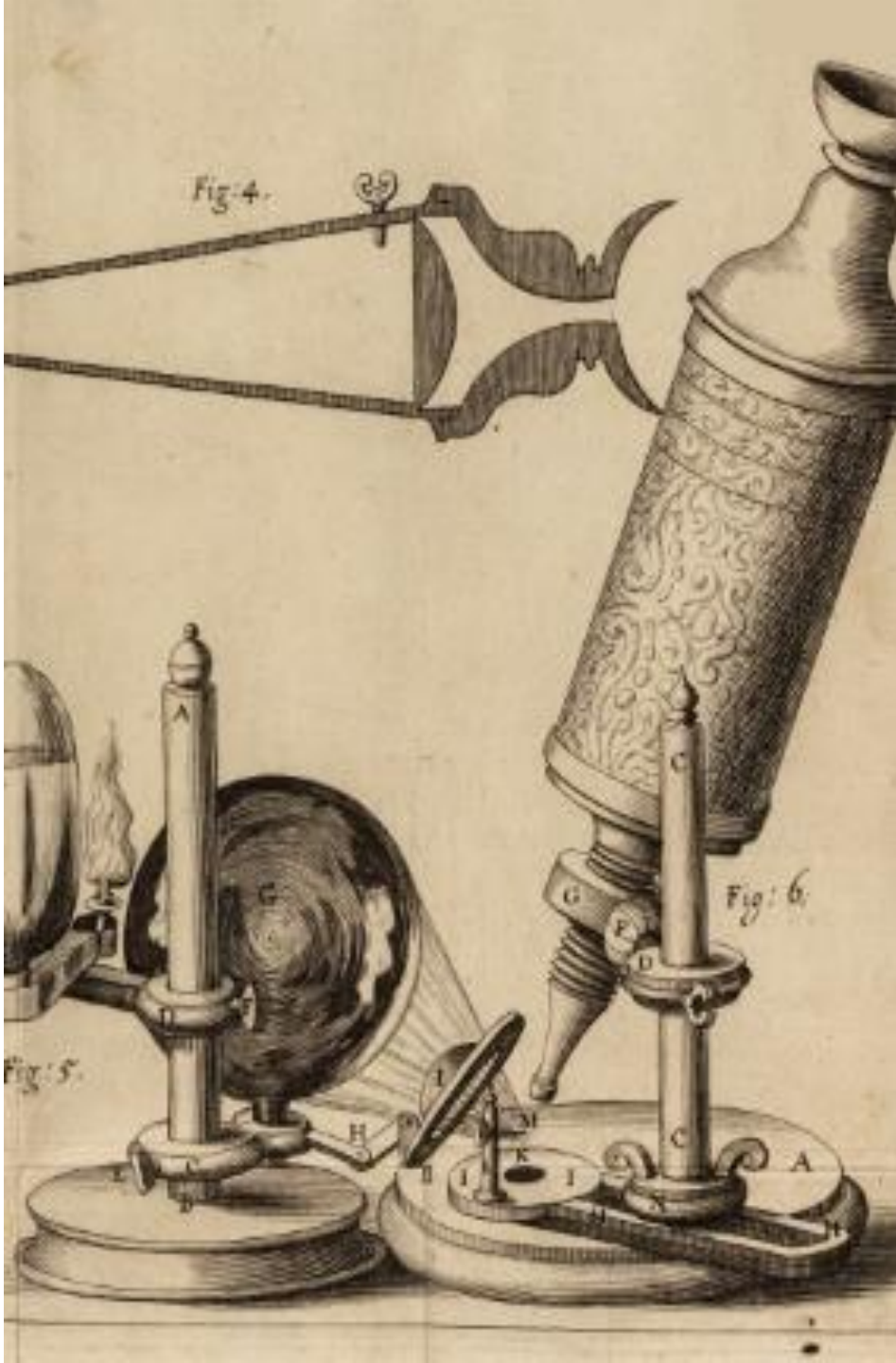




# Fundamentals of Biomicroscopy

MICRO-561



# Fundamentals of Biomicroscopy MICRO-561

Organisation & Logistics

# Fundamentals of Biomicroscopy

## MICRO-561

### ■ Instructor

- Prof. Hatice Altug  
Head of BioNanoPhotonic Systems  
Laboratory  
STI-IBI-BIOS

### ■ Teaching assistants

- Berkay Dagli  
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# Fundamentals of Biomicroscopy

## Logistics

- Lecture      When:            Tuesdays      15:15-17:00  
                  Where:            DIA005
- Exercise      When:            Tuesdays      17:00-19:00  
                  Where:            DIA005
- Website      Moodle.epfl.ch

# Fundamentals of Biomicroscopy

## Course Summary

- Understand the principles of optical microscopes, their limitations and advantages by using geometrical and wave optics.
- Introduce commonly used biomicroscopy methods such as wide-field and fluorescence.
- Cover basic microscopy components for investigating biological samples.

# Fundamentals of Biomicroscopy

## Learning Outcomes

- Sketch basic optical systems
- Characterize the main elements of an optical microscope
- Estimate the resolution of the imaging system
- Understand principles of wide-field microscopy and fluorescence microscopy
- Propose a suitable optical microscopy configuration for imaging a biological sample

# Fundamentals of Biomicroscopy

## Content

- Ray (geometrical) optics
- Matrix (ABCD) optics
- Wave optics
- Fourier optics
- Magnification and optical design
- Resolution in microscopy  
point-spread function (PSF)
- Contrast in microscopy
- Aberrations in microscopy
- Principles of wide field and fluorescence microscopies
- Microscope elements:  
objectives, eyepiece, filters,  
sources, detectors
- Biomicroscopy application, -  
examples

# Fundamentals of Biomicroscopy

## Syllabus (Tentative)

Lecture 1	09 September	Introduction & Ray Optics-1
Lecture 2	16 September	Ray Optics-2 & Matrix Optics-1
Lecture 3	23 September	Matrix Optics-2
Lecture 4	30 September	Matrix Optics-3 & Microscopy Design-1
Lecture 5	07 October	Microscopy Design-2
Lecture 6	14 October	Microscopy Design-3
<b>Lecture X</b>	<b>21 October</b>	<b>Holiday</b>
Lecture 7	28 October	Resolution-1
Lecture 8	04 November	Resolution-2
Lecture 9	11 November	Resolution-3
Lecture 10	18 November	Contrast & Fluorescence-1
Lecture 11	25 November	Fluorescence-2
Lecture 12	02 December	Fluorescence-3, Sources
Lecture 13	09 December	Filters & Detectors
Lecture 14	16 December	Bio-application Examples

### ■ LECTURE MATERIALS:

- Course slides, exercises and solutions will be posted on Moodle.
- Any supporting reading materials and information will be posted on Moodle.

### ■ SUGGESTED BOOKS:

- Fundamentals of Light Microscopy and Electronic Imaging by Murphy and Davidson.
- Fundamentals of Photonics by Saleh & Teich.
- Optics by Hecht.

# The Minor in Imaging

Open to all EPFL students

- ▶ **Transversal & interdisciplinary program**
- ▶ **Covers theoretical and practical aspects in imaging**
- ▶ **Useful in industry and academic world**

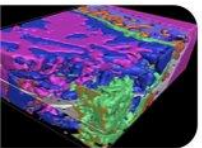
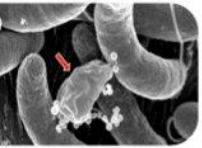
## Requirements

- ▶ **Mathematics**  
*Linear algebra & analysis*
- ▶ Basis of programming  
*One language*
- ▶ Basis of physics  
*Optics*

## Minor (30 ECTS):

- ▶ 22 ECTS of courses
- ▶ 8 ECTS for a project

Broaden your career horizon

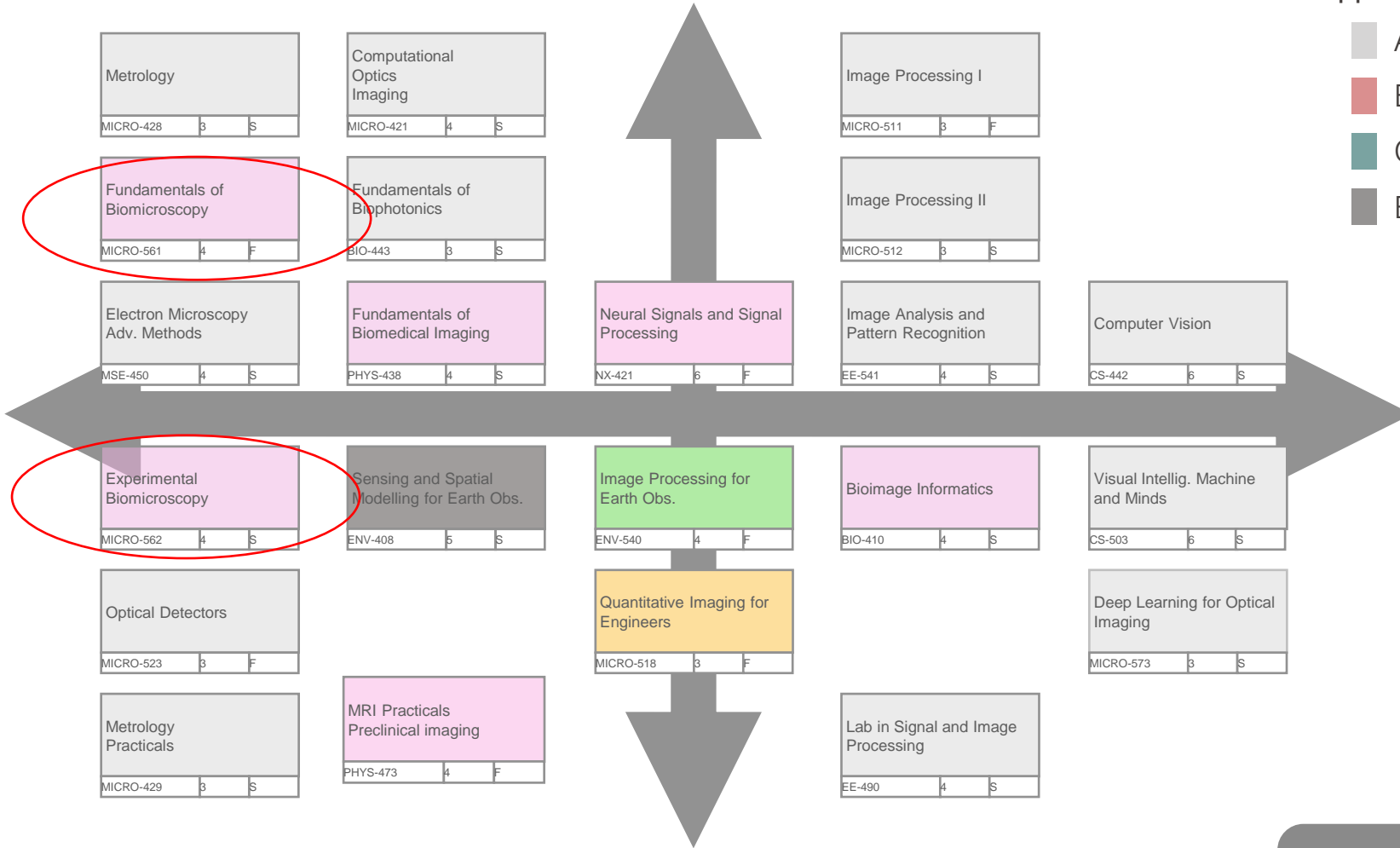


# The Minor in Imaging

Fundamentals/Theory

Application Fields:

- Application Agnostic
- Biomedical, Life Sciences
- Civil Engineering
- Earth Observation



Instrumentations Optics

Computation Data Science

Applied Labs/Practice

Coordination

Dr. Daniel Sage  
daniel.sage@epfl.ch

Organization

EPFL Center for Imaging  
Microengineering Section