutes
5. Plant cell types 14+ | 45 minutes

Arts and science (🇬🇧 & 🇩🇪)

1. Micro-Macro: Art edition 12+| 90 minutes
2. Micro-Marco: Digital edition 14+ | 120 minutes

Scientific dissemination (🇬🇧 & 🇩🇪)

1. Scientific report 12+| 120 minutes
2. Designing a scientific poster 12+ | 60 minutes

We have also developed some computer/paper-based activities for the following topics which can be run either face2 face or virtually: (🇬🇧)

1. Cell-ebration 15+ | 45 minutes

Paper based activity where students will get familiar with cell culture and will understand how cells are counted.

2. Build a vector - paper models. 15+ | 90 minutes
   Simulation of plasmid vector construction with paper models

3. Sampling like a scientist. How to choose samples for scientific data analysis
   15+ | 45 minutes
   Paper/computer-based activity where students will get familiar with the concepts of "representative sample" and "bias in science", and will analyse microscopy images of a cell population.

Further resources

Most of the following links' lead to articles and short videos on external pages. These are not only focusing on fluorescence microscopy and optics, but also touch upon related topics and applications in research and diagnostics. By integrating a selection of these in your project, you can support the students' learning process and give more insight into real-world applications.

Please note that ELLS is not responsible for the web content of other providers.

Articles on optics, fluorescence microscopy and GFP

1. Painting life green: GFP - Science in School
2. What is GFP? - PDB-101 Molecule of the Month
3. A bright future for light microscopy - Science in School
4. Introduction into Optics - Encyclopaedia Britannica
5. Fluorescence Microscopy - Nature Methods (restricted access)

Articles on applications of fluorescence microscopy

1. Fluorescent Protein Lets Us Read a Fish's Thoughts - New Scientist
2. A Cell Becomes a Laser - Science
3. Sloppy fishing: why meiosis goes wrong - Science in School
4. Watching it grow: developing a digital embryo - Science in School
5. Fluorescence In Situ Hybridization (FISH) - Scitable by Nature Education

Videos

1. EMBL Insight Lecture 2015: "Cell division in focus – imaging an essential step of life"
2. How glow-in-the-dark jellyfish inspired a scientific revolution
3. GFP: How "Glow-in-the-dark" Revolutionized Biology
4. What is GFP?
5. STED - Mikroskopie jenseits optischer Grenzen (German only)
6. Stefan Hell (Nobel Prize in Chemistry 2014): STED - Insights into the nanoworld

7. TED talk: Color coded surgery
8. TED talk: How to look inside the brain