



UNIVERSITY OF
OXFORD

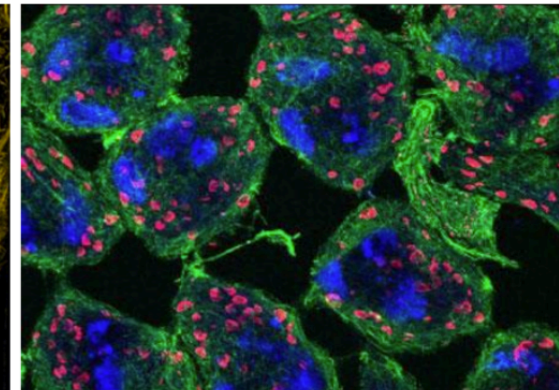
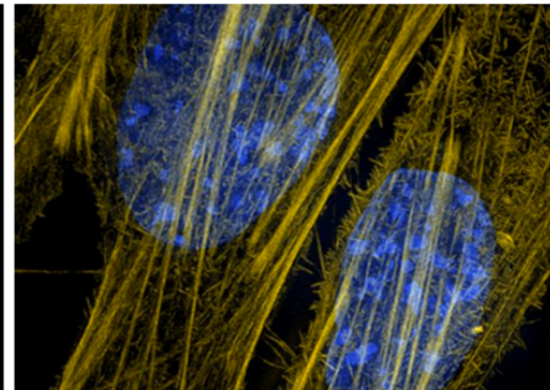
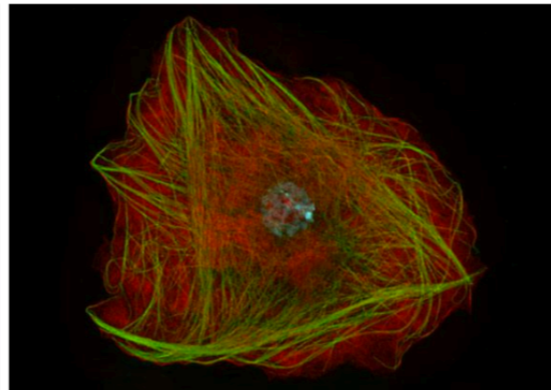
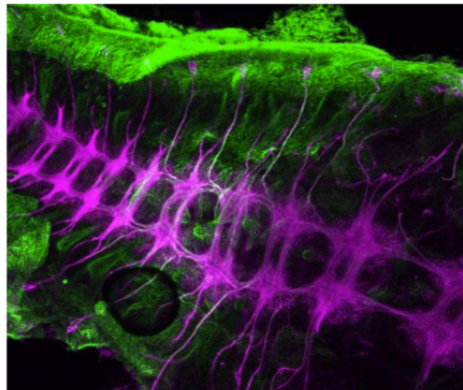
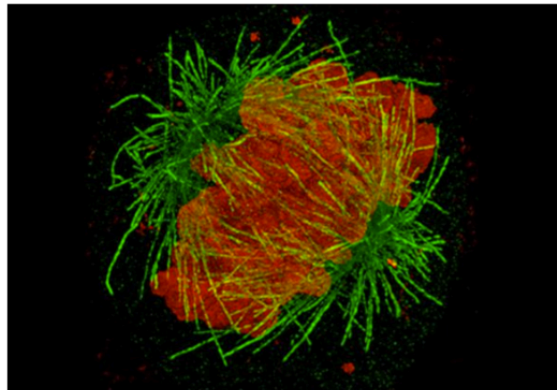
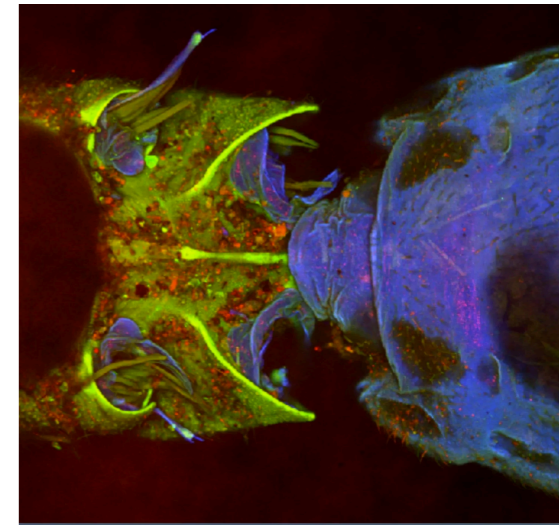
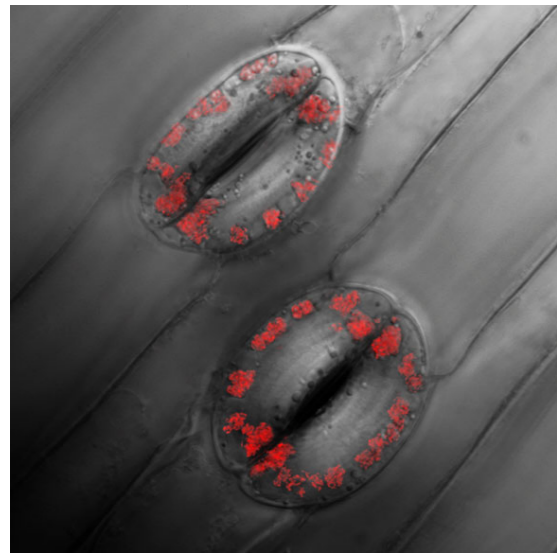
Department of
Biochemistry

Micron
OXFORD

Introduction to light microscopy

Nadia Halidi

Imaging Facility Manager
@ Micron Advanced Bioimaging Unit



Why do we need microscopes?

Can you see the majestic worm?

No!

It's really hard to spot!



Explore, detect, resolve.

A brief history of microscopy

Abbas ibn Firnas
9th Century



Janssen, 1590



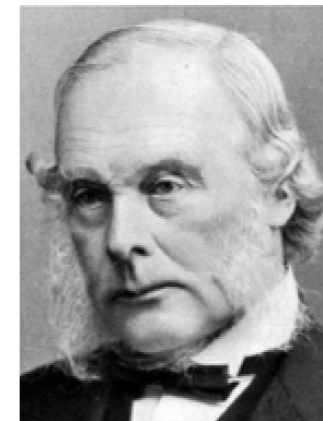
Galilei, 1604



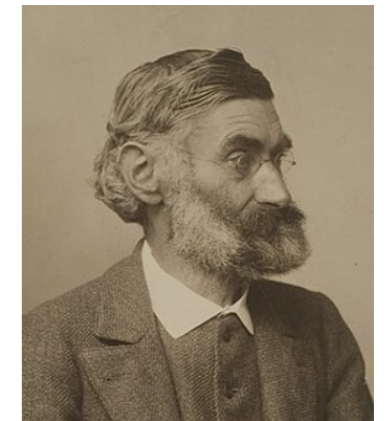
Hook, 1659



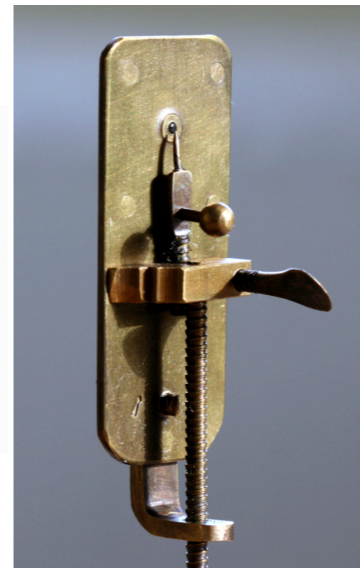
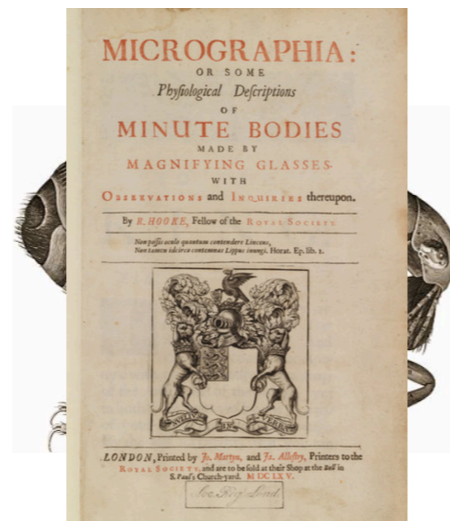
Leeuwenhoek, 1674



Lister, 1826

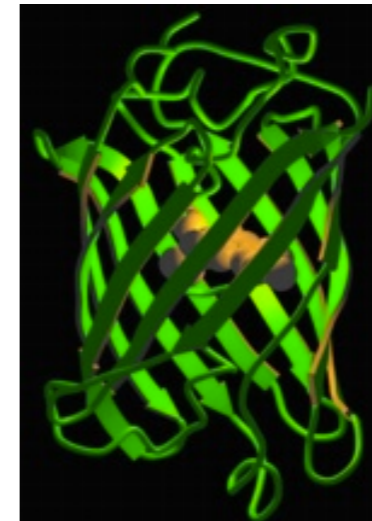


Abbe, 1860



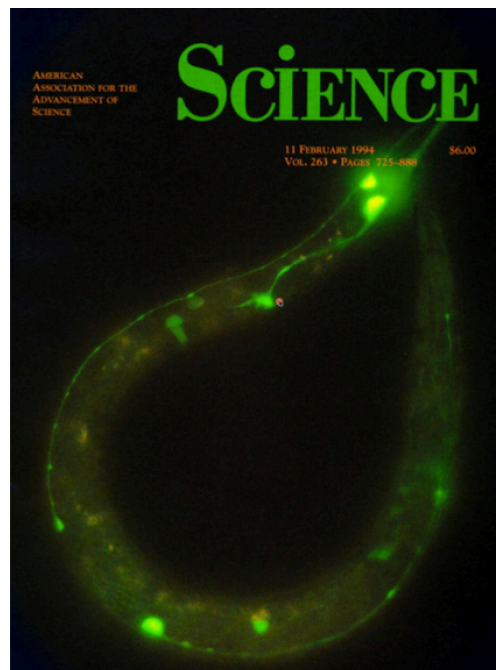
The breakthrough discovery of GFP

Green
Fluorescent
Protein

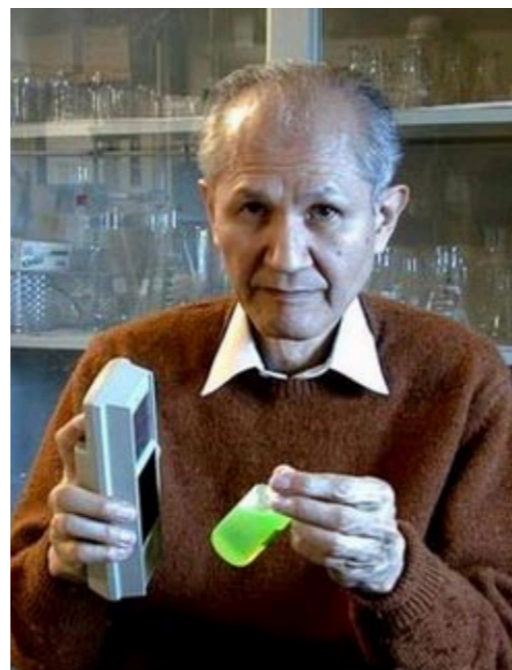


2008 Nobel Prize in Chemistry

“for the discovery and development of the green fluorescent protein, GFP”



Science 1994



Osamu Shimomura

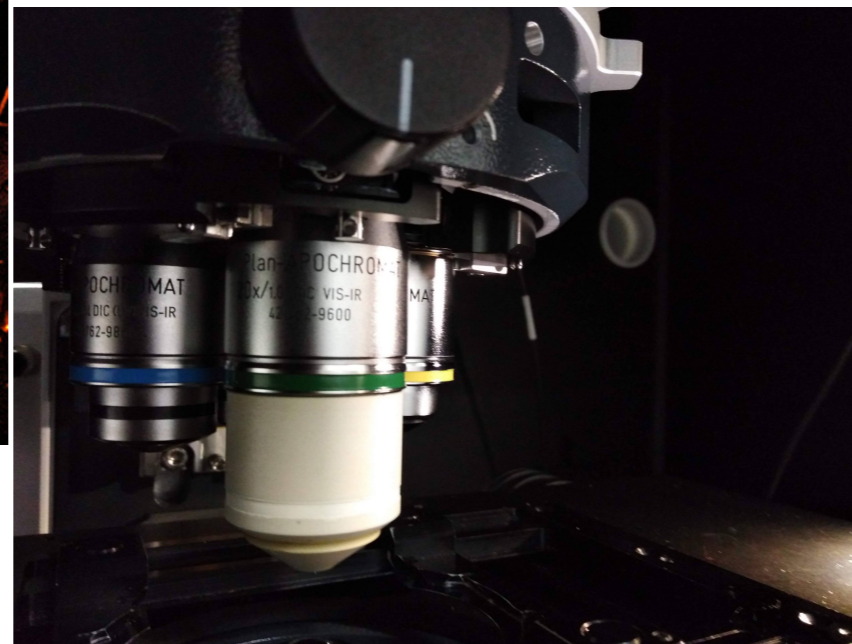
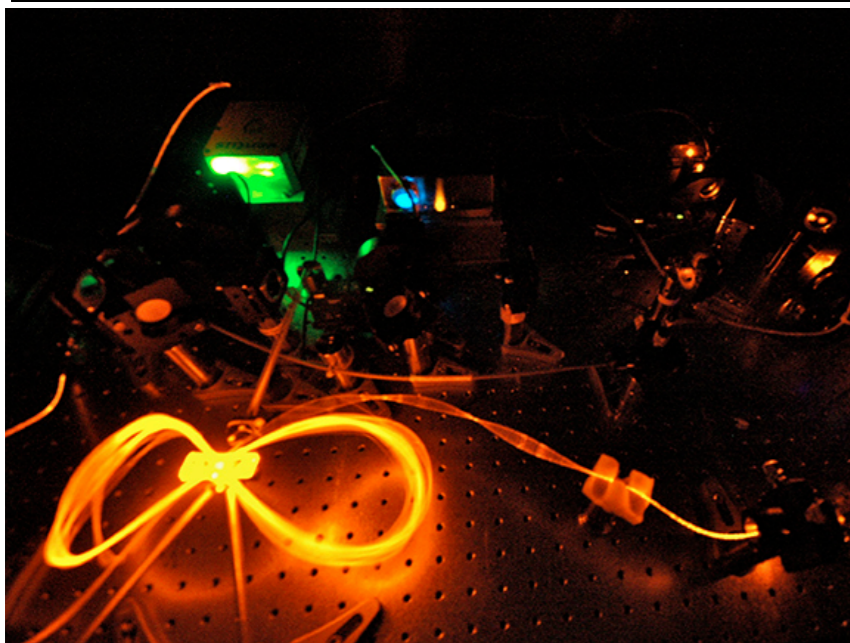
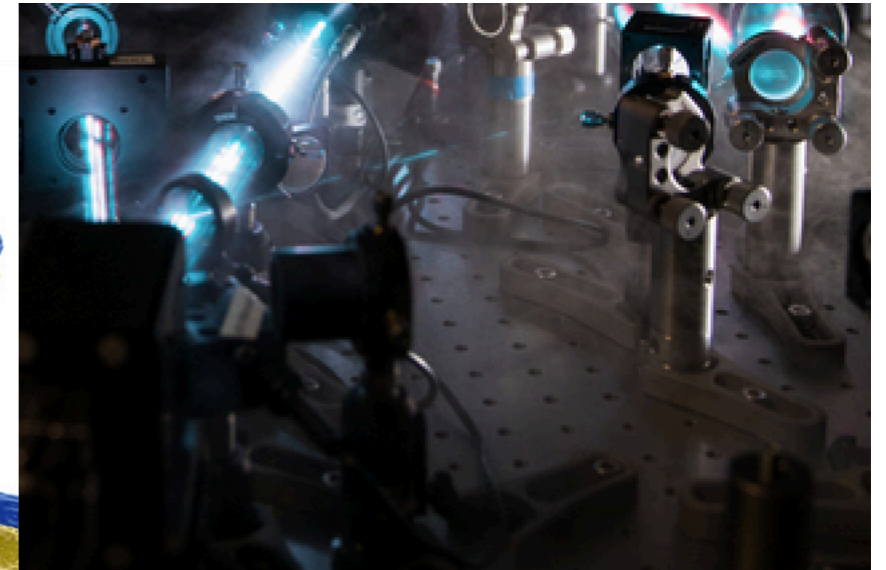
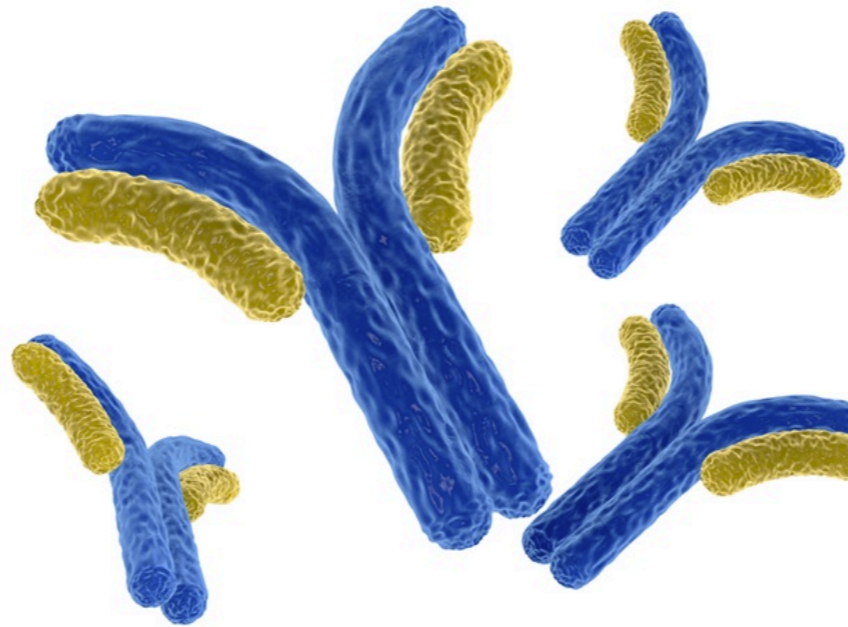
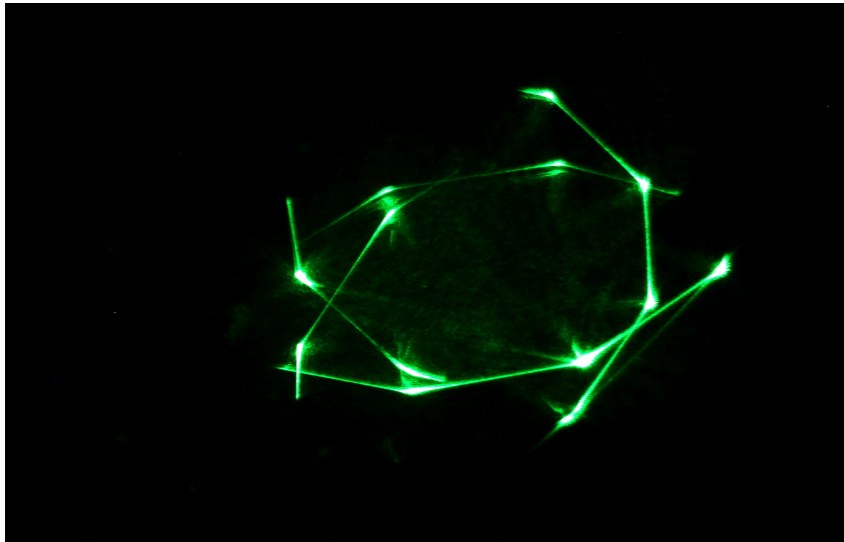


Martin Chalfie



Robert Tsien

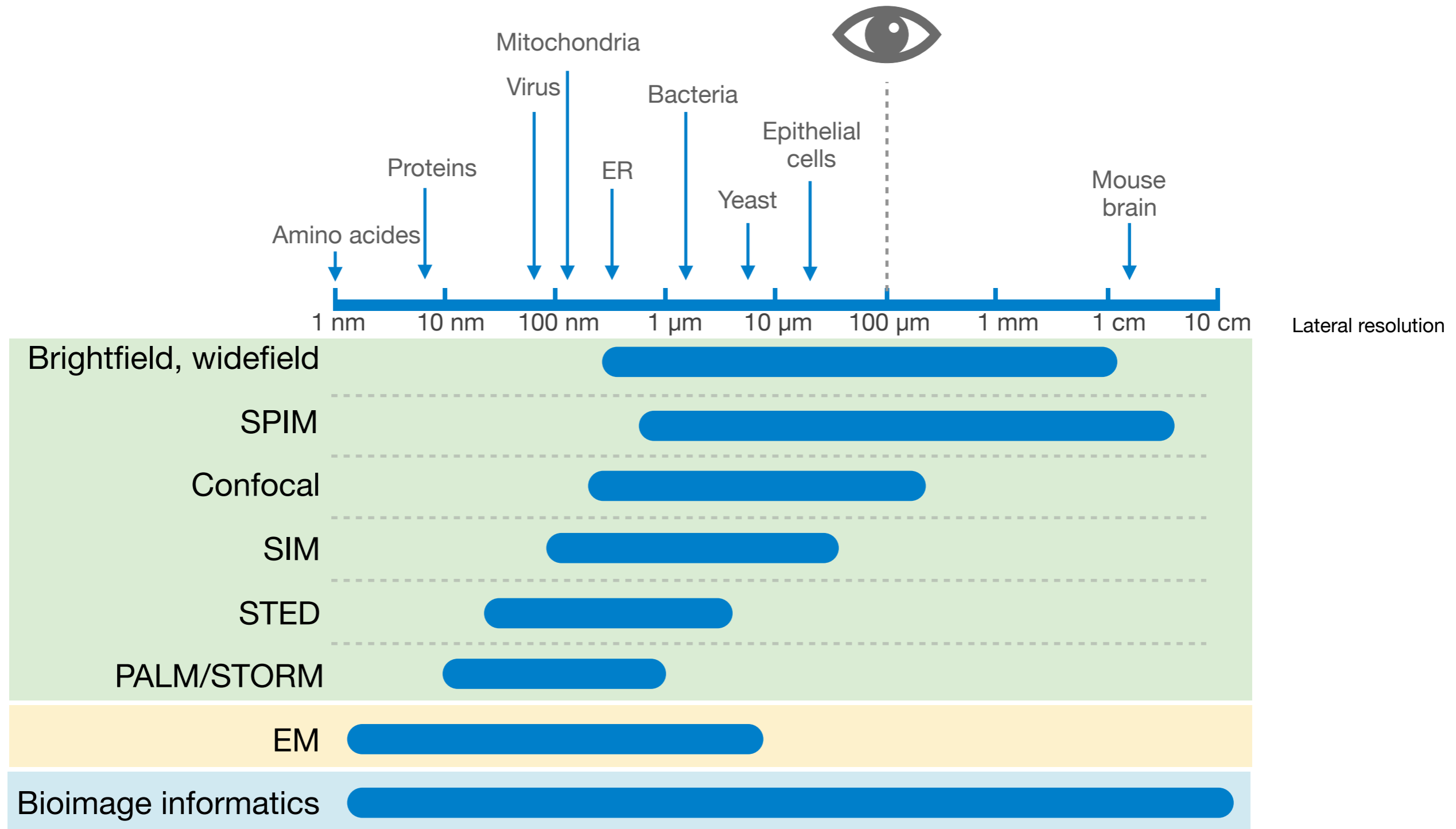
Revolution in technology development



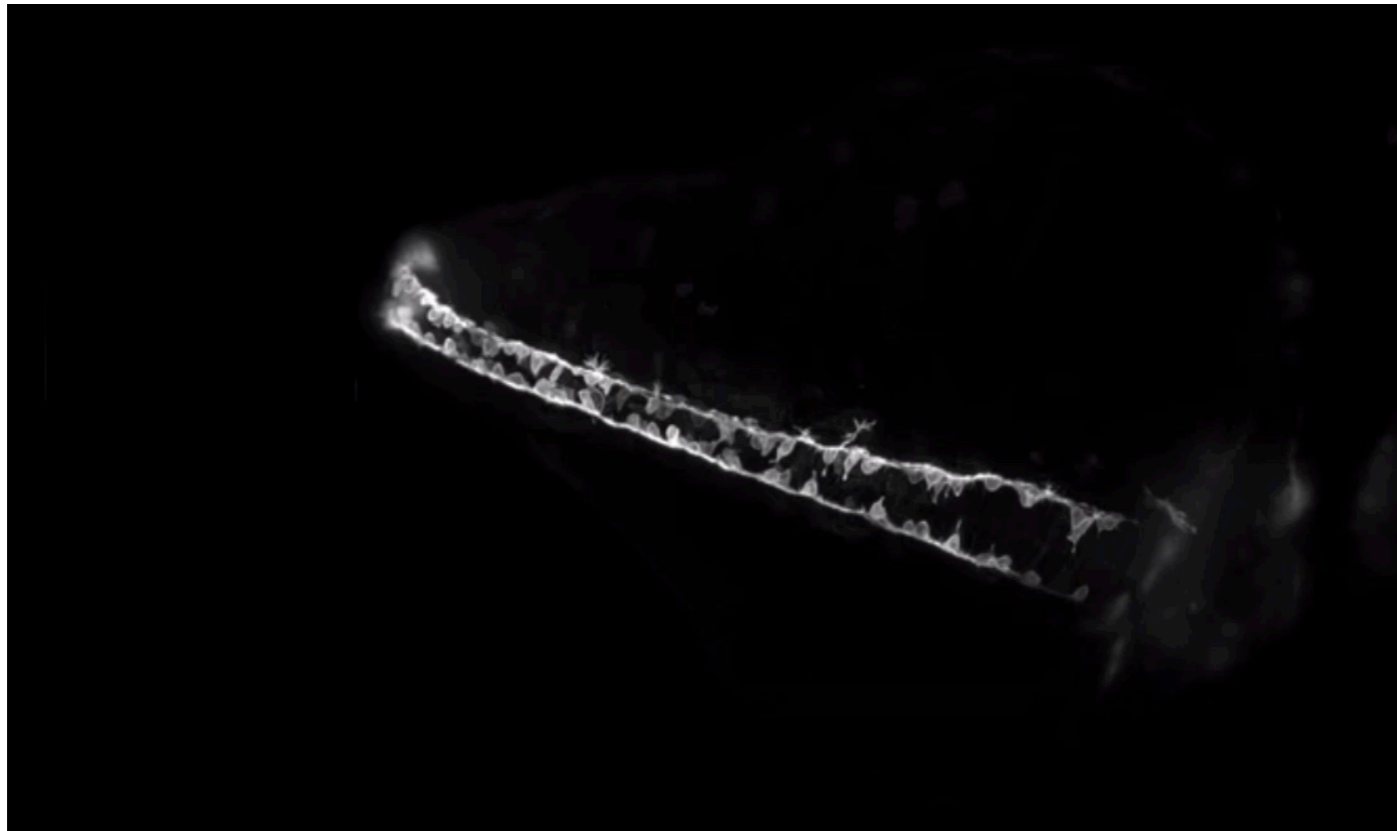
Light sources
Cameras
Detectors

➔ Breaking the diffraction limit

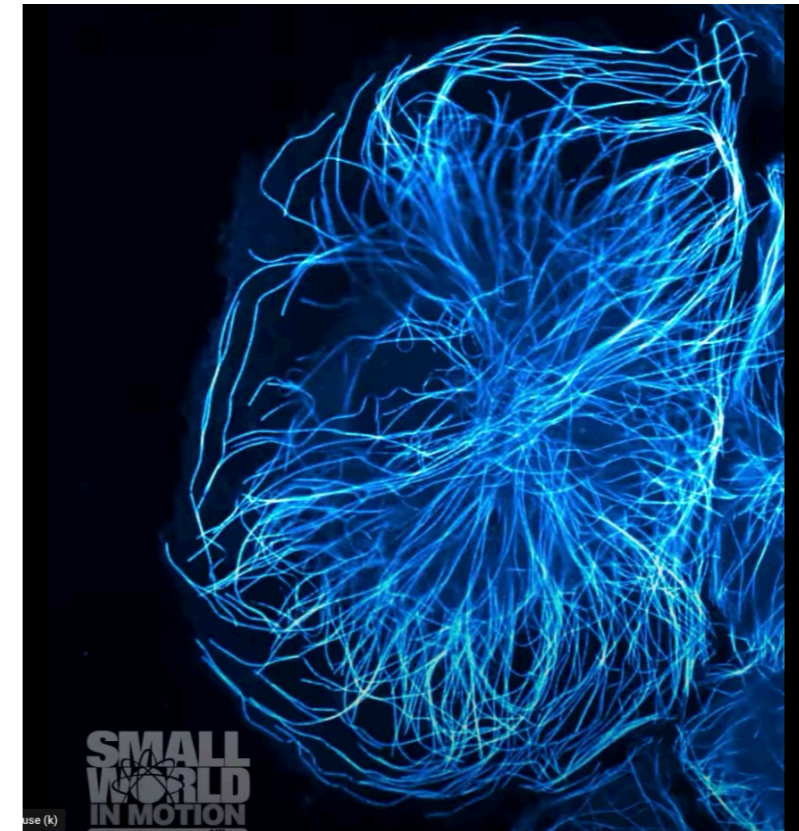
Resolving power of microscopes



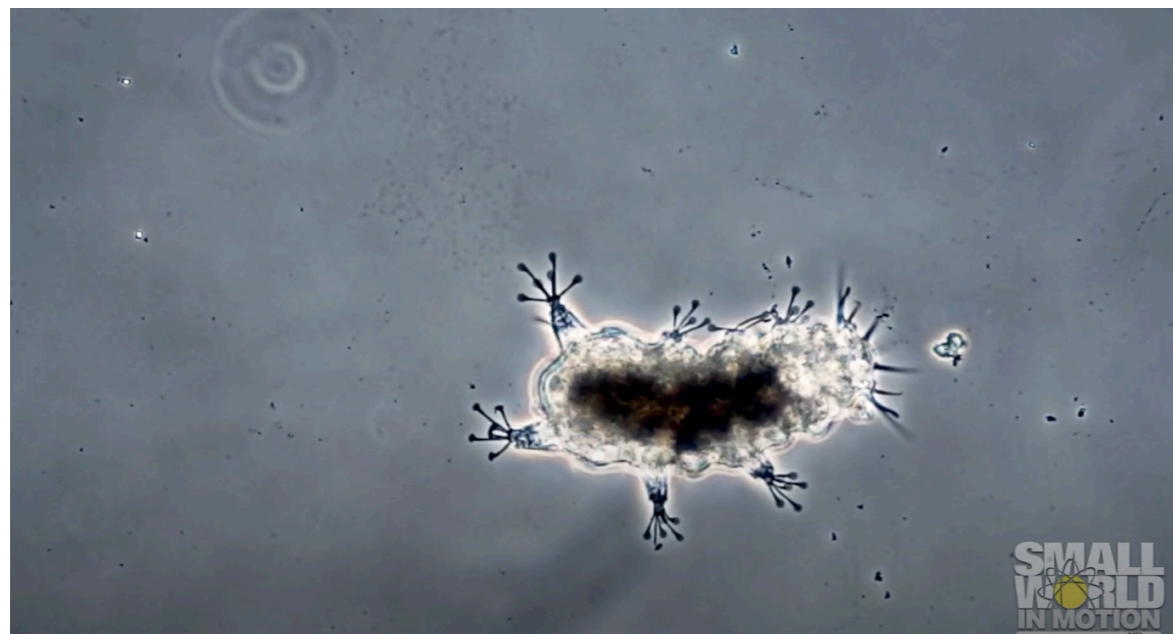
From the Nikon small world in motion competition



Zebrafish embryo growing its sensory nervous system, 2015
E. Haynes, Uni. Wisconsin (SPIM)



Microtubules in Human cells, 2018
J. van Haren, UCSF (Confocal)

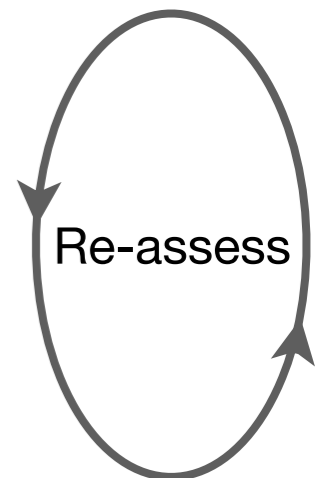


A marine tardigrade (*Batillipes lusitanus*), 2015
R. Martin-Ledo, (Phase contrast)

Designing a microscopy experiment

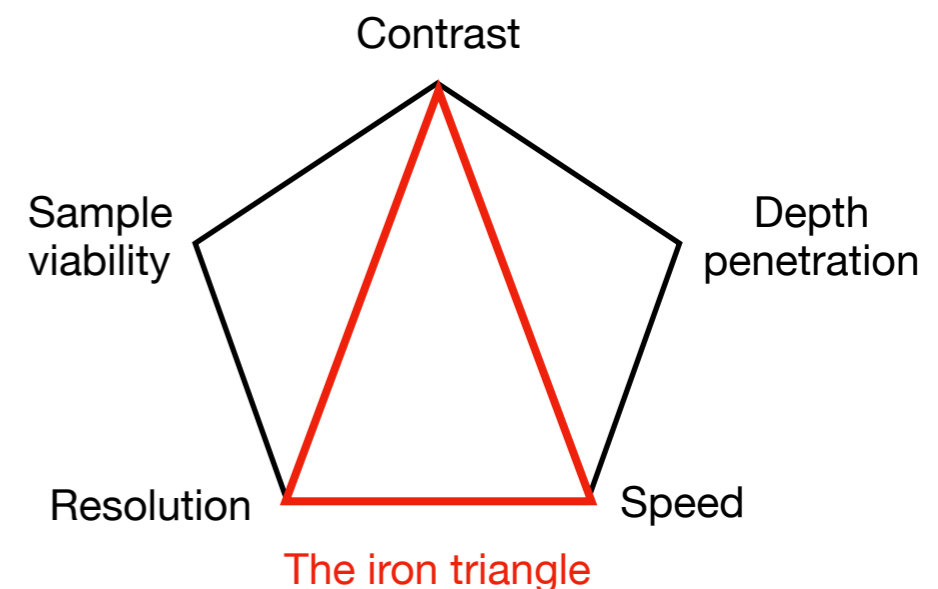


- **Informative results** — what kind of informative results are needed to test the hypothesis
- **Required data** — what data are required to produce the informative results
- **Required controls** — what controls are required to support the informative results
- **Parameters** — what are the experimental parameters dictated by the data
- **Microscope selection** — which instruments aligns with the experimental parameters
- **Data management and storage**
- **Data analysis** — what tools are required to extract the informative results



The limiting factor is: Photon budget.

One must choose and optimise the design of a microscope and the fluorescent probes to address the biological question at hand.



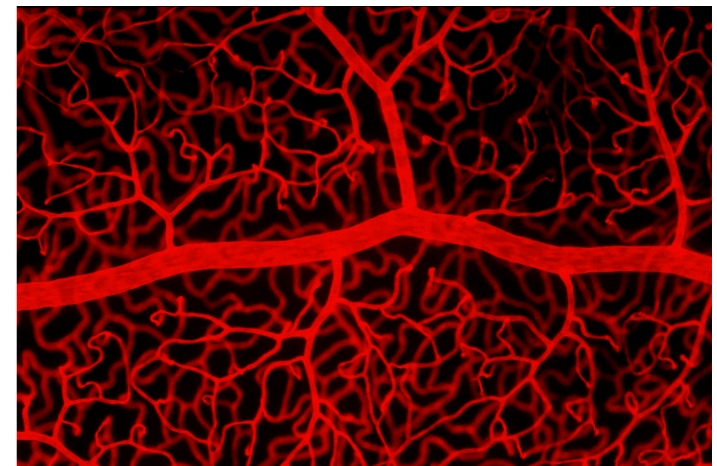
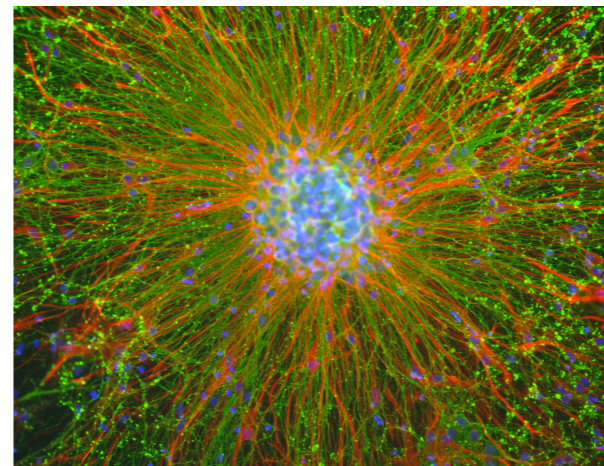
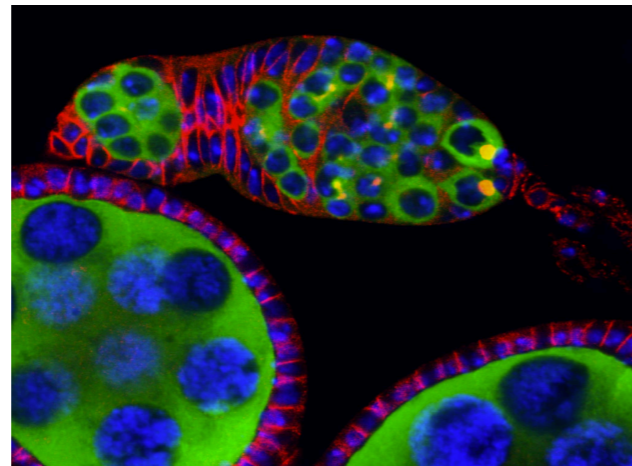
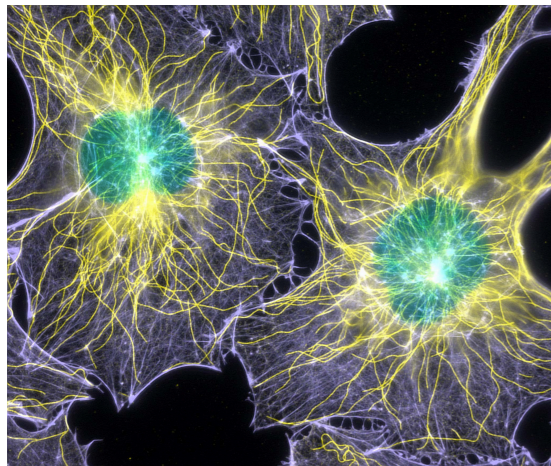
GIGO!



Thank you!



1st prize, 2020



Images from the Nikon small world competition