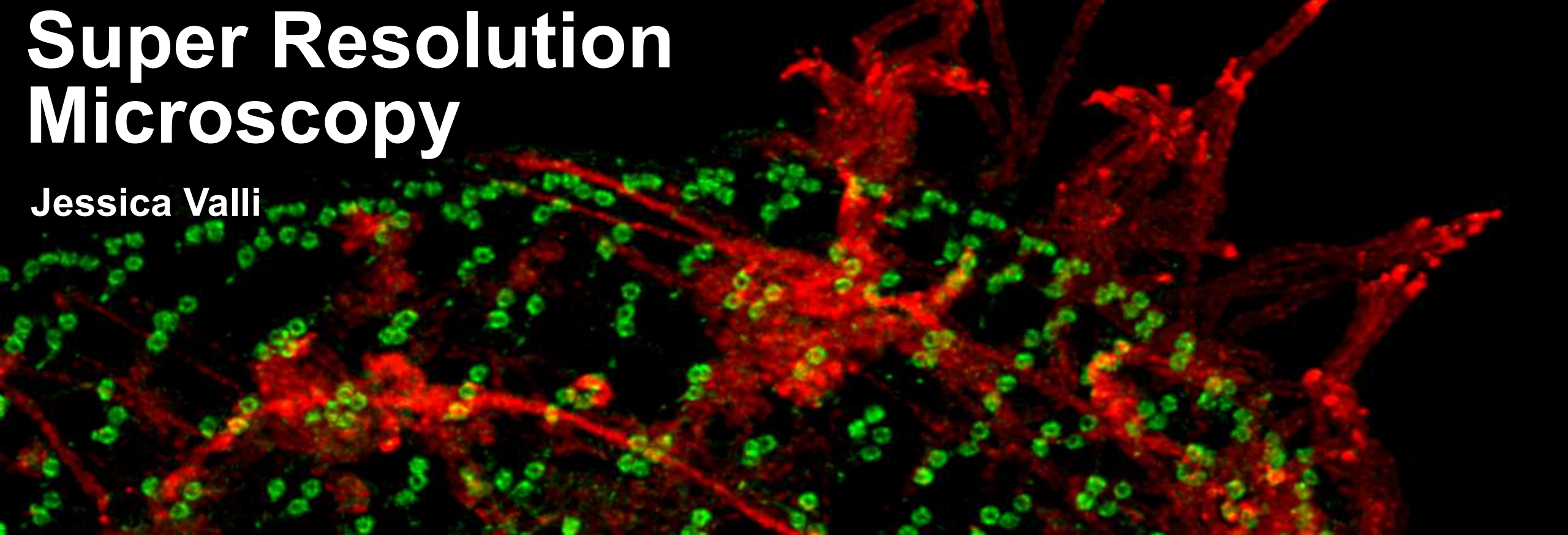


Super Resolution Microscopy

Jessica Valli



ESRIC

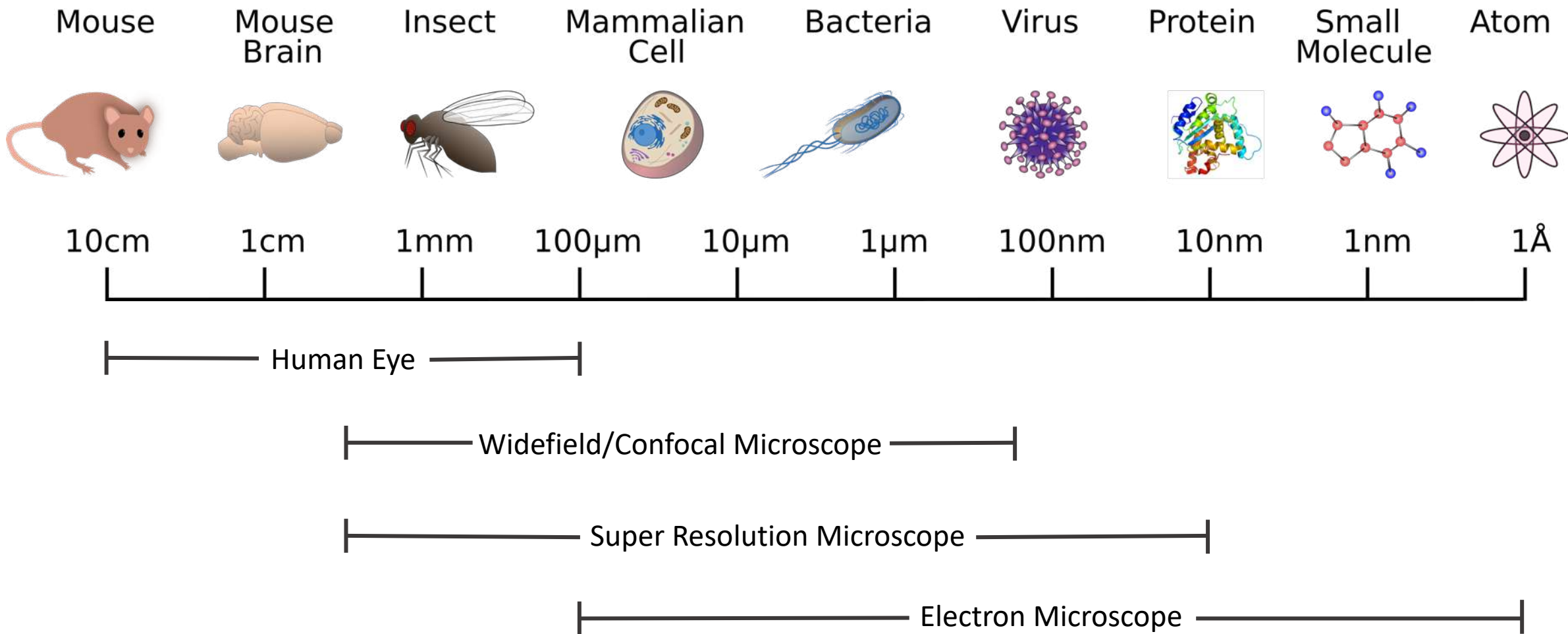
EDINBURGH SUPER-RESOLUTION
IMAGING CONSORTIUM



A NATIONAL SUPER-RESOLUTION IMAGING FACILITY
With a focus on interdisciplinary collaboration and
training

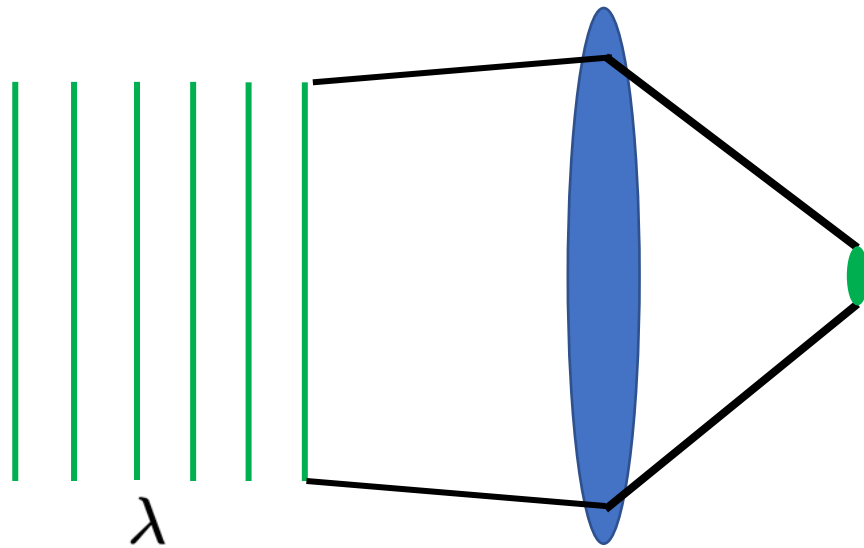


Microscopy Techniques





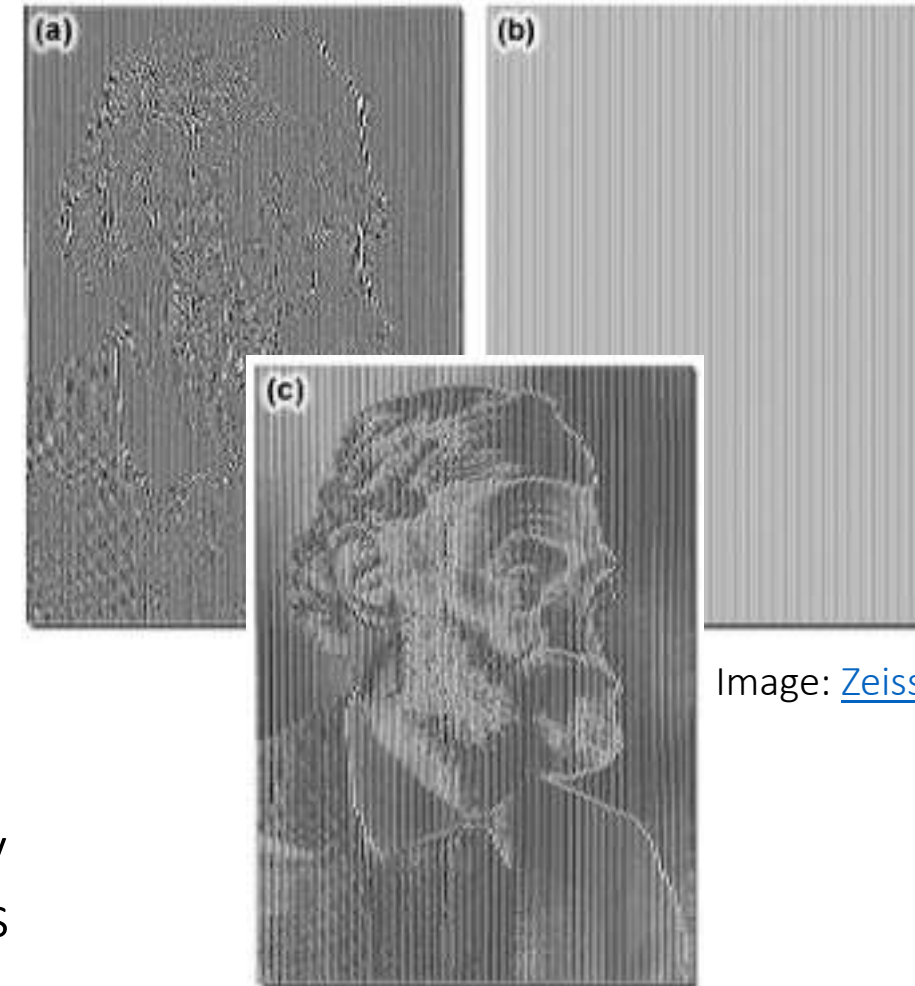
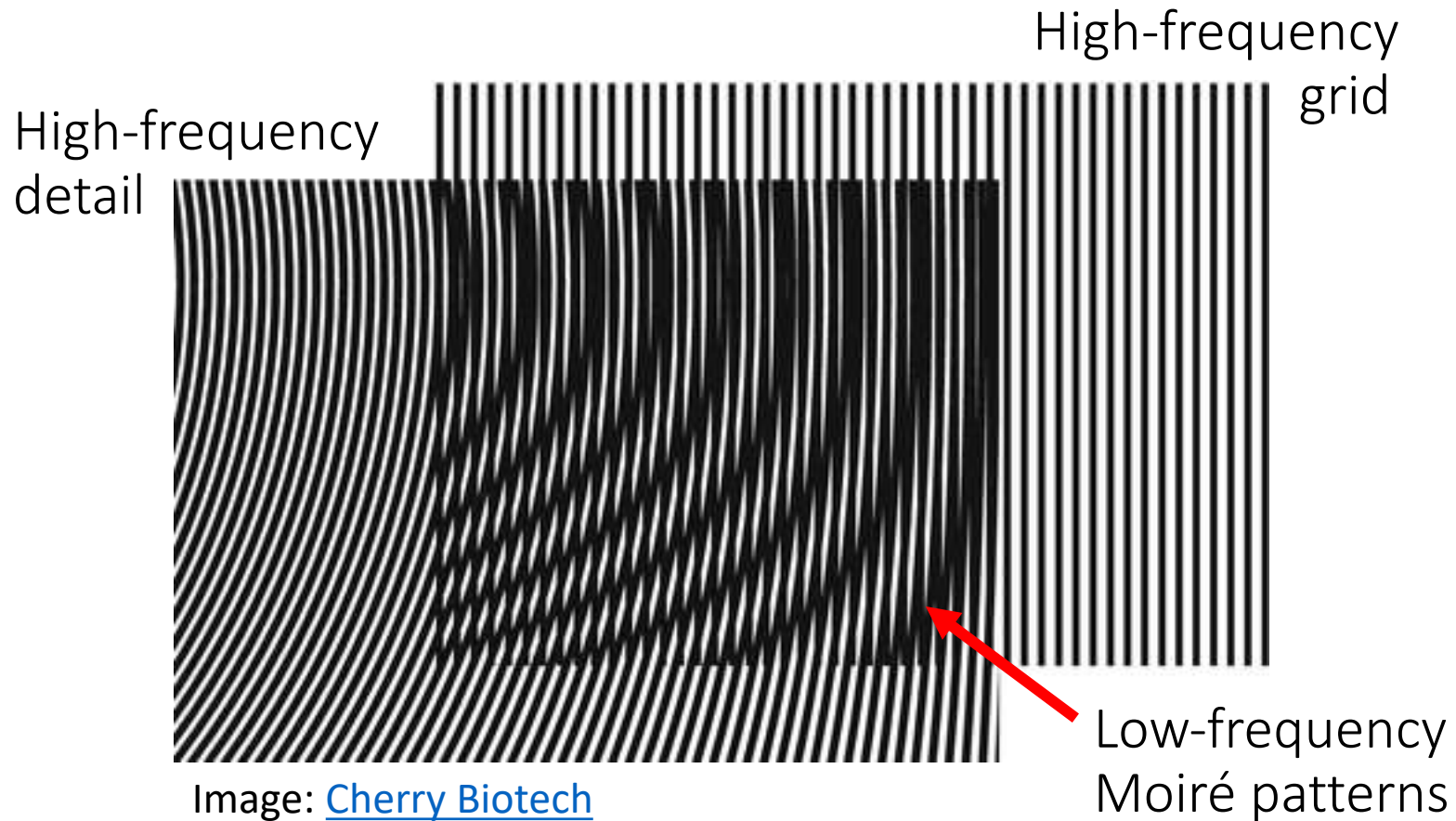
Diffraction Limit



$$d = \frac{\lambda}{2n \sin \theta} = \frac{\lambda}{2NA}$$



Structured Illumination Microscopy (SIM)



Structured Illumination Microscopy (SIM)

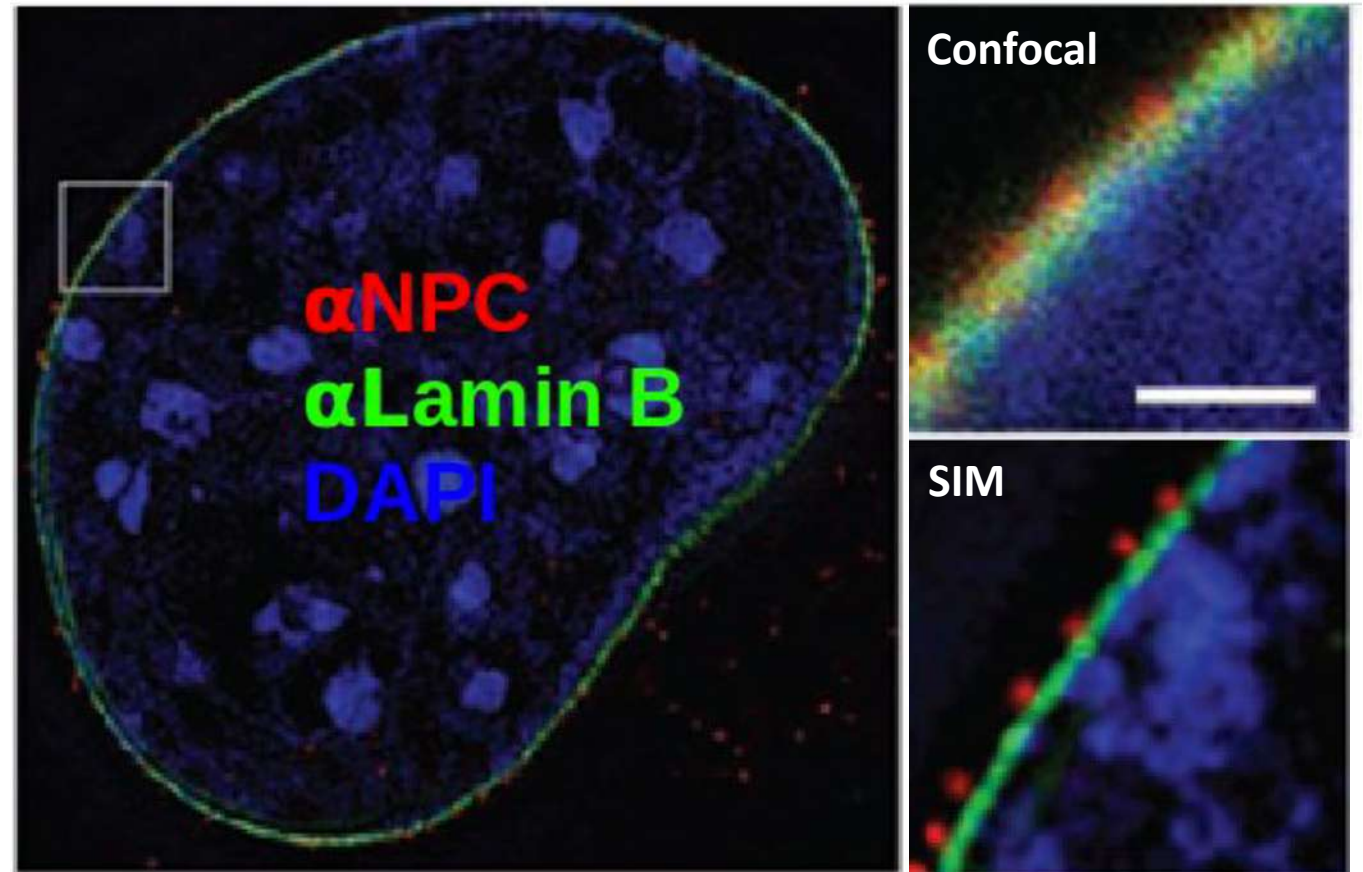
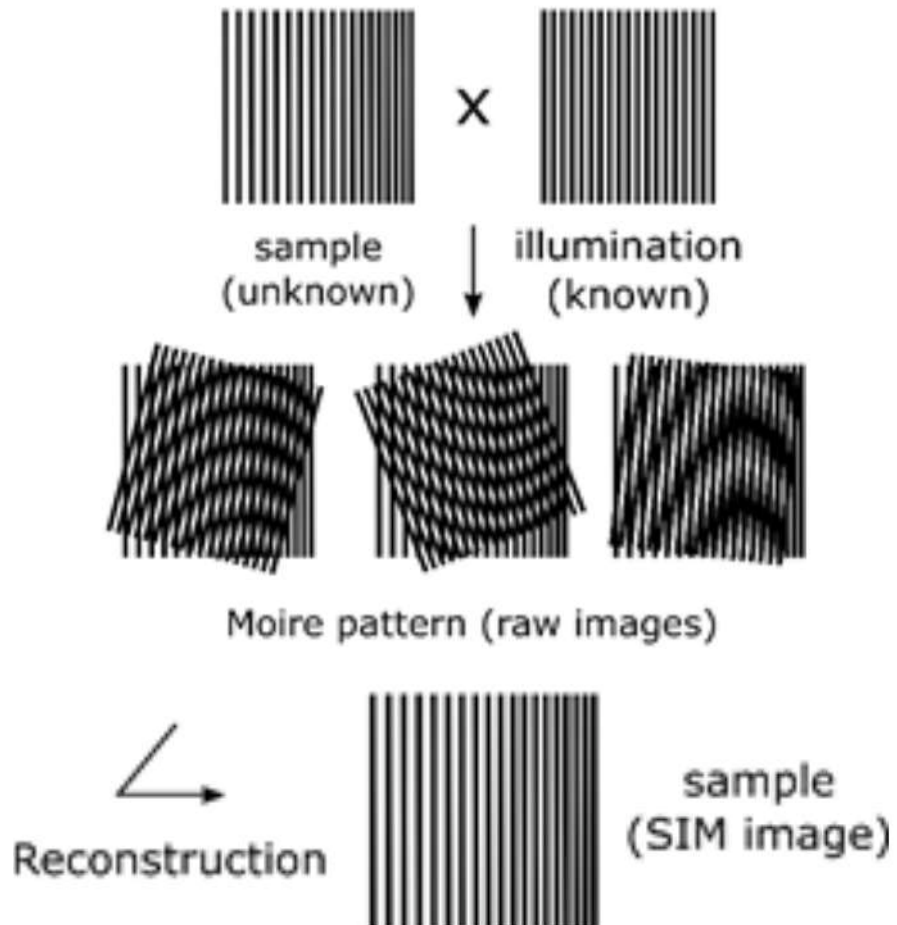
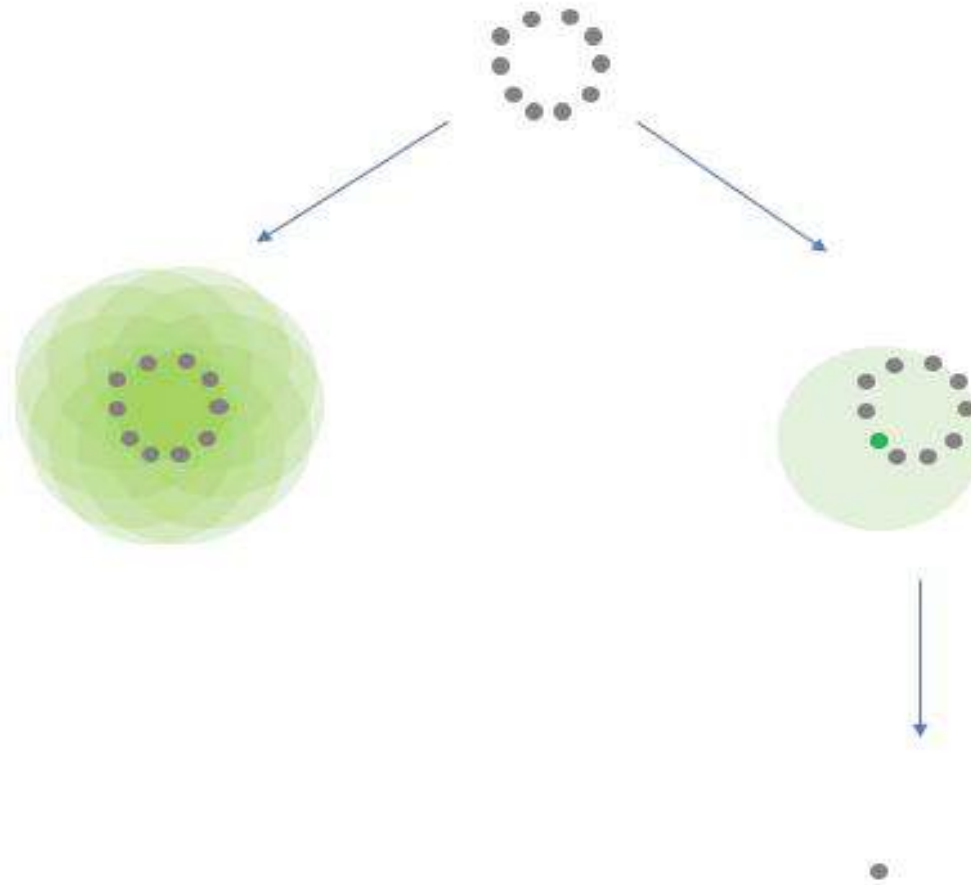


Image: [Biological Nanoimaging](#)

[Schermelleh et al. \(2008\) Science](#)

Single Molecule Localisation Microscopy (SMLM)

PALM	(Betzig, ZEISS)
fPALM	(Hess)
STORM	(Zhunag, NIKON)
dSTORM	(Sauer)
GSDIM	(Hell, LEICA)
SMACM	(Moerner)
SPDM	(Cremer)
SMSM	(Bewersdorf)



Direct Stochastic Optical Reconstruction Microscopy (dSTORM)

SMLM:
dSTORM

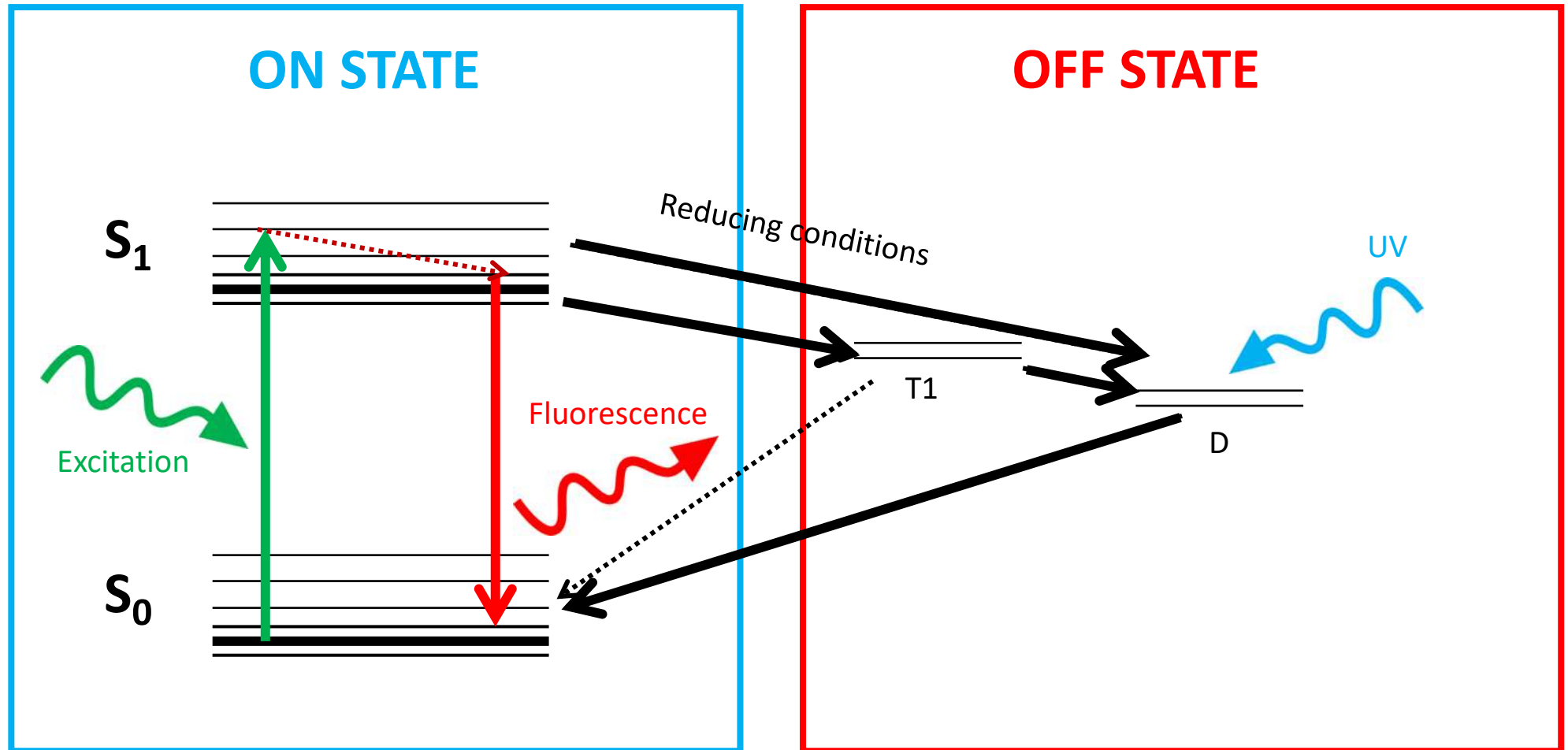
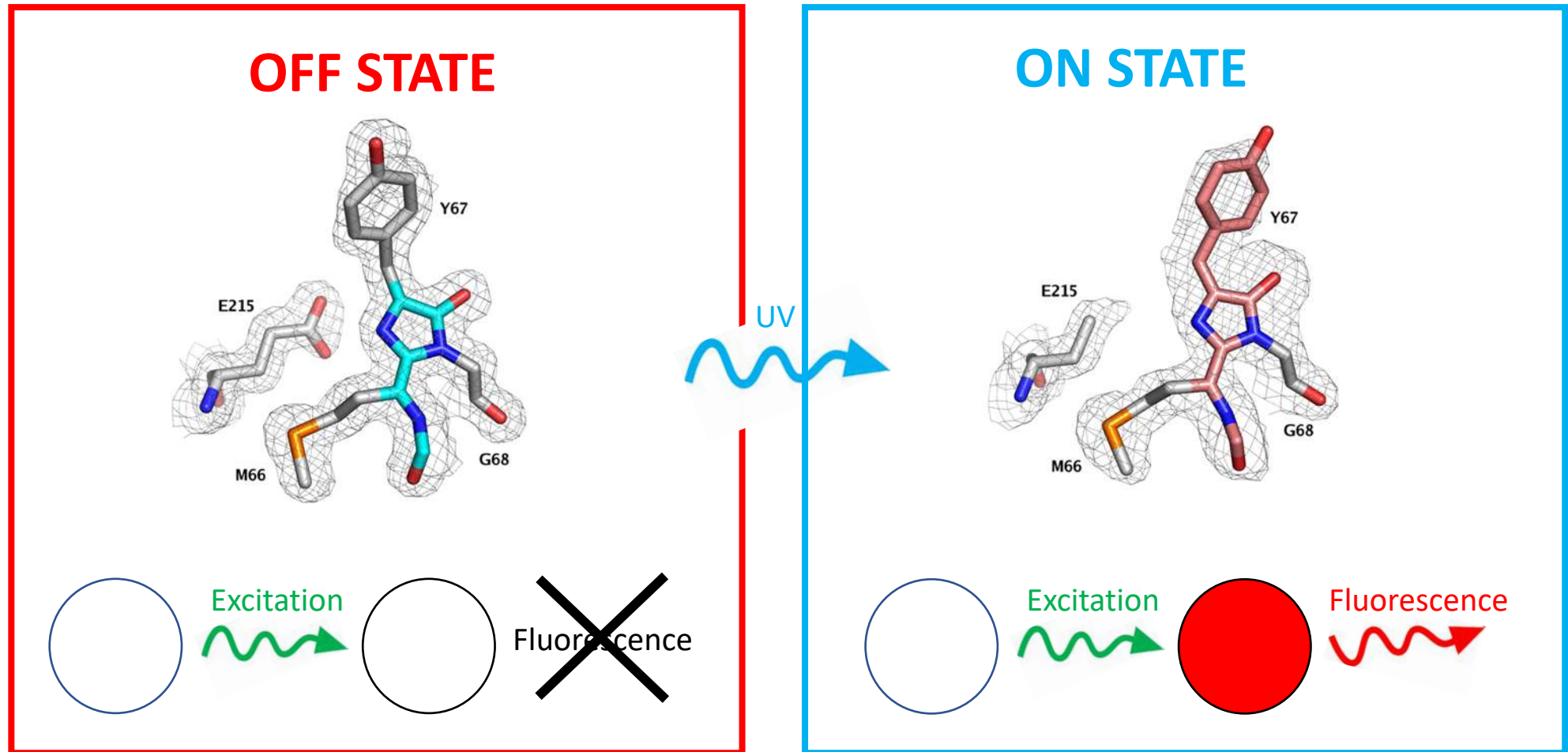


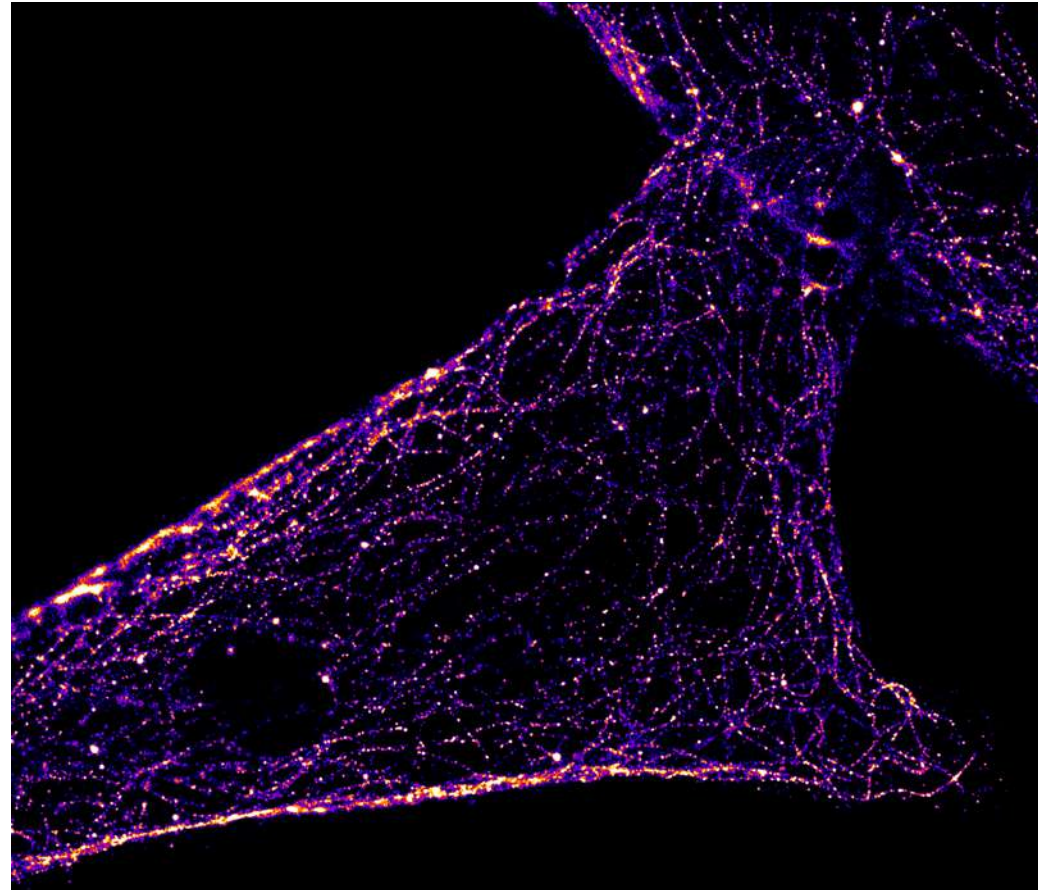
Photo-Activated Localisation Microscopy (PALM)

SMLM:
PALM

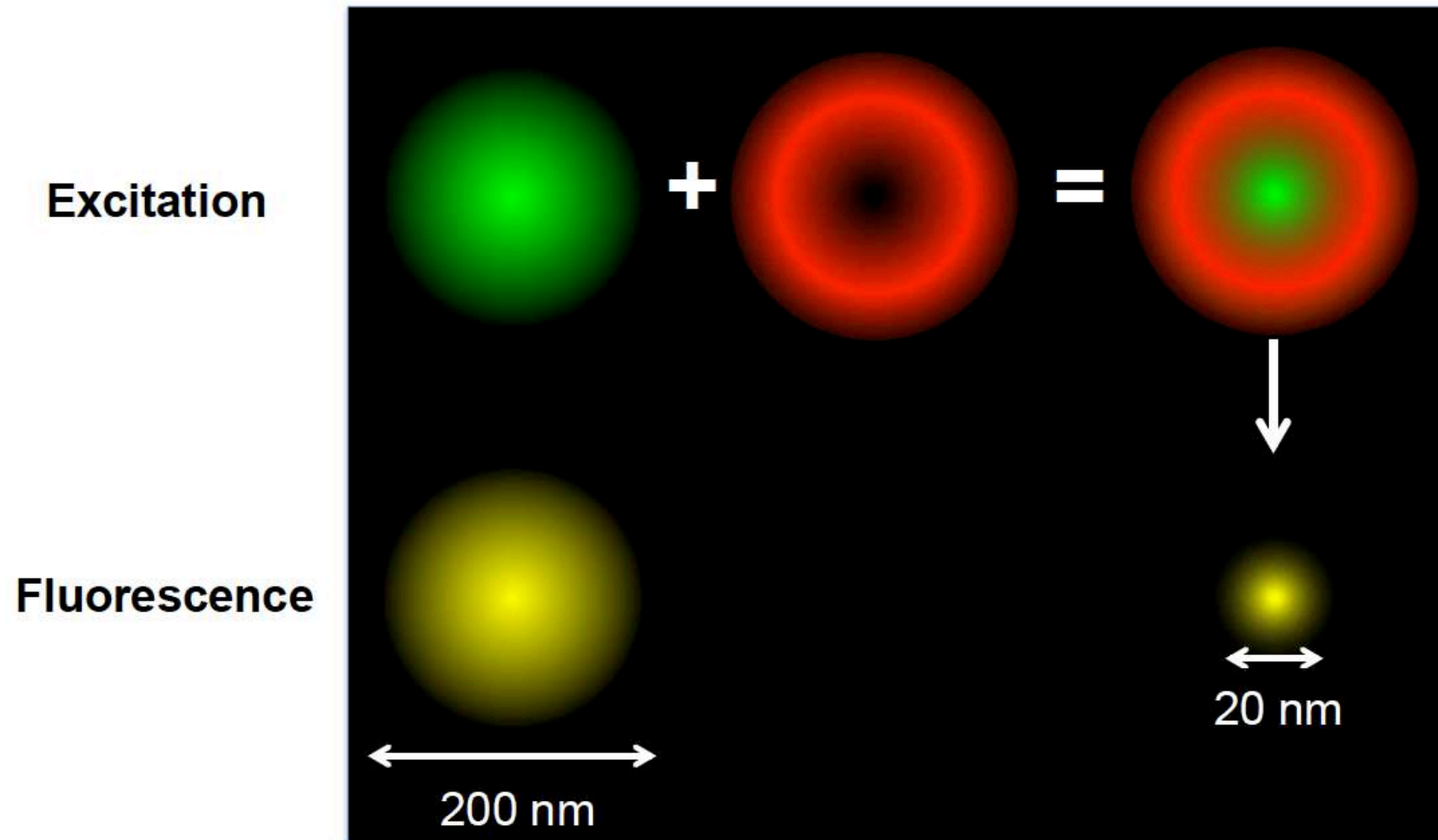




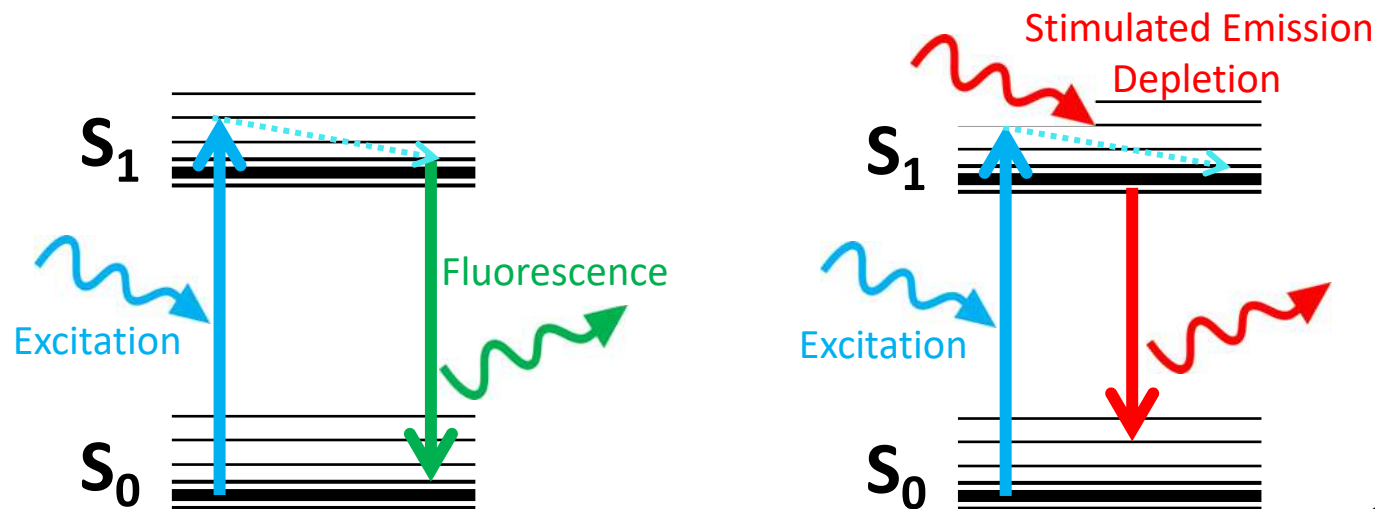
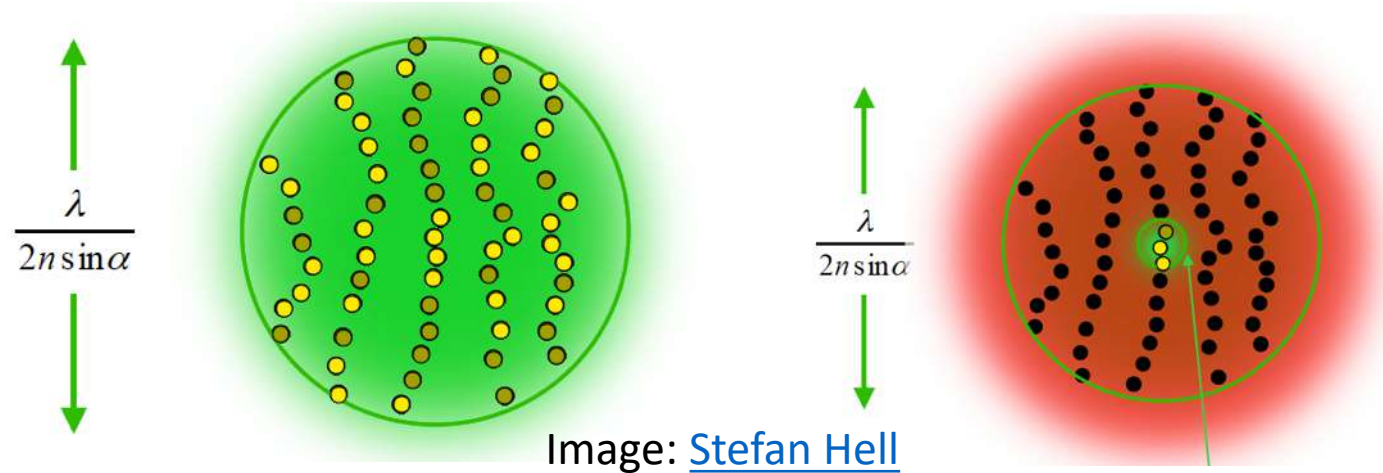
Single Molecule Localisation Microscopy (SMLM)



Stimulated Emission Depletion (STED) Microscopy



Stimulated Emission Depletion (STED) Microscopy



Stimulated Emission Depletion (STED) Microscopy

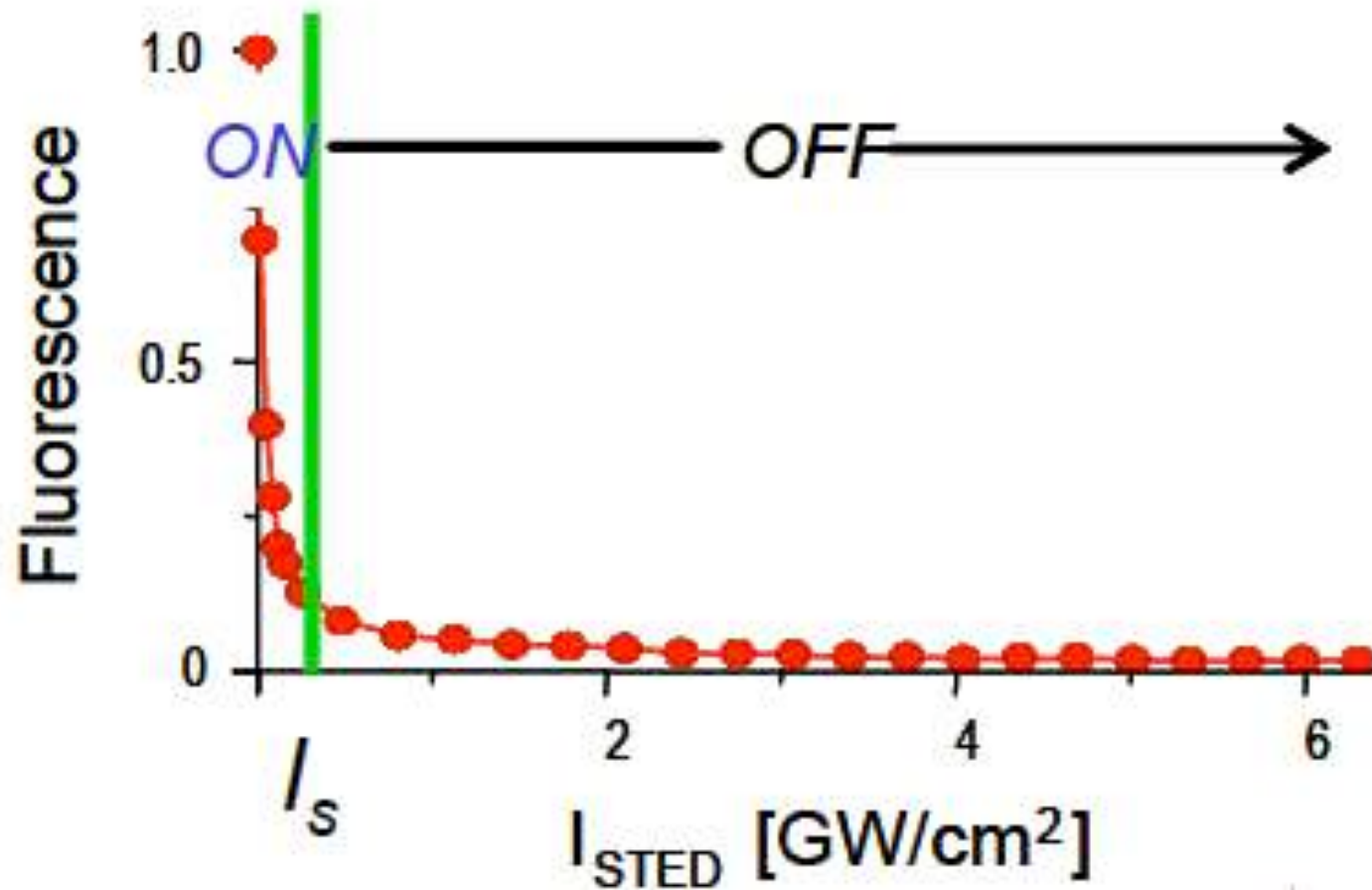


Image: [Stefan Hell](#)

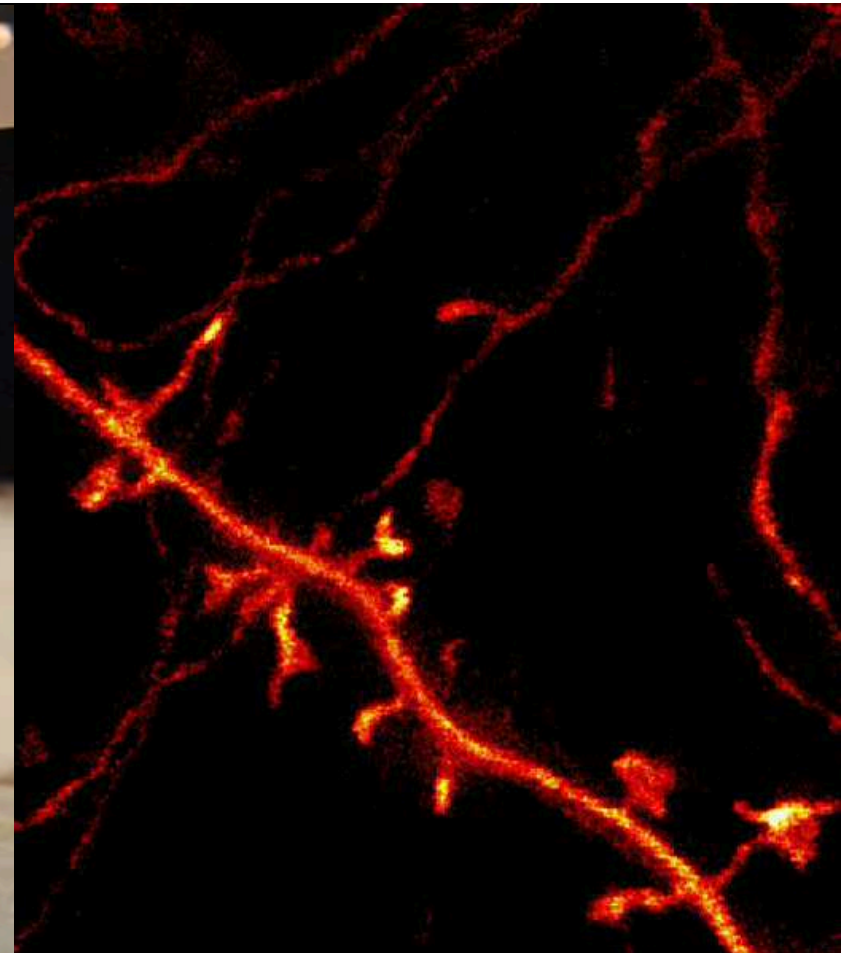
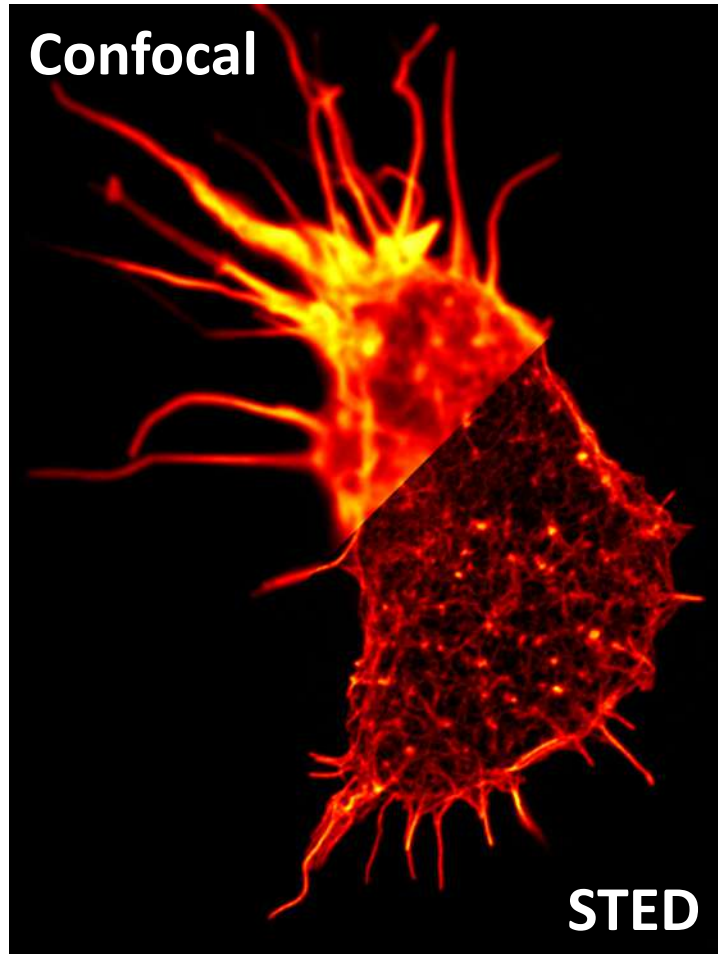
$$d \approx \frac{\lambda}{2n \sin \alpha \sqrt{1 + I/I_s}}$$



Stefan Hell et al. (1994) Opt Express

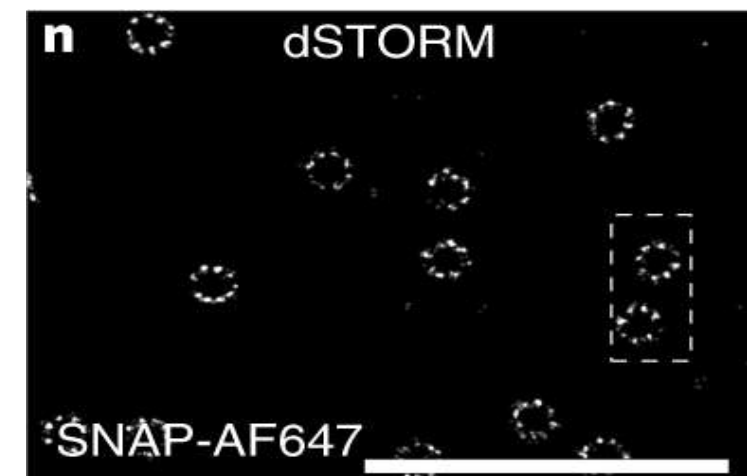
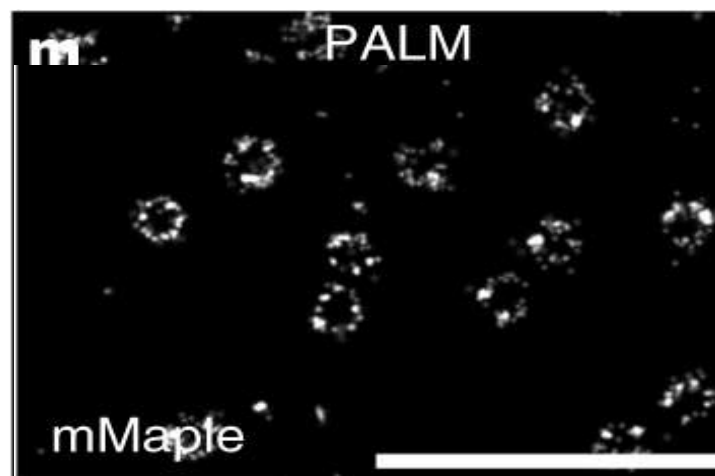
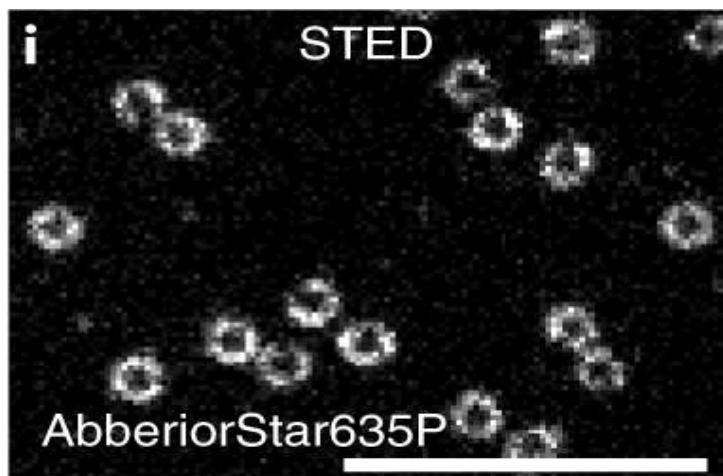
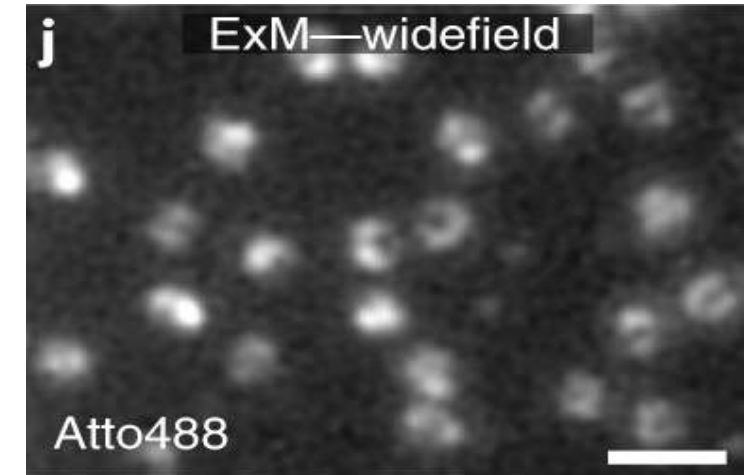
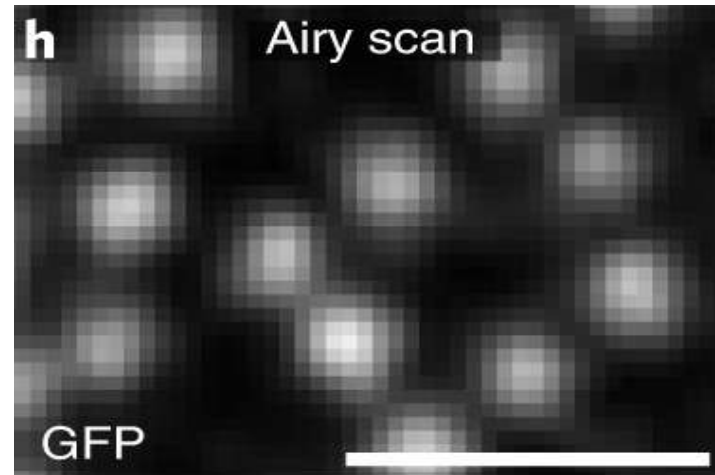
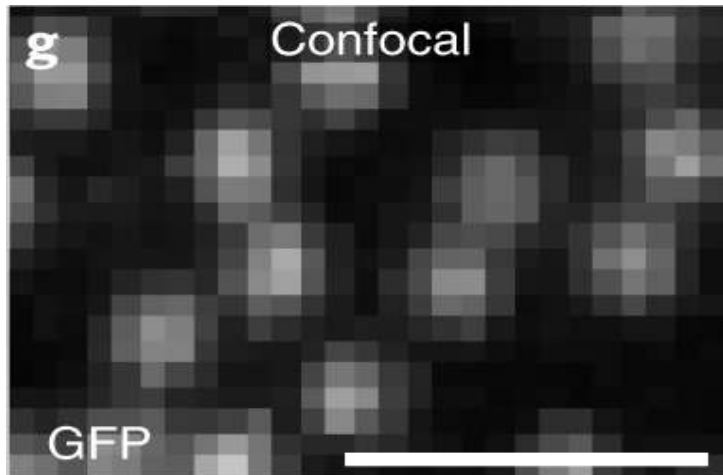


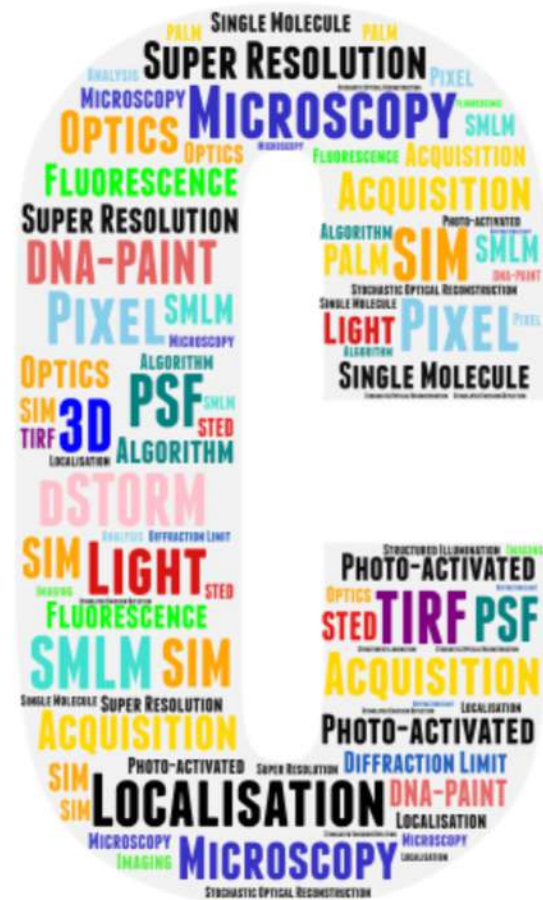
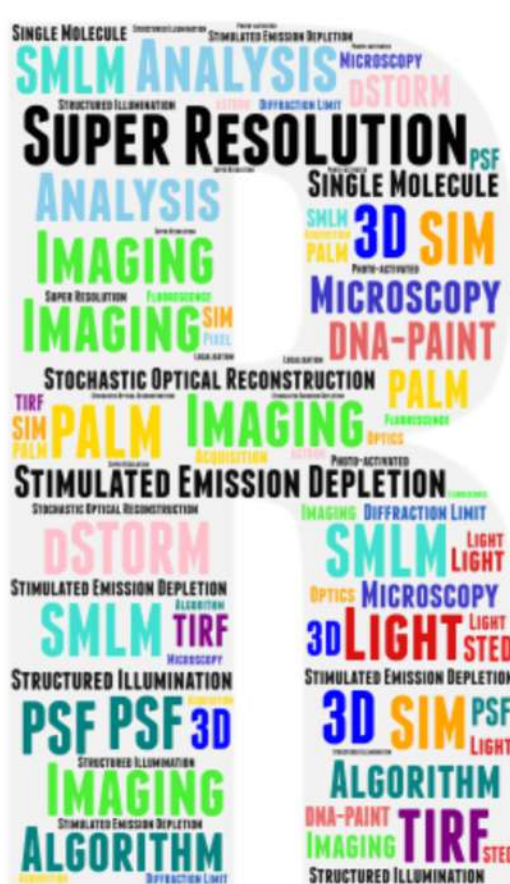
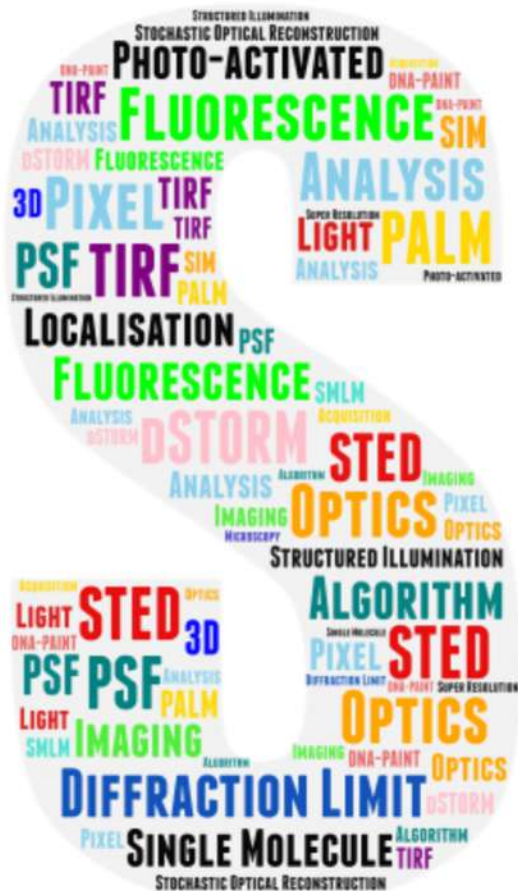
Stimulated Emission Depletion (STED) Microscopy





Comparison of Super Resolution Techniques





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Edinburgh Super-Resolution
Imaging Consortium

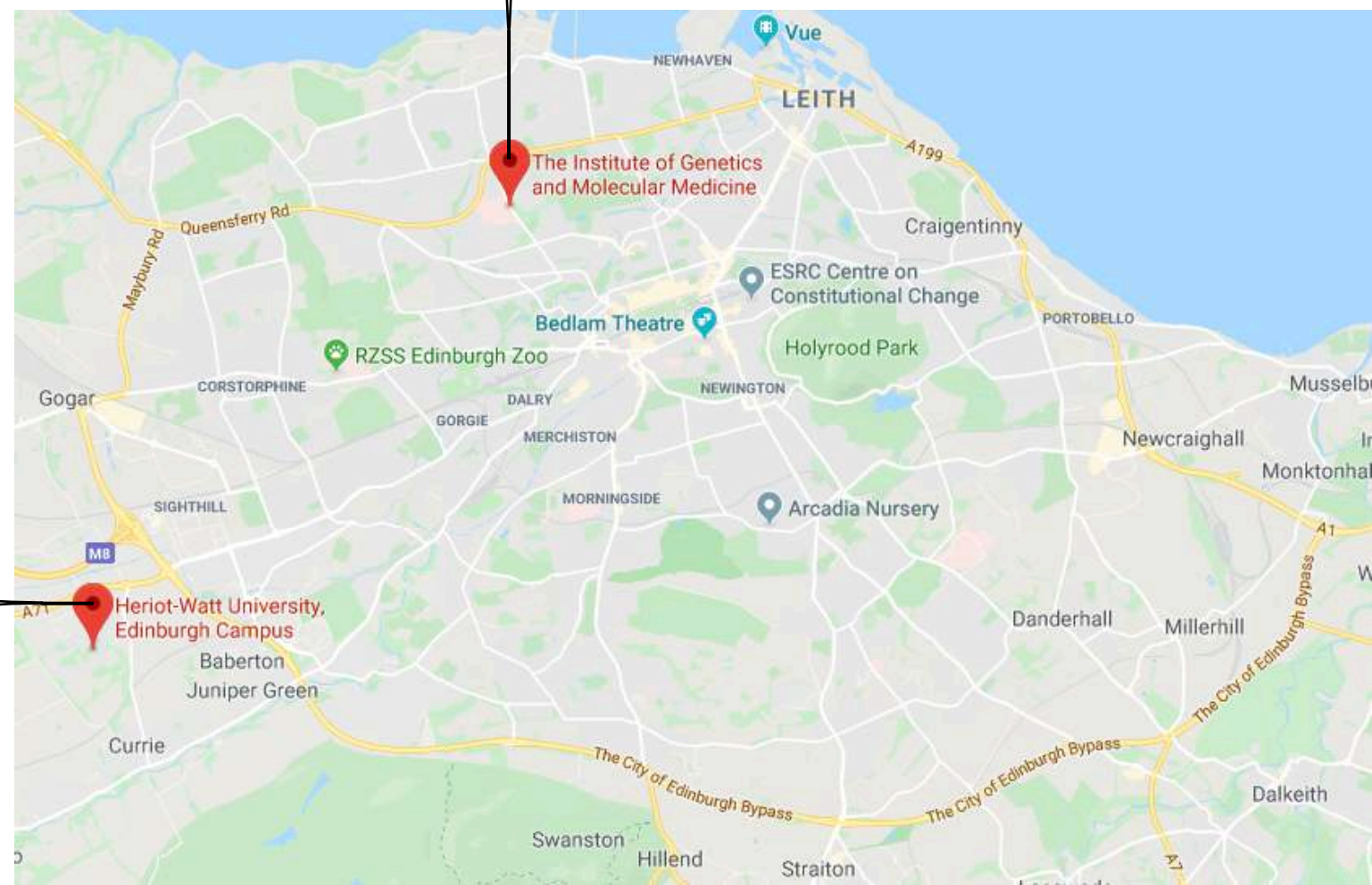


Institute of Biological
Chemistry, Biophysics
and Bioengineering

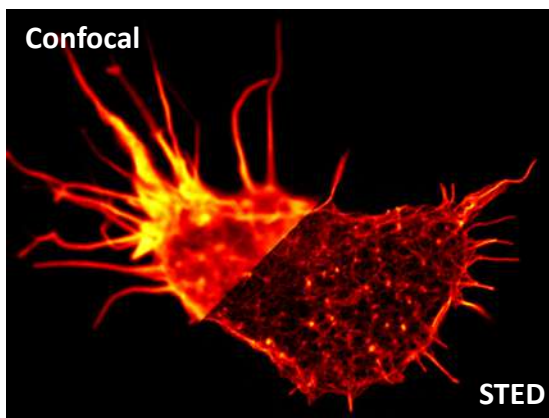
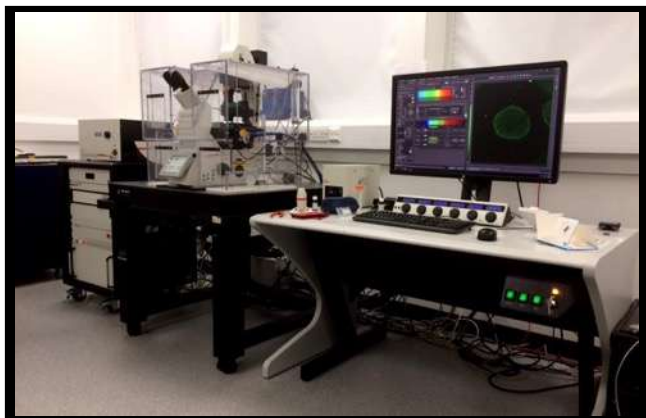


MRC INSTITUTE OF GENETICS & MOLECULAR MEDICINE

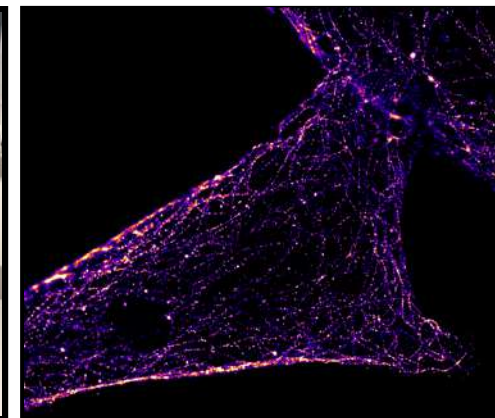
Advanced Imaging Resource



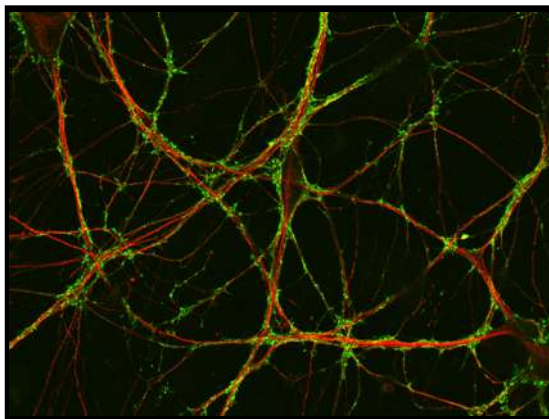
Leica TCS SP8 3D multicolour gSTED



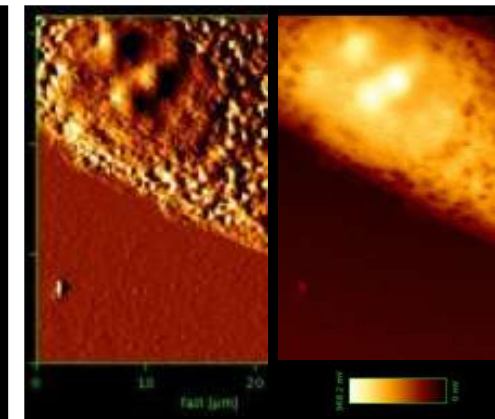
Olympus Cell Excellence IX81 – TIRF/SMLM



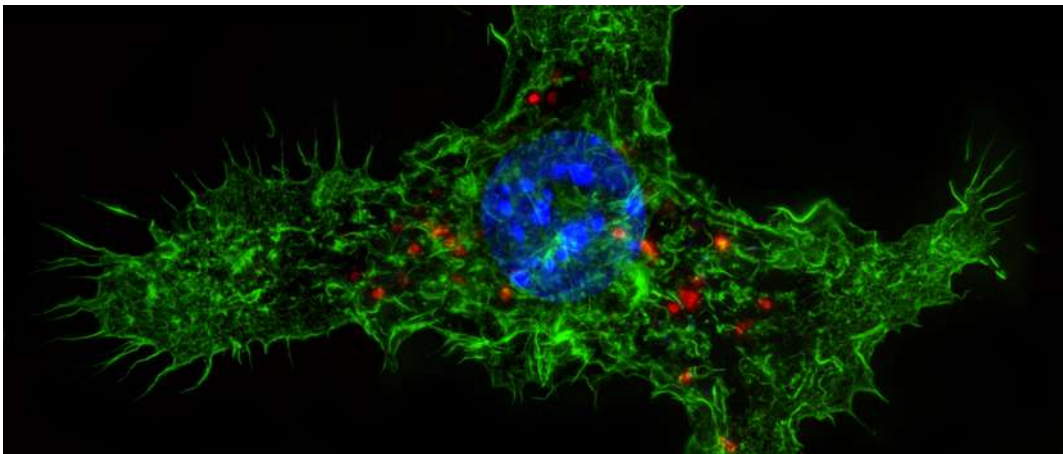
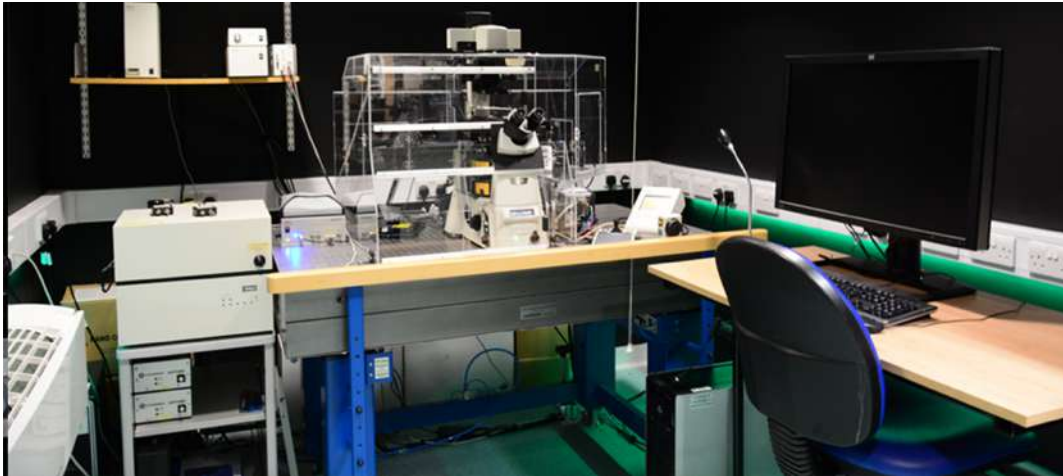
Leica TCS SP5 SMD Confocal – FLIM/FCS/FCCS



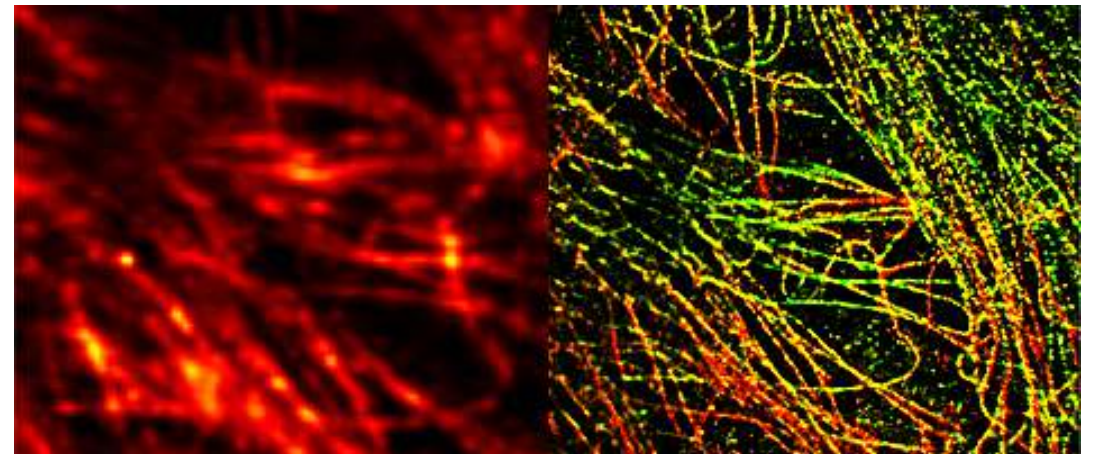
JPK (Bruker) NanoWizard 3 Bio-AFM



Nikon N-SIM



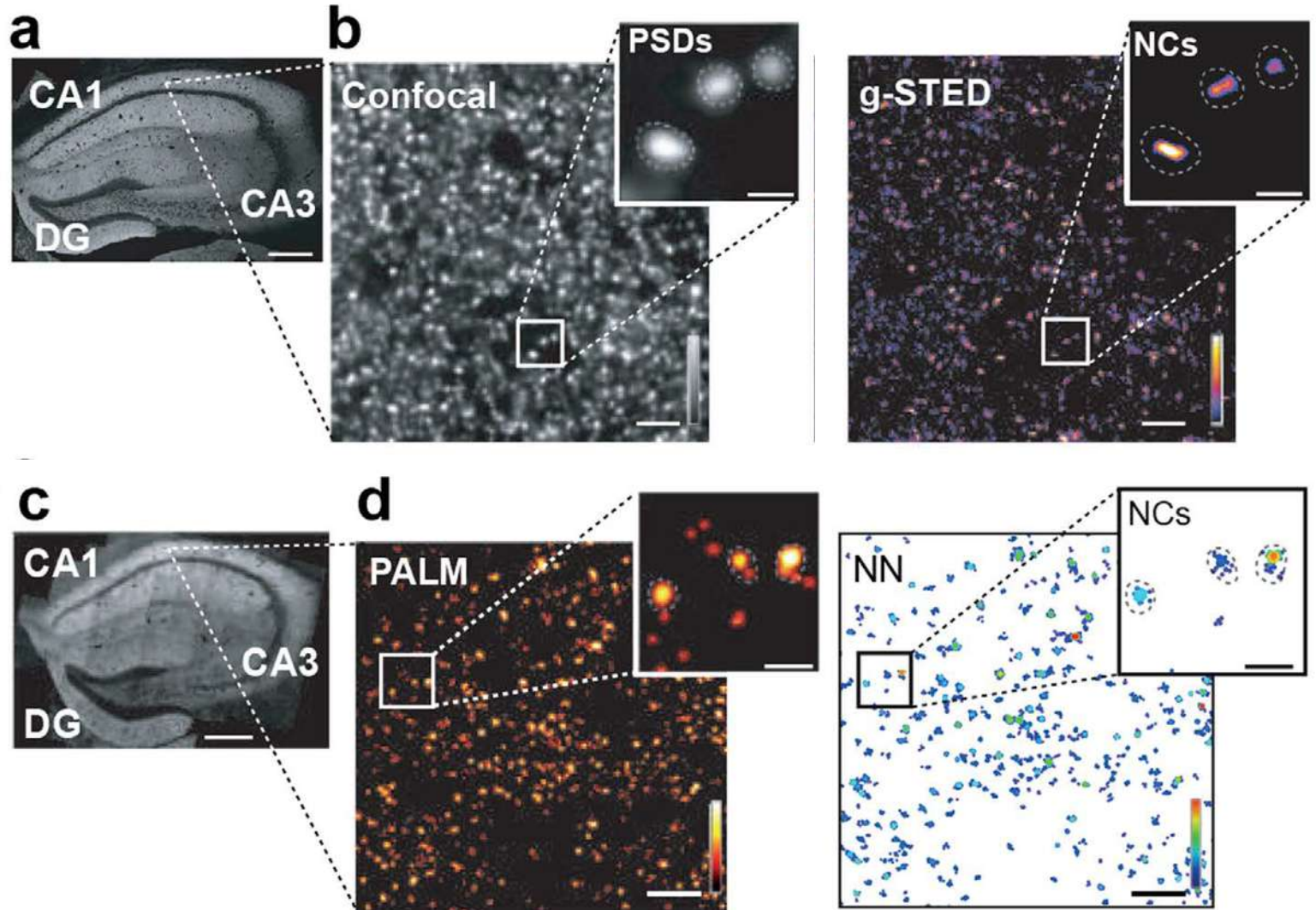
Nikon Thunder N-STORM



ESRIC Case Study



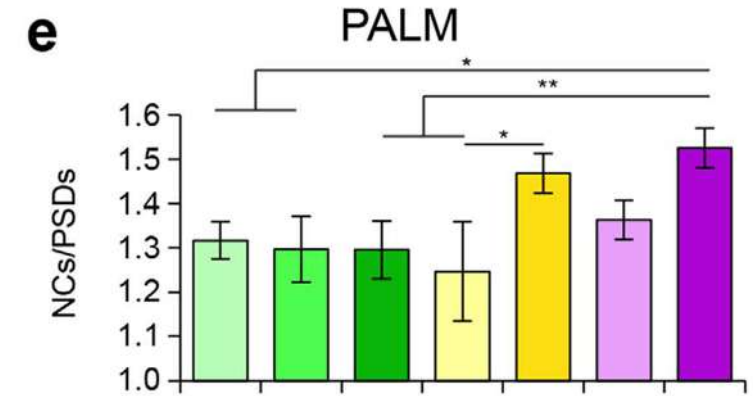
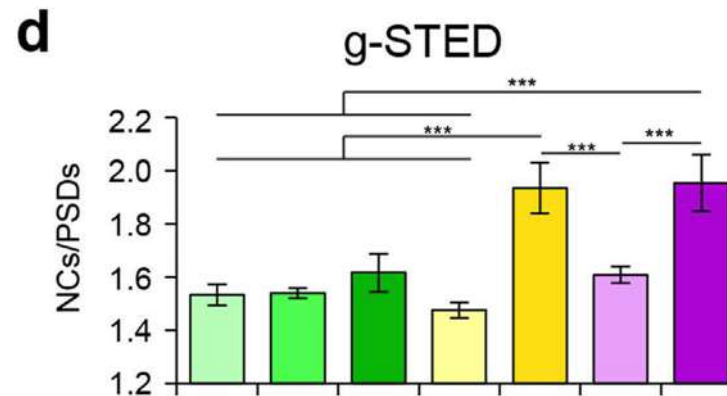
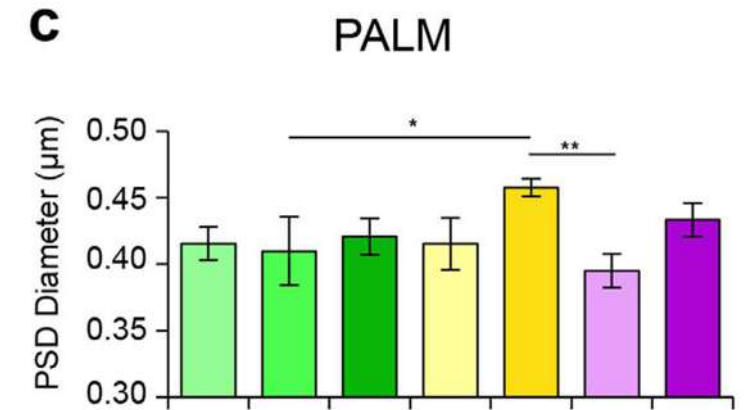
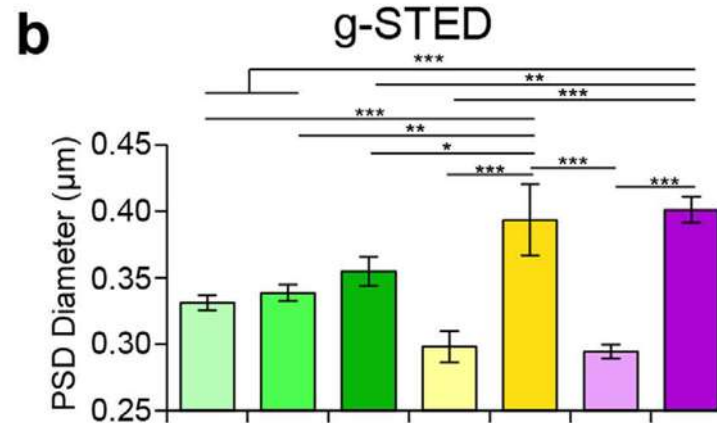
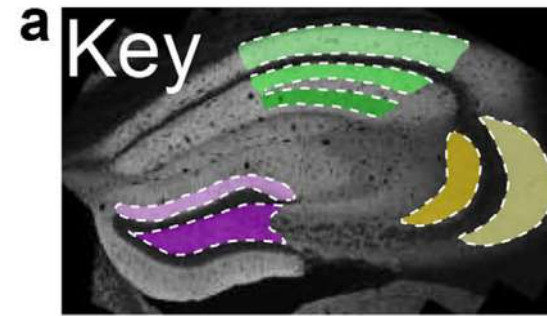
Dr Matthew Broadhead
Postdoctoral Researcher
University of St Andrews



ESRIC Case Study



Dr Matthew Broadhead
Postdoctoral Researcher
University of St Andrews





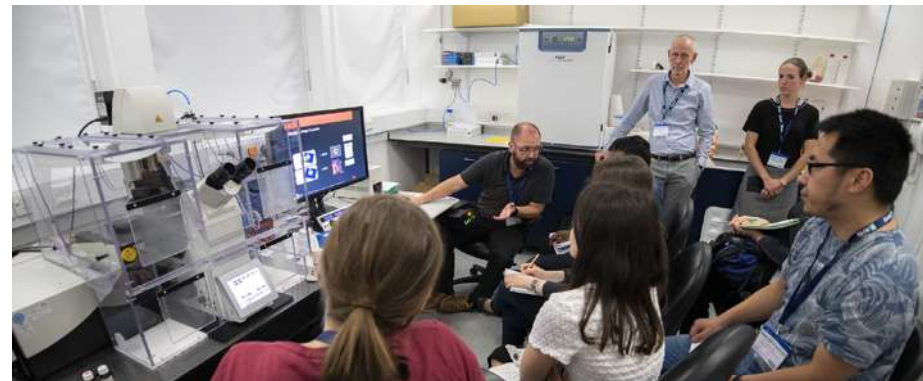
ESRIC Case Study – postsynaptic PSD95 nanoclusters



Dr Matthew Broadhead
Postdoctoral Researcher
University of St Andrews

“The work at ESRIC has aided my career beyond merely a publication record. It has introduced me to a world of inter-collaborative science.”

Super Resolution Summer School





Super Resolution Summer School – 2020 Speakers

SAMPLE PREP



Silvio Rizzoli
Goettingen University

SIM



Andrew York
Calico Labs

STED



Ilaria Testa
KTH Stockholm

SMLM



Sebastian van de Linde
Strathclyde University

DATA ANALYSIS



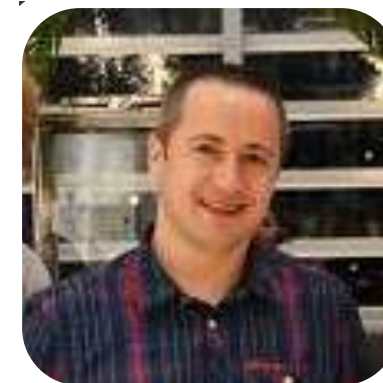
Susan Cox
Kings College London

MACHINE
LEARNING



Christophe Zimmer
Pasteur Institute

CORRELATIVE
SUPER RES + EM



Chris Peddie
Francis Crick Institute

Super Resolution Summer School – 2020 Workshops

Intro to Super
Resolution



Gated STED



SMLM
Pipeline



Dee Kavanagh
COMPARE

Quantitative
Analysis



Jonas Ries
EMBL Heidelberg

Super Resolution
by Optical Pixel
Reassignment (SoRa)



Super Resolution Radial
Fluctuations (SRRF)



+
Ricardo Henriques
UCL



Camera Technologies
for Super Resolution
HAMAMATSU
PHOTON IS OUR BUSINESS

SMLM



Lattice SIM





Super Resolution Summer School

Summer School 2020: 13th - 17th July

Registration opens 10th February

www.rms.org.uk/esric-summer-course/

“ I left ESRIC with a notebook full of new experiments to try - I would definitely recommend this course to anyone using or hoping to use super resolution techniques! ”

- Feedback from a 2019 delegate

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