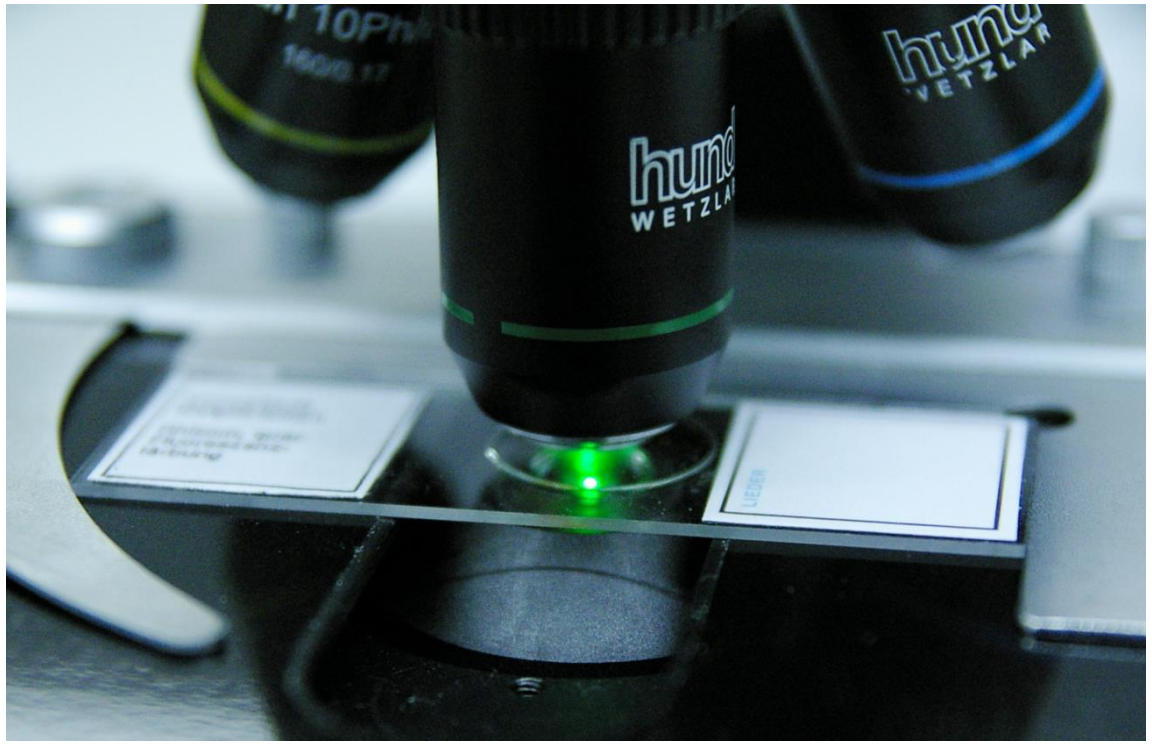
we bring
technologies
together

Light Microscopes by Hund

Contents



- History
- The Microscope
- Contrasting Techniques
- Stand Systems
- Documentation

General

μικρός **(mikros): small**

σκοπεῖν **(skopein): to observe**

History

- **Zacharias Janssen (1588 – 1631):**

  1595: First compound microscope

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History

- **Antoni van Leeuwenhoek (1632 – 1723):**

  High-quality single lenses, 270x, stained specimens

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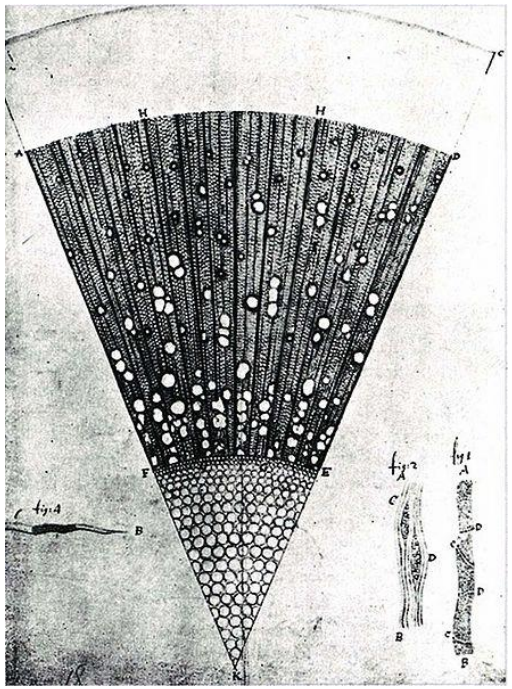

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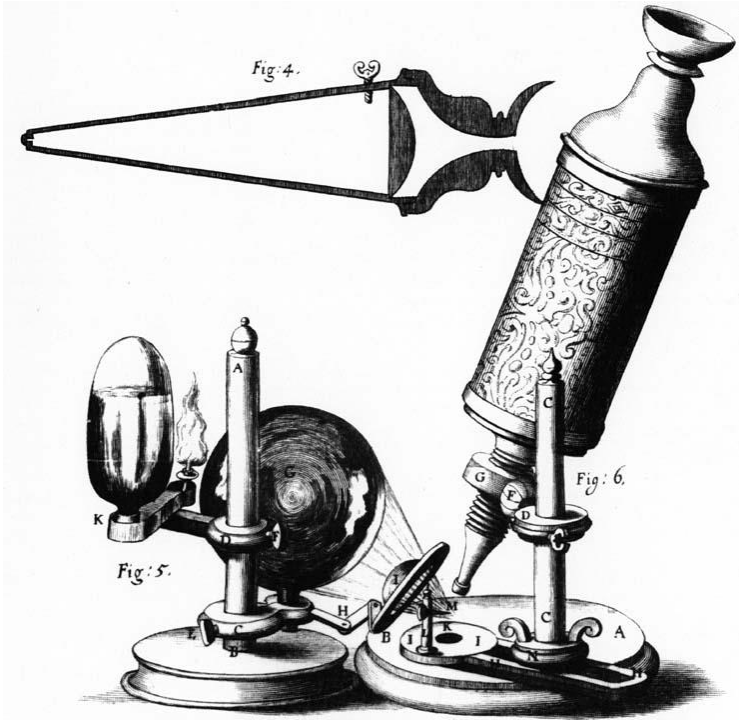
History

- **Robert Hooke (1635 – 1702):**

  Compound microscope, oblique illumination:
  „Micrographia“, 1665



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History

- **Étienne-Louis Malus (1755 – 1812):**

  Publications on light refraction and polarisation

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- **George Gabriel Stokes (1819 – 1903):**

  Research on fluorescence, publications on light absorption

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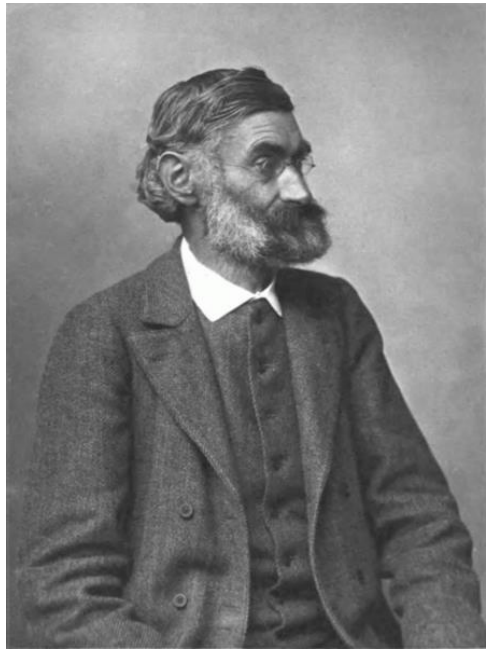
History

- **Ernst Abbe (1840 – 1905):**

  1866: Cooperation with Carl Zeiss
  1870: Imaging theory

$$\Delta x = \frac{\lambda}{NA_{Objective} + NA_{Condenser}}$$



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History

- **Paul Ehrlich (1845 – 1915):**

  Advancement of staining methods for immunology

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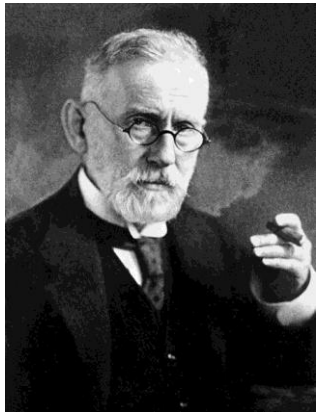

- **Hans Christian Gram (1853 – 1938):**

  Gram staining of bacteria

Source unknown

History

- **Frederik Zernike (1888 – 1966):**

  1930: Invention of phase contrast microscopy
  1941: First commercial instrument (Zeiss)
  1953: Nobel Prize in Physics

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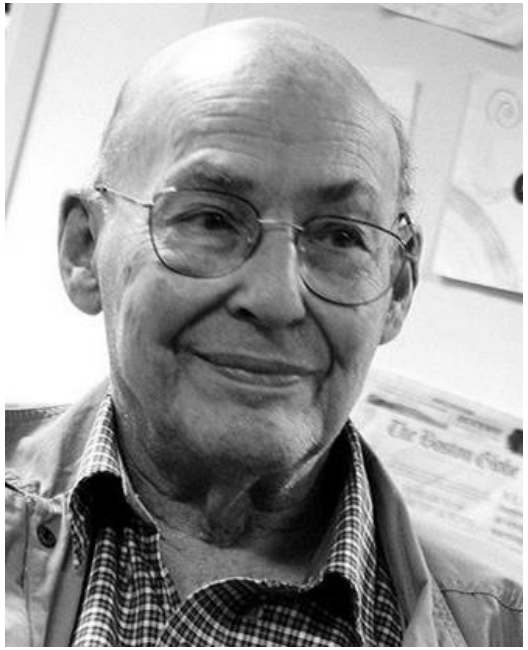
History

- **Marvin Minsky (1927 – 2016):**

  1955: Confocal microscope
  1956: Term „Artificial intelligence“



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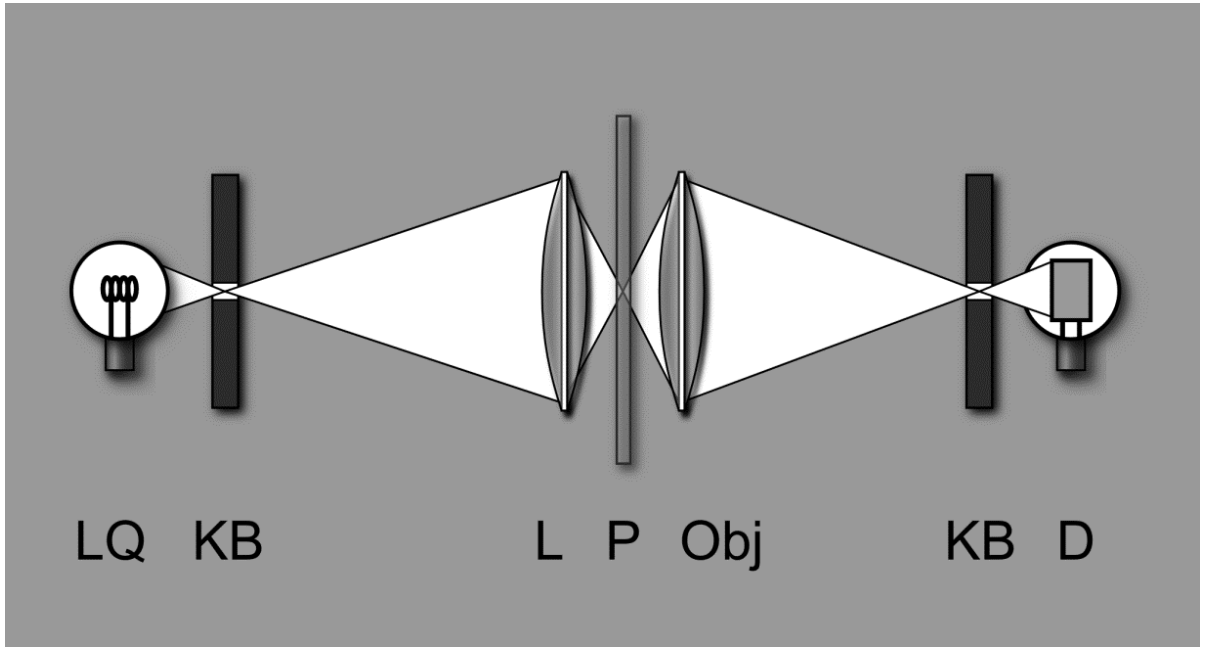

History

- **Stefan W. Hell (*1962):**

  2000: STED microscope
  2001: MPI for Biophysical Chemistry, Göttingen
  2014: Nobel Prize in Chemistry

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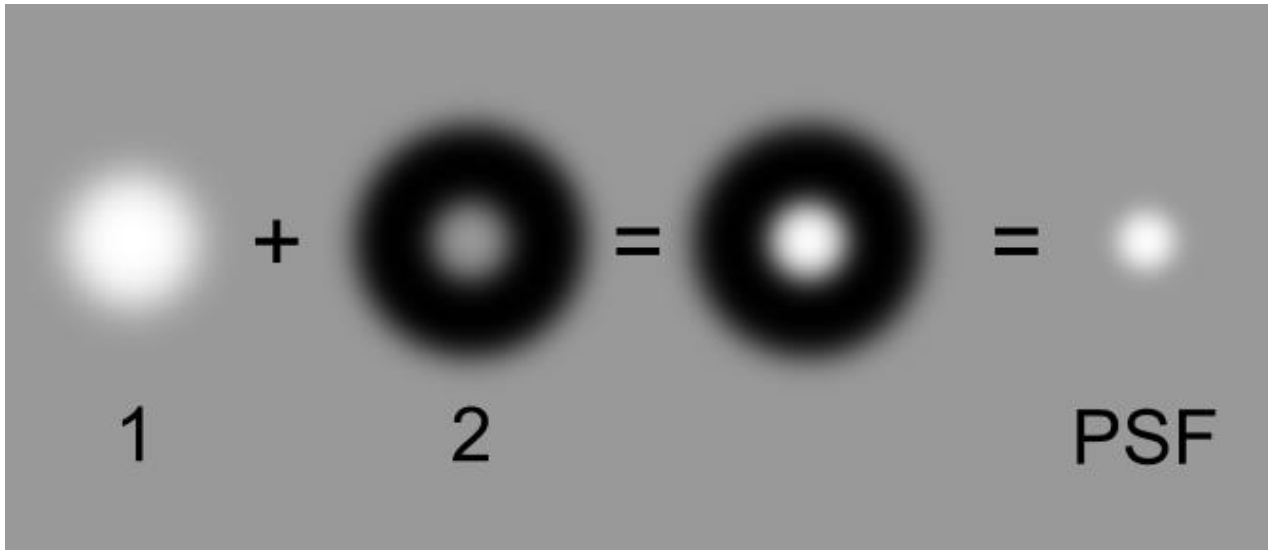


The Microscope: Parameters

Total Magnification

- How large is the observed image?
- Determined by objective, eyepiece and (optional) tube factor

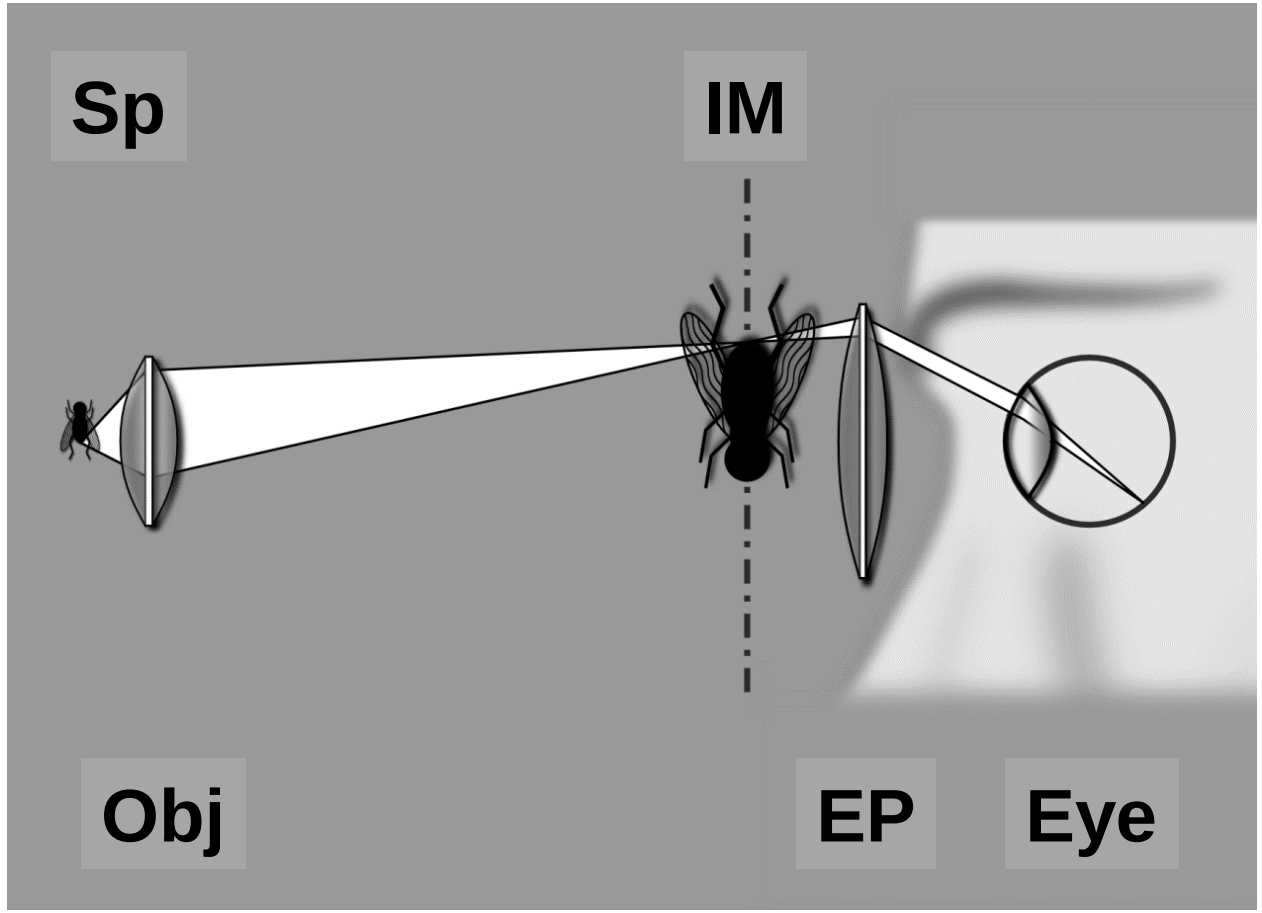
Resolving Power

- How much detail is contained in the image?
- Important: numerical apertures of objective and condenser

Contrast

- Are object details well discernible?
- There are different contrasting techniques

The Microscope: Parameters



Sp: Specimen

Obj: Objective

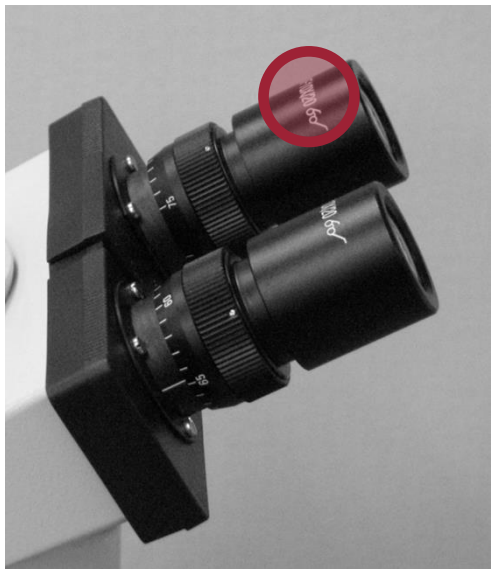
IM: Intermediate image

EP: Eyepiece

The Microscope: Parameters

Total Magnification

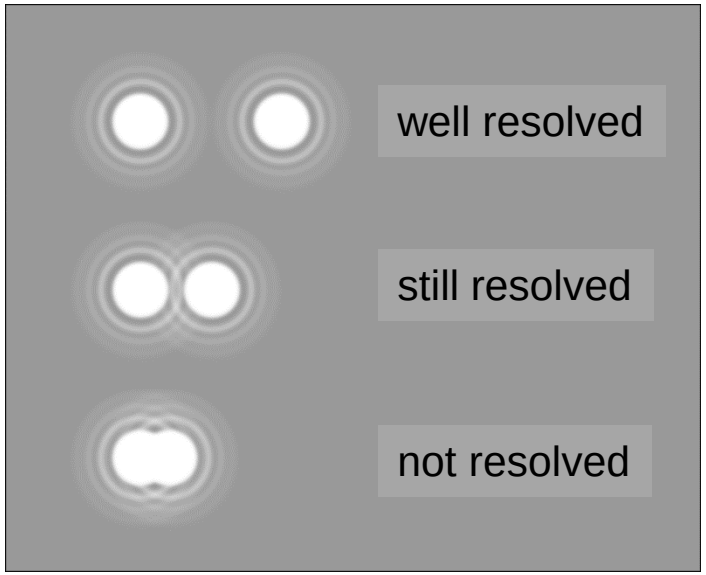
- How large is the observed image?
- Determined by objective, eyepiece and (optional) tube factor

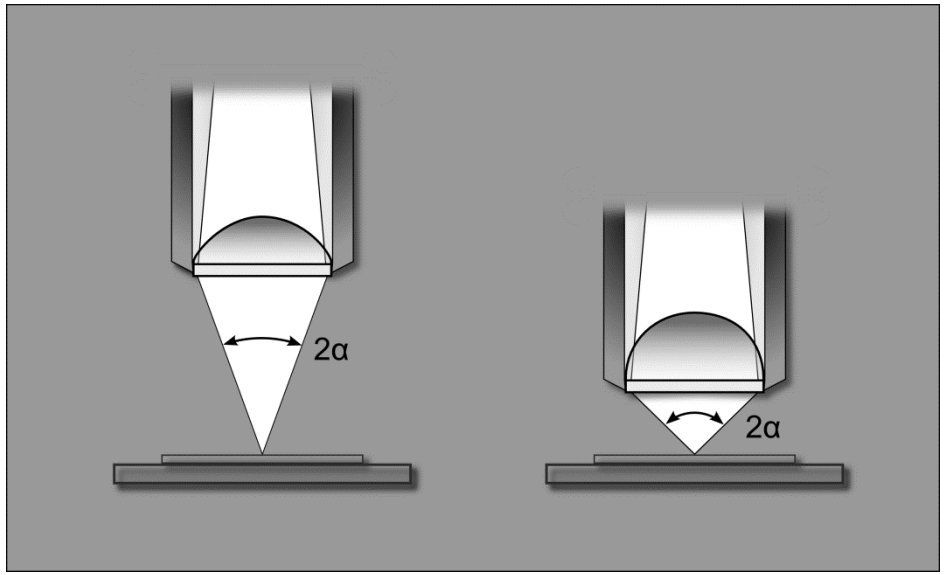
$$M = \text{  } \times \text{  }$$

The Microscope: Parameters

Resolving Power

- How much detail is contained in the image?
- Important: numerical apertures of objective and condenser





The Microscope: Parameters

Resolving Power

- How much detail is contained in the image?
- Important: numerical apertures of objective and condenser

$$\Delta x = \frac{\lambda}{NA_{Objective} + NA_{Condenser}}$$

The Microscope: Parameters

Resolving Power

Useful magnification of a microscope:

$$M_{useful} = (500 \ldots 1'000) \times NA$$

For an objective with NA 1.25, one gets:

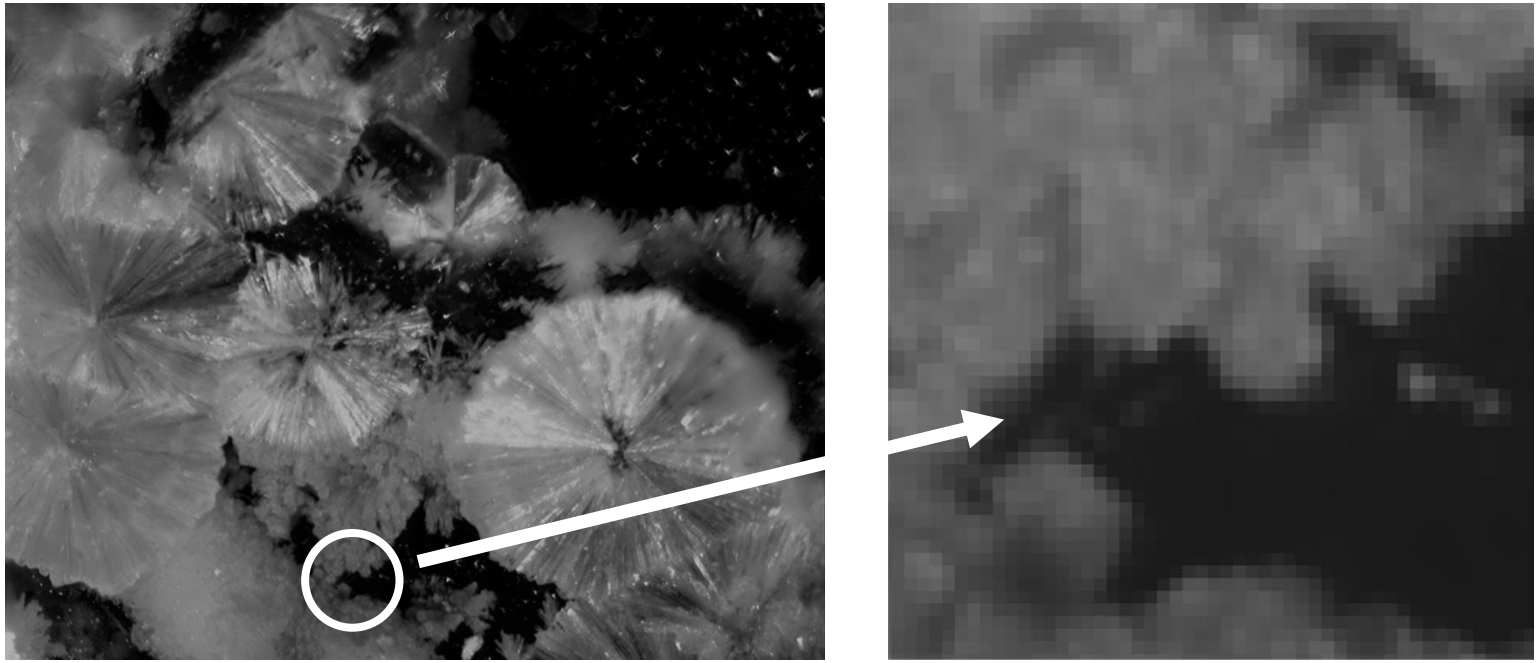
$$M_{useful,\ max} = 1'250,$$

can be realized e. g. with a 100:1 objective and 12.5x eyepiece(s)

The Microscope: Parameters

Resolving Power

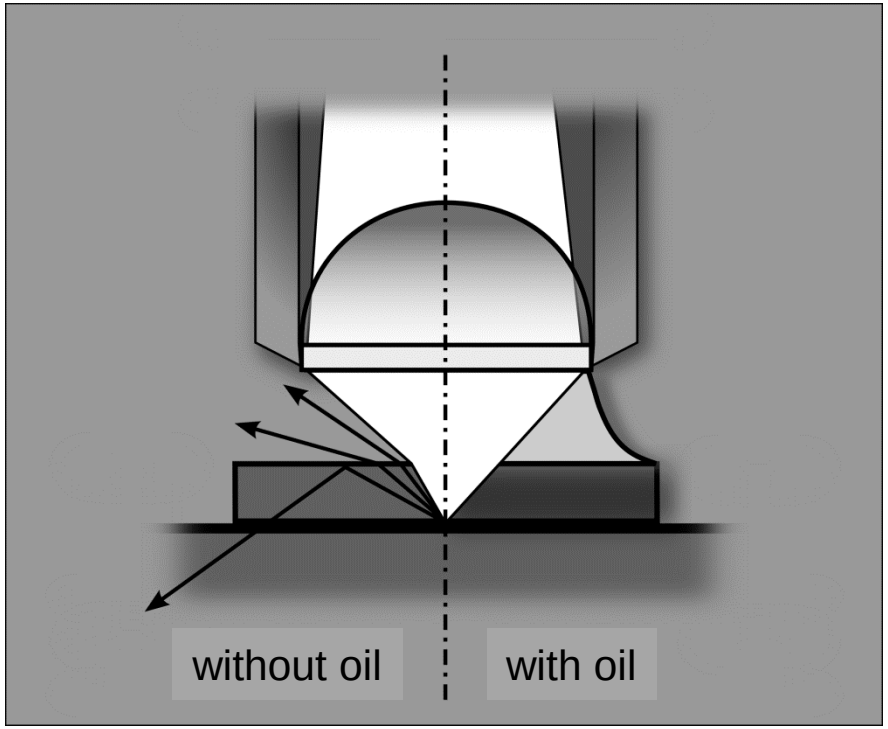
Magnifications larger than useful: empty magnification



The Microscope: Parameters

Resolving Power

For numerical apertures ≥ 1: Oil immersion



The Microscope: Parameters

Optical correction: Achromatic objectives

Chromatic aberrations:

- **longitudinal**
- **lateral**

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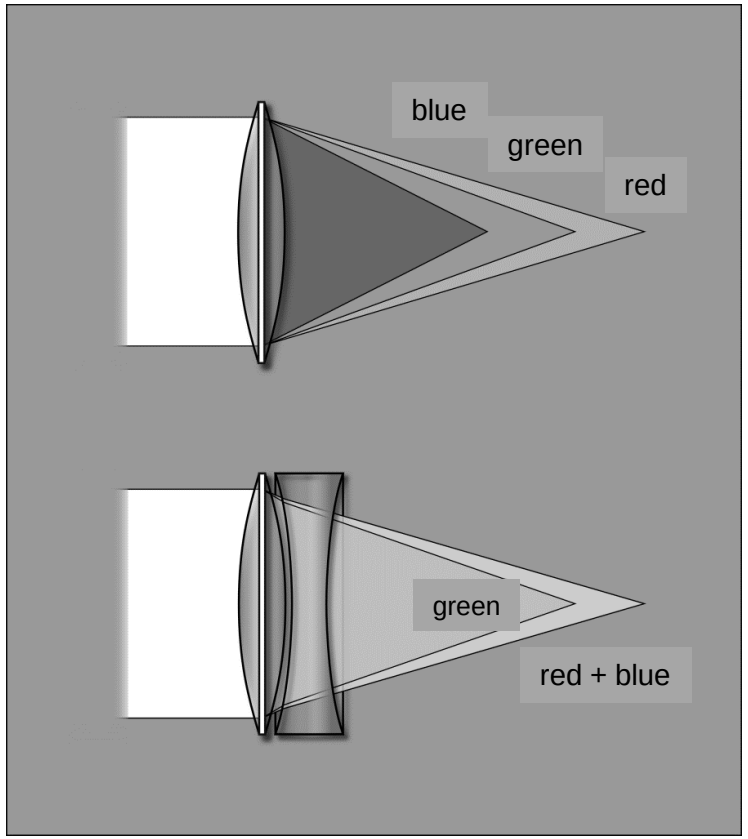
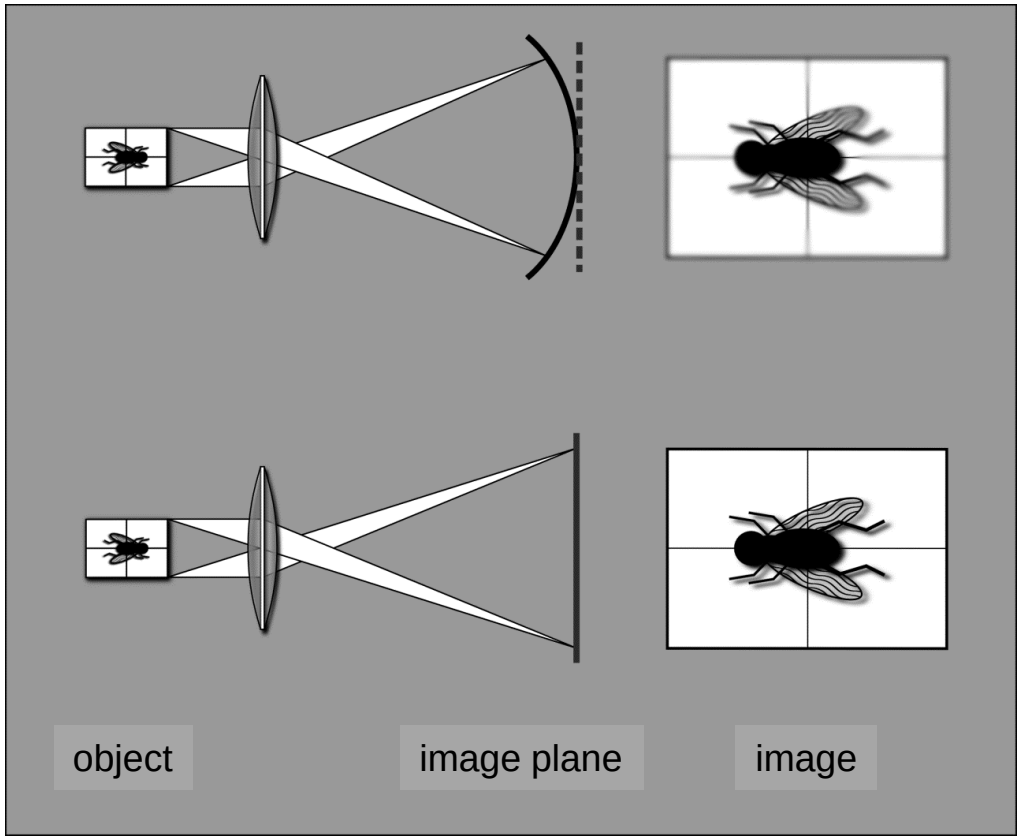
Optical correction: Achromatic objectives



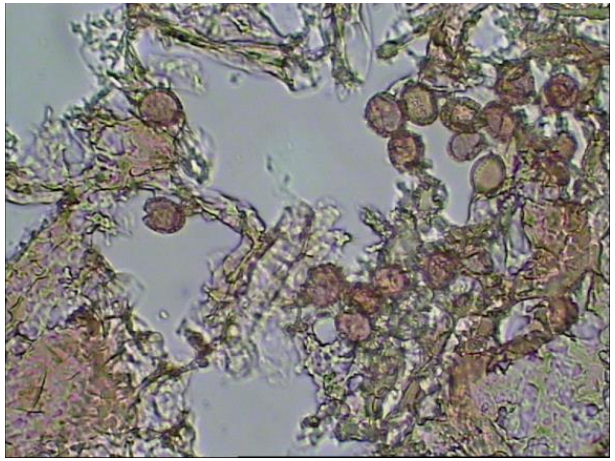
The Microscope: Parameters

Optical correction: Plan objectives for flat images

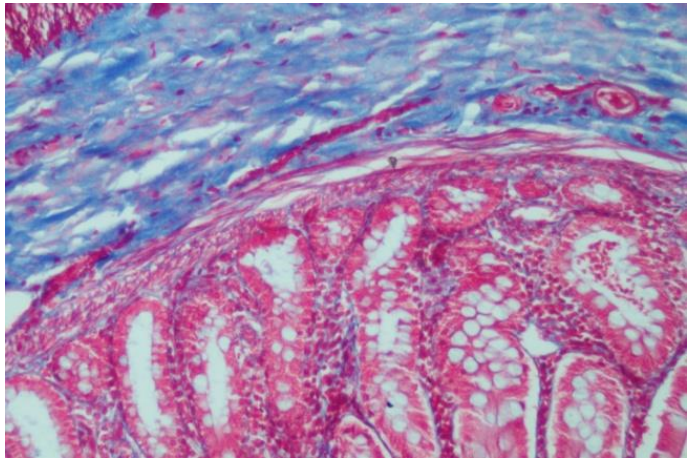


Brightfield (BF) Microscopy

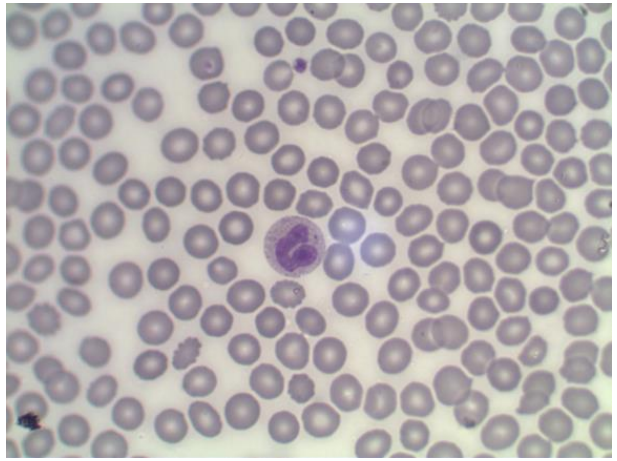
- High-contrast specimens with intrinsic colours
- Alternative: Staining (disadvantage: cells †)
- Example: Stained tissue sections and smears
- Specimen is screened ‘like a diapositive‘



Mushroom, intrinsic colour



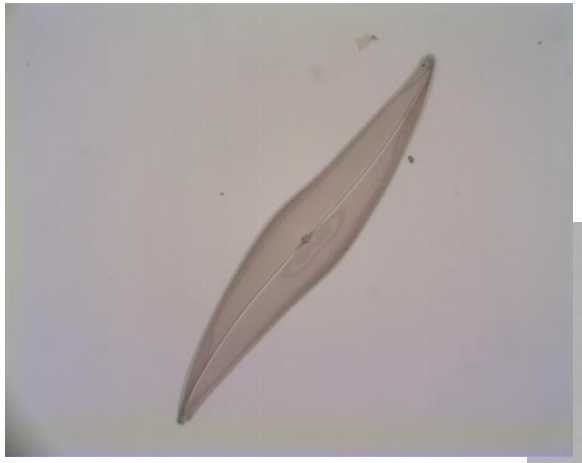
Duodenum section, AZAN staining



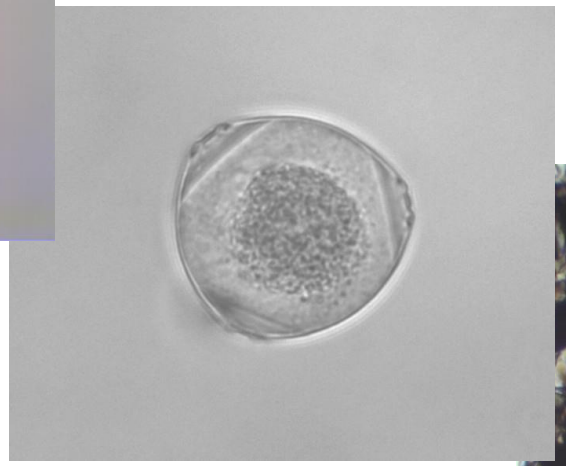
Blood smear, Giemsa staining

Brightfield (BF) Microscopy

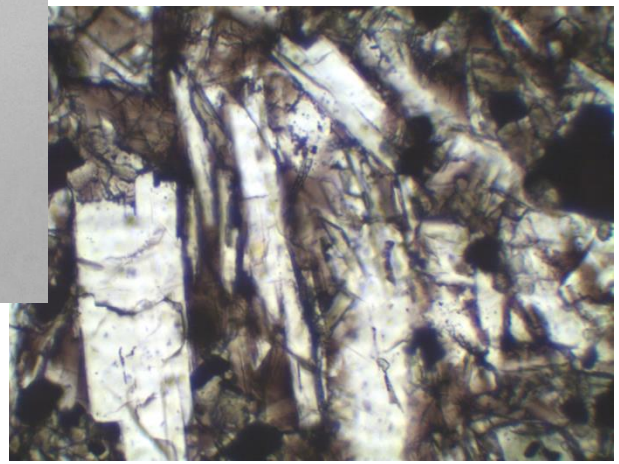
Examples: Intrinsic colours/sufficient contrast



Diatom



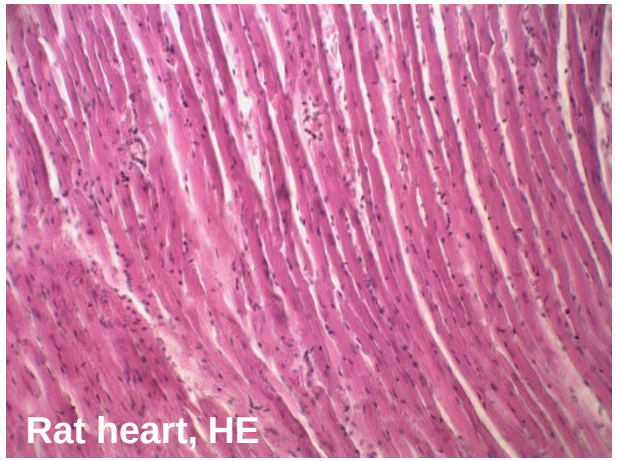
Hazel pollen

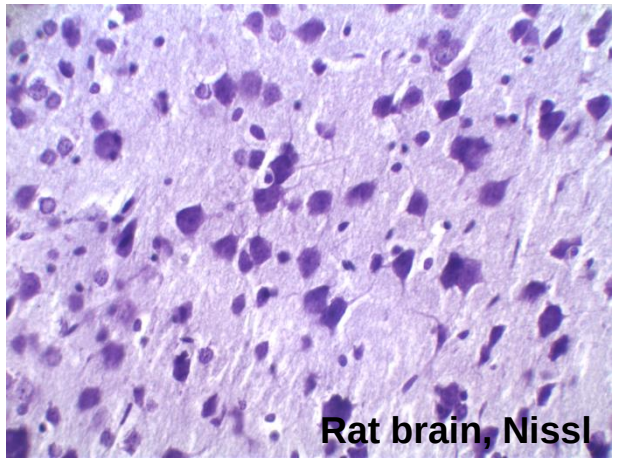


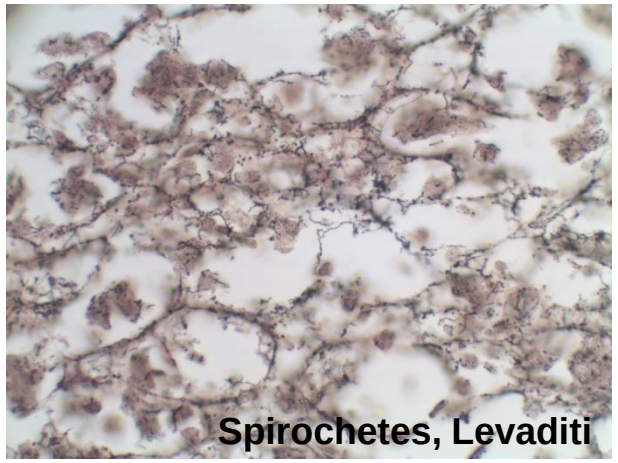
Thin section (basalt)

Brightfield (BF) Microscopy

Examples: Stained specimens

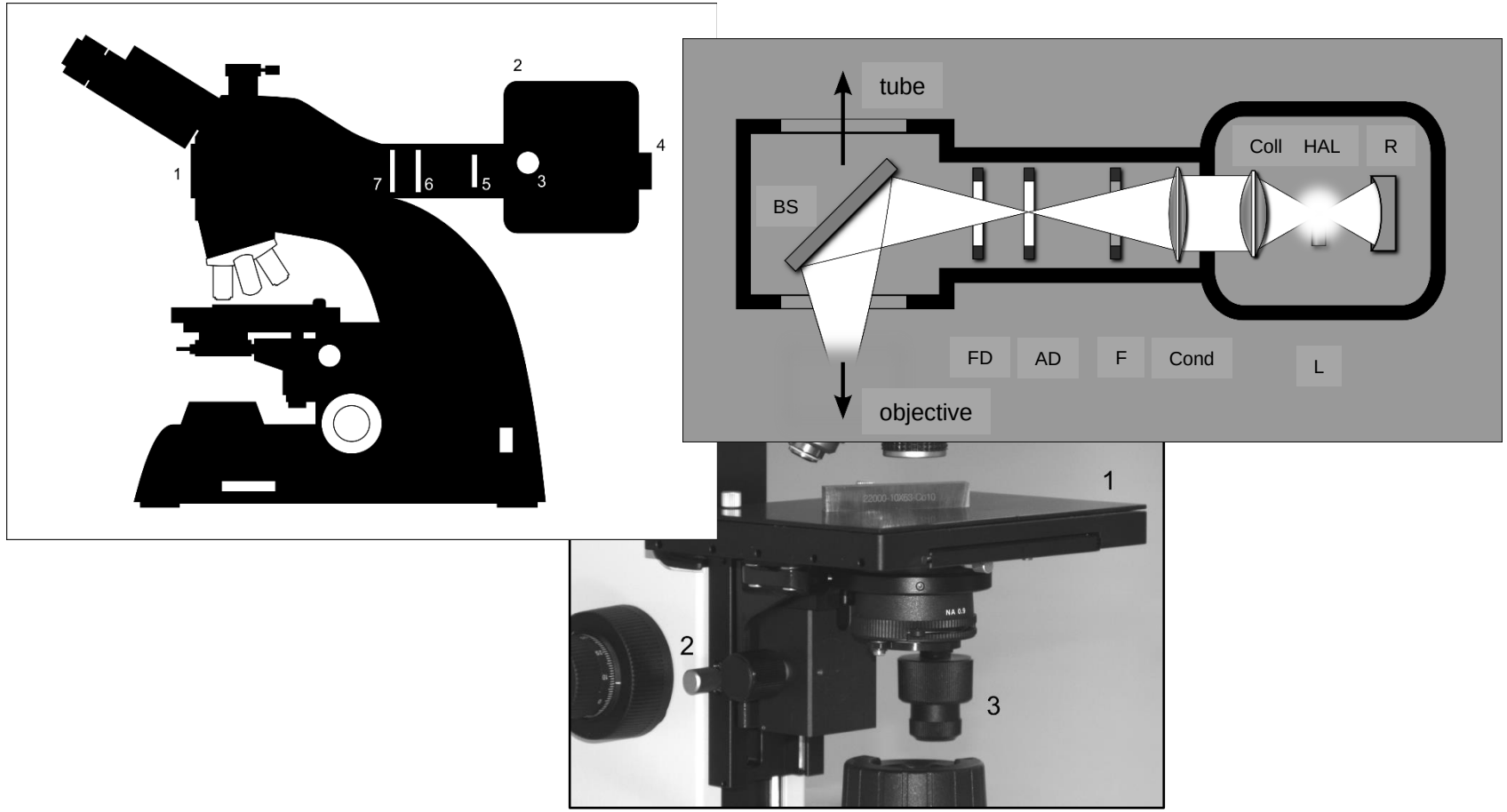






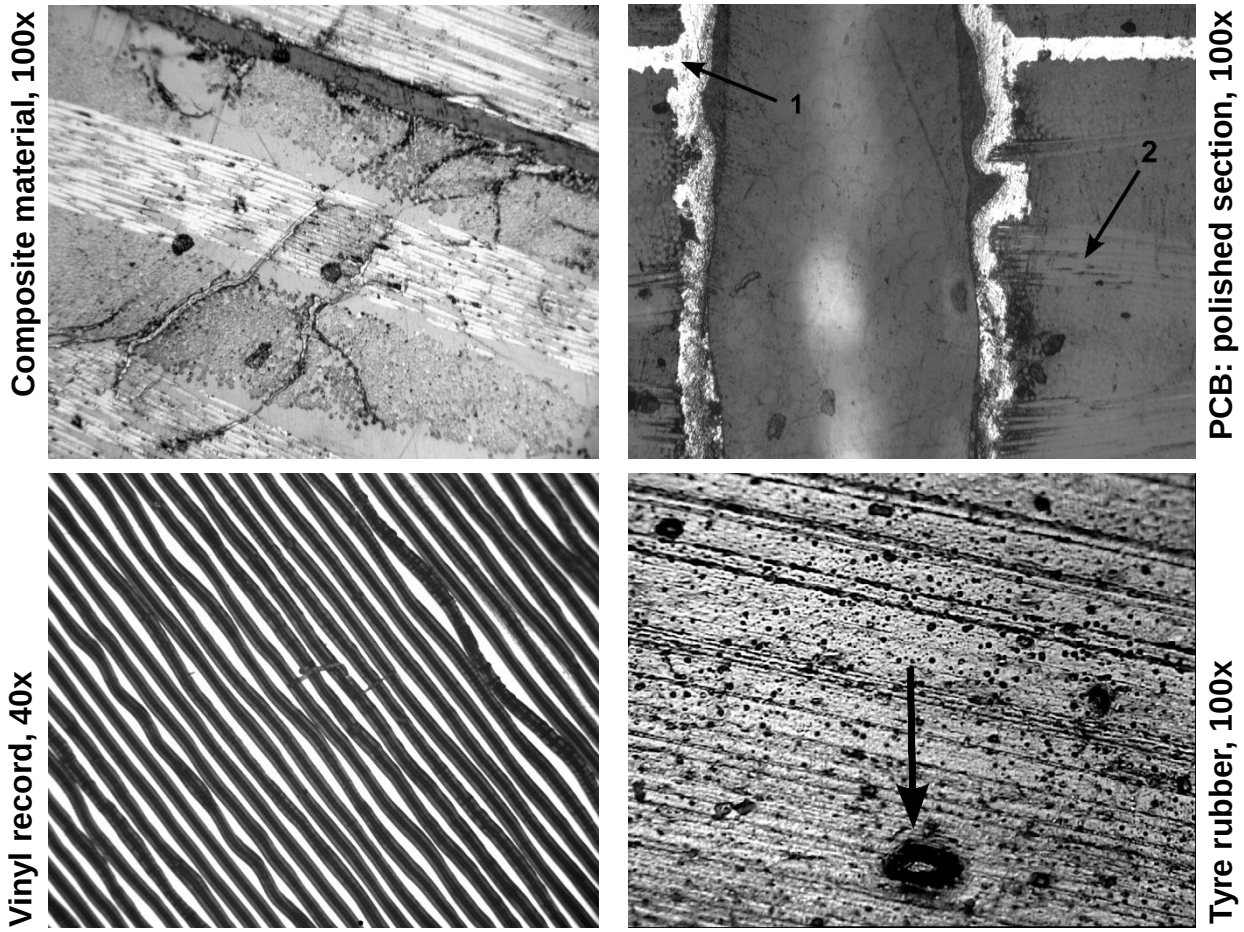
Brightfield (BF) Microscopy

Opaque specimens: Incident-light microscopy



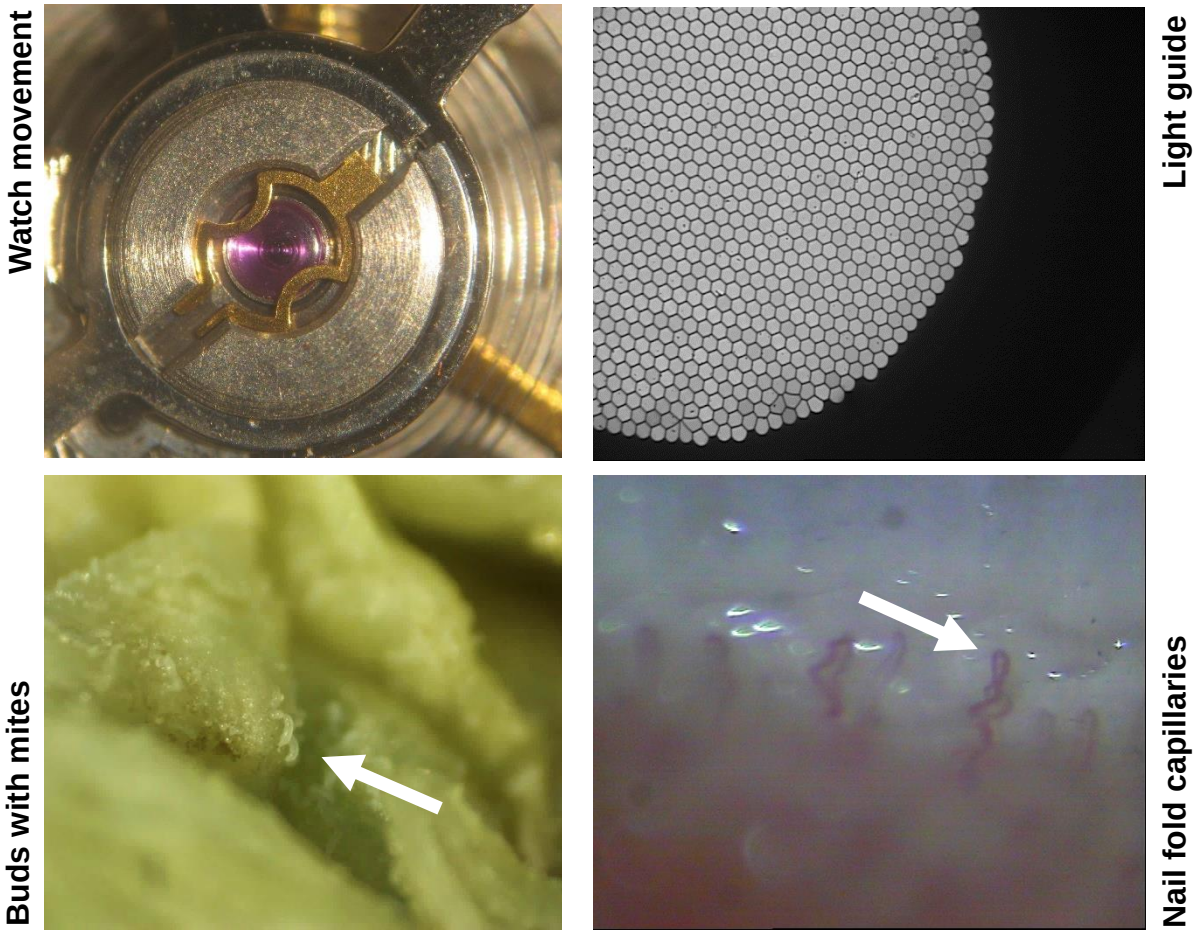
Brightfield (BF) Microscopy

Examples: Incident-light microscopy



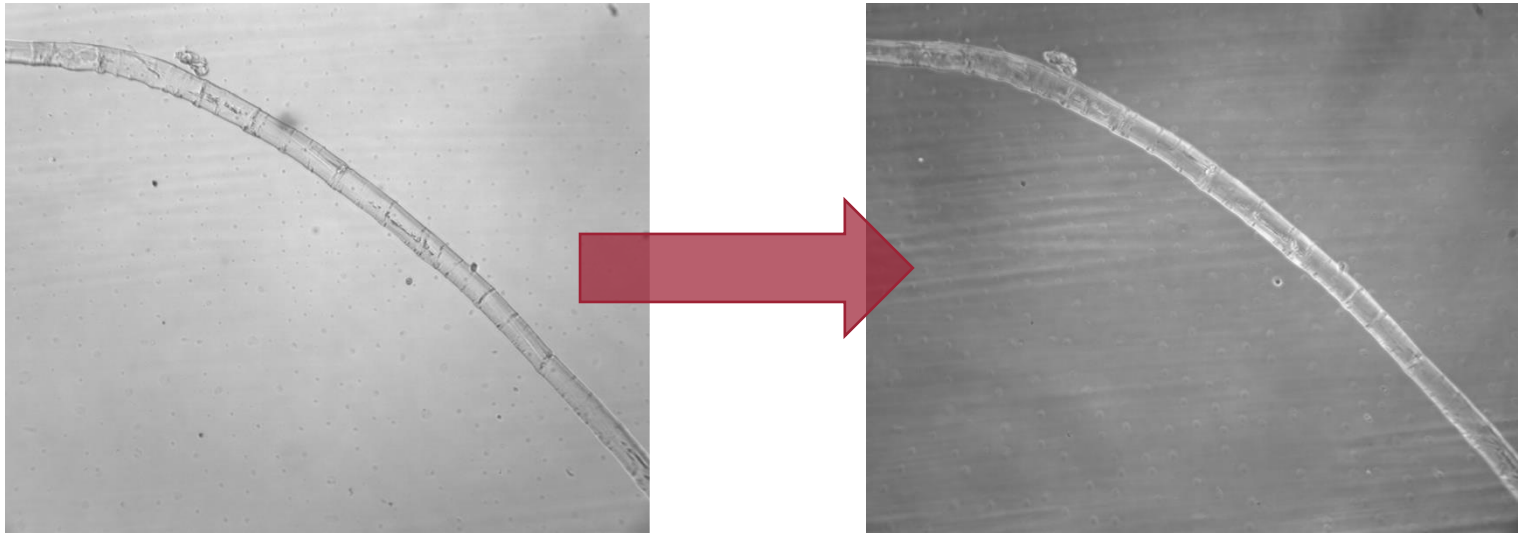
Brightfield (BF) Microscopy

Examples: Stereo microscopy, flexible illumination



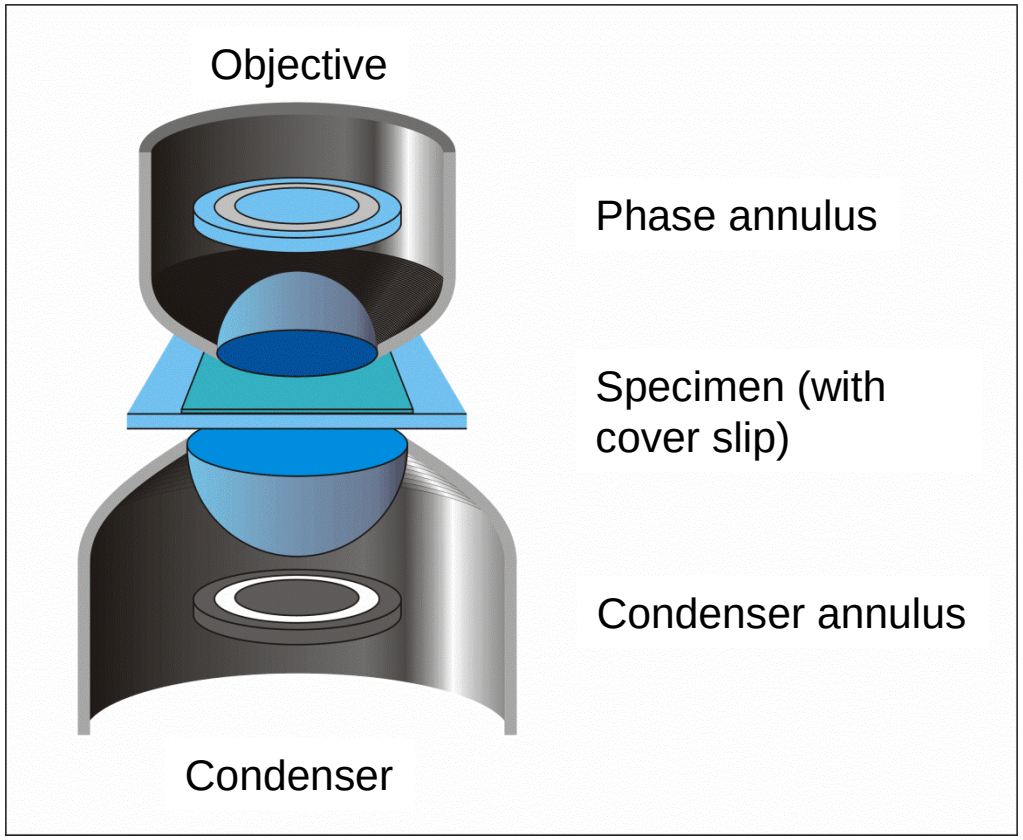
Phase Contrast (PH) Microscopy

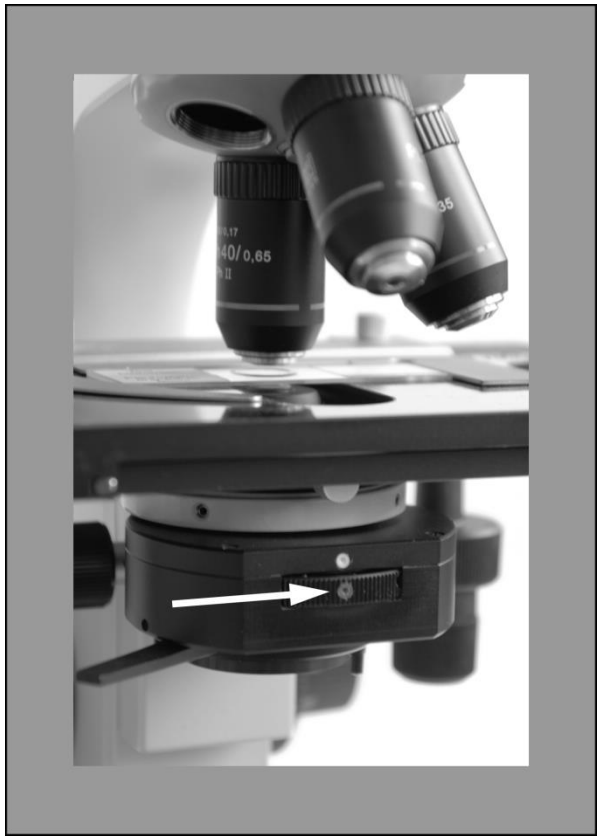
- Low-contrast, thin specimens
- Staining: Not possible/not desirable
- Example: Examination of saliva, urinary sediment
- BF microscope with special objectives and condenser annuli



Phase Contrast (PH) Microscopy

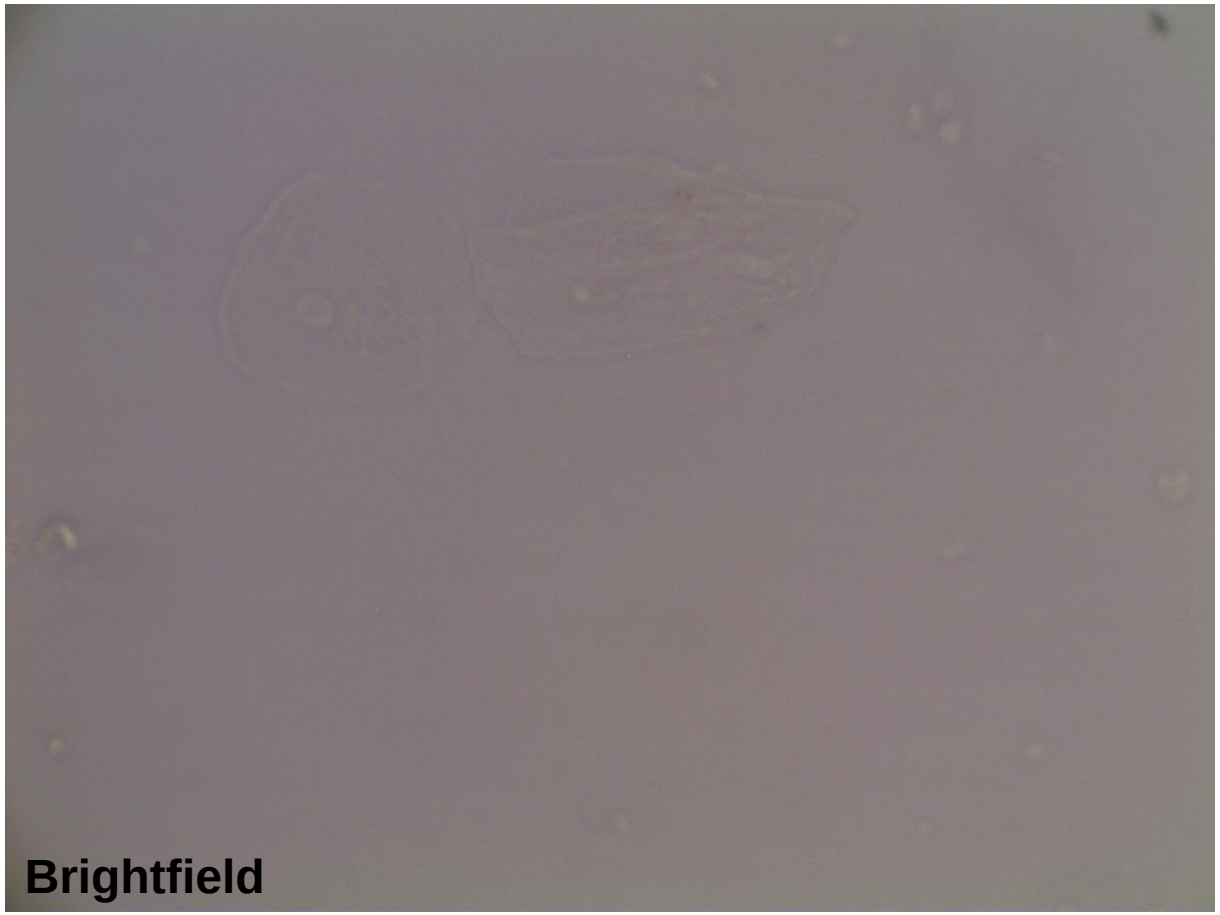
One annulus for **each** phase objective!





Phase Contrast (PH) Microscopy

Example: Epithelial cells



Phase Contrast (PH) Microscopy

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Example: Epithelial cells

Brightfield, aperture diaphragm closed

Phase Contrast (PH) Microscopy

Example: Epithelial cells

Phase Contrast (PH) Microscopy

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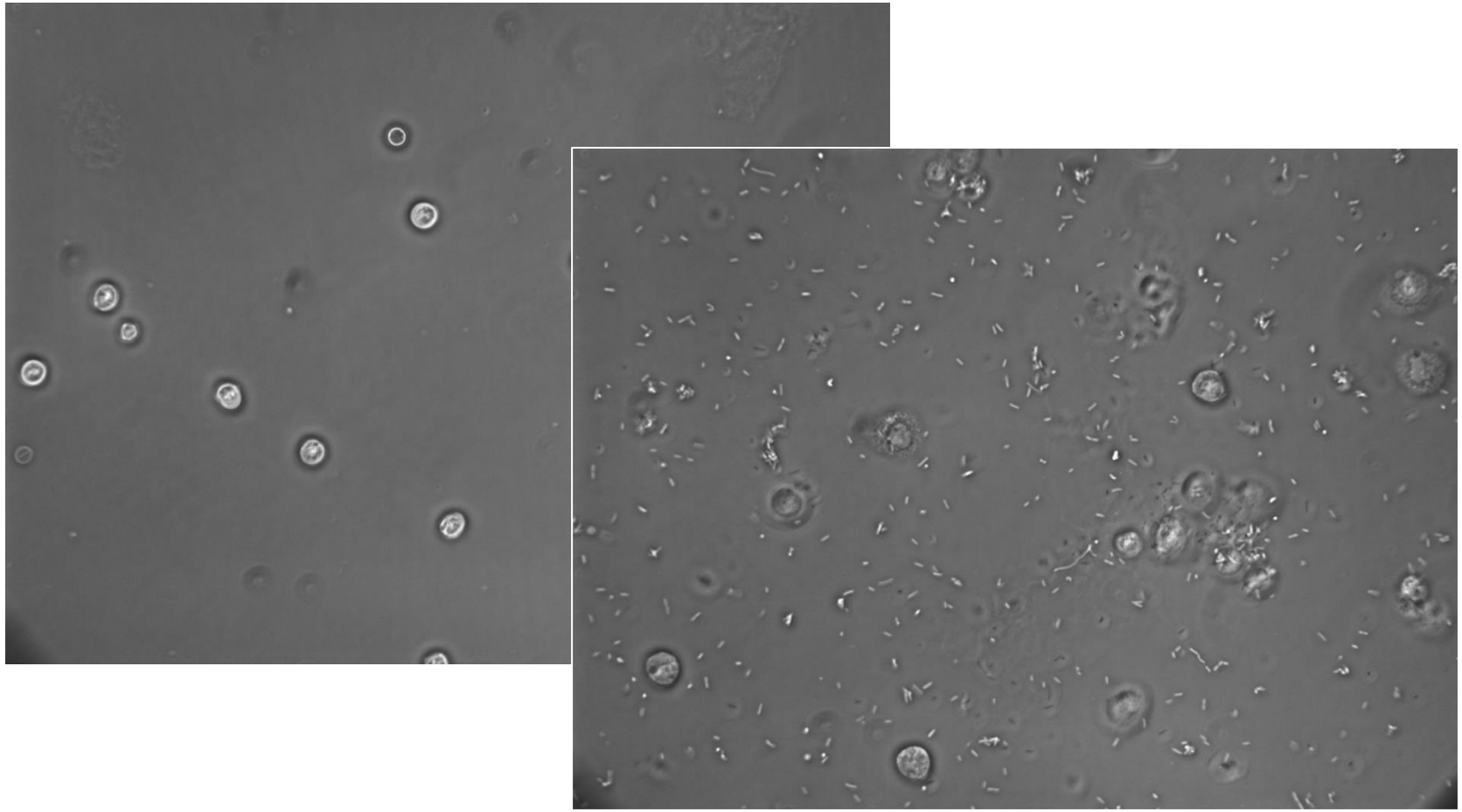
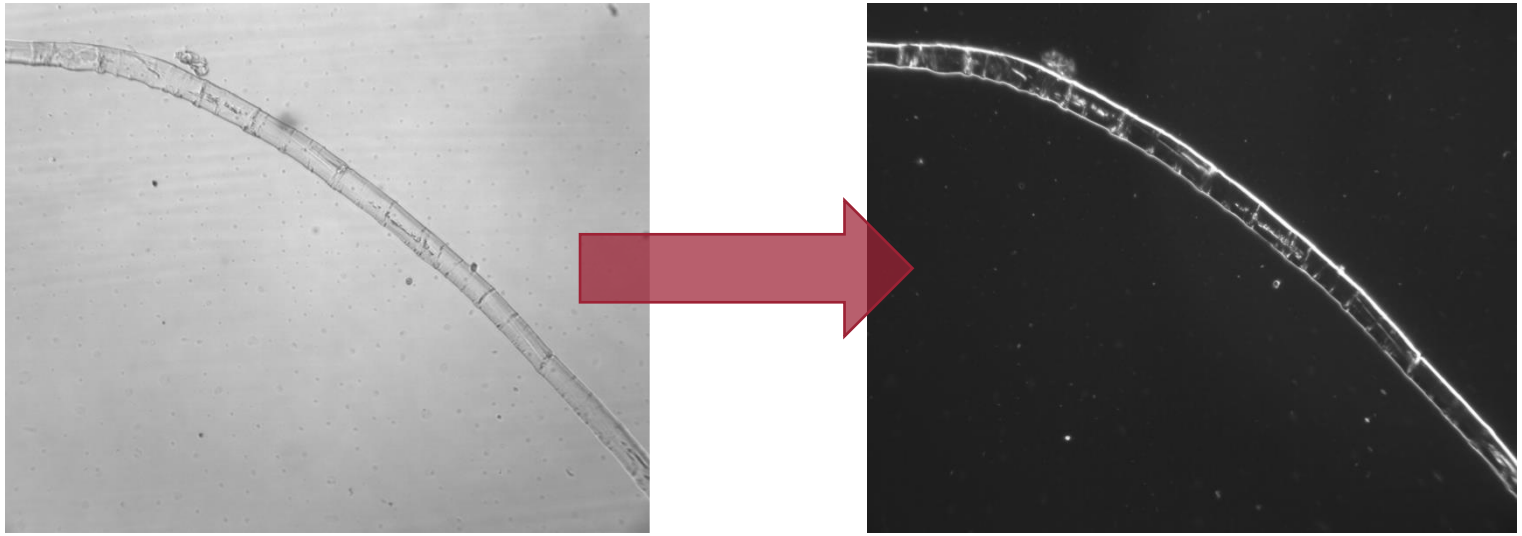
Example: Urinary sediment



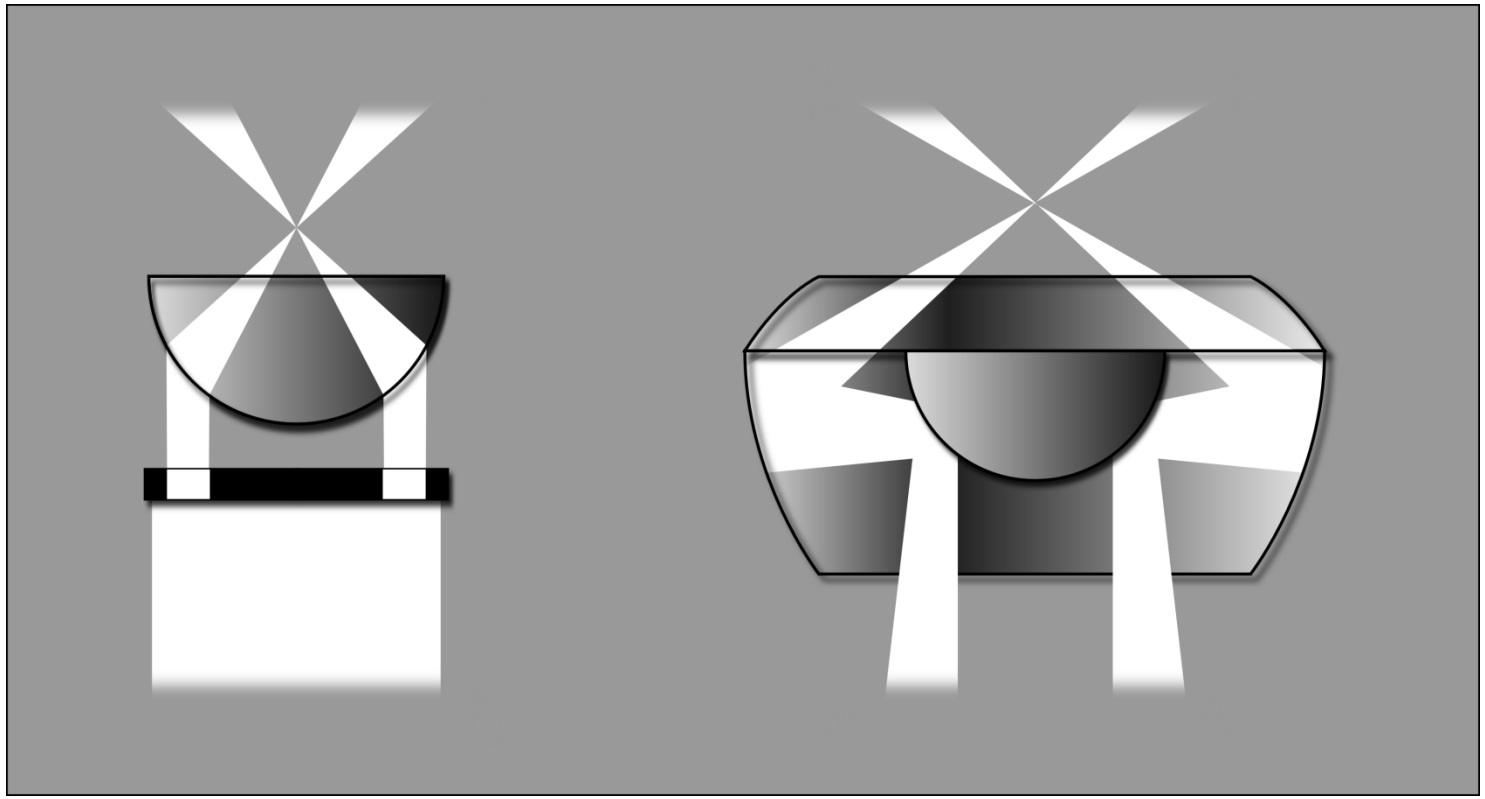
Darkfield (DF) Microscopy

- Low-contrast specimens
- Staining: Not possible/not desirable
- Example: Examination for spirochetes
- BF microscope with special condenser annulus or condenser



Darkfield (DF) Microscopy

Illumination with **hollow** light cone



Darkfield (DF) Microscopy

Example: Microbiology

Darkfield (DF) Microscopy

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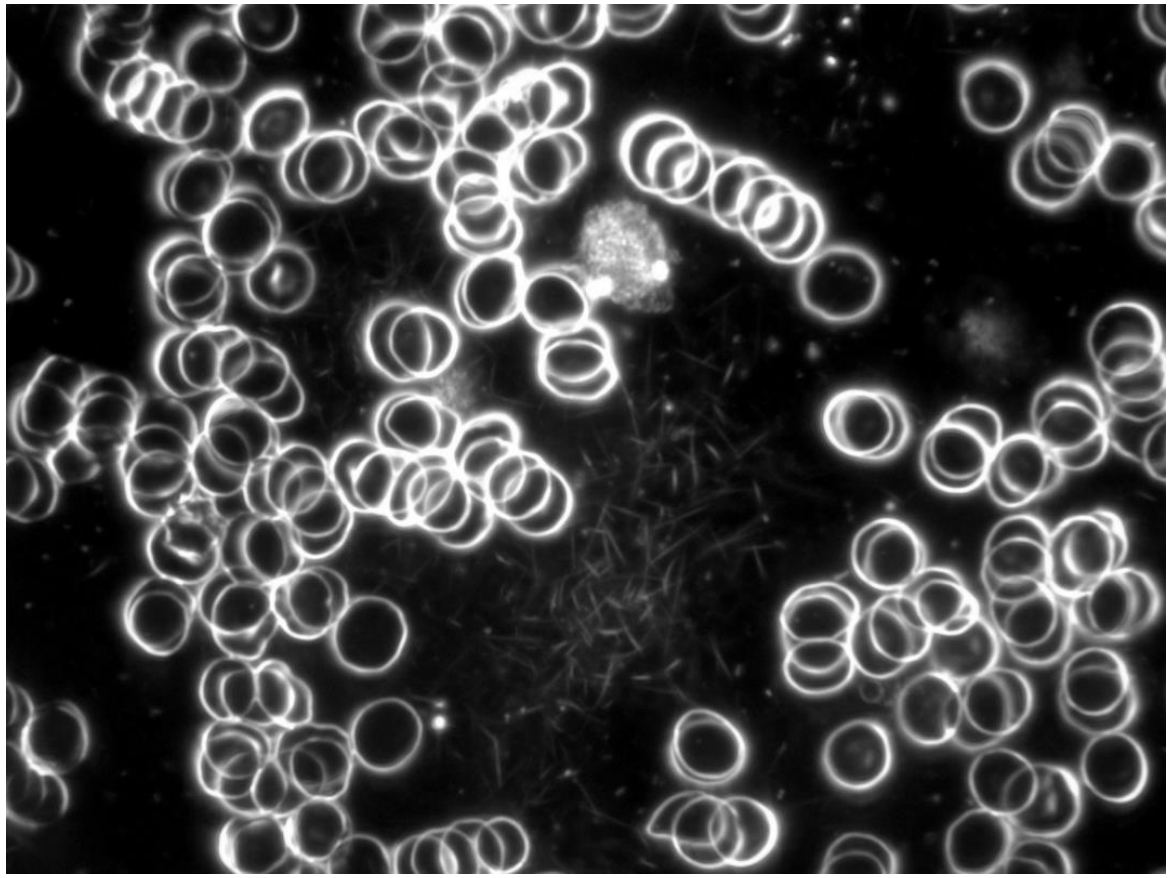
Example: Microbiology

Darkfield (DF) Microscopy

Example: Live blood (1000x, objective with iris diaphragm)



Darkfield (DF) Microscopy

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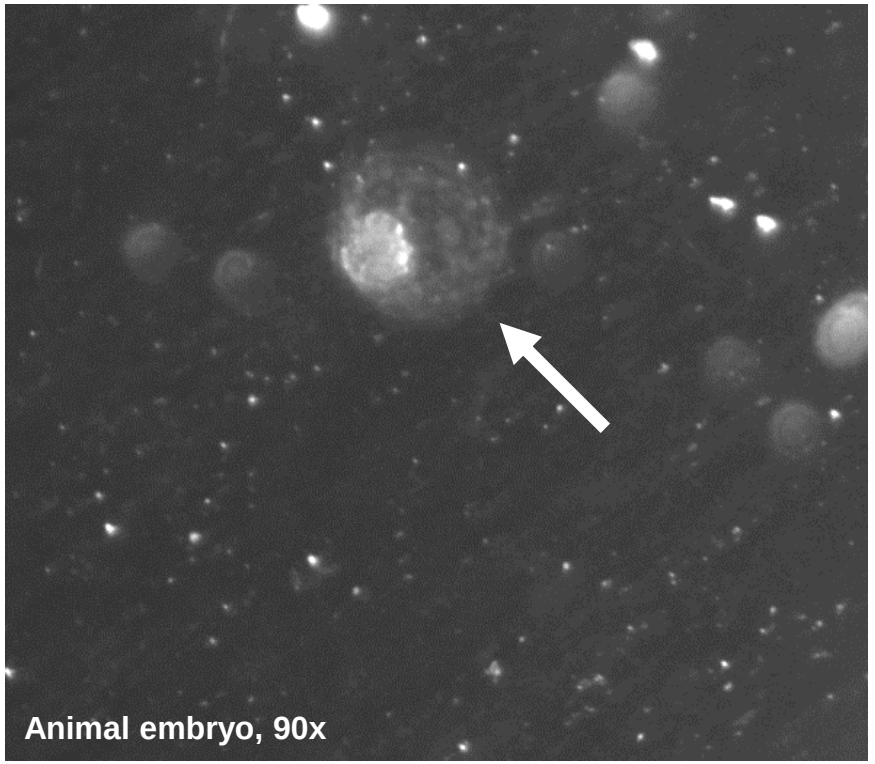
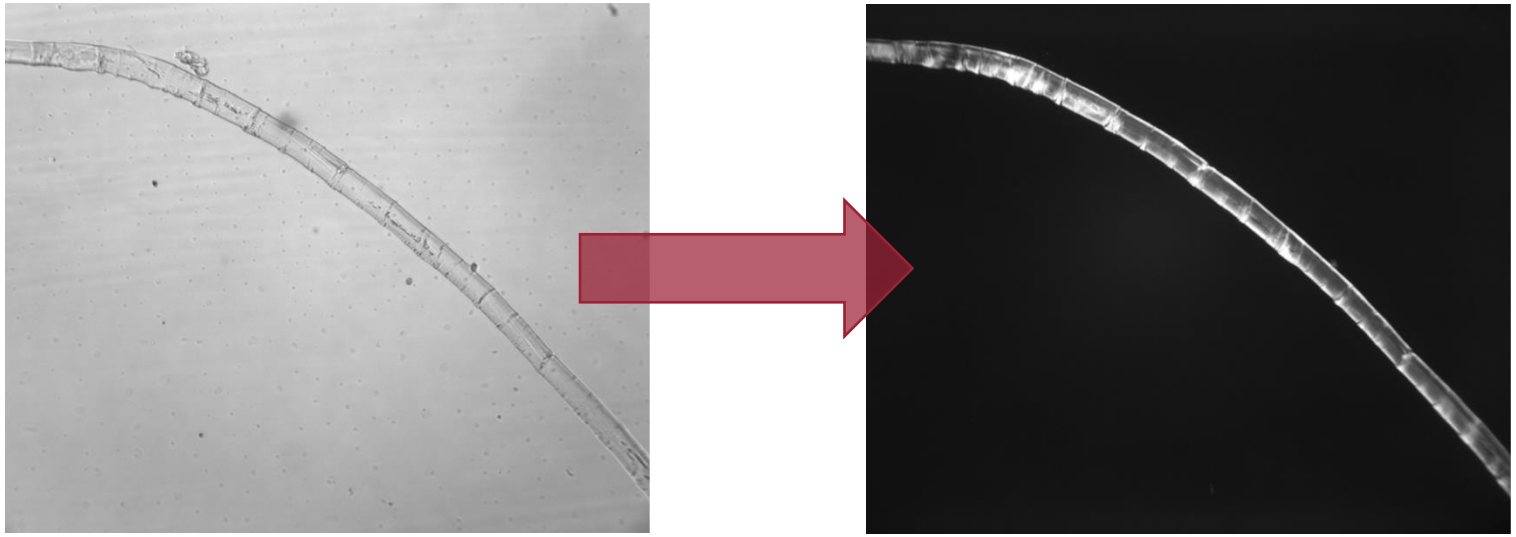
Example: Stereo microscopy, flexible illumination



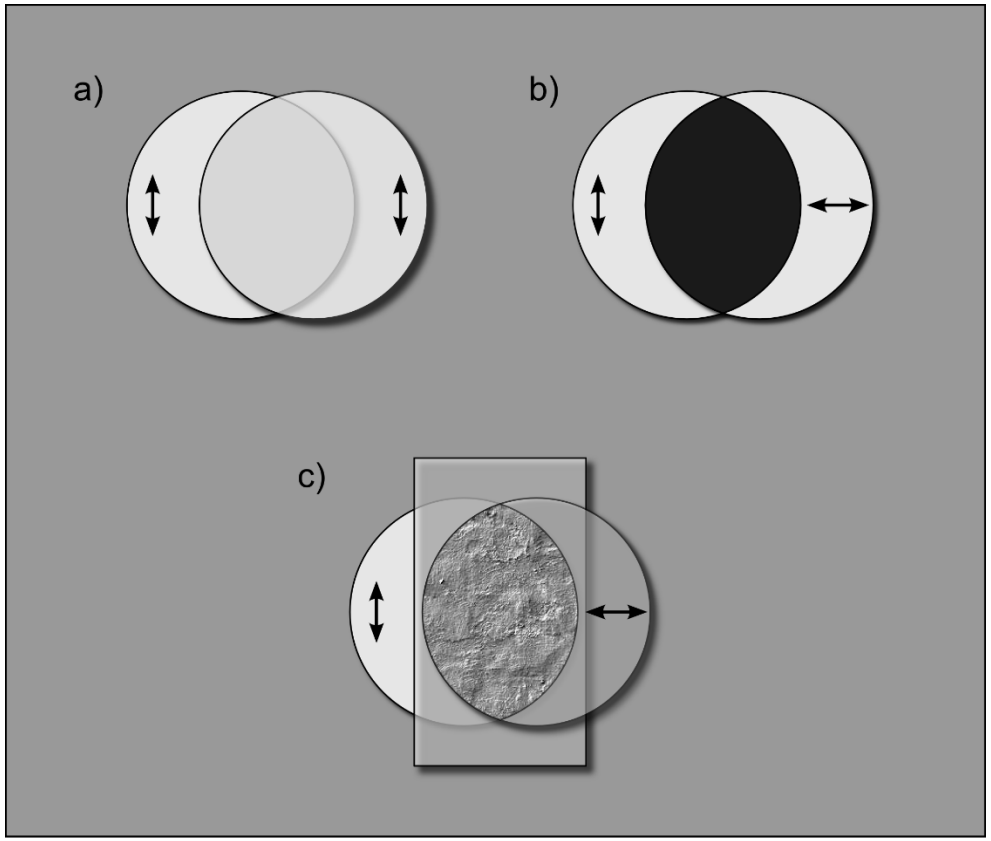
Polarisation (POL) Microscopy

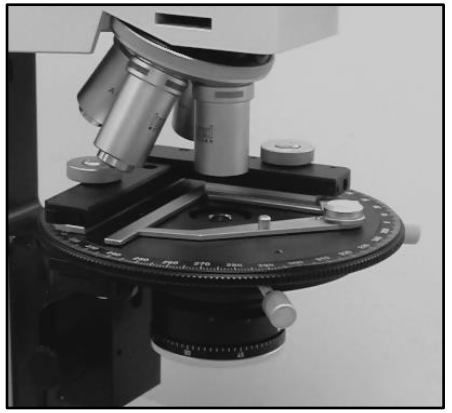
- Low-contrast specimens
- Staining: not possible
- Example: Examination for gout; mineralogy
- BF microscope with polariser/analyser combination



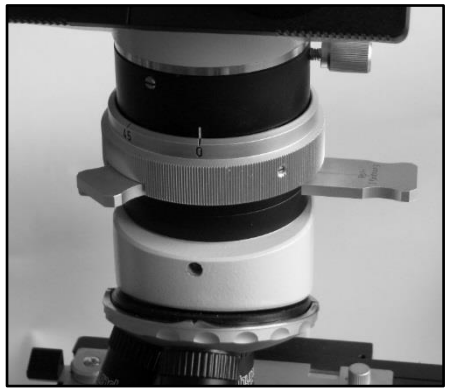
Polarisation (POL) Microscopy

Contrast through variations in birefringence: **Orthoscopy**





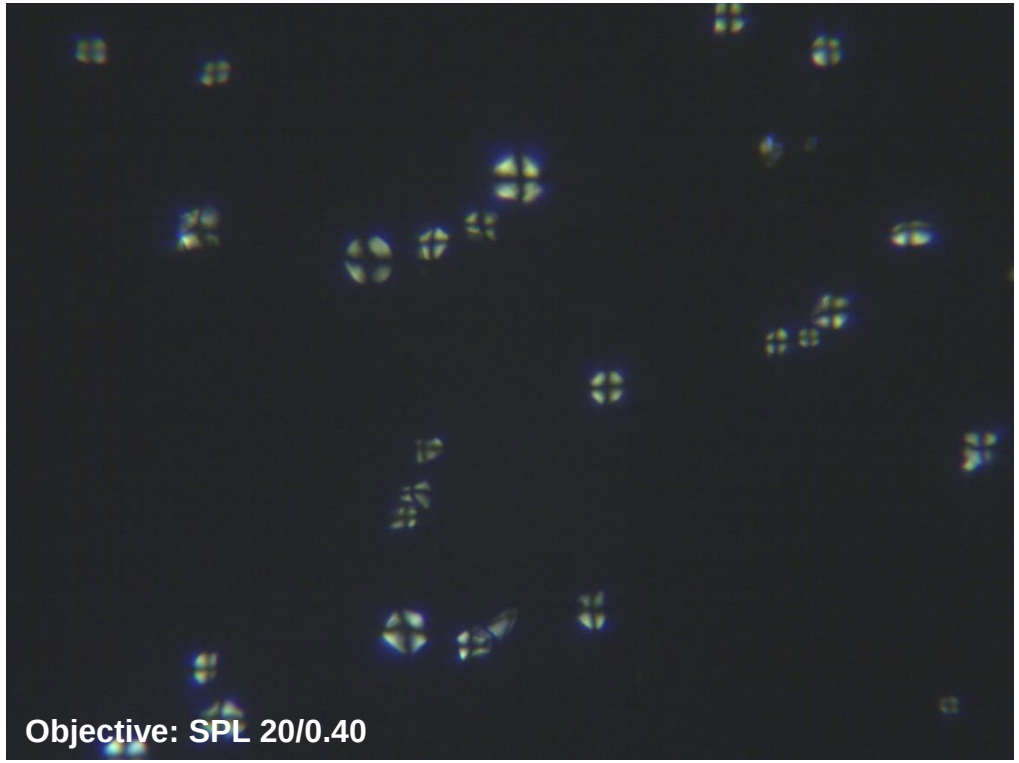
Polariser with rotary table



Analyser with compensator

Polarisation (POL) Microscopy

Example: Potato starch



Polarisation (POL) Microscopy

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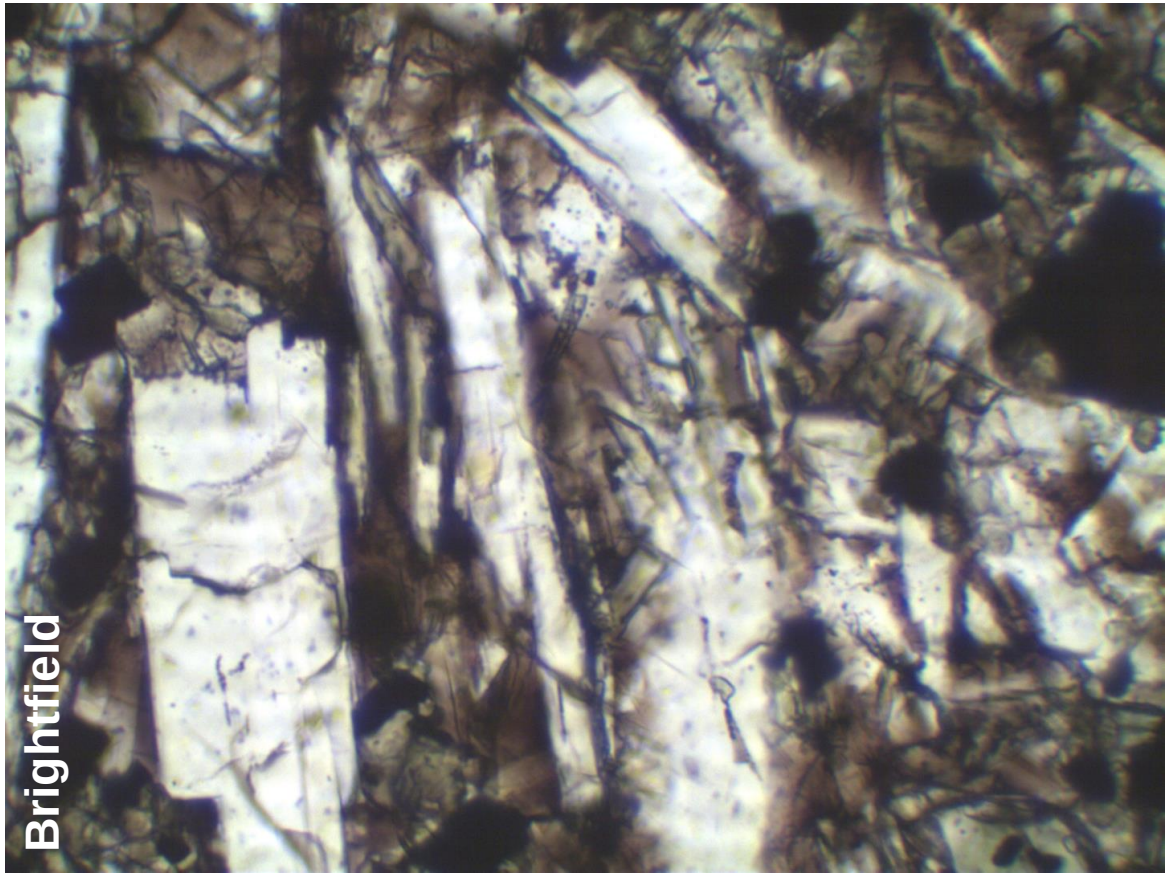
Example: Thin section (basalt)



Polarisation (POL) Microscopy

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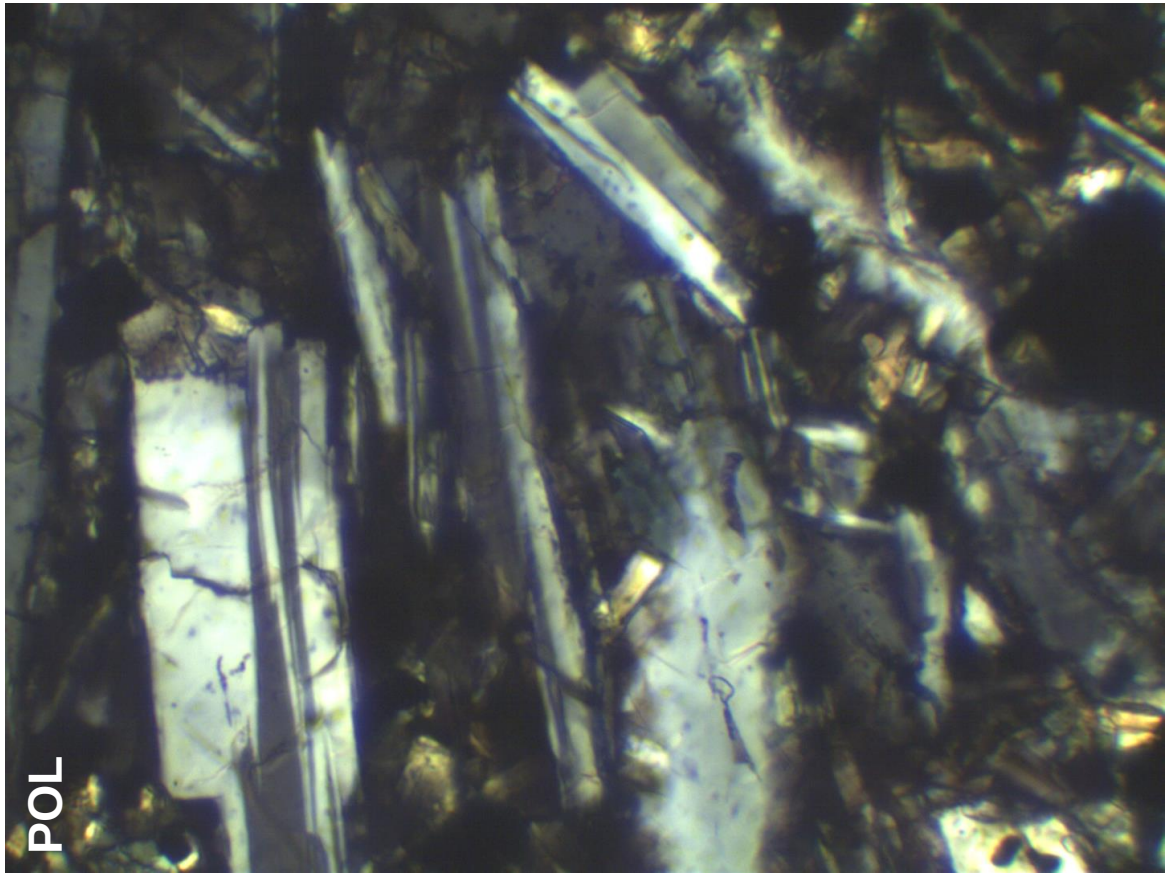
Example: Thin section (basalt)



Polarisation (POL) Microscopy

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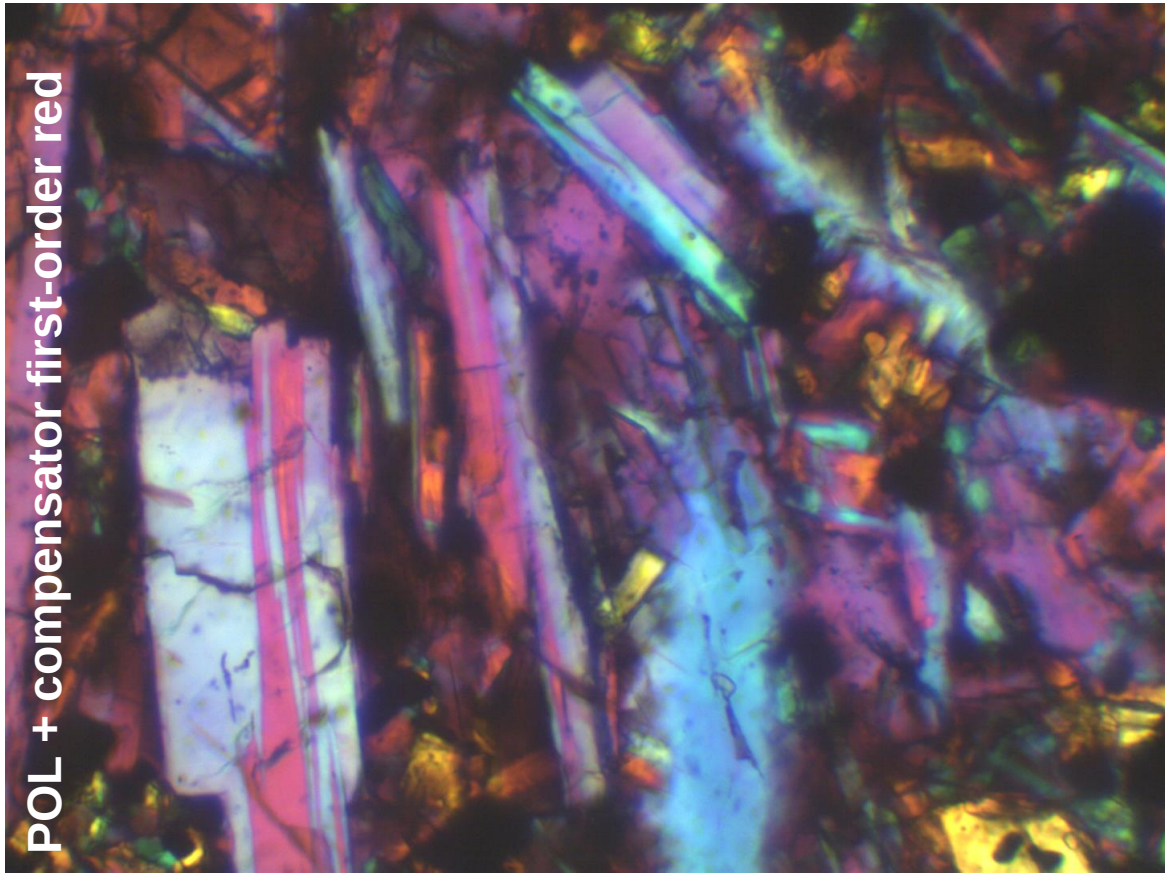
Example: Thin section (basalt)



Polarisation (POL) Microscopy

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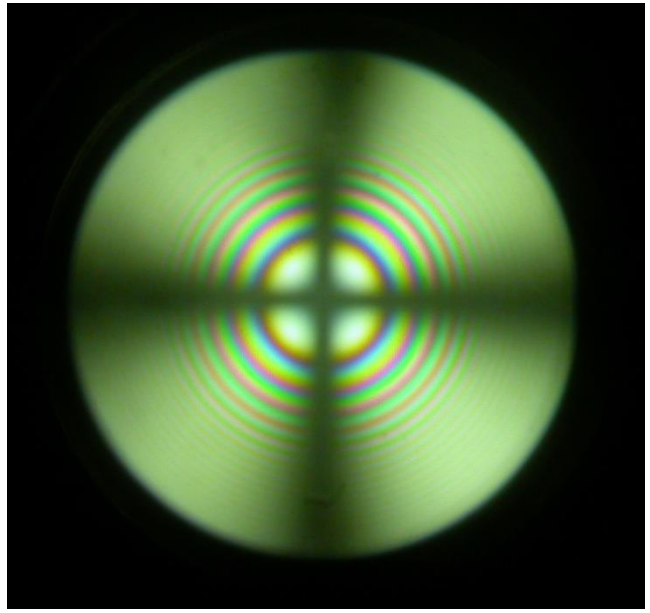
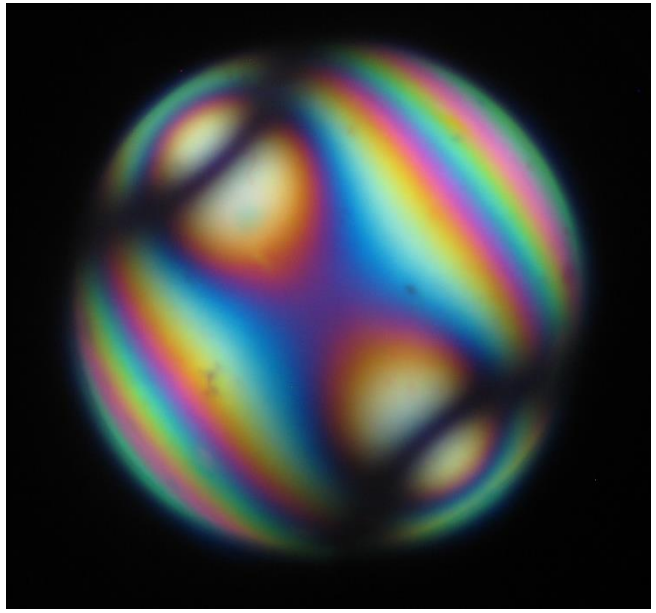
Interferences in back focal plane of objective: **Conoscopy**

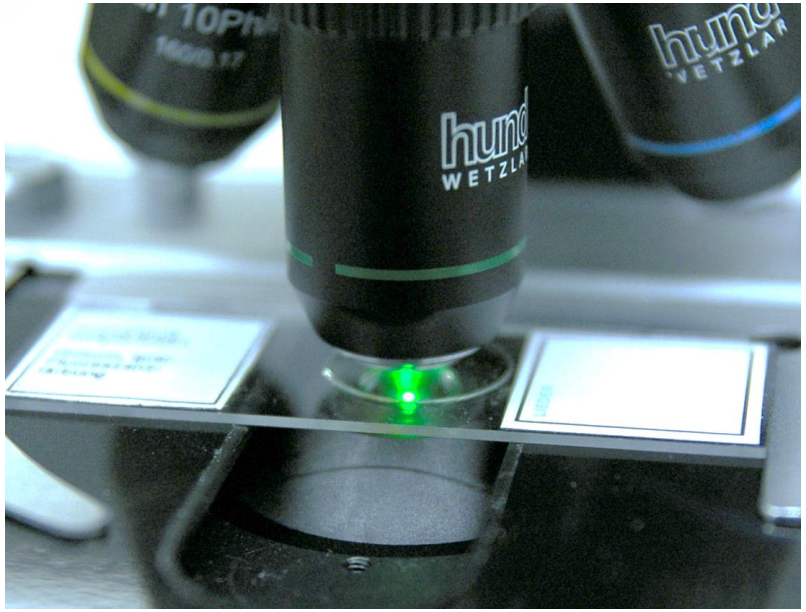




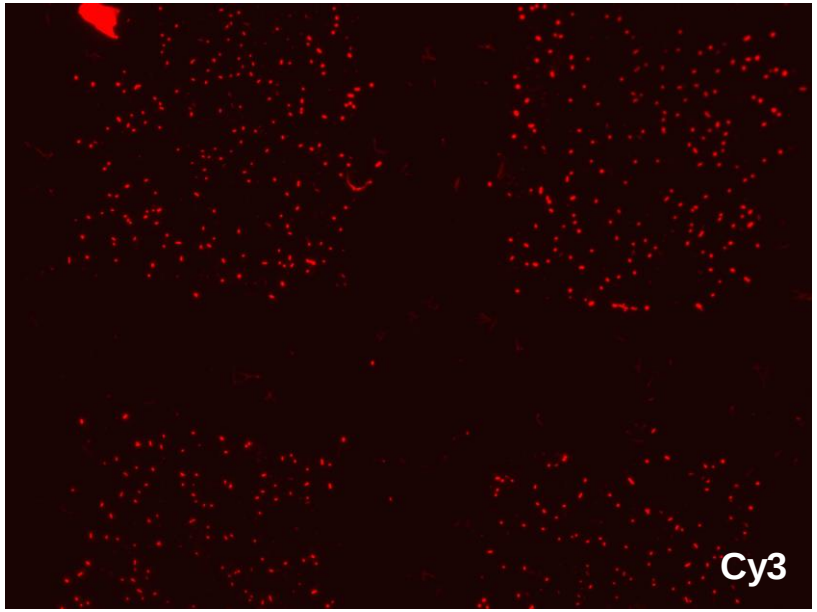
Accessory: Bertrand lens or (with Hund microscopes) auxiliary microscope

Fluorescence (FL) Microscopy

- Extreme specificity: specific detection of pathogens
- Short-wavelength excitation, long-wavelength detection



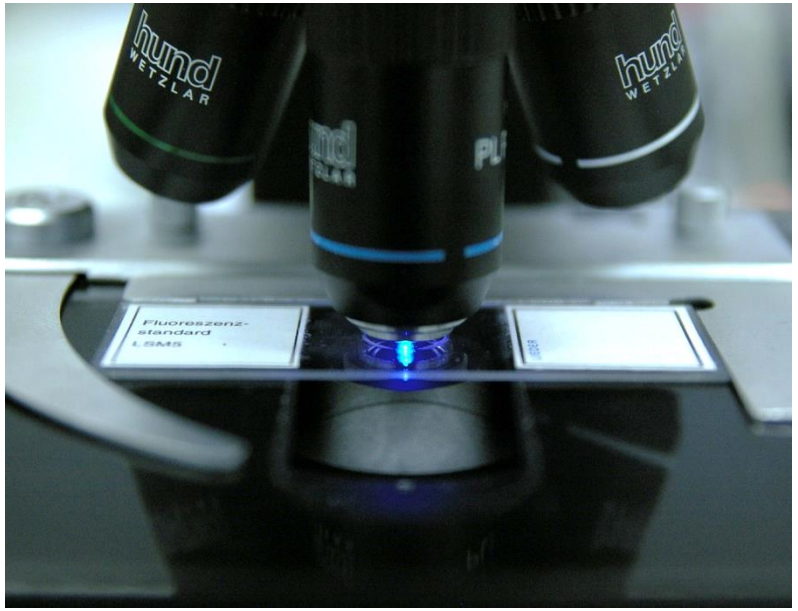
Green excitation (530 nm)



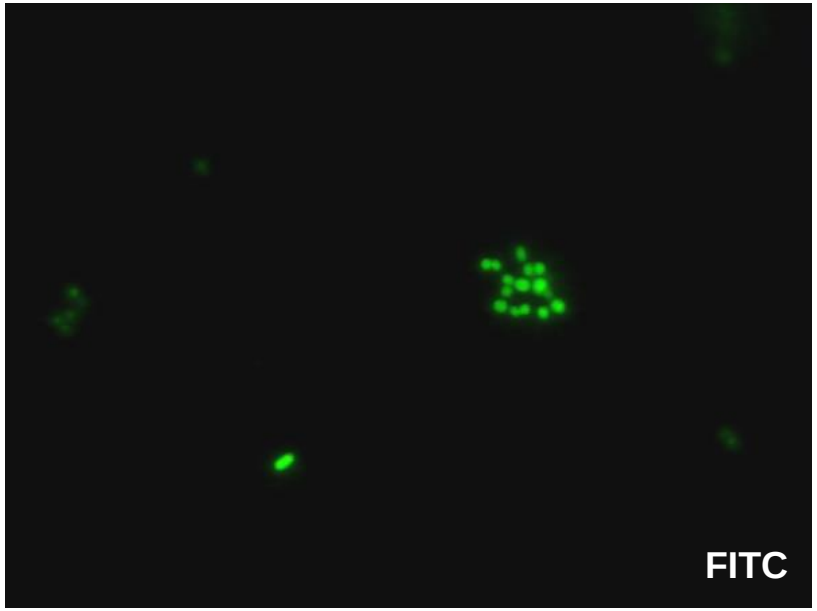
Red fluorescence (> 580 nm)

Fluorescence (FL) Microscopy

- Extreme specificity: specific detection of pathogens
- Short-wavelength excitation, long-wavelength detection



Blue excitation (470 nm)



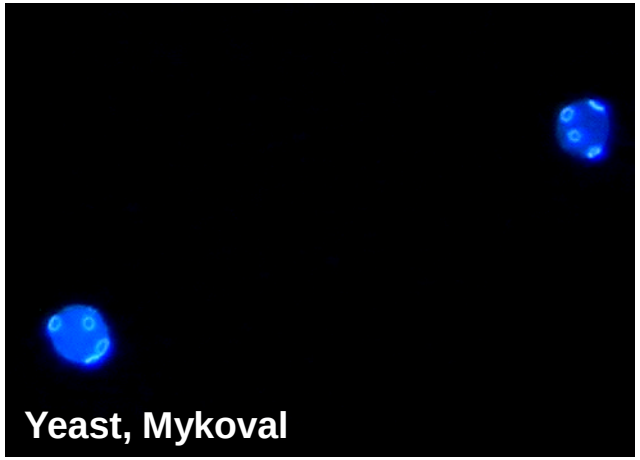
Green fluorescence (> 520 nm)

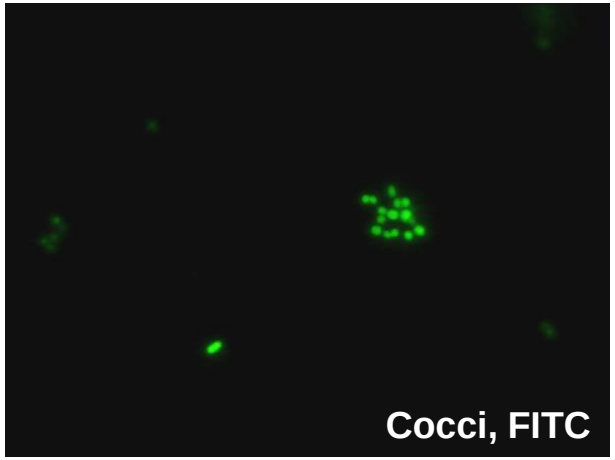
Fluorescence (FL) Microscopy

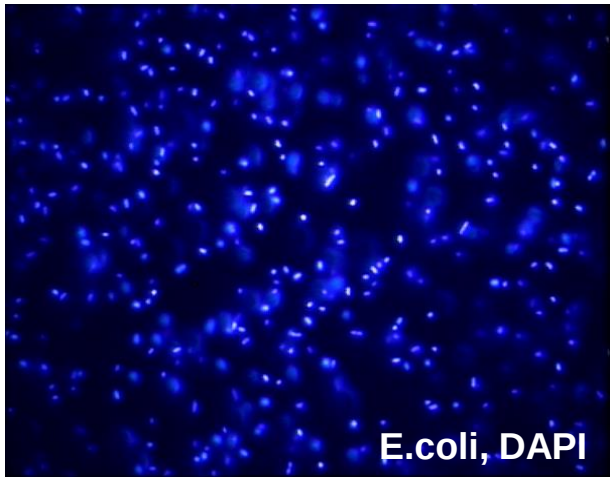
Mechanism	Description
Primary (auto-) fluorescence	Intrinsic fluorescence of many biological objects, e.g. pollen – also observed with some materials
Secondary fluorescence	After staining with fluorochromes, e.g. Mykoval (chitin, cellulose) or DAPI (DNA)
Immunofluorescence	After coupling with fluorochrome-labelled antibodies, VERY specific. Example: FITC, TRITC

Fluorescence (FL) Microscopy

Examples:

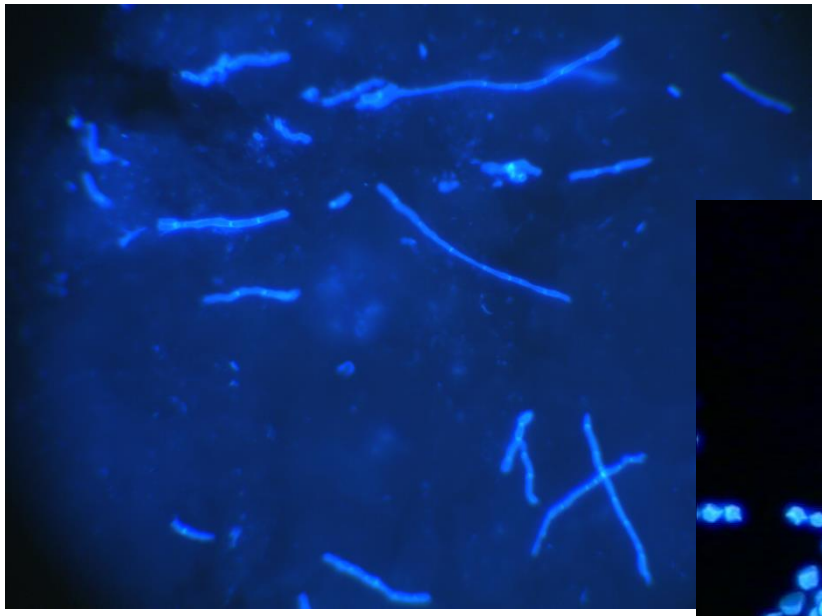




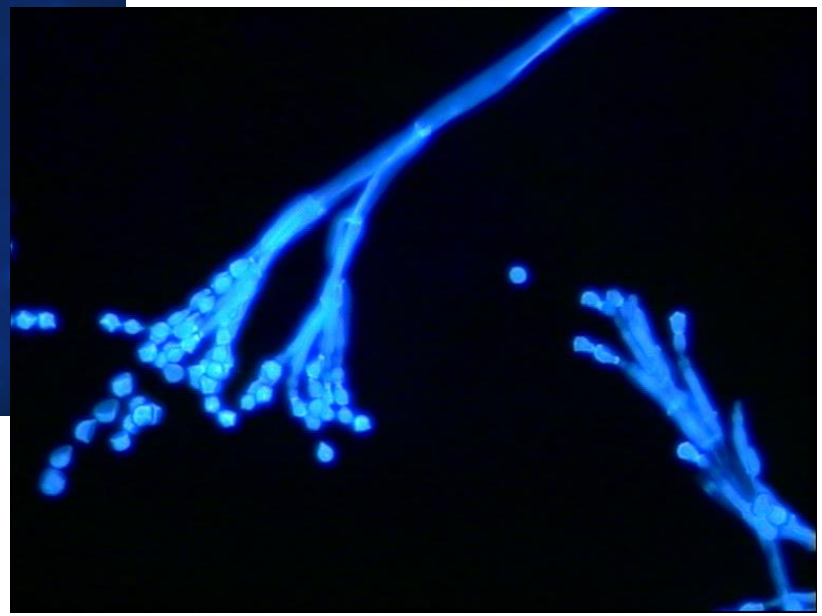


Fluorescence (FL) Microscopy

Fluorochrome **Mykoval** (Hund): Mycoses, yeasts, parasites



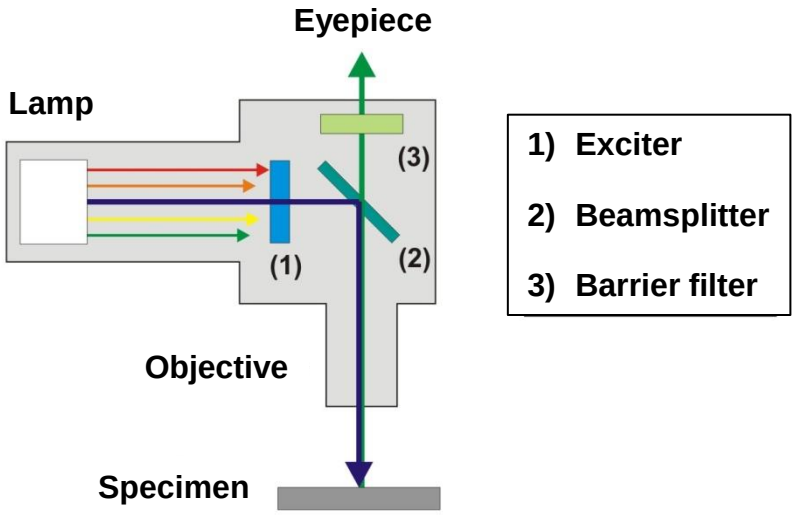
Skin scale with dermatomycosis



Penicillium spp. from adhesive film test

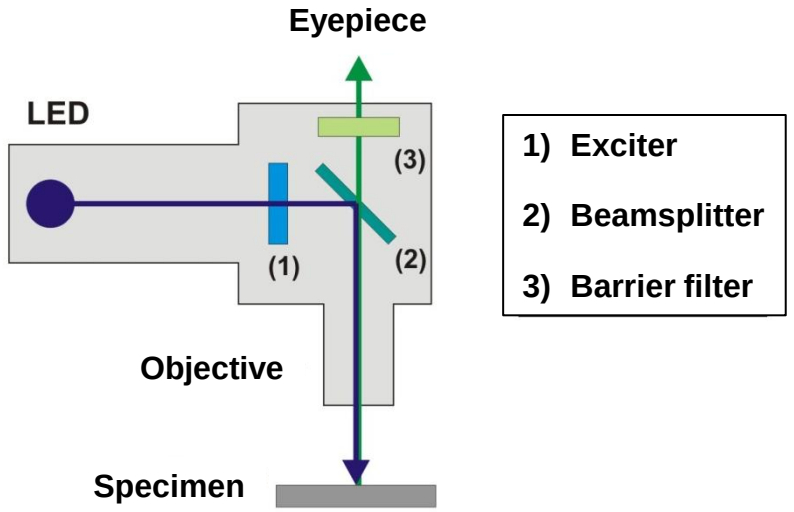
Fluorescence (FL) Microscopy

Incident-light illumination (HBO) with special filter sets



Fluorescence (FL) Microscopy

Incident-light illumination (LED) with special filter set



Fluorescence: Mycoses

Advantages:

- Native specimens: Fast results
- High diagnostic reliability
- Little expert knowledge necessary

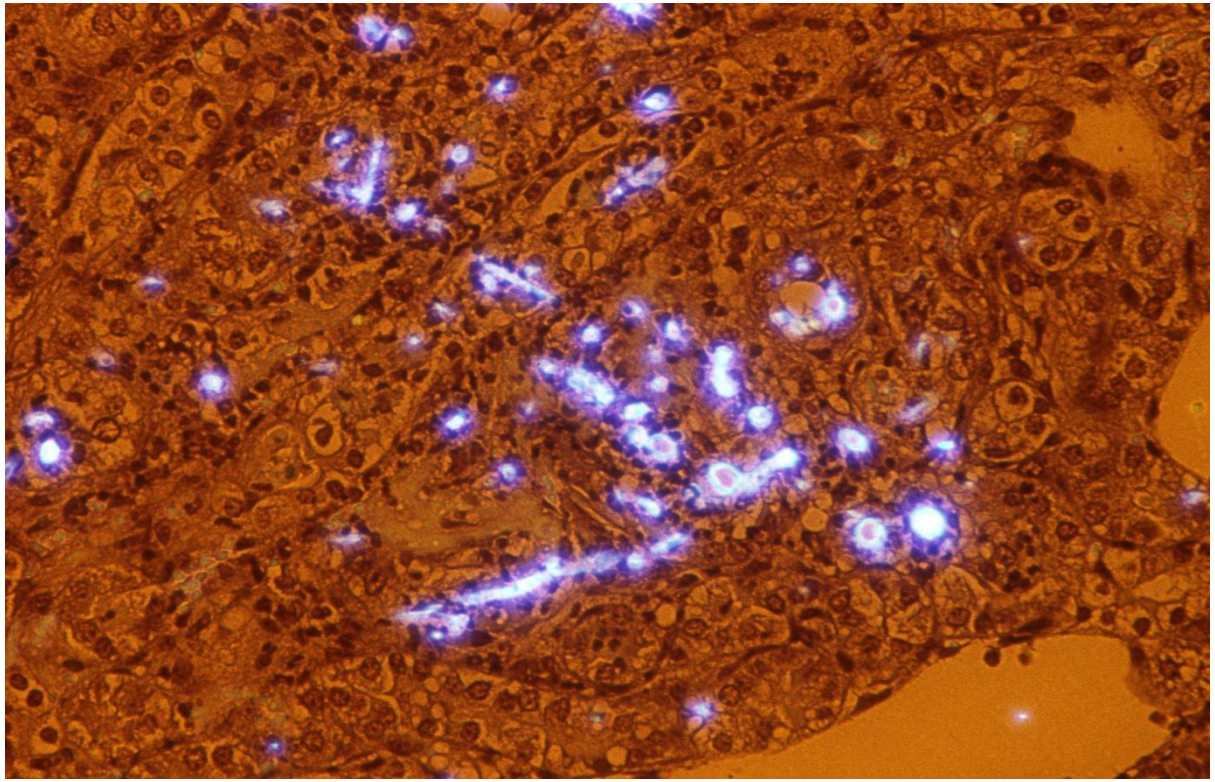
Fluorescence: Mycoses

Application of Mykoval

- Nativ specimens: Skin, hair, nails, mucous smears
- Histological specimens: Combined stainings
- Rapid diagnostics during surgical operations
- Body fluids, stool
- Gynaecology: Yeast colonies on mucous membranes
- Microsporidia in stool

Fluorescence: Mycoses

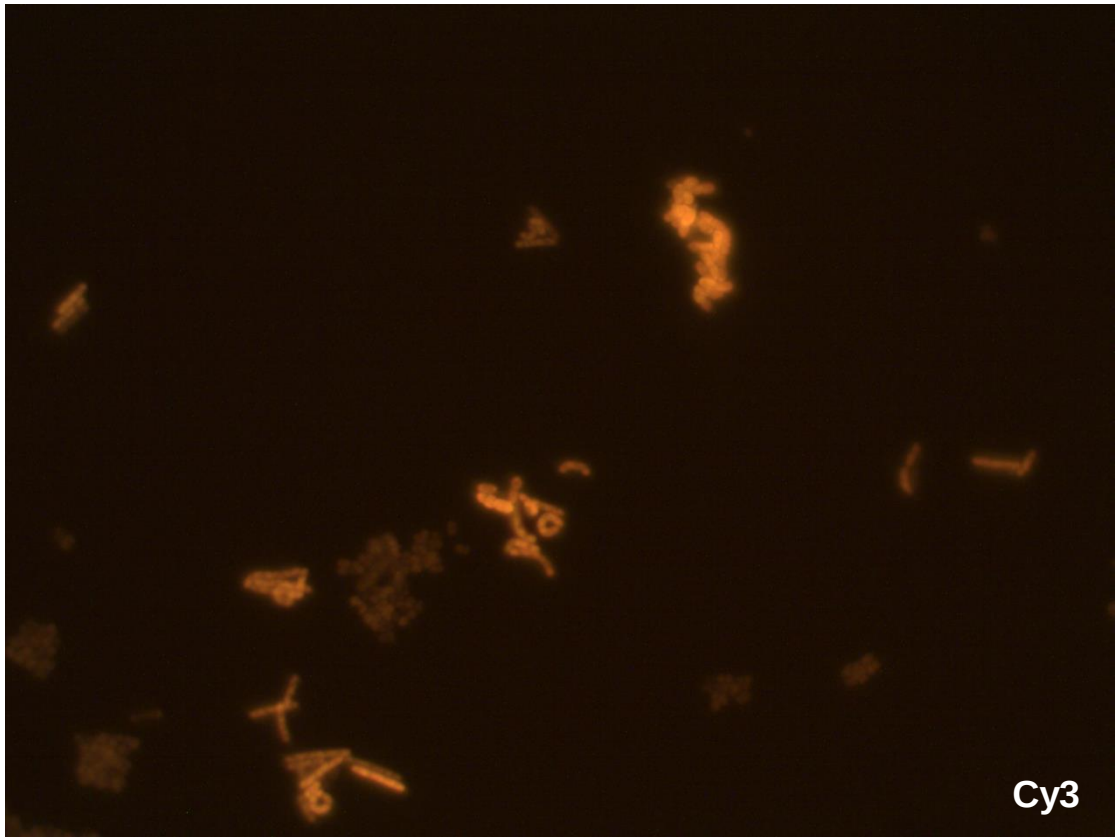
Combined staining: Mykoval + HE



Mouse, candidosis of the kidney, brightfield/fluorescence

Fluorescence: Beer

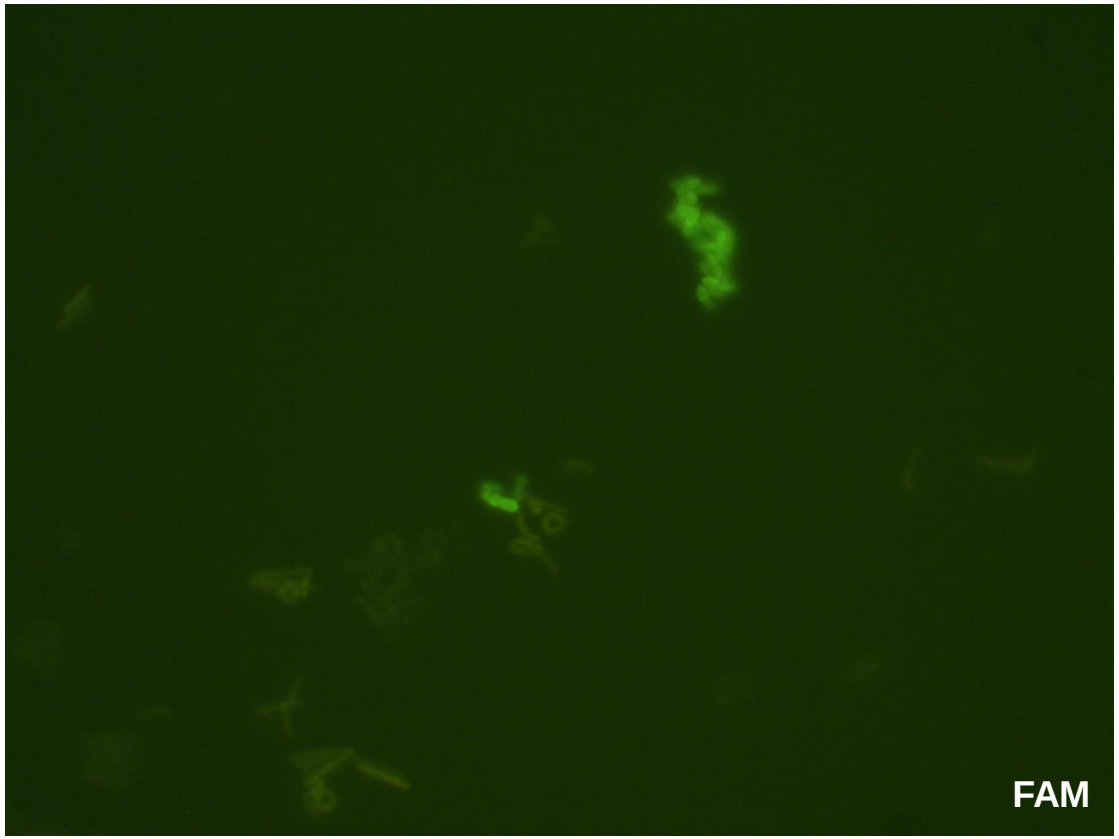
Combined staining: FAM + Cy3 (Vermicon)



Red: beer spoilage bacteria

Fluorescence: Beer

Combined staining: FAM + Cy3 (Vermicon)



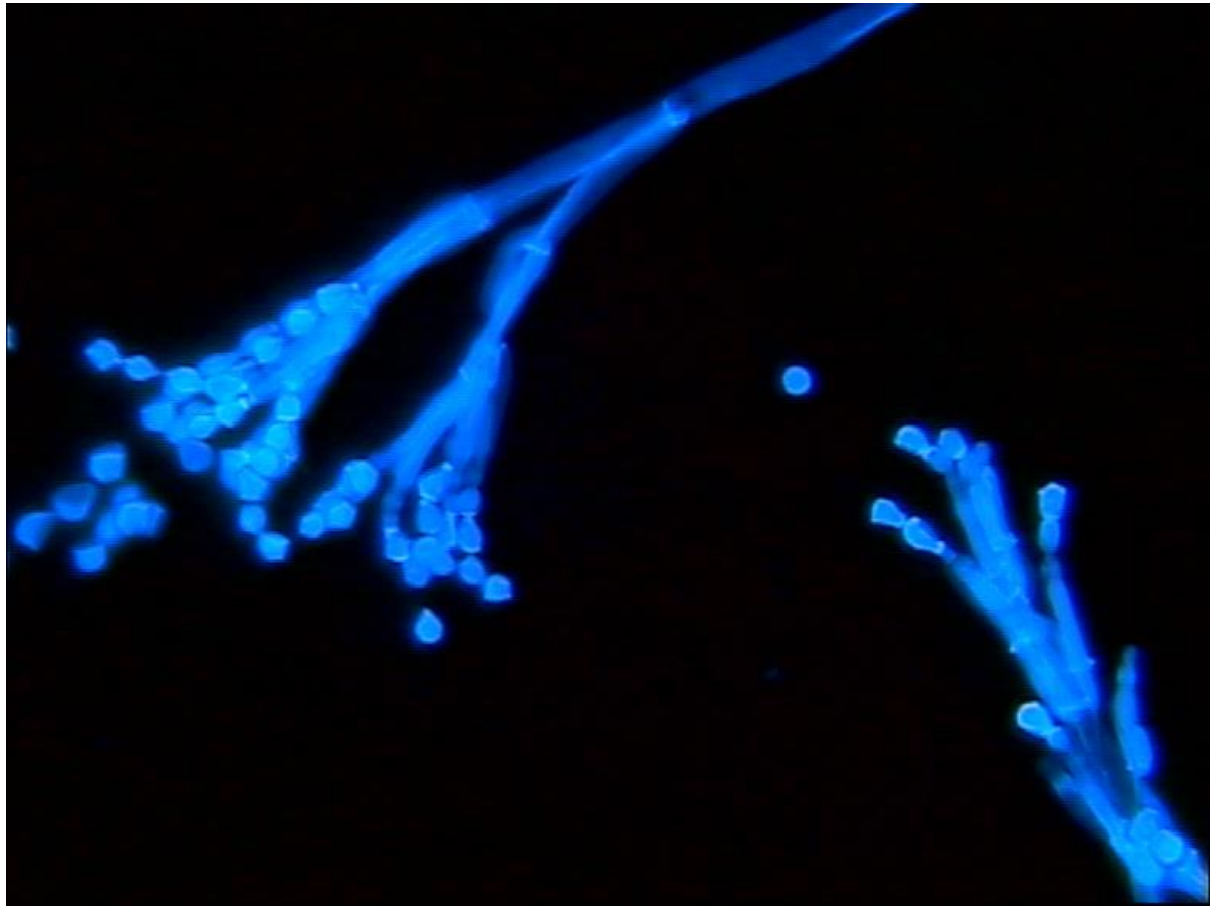
Green: Lactobazillus brevis

Comparisons

Brightfield – Fluorescence (Mykoval)

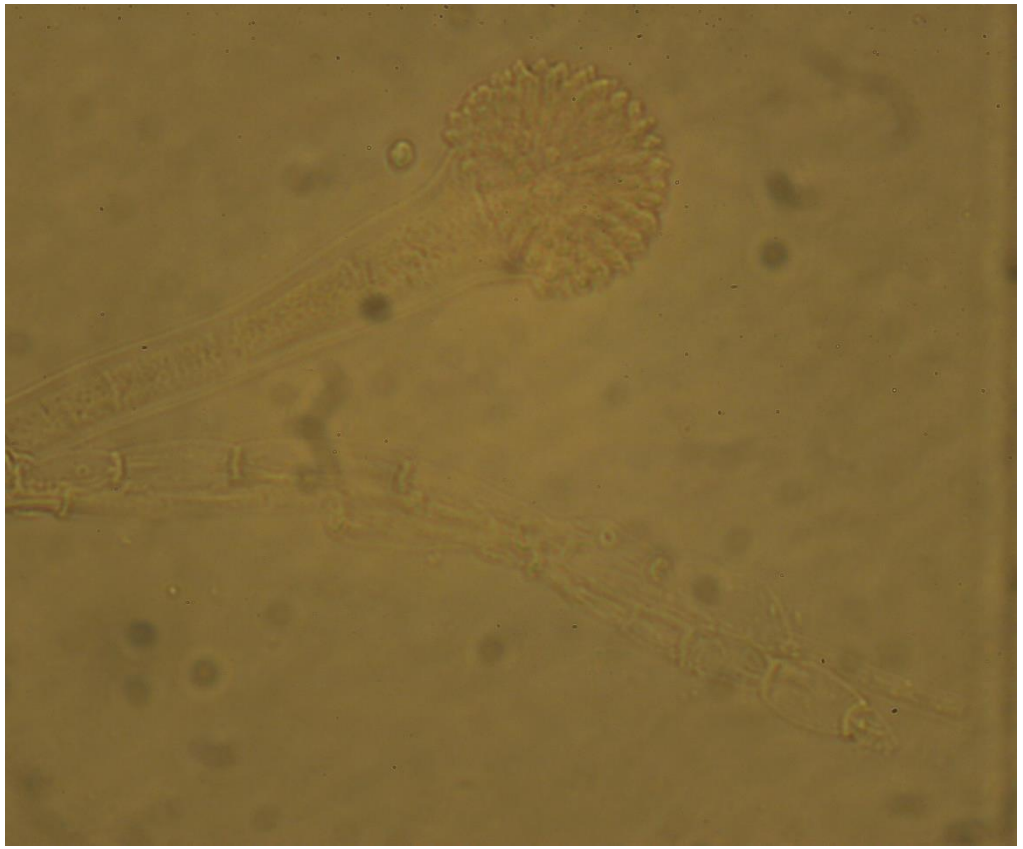
Comparisons

Brightfield – Fluorescence (Mykoval)



Comparisons

Brightfield – Phase contrast – Fluorescence (Mykoval)

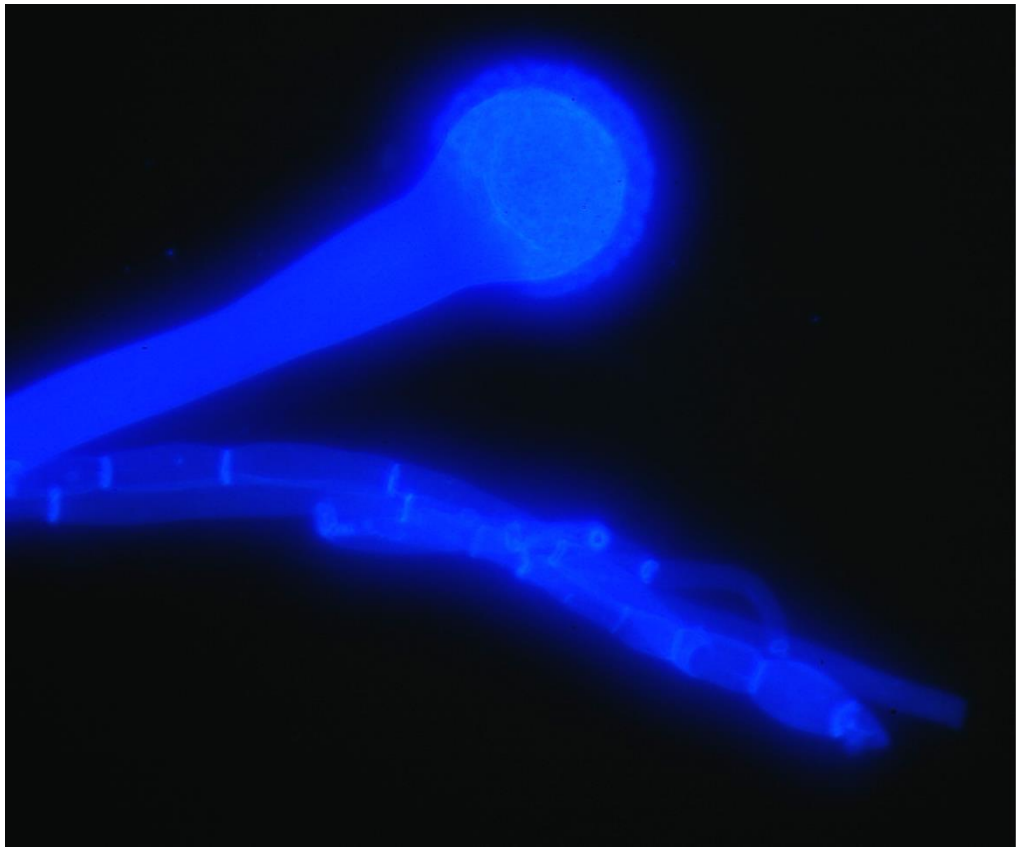


Comparisons

Brightfield – Phase contrast – Fluorescence (Mykoval)

Comparisons

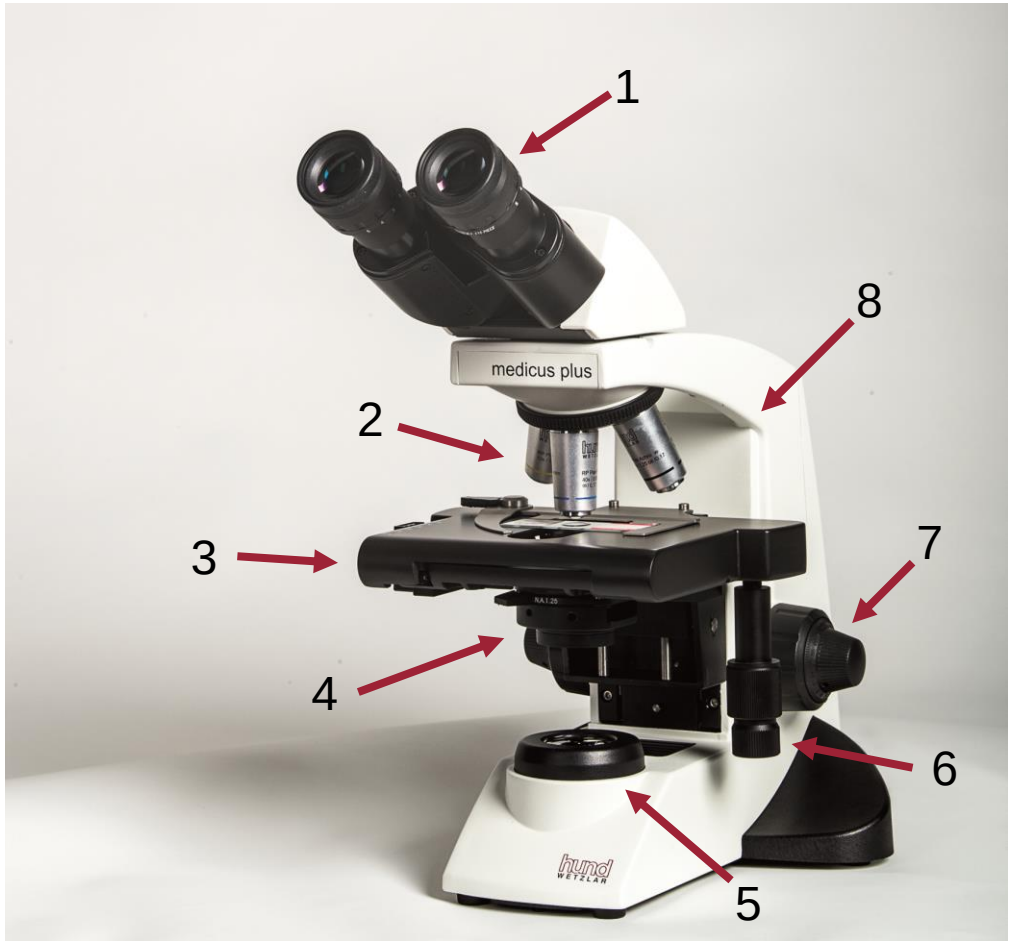
Brightfield – Phase contrast – Fluorescence (Mykoval)



Comparisons

Brightfield – Phase contrast – Fluorescence (Mykoval)

Components of a Microscope



1: Eyepieces and tube

2: Nosepiece with objectives

3: Microscope stage

4: Condenser with diaphragm

5: Illumination

6: Stage drive (x/y)

7: Focus drive (coarse/fine)

8: Stand

Med-Prax 3: Robustness

- For doctor‘s surgeries and education in biology
- Compact, robust design
- Long-life LED illumination
- Flat microscopic image: plan achromatic objectives 4x, 10x, 40x, 100x Oil
- Effortless operation through adjustable friction of coarse focus drive
- Attractive price
- Fixed configuration

medicus plus: Versatility

- For doctors‘ surgeries, medical and biological laboratories
- Compact, ergonomical design
- Low risk of injury due to rackless stage drives
- Flat microscopic image:
  plan achromatic objectives
- Counting chambers possible (BF)
- Effortless operation through adjustable Siedentopf tube
- Easy adaptation of cameras for documentation purposes
- Versatile accessories

medicus pro: For practitioners

- For doctors‘ surgeries, medical and biological laboratories
- Compact, ergonomical design
- Low risk of injury due to rackless stage drives
- Plan achromatic objectives
- Variable colour temperature
- „Light Memory“
- Counting chambers possible
- Effortless operation through adjustable Siedentopf tube
- Easy adaptation of cameras for documentation purposes
- Versatile accessories

medicus pro Myko

- Configuration medicus pro Myko
- Target group: Dermatologists, allergists, gynaecologists, building biologists
- No cultivation necessary
- Simple staining of the specimen with Mykoval
- Reliable diagnosis due to high contrast and high resolution
- UV protection shield
- Optical switch BF/FL
- Long lifetime of LED illuminator
- Easy retrofit of the illuminator to already existing medicus pro

H 600: High Flexibility

- For doctors‘ surgeries and clinical labs
- Sturdy, universally expandable microscope stand
- Nosepiece for up to 5 objectives
- Combination condensers for rapid switching between BF, DF, PH
- Components for high-resolution darkfield observations available
- Tungsten halogen or LED illumination, alignment acc. to Köhler
- Simple adaptation of cameras for documentation purposes
- Versatile accessories

H 600: Lots of Options

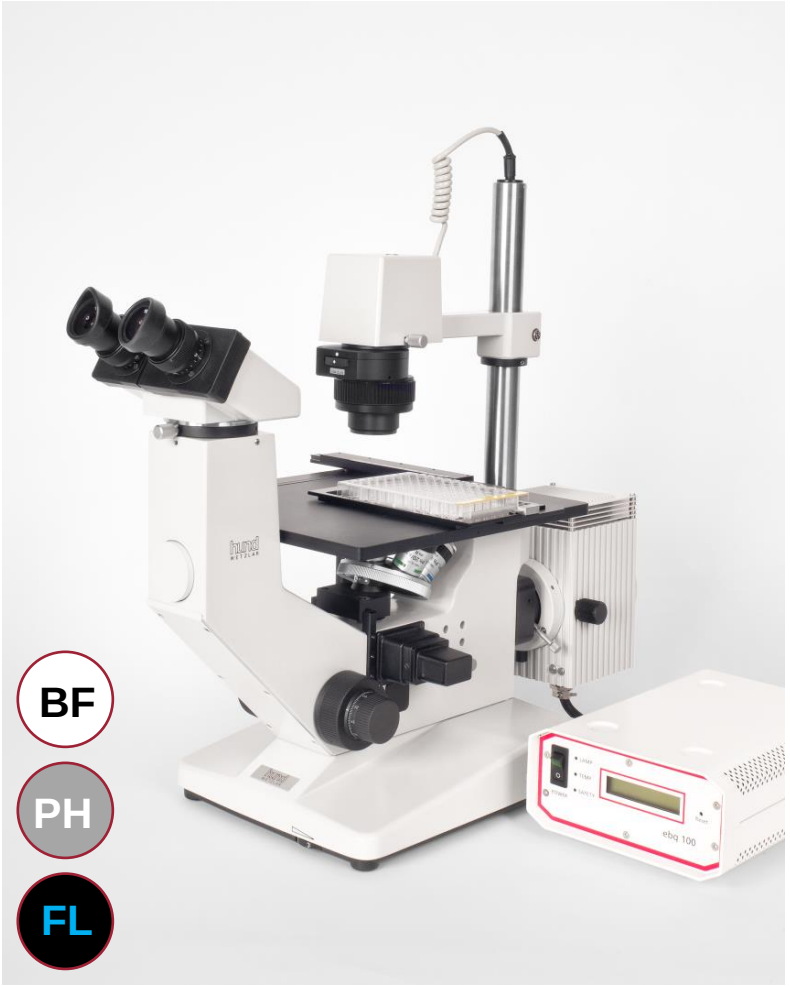
H 600 LL HP 100

H 600 HP LED

H 600 LED-AFL Myko

H 600 AFL Plan 100

Wilovert: The inverted Microscope



- For clinical and cell culture labs
- Sturdy, universally expandable microscope stand
- Nosepiece for up to 5 objectives
- Combination condensers for rapid switching between BF, PH
- Stand for incident-light fluorescence available
- Adapters for various sample vessels available
- Simple adaptation of cameras for documentation purposes
- Adaptation of micromanipulators possible

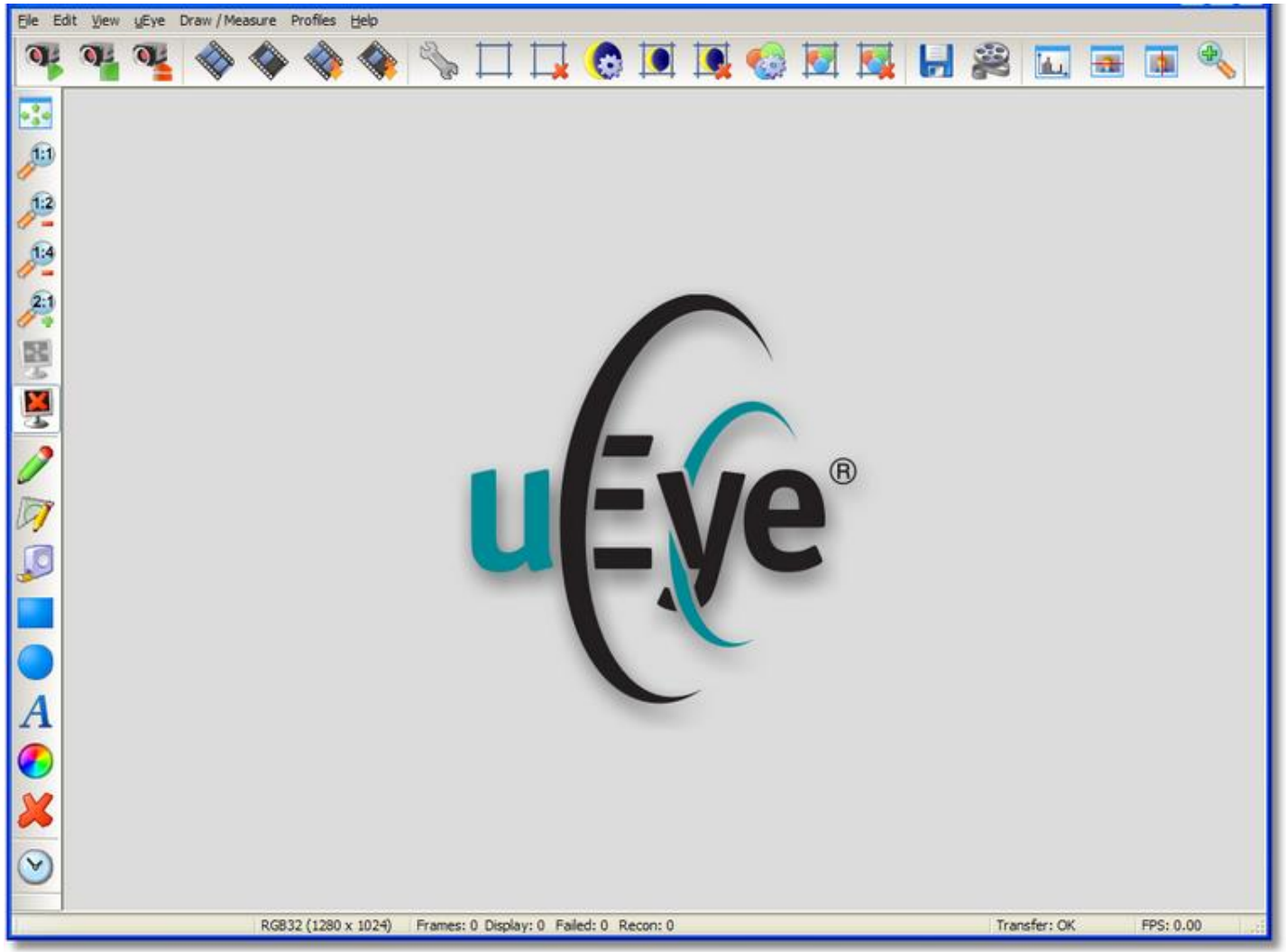
Wiloskop: The Stereo Microscope

- For dissection, workshops, education and school labs
- Continuous zoom: 6.7x – 45x (with eyepieces 10x)
- Expandable with eyepieces and auxiliary lenses
- Various stands and illumination configurations
- Cold-light tungsten halogen lamps with various light guide configurations available
- White-light LED ring with variable illumination geometry available
- Simple adaptation of cameras for documentation purposes

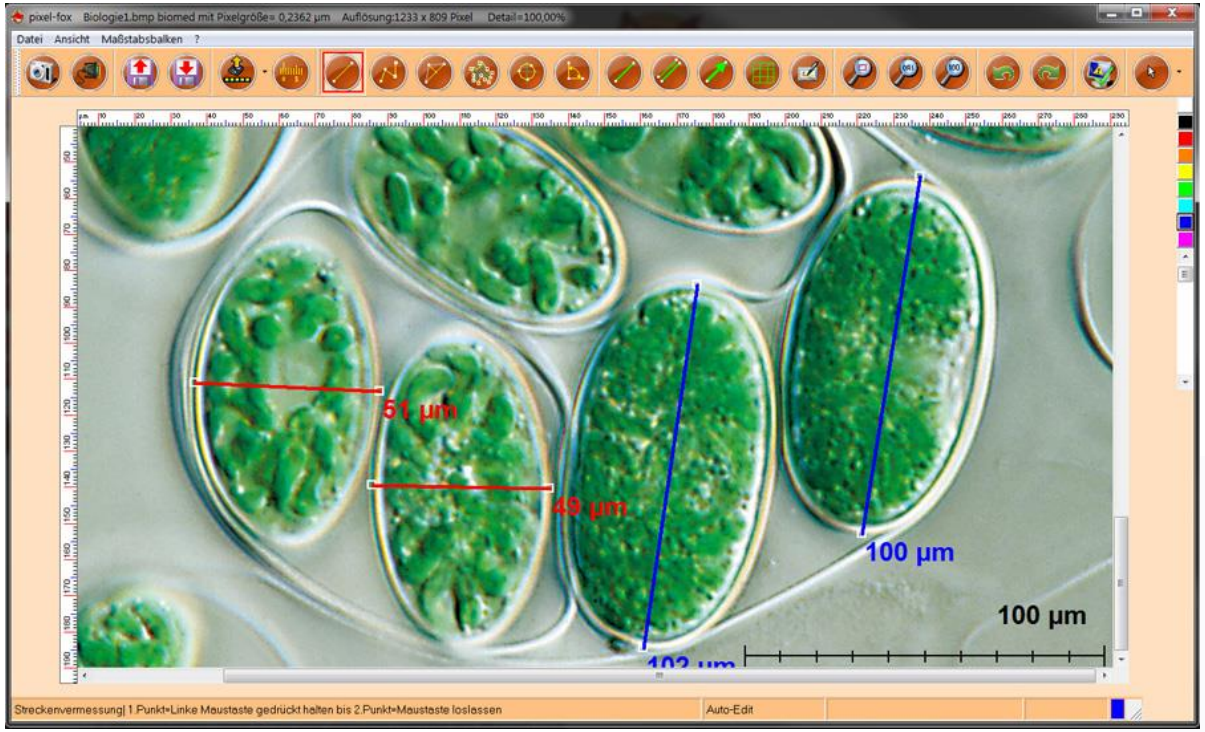
Cameras for Microscopy

	UI-1240LE-C	UI-3580SE-C
Chip size	1/1.8“	1/2“
Sensor type	CMOS	CMOS
Resolution [pixels]	1280 x 1024 (1.31 MPix)	2560 x 1920 (4.92 MPix)
Frame rate [fps]	25.8	15.2
Colour depth [Bit]	8	12
Interface	USB 2.0	USB 3.0
Software	uEye Cockpit	
C-Mount adapter	0.5x	0.5x
Windows version	10	

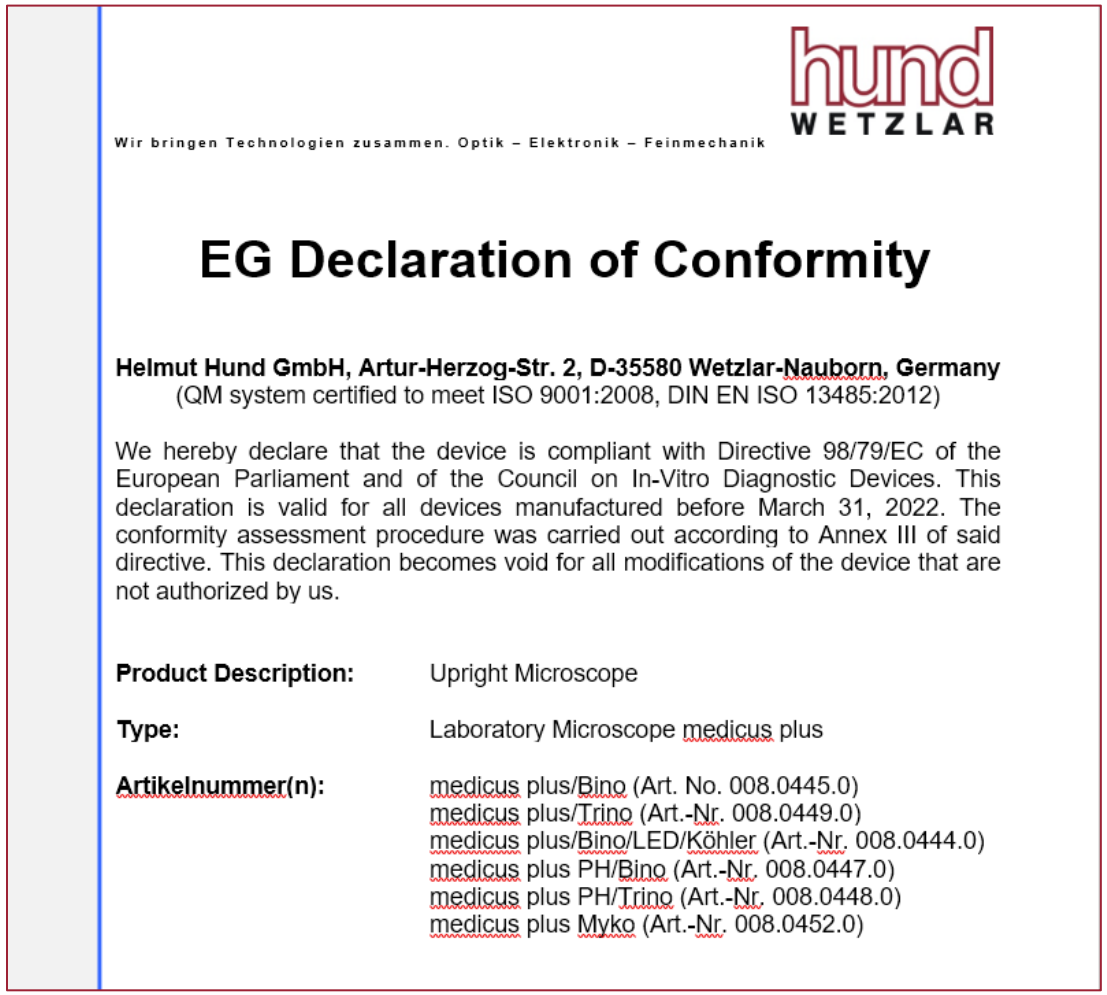
Software: uEye Cockpit



Measurement System: pixel-fox



All our Microscopes are IVDs



Wir bringen Technologien zusammen. Optik – Elektronik – Feinmechanik

EG Declaration of Conformity

Helmut Hund GmbH, Artur-Herzog-Str. 2, D-35580 Wetzlar-Nauborn, Germany
(QM system certified to meet ISO 9001:2008, DIN EN ISO 13485:2012)

We hereby declare that the device is compliant with Directive 98/79/EC of the European Parliament and of the Council on In-Vitro Diagnostic Devices. This declaration is valid for all devices manufactured before March 31, 2022. The conformity assessment procedure was carried out according to Annex III of said directive. This declaration becomes void for all modifications of the device that are not authorized by us.

Product Description:	Upright Microscope
Type:	Laboratory Microscope medicus plus
Artikelnummer(n):	medicus plus/Bino (Art. No. 008.0445.0) medicus plus/Trino (Art.-Nr. 008.0449.0) medicus plus/Bino/LED/Köhler (Art.-Nr. 008.0444.0) medicus plus PH/Bino (Art.-Nr. 008.0447.0) medicus plus PH/Trino (Art.-Nr. 008.0448.0) medicus plus Myko (Art.-Nr. 008.0452.0)

- Microscopes for diagnostic purposes and for samples of human origines are **in-vitro diagnostic devices (IVDs)**
- Hund laboratory microscopes are labelled as IVDs
- Corresponding declarations of conformity are available upon request

Ansprechpartner

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