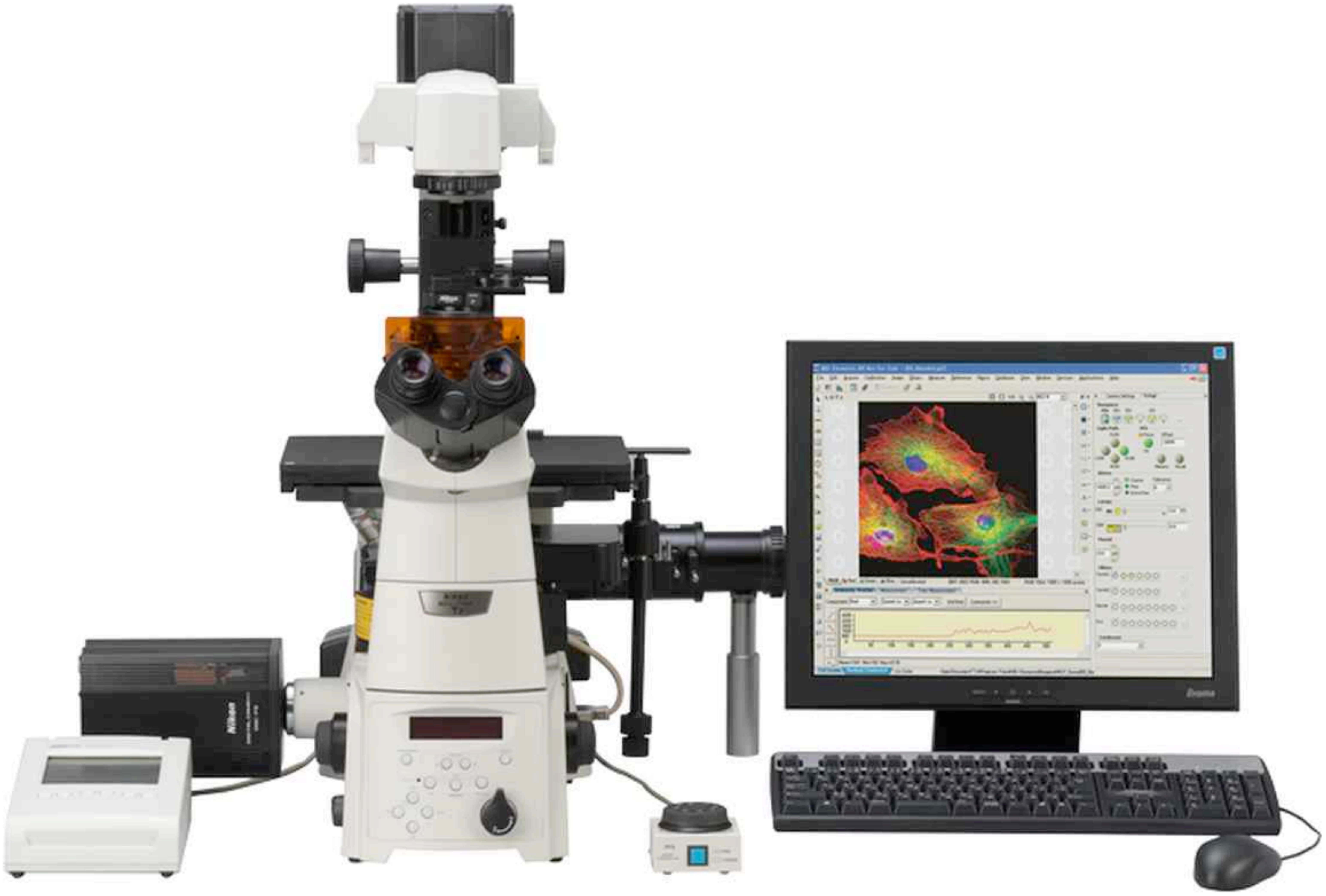
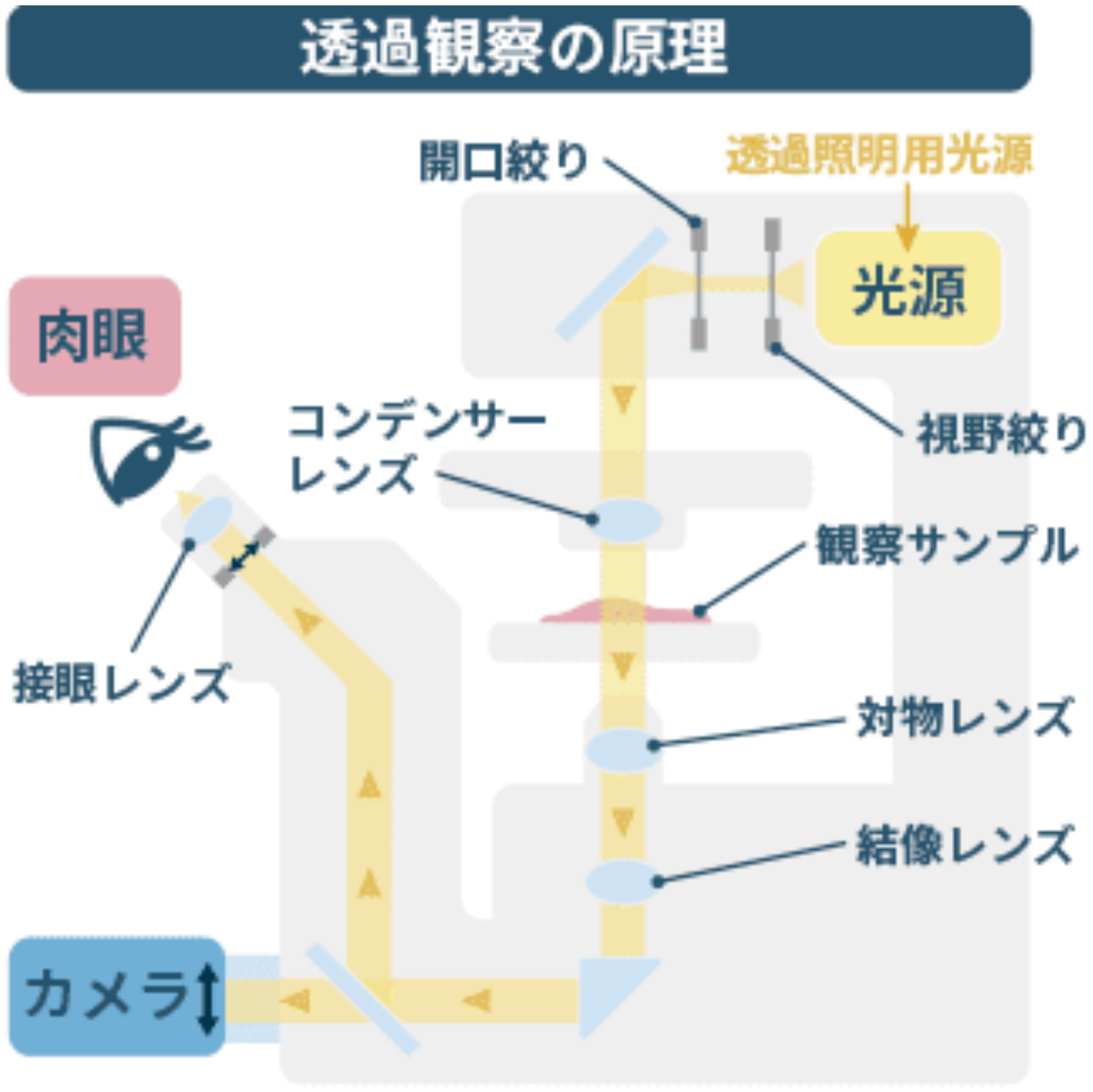
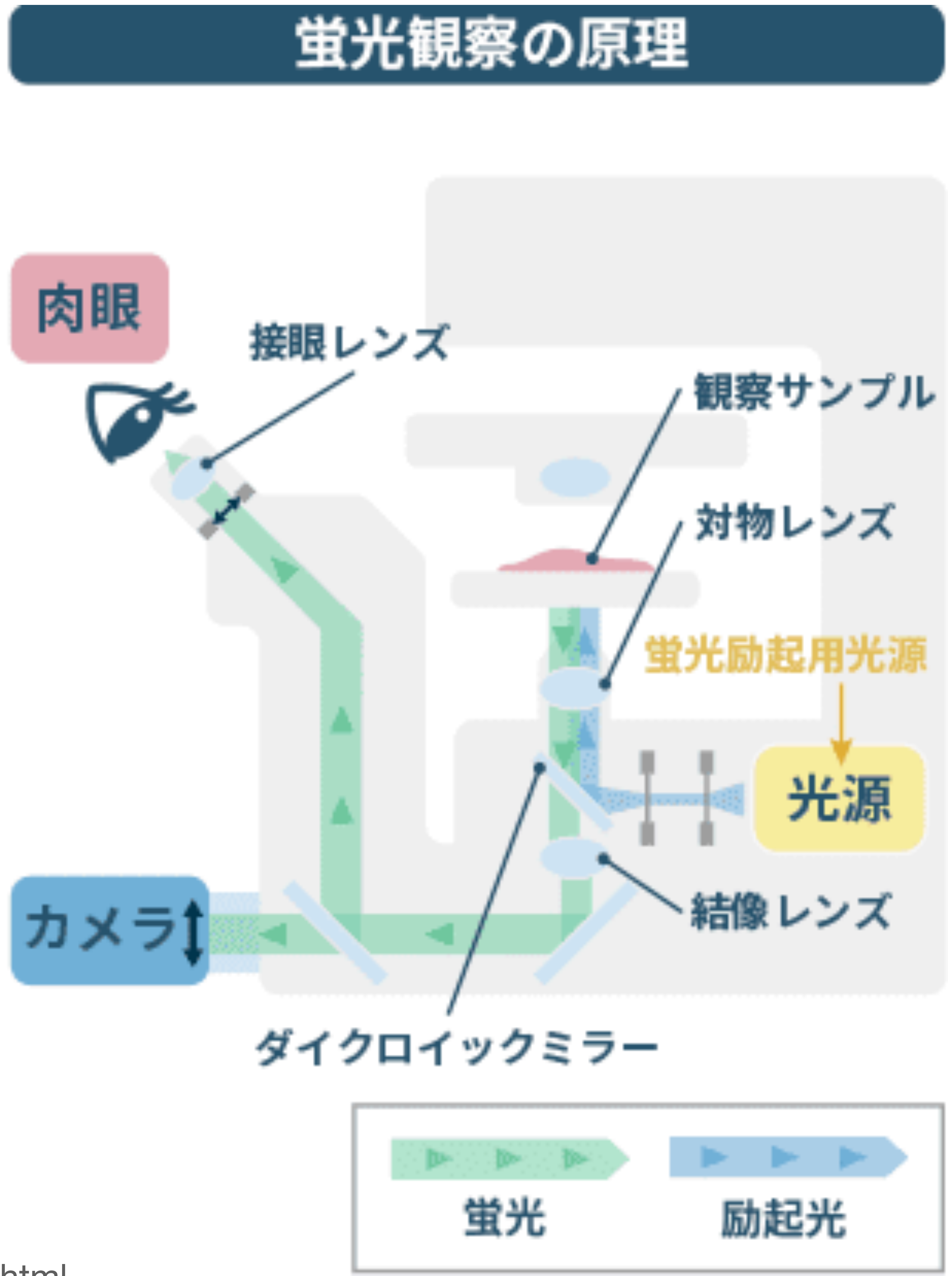
蛍光顕微鏡

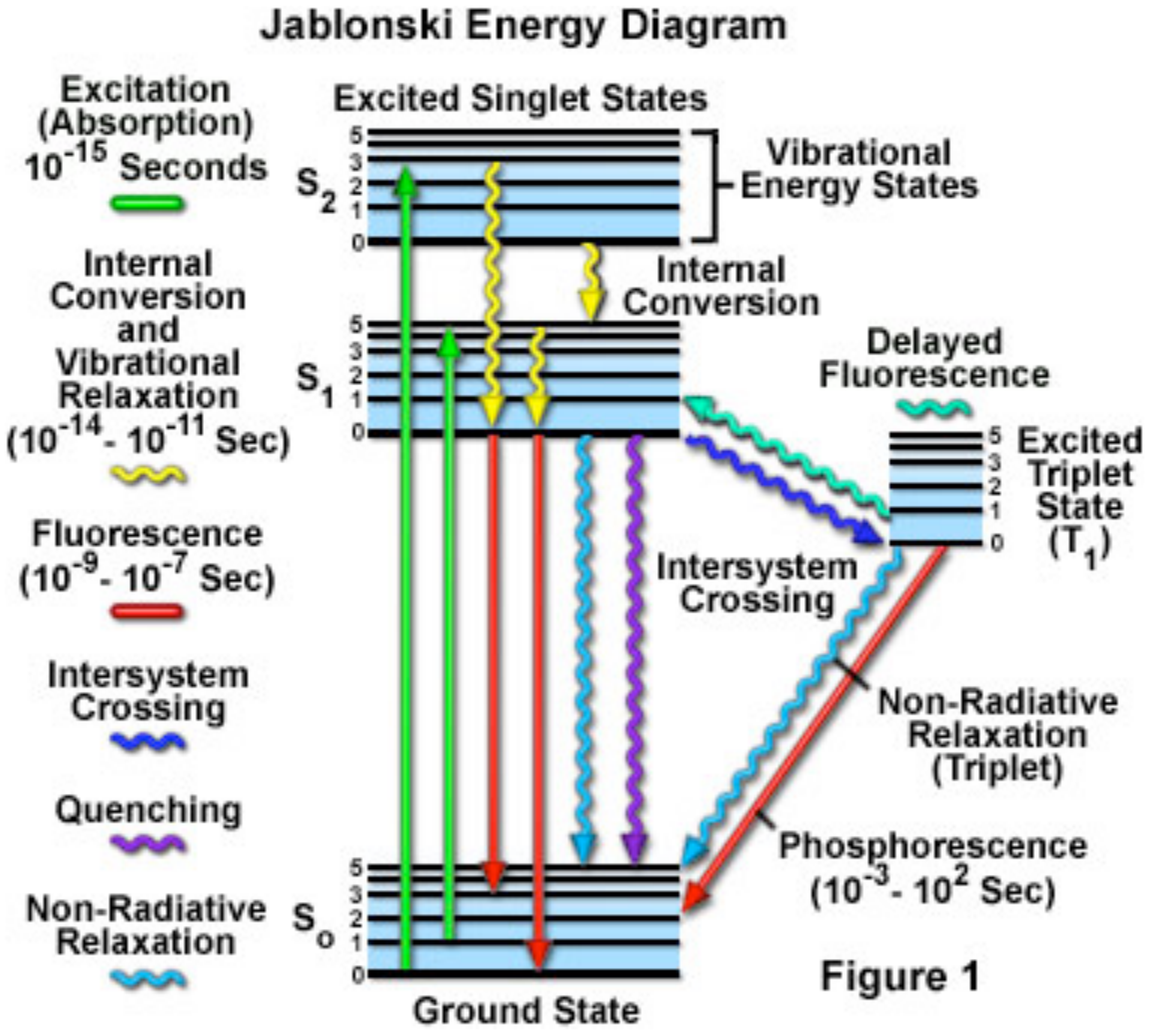




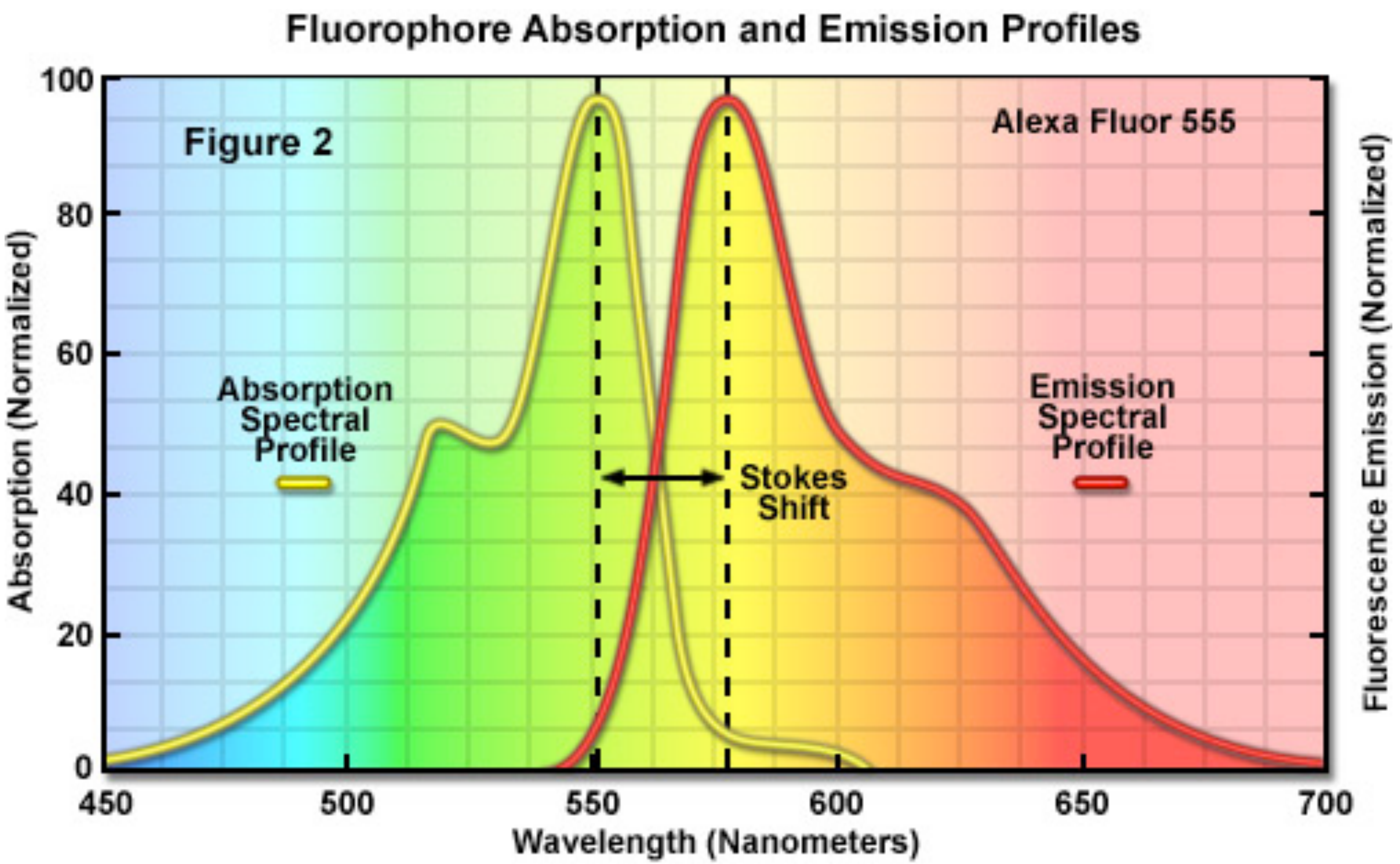


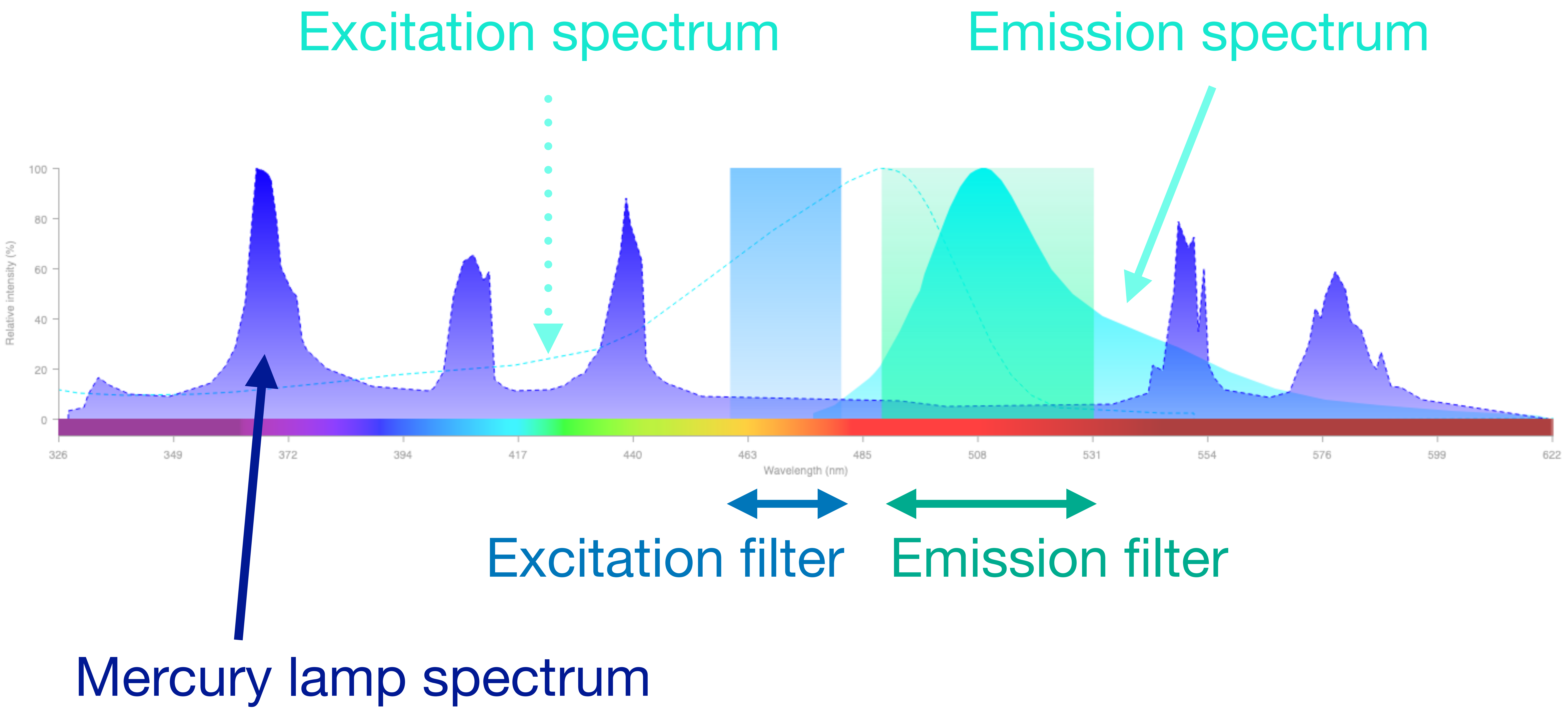
https://www.healthcare.nikon.com/ja/ss/cell-image-lab/knowledge/microscope-structure.html

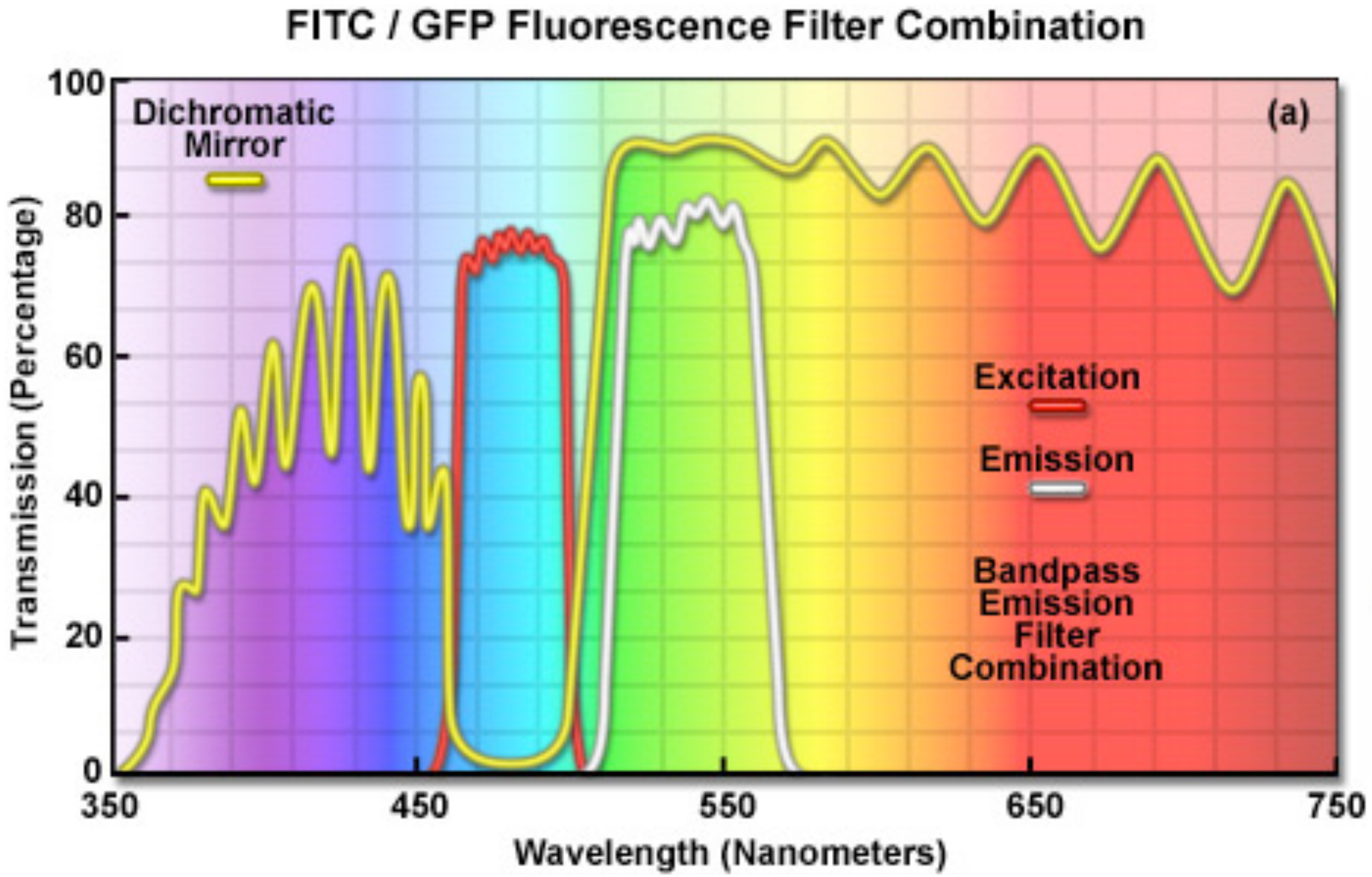
蛍光



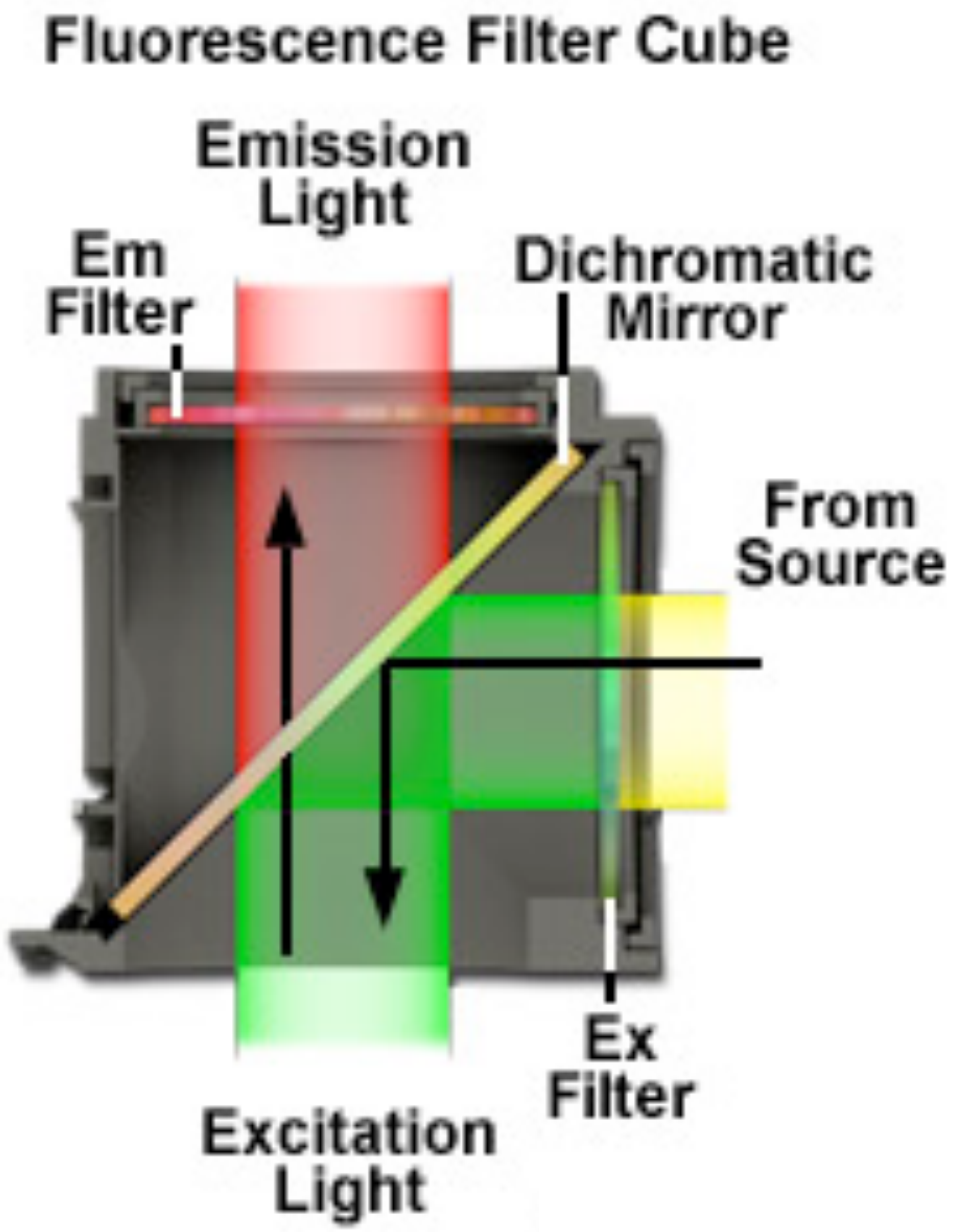
https://www.olympus-lifescience.com/ja/microscope-resource/primer/techniques/confocal/fluoroexciteemit/


Fluorophore Absorption and Emission Profiles
Figure 2
Alexa Fluor 555
Absorption Spectral Profile
Emission Spectral Profile
Stokes Shift
Absorption (Normalized)
Fluorescence Emission (Normalized)
Wavelength (Nanometers)
0
20
40
60
80
100
450
500
550
600
650
700


Excitation spectrum
Emission spectrum
100
80
60
40
20
0
Relative intensity (%)
326
349
372
394
417
440
463
485
508
531
554
576
599
622
Wavelength (nm)
Excitation filter
Emission filter
Mercury lamp spectrum



FITC / GFP Fluorescence Filter Combination
100
80
60
40
20
0
Transmission (Percentage)
Dichromatic Mirror
(a)
Excitation
Emission
Bandpass Emission Filter Combination
350
450
550
650
750
Wavelength (Nanometers)

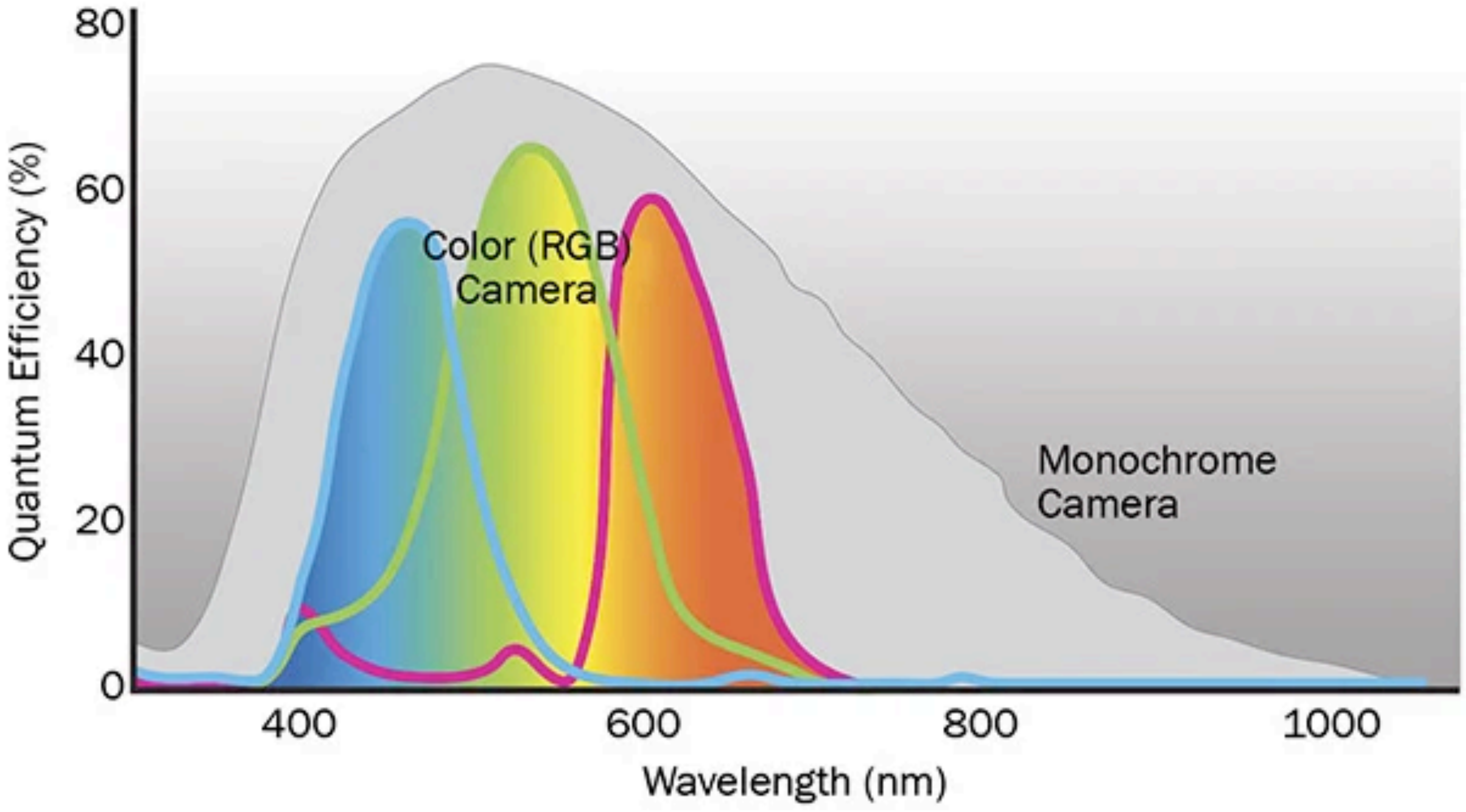


Fluorescence Filter Cube
Emission Light
Em Filter
Dichromatic Mirror
From Source
Ex Filter
Excitation Light

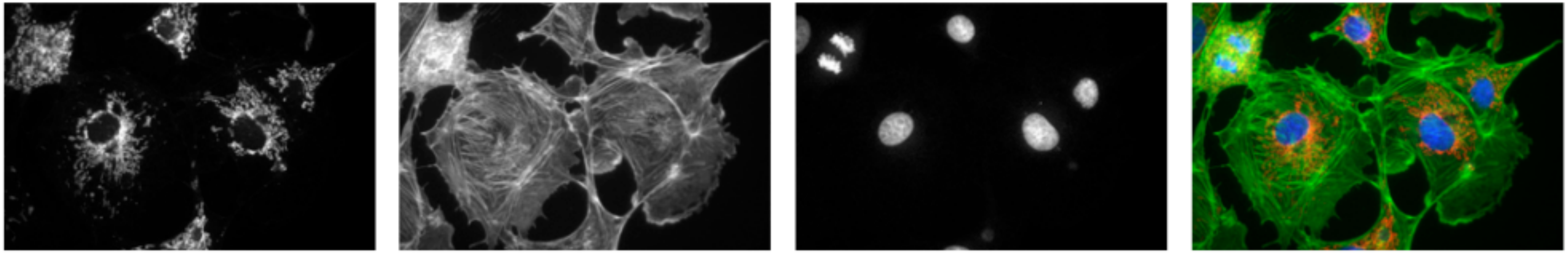
Sample

カメラ


HAMAMATSU
DIGITAL CAMERA C11440
ORCA-Flash4.0LT

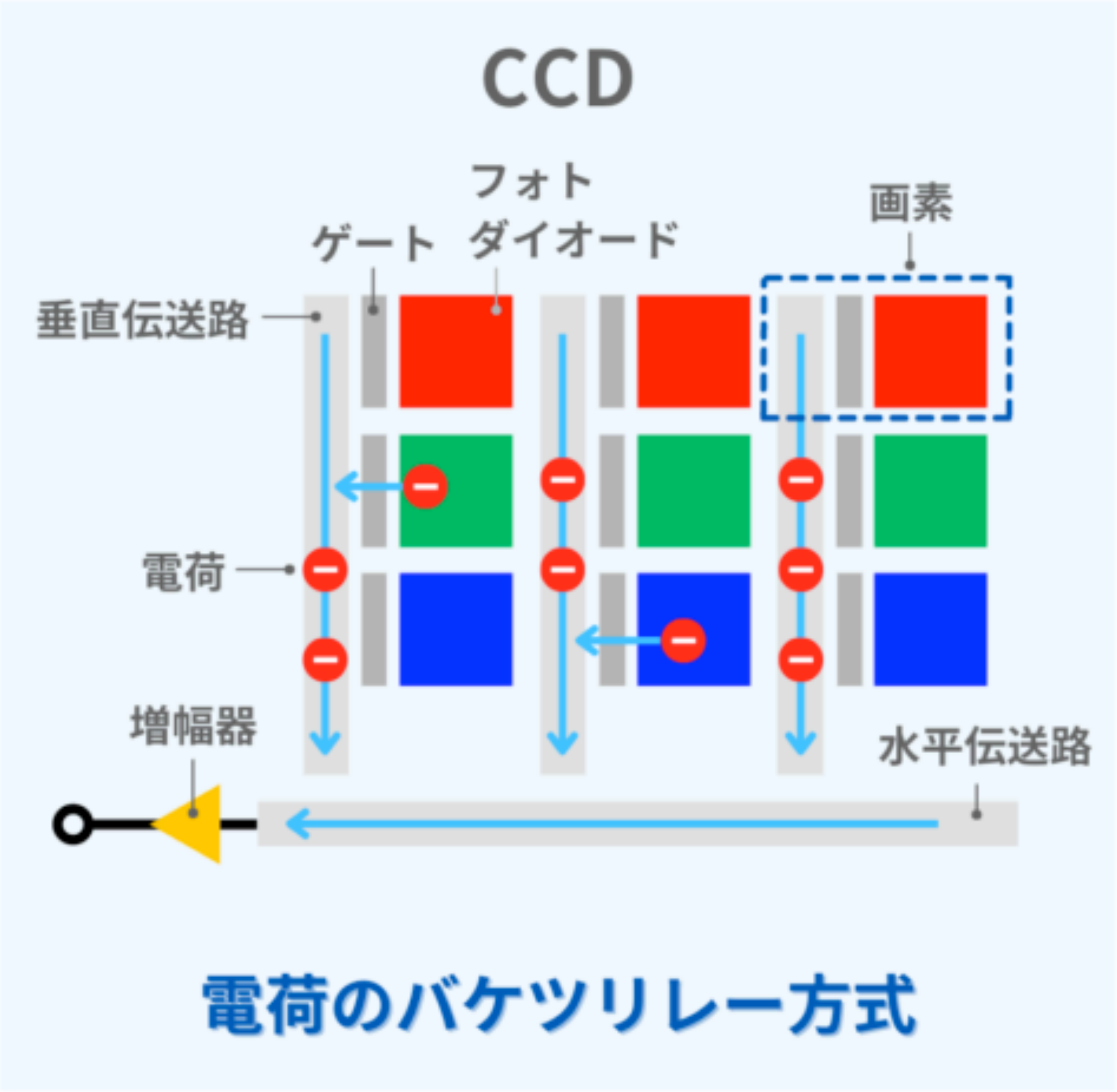

Quantum Efficiency (%)
80
60
40
20
0
400
600
800
1000
Wavelength (nm)
Color (RGB) Camera
Monochrome Camera

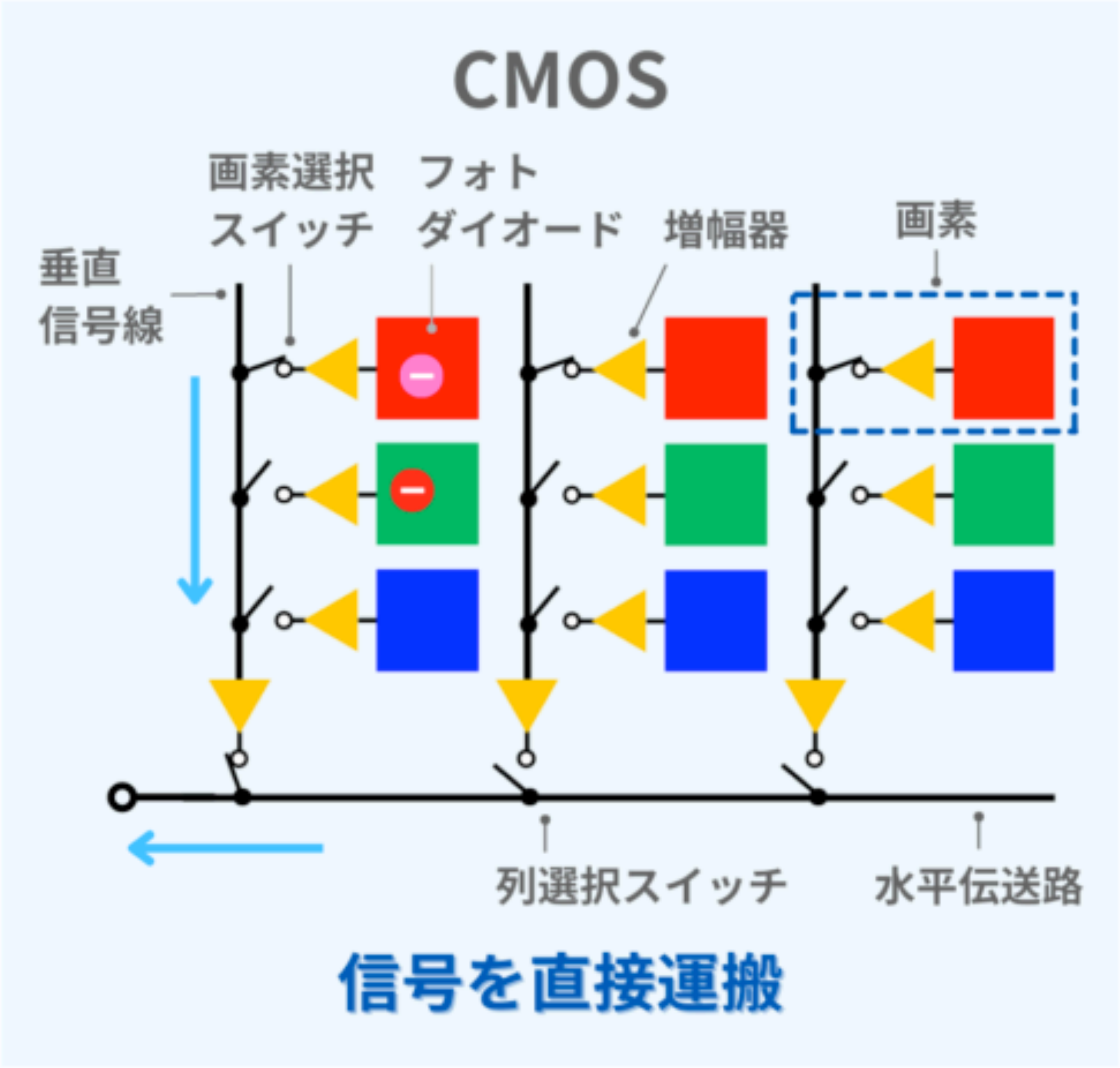
擬似カラー
Pseudocolor

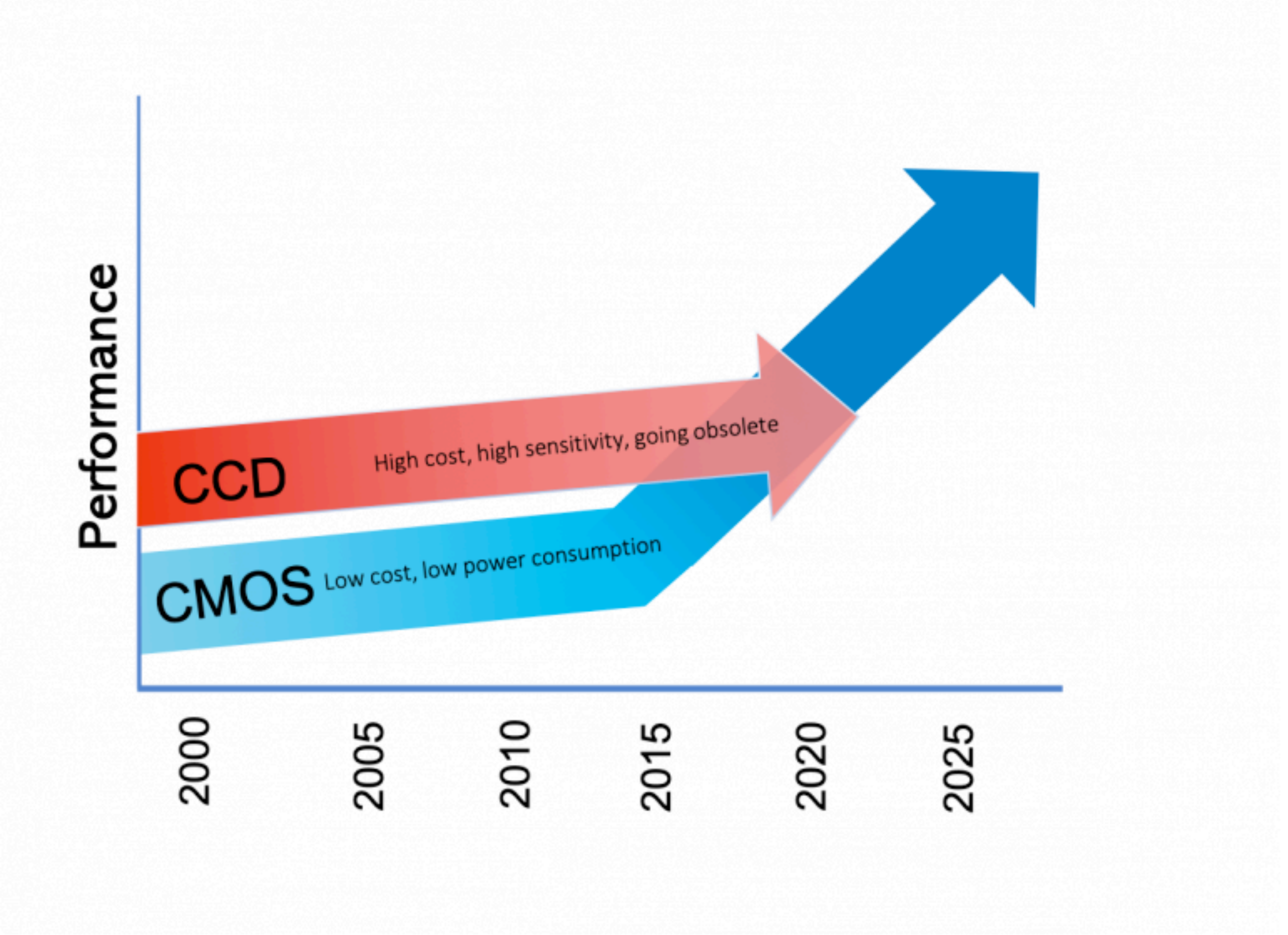


Gray scale images

CCD vs CMOS


CCD
フォト
ダイオード
ゲート
画素
垂直伝送路
電荷
増幅器
水平伝送路
電荷のバケツリレー方式


CMOS
画素選択
スイッチ
フォト
ダイオード
増幅器
画素
垂直
信号線
列選択スイッチ
水平伝送路
信号を直接運搬


Performance
CCD
High cost, high sensitivity, going obsolete
CMOS
Low cost, low power consumption
2000
2005
2010
2015
2020
2025

Fiji のダウンロード

https://imagej.net/software/fiji/downloads

Mexican Hat Filter Plug-inのダウンロード

https://imagej.nih.gov/ij/plugins/mexican-hat/index.html

home | news | docs | download | plugins | macros/dev | list | links

Mexican Hat Filter

Author: Dimiter Prodanov (dimiterpp at gmail.com)

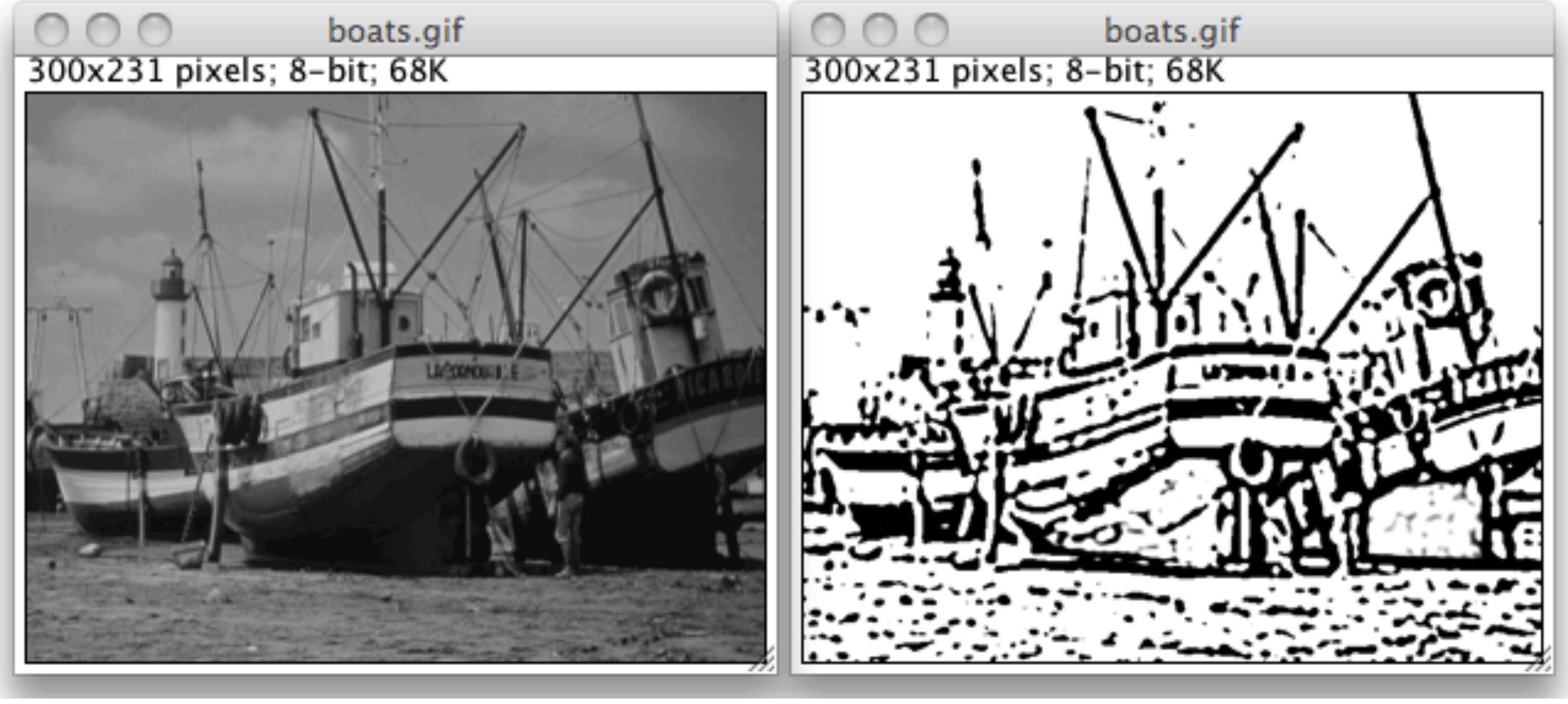
History: 2012/11/10: First release
2012/11/24: Added "Separable" option; requires v1.47g
2012/11/26: Multi-threaded
2015/09/12: Bug fixes
2017/12/31: Fixed kernel calculation bug

Source: Mexican_Hat_Filter.java

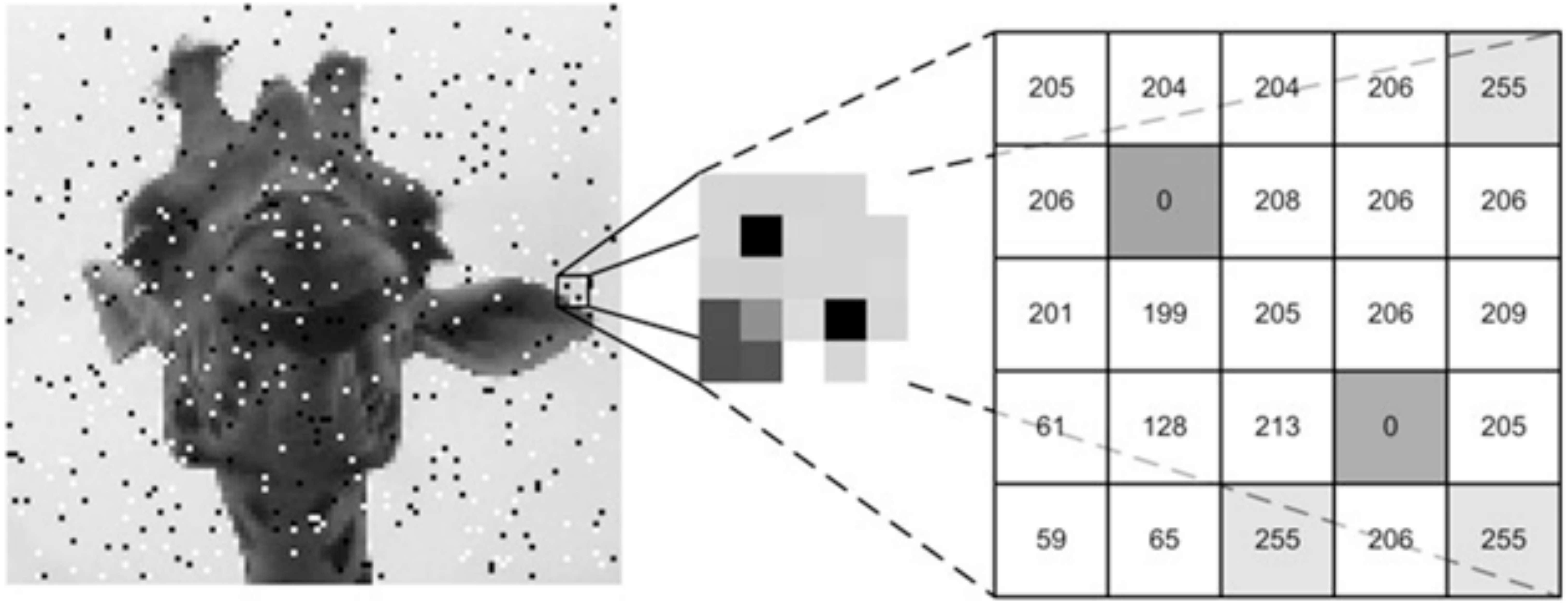
Installation: Drag and drop Mexican_Hat_Filter.class onto the "ImageJ" window.

Description: This plugin applies a Laplacian of Gaussian (Mexican Hat) filter to a 2D image.

See Also: 3D Laplacian of Gaussian (LoG) plugin
Difference of Gaussians plugin

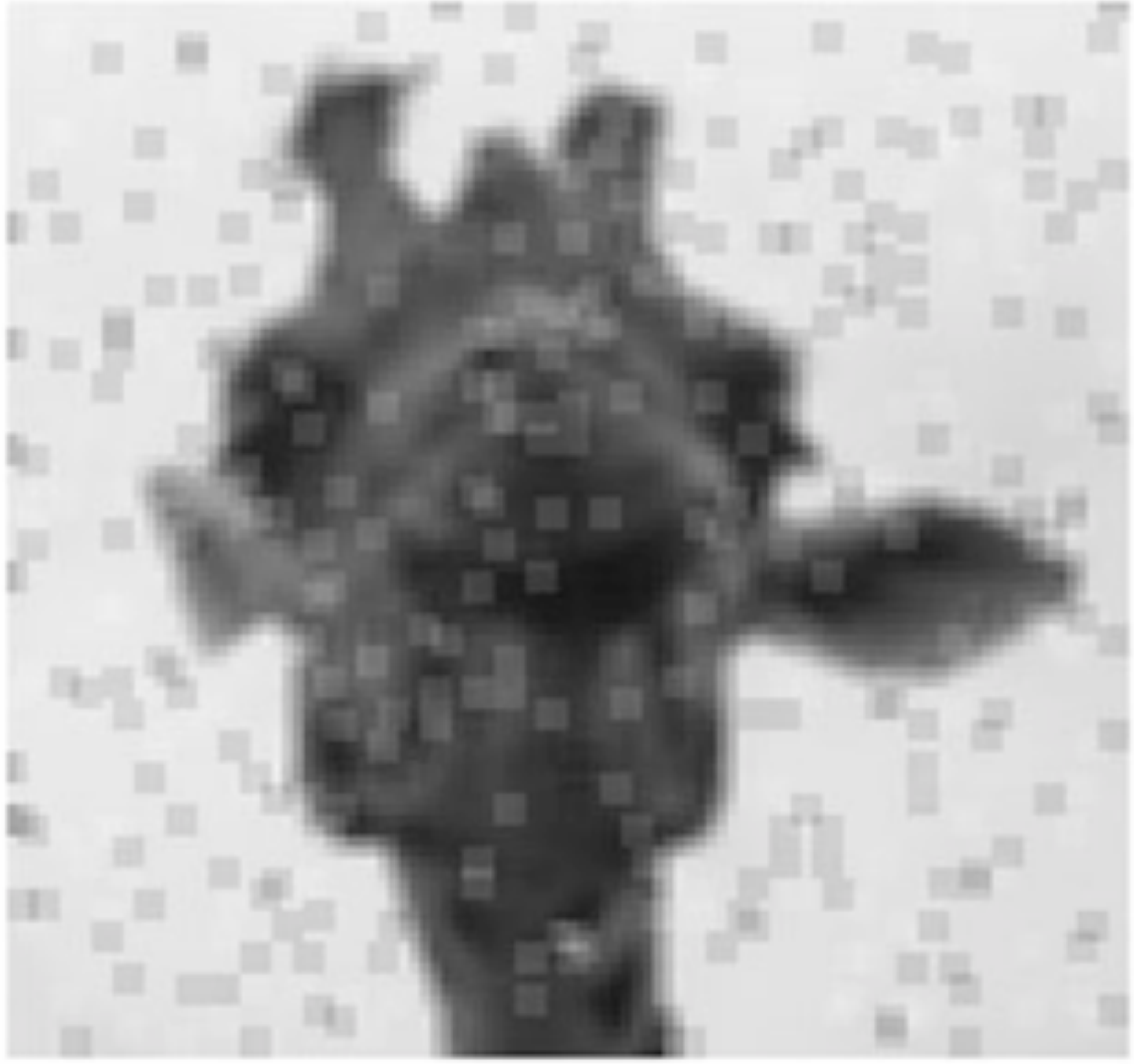


画像処理
— *Filter* —



ノイズ (外れ値) を除去したい

画像処理
― *Filter* ―

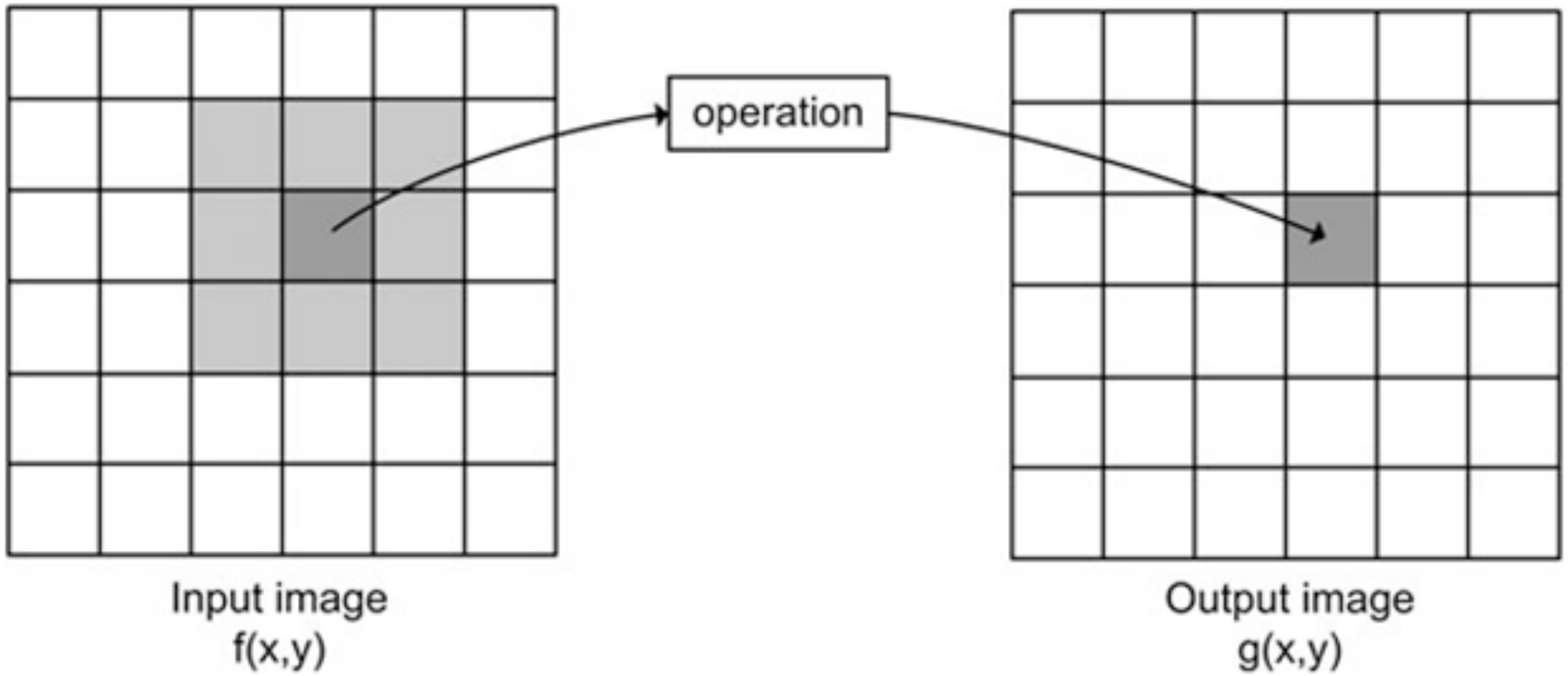

Mean filtered


Median filtered

ノイズ (外れ値) を除去したい

画像処理

— *Filter* —

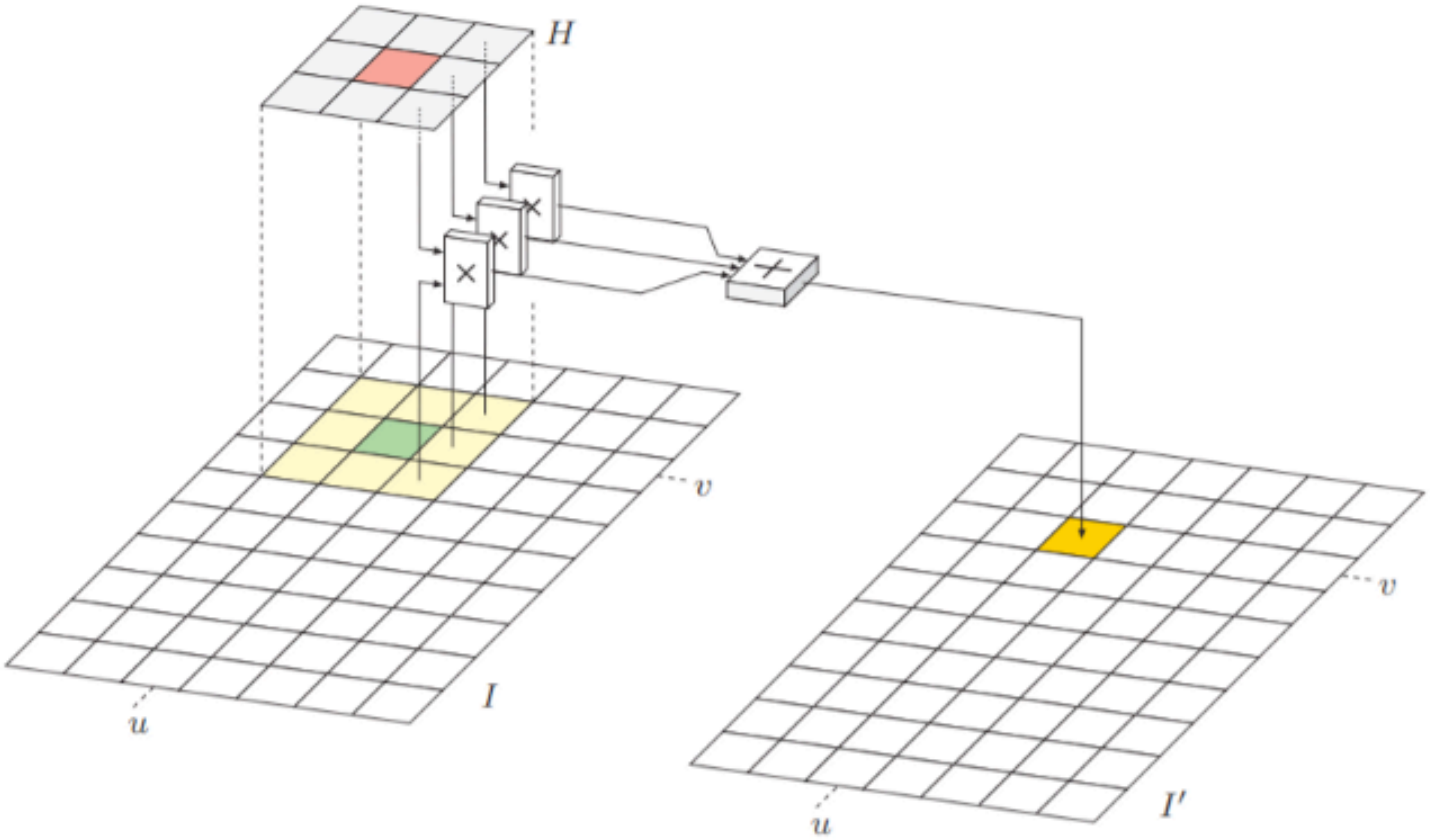


Radius = 1

Kernel width/height = (Radius x 2) + 1 = 3

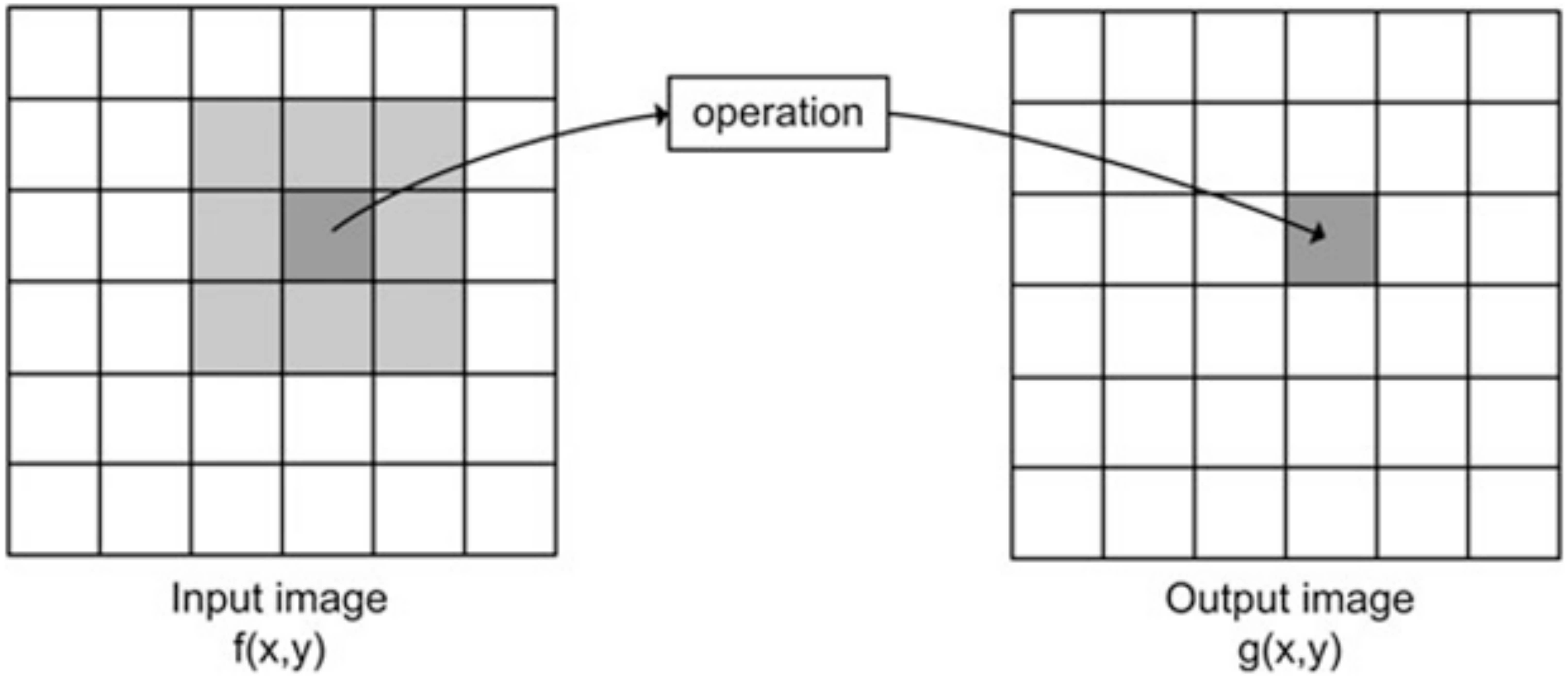
画像処理

— *Filter* —



画像処理

— Filter —

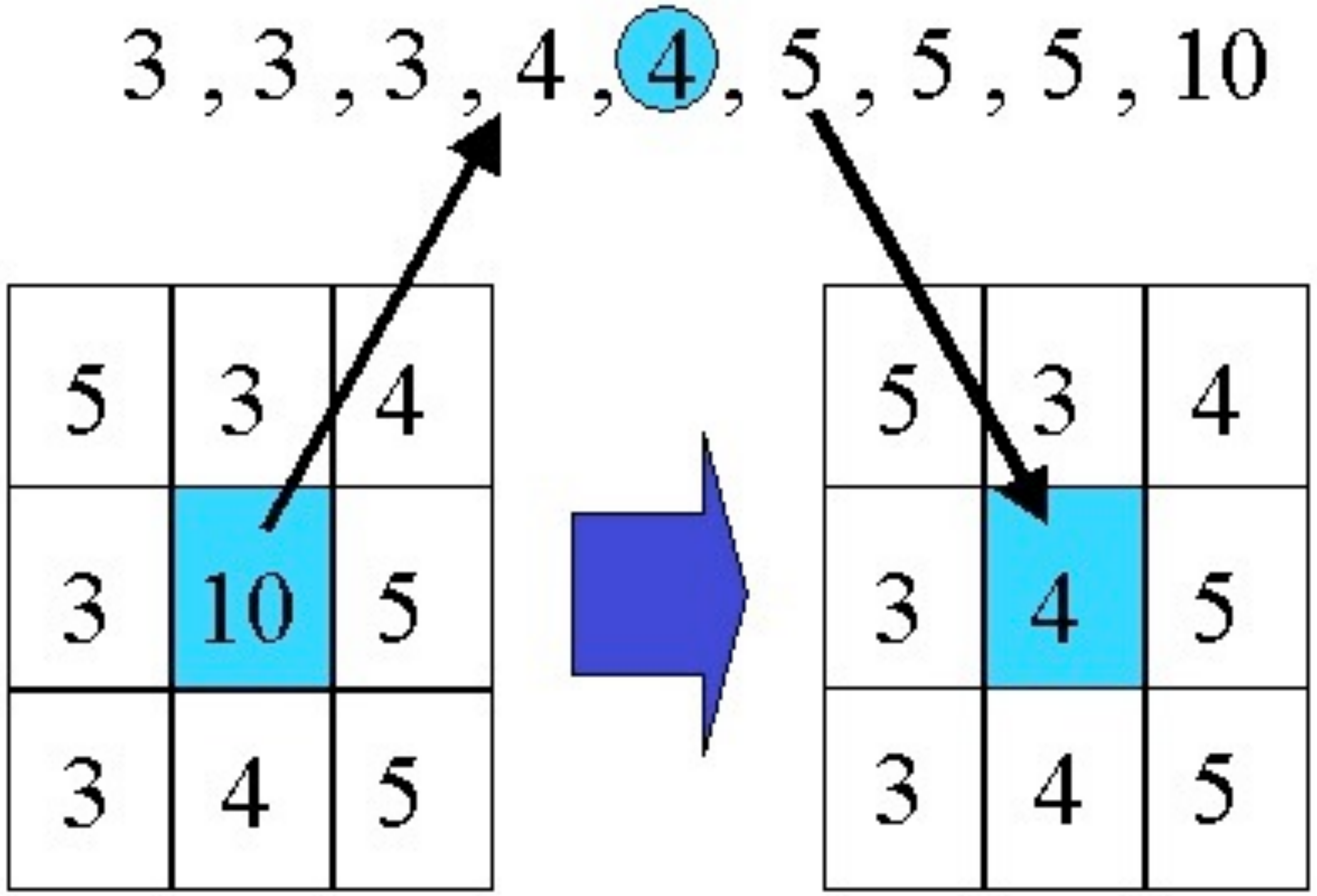


$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$
$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$
$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$

Kernel for 3 x 3 mean filter

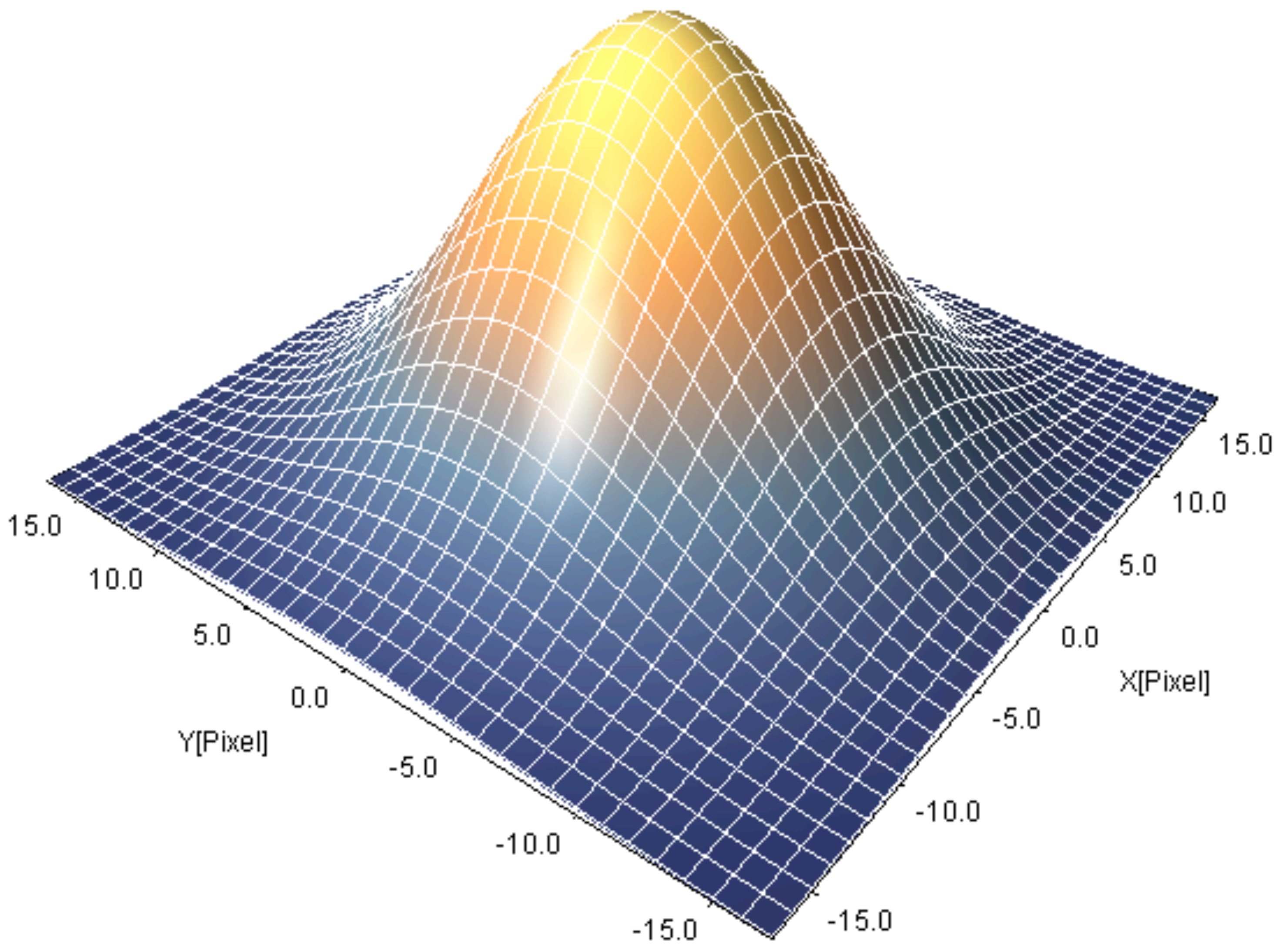
画像処理

— *Filter* —



3 x 3 median filtering

Gaussian Filter



$$Gauss(x,y) = \frac{1}{2\pi\sigma^2} exp(-\frac{x^2+y^2}{2\sigma^2})$$

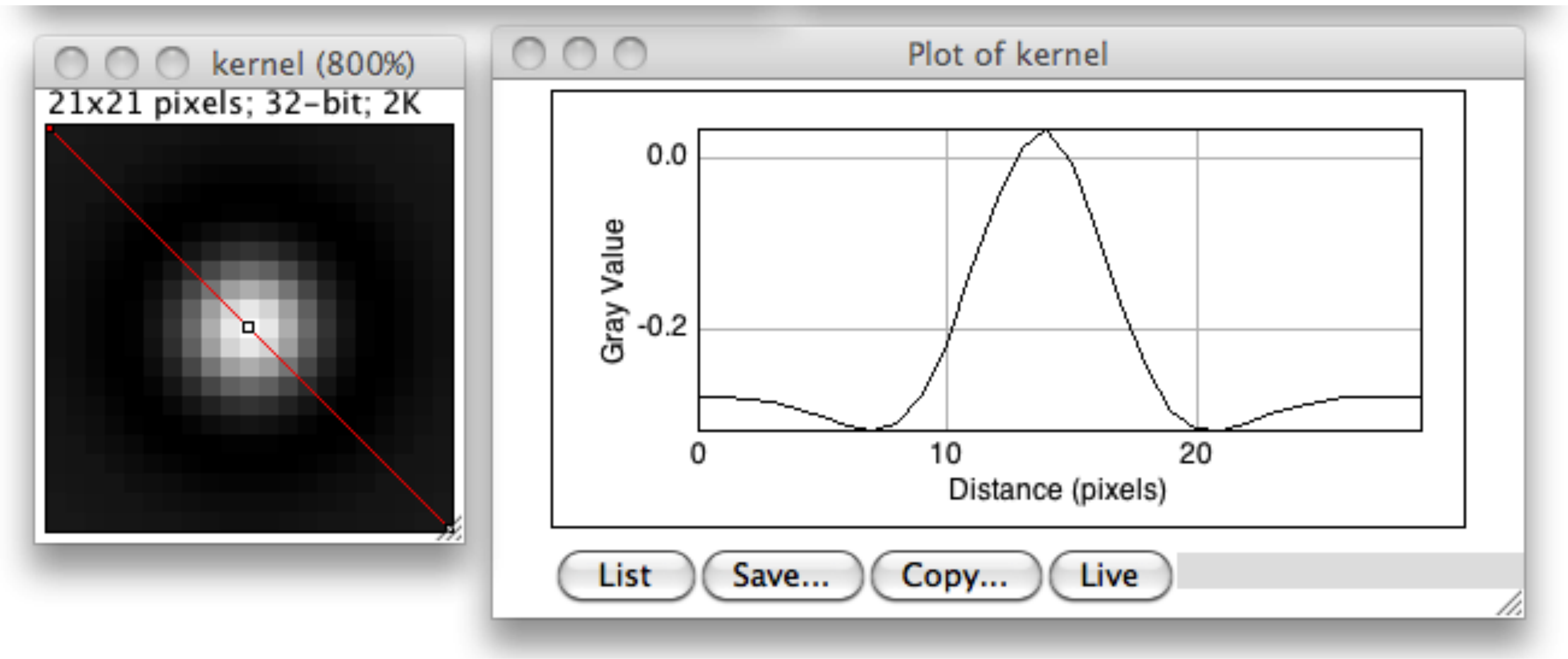
1/16	2/16	1/16
2/16	4/16	2/16
1/16	2/16	1/16

3×3の重みづけ

1/256	4/256	6/256	4/256	1/256
4/256	16/256	24/256	16/256	4/256
6/256	24/256	36/256	24/256	6/256
4/256	16/256	24/256	16/256	4/256
1/256	4/256	6/256	4/256	1/256

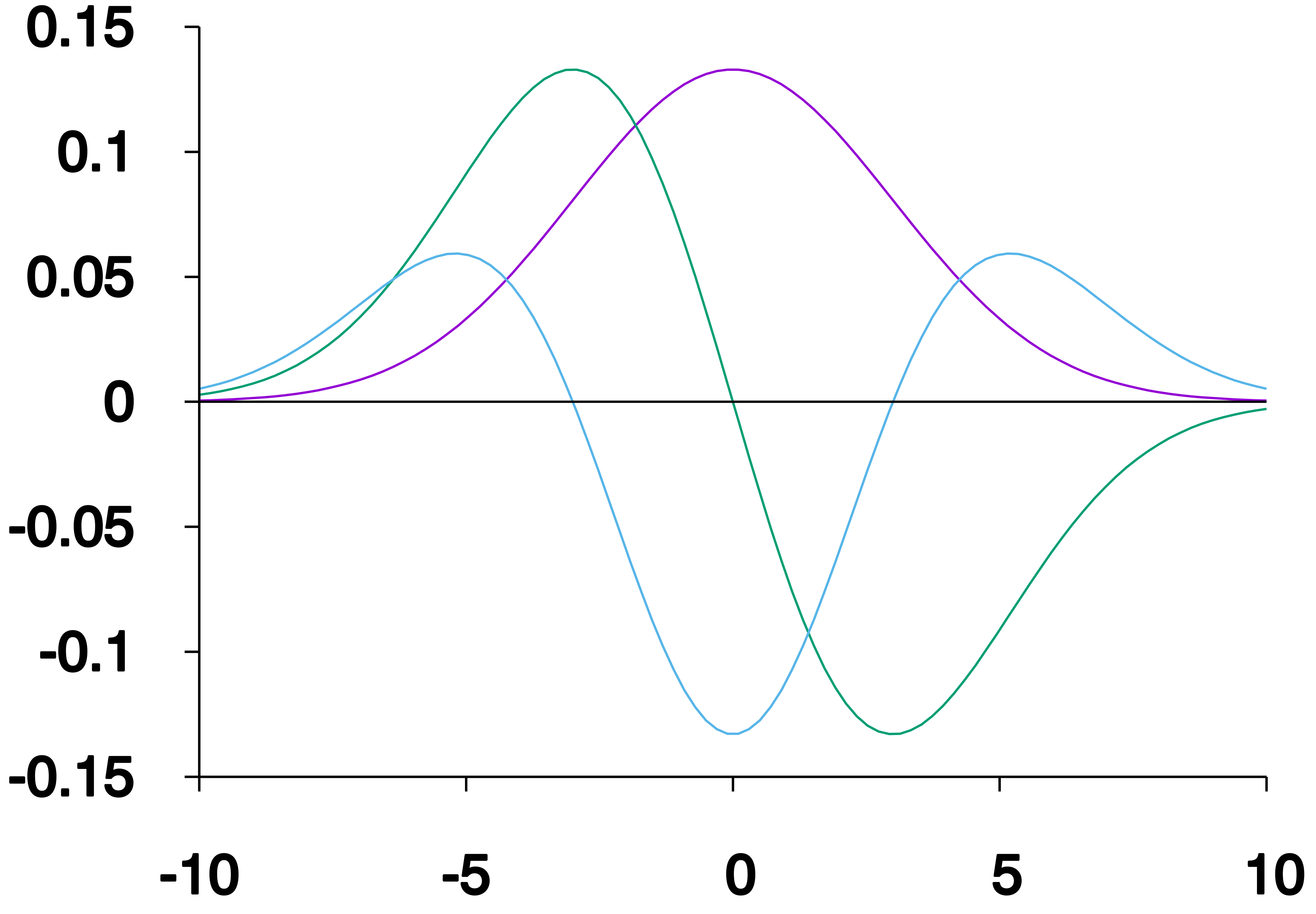
5×5の重みづけ

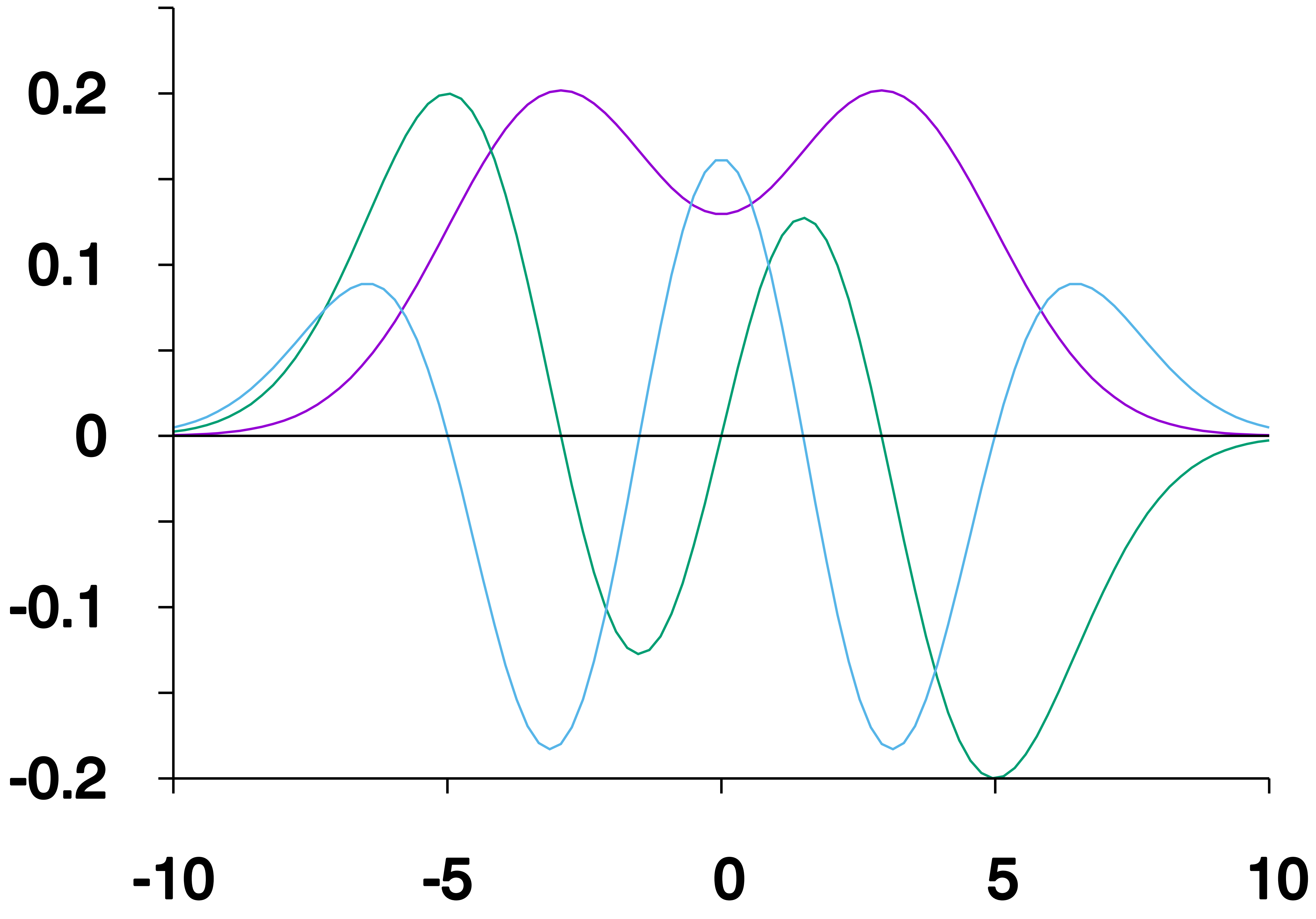
Mexican hat filter



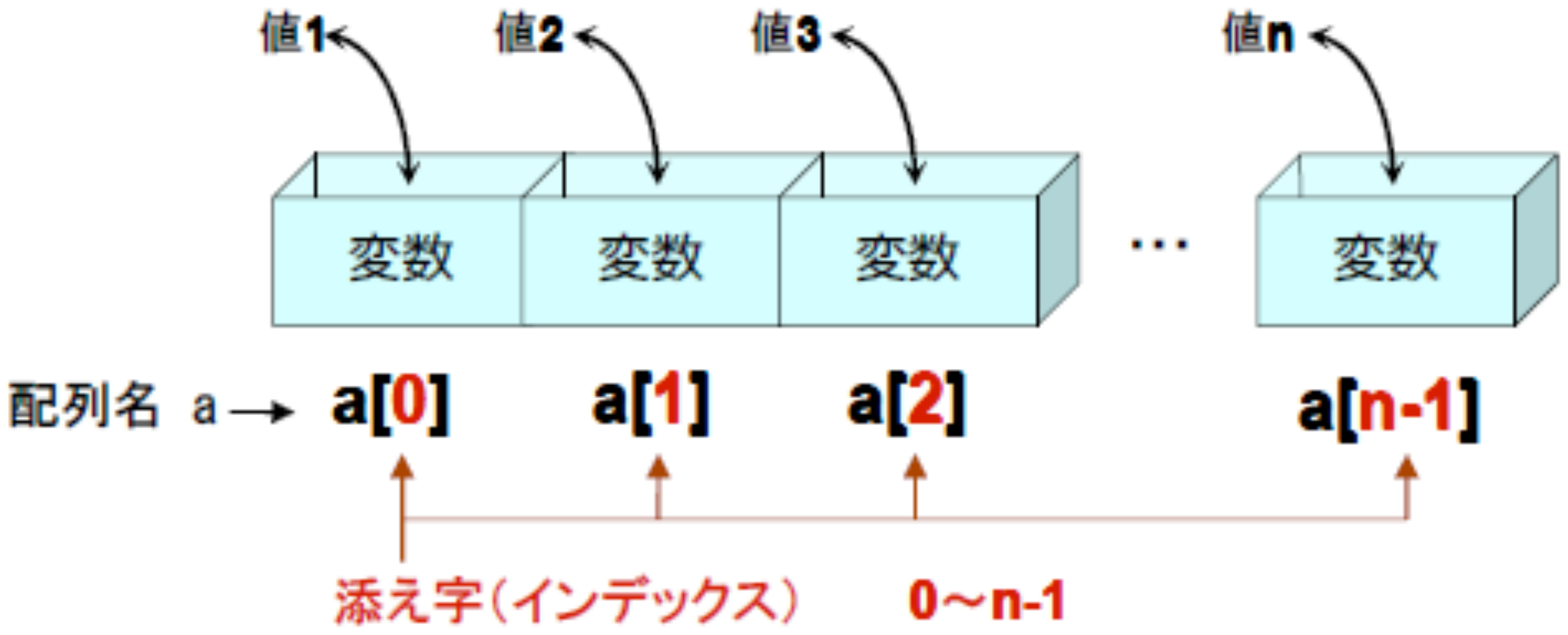
Edge detection

Original
1st derivative
2nd derivative





プログラミング：
配列

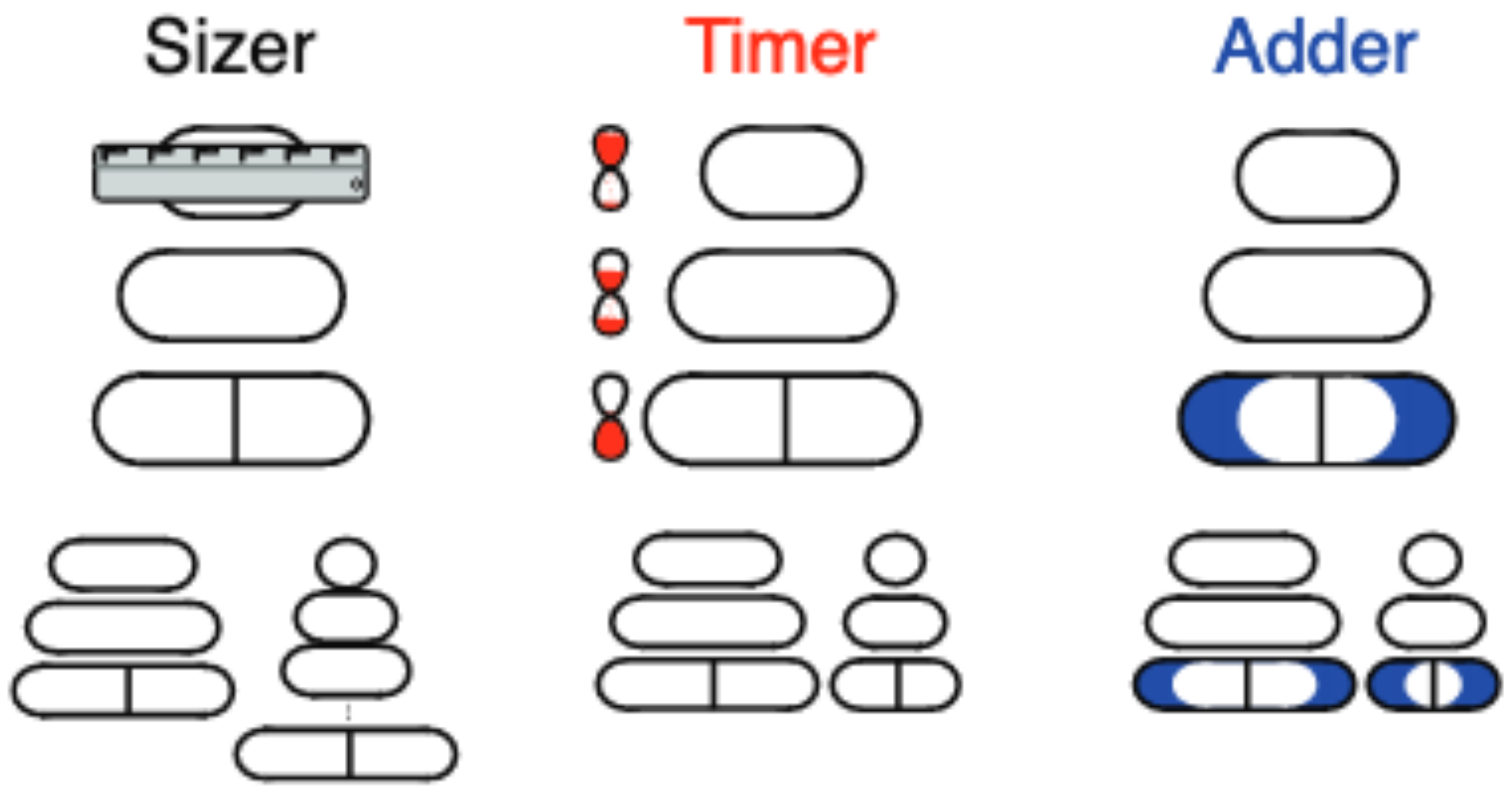


細胞分裂の３つのモデル

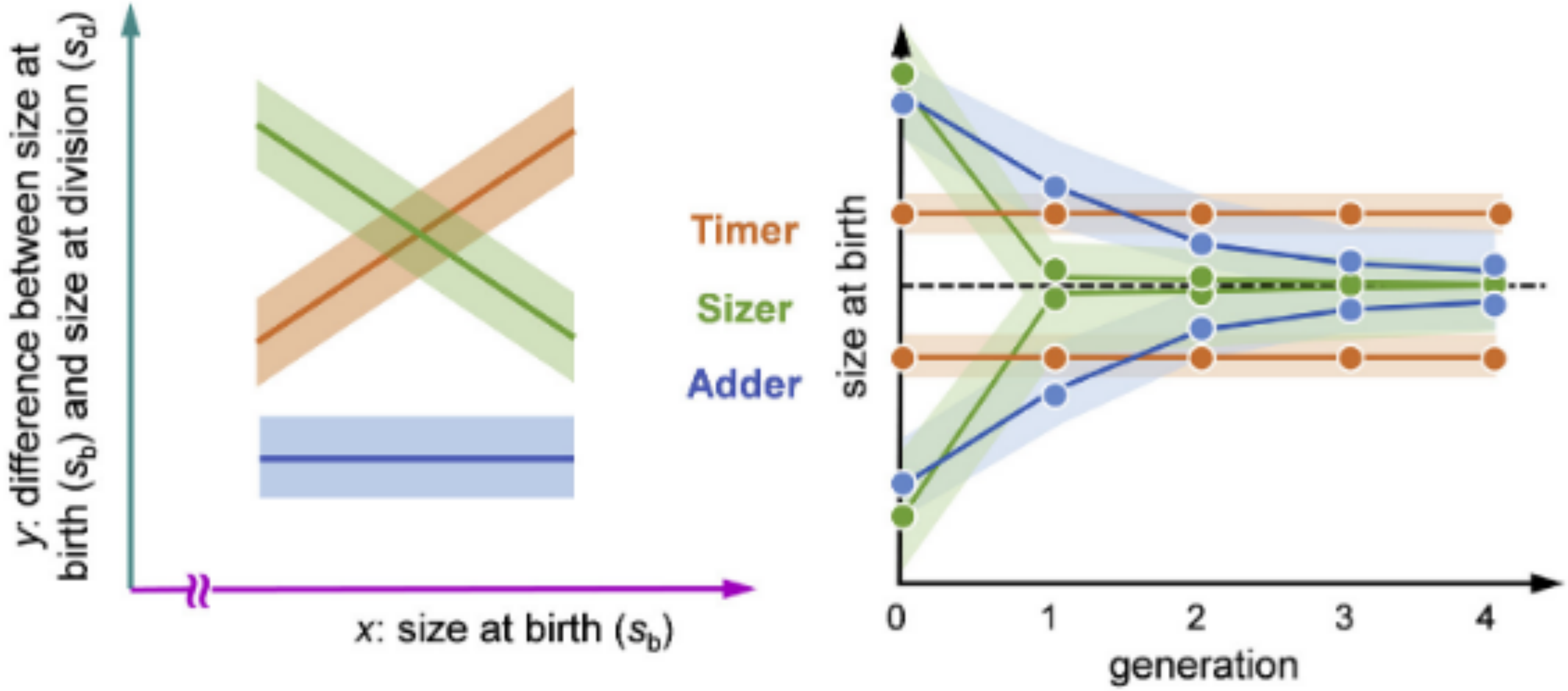
Sizer : ある決まった大きさになったら分裂する

Timer : ある決まった時間が経過したら分裂する

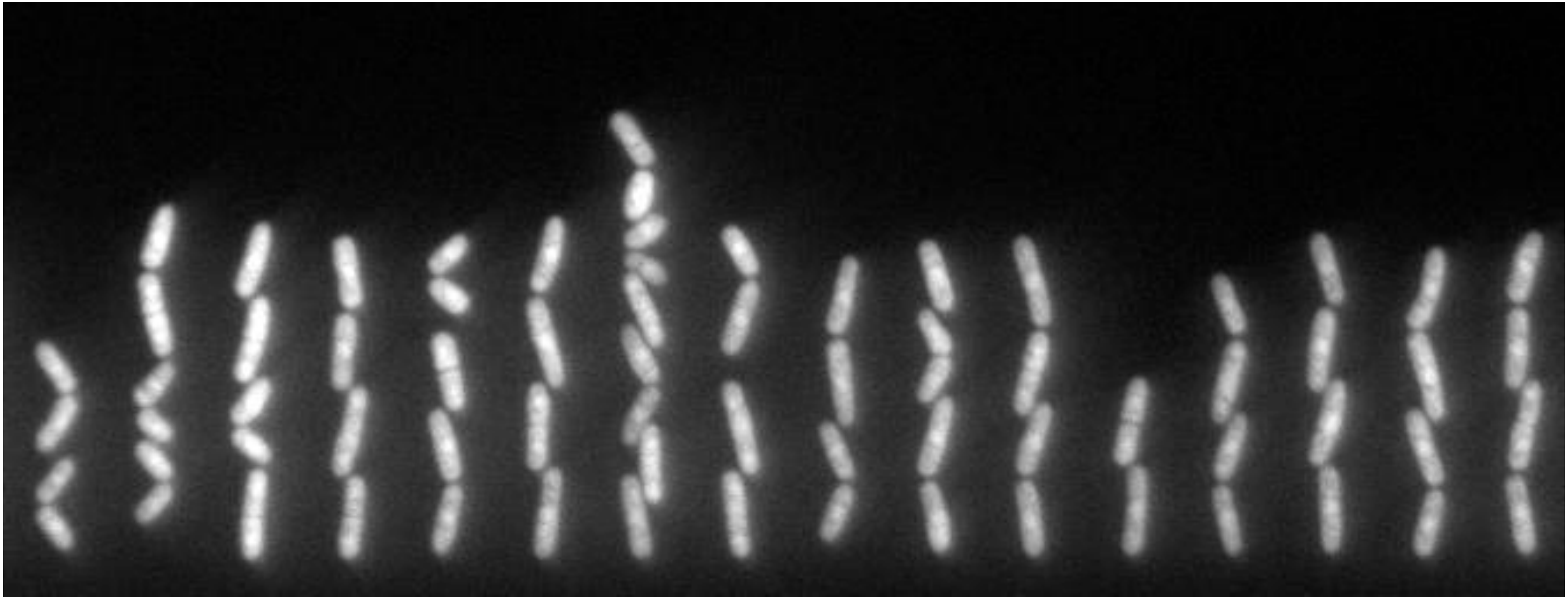
Adder : ある決まった体積分成長したら分裂する



細胞分裂の３つのモデル



マイクロ流体デバイスを用いた分裂酵母のイメージング



自己相関係数の計算

オリジナルデータ	x[0]	x[1]	x[2]	x[3]	x[4]	x[5]	(N = 6)
τ = 1	x[0]	x[1]	x[2]	x[3]	x[4]	x[5]	(x[0]x[1] + x[1]x[2] + x[2]x[3]) / 3
τ = 2	x[0]	x[1]	x[2]	x[3]	x[4]	x[5]	(x[0]x[2] + x[1]x[3] + x[2]x[4]) / 3
τ = 3	x[0]	x[1]	x[2]	x[3]	x[4]	x[5]	(x[0]x[3] + x[1]x[4] + x[2]x[5]) / 3

自己相関係数の計算

オリジナルデータ　x[0]　x[1]　x[2]　x[3]　x[4]　x[5]　(N = 6)

τ = 1　(x[0]x[1] + x[1]x[2] + x[2]x[3]) / 3

τ = 2　x[0]　x[1]　x[2]　x[3]　x[4]　x[5]　(x[0]x[2] + x[1]x[3] + x[2]x[4]) / 3

τ = 3　(x[0]x[3] + x[1]x[4] + x[2]x[5]) / 3

分散の定義と計算

Sample mean : $\bar{x}$

True mean : μ

Sample variance : $s^2 = \dfrac{1}{n}\sum_i (x_i - \bar{x})^2$

True variance : $\sigma^2 = E[(x_i - \mu)^2]$

$$
\begin{aligned}
s^2 &= \frac{1}{n}\sum (x_i - \bar{x})^2 \\
&= \frac{1}{n}\sum (x_i - \mu + \mu - \bar{x})^2 \\
&= \frac{1}{n}\sum (x_i - \mu)^2 - 2(\bar{x} - \mu)\frac{1}{n}\sum (x_i - \mu) + (\bar{x} - \mu)^2 \\
&= \frac{1}{n}\sum (x_i - \mu)^2 - 2(\bar{x} - \mu)\frac{1}{n}(n\bar{x} - n\mu) + (\bar{x} - \mu)^2 \\
&= \frac{1}{n}\sum (x_i - \mu)^2 - (\bar{x} - \mu)^2
\end{aligned}
$$

分散の定義と計算

Sample mean : $\bar{x}$

True mean : μ

Sample variance : $s^2 = \frac{1}{n}\sum_i (x_i - \bar{x})^2$

True variance : $\sigma^2 = E[(x_i - \mu)^2]$

$$
\begin{aligned}
E[s^2] &= E[\frac{1}{n}\sum (x_i - \mu)^2 - (\bar{x} - \mu)^2] \\
&= \frac{1}{n}\sum E[(x_i - \mu)^2] - E[(\bar{x} - \mu)^2] \\
&= \sigma^2 - E[(\bar{x} - \mu)^2] \\
&= \sigma^2 - E[\{\frac{1}{n}(x_1 + x_2 + \ldots - n\mu)\}^2] \\
&= \sigma^2 - \frac{1}{n^2}\sum E[(x_i - \mu)^2] \\
&= \sigma^2 - \frac{1}{n}\sigma^2 = \frac{n-1}{n}\sigma^2
\end{aligned}
$$