CFIM MICROSCOPY COURSE

TIMETABLE

PRINCIPLES OF MICROSCOPY

MONDAY 6TH OF JANUARY 2014 – FRIDAY 10TH OF JANUARY 2014

CONFOCAL AND FLUORESCENCE MICROSCOPY

MONDAY 20TH OF JANUARY 2014 – FRIDAY 24TH OF JANUARY 2014

PHD COURSE
UNIVERSITY OF COPENHAGEN
JANUARY 2014

DEPARTMENT OF BIOMEDICAL SCIENCES
IN COLLABORATION WITH
THE ROYAL MICROSCOPICAL SOCIETY

Monday 6th of January		
09:00 – 09:30	*Introduction*	KQ
09:30 – 10:15	*Lecture* The story of the microscope	PJE/AS
10:15	**Coffee**	
10:30 – 12:45	*Lecture* Limitations of the eye. Resolution, contrast, magnification. Lenses, magnifying glasses, compound microscopes. Conjugate planes	PJE
12:45	**Lunch**	
13:30 – 15:00	*Lecture* Lens defects and their correction Köhler illumination	PJE
15:00	**Coffee**	
15:15 – 16:45	*Practical 1* ▪ Köhler illumination (4) ▪ Conjugate planes on the optical bench (3) ▪ Conjugate planes in the microscope (3) ▪ Workbook DIY (1 – 4, 9, and 10)	KQ AS PJE THB/CP/LP
16:45 – 17:00	*Summary of day's work; questions and workbook*	

You should now understand the geometrical optics of the microscope, know how to set it up, and begin to understand why these steps are necessary.

Tuesday 7th of January		
09:00 – 09:45	*Practical 1 continued*	
09:45	**Coffee**	
10:00 – 10:45	*Practical 1 continued*	
10:45 – 11:30	*Demonstration* Setting up Köhler illumination in transmitted light Depth of field and depth of focus	
11:30 – 12:30	*Lecture-demonstration* Diffraction, resolution and contrast	PJE
12:30	**Lunch**	
13:15 – 14:00	*Lecture-demonstration continued*	PJE
14.00 – 14.45	*Practical 2* ▪ Diffraction experiments ▪ Aperture (7) ▪ Resolving power (9,12, and 13) ▪ Work Book DIY (continue + 4, 6 - 9)	KQ AS PJE THB/CP/LP
14:45	**Coffee**	
15:00 – 15:45	*Practical 2 continued*	
15:45 – 16:45	*Lecture* Equations for limit of resolution of optical instruments	AS
16:45 – 17:00	*Summary of day's work; questions and workbook*	

You should now understand how diffraction sets the limits to resolving power, and provides the basis for generation of contrast.

Wednesday 8th of January		
09:00 – 09:45	*Practical 2 continued*	
09:45	**Coffee**	
10:00 – 10:45	*Practical 2 continued*	
10:45 – 11:45	*Lecture* Contrast: Bright field, dark ground, Rheinberg, Phase contrast	PJE
11:45	**Lunch**	
12:30 – 14:30	*Practical 3* Dark field – patch stop (13) Rheinberg (14)	
14:30	**Coffee**	
14:45 – 15:45	*Lecture* The nature and properties of light	AS
15.45 – 16.15	*Summary of day's work; questions and workbook*	
17.00 -	*Dinner and Invited lecture at the Faculty Club*	

You should now understand how the properties of specimens may be exploited in the microscope to give rise to contrast.

Thursday 9th of january		
09.00 – 10.00	*Practical 4* Phase contrast (15)	
10.00	**Coffee**	
10.15 – 11.15	*Lecture-demonstration* Polarised light	AS
11.15 – 12.30	*Practical 5* ▪ Contrast in the polarised-light microscope (17) ▪ Effects of mounting media	
12.30	**Lunch**	
13.15 – 13.45	*Lecture* Understanding interference colours	AS
13.45 – 14.30	*Lecture* Differential interference contrast	PJE
14.30	**Coffee**	
14.45 – 16.15	*Practical 6* ▪ Polarised light: examples at lightbox (16) ▪ DIC (Epi-illumination and transmitted light) (18) ▪ CFIM introduction ▪ Workbook (continue + 19)	 AS PJE KQ THB/CP/LP
16.15 – 16.45	*Lecture* Principles of the confocal microscope	PJE
16.45 – 17.00	*Summary of day's work; questions and workbook*	

You should now understand the concept of optical path difference and how polarisation colours arise, and how these can be applied to generate contrast in the microscope image.

Friday 10th of January		
09.00 – 09.30	*Lecture* Methods of recording images	PJE
09.30 – 10.30	*Lecture* Principles of digital image recording Optical considerations in fitting a camera to a microscope	PJE
10.30	**Coffee**	
10.45 – 11.30	*Lecture* Stereomicroscopes	PJE
11.30 – 12.00	*Lecture* Cleaning and maintenance	PJE
12.00 – 12.45	**Lunch**	
12.45 – 14.15	*Lecture* Principles of electron microscopy	PJE /AS
14.10 – 14.30	**Coffee**	
14.30 – 16.30	*Practical 7* ▪ Transmission electron microscopy ▪ Scanning electron microscopy ▪ Image recording; fitting the camera (20) ▪ Fluorescence	 RL KQ PJE THB/CP/LP
16.30 – 17.00	*Questions; summary of course*	

Now you know the principles; see you in a week.

Monday 20th of January			
9.00 – 09.15	*Welcome & introduction*	*KQ*	*15.2.18*
09.15 – 10.15	*Lecture*		*15.2.18*
	Atoms, light and matter	AE	
10.15	**Coffee**		
10.30 – 11.30	*Lecture*		*15.2.18*
	Fluorescence and fluorophores	AE	
11.30 – 12.45	*Interactive Lecture*		*15.2.18*
	Computers and software	AE	
13.00	**Lunch**		
13.45 – 14.45	*Lecture*		*15.2.18*
	Fluorescence microscopy: an overview.	AE	
14.45 – 15.15	*Interactive lecture*		*15.2.18*
	Fluorescence microscopy: the stand		
15.15	**Coffee**		
15.30 – 16.40	*Lecture*		*15.2.18*
	Signal, noise and detectors	AE	
16.40 – 17.00	*Lecture*		*15.2.18*
	Fluorescence microscopy: an overview (cont.)	AE	

Tuesday 21th of January			
09.00 – 10.00	*Lecture*		*15.2.18*
	Confocal and wide-field fluorescence microscopy	AE	
10.00	**Coffee**		15.2.18
10.15 – 11.15	*Lecture*		*15.2.18*
	Photon sensing arrays	Andor	
11.15 – 12.15	*Lecture continued*		*15.2.18*
	Confocal and wide-field fluorescence microscopy	AE	
12:15 – 13:00	*Practical in 5 groups – 1 rotation*		*CFIM*
	▪ Zeiss LSM 710 Configuring a confocal microscope	AE	
	▪ Zeiss LSM700 Collecting 3D data and sampling	JC	
	▪ Zeiss LSM 780 Collecting spectral data	LP	
	▪ Zeiss cell observer TIRF microscopy	TH	
	▪ Digital cameras	Andor	
13.00	**Lunch**		
13.45 – 15.15	*Practical continued – 2 rotations*		*CFIM*
15.15	**Coffee**		*CFIM*
15.30 – 17.00	*Practical continued – 2 rotations*		*CFIM*

Wednesday 22th of January			
09.00 – 10.00	*Lecture*		*15.2.18*
	3D Reconstruction	JC	
10.00	**Coffee**		15.2.18
10.15 – 11.15	*Lecture continued*		*15.2.18*
	3D Reconstruction c	JC	
11.15 – 12.15	*Lecture*		*15.2.18*
	Quantification of Fluorescence	AE	
12:15 – 13:00	*Interactive lecture*		*15.2.18*
	Deconvolution and Image restoration	JC	
13.00	**Lunch**		
13.45 – 14.45	*Interactive lecture continued*		*15.2.18*
	Deconvolution and Image restoration	JC	
14.45 – 15.45	*Lecture*		
	Immunofluorescence and affinity fluorescent staining	AE	
15.45	**Coffee**		*15.2.18*
15.30 – 17.00	*Lecture*		*15.2.18*
	Beyond the diffraction limit	JC	

Thursday 23th of January			
09.00 – 09.45	*Lecture* Fluorescence Recovery After Photobleaching (FRAP) and fluorescence correlation spectroscopy (FCS)	*DZ*	*15.2.18*
09.45	**Coffee**		15.2.18
10.00 – 11.00	*Lecture* Fluorescent Resonance Energy Transfer (FRET)c	 DZ	*15.2.18*
11.00 – 13.00	*Practical – 1 rotation*		
	▪ Zeiss LSM 710 Checking the confocal microscope	AE	*CFIM*
	▪ 3D reconstruction	JC	*CFIM*
	▪ Zeiss LSM 780 FRAP, FRET & FCS	DZ	*CFIM*
	▪ TIRF, Spinning disc	THB	*CFIM*
	▪ LSM 700 collecting confocal data (1h 15 min) & Fluorescence, alignment of the Hg arc (45 min)	CP KQ	*CFIM* *15.2.10*
13.00	**Lunch**		
13.45 – 15.45	*Practical continued– 1 rotation*		
15.45	**Coffee**		*15.2.18*
16.00 – 17.00	*Lecture* Creating micrographs from digital data	 AE	*15.2.18*

Friday 24th of January			
09.00 – 11.00	*Practical continued– 1 rotation*		*CFIM*
11.00	**Coffee**		CFIM
11.15 – 13.15	*Practical continued– 1 rotation*		*CFIM*
13.15	**Lunch**		
14.00 – 16.00	*Practical continued– 1 rotation*		
16.00	**Coffee**		*CFIM*
16.15 – 17.00	*Lecture* Fluorescence Localization After Photobleaching (FLAP)	 DZ	*15.2.18*