

# Proper Feature Size

**Image Processing & Analysis for Life Scientists**

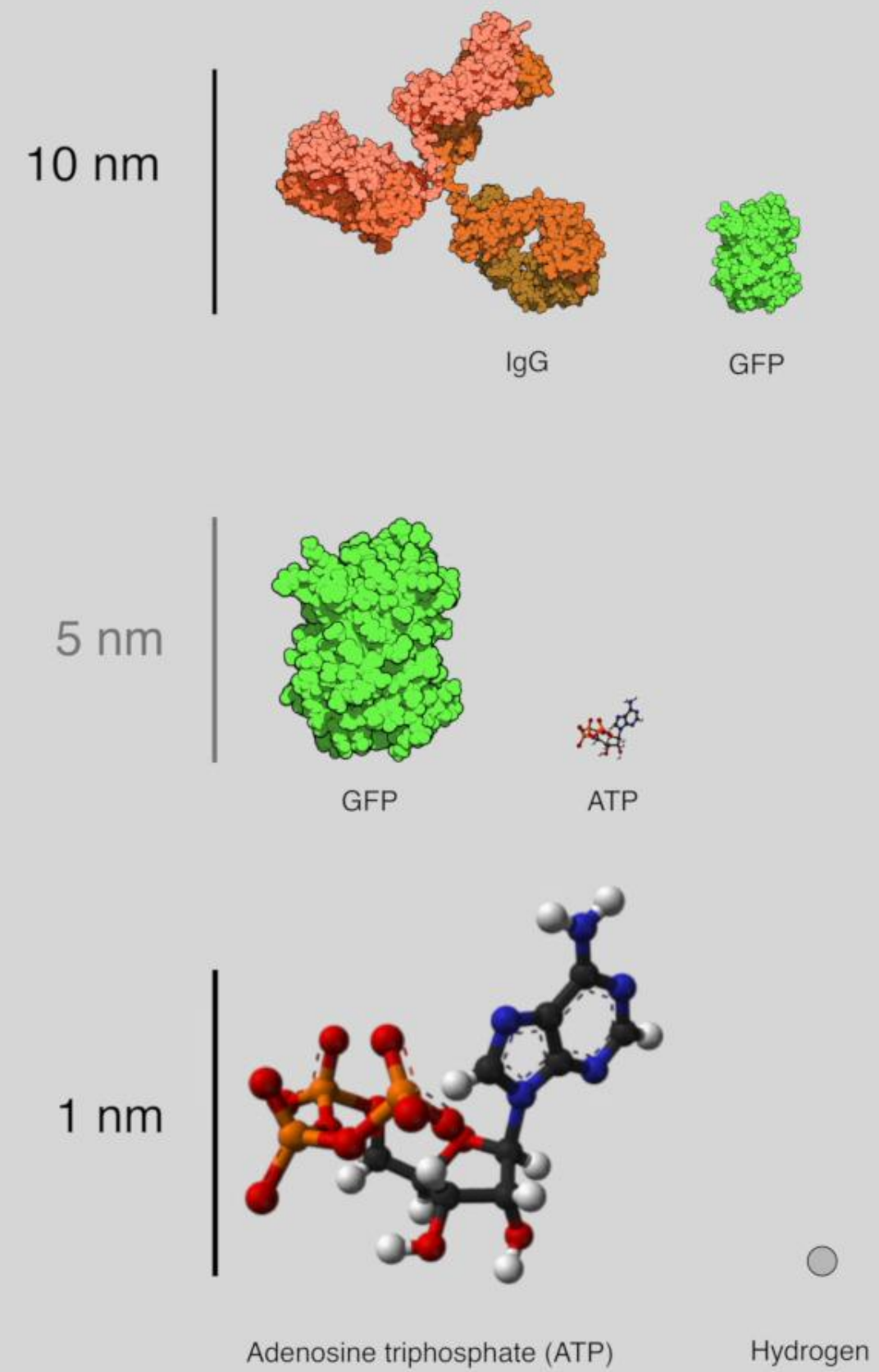
Olivier Burri, Romain Guiet & Arne Seitz

# Proper Feature Size

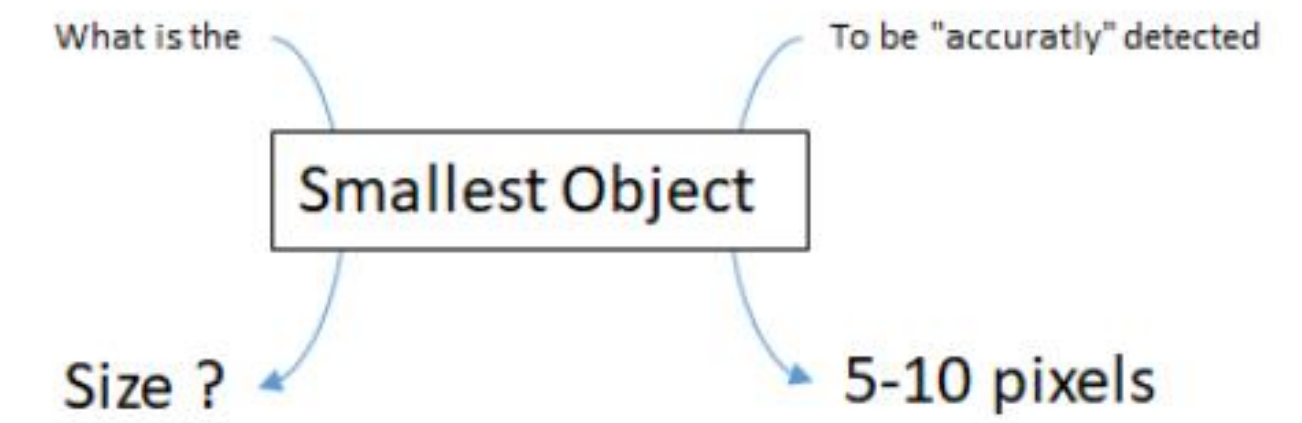
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- Scales in Life Science
- Choosing Pixel Size
  - Rule of Thumb
- Limitation

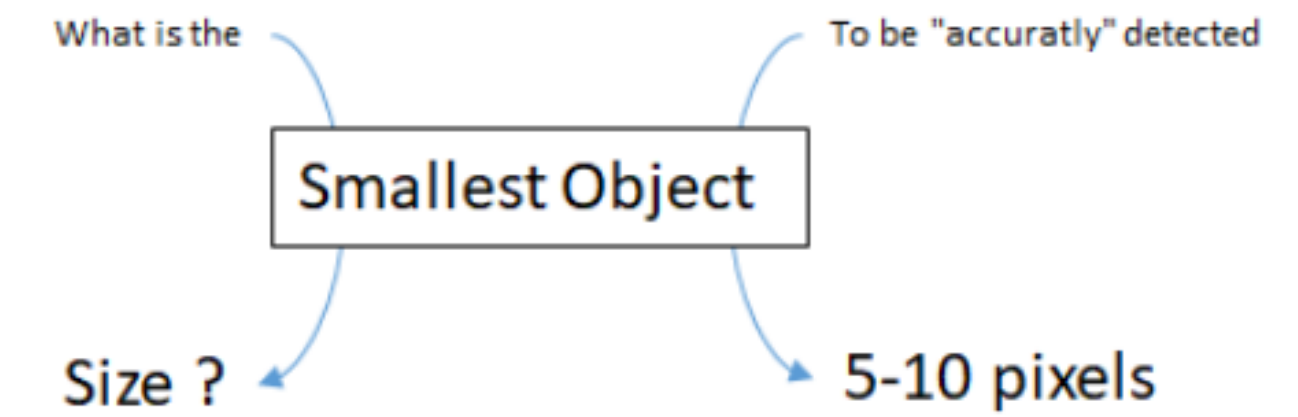
# Scales in Life Science



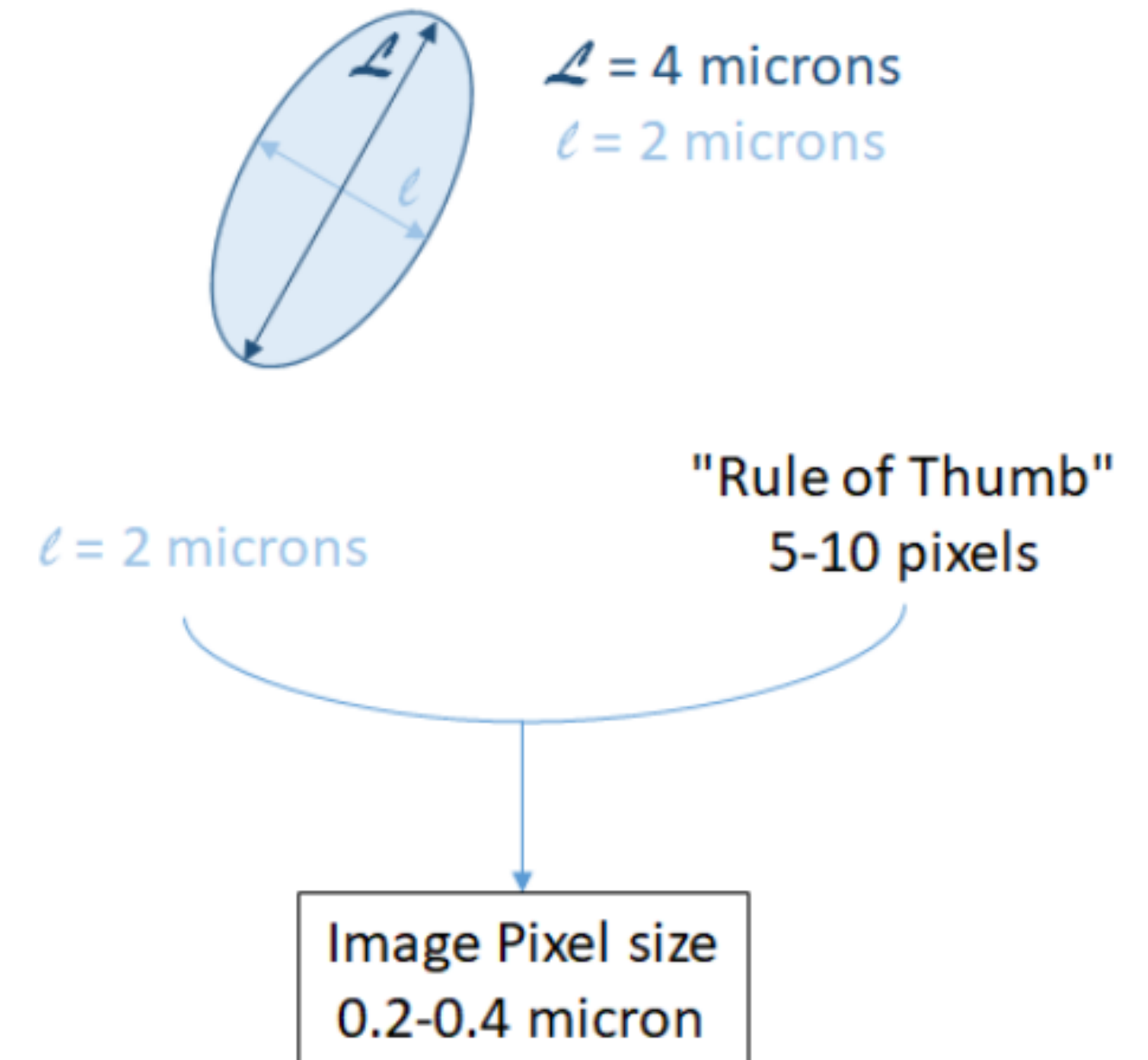
# Rule Of Thumb



# Rule of Thumb



## Example



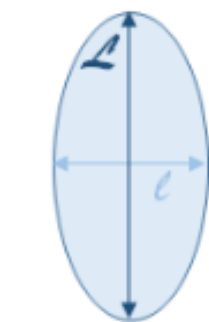
# Object Size & Intensity Measurement

Pixel Size  
(micron)

2

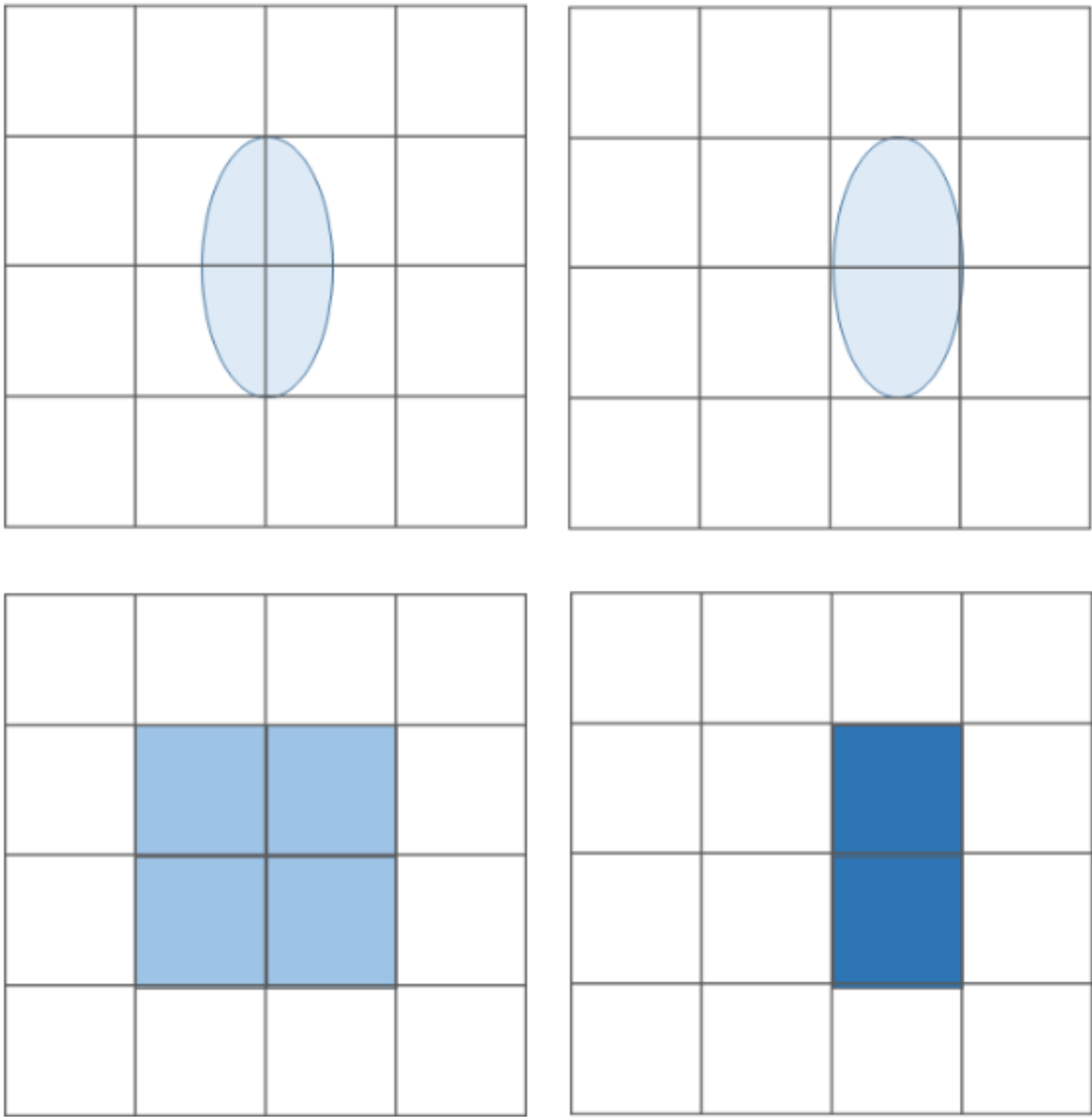
Half-pixel translation

Object



$L = 4$  microns  
 $l = 2$  microns

Resulting  
Image





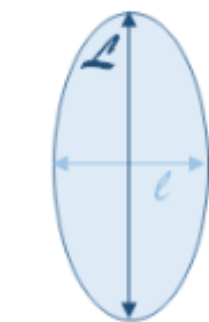
# Object Size & Intensity Measurement

Pixel Size  
(micron)

0.2

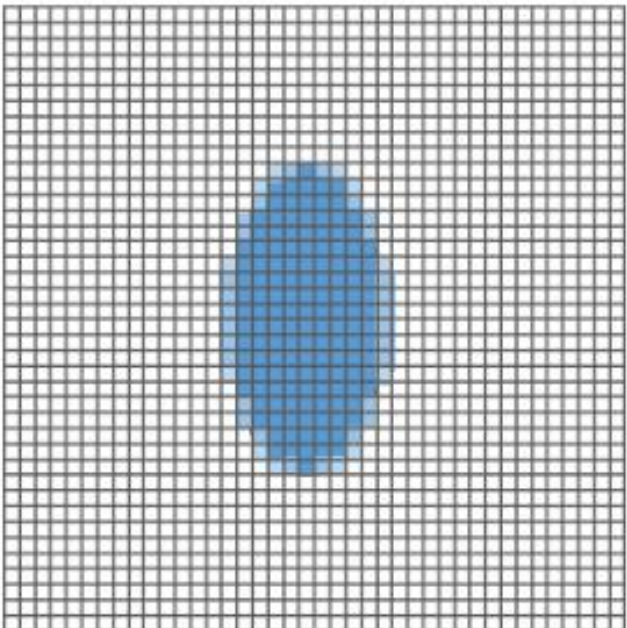
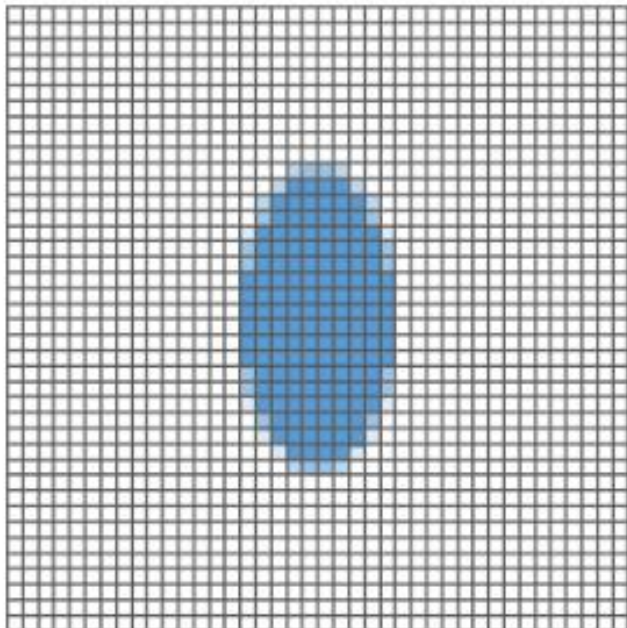
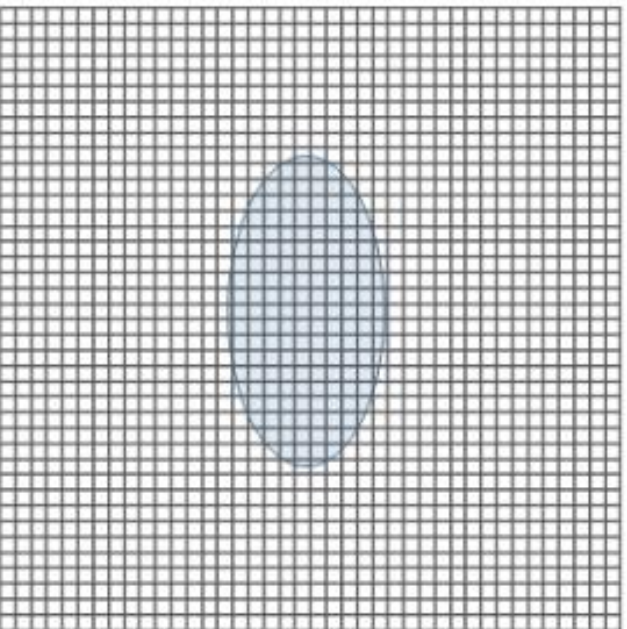
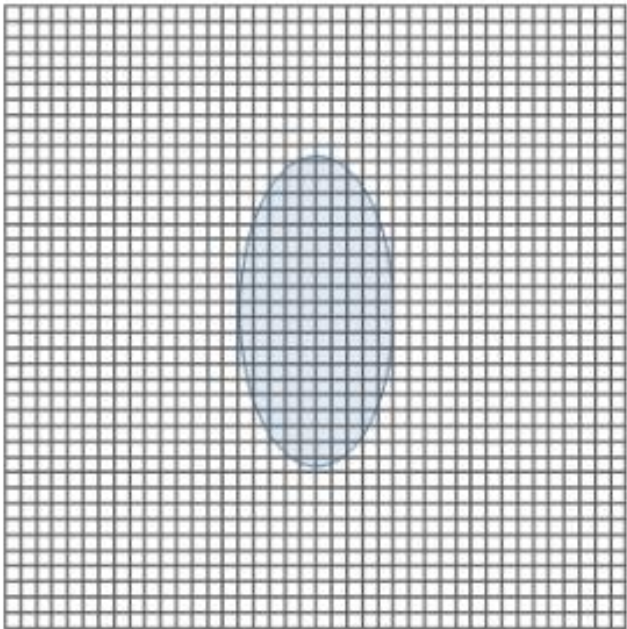
Half-pixel translation

Object



$L = 4$  microns  
 $l = 2$  microns

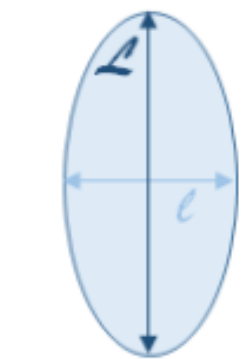
Resulting  
Image





# Recommended Sampling

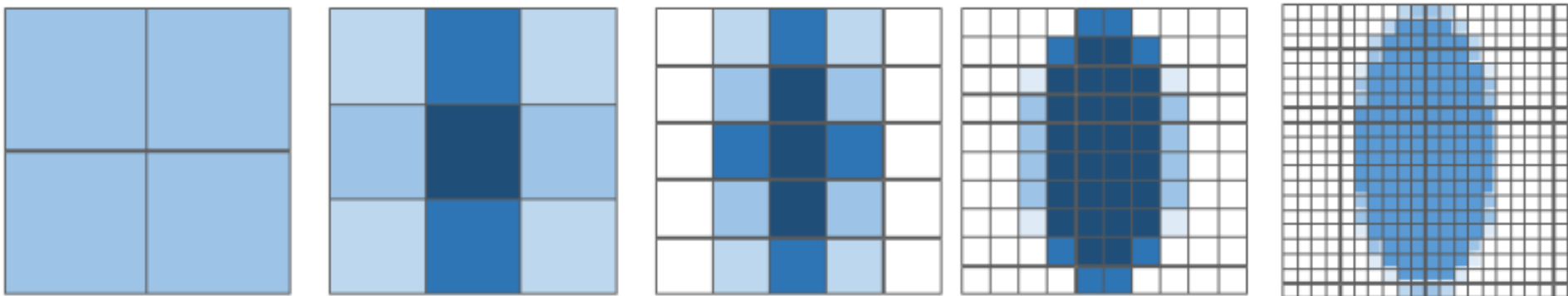
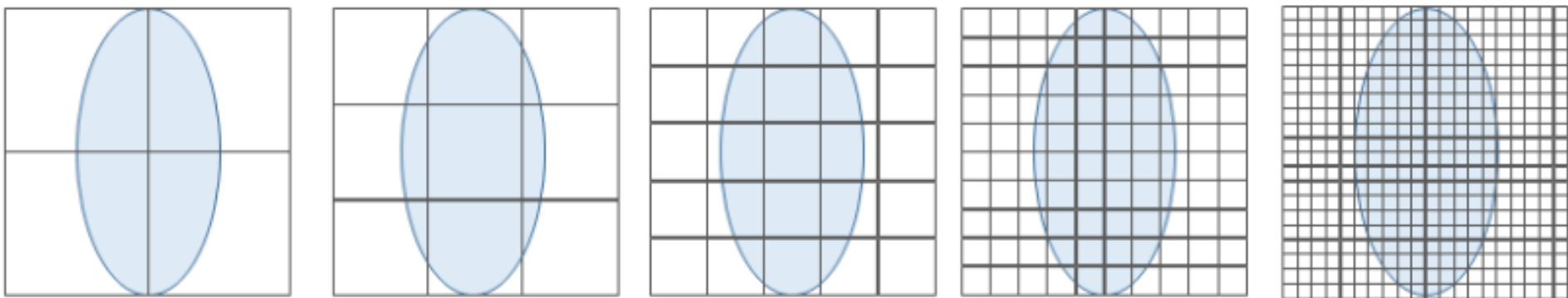
Object



$L = 4$  microns  
 $l = 2$  microns

Resulting  
Image

Pixel Size  
(micron)



2

1.3

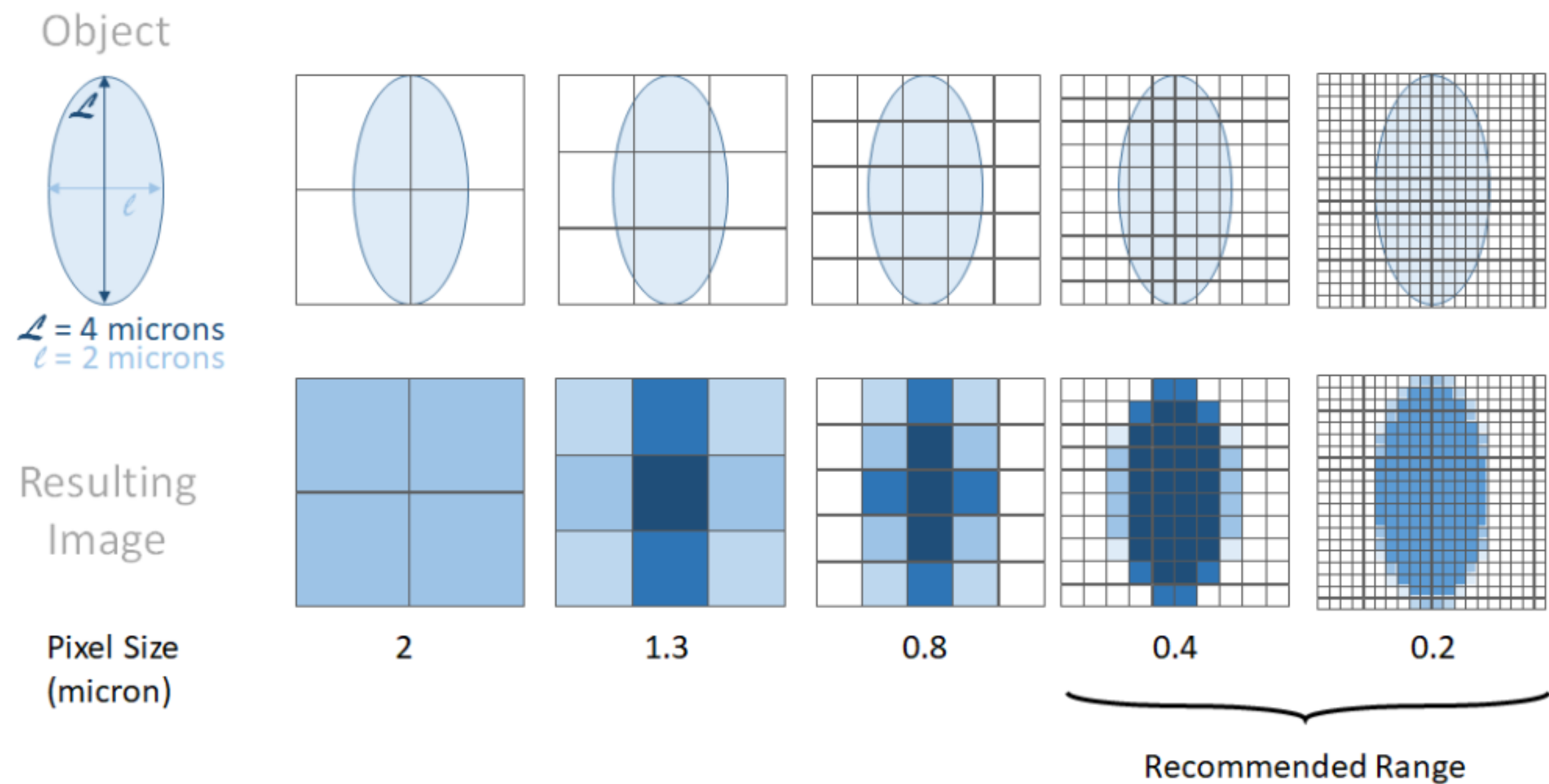
0.8

0.4

0.2

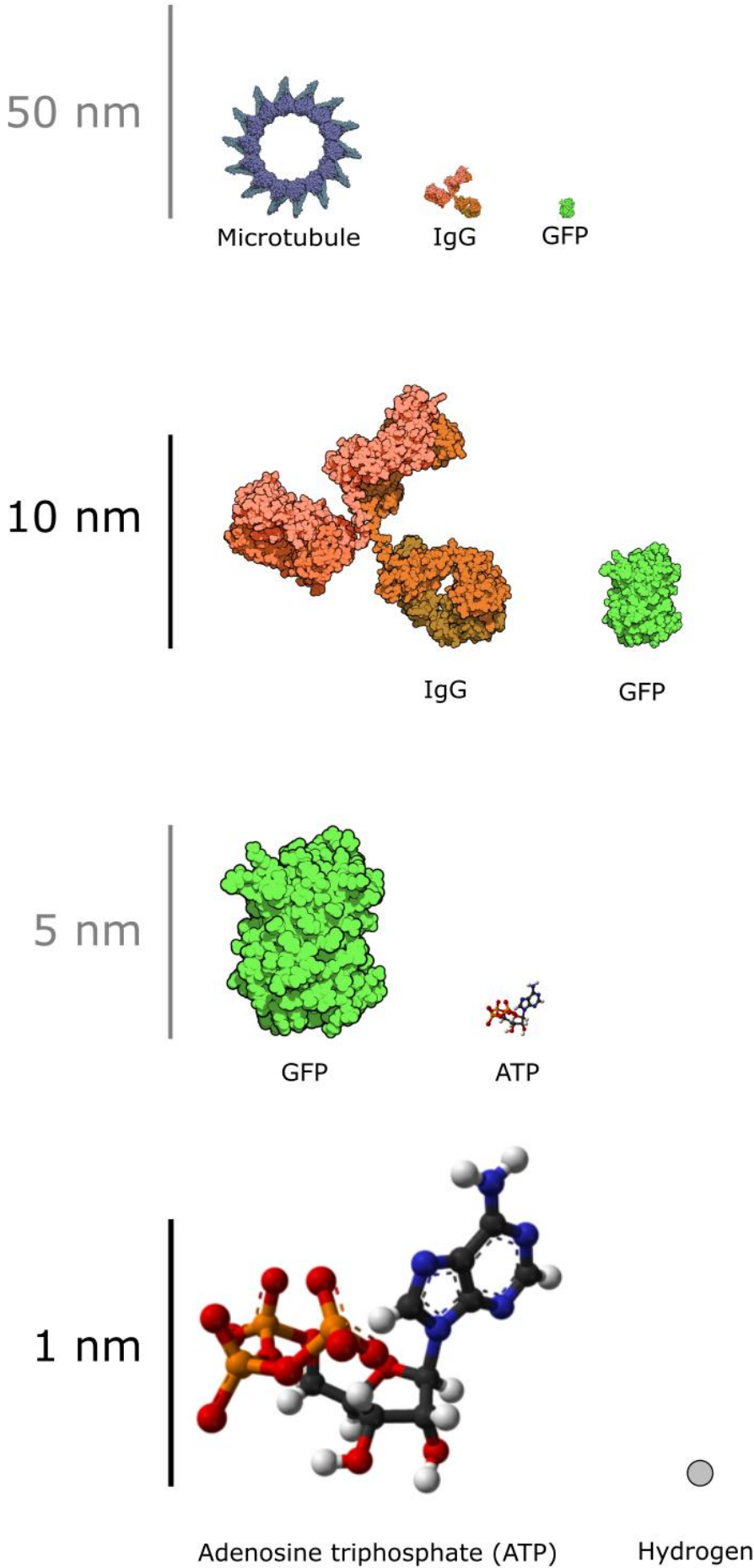
Recommended Range

# Recommended Sampling



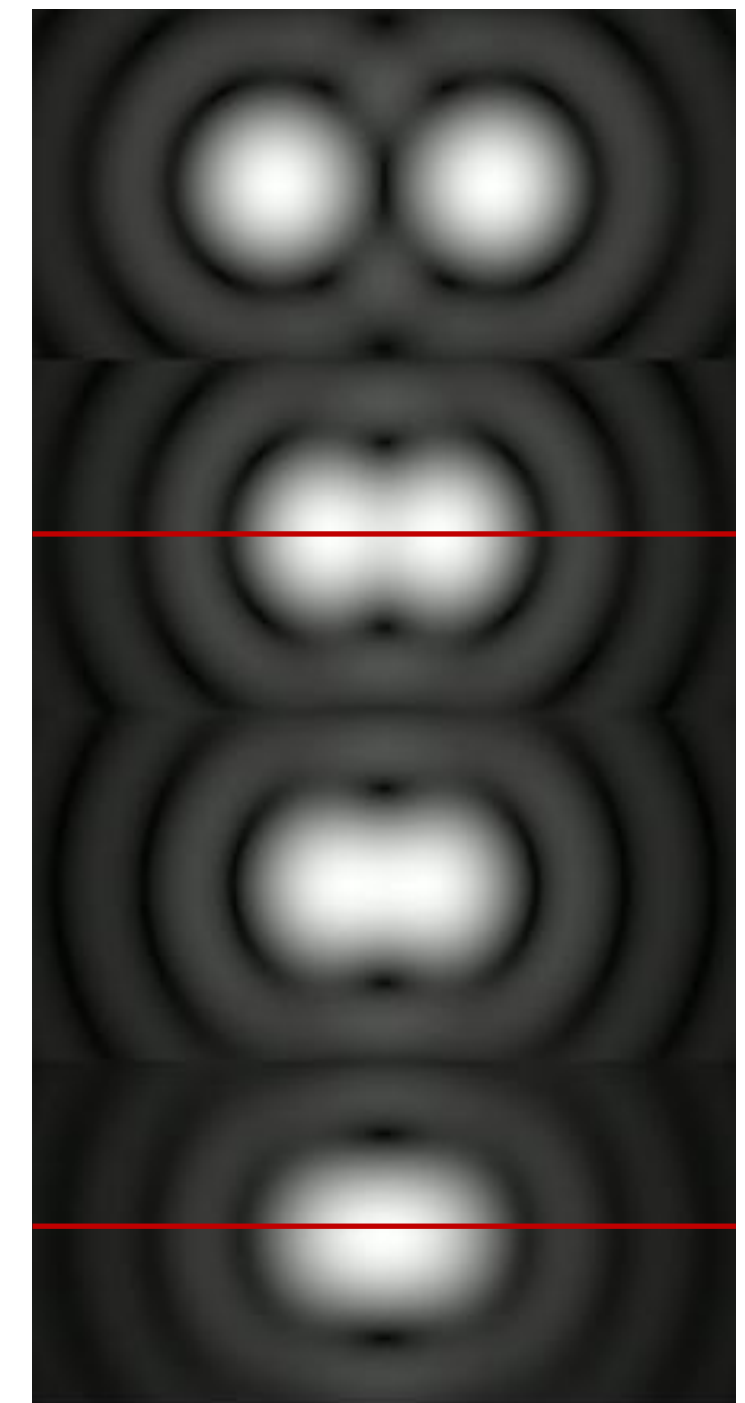
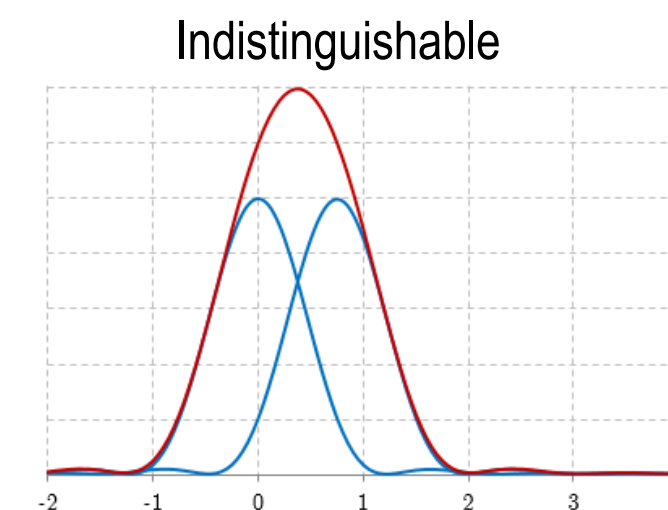
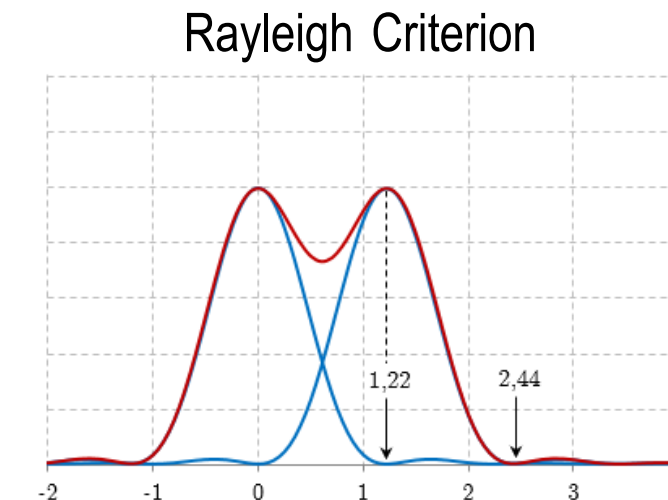
Nyquist–Shannon  
Sampling Theorem

# Limits

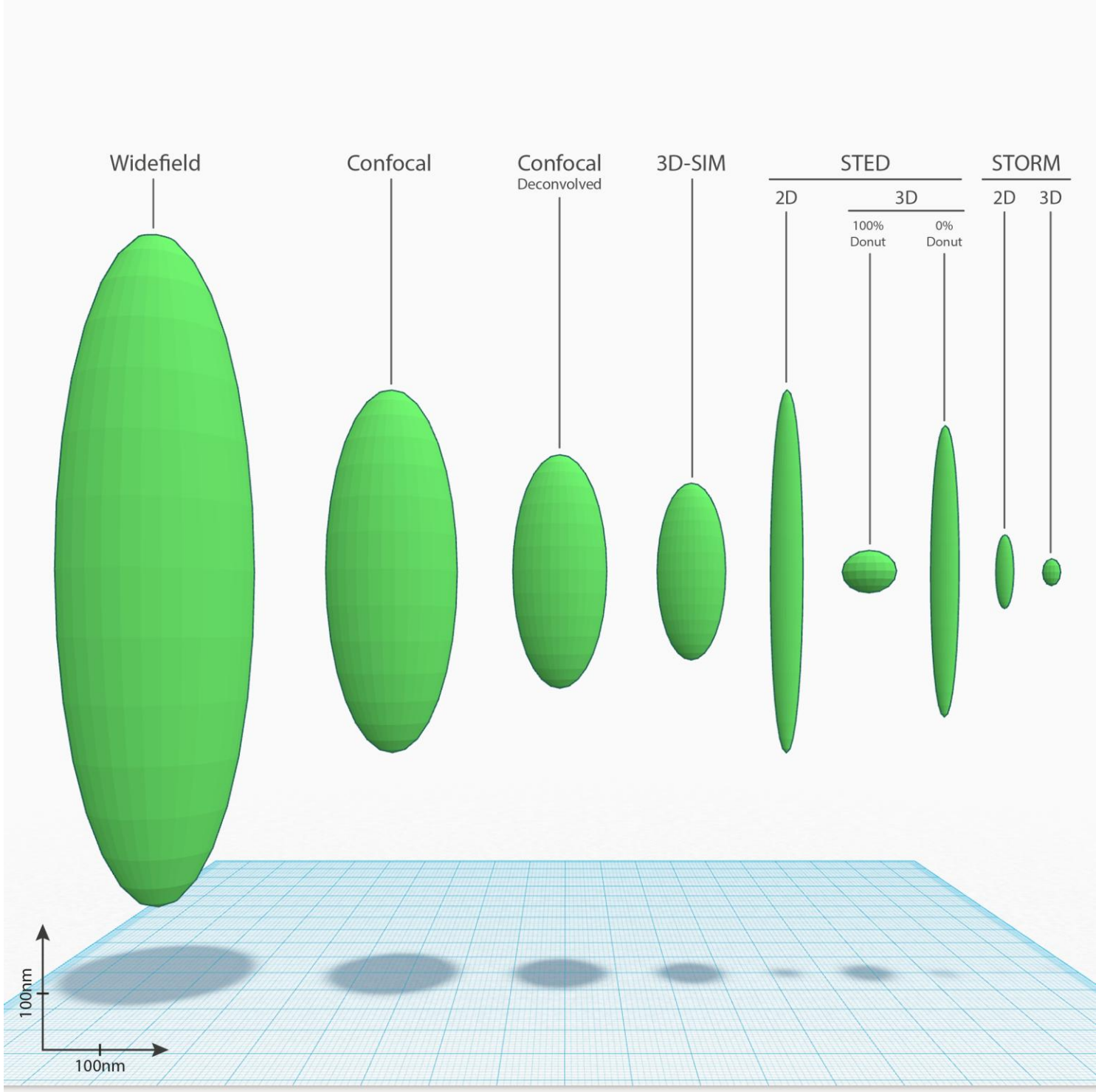


Pixel with a  
100x Objective

- Physical Law
  - The Abbe Diffraction Limit
  - $250 \text{ nm} \Rightarrow 5 \text{ pixels} = 50 \text{ nm} / \text{pixel}$

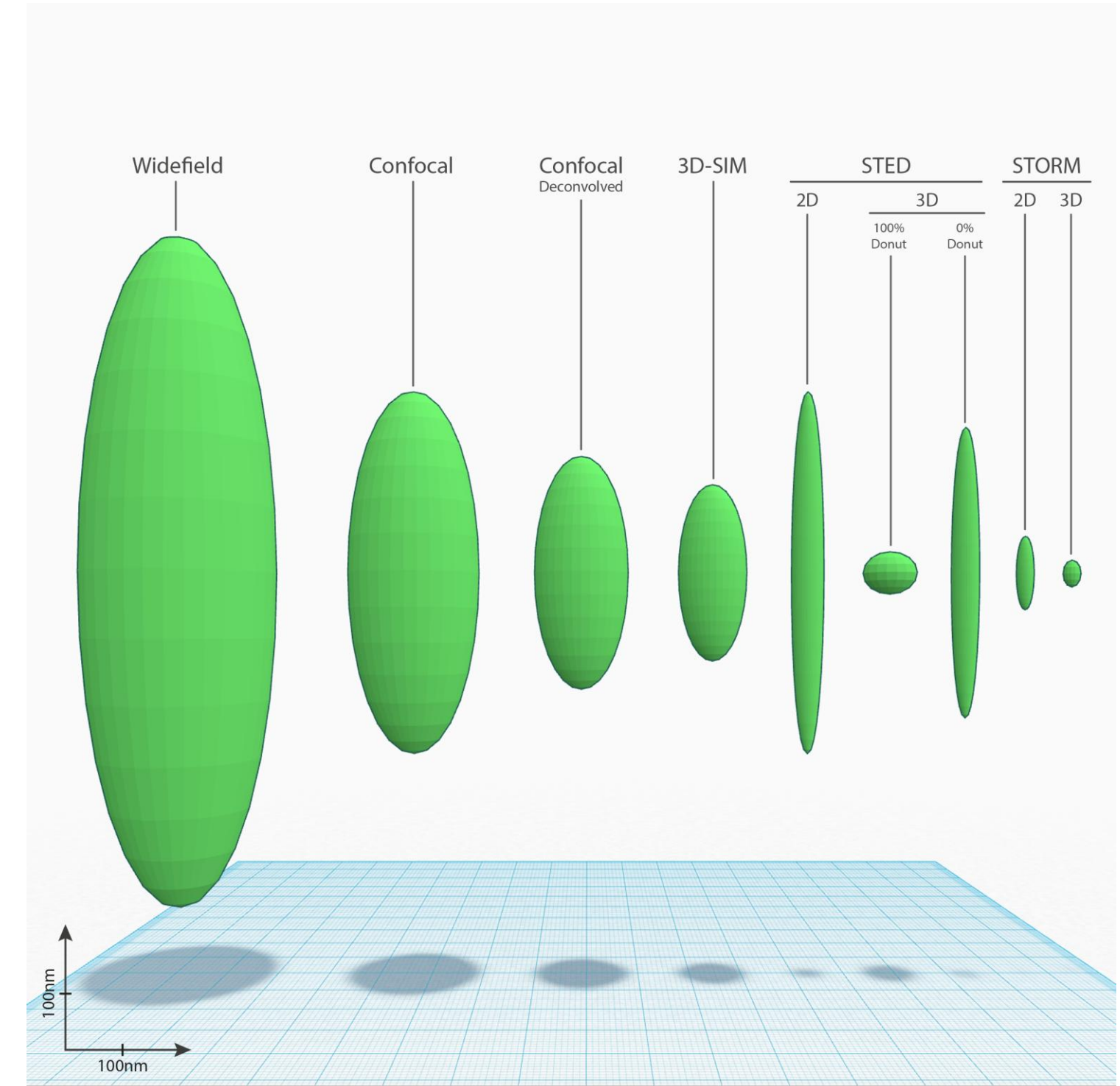


# Super-Resolution





# Super-Resolution



**Fluorescence nanoscopy in cell biology.**

Sahl SJ, Hell SW, Jakobs S.

Nat Rev Mol Cell Biol. 2017

PMID: 28875992

- Scales From Proteins to Cells
- Recommended Sampling Rate
- Limits
  - Staying Rational
  - Super-Resolution Microscopy