ЦЕНТЪР ЗА ОБУЧЕНИЕ – БАН

1000 София
ул. „Сердика“ № 4
http://edu.bas.bg

email: tdc-phd@cu.bas.bg
тел.: 02 987 31 67
02 979 52 60

Basic Information:
Course Title: Light microscopy and photomicrography
Lecturer: Boyan Zlatkov
Phone: +359899284596
Email: bzlatkov@gmail.com
Total Teaching Hours: 30

Annotation (up to 150 words)

Main objective of the lecture course are the basic principles of operation of the optical microscope and practical skills in its use. Various optical and mechanical components in a standard optical microscope are considered: objectives, eyepieces, condensers, illuminators. The students are introduced to some special microscopic techniques: phase contrast, differential interference contrast, polarized light, fluorescence and confocal microscopy. Different designs of stereomicroscopes are presented. Particular attention is paid to the use of main types of digital cameras and to some of the specifics of digital photographs, including their processing for production of scientific illustration, as well as drawing of objects through camera lucida.

Course content (brief description by topics or modules)

Topic / Module 1: Basic concepts in geometric optics. Principle of magnification. Light phenomena. Light microscope: optical paths, types of lenses, diaphragms, prisms, modulators, filters. Conjugated planes.

Topic / Module 2: Optical aberrations and corrections. Objectives: design and types. Numerical aperture and resolution. Refractive index, immersion media.

Topic / Module 3: Characteristics of objectives. Finite tube length and correction for infinity, parfocality. Condensers: designs and types, Koehler illumination.

Topic / Module 4: Transmitted and reflected illumination. Eyepieces: types, field of view, field number. Useful magnification of microscope. Measuring with microscope.

Topic / Module 5: Special techniques: dark field, phase contrast, polarisation, differential interference contrast, Hoffmann modulation, oblique illumination.

Topic / Module 6: Fluorescence microscope. Confocal microscope. Tube devices. Work with camera lucida.

Topic / Module 7: Photomicrography with a light microscope. Optical adapters and projection eyepieces. CMOS and CCD digital cameras, SLR. Depth of focus, image stacking.

Topic / Module 8: Basic properties of digital images and their initial processing. Software.

Topic / Module 9: Stereomicroscope. Design and types: parallel and convergent trains, magnification systems of Galileo and Greenough. Types of illumination. Tube attachments. Photomicrography with stereomicroscope.

Topic / Module 10: Mechanical part of microscope. Cleaning and care of microscope. How to select microscope configuration.

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Teaching and assessment methods
The theoretical fundaments of microscope optics are explained and discussed via lectures. Main part of the course are demonstrations and acquiring practical skills for routine and specialised work with light microscope. The assesment is based on skills demonstrated by the student after finishing every topic.

Competencies acquired as a result of training (3–5 points)
Basic and specialised knowledge on light microscope. Production of high-quality photomicrographs. Technical skills for various contrasting techniques.

Literature:

Pawley JB (ed.) (2006). Handbook of Biological Confocal Microscopy (3rd ed.). Berlin: Springer.

Solomon, Chris (2010). *Fundamentals of Digital Image Processing*. John Wiley & Sons, Ltd.

Lakowicz, Joseph R. (1999) Principles of Fluorescence Spectroscopy. New York: Kluwer Academic/Plenum

Abramowitz M, Davidson MW (2007). "Introduction to Microscopy". Molecular Expressions. https://micro.magnet.fsu.edu/primer/ (acessed 4.5.2026)

https://evidentscientific.com/en/microscope-resource (acessed 4.5.2026)