

MICRON Advanced Microscopy Course

Welcome - explanation of course outline

Ilan Davis, March 2013



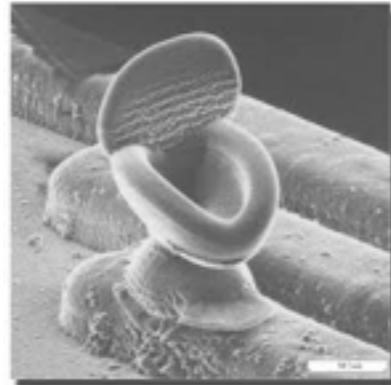
<http://www.micronoxford.com>



<http://www.nanoscopyoxford.com>



Fire escapes



Toilets

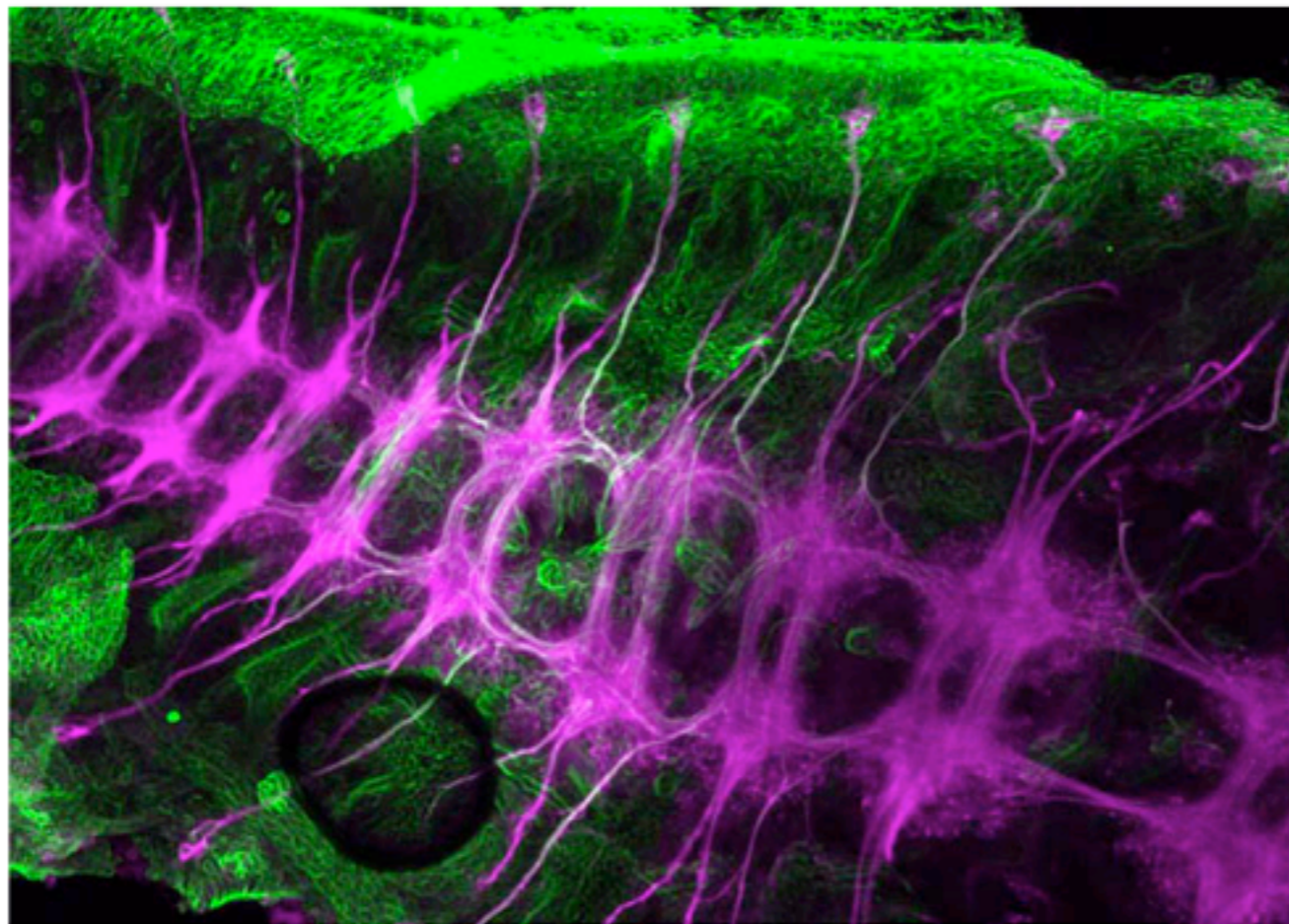


Free lunch !!! - Tuesday in Cafe

[http://www2.bioch.ox.ac.uk/
microngroup/micron_resources.php](http://www2.bioch.ox.ac.uk/microngroup/micron_resources.php)

Lectures available on micron web site (no handouts)

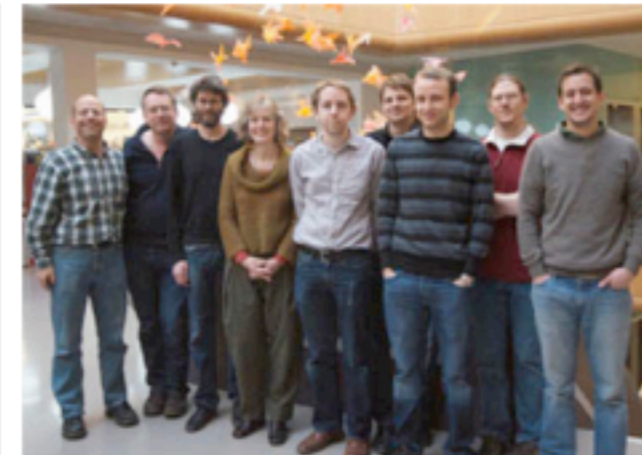
Micron Oxford is located within the [Department of Biochemistry](#) and the [Dunn School of Pathology](#) in the South Parks Road science area at the University of Oxford, and is funded by a strategic award from the [Wellcome Trust](#). We are a collaborative, multidisciplinary bioimaging unit working with biomedical researchers in the Oxford area and beyond to apply advanced cellular imaging techniques to address key questions in biology. We are focusing on the development and use of single molecule methods, light sheet and [super-resolution microscopy](#).



This is an image of a grasshopper embryo stained to reveal the nervous system in pink and acetylated tubulin in green. (Anna Franz, Raff Lab).

[more research images](#)

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MicronOxford @NanoscopyOxford
Superresolution approaches applied to biomedical imaging, mostly funded by the MRC in association with @Micronoxford
13 days ago · reply · retweet · favorite

MicronOxford Dont Forget! The deadline for the SNAPSHOT research image competition (Cover of Phenotype Magazine) is only a few weeks away (8th March).
23 days ago · reply · retweet · favorite

MicronOxford exciting news! The OMX V3 (tinyurl.com/acqxcov) has been upgraded to enable TIRF microscopy and photobleaching/photoactivation experiments.



[Join the conversation](#)

THANKS to everyone

Particularly Eva Wegel

also Wellcome trust 4 year programme Chromosomes in Heredity and Development
and Susan Baylis - Medical Sciences Skills Training

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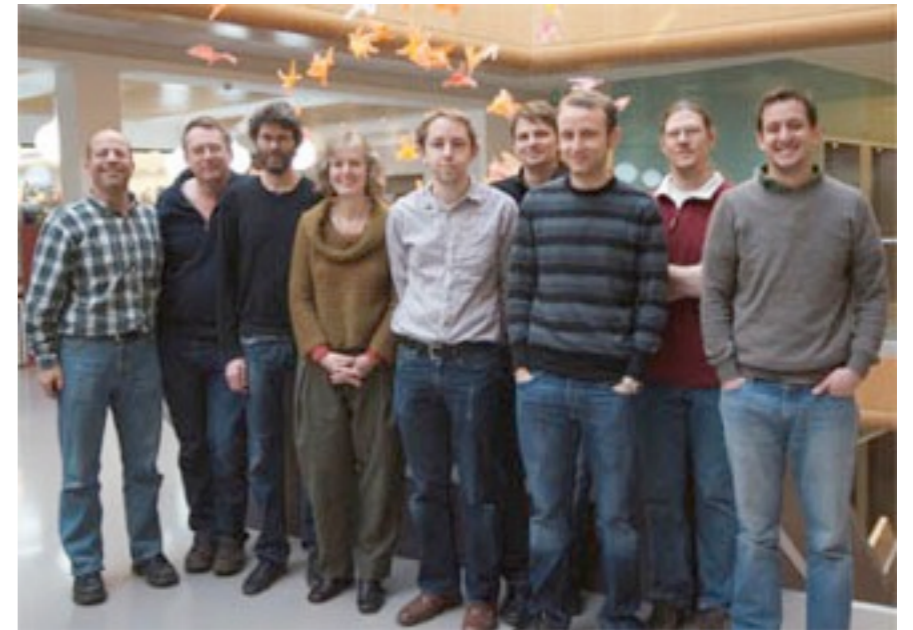
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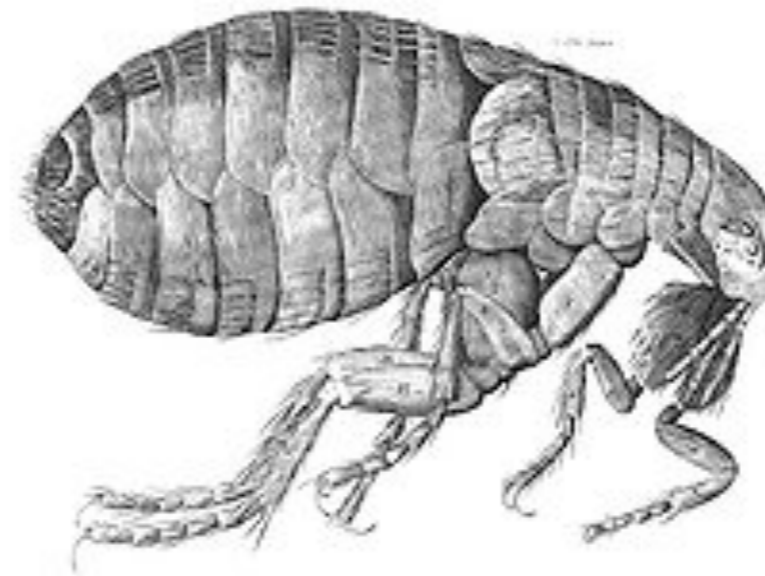
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The importance of microscopes



Milestones in the history of microscopy

http://www.nature.com/milestones/milelight/pdf/milelight_timeline.pdf

http://www.nature.com/milestones/milelight/pdf/milelight_all.pdf

1st century AD, glass was been invented by the Romans - who then discovered crude lenses.

13th century when spectacle makers were producing lenses to be worn as glasses.

MILESTONES TIMELINE

1595	Invention of the microscope (Milestone 1)	Zaccharias Janssen Galileo
1858	First histological stain (Milestone 2)	
1871	Synthesis of fluorescein (Milestone 2)	
1873	Diffraction limit theory (Milestone 3)	Ernst Abbe
1911	First fluorescence microscopy (Milestone 4)	1880 Agust Kohler
1929	First epifluorescence microscope (Milestone 4)	1931 EM Ernst Ruska
1935	Phase contrast microscopy (Milestone 5)	1932 Fritts Zernike
1939	Polarization microscopy (Milestone 6)	
1942	Immunofluorescence (Milestone 7)	
1955	Differential interference contrast (Milestone 8)	Normaski
1961	Concept of confocal microscopy (Milestone 9)	Marvin Minsky
1967	The dichroic mirror (Milestone 4)	
1972	Fluorescence correlation spectroscopy (Milestone 10)	
1976	FRAP (Milestone 10)	
	FRET (Milestone 11)	
1980	Calcium probes (Milestone 12)	

1981	Video-enhancement differential interference contrast (Milestone 8)	
	TIRF microscopy (Milestone 13)	
1983	Deconvolution microscopy (Milestone 14)	Agard and Sedat
1987	Realization of confocal microscopy (Milestone 9)	AFM Calvin Quate
1990	Two-photon microscopy (Milestone 15)	
1993	Light sheet microscopy (Milestone 16)	Ernst Stelzer
	Single molecule microscopy (Milestone 17)	
1994	GFP (Milestone 18)	Martie Chalfie , Roger Chen
1997	Fluorescent protein-based biosensors (Milestone 19)	
1999	Red fluorescent proteins (Milestone 20)	Roger Chen
2000	Breaking the diffraction limit: STED (Milestone 21)	Stefan Hell
2002	Photoactivatable fluorescent proteins (Milestone 20)	Jennifer Lippincott-Schwartz
2006	Breaking the diffraction limit: PALM/STORM (Milestone 21)	

Nobel Prizes in Microscopy

<http://nobelprize.org/educational/physics/microscopes/I.html>

1903 – Richard Zsigmondy develops the ultramicroscope and is able to study objects below the wavelength of light.
[The Nobel Prize in Chemistry 1925 »](#)

1932 – Frits Zernike invents the phase-contrast microscope that allows the study of colorless and transparent biological materials.
[The Nobel Prize in Physics 1953 »](#)

1938 – Ernst Ruska develops the electron microscope. The ability to use electrons in microscopy greatly improves the resolution and greatly expands the borders of exploration.
[The Nobel Prize in Physics 1986 »](#)

1981 – Gerd Binnig and Heinrich Rohrer invent the scanning tunneling microscope that gives three-dimensional images of objects down to the atomic level.
[The Nobel Prize in Physics 1986 »](#)

2008 – GFP Shimomura, Tsien, Chalfie

Microscopy Course 2013

Day 1: Monday 11 March - **Fundamental Principles of Microscopy**

Ilan 9:30 Welcome to the course

- 1 Richard 9.45-10.45 General introduction to light microscopy
- 2 Ian 10.45-12.00 Principles of microscopy and microscope anatomy
- 3 Ian 1.00-2.00 Contrast enhancement (phase contrast and DIC)
- 4 Eva 2.00-3.00 Basic Fluorescence Microscopy and sample prep
- 5 Richard 3.30-4.30 Basic image analysis
- 6 Mark 4.30-5.30 Fluorescent dyes and proteins

Day 2: Tuesday 12 March - **Imaging Molecules in Cells**

- 7 Richard 9.00-10.00 Live cell imaging
- 8 Alan 10.00-11.00 Confocal, spinning discs and Multiphotons
- 9 Ilan 11.20-12.20 Advanced widefield microscopy and bespoke systems
- 10 James 1.30-2.30 Detectors for microscopy
- 11 Ian 2.30-3.30 F* techniques: FRET, FLIM, FCS, FRAP, FLIP
- 12 Chris E. 4.30-5.30 STED, FCS
- 13 Eva 5.00-5.20 Light-sheet microscopy of cellular dynamics

Day 3: Wednesday 13 March - **New and emerging Imaging Approaches**

- 14 Chris L. 9.00-10.00 Single molecule techniques
- 15 Rainer 10.00-11.00 Storm/PALM techniques.
- 16 Lothar 11.30-12.30 OMX
- 17 Errin 1.30-2.00 Electron Microscopy
- 18 Douglas 2.30-3.00 Image Management
- 19 Graeme 3.00-4.00 Applied Image analysis and Matlab

AND

Day 4: Thursday 14 March – Microscope demos and practical image analysis

9.00-12.00 and 14.00-17.00

DV live

Spinning disk live

OMX V2 dSTORM

OMX V3 SIM

Olympus scanning confocal

Olympus basic wide-field

Olympus TIRF

Image analysis

15 min demos + 5 min walking: 8 sessions in the morning, 8 sessions in the afternoon (4 people per group, 64 people in total)

Nanoscopy Oxford

Super-resolution microscopy
applied to biomedical research



Now recruiting six postdoctoral positions

Image analysis

Adaptive optics

Software development

Correlative EM, X-ray and light microscopy

Neuro-imaging

Advanced structured illumination

Suitable candidates will have significant experience in development and application of advanced imaging methods ideally with experience in optical design, programming and hardware control

Participating research groups

Ilan Davis, Christian Eggeling,
Martin Booth, Veronica Buckle,
Doug Higgs, Vincenzo Cerundolo,
Jordan Raff, Achillefs Kapanidis,
David Sherratt, Lothar Schermelleh,
Yvonne Jones, Kay Grunewald,
Dave Stuart, Shankar Srinivas

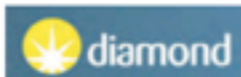
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For details and to apply
<http://www.nanoscopyoxford.com>



The John Fell Fund



The Wellcome Trust Centre for Human Genetics



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