

Principles of Light Microscopy



Monday 11 September 2017 - Friday 15 September 2017

MPI-CBG

Scientific Programme

<u>Course content:</u>

The course will cover:

Basics of bright field microscopy.

Contrast techniques (phase contrast, DIC, dark field, polarized light, basics of fluorescence).

Digital imaging using scientific cameras (CCD, sCMOS) will be covered along with a very basic introduction to confocal microscopy and other optical sectioning methods. Please see the more detailed overview of the topics in the overview below.

As the course content is **BASIC** "principles of microscopy", we would like to point out that advanced imaging applications such high performance confocal, 2-photon, FRAP, FRET, FLIM, TIRF and super resolution light microscopy will not be addressed in depth.

<u>Preparation: </u>

It is highly recommended to watch the on-line open iBiology Microscopy Course: <http://www.ibiology.org/ibioeducation/taking-courses/ibiology-microscopy-course.html>

<u>Course structure:</u>

All students will work together with teachers, forming one group, in a round table setting. Theoretical parts will be followed by practical "hands on" sessions at teaching microscopes. We plan to keep a ratio of 2 students per one teaching microscope always supported by one local tutor. During practical parts and demonstrations we will form small subgroups of students working together with teachers.

<u>Preliminary overview of the course topics</u>**Monday**

Resolution, Contrast, Magnification, Lenses: how they work and what they can do. Importance of Numerical Aperture
Geometrical optics
Illumination methods
Choice of optical components
Summary of setting up the microscope illumination
Lens aberrations and their correction

<u>Practical:</u> Model microscope on an optical bench, identifying components of the microscope, setting up Koehler illumination

Tuesday

Diffraction and Image formation
Demonstration of Abbe's diffraction experiments
Methods of enhancing contrast (1): bright field, dark field, phase contrast

<u>Practical:</u> Dark field microscopy, phase contrast microscopy

Wednesday

Methods of enhancing contrast (2): Polarised light, Differential Interference Contrast (DIC)
Introduction to fluorescence

<u>Practical:</u> Polarized light microscopy, DIC

Thursday

Methods of enhancing contrast (3): Fluorescence microscopy
Introduction to digital imaging using scientific cameras (CCD, sCMOS)

<u>Practical:</u> Fluorescence microscopy, digital imaging using scientific cameras

Friday

Basic introduction to advanced optical sectioning methods and deconvolution (laser scanning confocal microscopy, two photon microscopy, spinning disk confocal microscopy, TIRF microscopy, light-sheet microscopy, super resolution light microscopy)
What you need to know about planning your imaging experiments
Round table course discussion and evaluation

<u>Practical:</u> Demonstration of key components of advanced imaging systems

Monday following week – voluntary 13:00 – 18:00

<u>Practical: </u>Voluntary “hands on sessions” on advanced imaging systems