Les étapes du traitement de l'analyse d'image

La capture → image brute

Prétraitement → niveaux de gris

Segmentation → image binaire

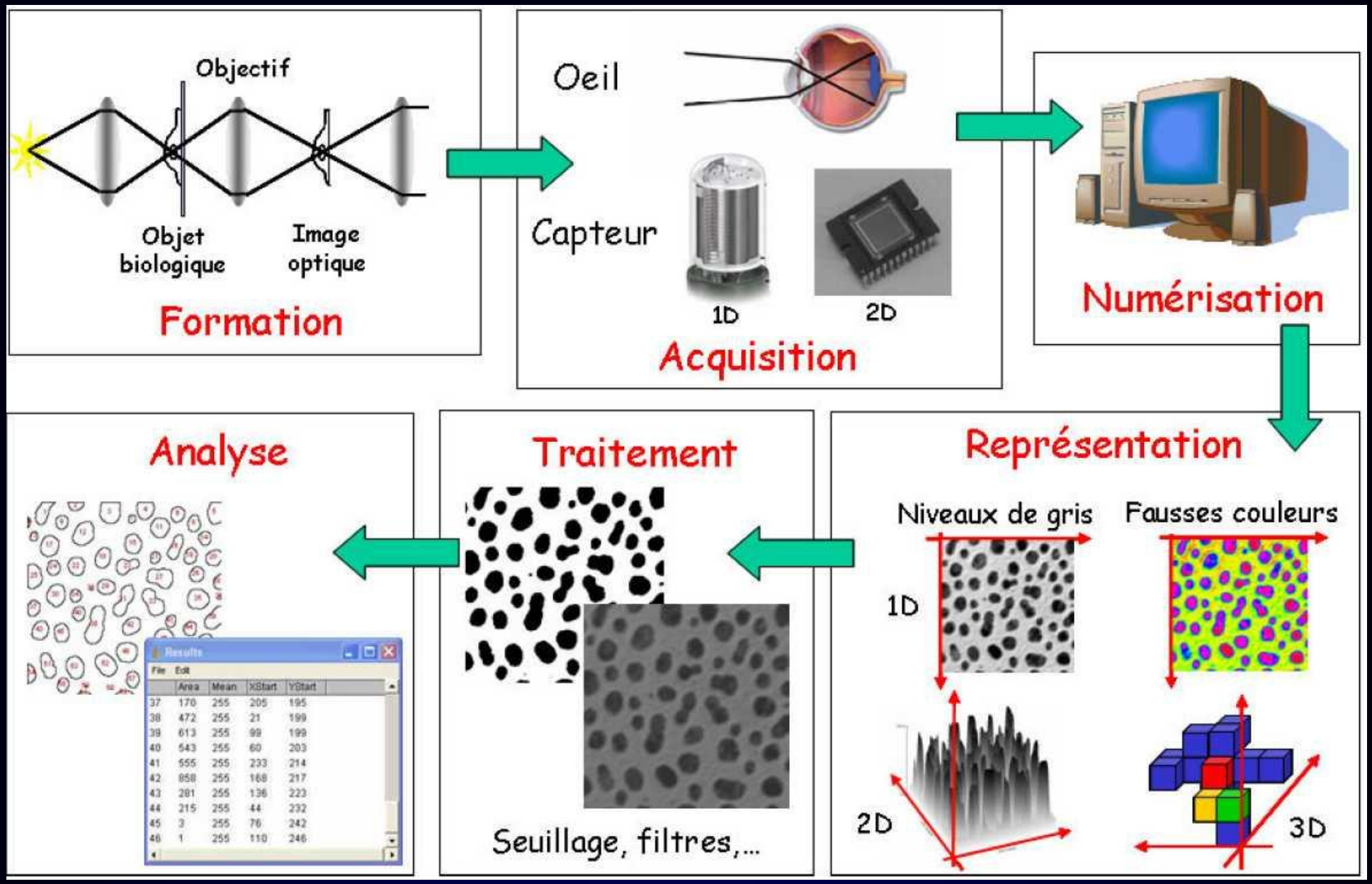
Post-traitement → régions d'intérêts

Quantification → données

Amélioration

Publication

Le traitement et l'analyse d'images



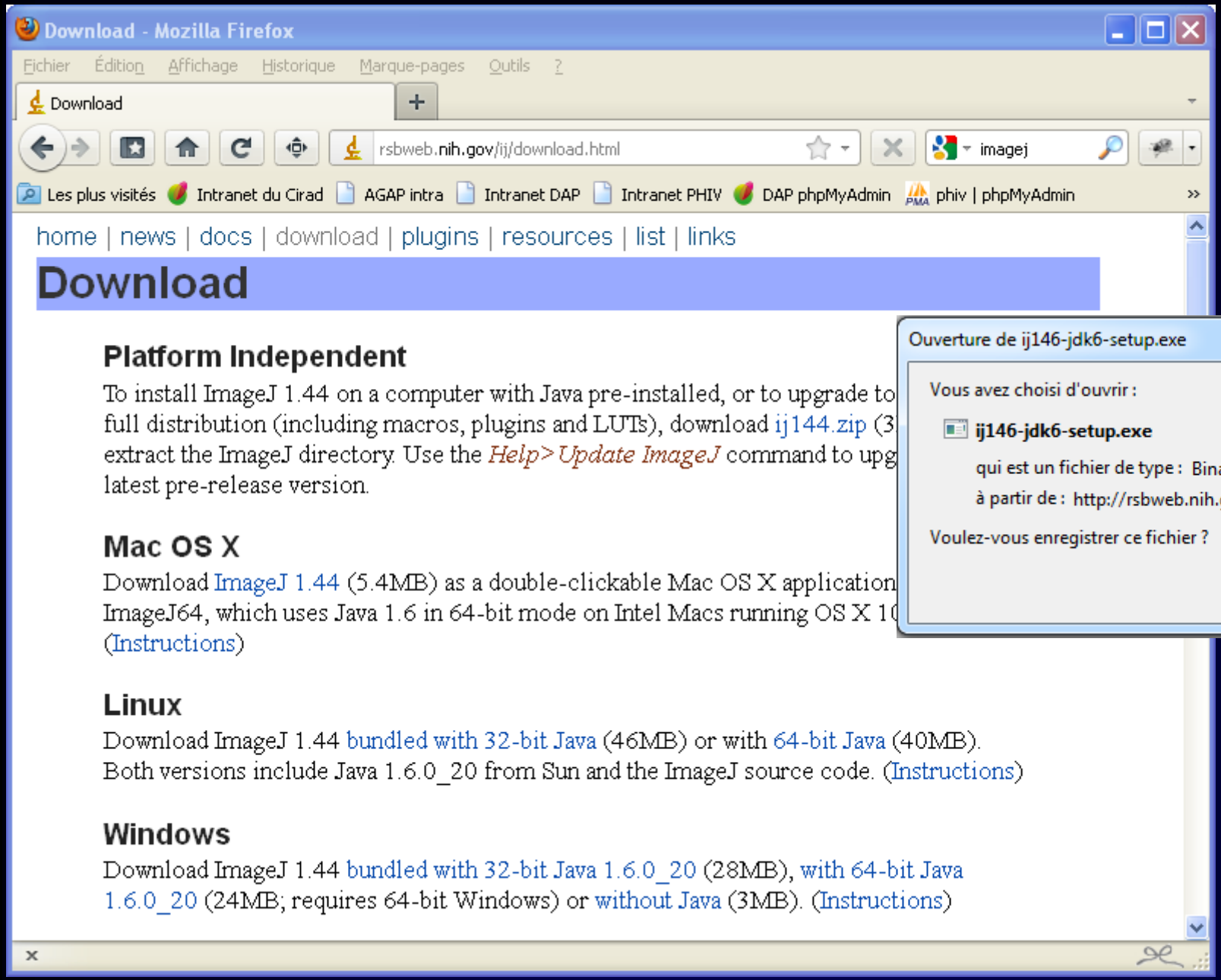
ImageJ est un logiciel libre de traitement et d'analyse d'images

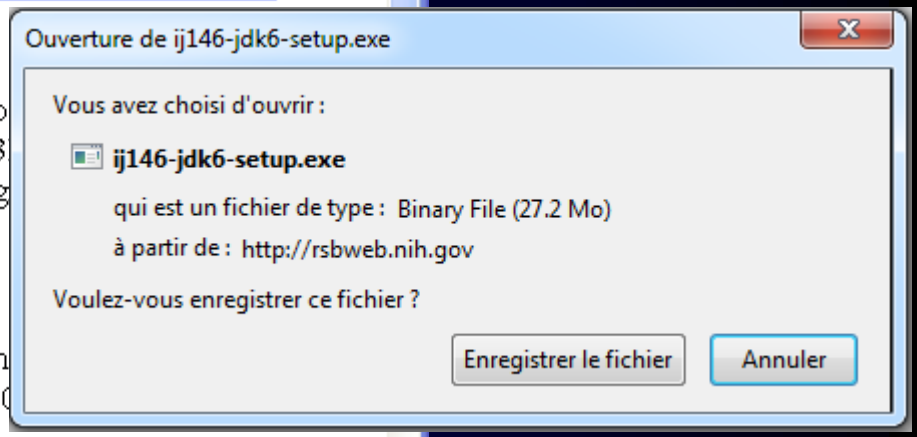
Traduction en Java du logiciel NIH Image
du National Institutes of Health (USA)
développé par Wayne Rasband

Il fonctionne sur de multiples plates-formes (Windows, Mac, Linux, Unix, …).

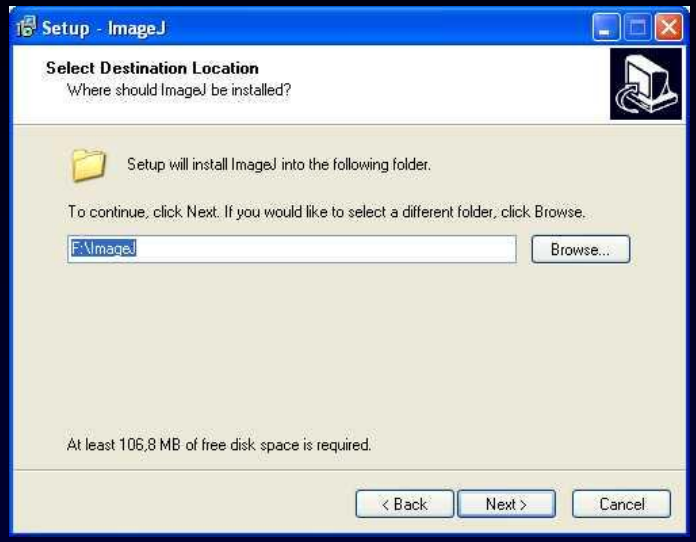
http://rsbweb.nih.gov/ij/

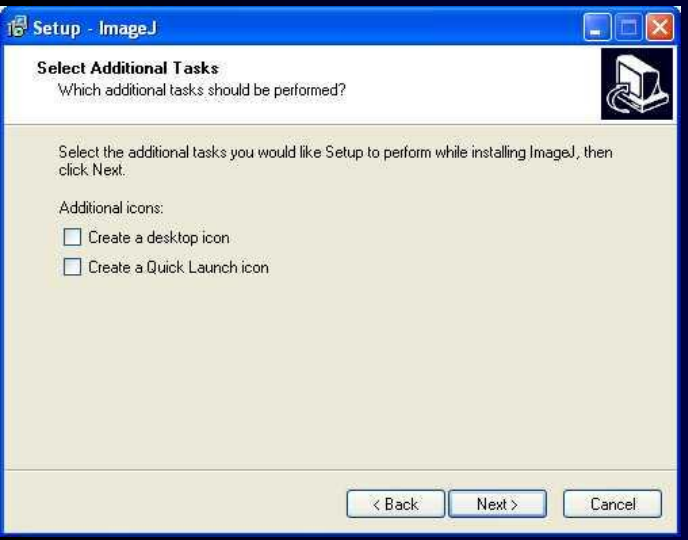
Installation





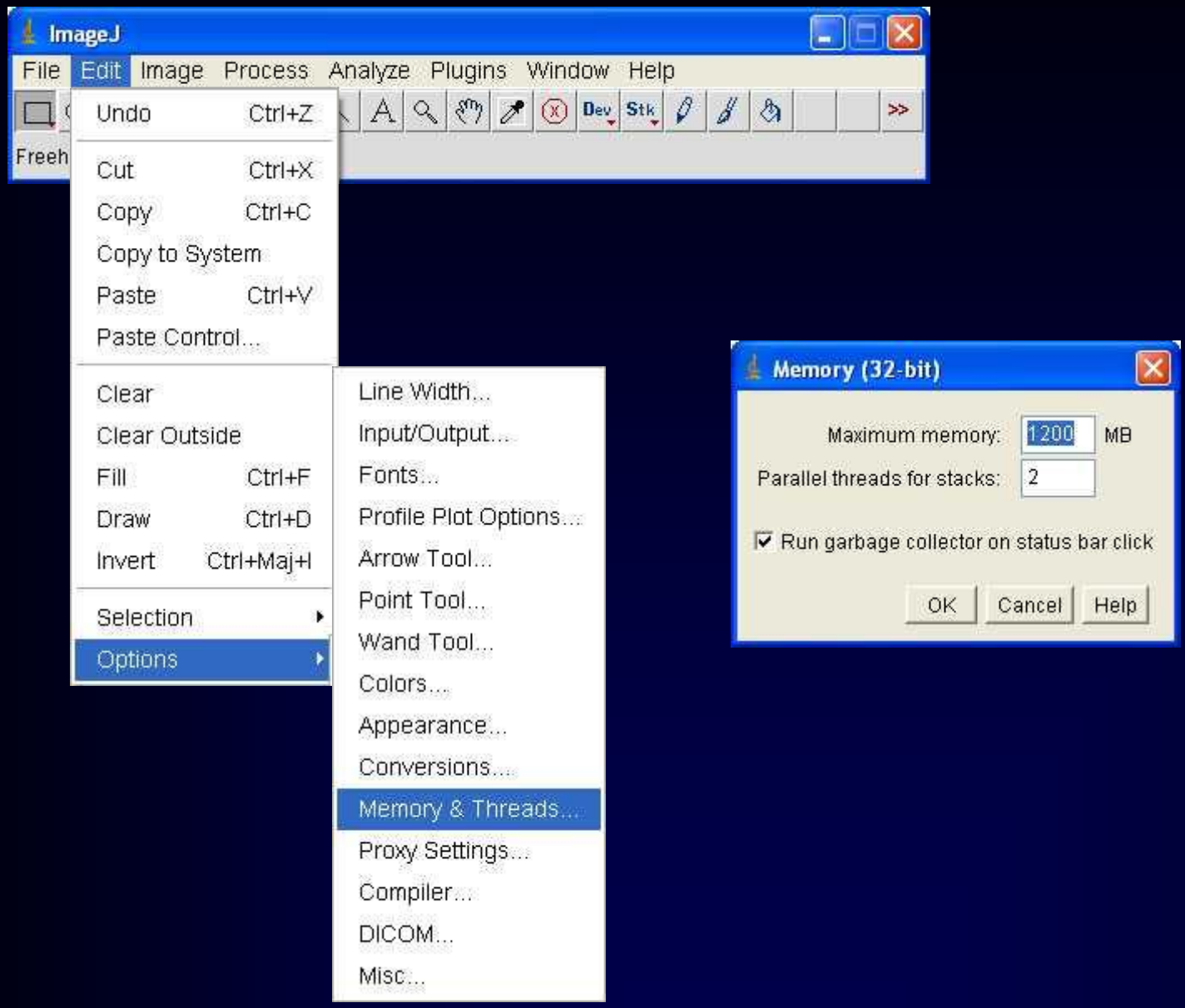
Installation





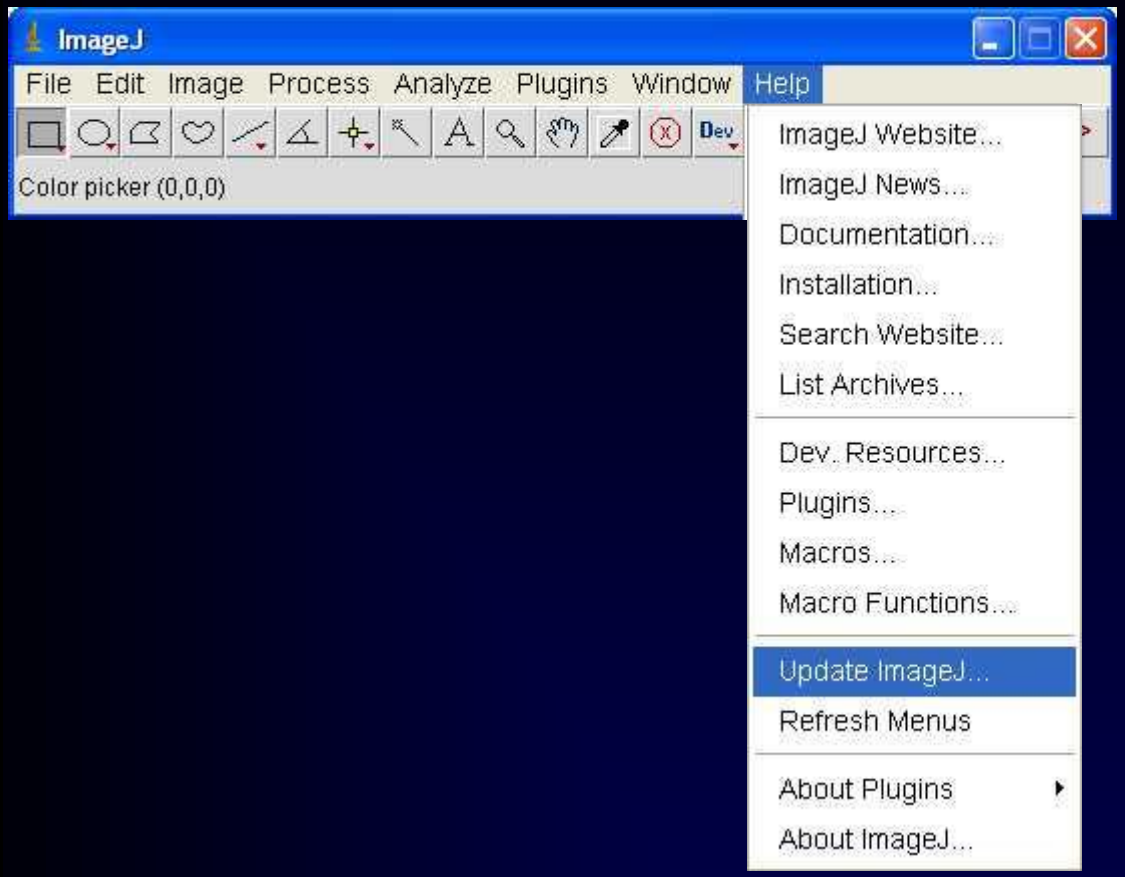
Configuration

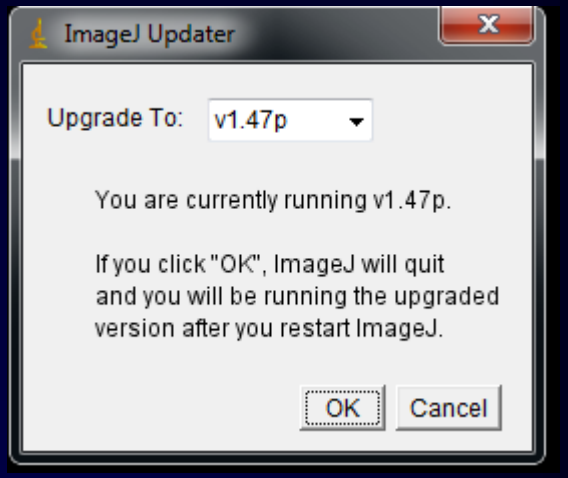
Configuration

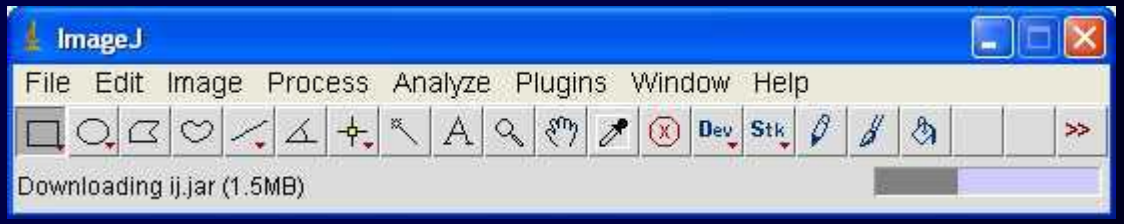


Edit → Option → Memory & Treads...

Mise à jour

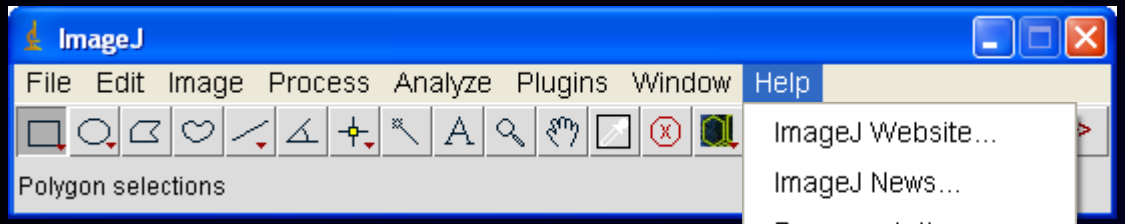


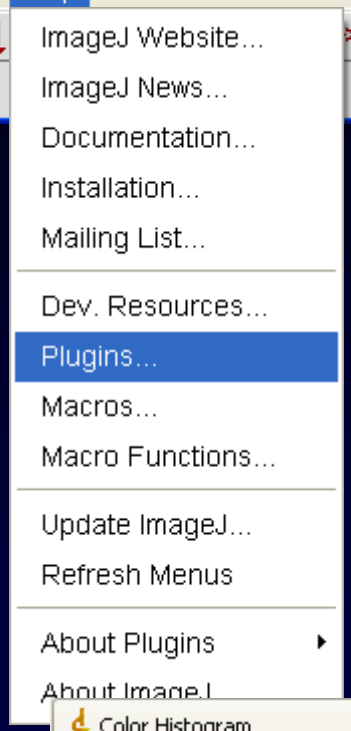


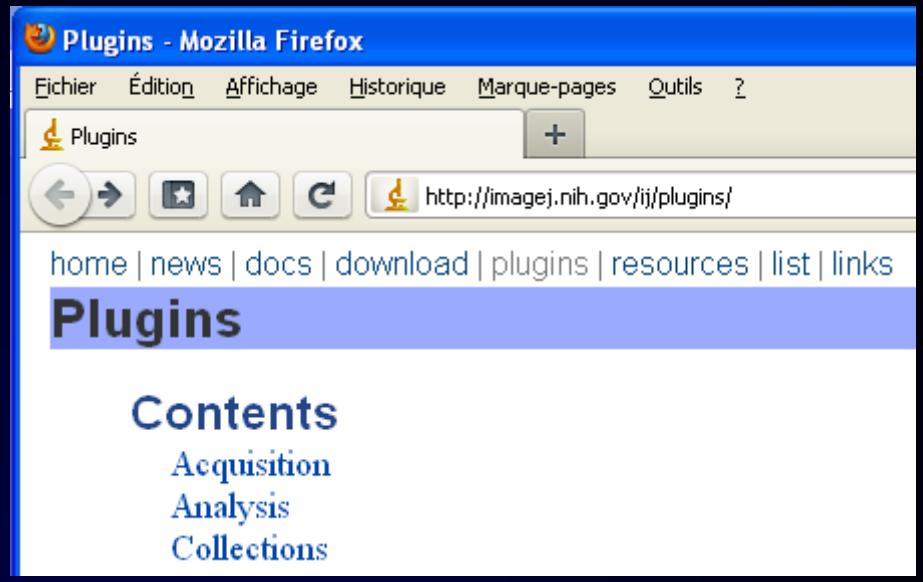


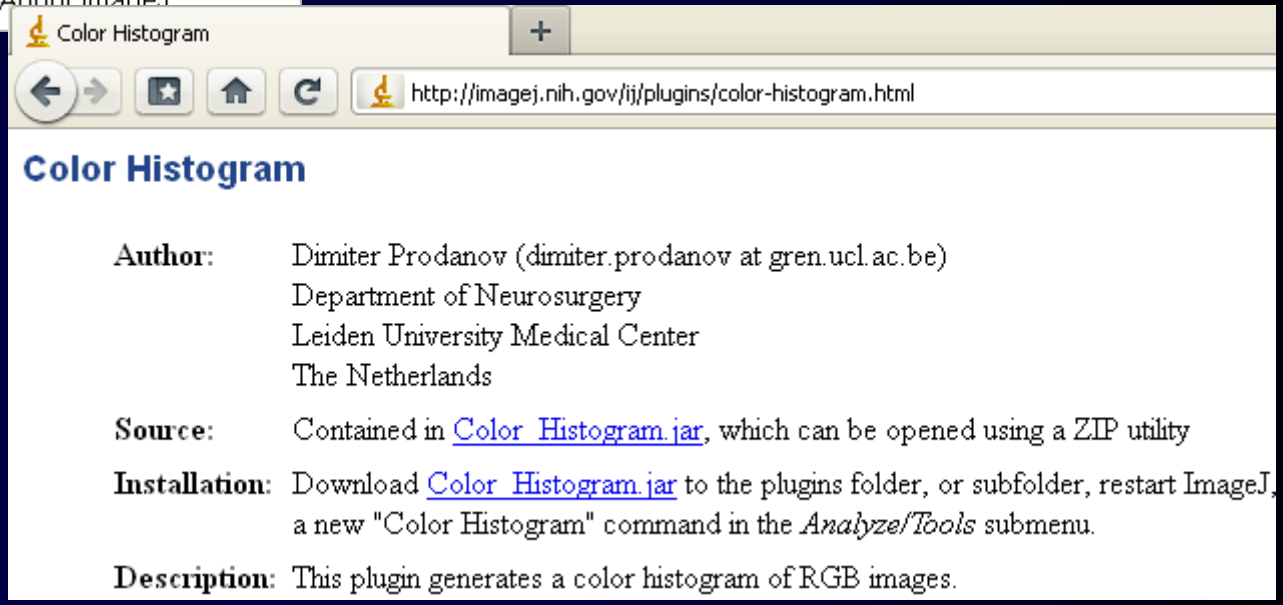
Help→ Update ImageJ...

Installation de Plugins









- Recherche des plugins Sur internet Help-->Plugins...

- Glisser-Déposer les fichiers .class ou .jar sur la fenêtre ImageJ

- Choisir l'emplacement dans le répertoire Plugins

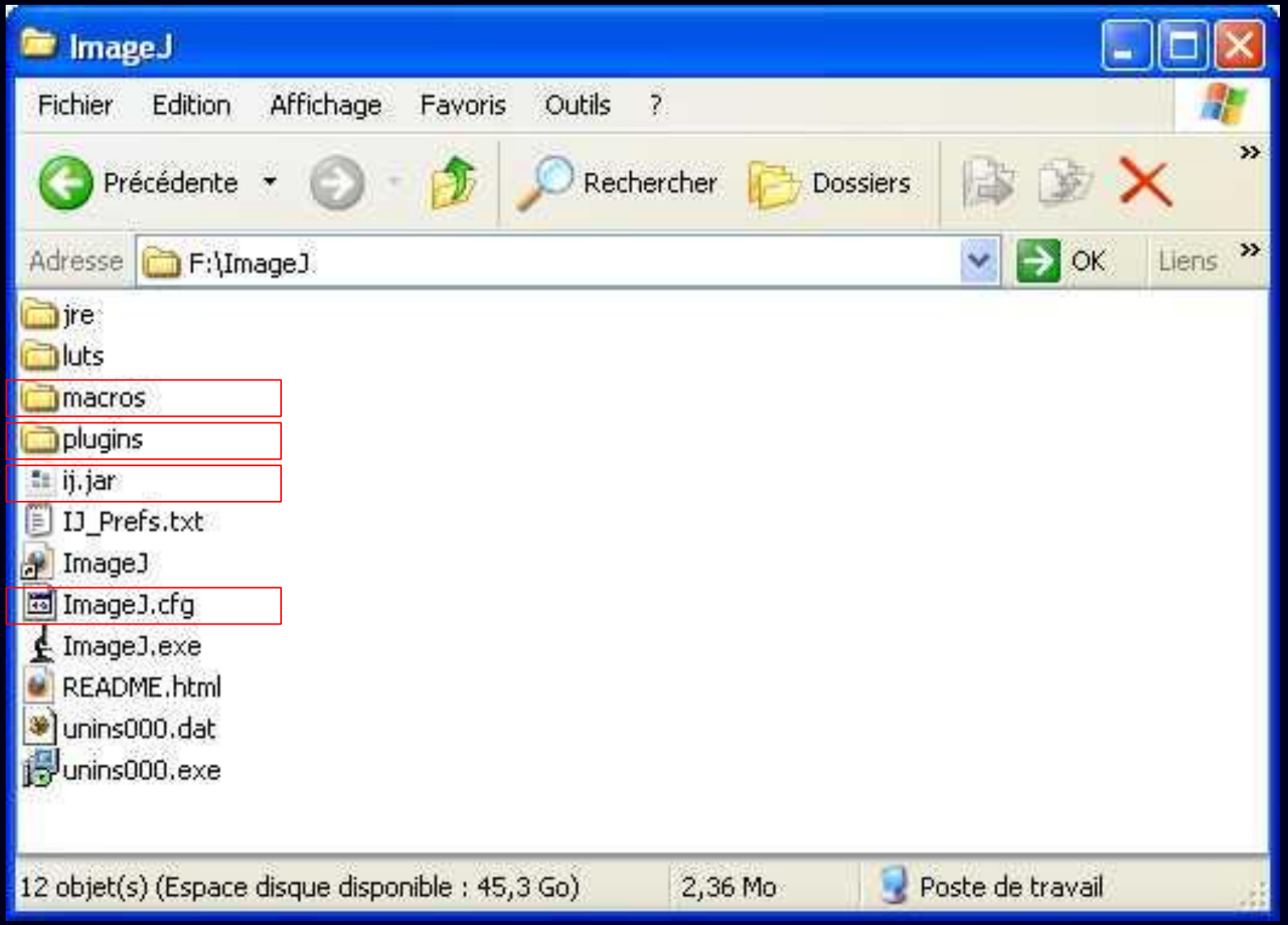
- Mettre à jour les menus Help--> Refresh Menus

- Apparition de la nouvelle commande dans le menu Plugins

Help→ Plugins...

Help→ Refresh Menus

Dossiers ImageJ



Topic 01 - Installation, configuration, help and updates

Les bases pour l'utilisation d'ImageJ

Interface

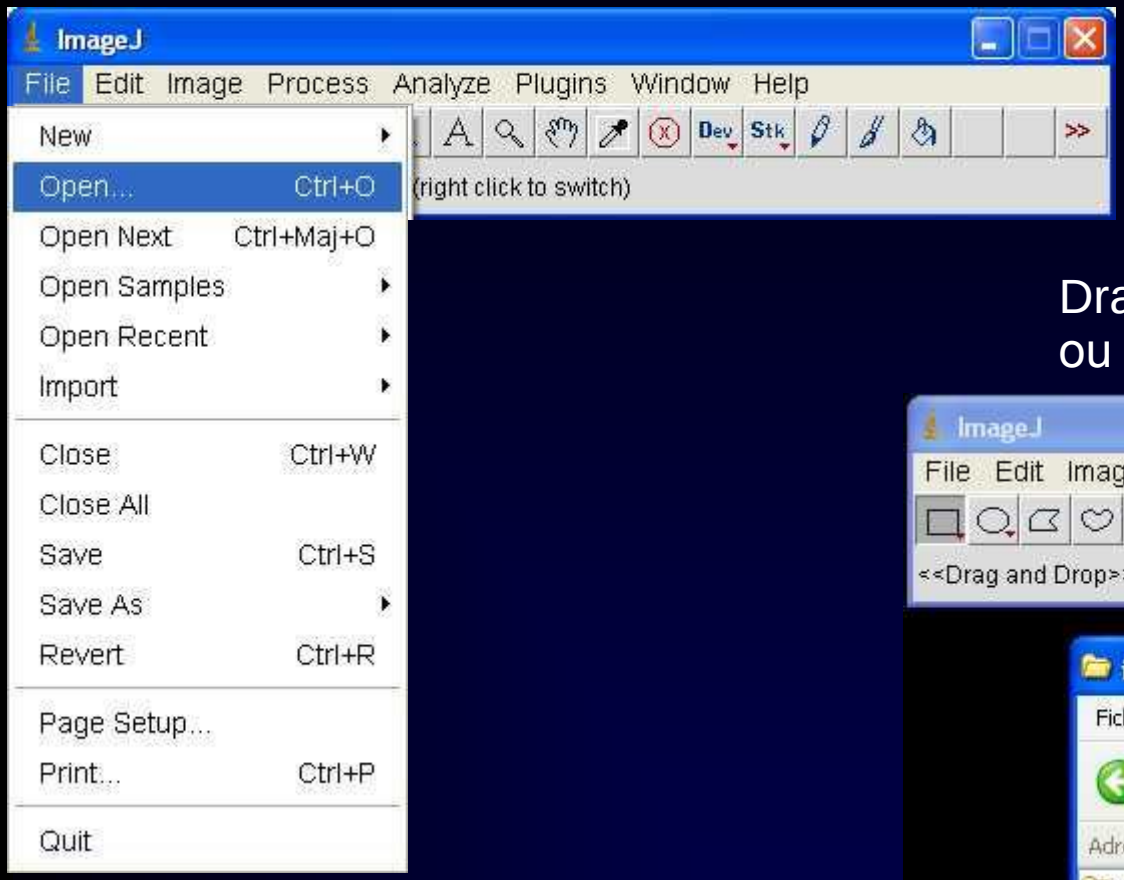
Barre de menu

Barre d'outils

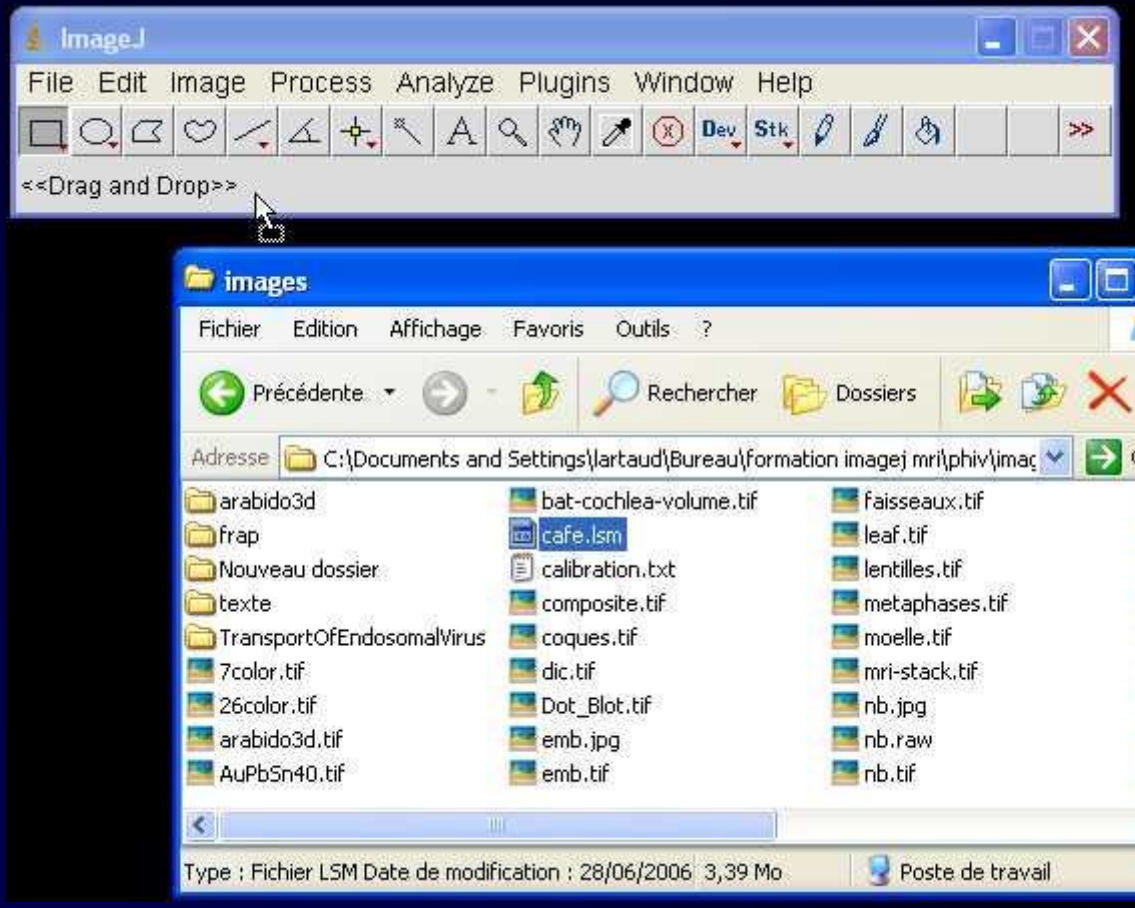
Barre d'état

Ouvrir une image

File → Open...



Drag and Drop sur la fenêtre
ou l'icône



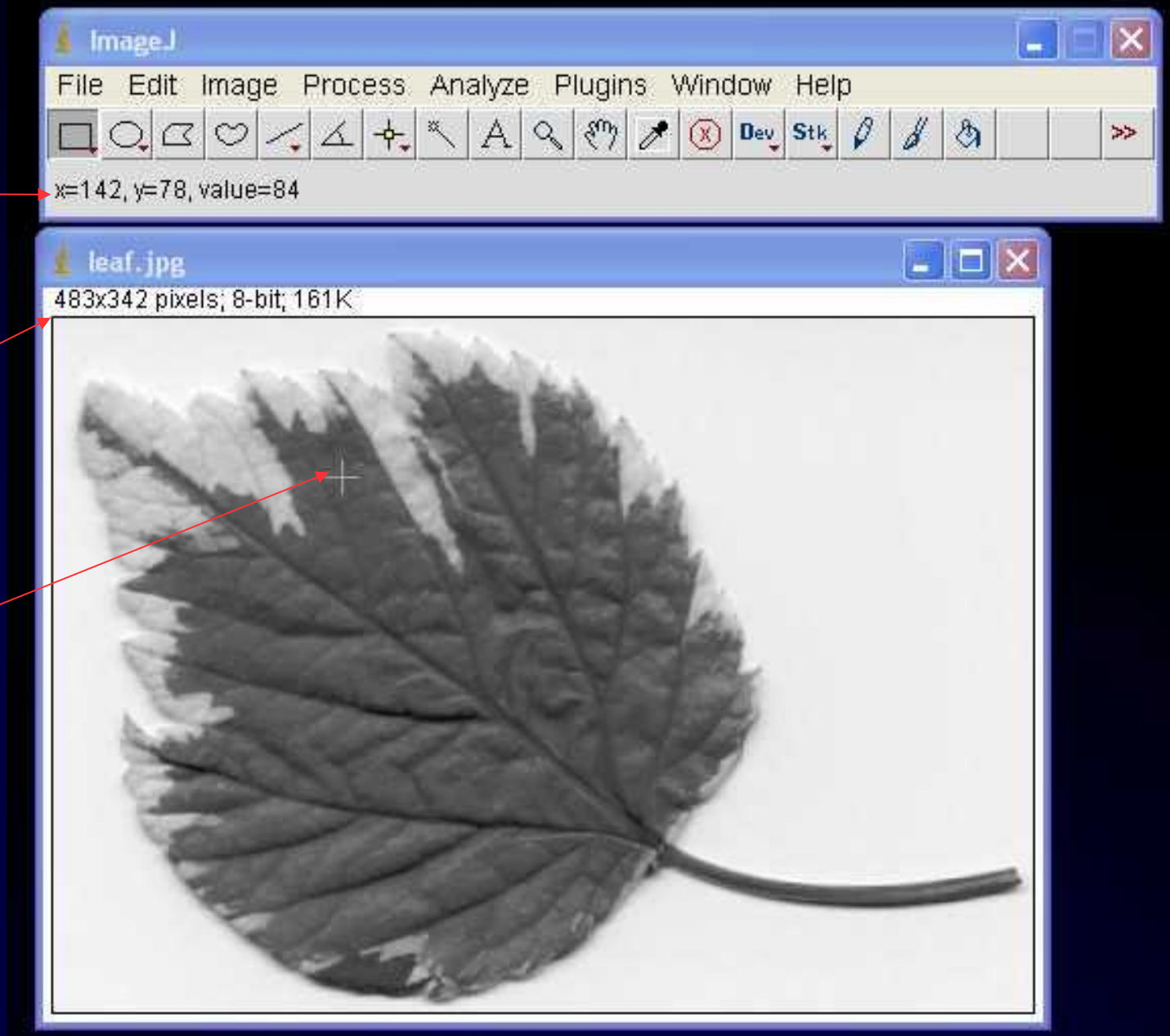
File → Open ...

Informations pixel

Informations sur le pixel
sous le curseur de la souris
position en x,y
et valeur en niveau de gris

Informations image

Curseur de souris



Zoom

Déplacement de l'image dans la fenêtre
Avec la souris et la barre d'espace appuyée

Touche « - »

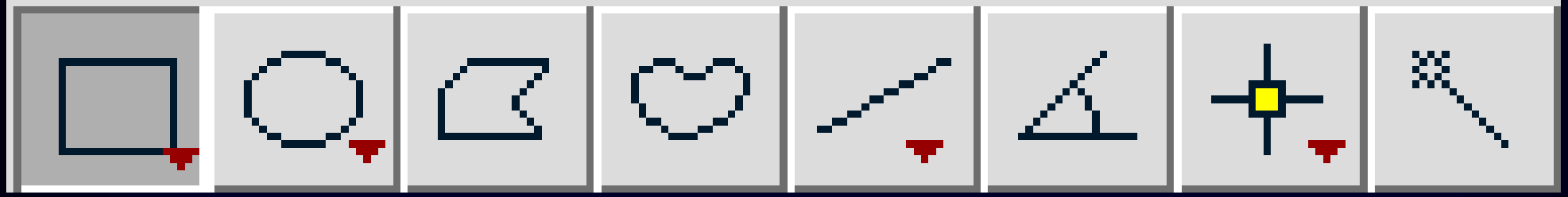
Touche « + »

Zone affichée

Rapport affichage/image

Outils de sélection (ROI)

Rectangle | Ovale | Polygone | À main levée | Ligne | Angle | Point | Baguette



Choix d'outils différents : Clic droit sur triangle rouge

- ✔ Rectangle Tool
  - Rounded Rectangle Tool
- ✔ Oval selections
  - Elliptical selections
  - Selection Brush Tool
- ✔ Straight Line
  - Segmented Line
  - Freehand Line
  - Arrow tool
- ✔ Point Tool
  - Multi-point Tool

Options : Double clic sur l'icône de l'outil

Rounded Rectangle Tool

Stroke width: 2
Corner diameter: 20
Stroke color: black
Fill color: none
OK | Cancel

Selection Brush

Enable selection brush
Size: 15 pixels
OK | Cancel

Line Width

1
Spline Fit

Point Tool

Mark Width: 0 pixels
Auto-Measure
Auto-Next Slice
Add to ROI Manager
Label Points
Selection Color: yellow
OK | Cancel

Wand Tool

Mode: Legacy
Tolerance: 10.0
Enable Thresholding
OK | Cancel

Ajouter à la sélection : Maj-clic

Supprimer de la sélection : Alt-clic

Retrouver la sélection : Edit → Selection → Restore Selection

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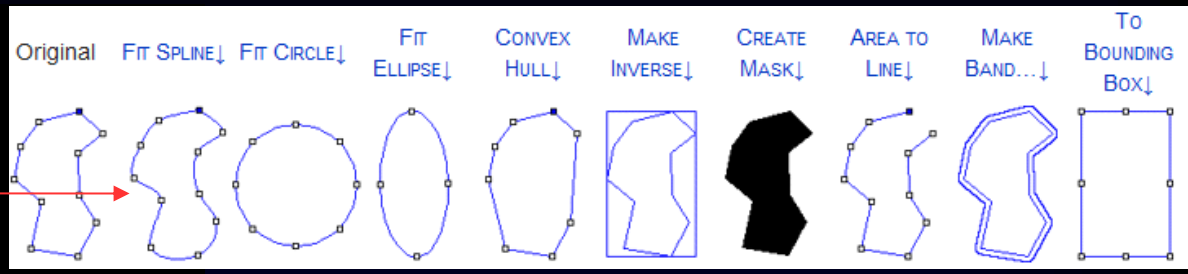
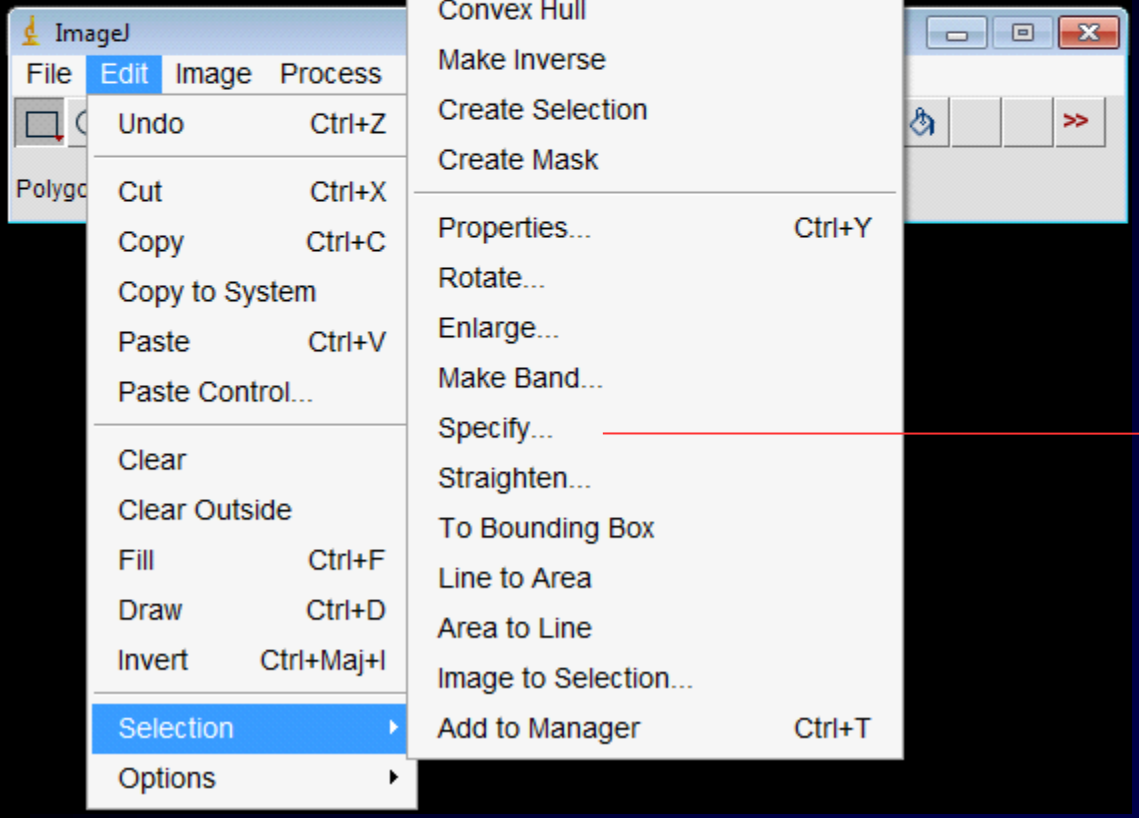
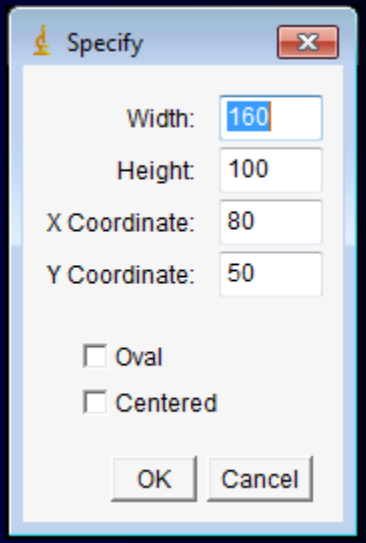
Menus de sélection







Edit → Selection

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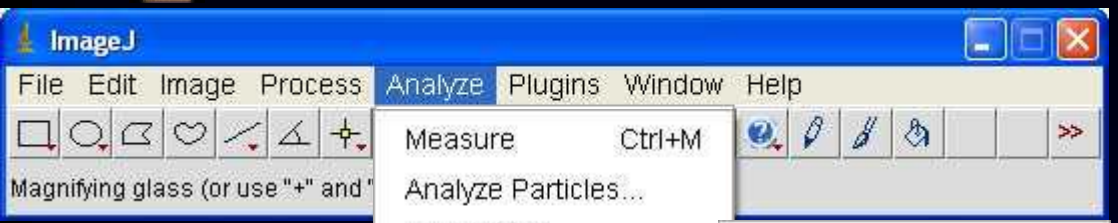
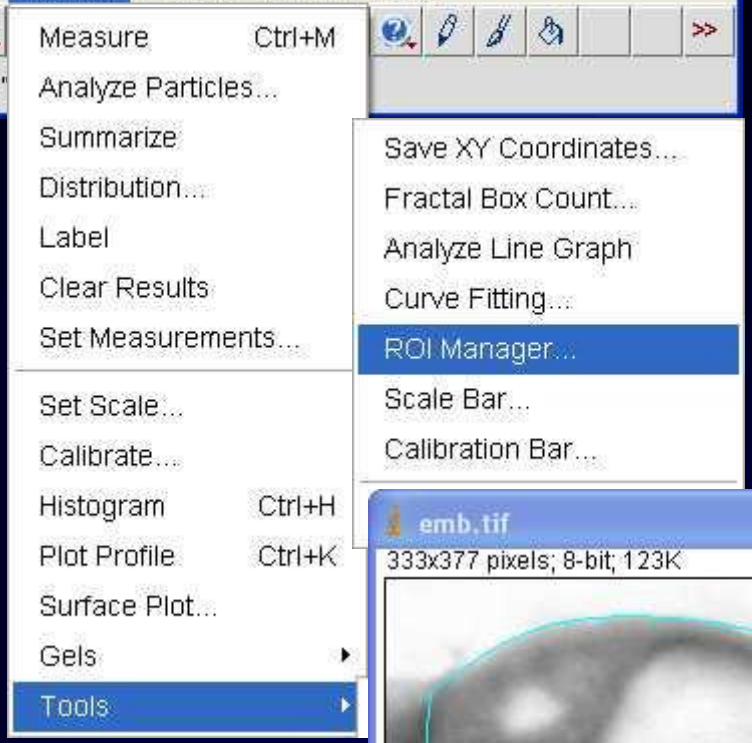
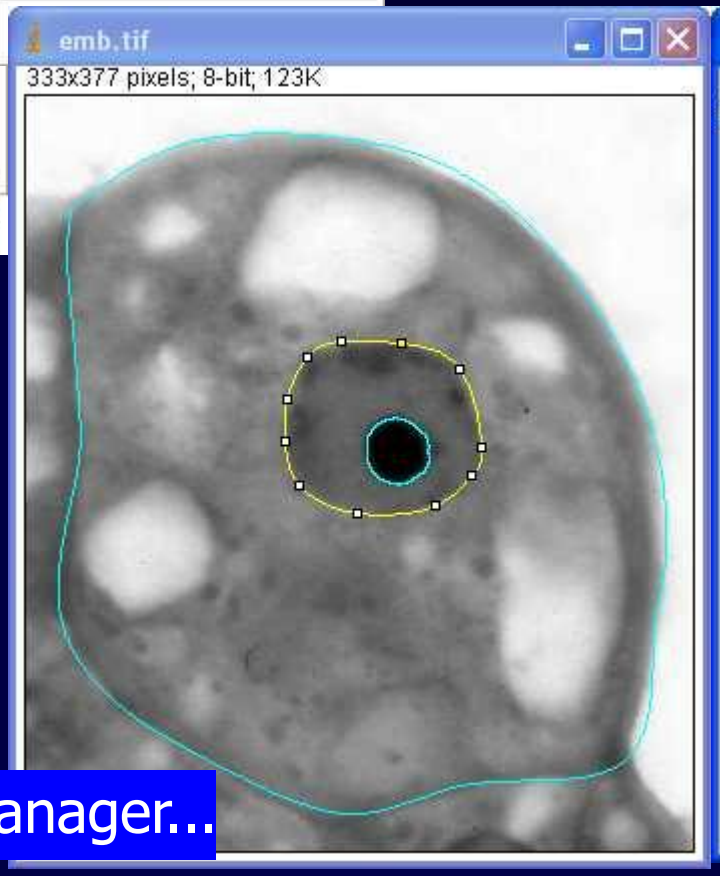
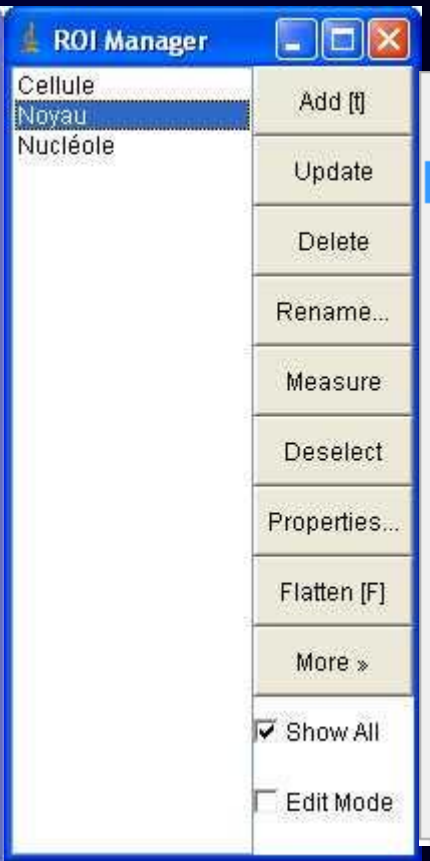
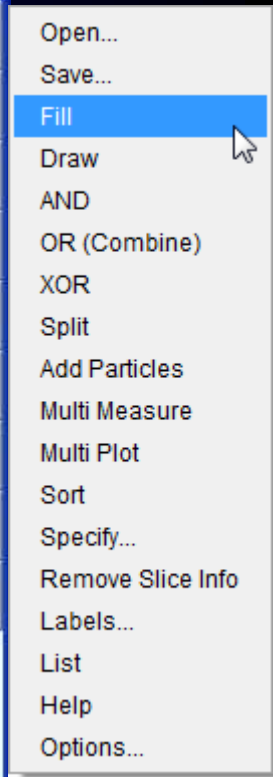
ROI Manager











Analyse → Tools → ROI Manager...

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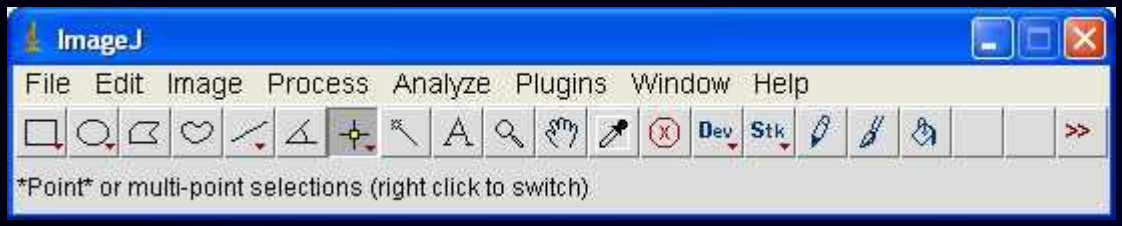
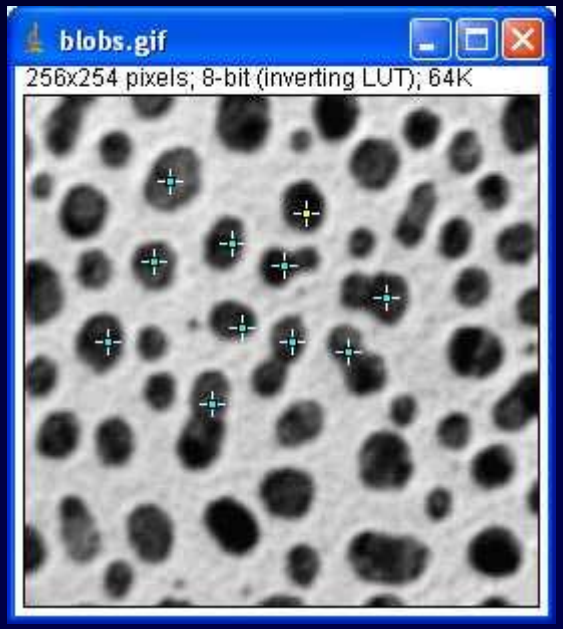
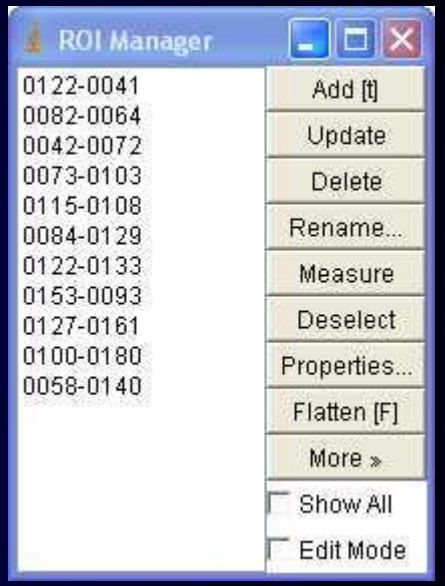
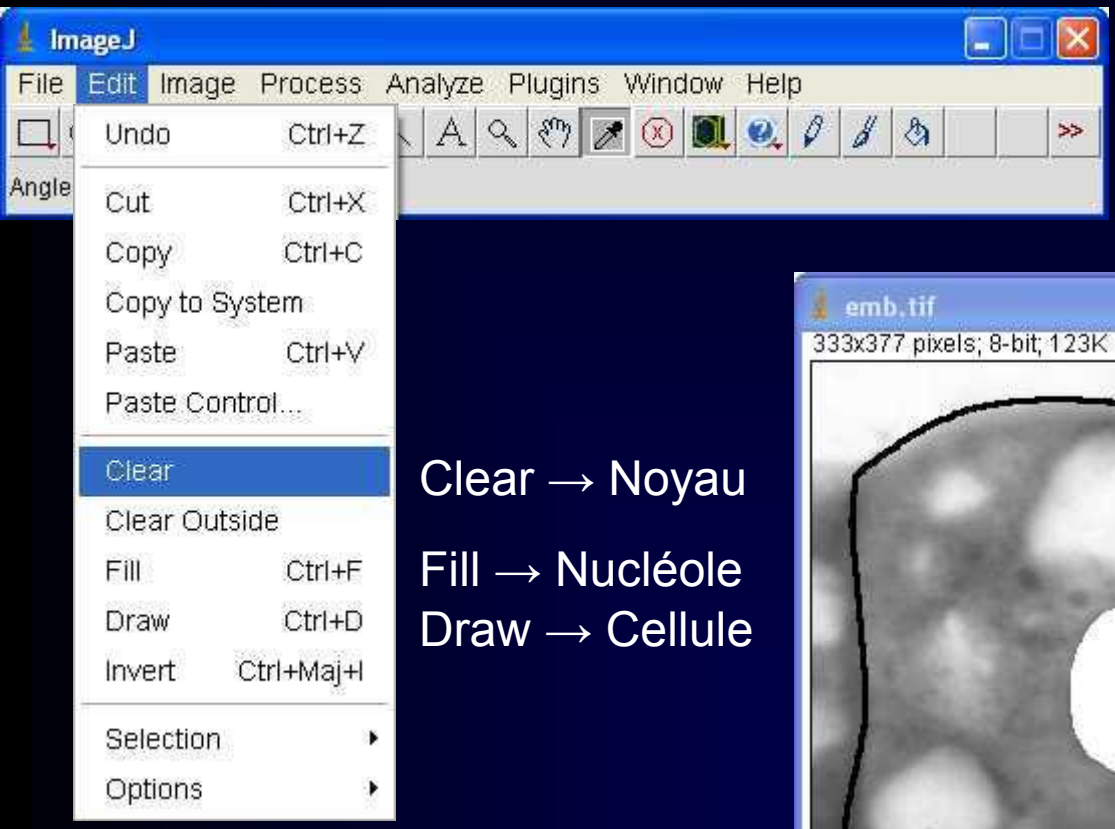
Outil Point pour le comptage







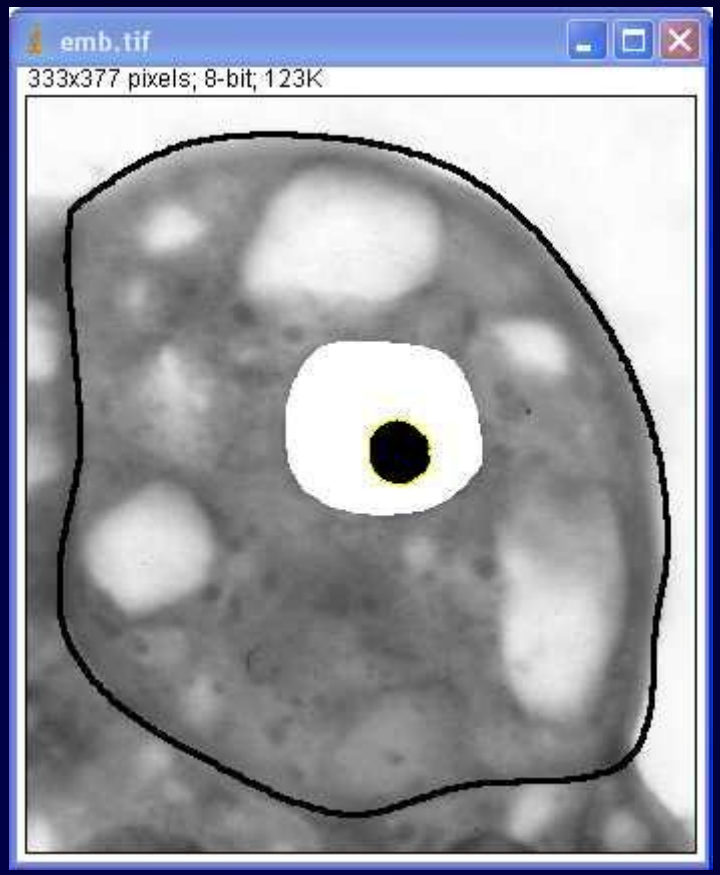
Dessin



Clear → Noyau

Fill → Nucléole

Draw → Cellule



Edit → Clear...

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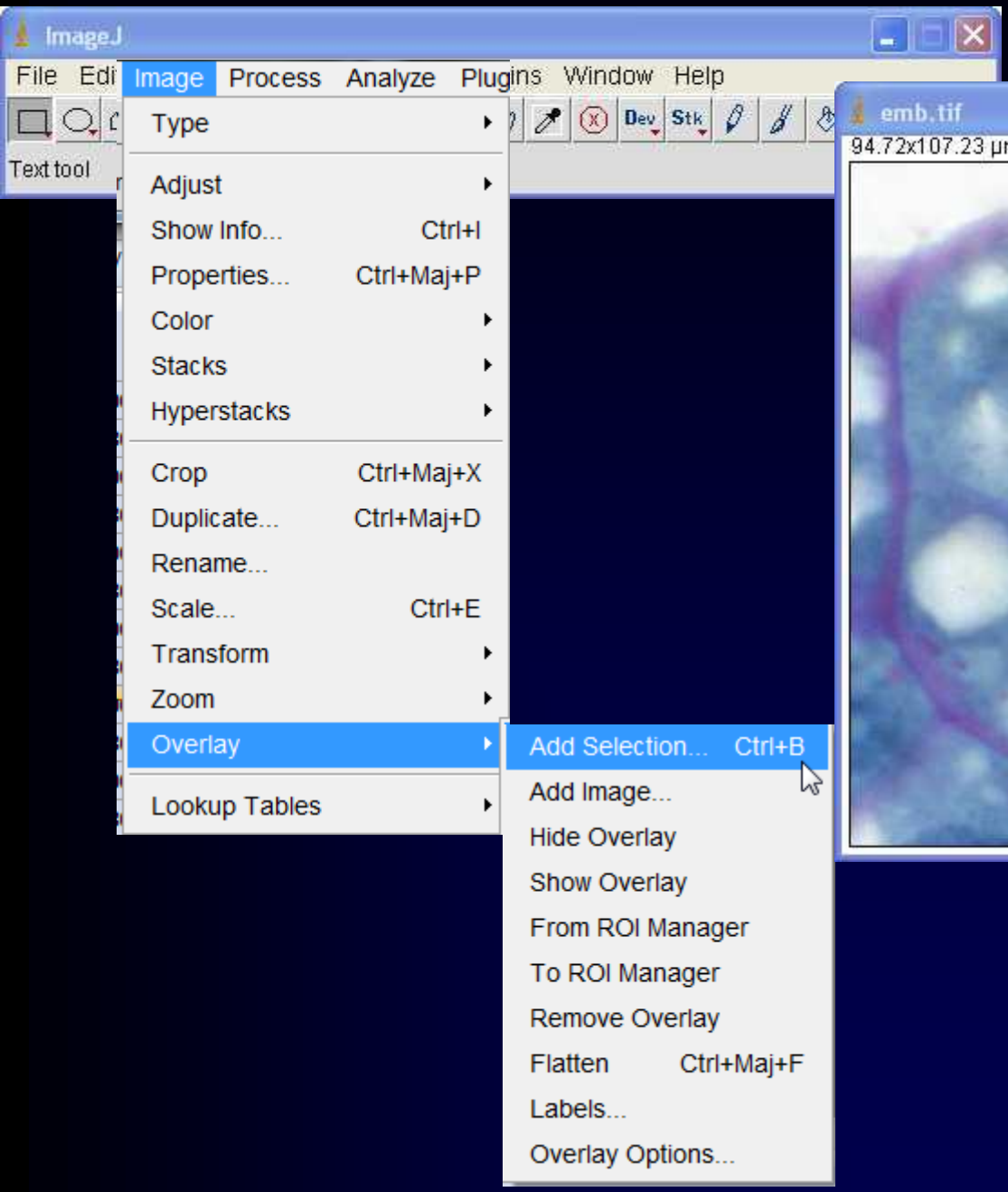
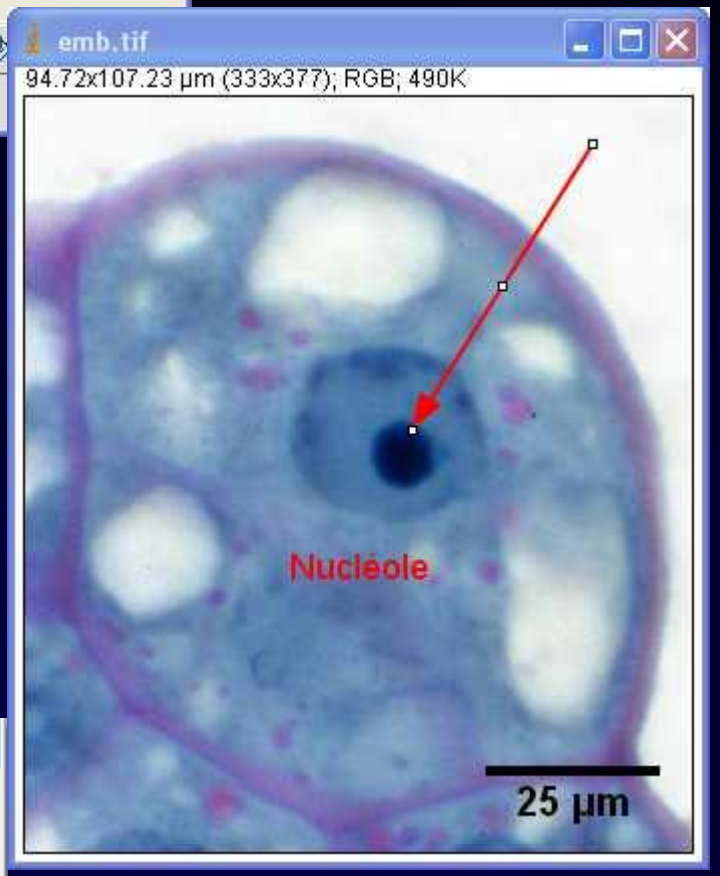
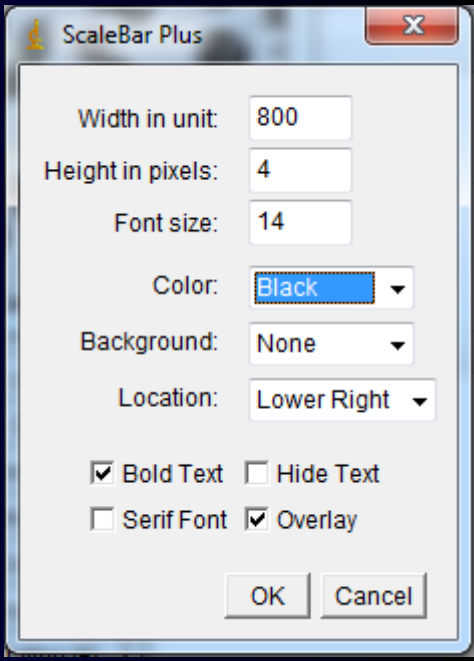
Annotations







Image→Overlay→Add Selection...

Analyse→Tools→Scale Bar...

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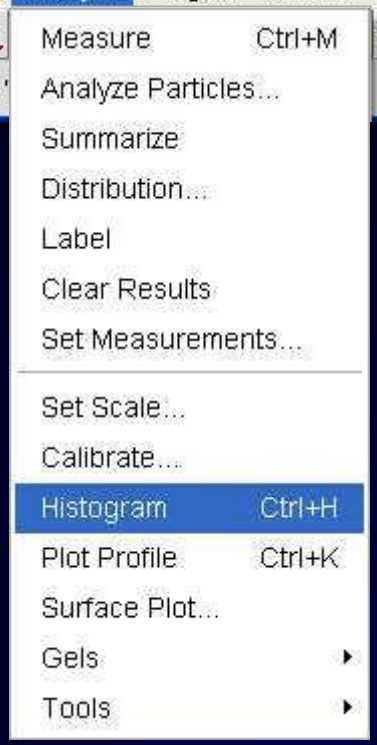
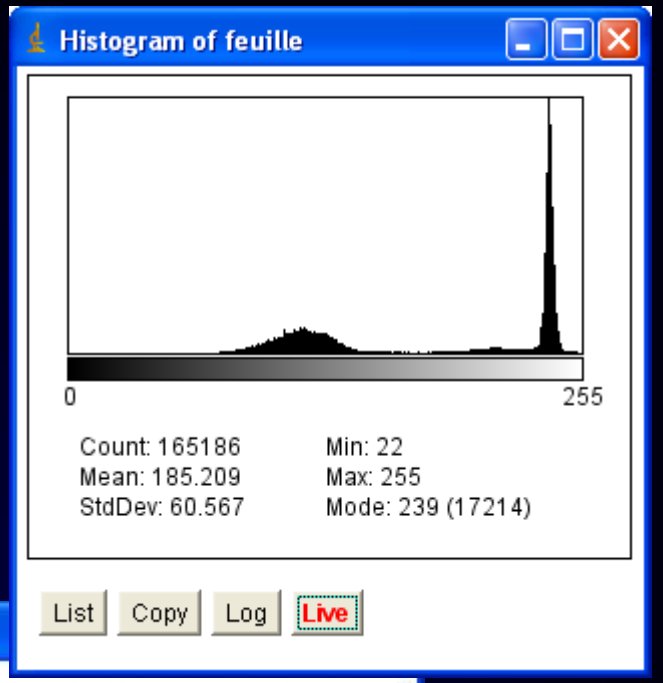
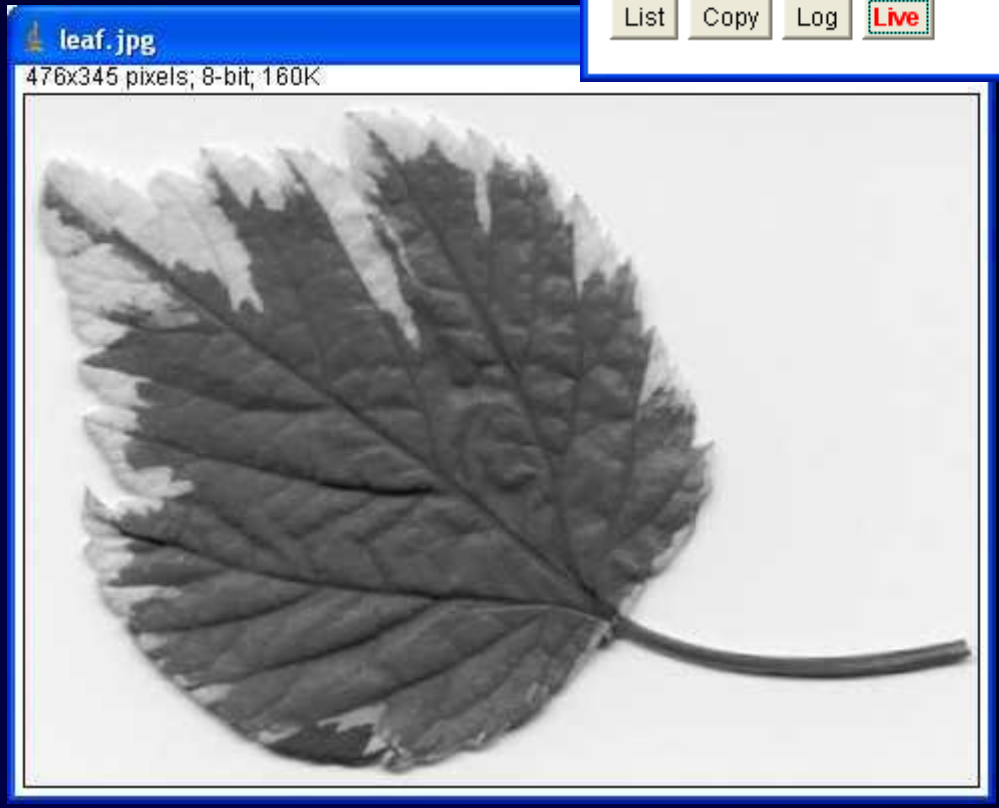
Histogramme

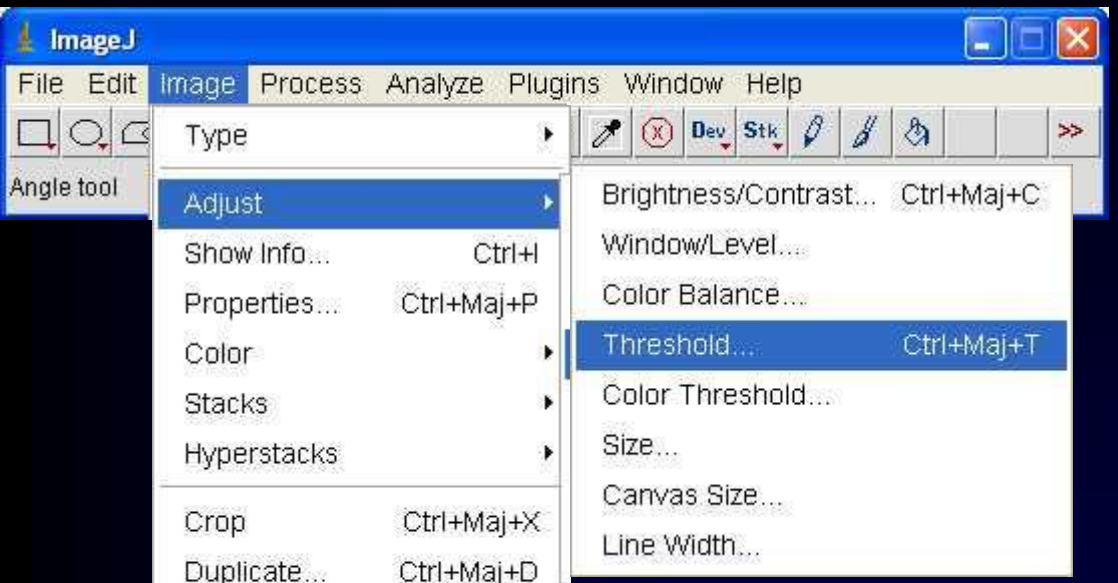


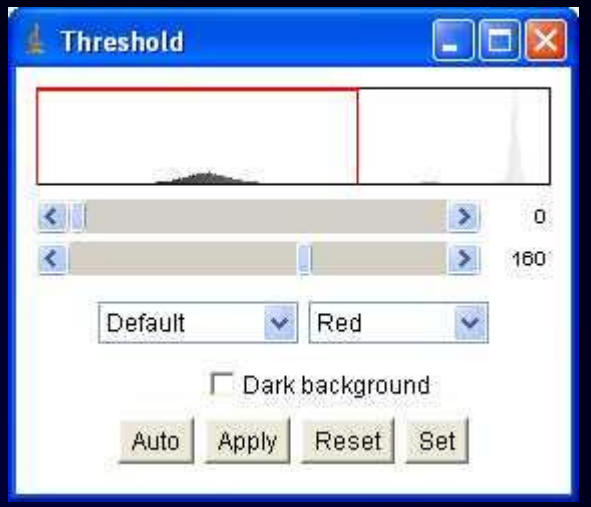


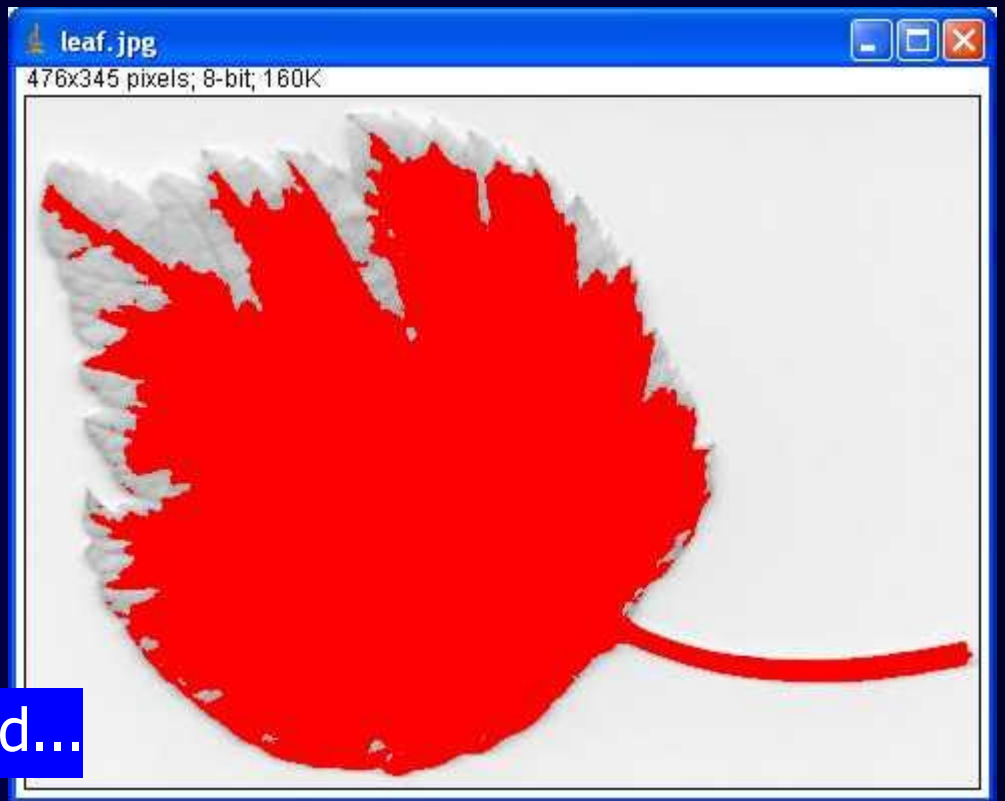


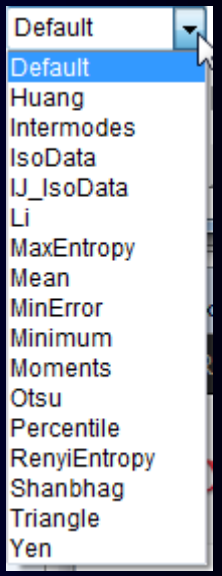
Analyse→Histogram

Seuillage









Image→Adjust→Threshold...

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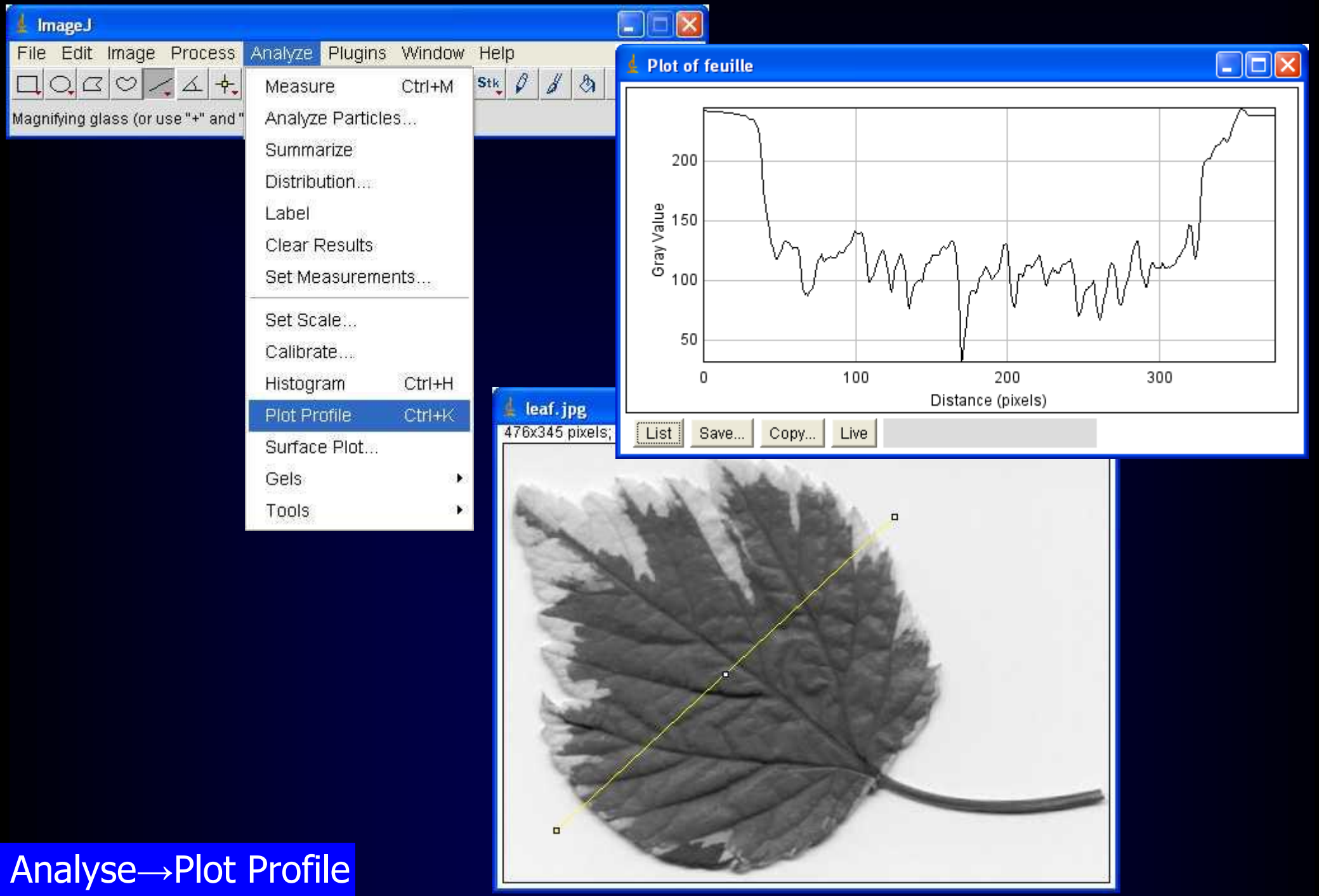
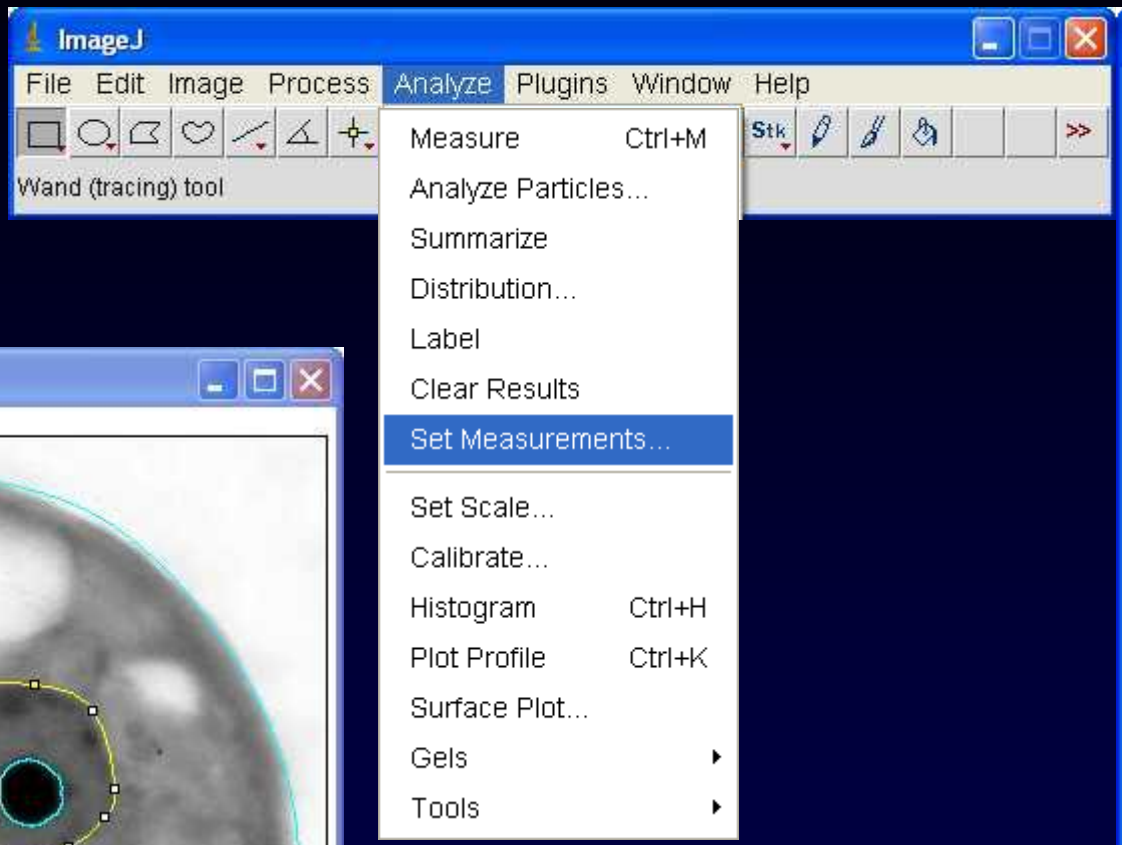
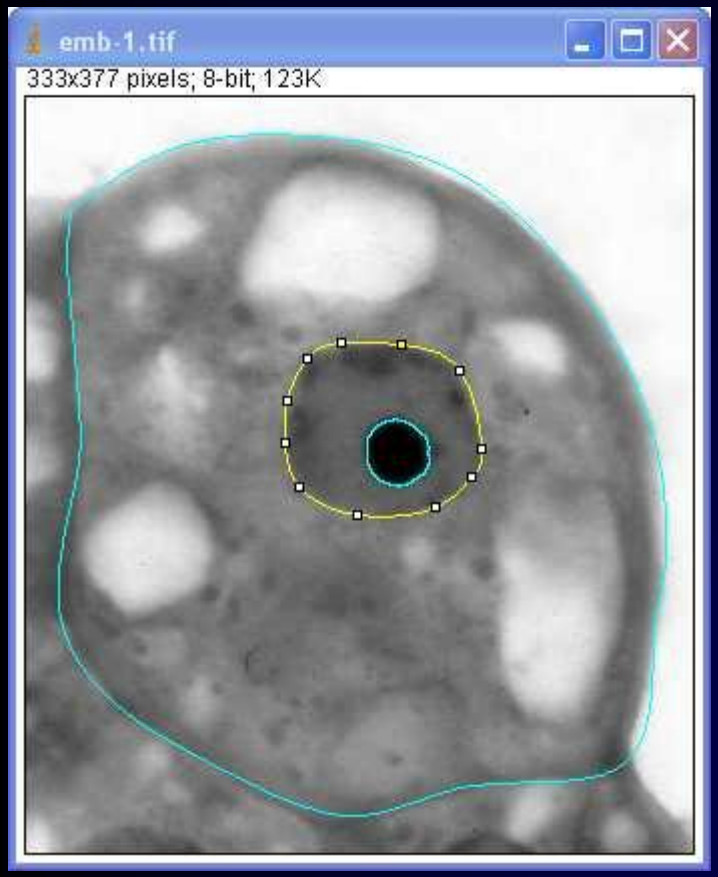
Plot Profile

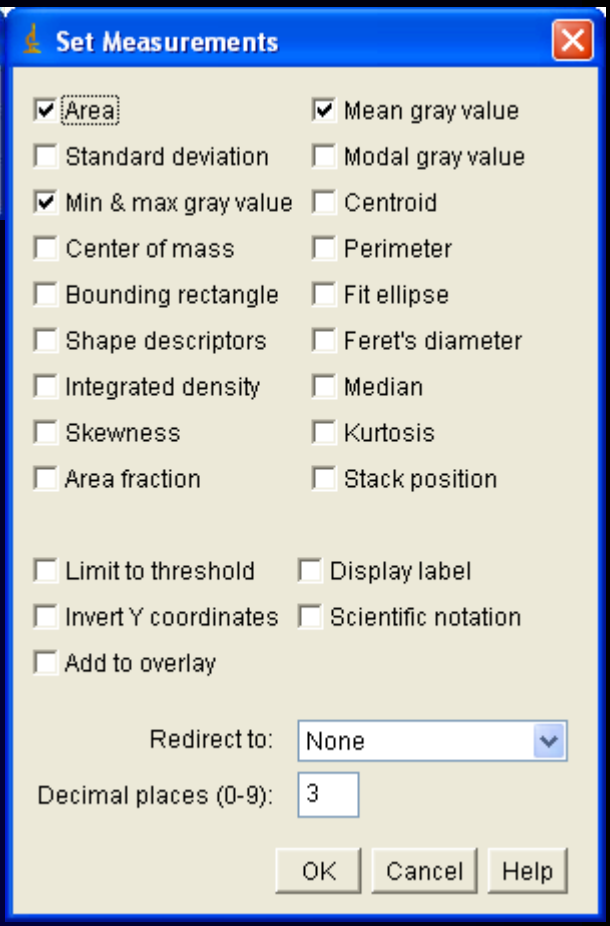


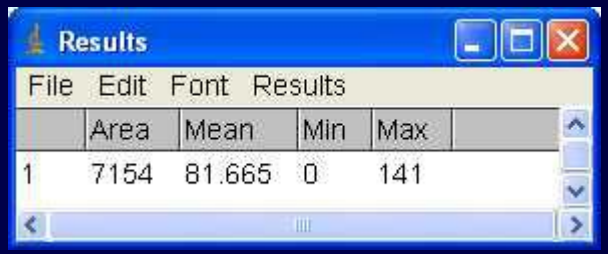
Analyse→Plot Profile

Mesures de sélection









Analyse→Measure

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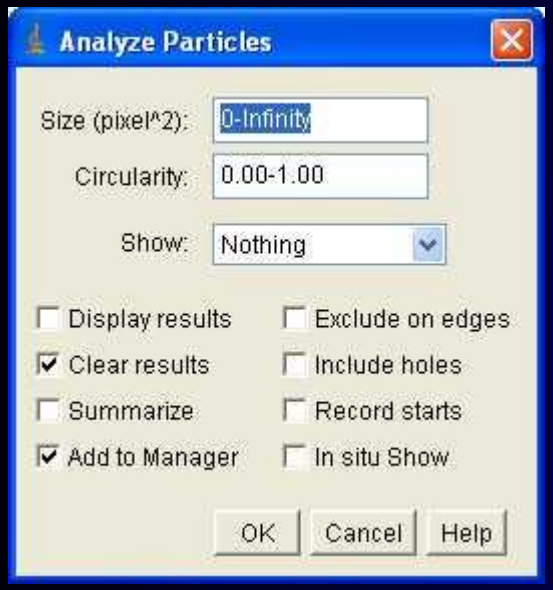
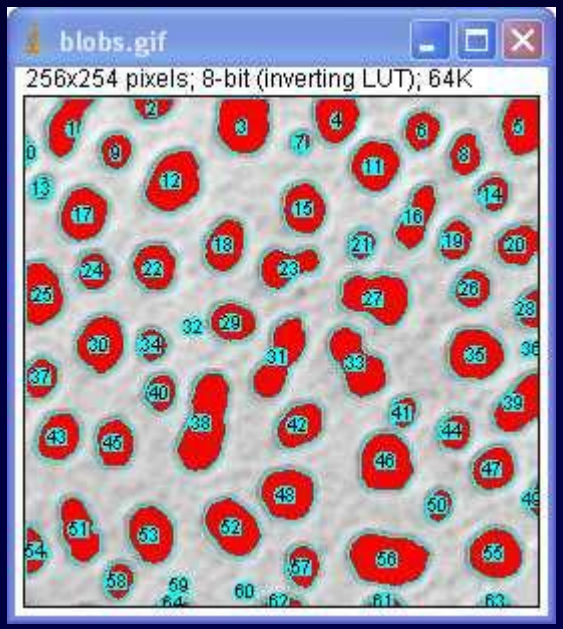
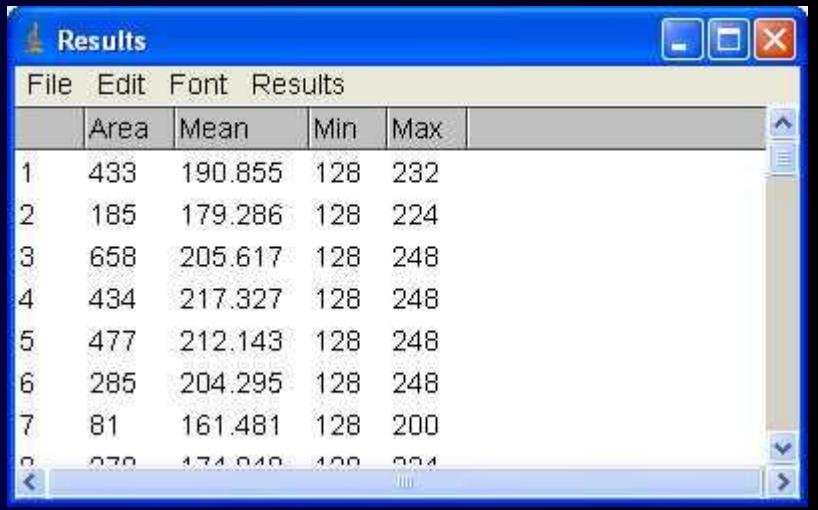
Mesures d'objets

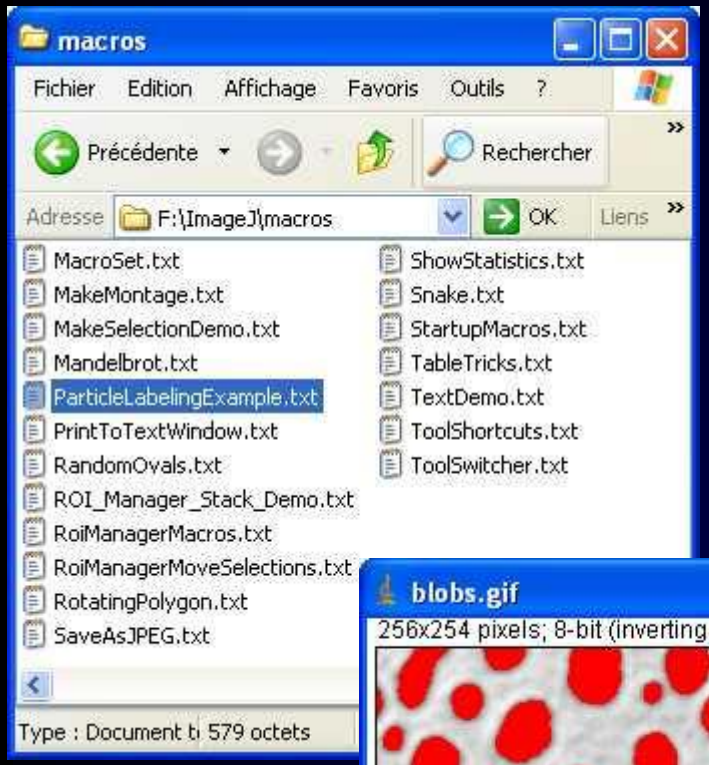


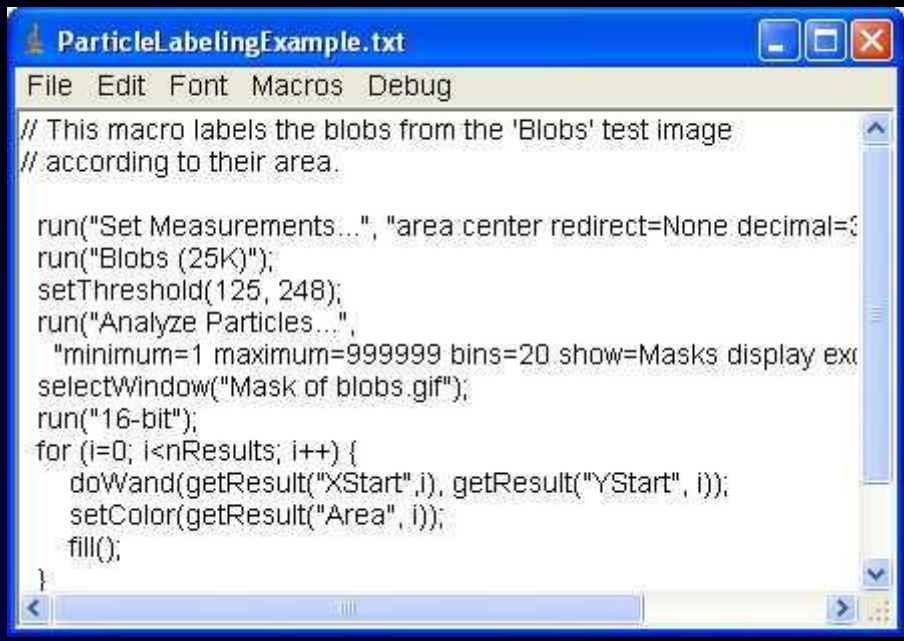


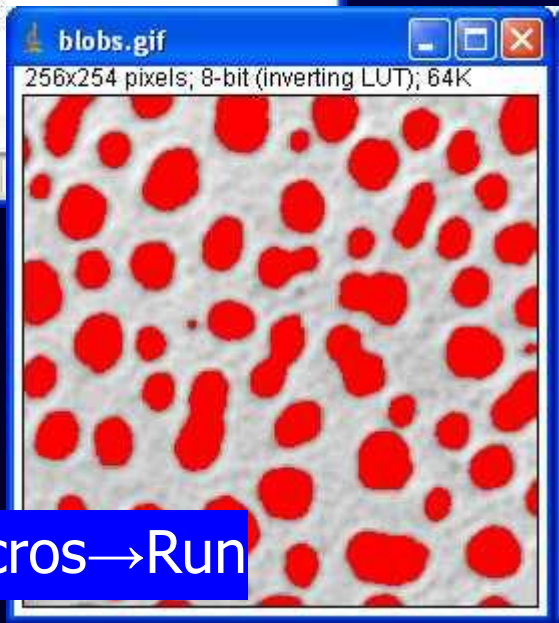


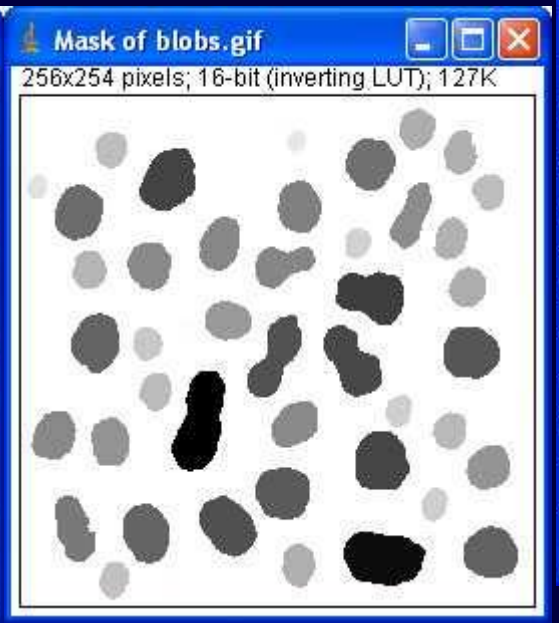
Analyse→Analyse Particles...

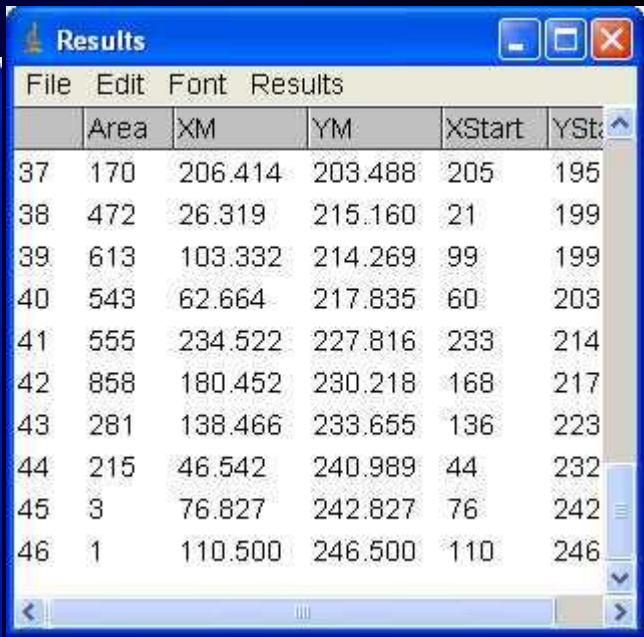
Macro







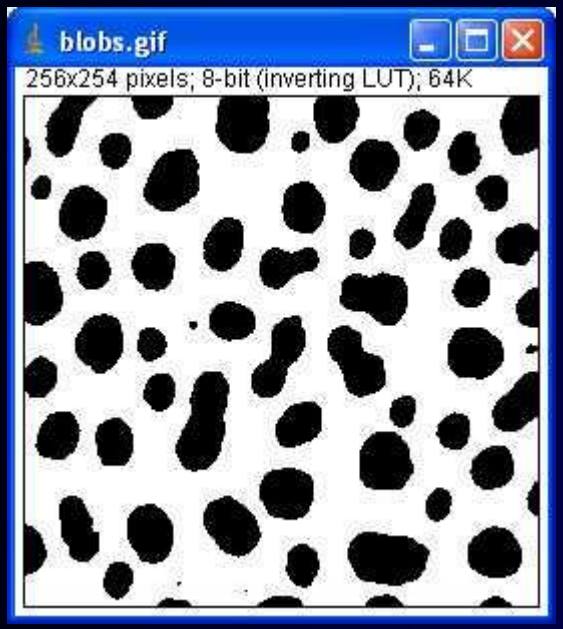


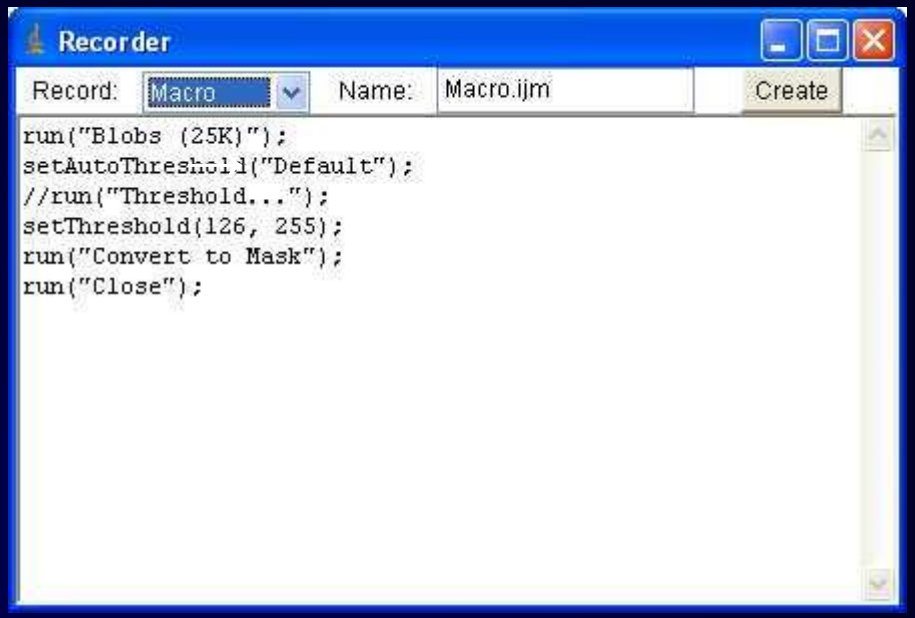


	Area	XM	YM	XStart	YSt
37	170	206.414	203.488	205	195
38	472	26.319	215.160	21	199
39	613	103.332	214.269	99	199
40	543	62.664	217.835	60	203
41	555	234.522	227.816	233	214
42	858	180.452	230.218	168	217
43	281	138.466	233.655	136	223
44	215	46.542	240.989	44	232
45	3	76.827	242.827	76	242
46	1	110.500	246.500	110	246

Plugins→Macros→Run

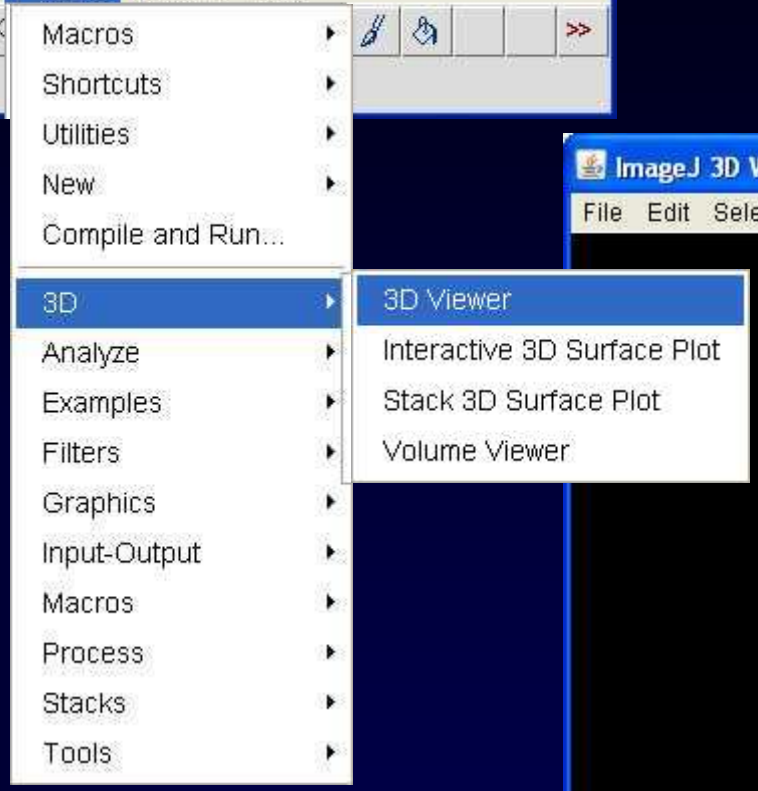
Enregistrement de macro

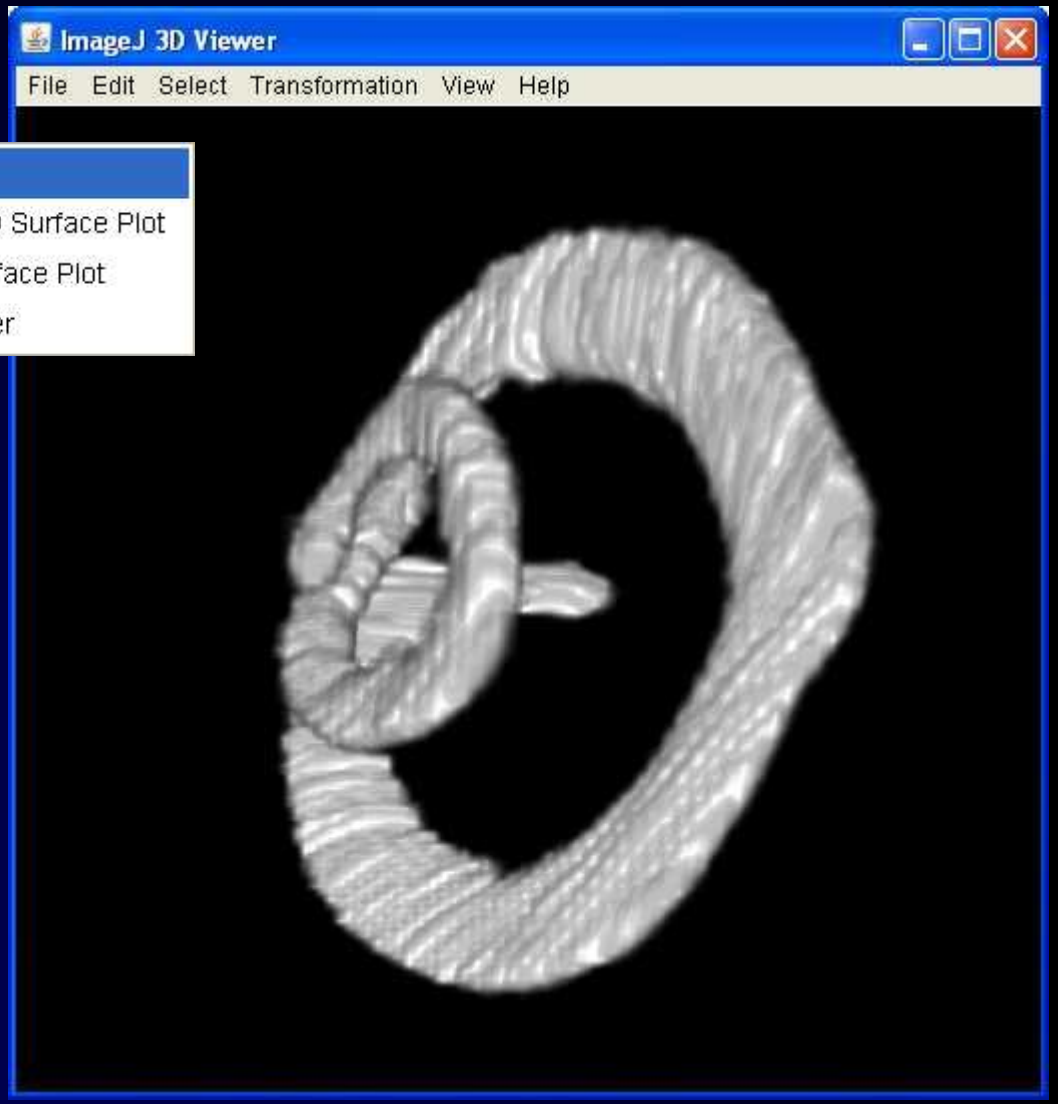




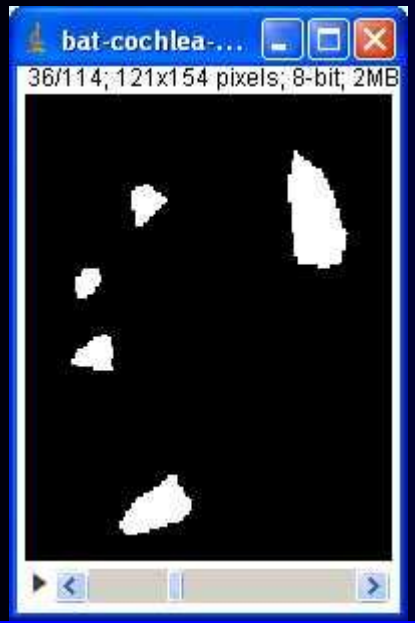
Plugins→Macros→Record...

Plugins



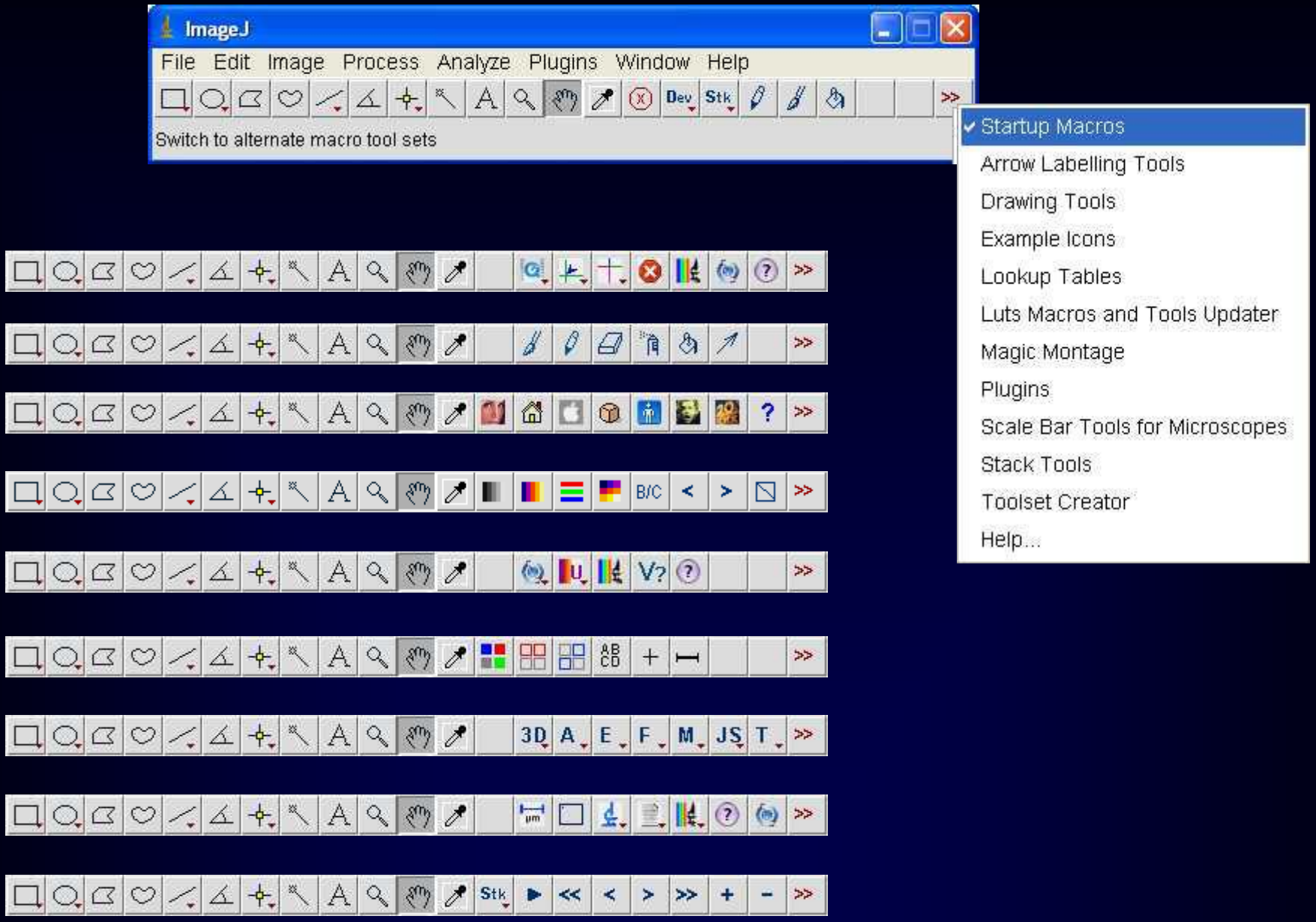


Stack

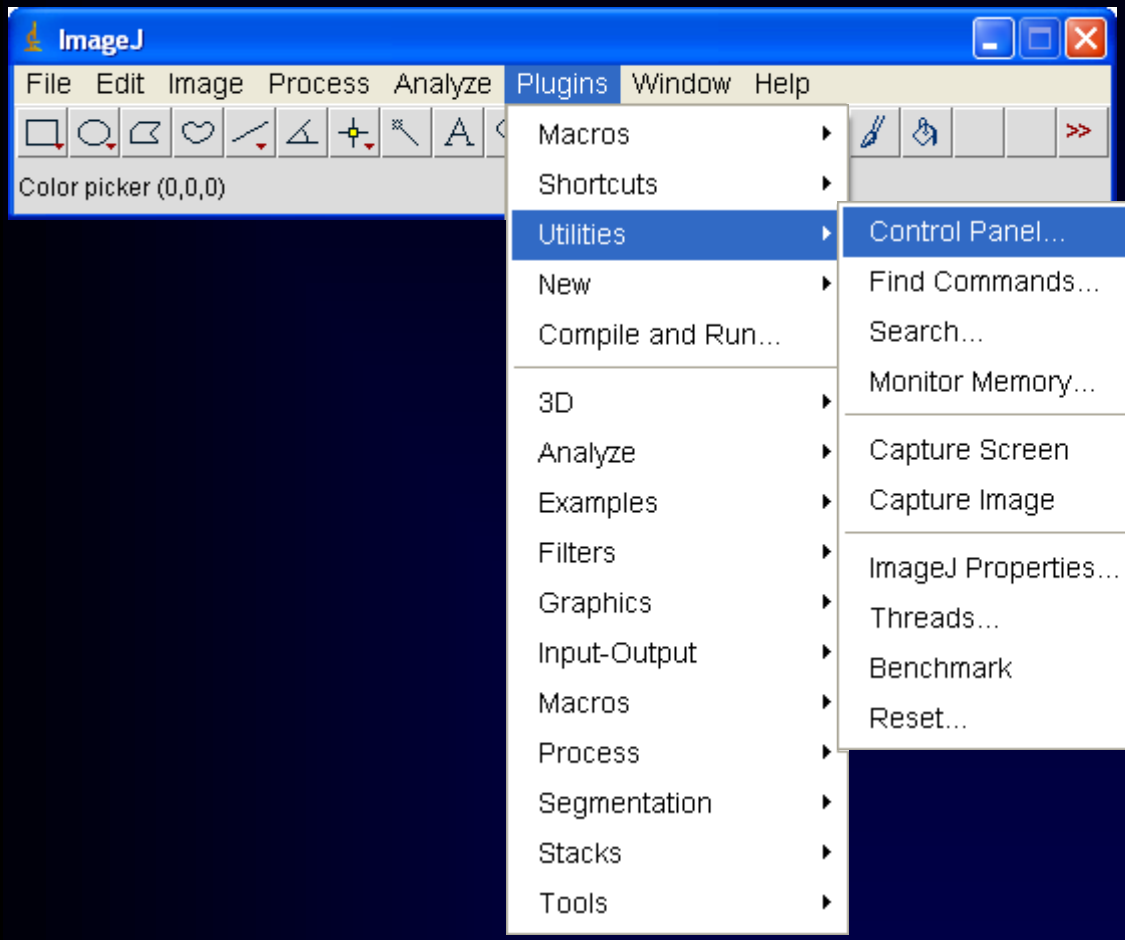


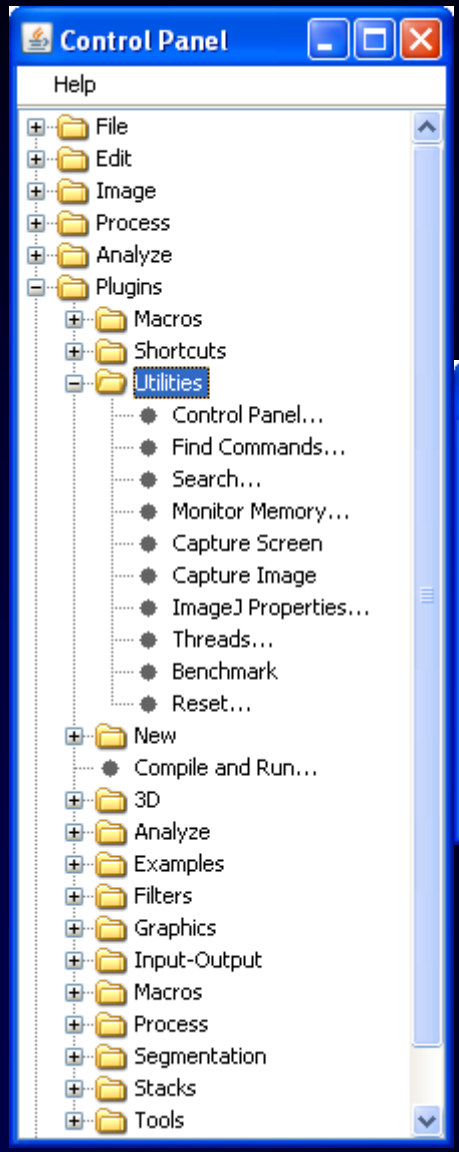
Plugins→3D→3D Viewer

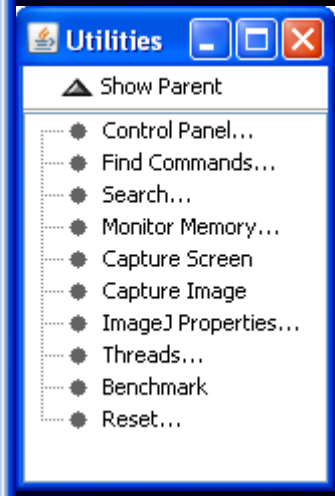
Barres d'outils



Panneaux de commandes







Plugins→Utilities→Control Panel

Topic 02 – Basic tools 1

Topic 03 – Basic tools 2

L’image numérique

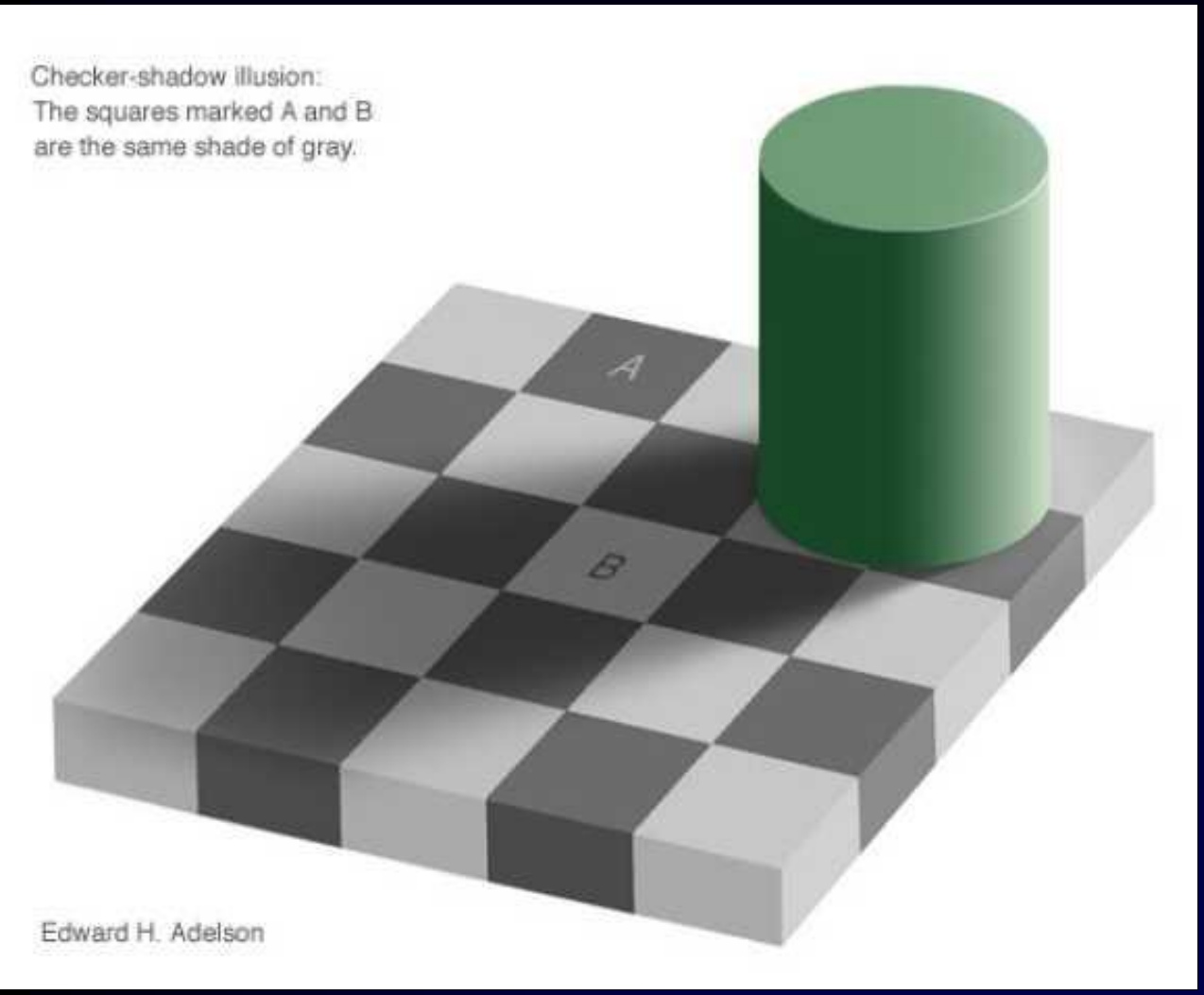
Les Prétraitements

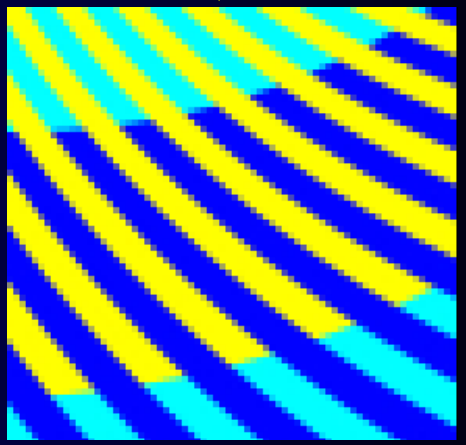
La Segmentation

Les Post-traitements

La Quantification

Image et perception





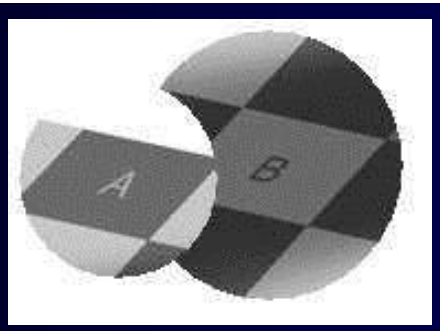
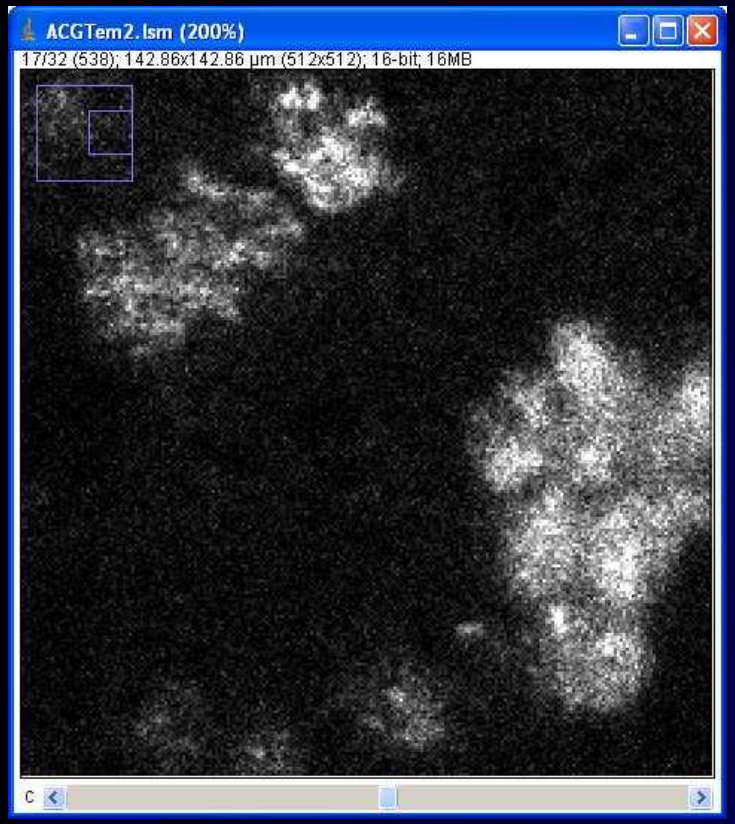


Image et déformations

Bruit



PSF

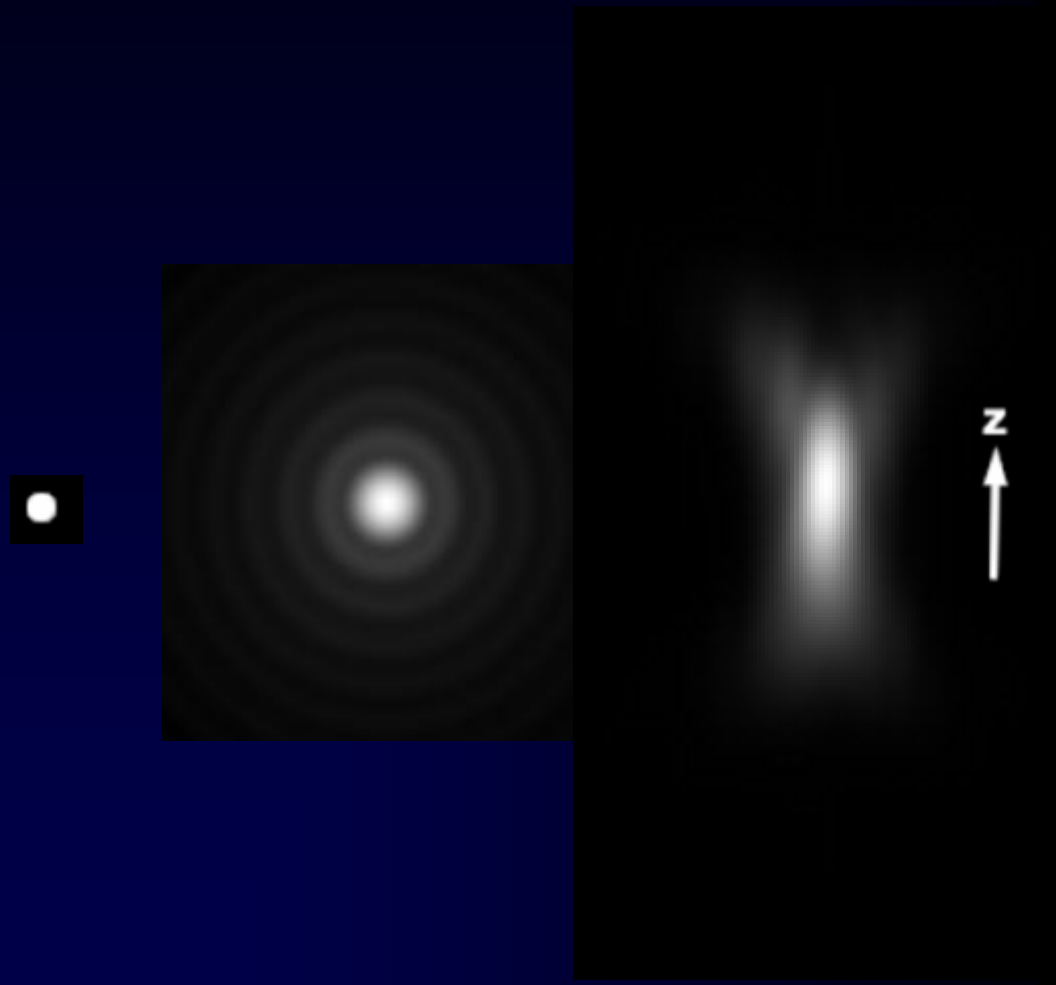


Image numérique = tableau de pixels

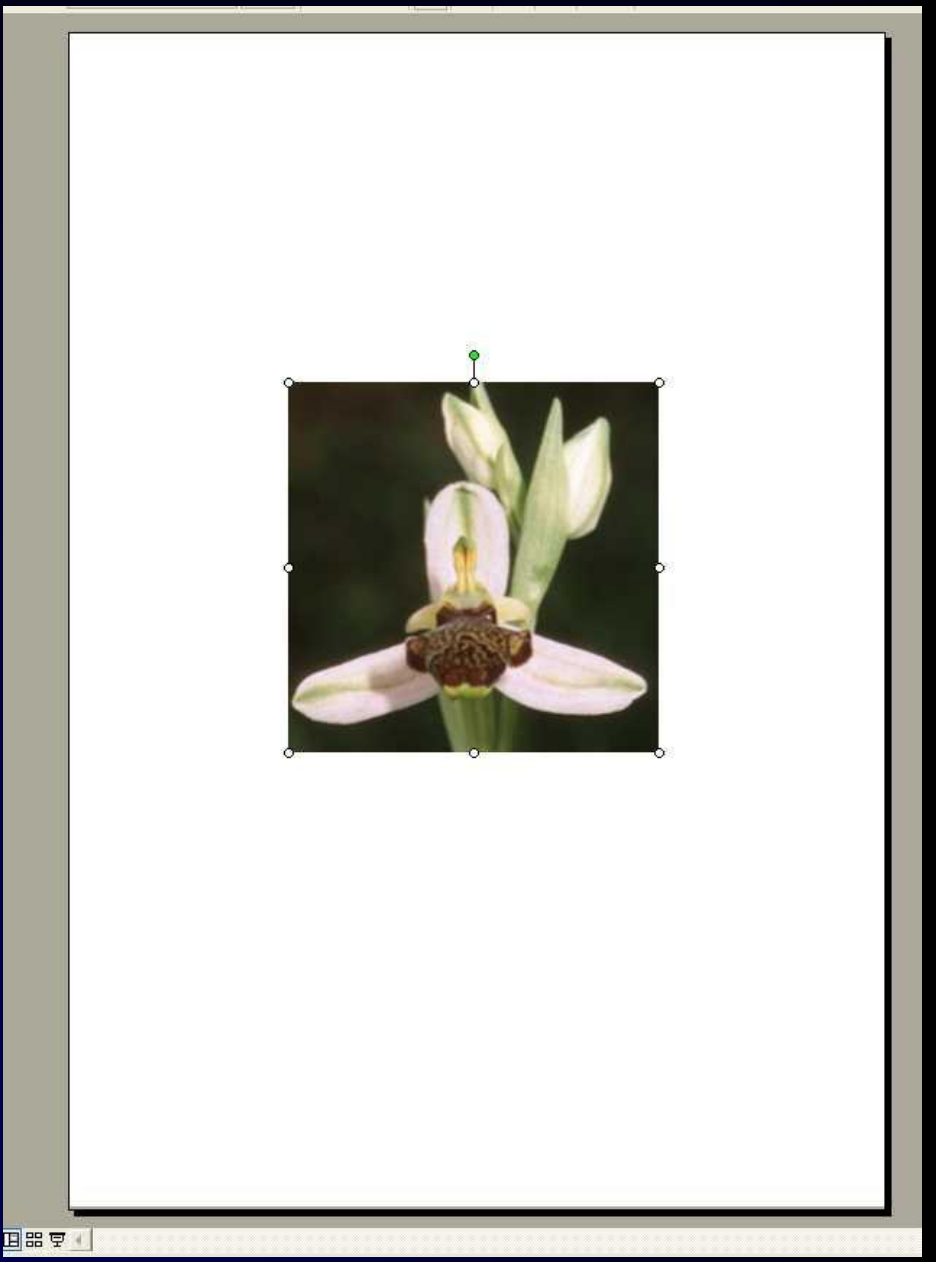
Détail = Affichage * 6

Résolution

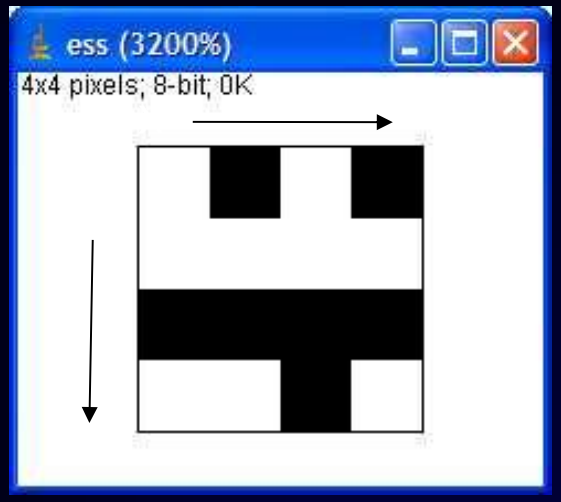
1024*1024
1 Mega pixels

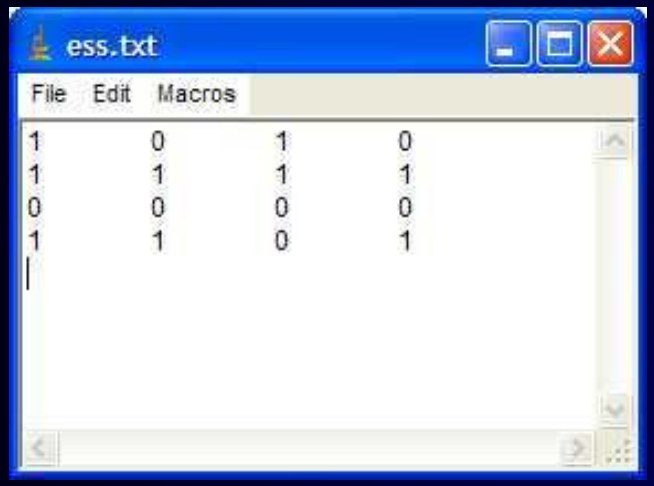
Ecran 72 dpi → 35cm

Impression 300 dpi → 8,5cm



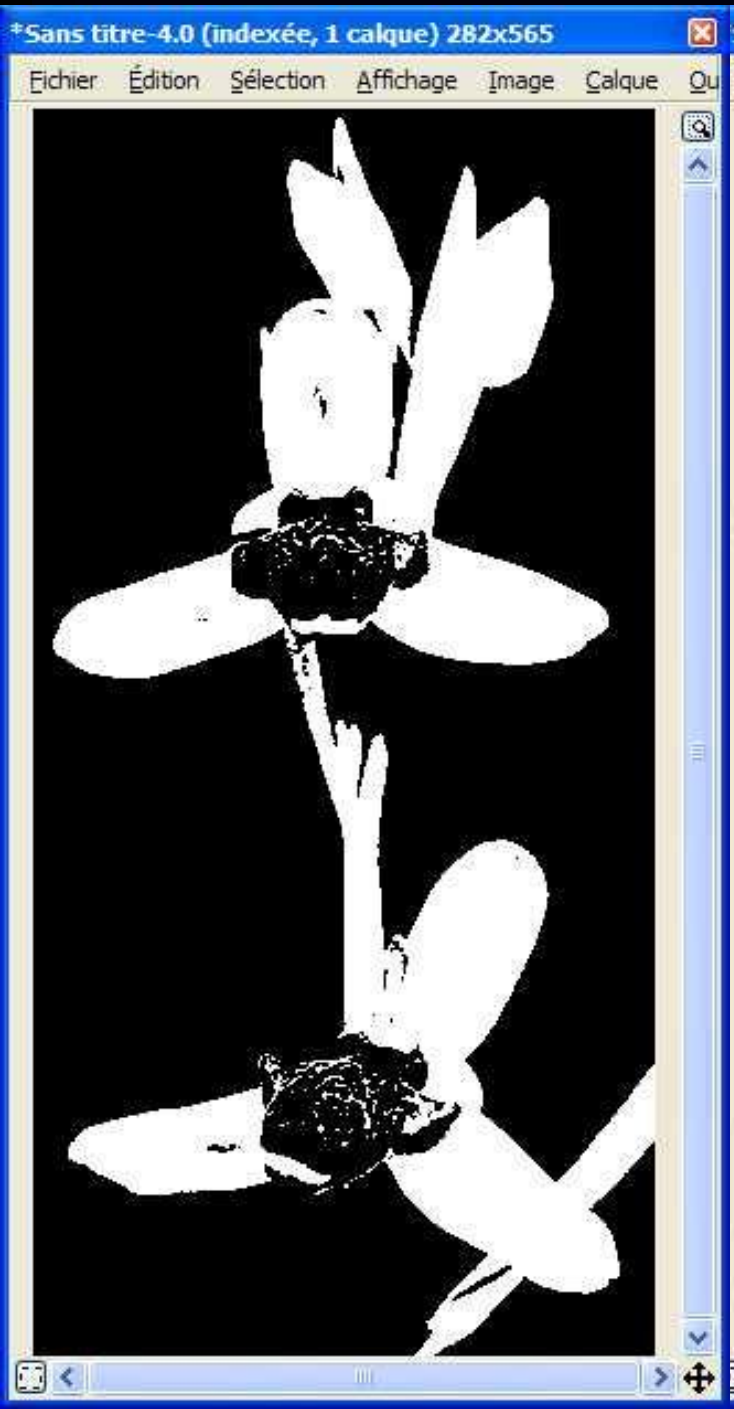
Codage binaire





Codage

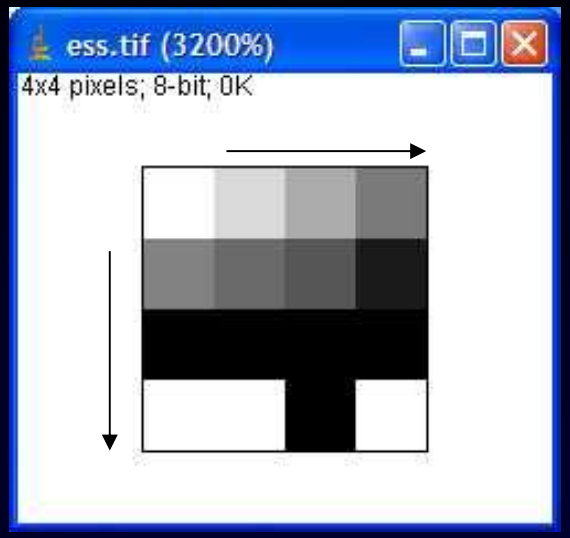
1bit→2 valeurs

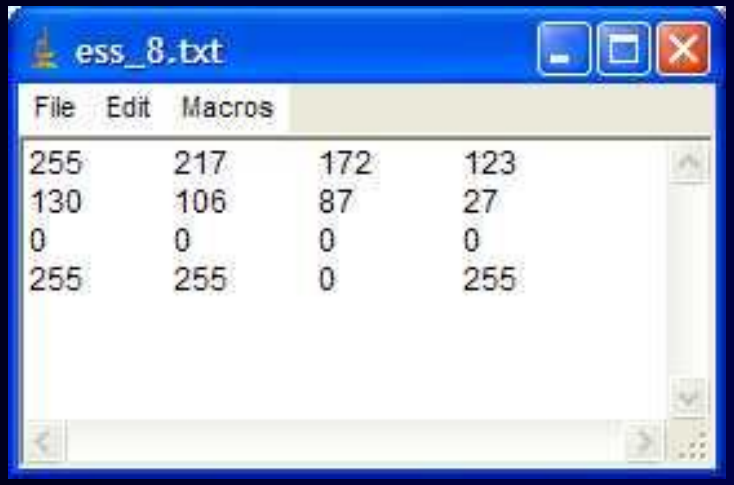


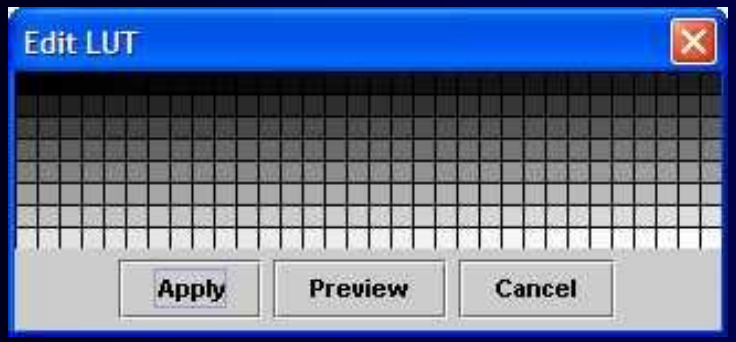
3bits→8 valeurs

5bits→32 valeurs

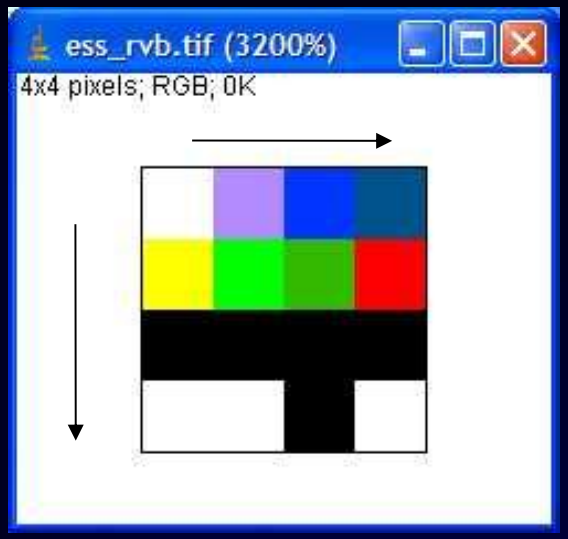
Codage 8 bits 0→255 Valeurs de Niveaux de gris







Codage couleur 24 bits RVB

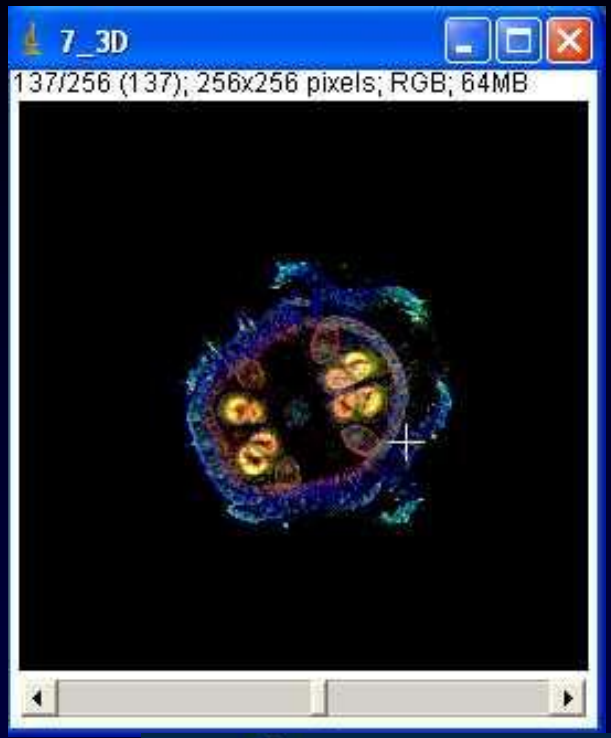


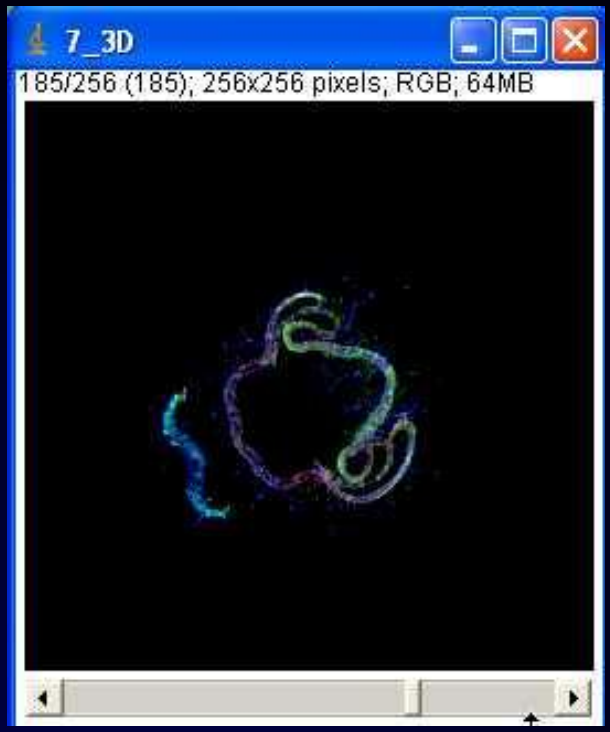
ess_rvb.txt

File Edit Macros

255,255,255	180,139,125	0,54,255	0,82,139
255,255,0	0,255,0	51,185,0	255,0,0
0,0,0	0,0,0	0,0,0	0,0,0
255,255,255	255,255,255	0,0,0	255,255,255

Piles d'images : Stack





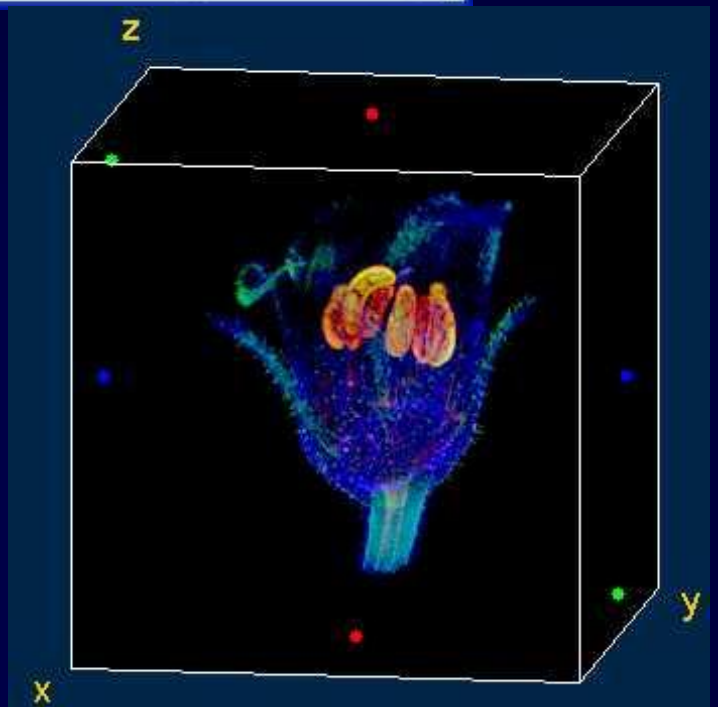
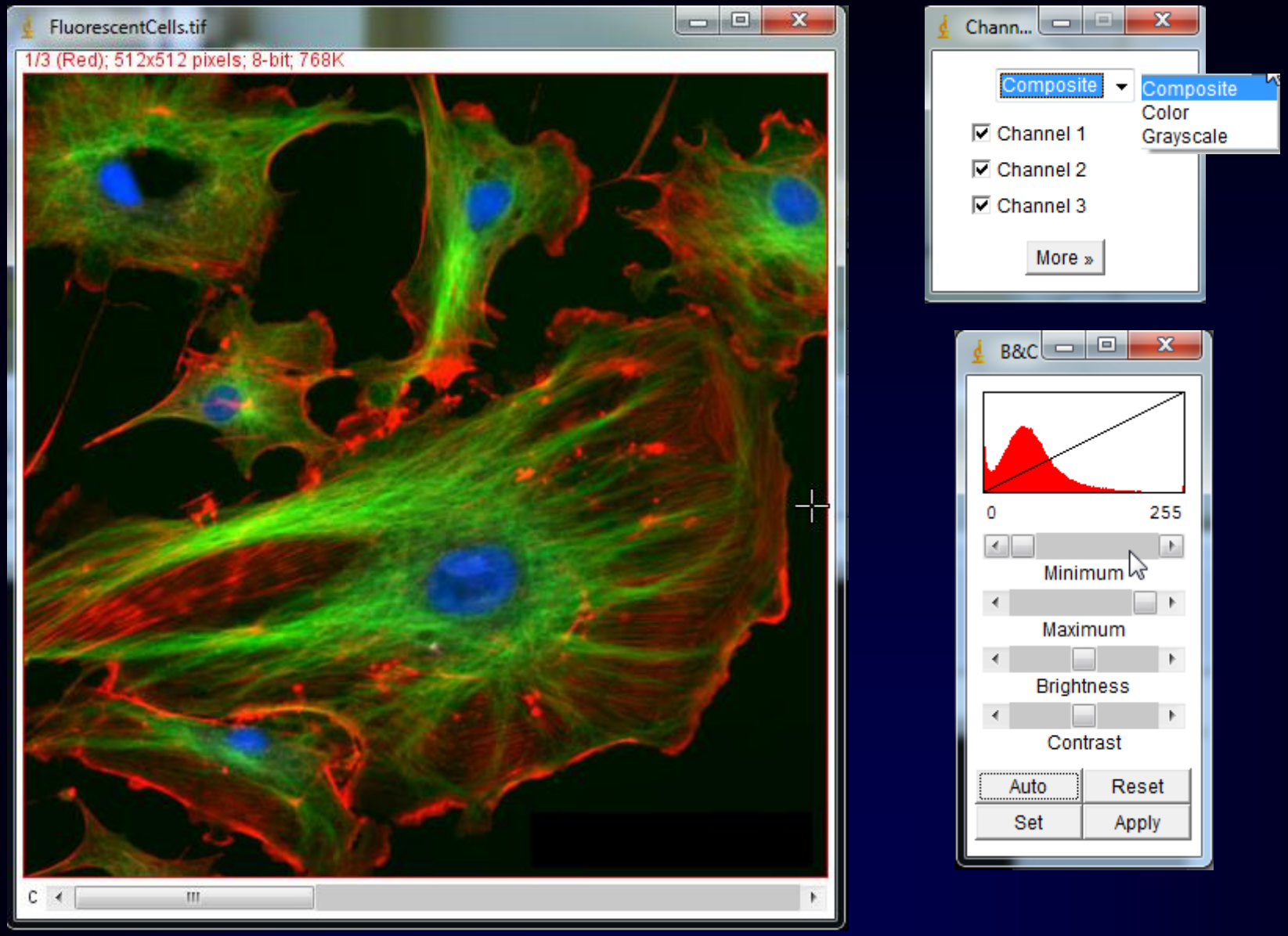


Image Composite



Format d'image

8bit [0,255]
16bit [0,65 535],
32bit [-3.4*10^38 , +3.4*10^38]
8bit color (LUT)
RGB 24bit [(0.0.0),(255.255.)]
Stack
HyperStack

Format de fichier

RAW : image brute
TIFF : sans perte + metadonnées
JPEG : compression avec perte d'information
LSM : format propriétaire de chez Zeiss
OME-TIFF : format Open Microscopy Environment

Topic 04 – What is a digital image?

L’image numérique

Les Prétraitements

Amélioration de la visualisation

Filtres et opérations

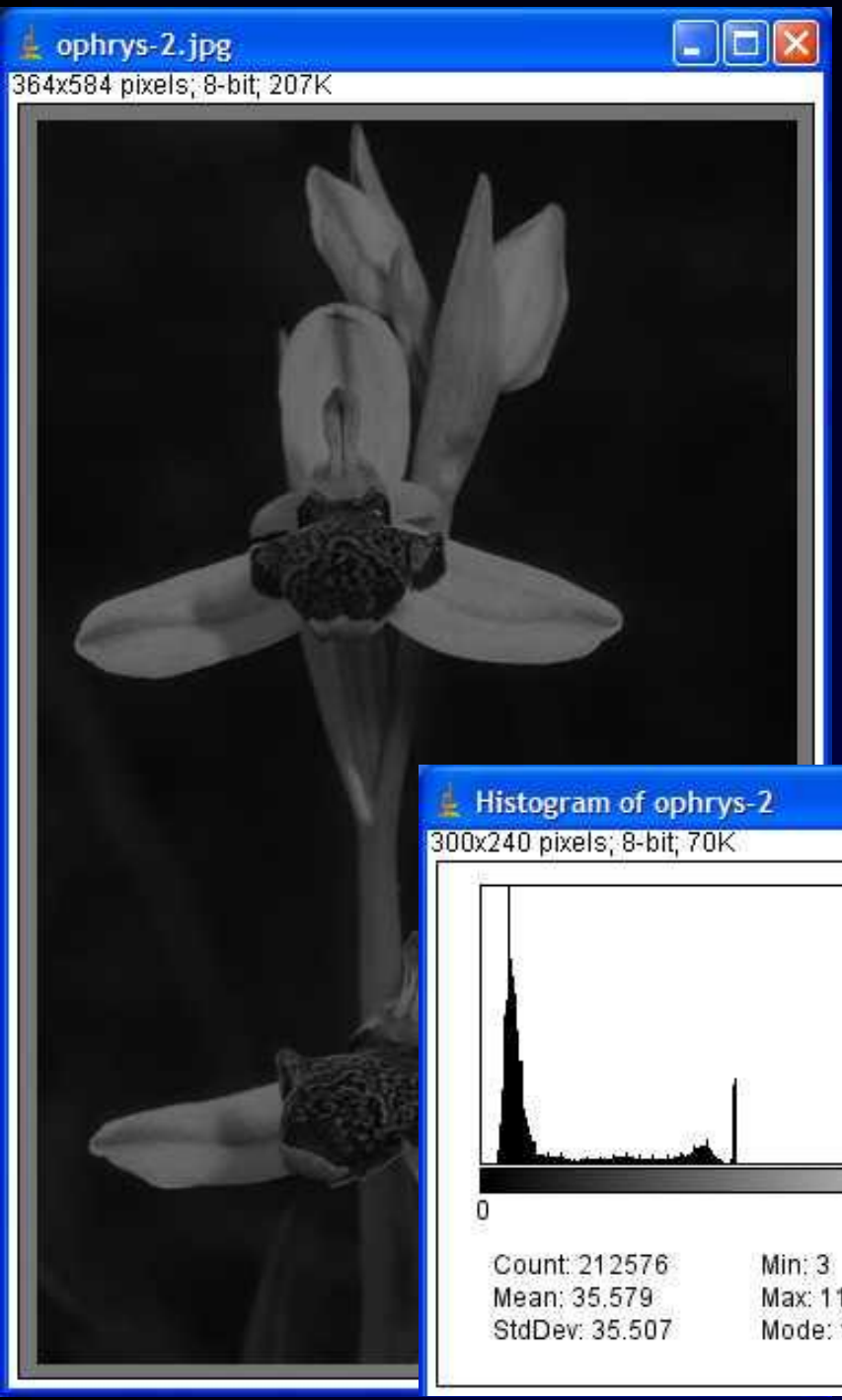
La Segmentation

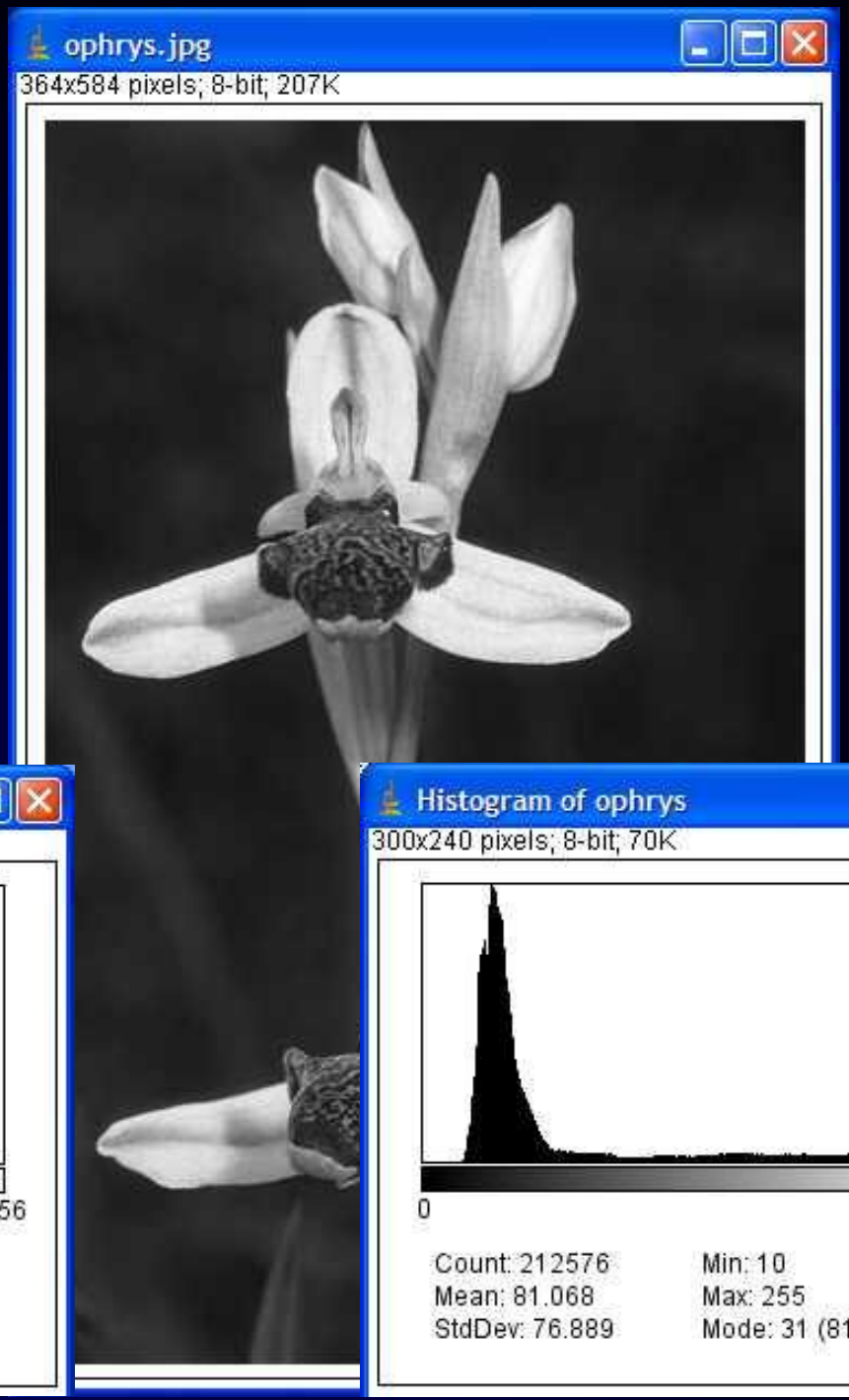
Les Post-traitements

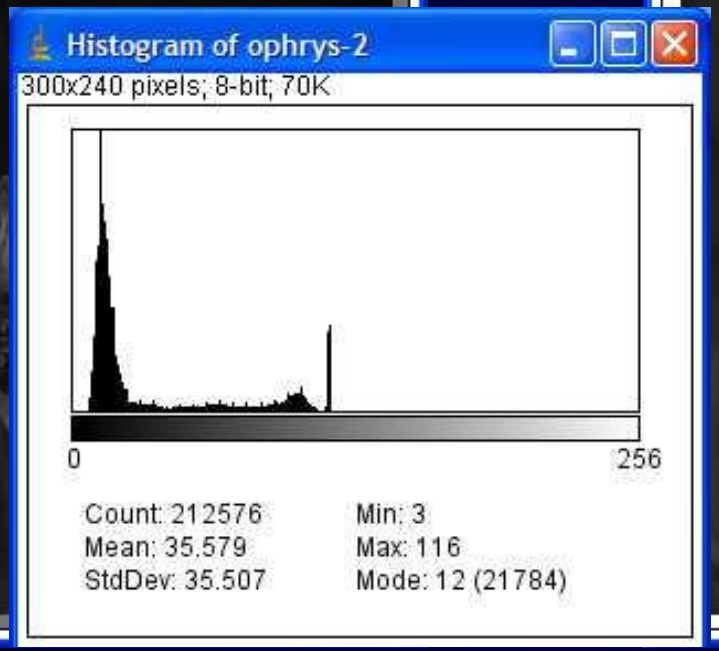
La Quantification

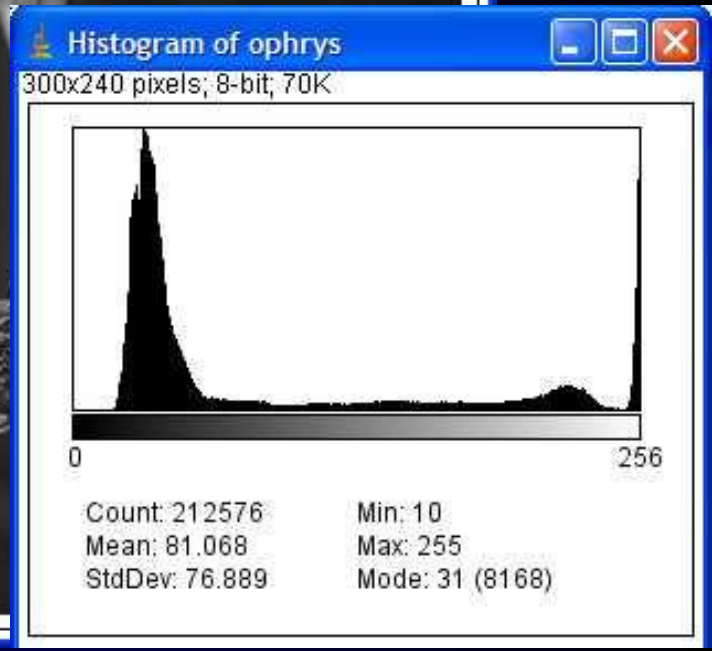
Histogramme

Dynamique = [valeur_mini , valeur_maxi]

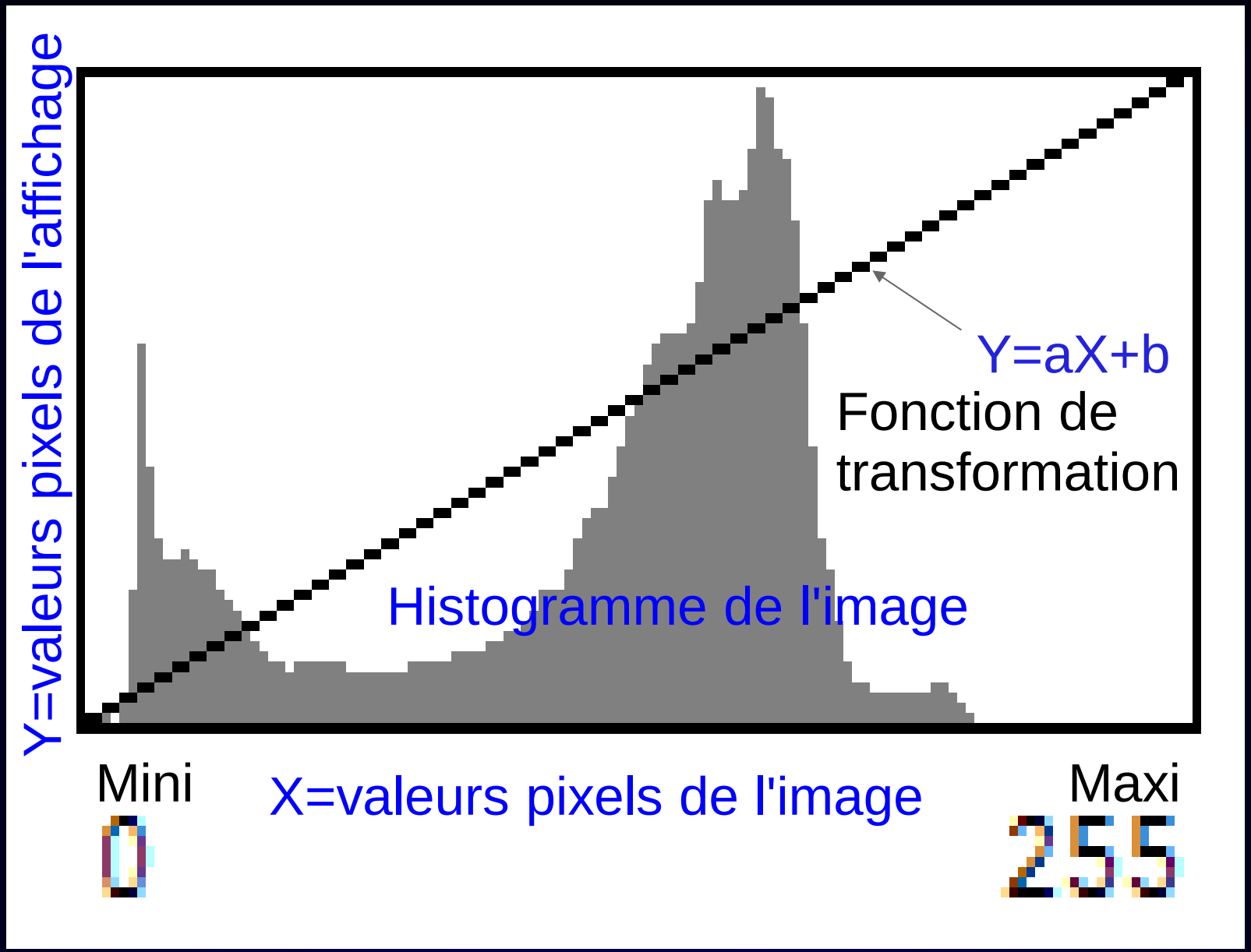








Corrections linéaires

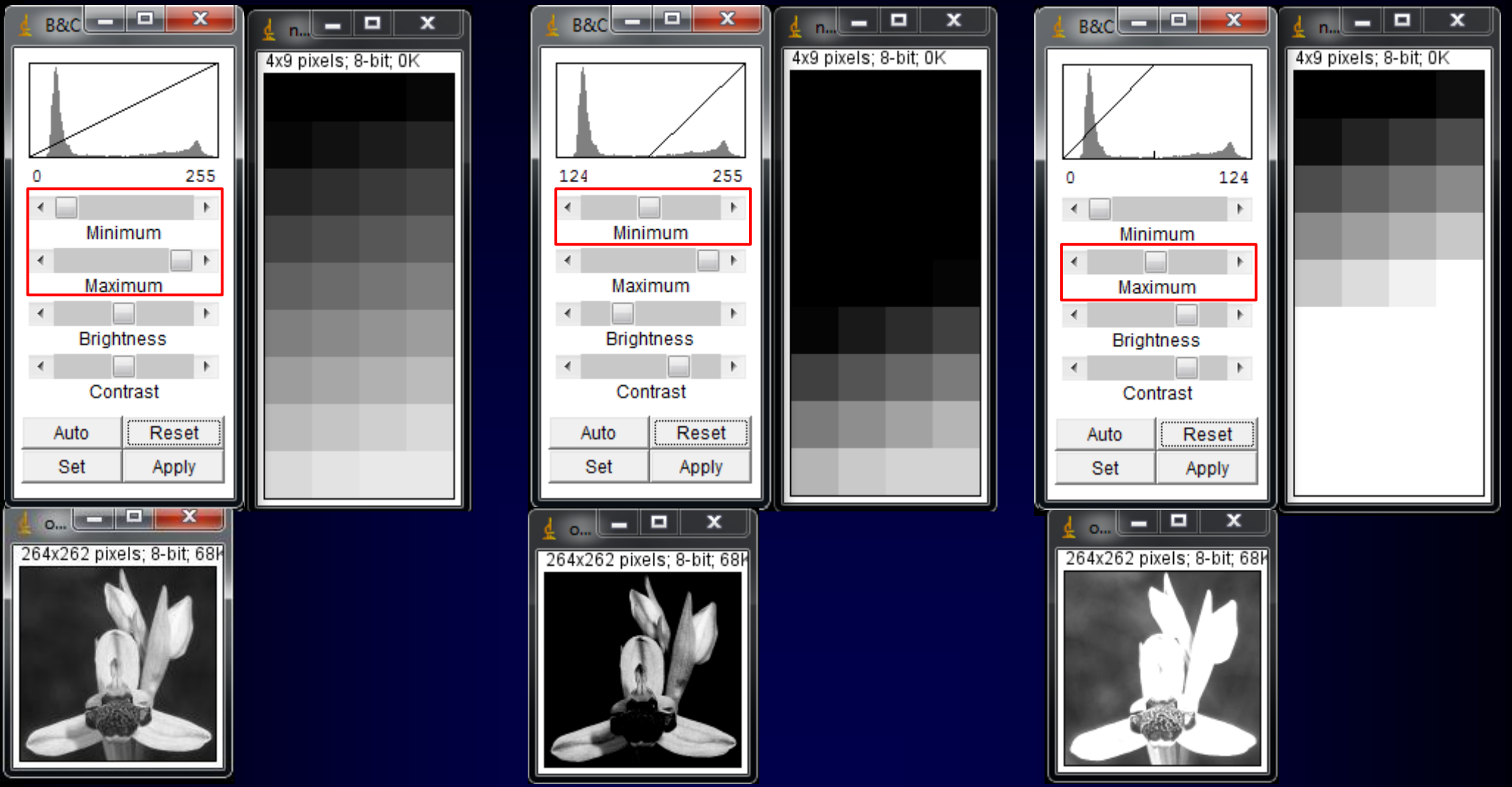


Image→Adjust→Brightness/Contrast...

a=Contraste
b=Luminosité

Corrections linéaires

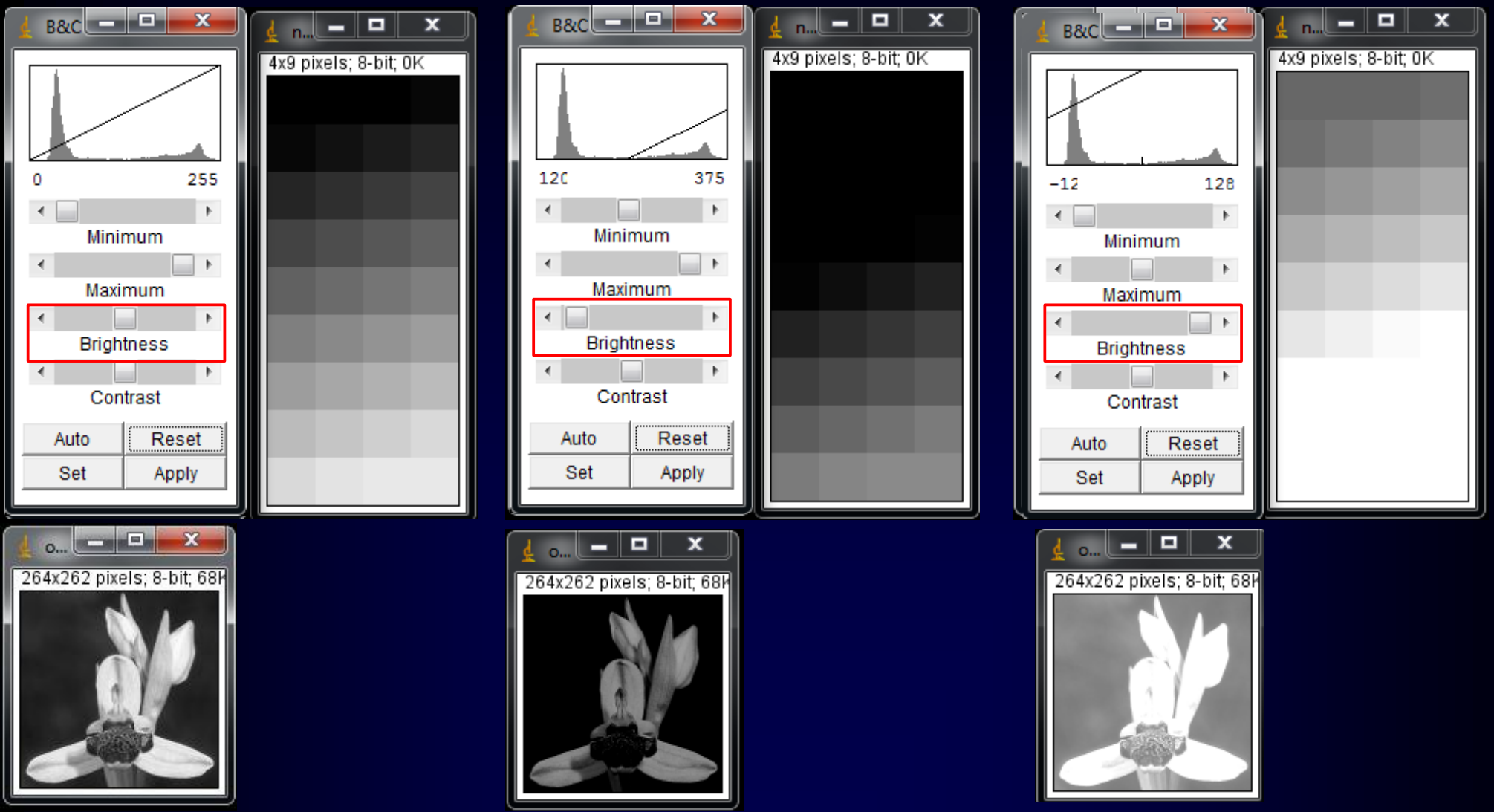
mini maxi : les limites de la courbe de transformation



Image→Adjust→Brightness/Contrast...

Corrections linéaires

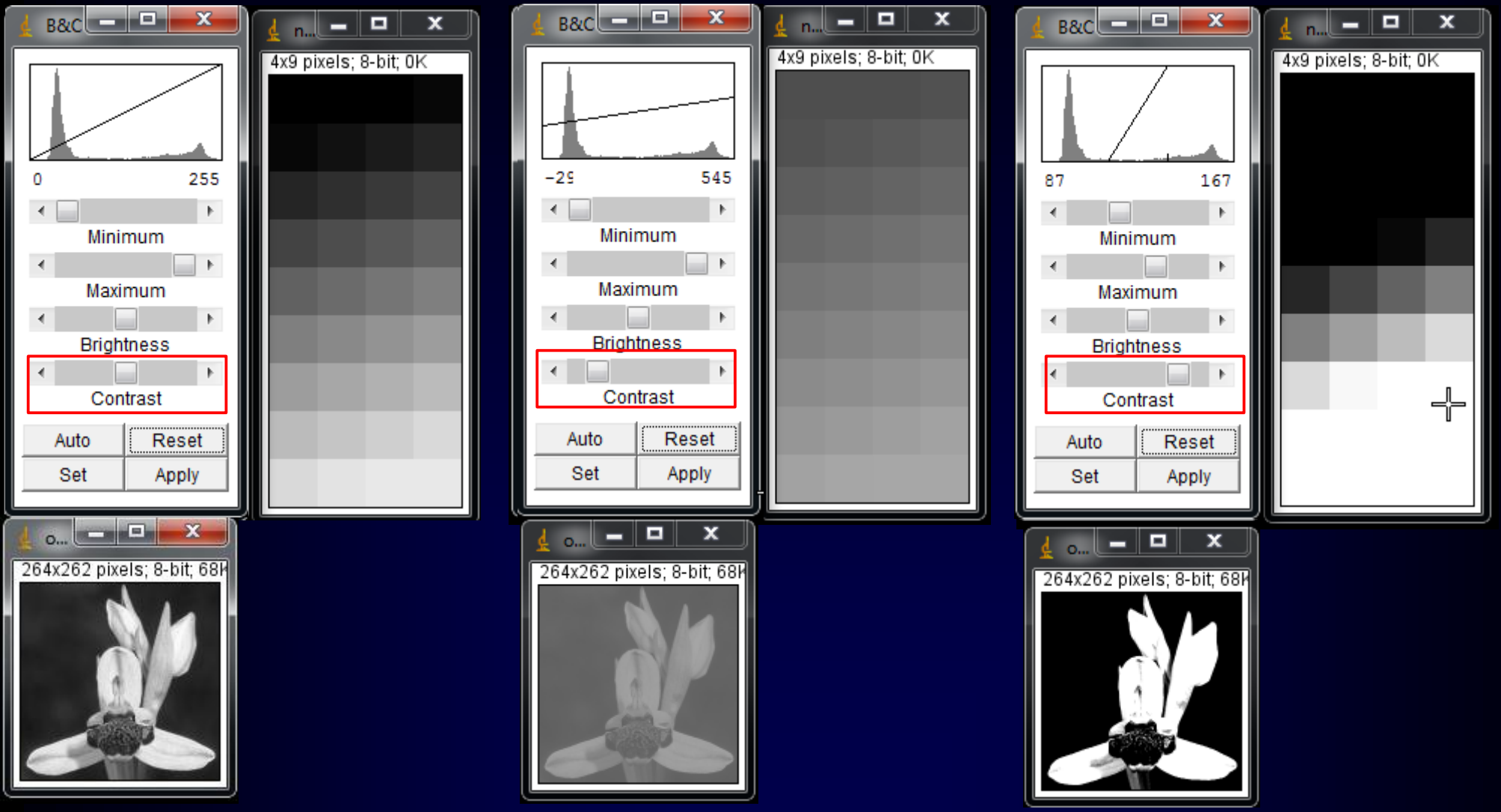
Luminosité « Brigthness » déplace la courbe



Image→Adjust→Brightness/Contrast...

Corrections linéaires

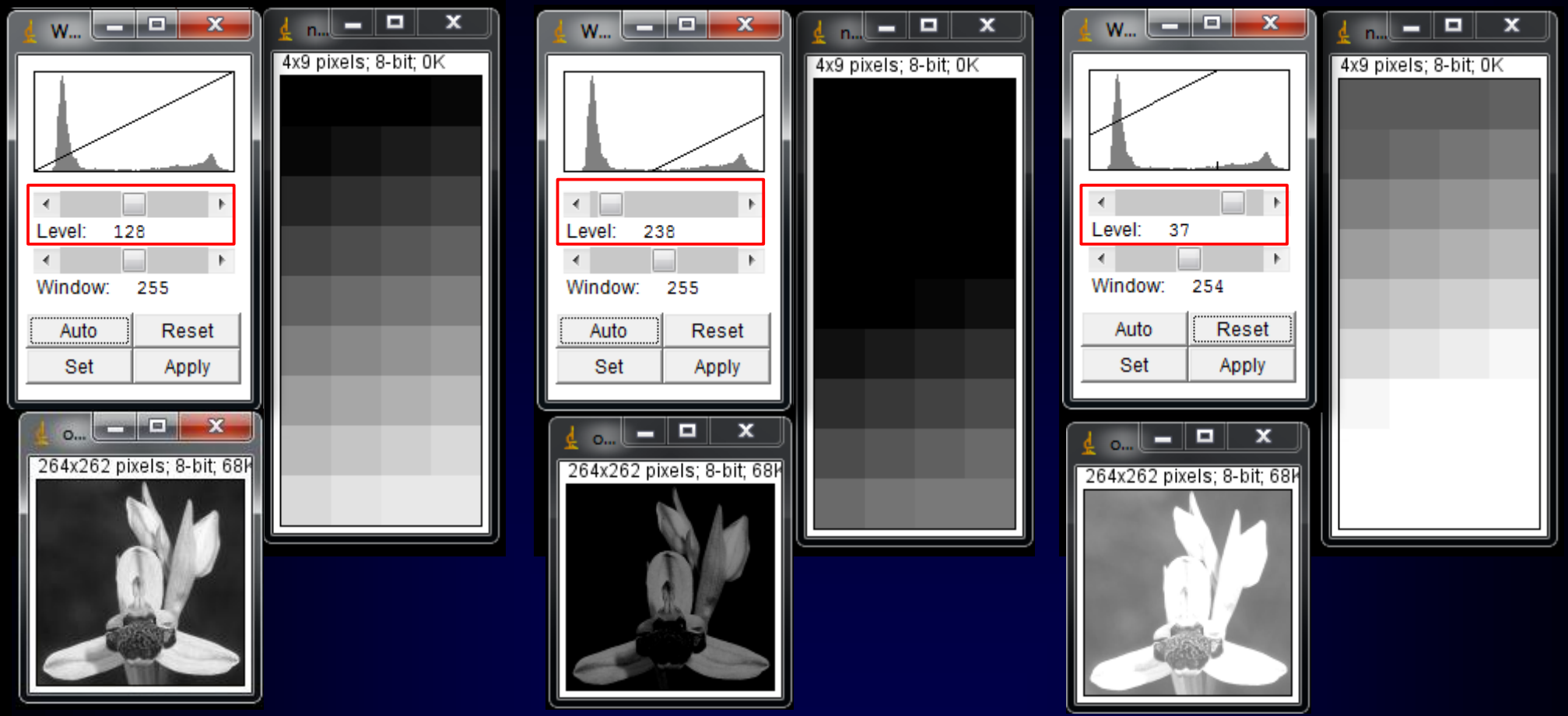
Contraste change la pente de la courbe



Image→Adjust→Brightness/Contrast...

Corrections linéaires

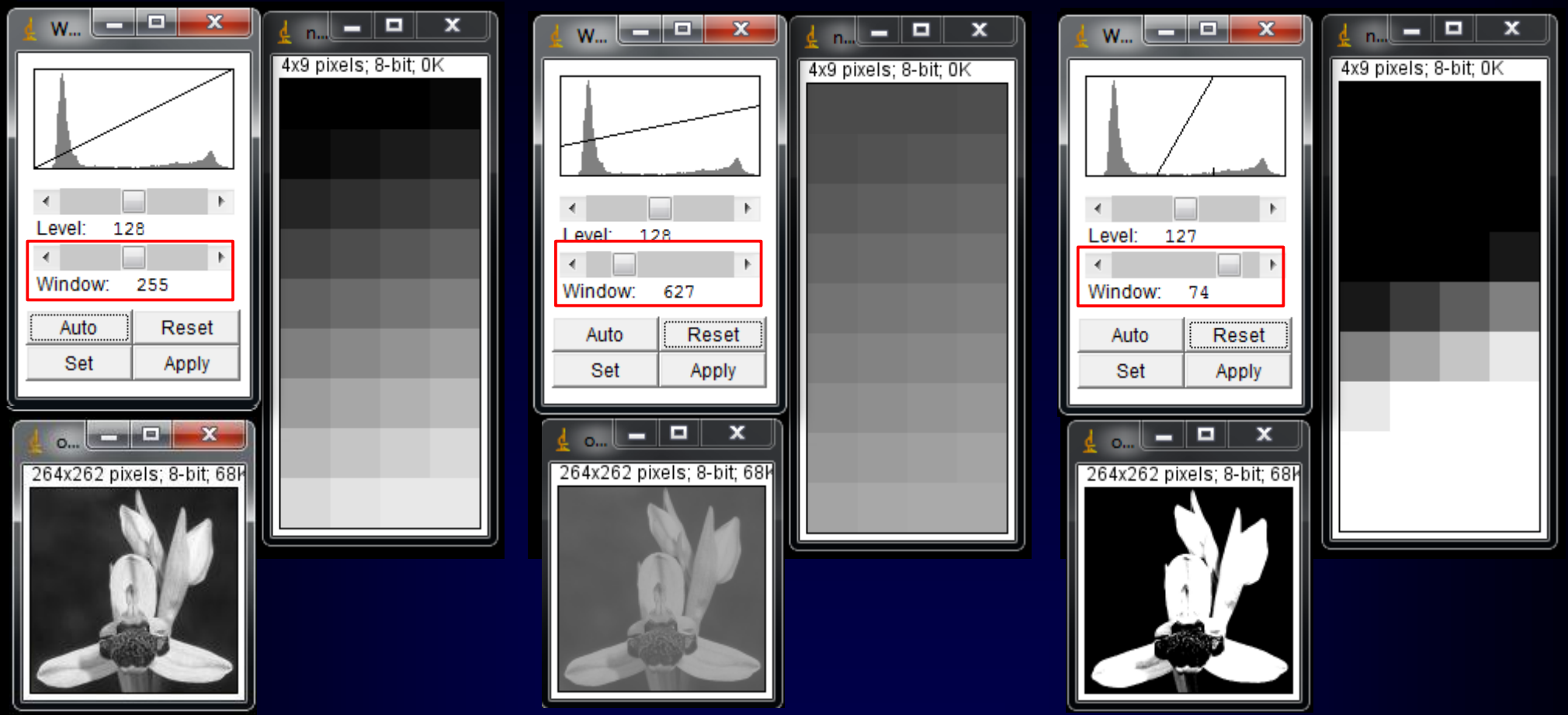
Niveaux « Level » valeur centre de la fenêtre <> b



Image→Adjust→Window/Level...

Corrections linéaires

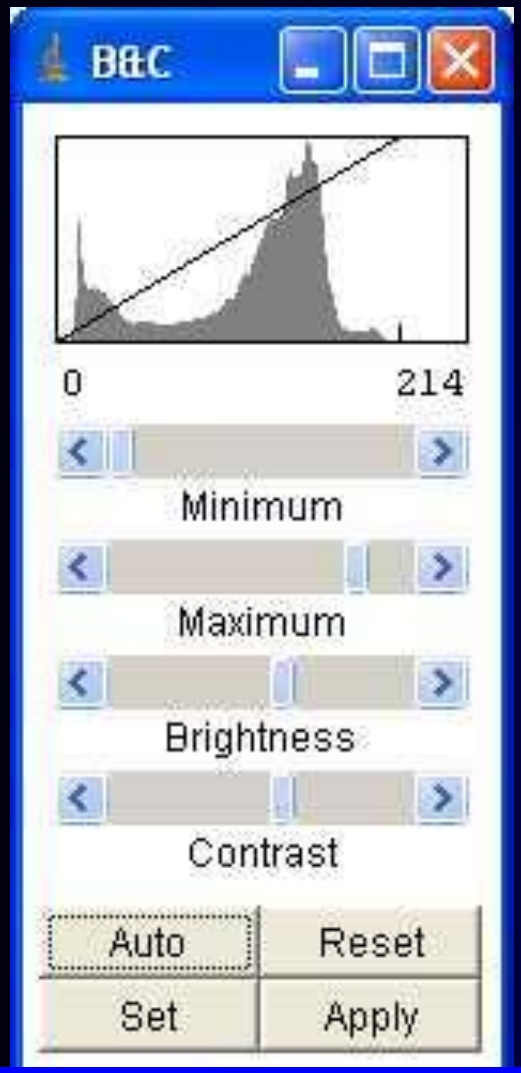
Window : largeur de la fenêtre <> a = pente



Image→Adjust→Brightness/Contrast...

Corrections linéaires

Luminosité Contraste



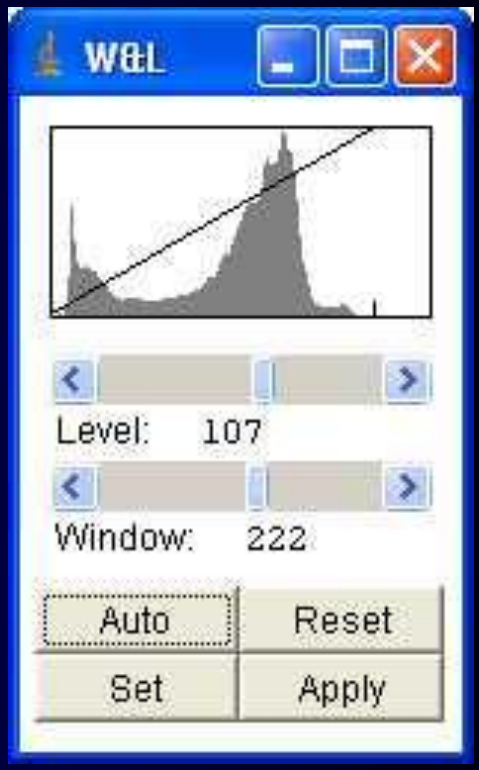
Mini

Maxi

Luminosité

Contraste

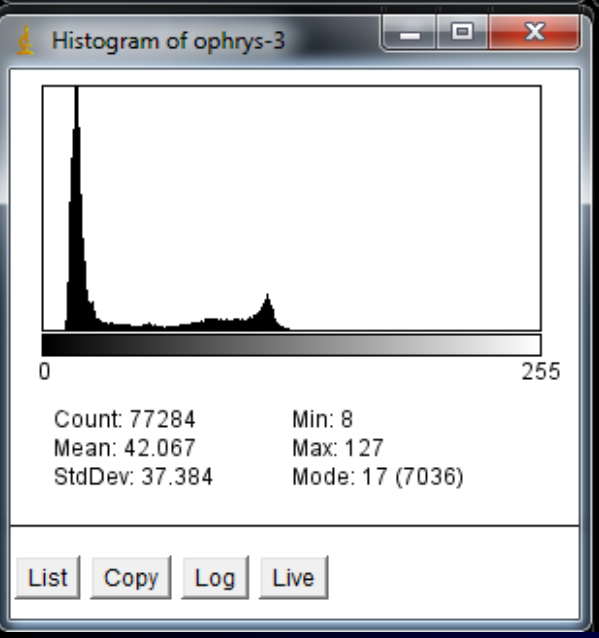
Niveaux

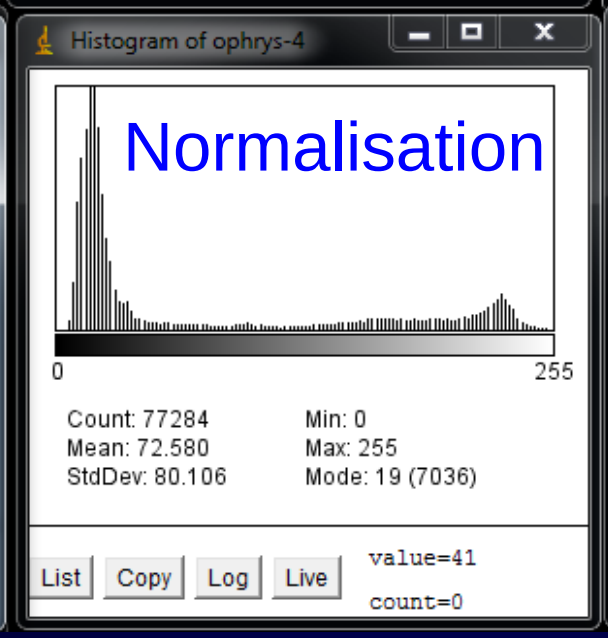


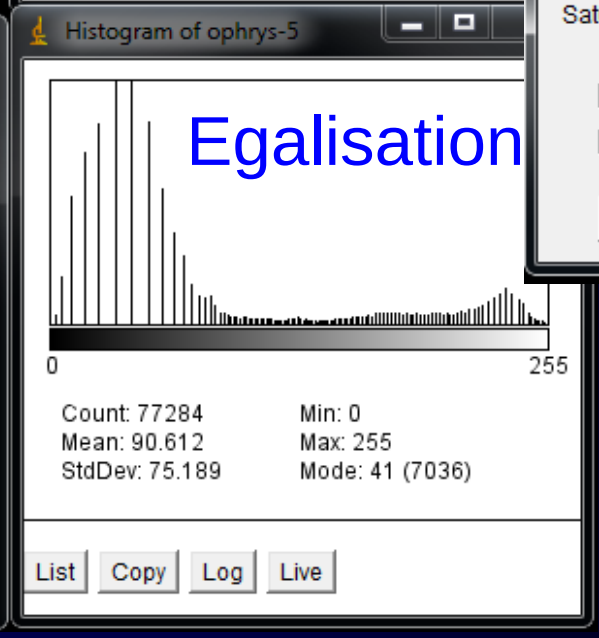
Image→Adjust→Brightness/Contrast...

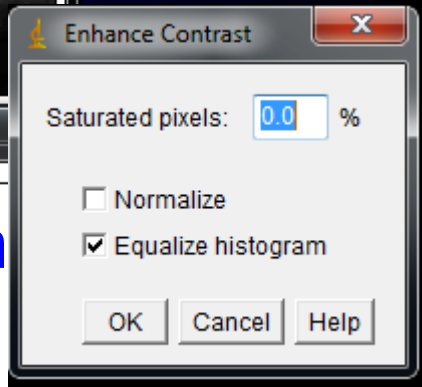
Correction non linéaire : Egalisation de l'histogramme

Densité de probabilité normalisée pour aplatir l'histogramme







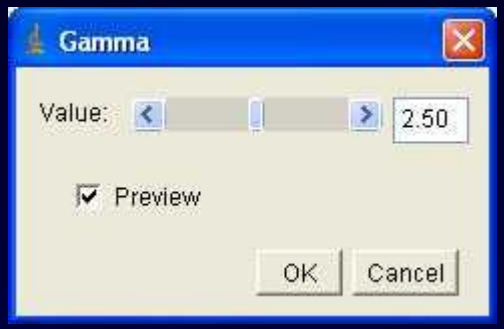


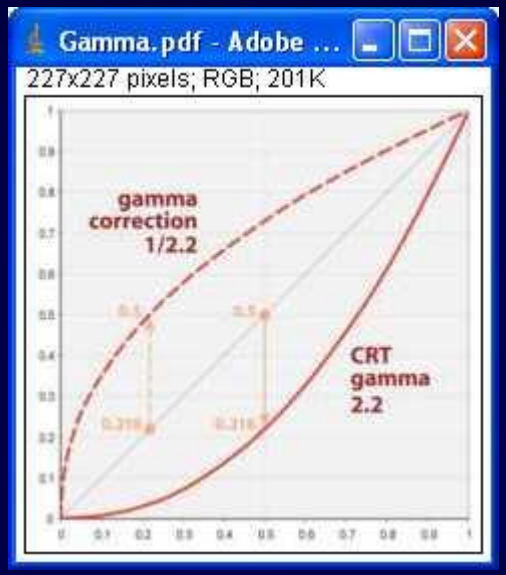
Process→Enhance Contrast

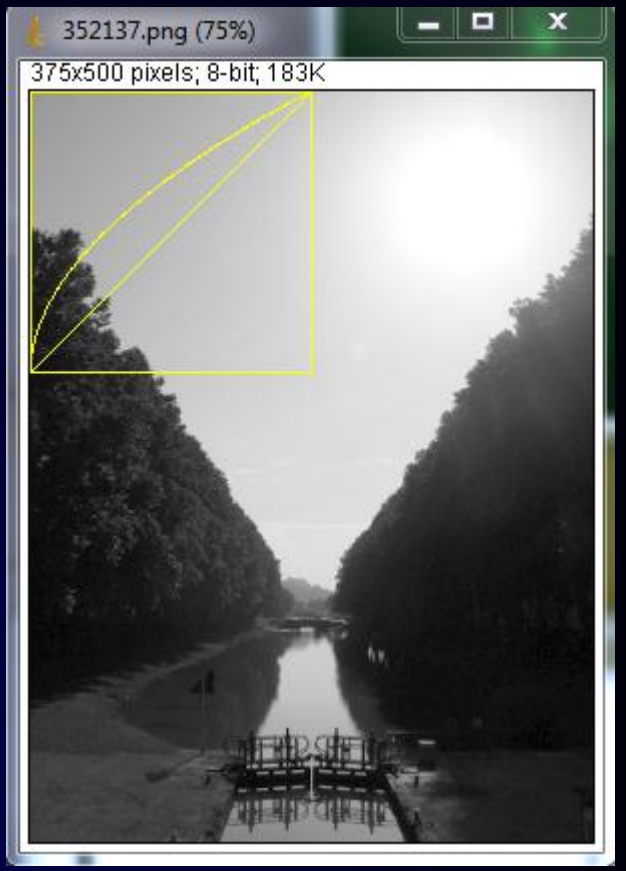
Volker BAECKER - Marc LARTAUD

Correction non linéaire du Gamma

y = range * (x / range) ^ gamma
range = gamme de valeurs des pixels de l'image

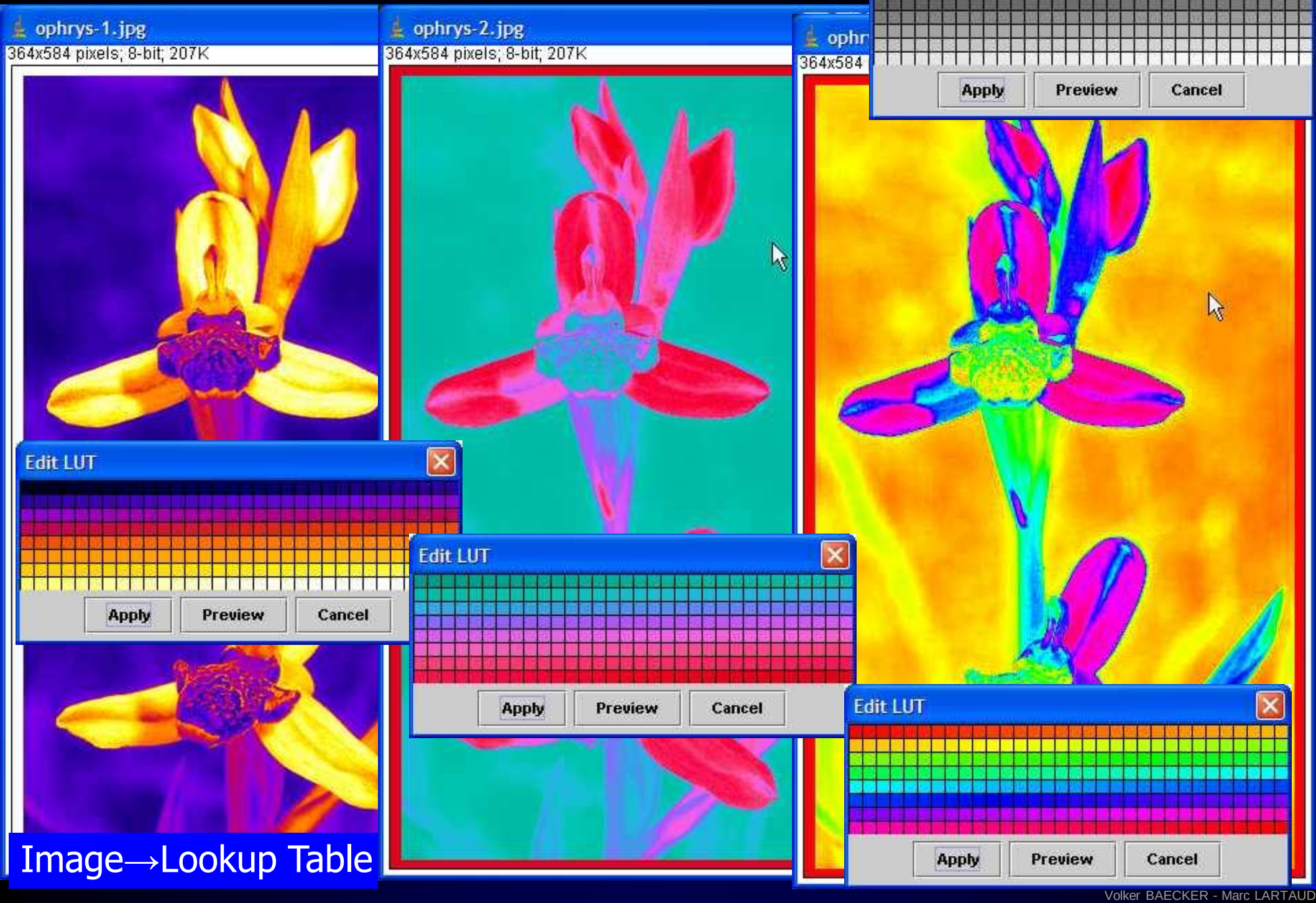




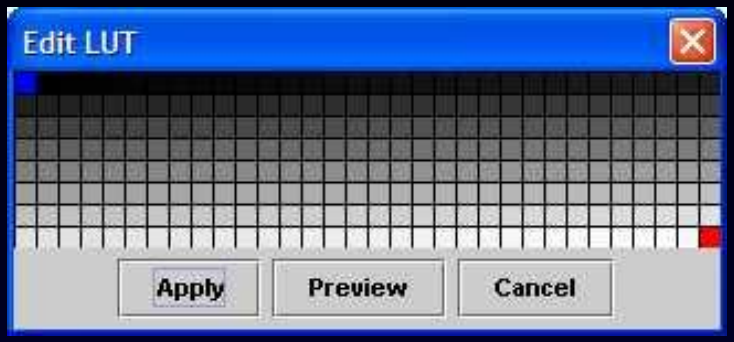


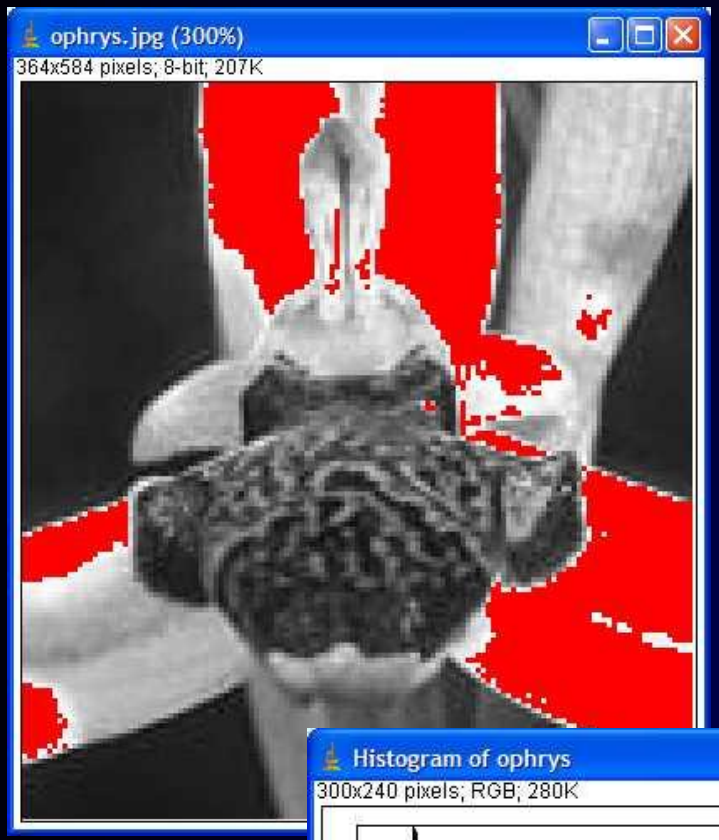
Process→Math→Gamma...

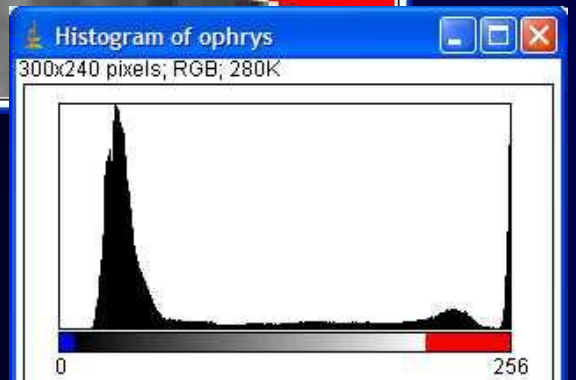
LUT : Lookup Unit Table

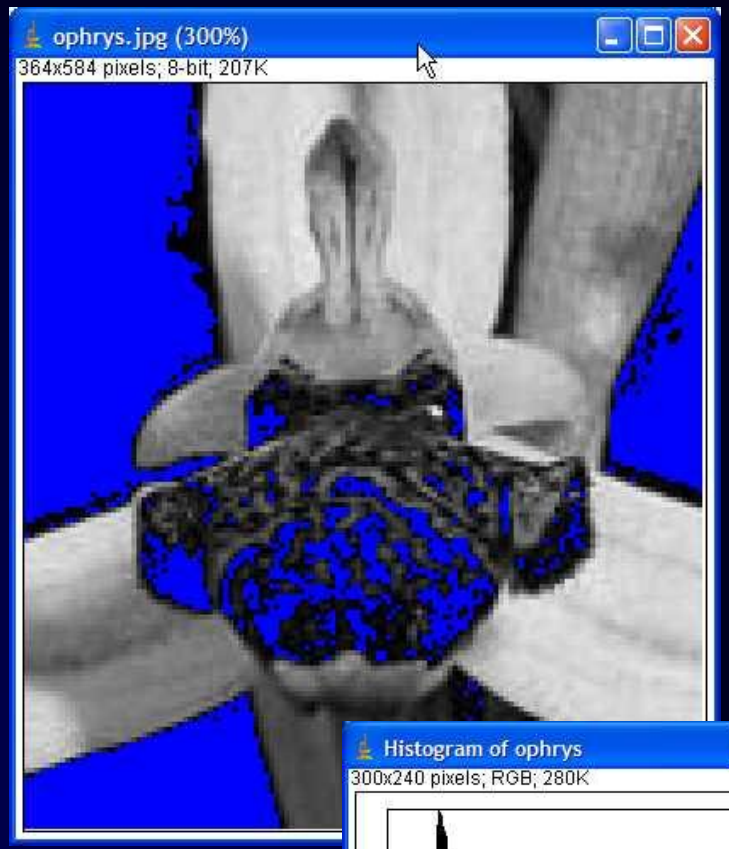


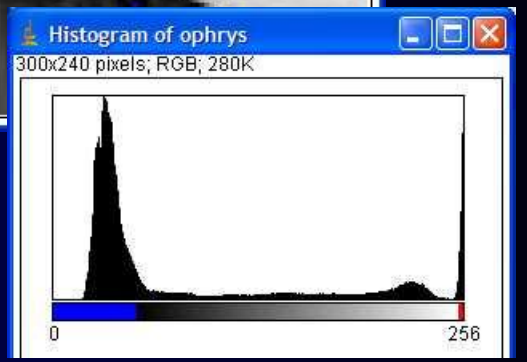
Réglages avec la LUT Hi Lo



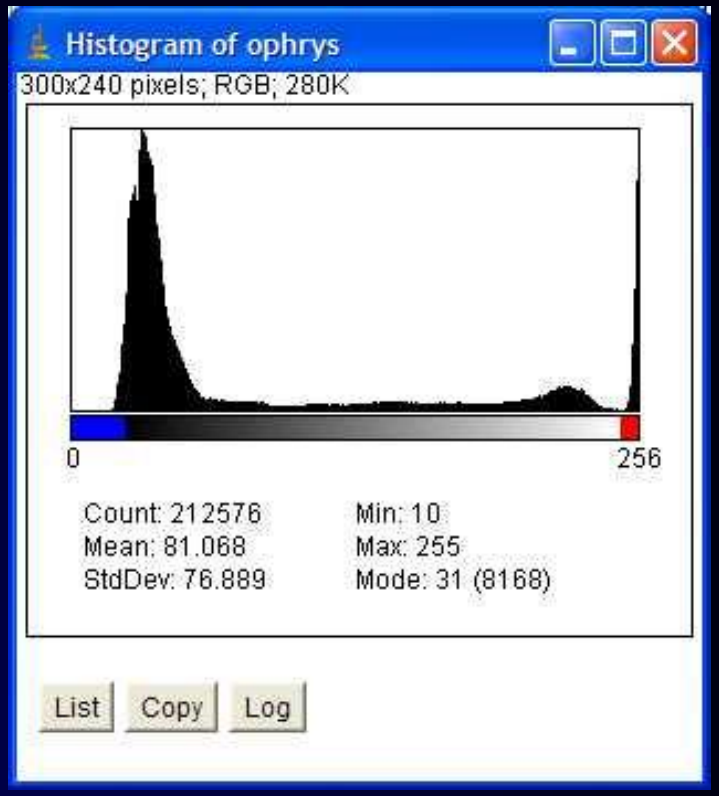




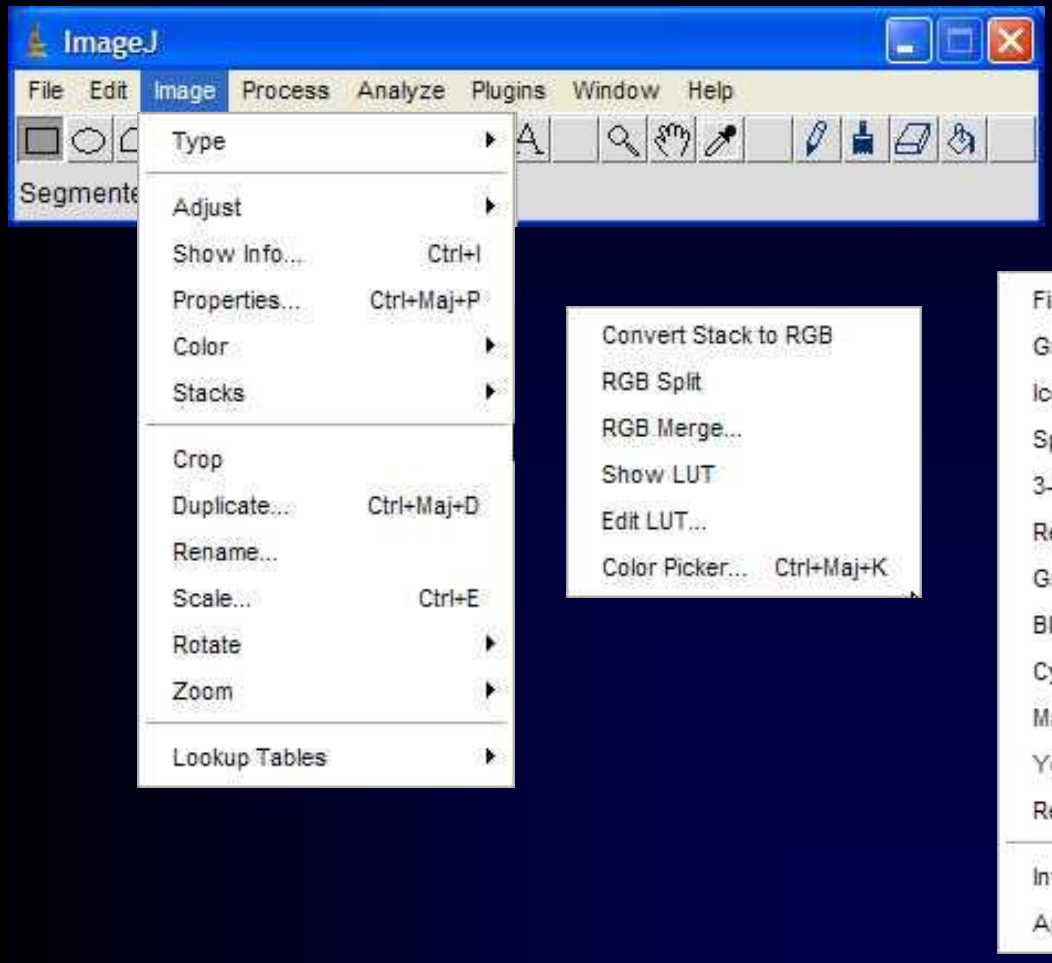




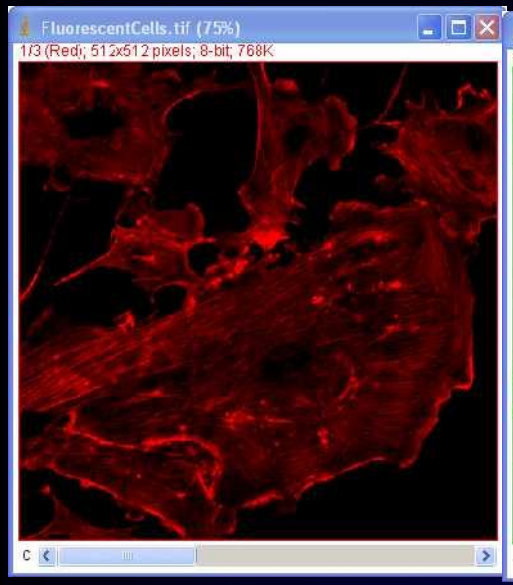
Réglages avec la LUT Hi Lo

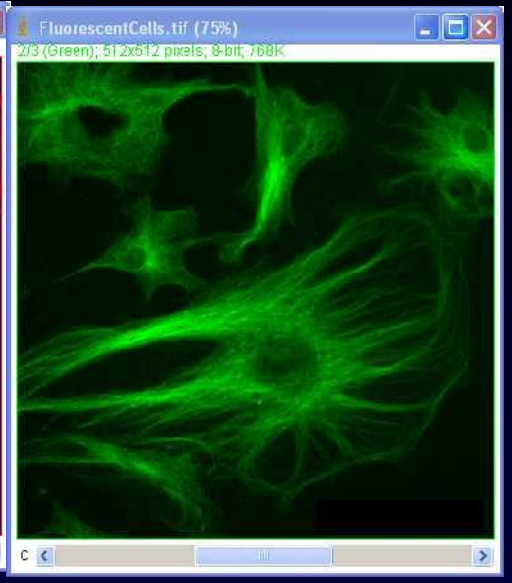


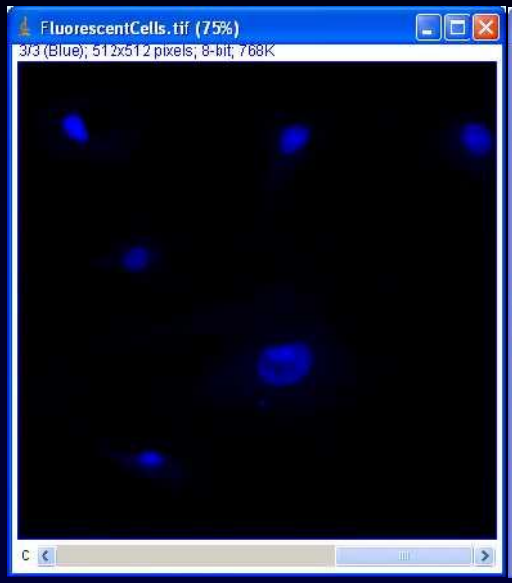
Outils LUT dans ImageJ

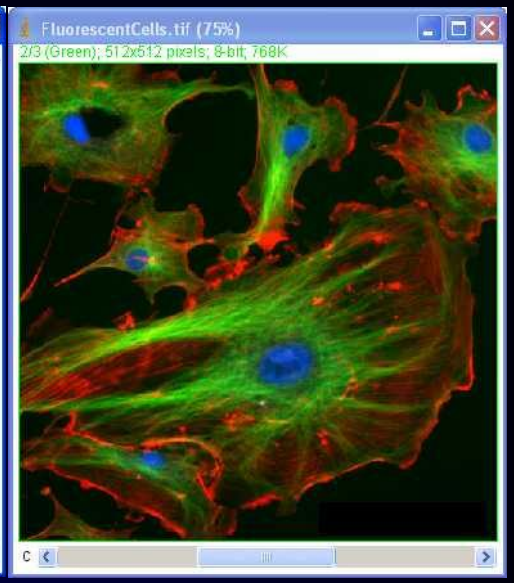


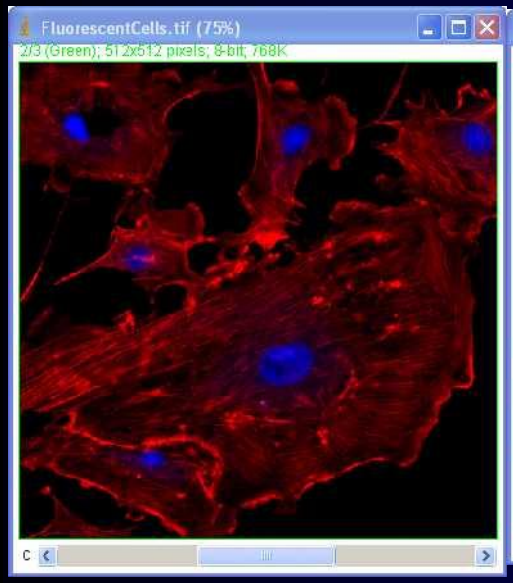
Réglages d'images composites

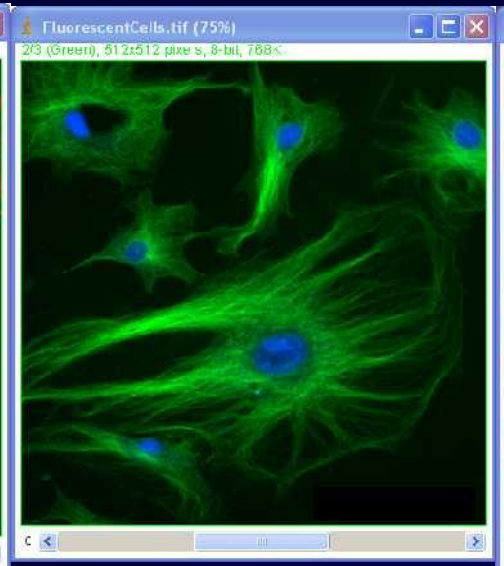


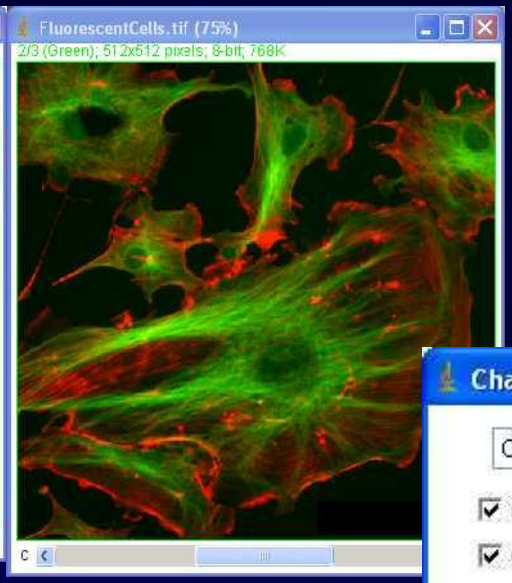


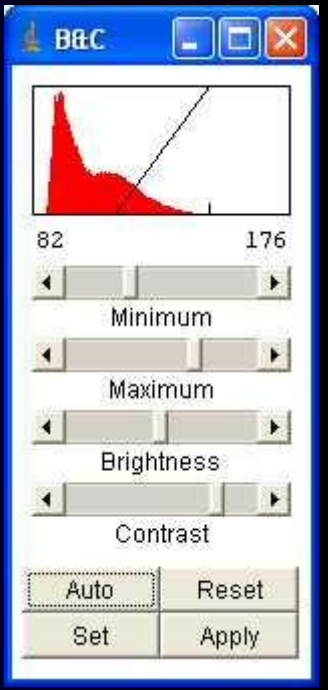












Image→Color→Make Composite

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Topic 05 – Brightness and Contrast Adjustment

L’image numérique

Les Prétraitements

Amélioration de la visualisation

Filtres et opérations

La Segmentation

Les Post-traitements

La Quantification

Filtres de convolution

Image source | Noyau | Image résultante

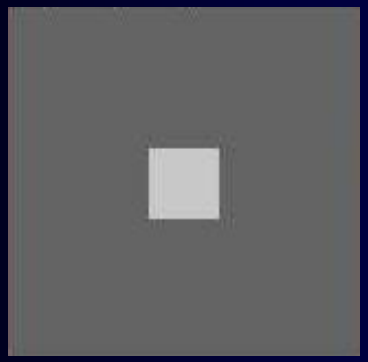
100	100	100	100	100
100	100	100	100	100
100	100	200	100	100
100	100	100	100	100
100	100	100	100	100

*

1	1	1
1	4	1
1	1	1

=

100	100	100	100	100
100				100
100				100
100				100
100	100	100	100	100



Filtres de convolution

Image source | Noyau | Image résultante

100	100	100	100	100
100	100	100	100	100
100	100	200	100	100
100	100	100	100	100
100	100	100	100	100

*

1	1	1
1	4	1
1	1	1

=

100	100	100	100	100
100	108			100
100				100
100				100
100	100	100	100	100

100*1	100*1	100*1
100*1	100*4	100*1
100*1	100*1	200*1

Somme / 12 = 108

Filtres de convolution

Image source | Noyau | Image résultante

100	100	100	100	100
100	100	100	100	100
100	100	200	100	100
100	100	100	100	100
100	100	100	100	100

*

1	1	1
1	4	1
1	1	1

=

100	100	100	100	100
100	108	108		100
100				100
100				100
100	100	100	100	100

100*1	100*1	100*1
100*1	100*4	100*1
100*1	200*1	100*1

Somme / 12 = 108

Filtres de convolution

Image source | Noyau | Image résultante

100	100	100	100	100
100	100	100	100	100
100	100	200	100	100
100	100	100	100	100
100	100	100	100	100

*

1	1	1
1	4	1
1	1	1

=

100	100	100	100	100
100	108	108	108	100
100				100
100				100
100	100	100	100	100

100*1	100*1	100*1
100*1	100*4	100*1
200*1	100*1	100*1

Somme / 12 = 108

Filtres de convolution

Image source | Noyau | Image résultante

100	100	100	100	100
100	100	100	100	100
100	100	200	100	100
100	100	100	100	100
100	100	100	100	100

*

1	1	1
1	4	1
1	1	1

=

100	100	100	100	100
100	108	108	108	100
100	108			100
100				100
100	100	100	100	100

100*1	100*1	100*1
100*1	100*4	200*1
100*1	100*1	100*1

Somme / 12 = 108

Filtres de convolution

Image source | Noyau | Image résultante

100	100	100	100	100
100	100	100	100	100
100	100	200	100	100
100	100	100	100	100
100	100	100	100	100

*

1	1	1
1	4	1
1	1	1

=

100	100	100	100	100
100	108	108	108	100
100	108	133		100
100				100
100	100	100	100	100

100*1	100*1	100*1
100*1	200*4	100*1
100*1	100*1	100*1

Somme / 12 = 133

Filtres de convolution

Image source | Noyau | Image résultante

100	100	100	100	100
100	100	100	100	100
100	100	200	100	100
100	100	100	100	100
100	100	100	100	100

*

1	1	1
1	4	1
1	1	1

=

100	100	100	100	100
100	108	108	108	100
100	108	133	108	100
100				100
100	100	100	100	100

100*1	100*1	100*1
200*1	100*4	100*1
100*1	100*1	100*1

Somme / 12 = 108

Filtres de convolution

Image source | Noyau | Image résultante

100	100	100	100	100
100	100	100	100	100
100	100	200	100	100
100	100	100	100	100
100	100	100	100	100

*

1	1	1
1	4	1
1	1	1

=

100	100	100	100	100
100	108	108	108	100
100	108	133	108	100
100	108			100
100	100	100	100	100

100*1	100*1	200*1
100*1	100*4	100*1
100*1	100*1	100*1

Somme / 12 = 108

Filtres de convolution

Image source | Noyau | Image résultante

100	100	100	100	100
100	100	100	100	100
100	100	200	100	100
100	100	100	100	100
100	100	100	100	100

*

1	1	1
1	4	1
1	1	1

=

100	100	100	100	100
100	108	108	108	100
100	108	133	108	100
100	108	108		100
100	100	100	100	100

100*1	200*1	100*1
100*1	100*4	100*1
100*1	100*1	100*1

Somme / 12 = 108

Filtres de convolution

Image source | Noyau | Image résultante

100	100	100	100	100
100	100	100	100	100
100	100	200	100	100
100	100	100	100	100
100	100	100	100	100

*

1	1	1
1	4	1
1	1	1

=

100	100	100	100	100
100	108	108	108	100
100	108	133	108	100
100	108	108	108	100
100	100	100	100	100

200*1	100*1	100*1
100*1	100*4	100*1
100*1	100*1	100*1

Somme / 12 = 108

Filtres de convolution

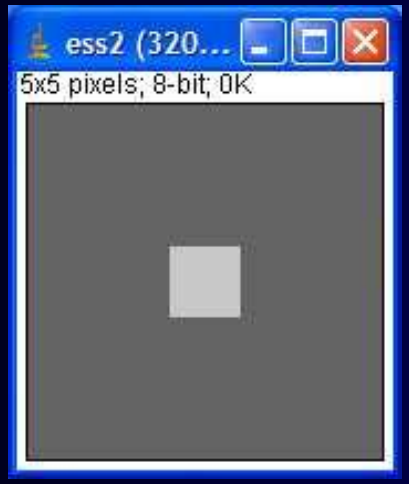
100	100	100	100	100
100	100	100	100	100
100	100	200	100	100
100	100	100	100	100
100	100	100	100	100

*

1	1	1
1	4	1
1	1	1

=

100	100	100	100	100
100	108	108	108	100
100	108	133	108	100
100	108	108	108	100
100	100	100	100	100



☞ Le résultat d'un tel filtrage est un lissage de l'image, il s'agit d'un **filtre passe-bas**.

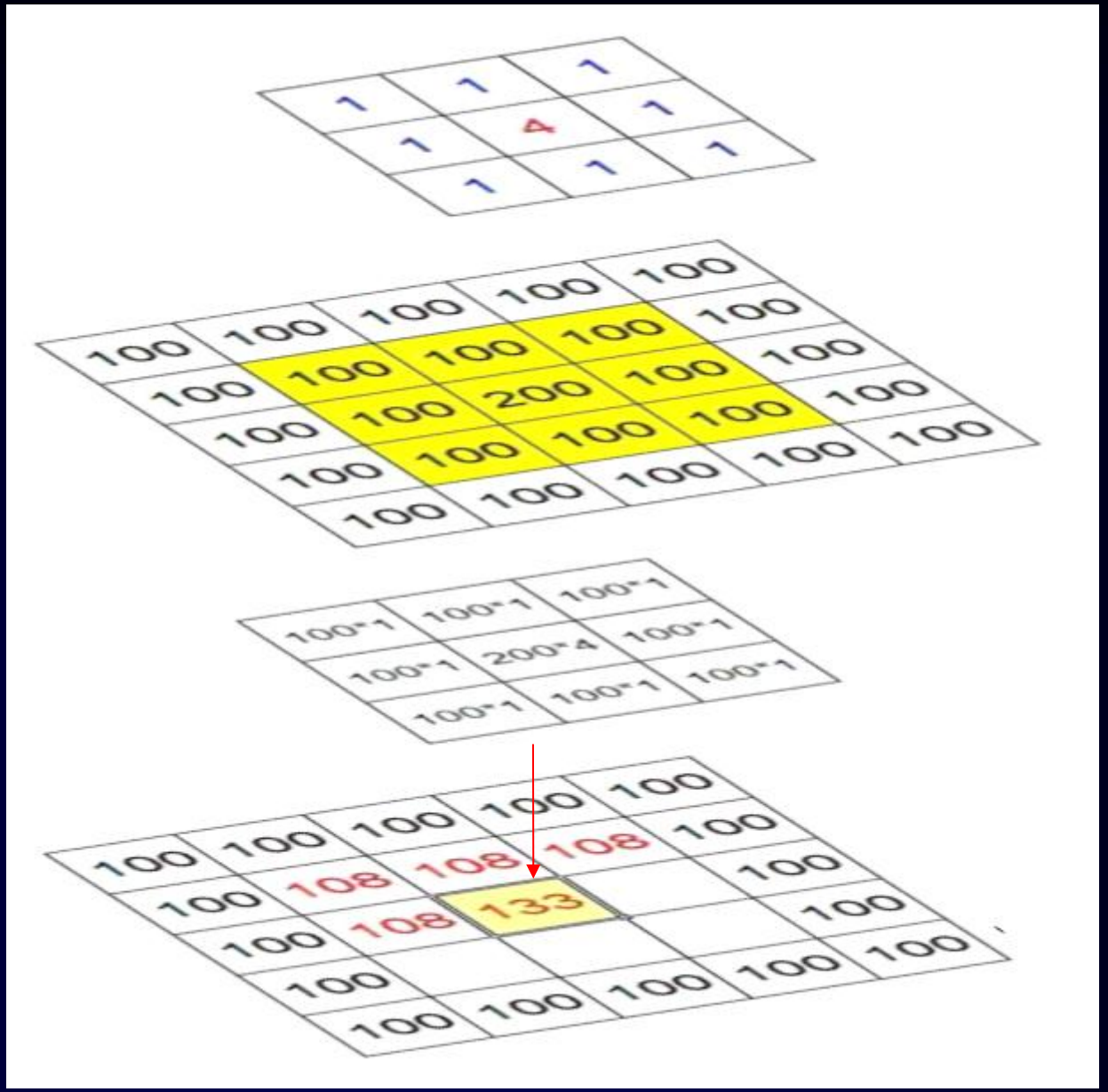
Filtres de convolution

Noyau

Image source

Produits du noyau et de la source

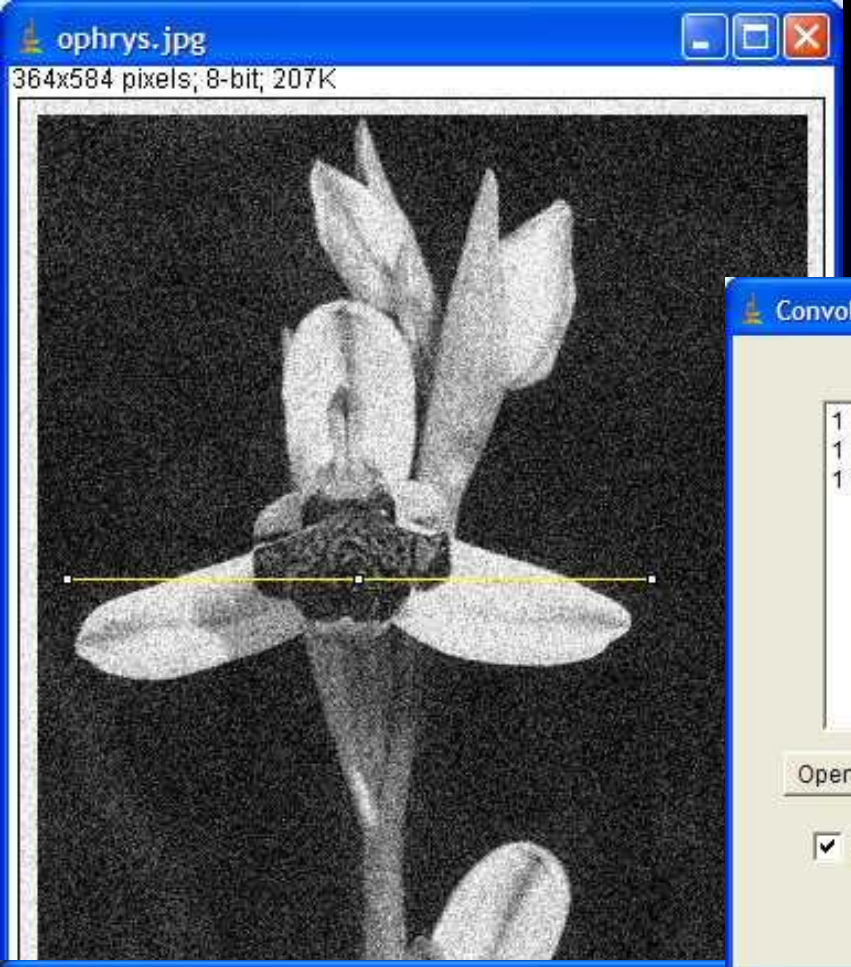
Image résultante

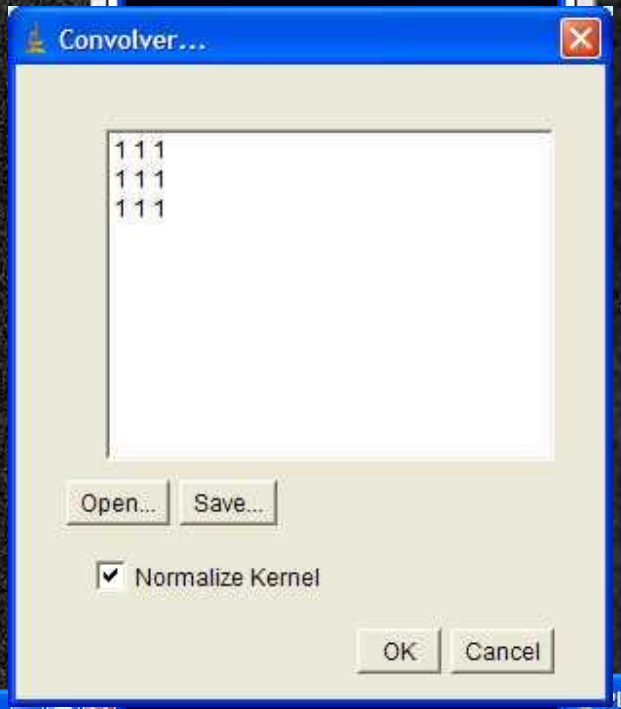


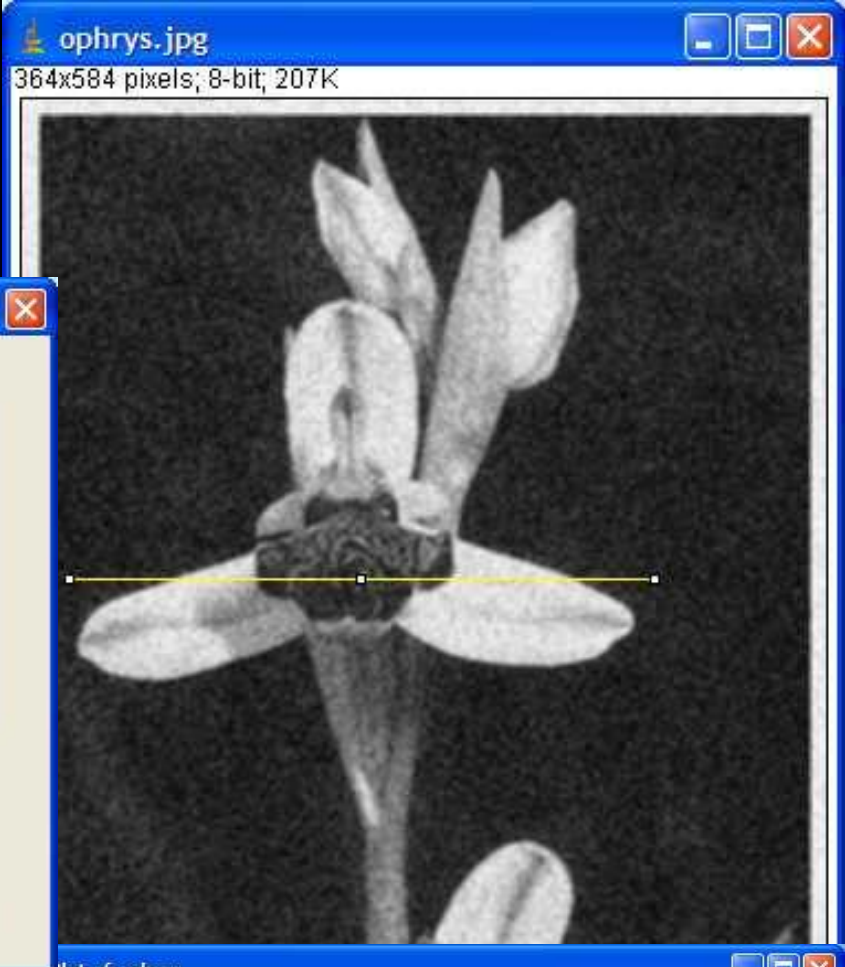
Le pixel cible prend la valeur de la somme des produits normalisée

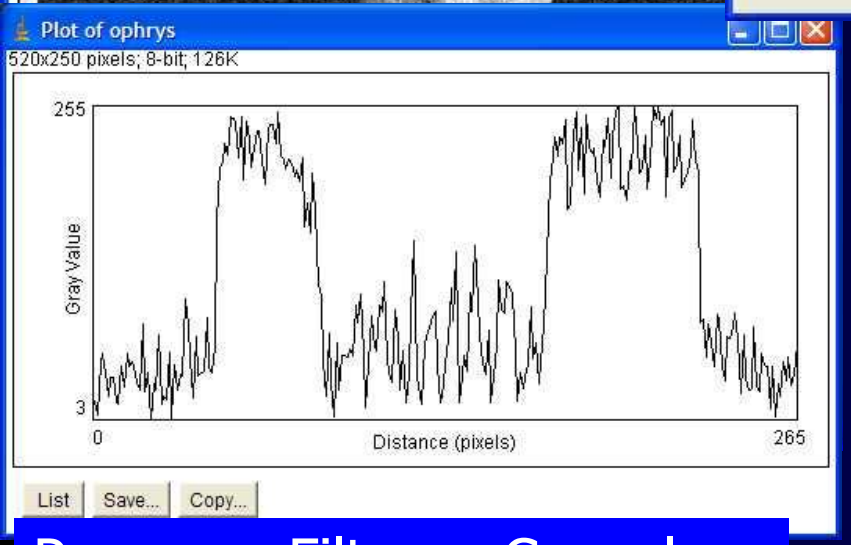
1600/12=133

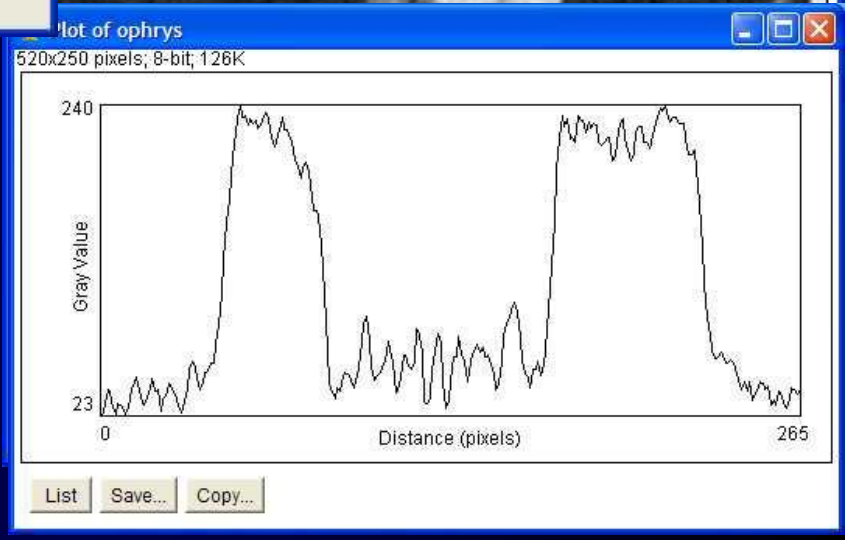
Filtre passe-bas moyenneur





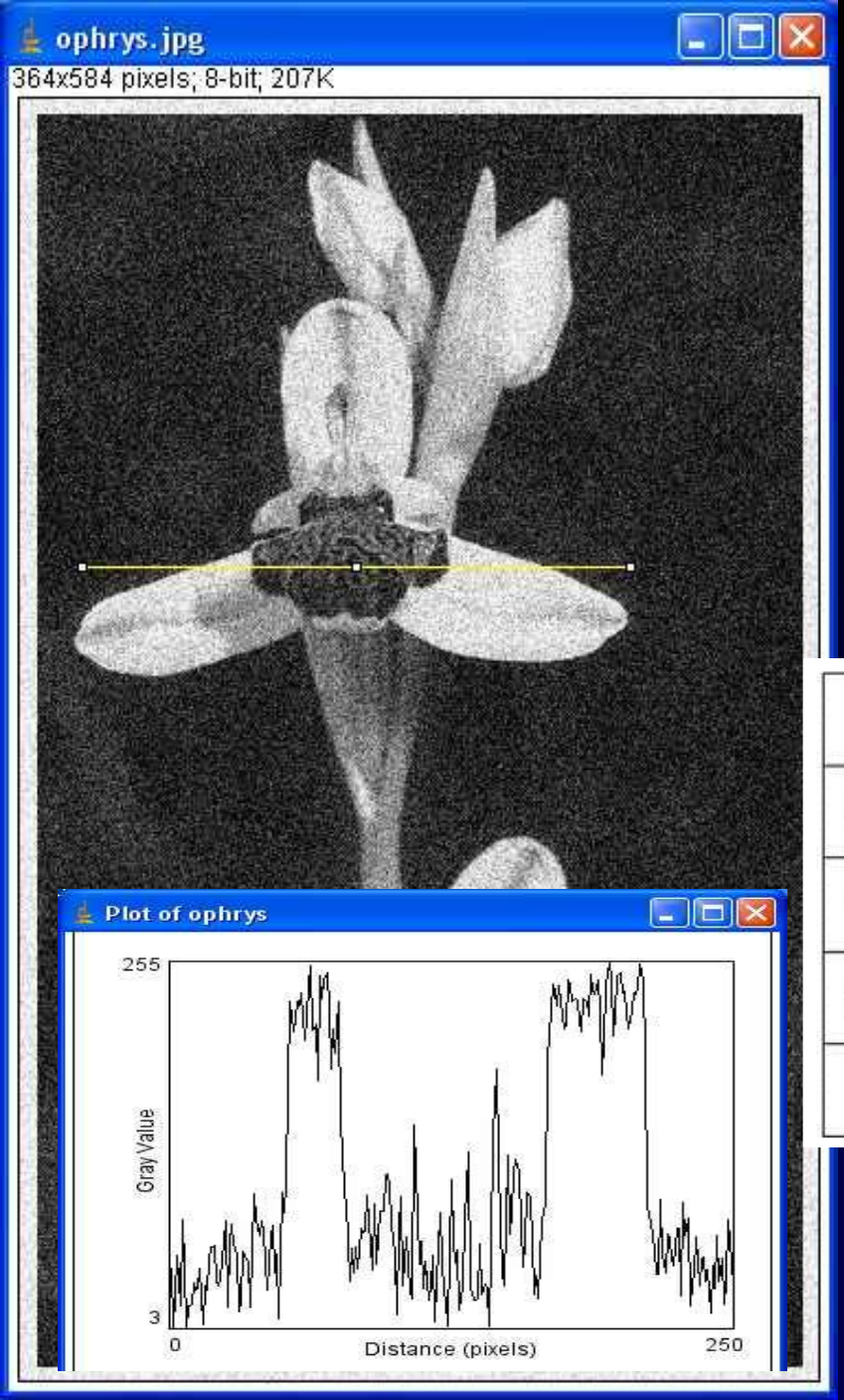




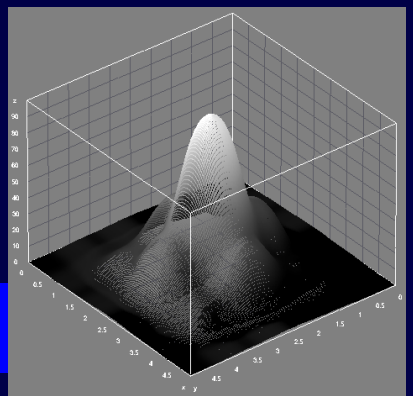


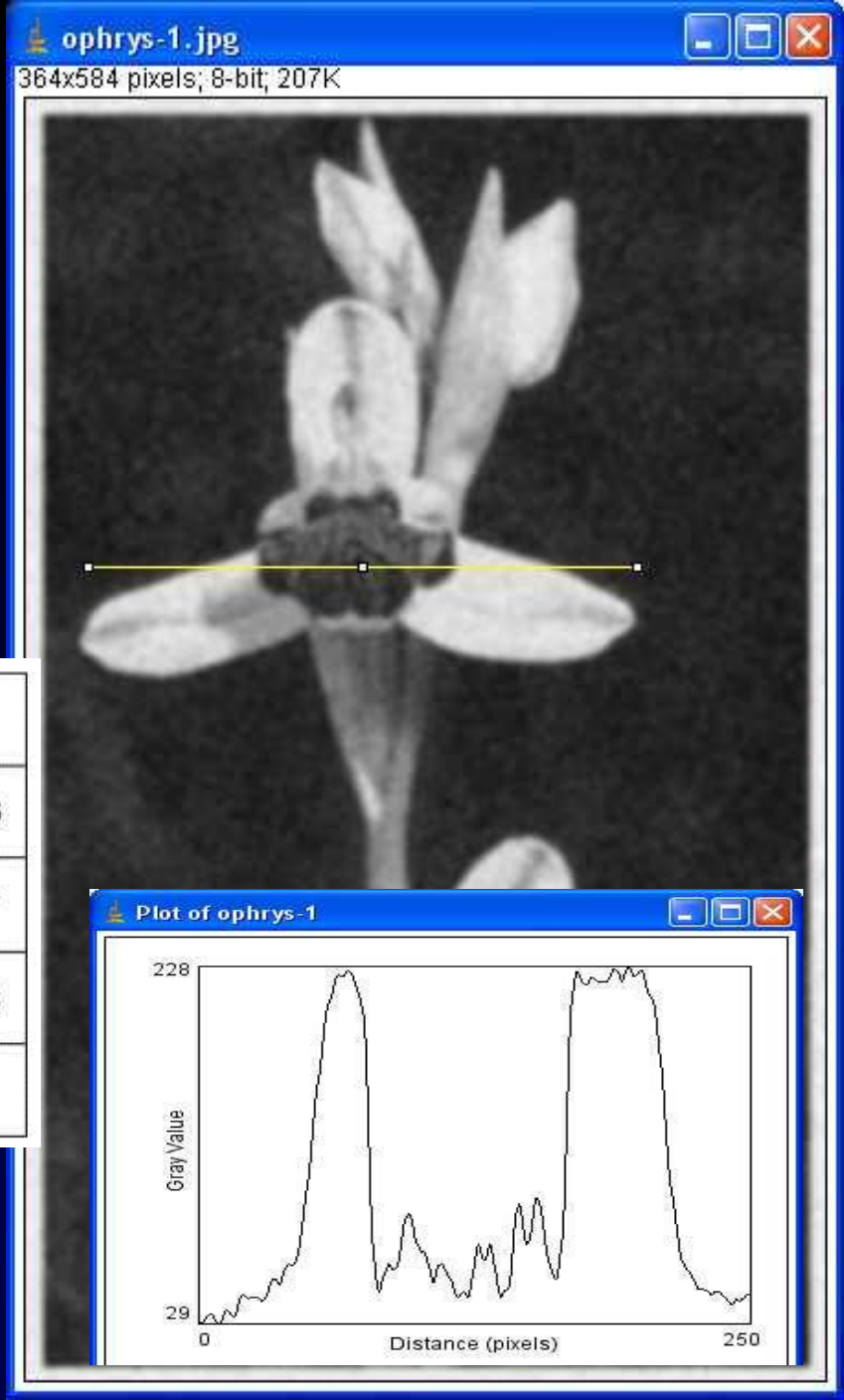
Process→Filters→Convolve...

Filtre Gaussien



0	0.6	1.7	0.6	0
0.6	13	36	13	0.6
1.7	36	100	36	1.7
0.6	13	36	13	0.6
0	0.6	1.7	0.6	0





Process→Filters→Gaussian Blur.

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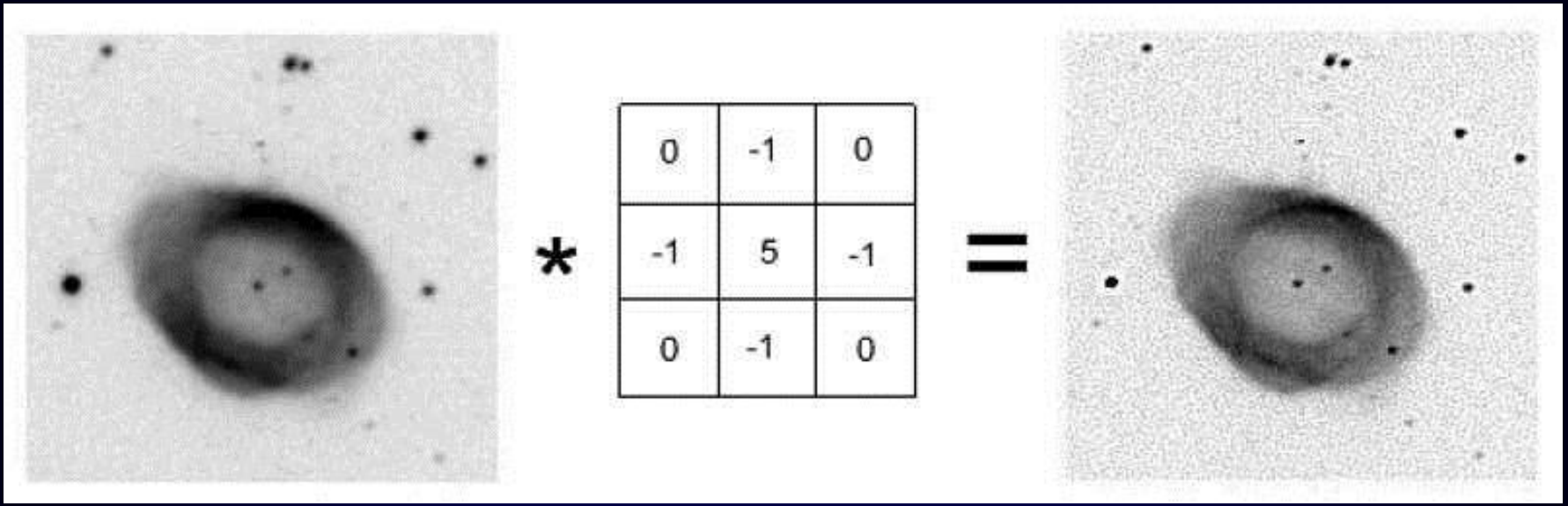
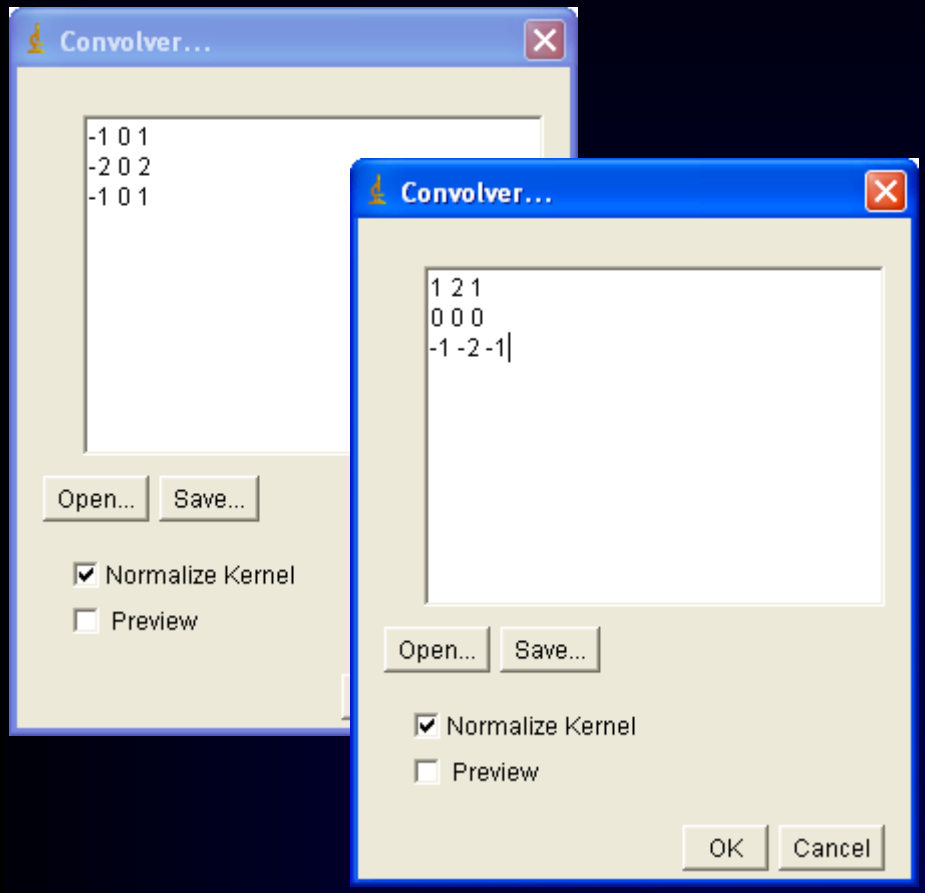
Filtres Passe-haut



Le résultat est une accentuation des détails et du contraste mais aussi une augmentation du bruit

Filtre Détection de bords



Les images sont convoluées
par les filtres de Sobel
Le résultat est la racine carrée
de la somme des carrés des images

Process→Finds Edges

$$\sqrt{D_x^2 + D_y^2}$$

Filtre non linéaire : le filtre médian

Un filtre médian affecte au pixel central la valeur médiane de la série :

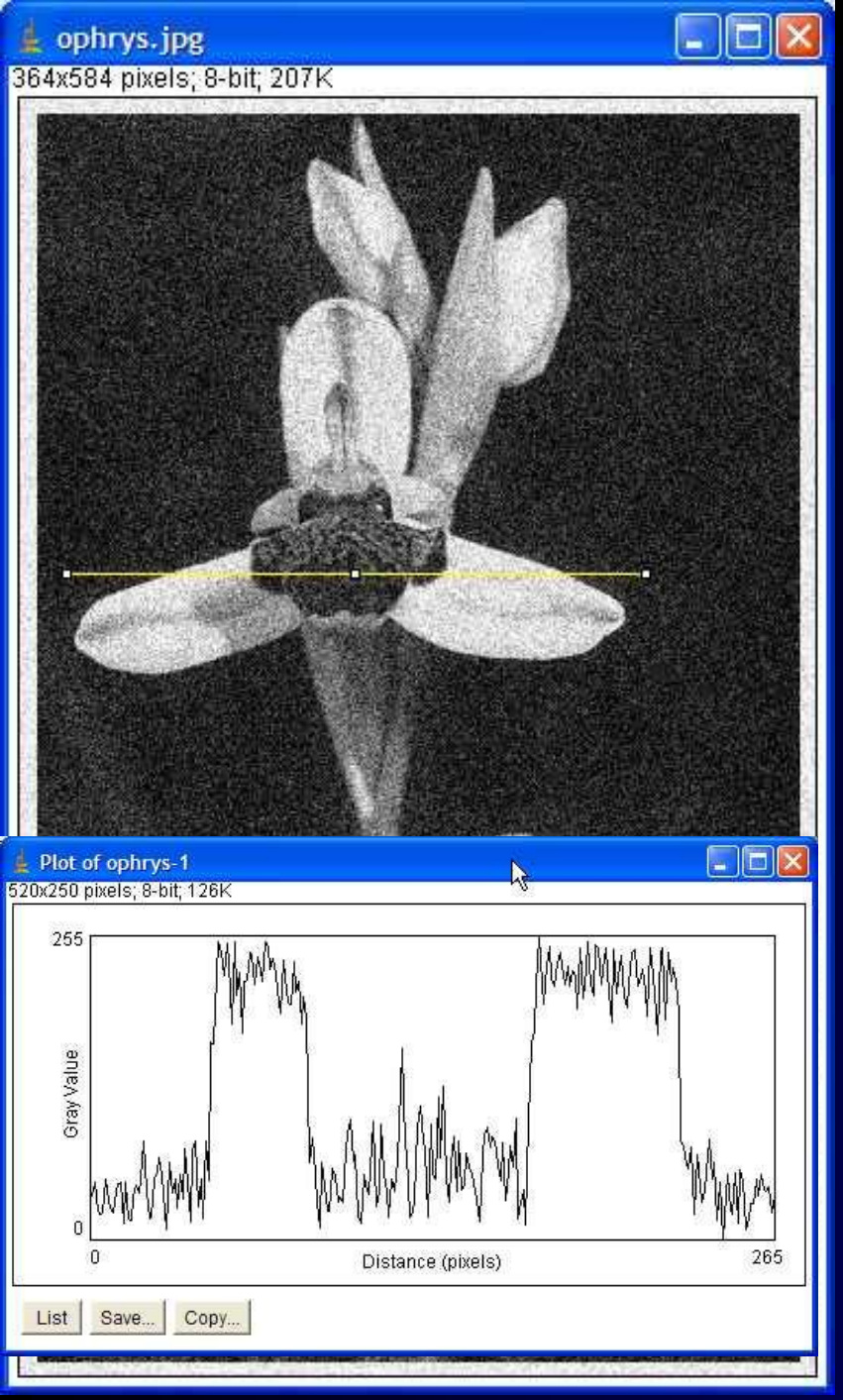
15	18	14
29	27	13
12	19	21

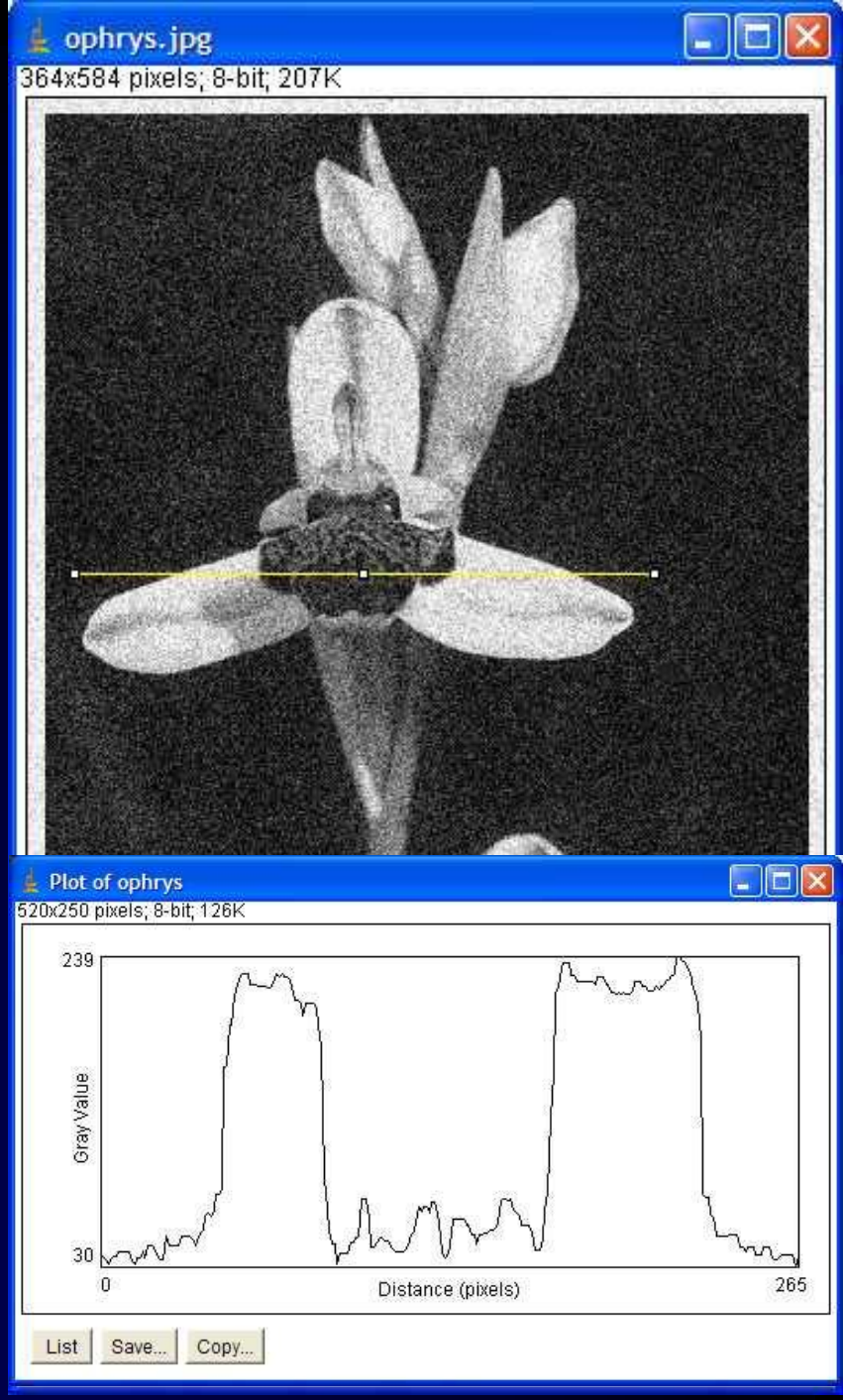
15	18	14
29	18	13
12	19	21

La valeur médiane de : 12,13,14,15,18,19,21,27,29 est 18.

Filtre min → 12
Filtre max → 27

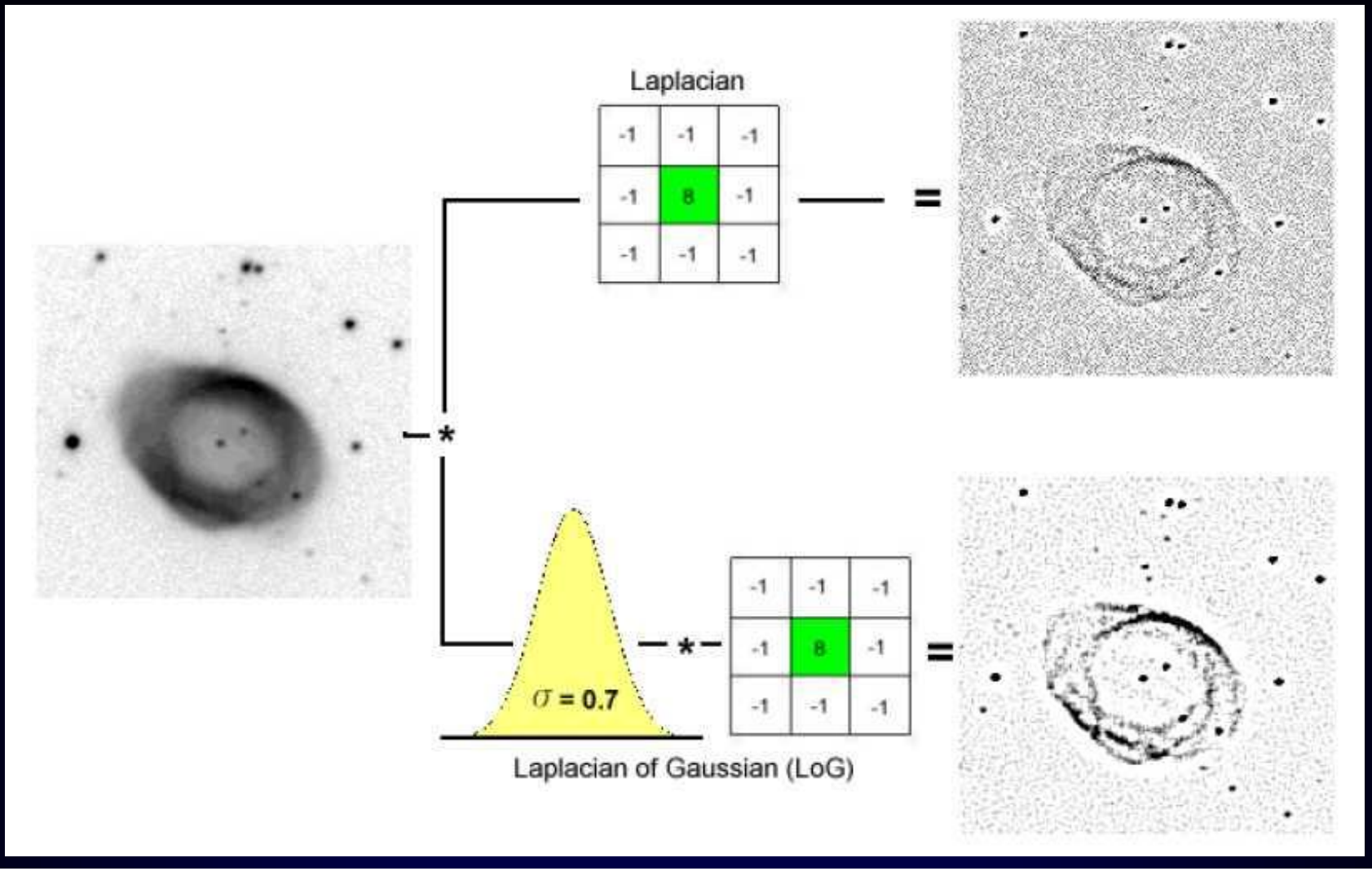
Filtre médian





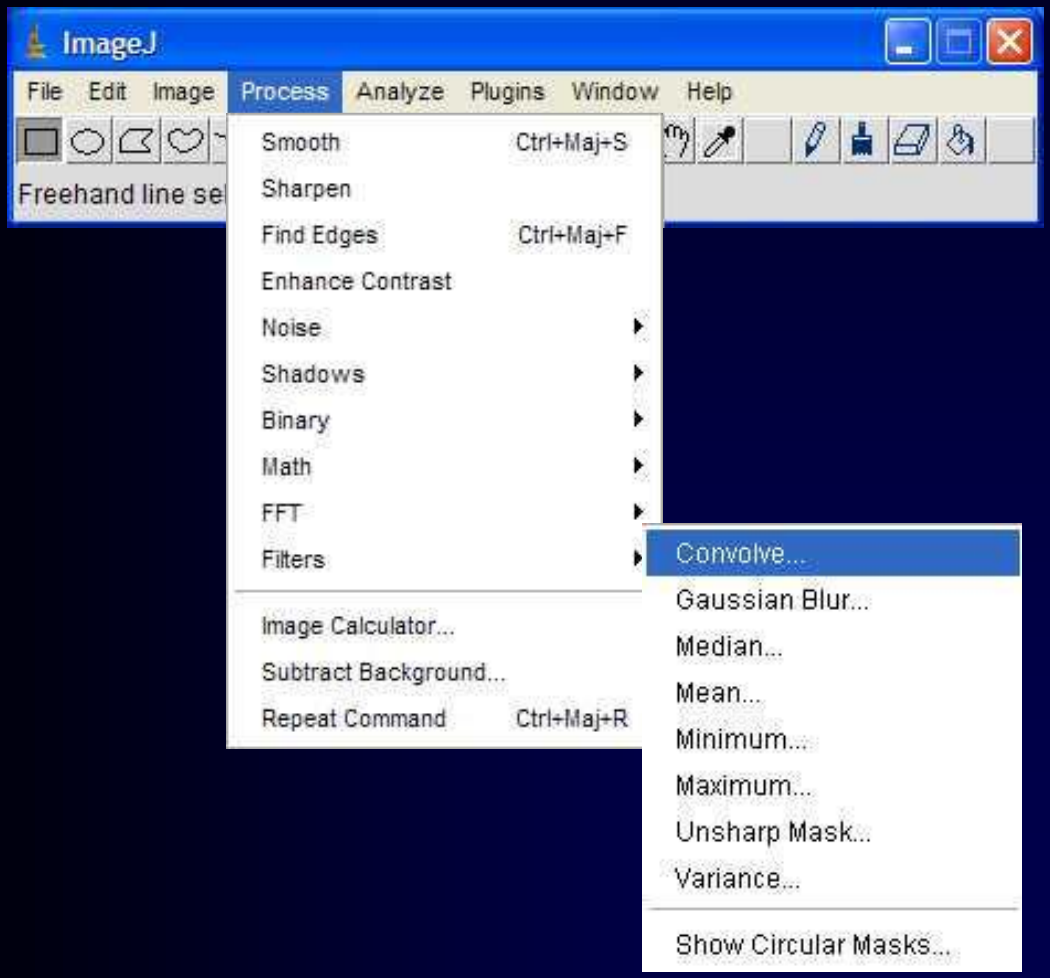
Process→Filters→Median...

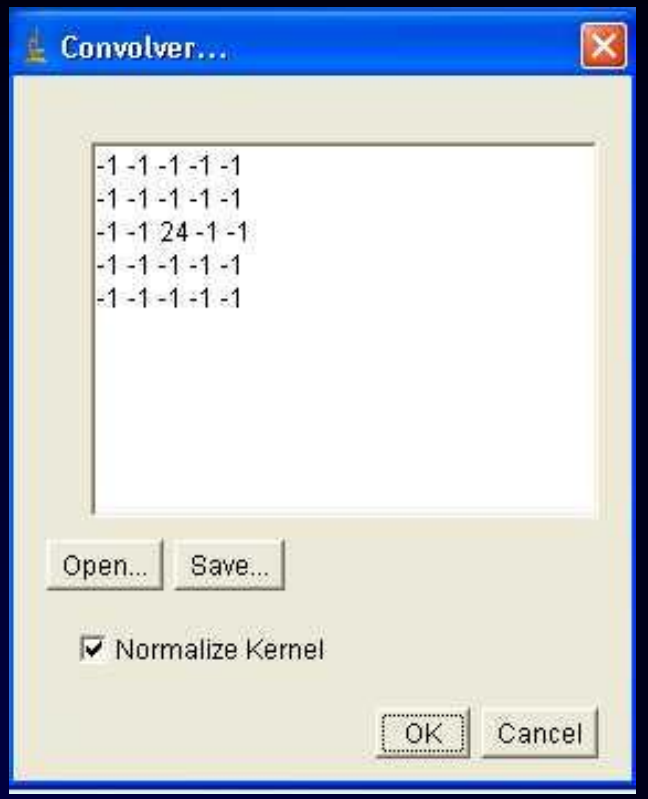
Combinaison Gaussien Laplacien

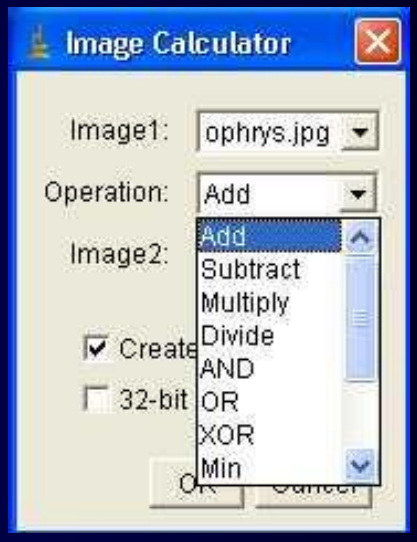


Les propriétés de réduction de bruit des filtres Gaussiens peuvent être utilisées en combinaisons avec d'autres filtres qui au contraire génèrent du bruit, comme les filtres Laplaciens. On peut par exemple choisir d'appliquer d'abord un filtre Gaussien pour réduire le bruit, avant d'appliquer un filtre Laplacien pour détecter les points autour desquels les variations de luminosité sont importantes.

Filtres et Opérations dans ImageJ







Topic 06 – Noise and filter

Correction du fond

Sources de dégradation

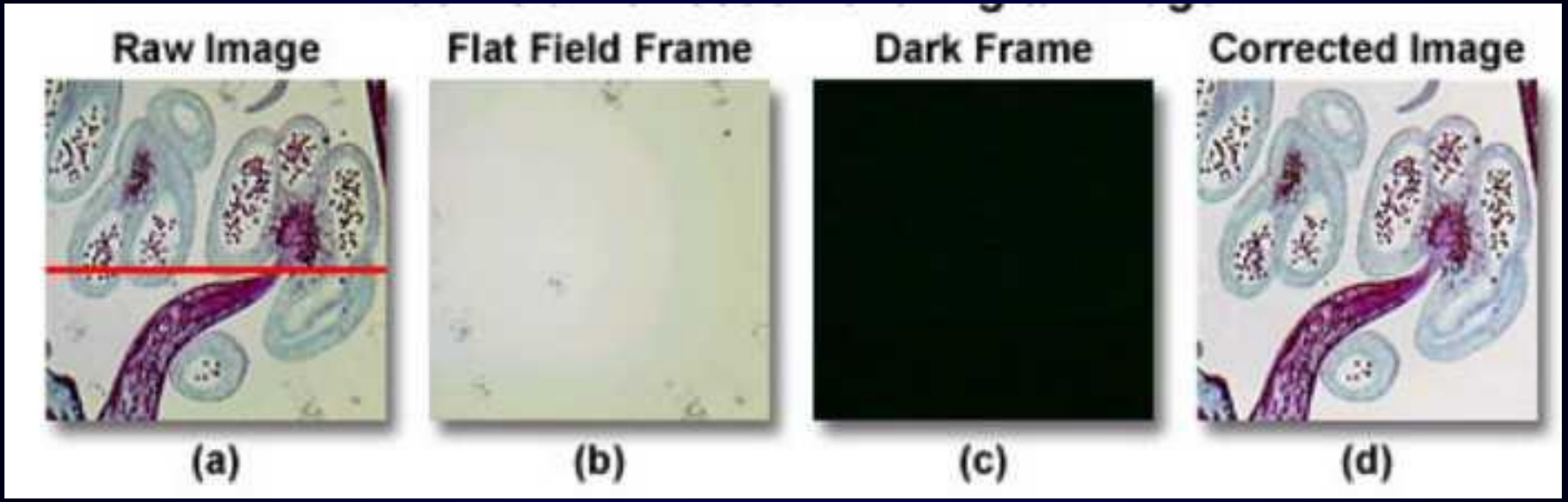
- Bruits de la caméra: bruit aléatoire, «pixels chauds» ,bruits périodiques
- Illumination non-homogène

Correction à la capture

Fixer les réglages microscope – acquisition

Captures moyennées d'un champs noir CN (en coupant le trajet optique) d'un champs clair CC (lame sans échantillon) et de l'échantillon

Image corrigée = ((échantillon - CN) / (CC - CN)) * 255



Correction du fond

Correction après la capture

Bruit aléatoire : filtre gaussien ou médian mais perte de détail

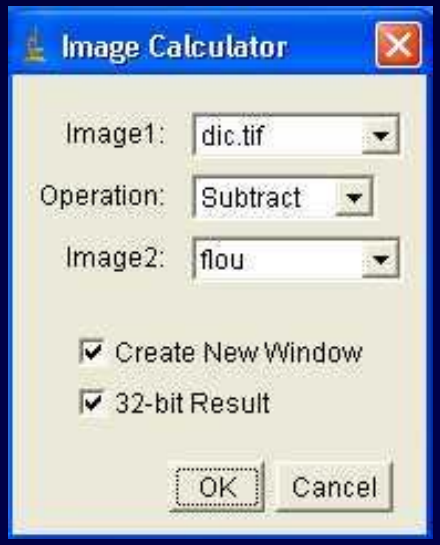
Pixels chauds : filtrer les pixels saturés isolés

Bruit périodique : filtre de Fourier

Illumination non-homogène :

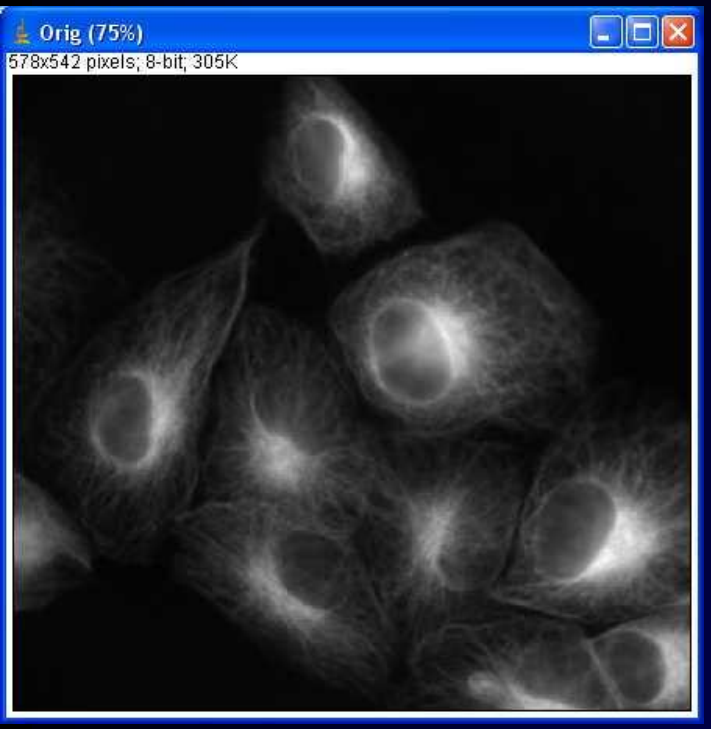
- Soustraire la même image très floue (filtre gaussien très large)
- Algorithme « rolling ball » (ImageJ Process→Substract Background)
- Toute une serie de plugins implémentés dans ImageJ (Fitting a polynomial surface)

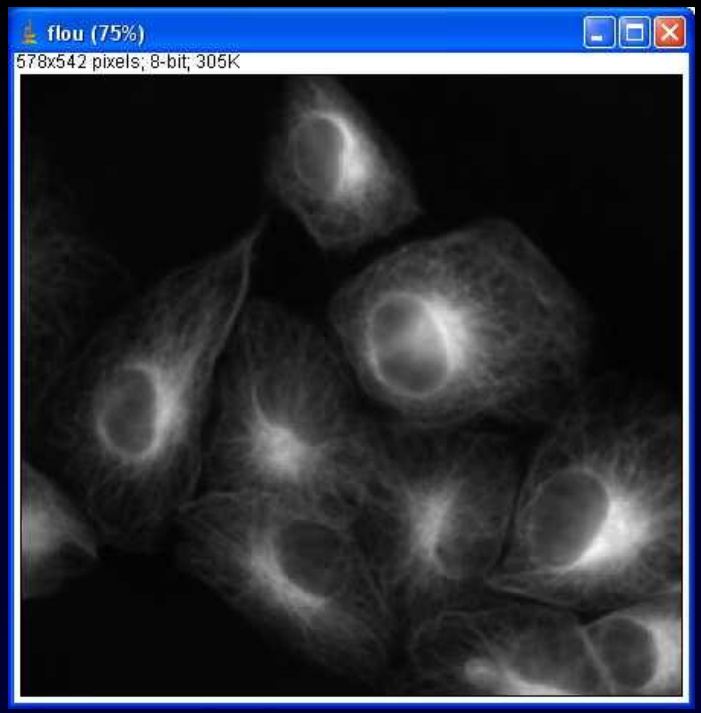
Masquer le fond

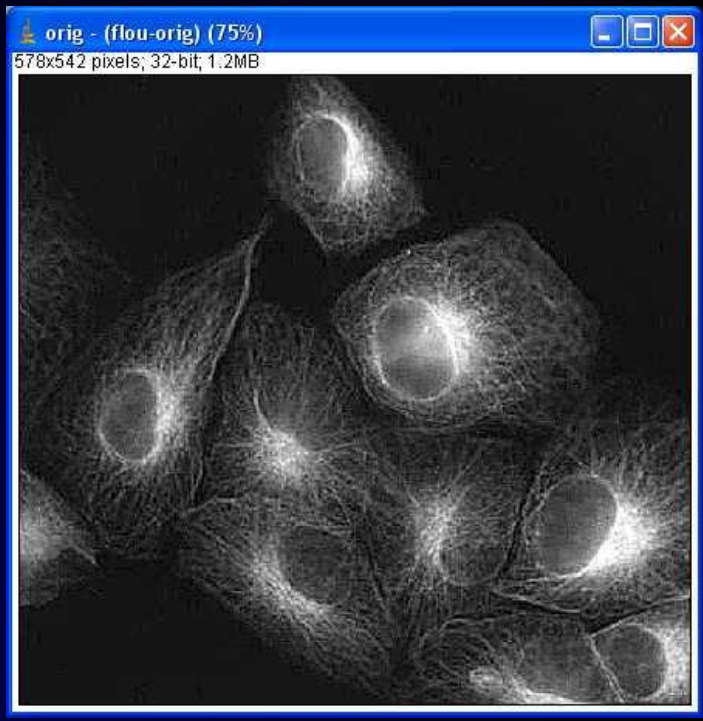


Masque de Flou

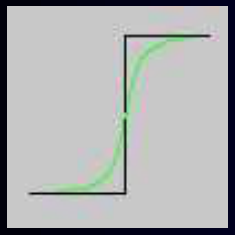
1 1 1
1 1 1
1 1 1

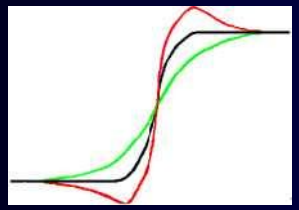


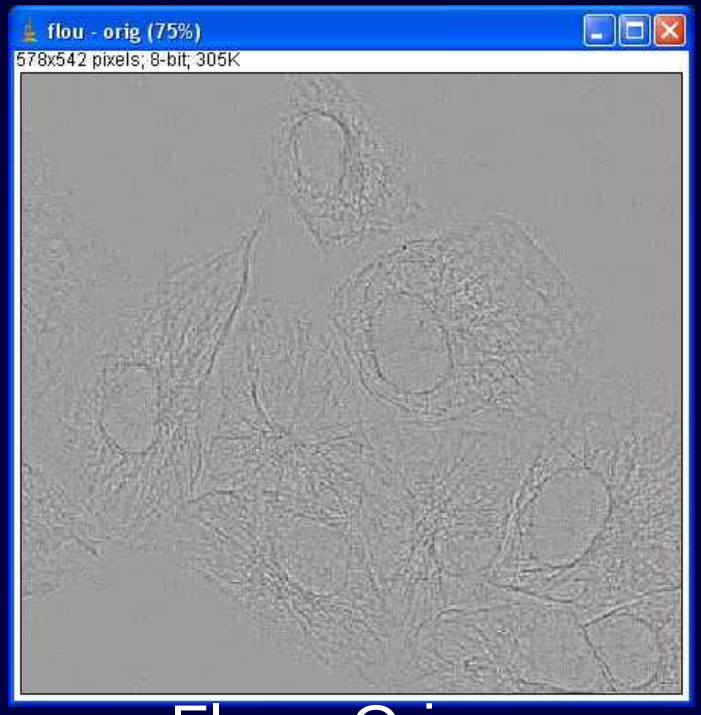




Orig –(Flou – Orig)







Flou - Orig

Topic 07 – Background correction
Unsharp masking

L’image numérique

Les Prétraitements

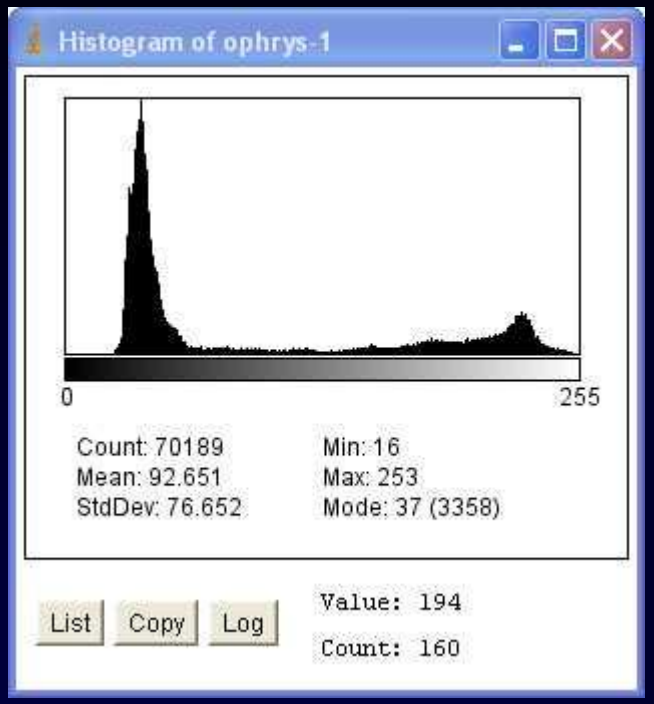
La Segmentation

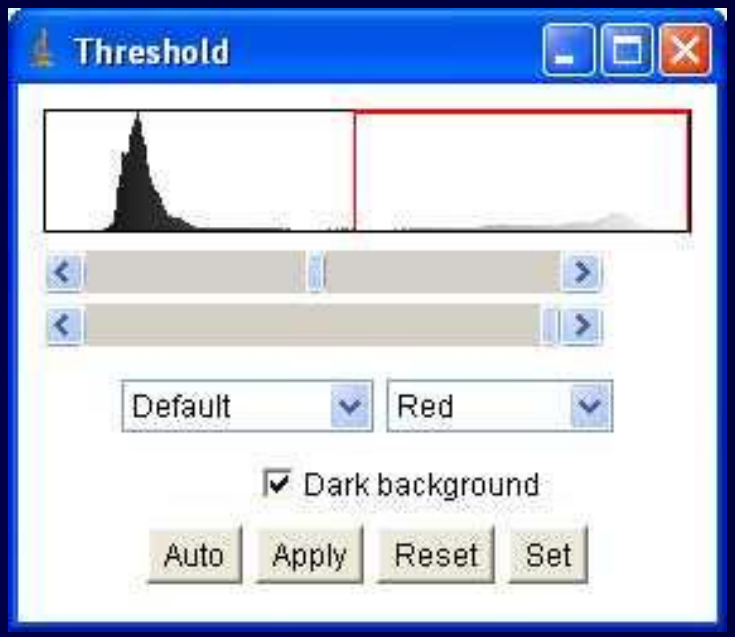
Les Post-traitements

La Quantification

Permet de séparer les régions d'intérêt du fond.

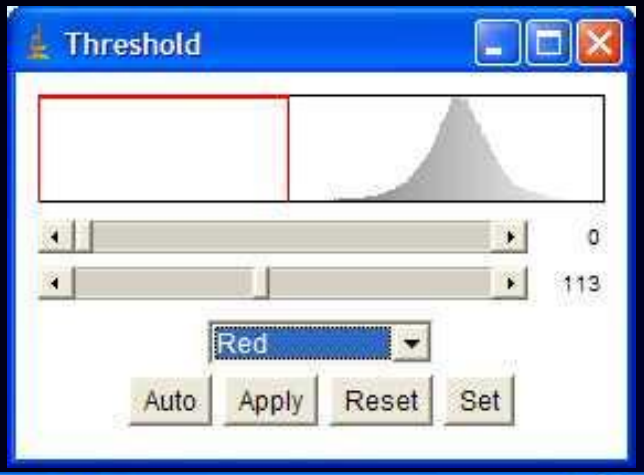
Le Seuillage automatique

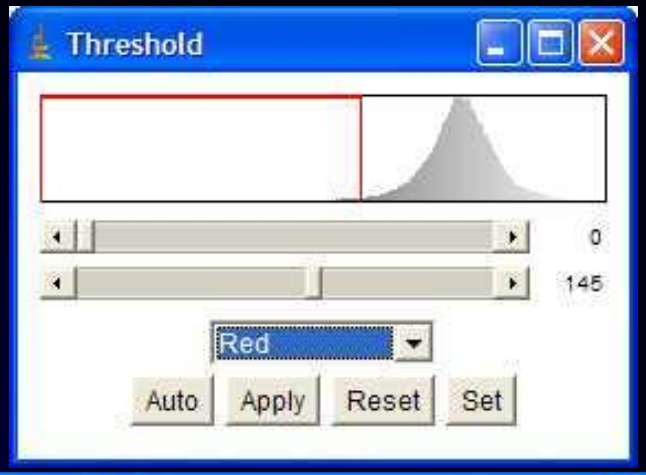


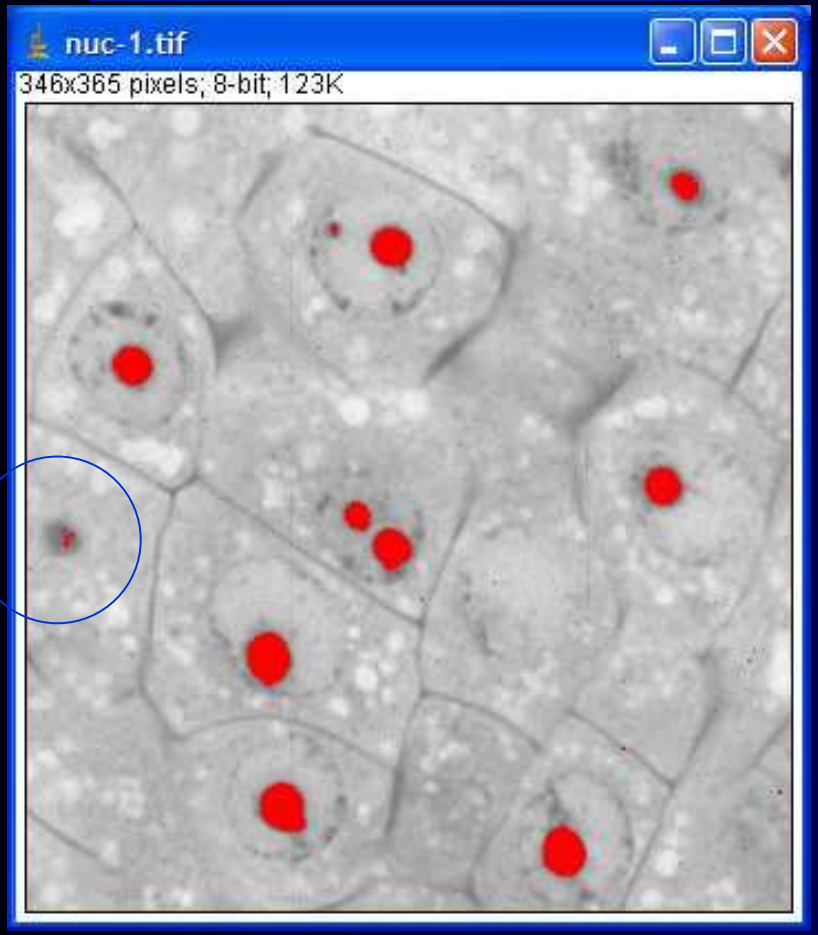


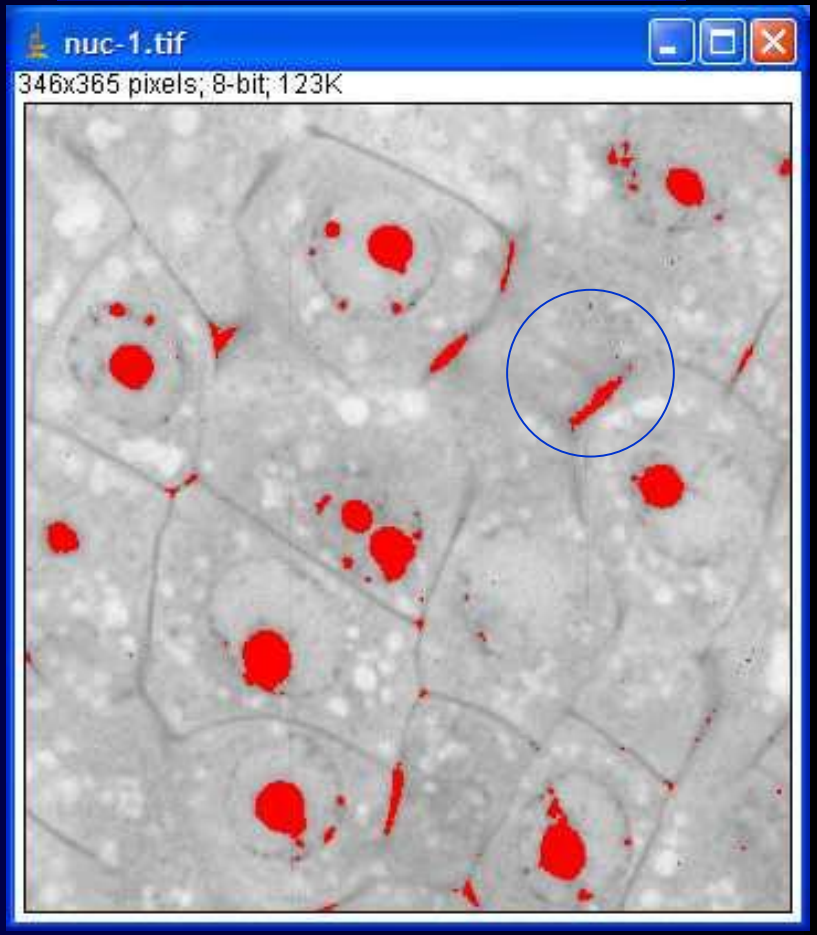
Image→Adjust→Threshold...

Le Seuillage manuel

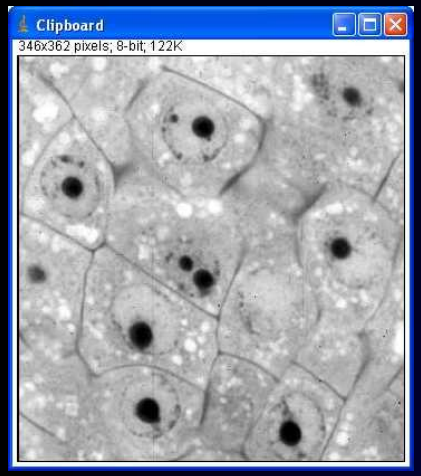


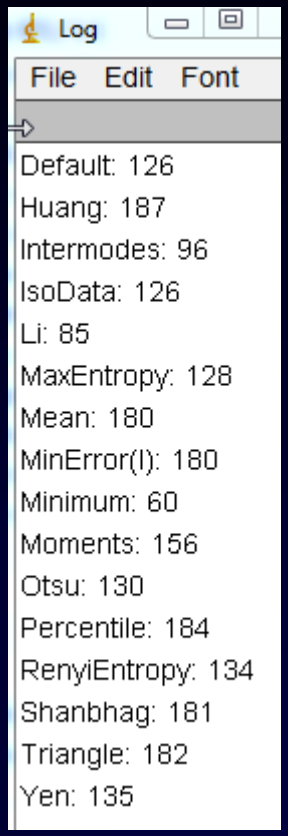


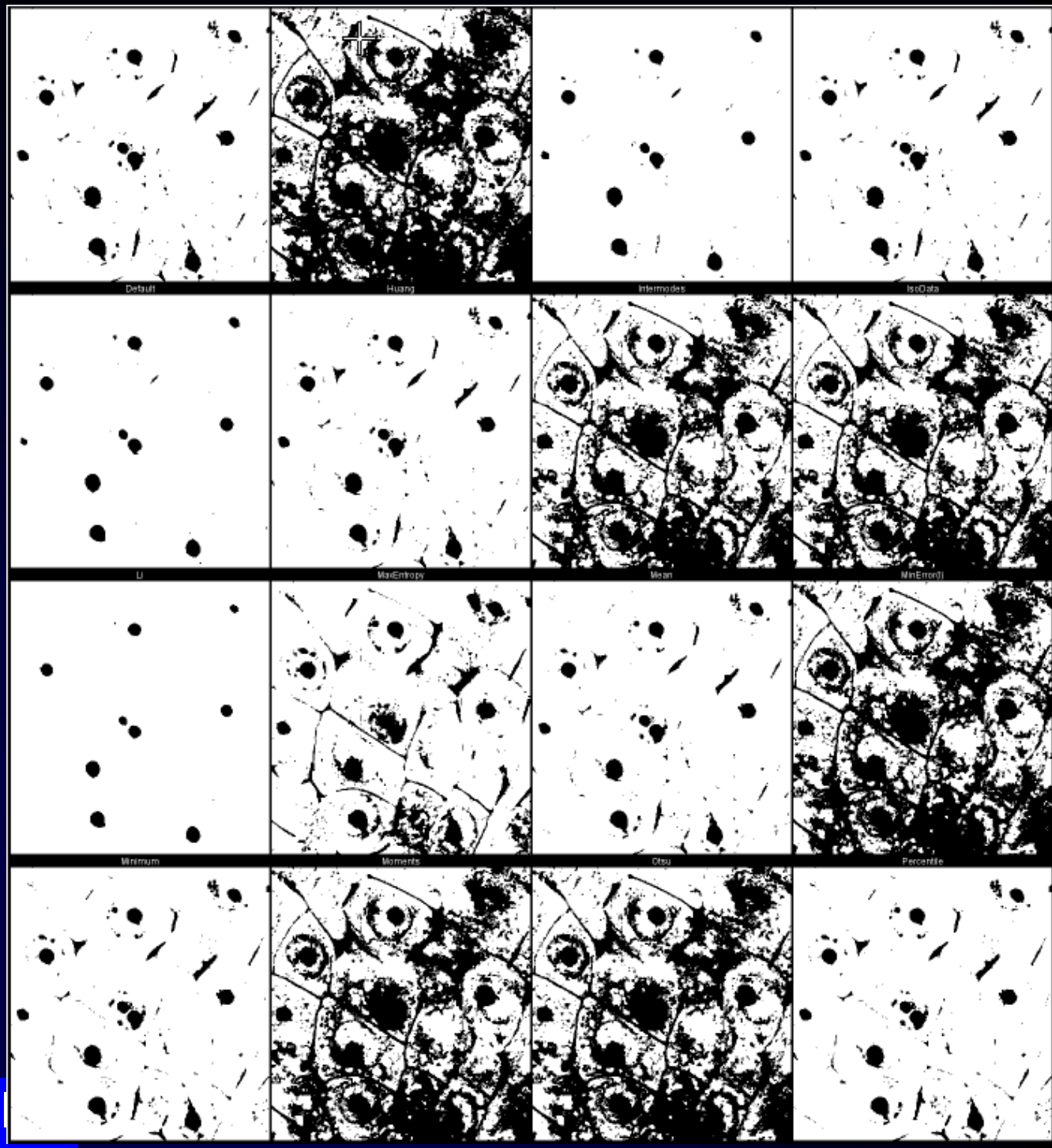




Le Seuillage automatique







Image→Adjust→AutoThreshol

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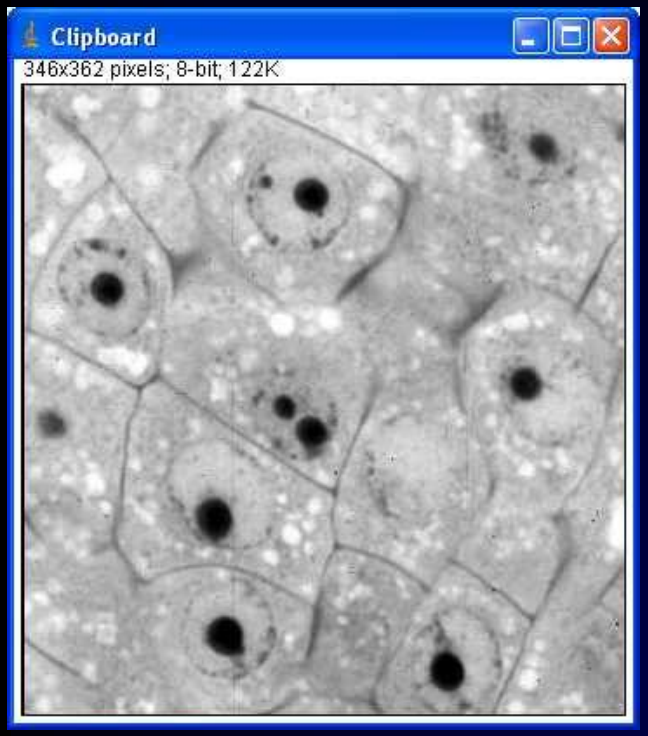
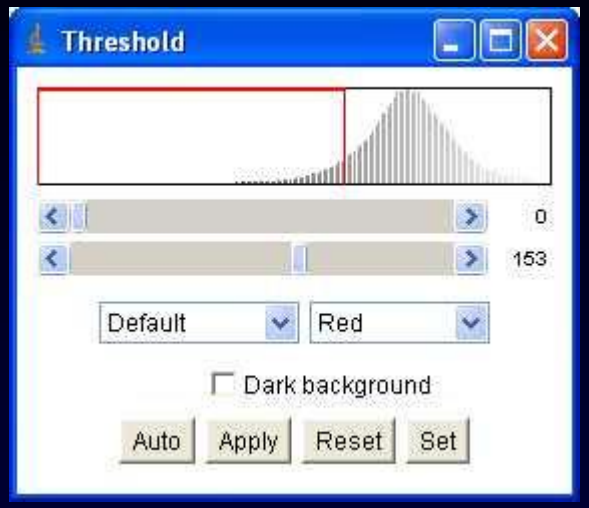
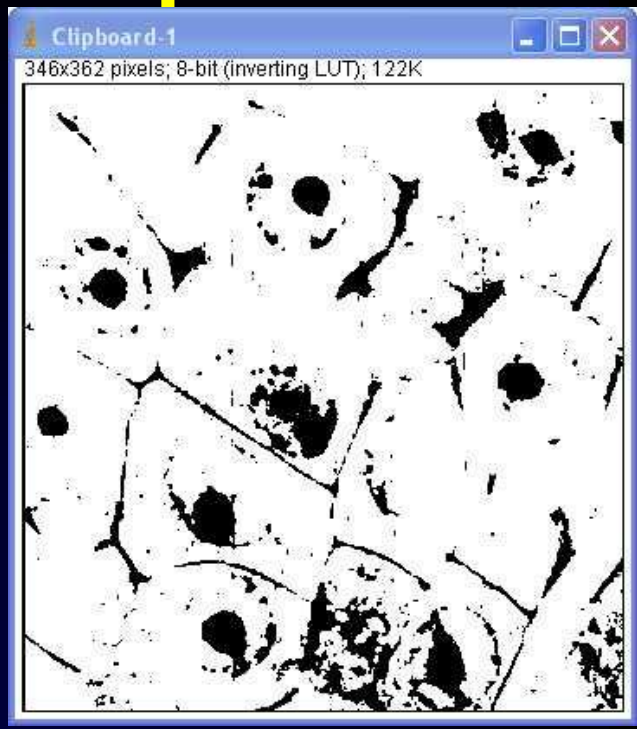
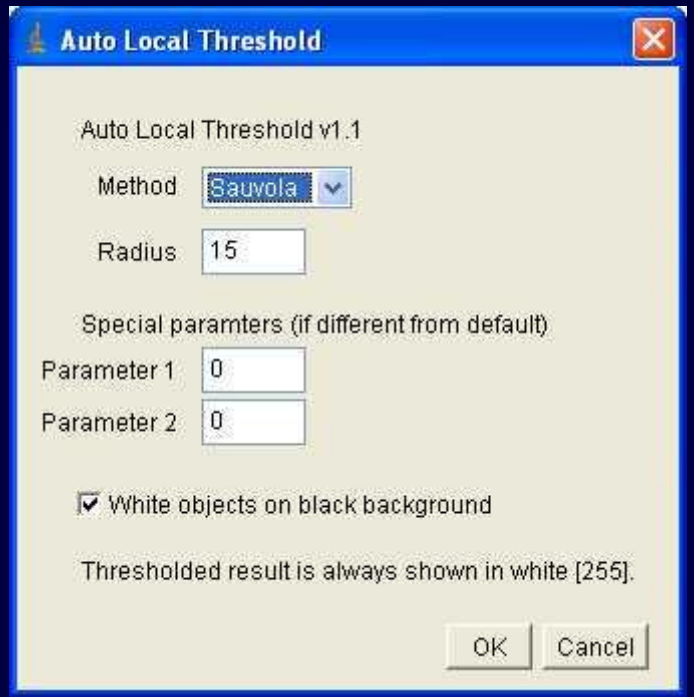
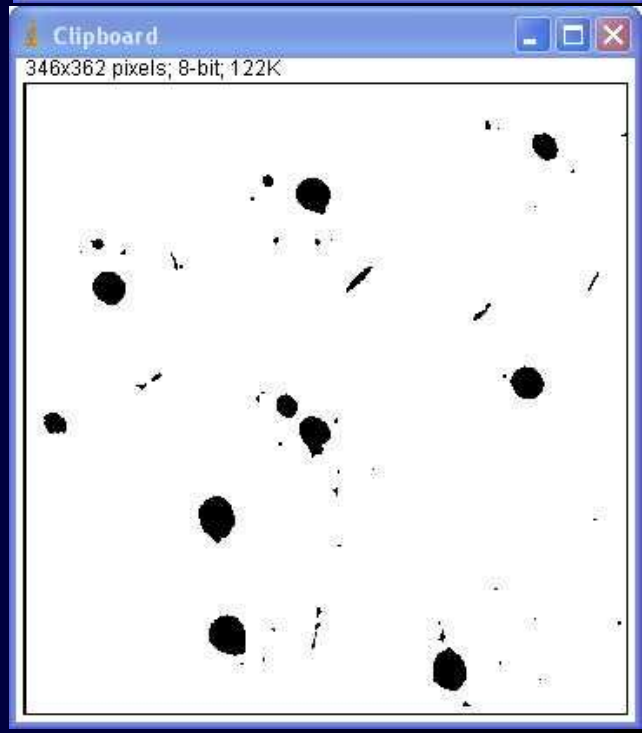
Seuillage local automatique



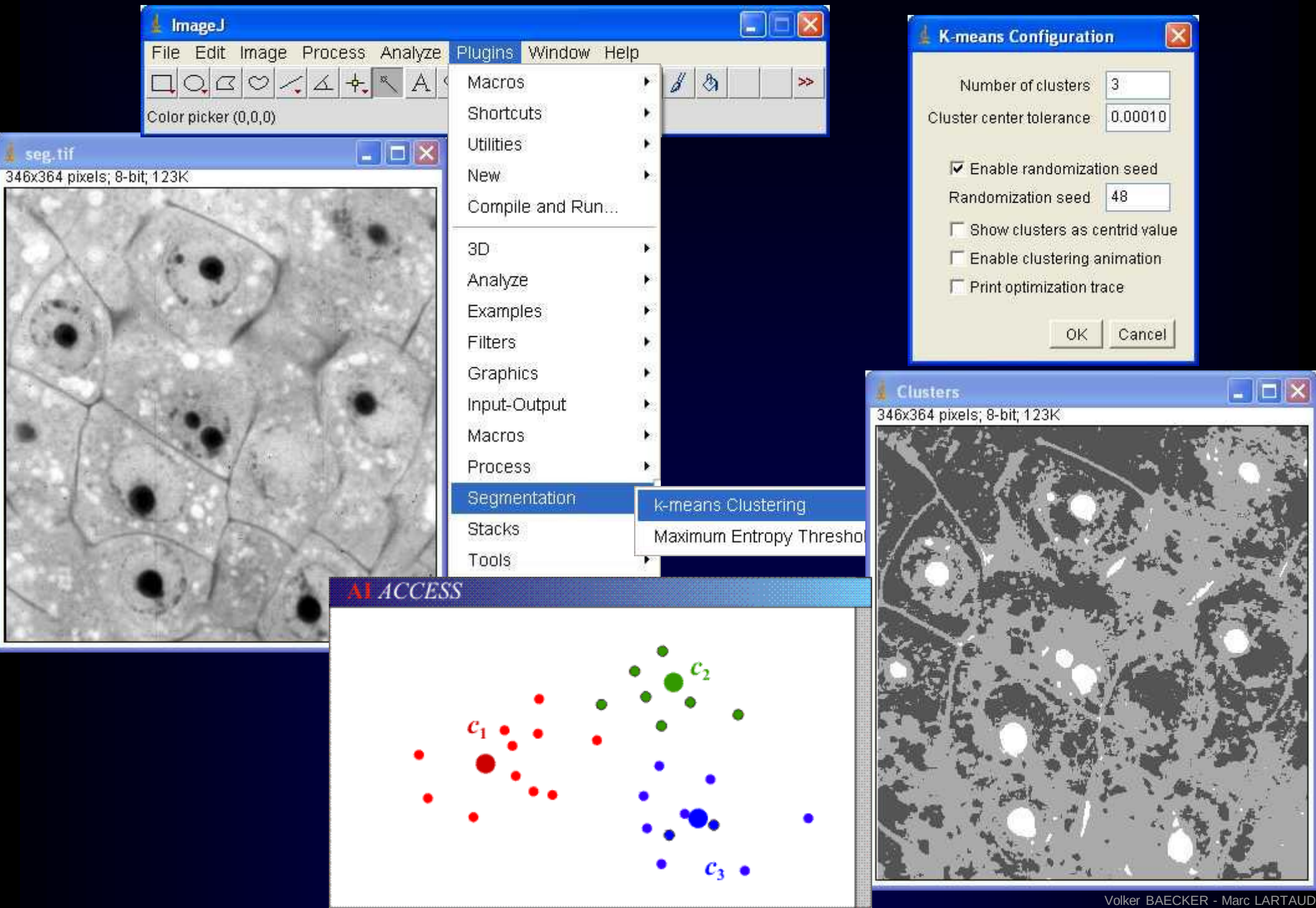




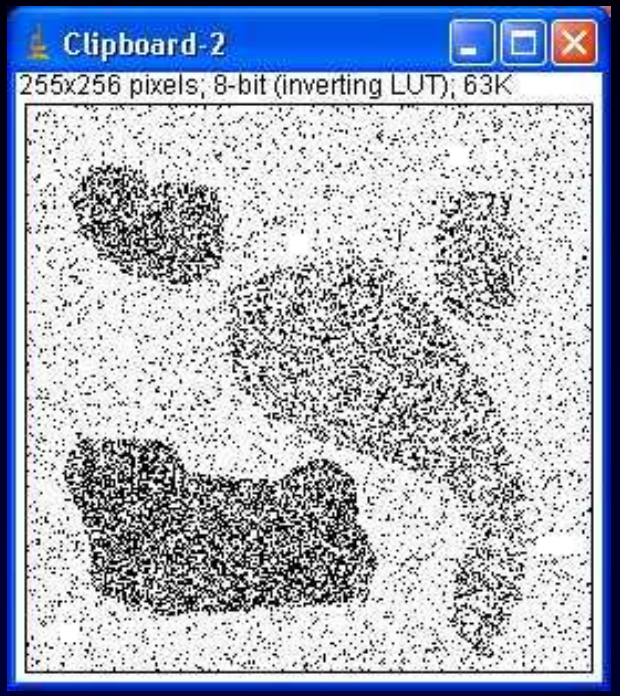




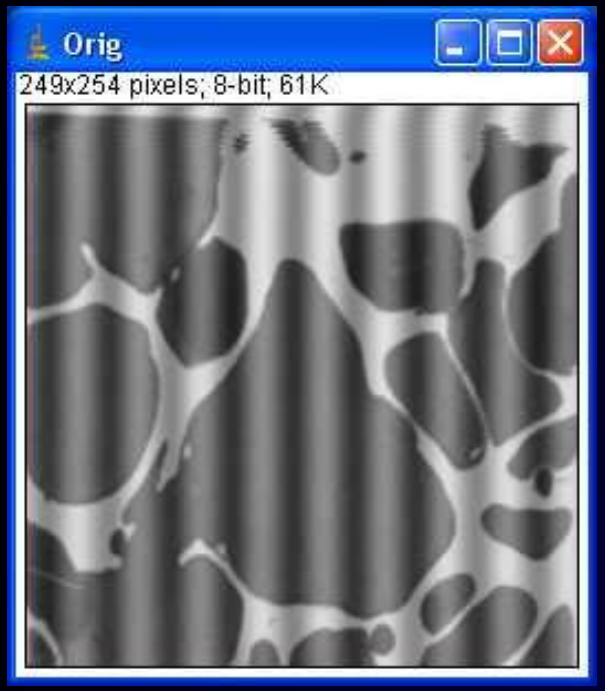
Plugin k-mean clustering

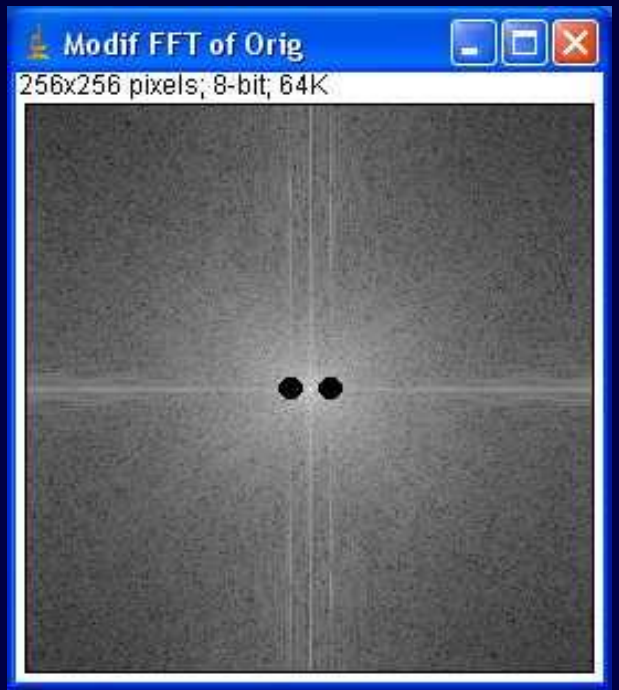


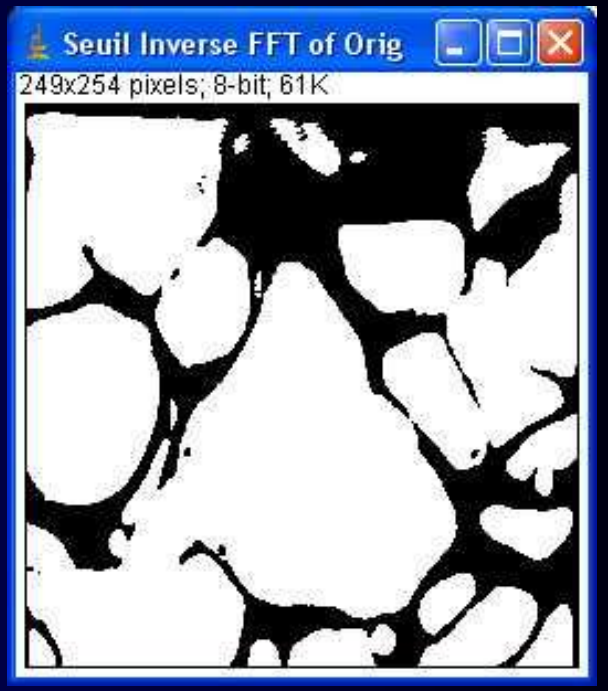
Filtrage avant le seuillage



FFT filtres dans le domaine de Fourier







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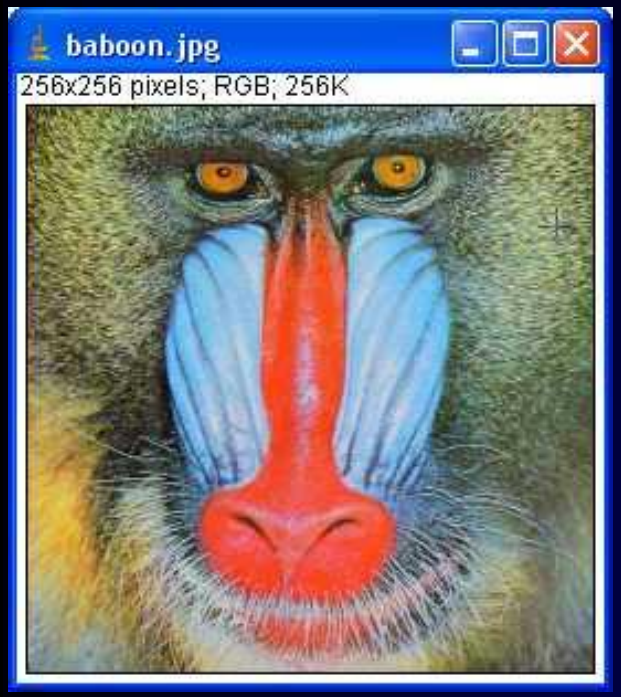
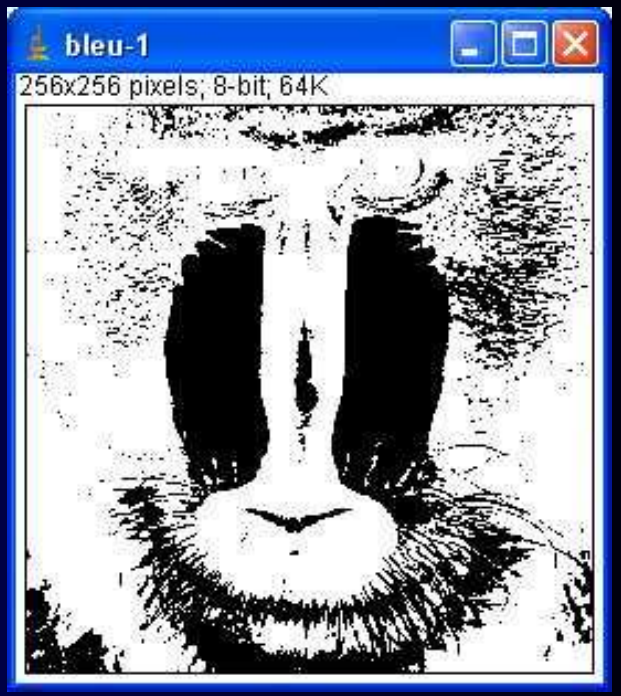
Couleur et segmentation séparation RGB





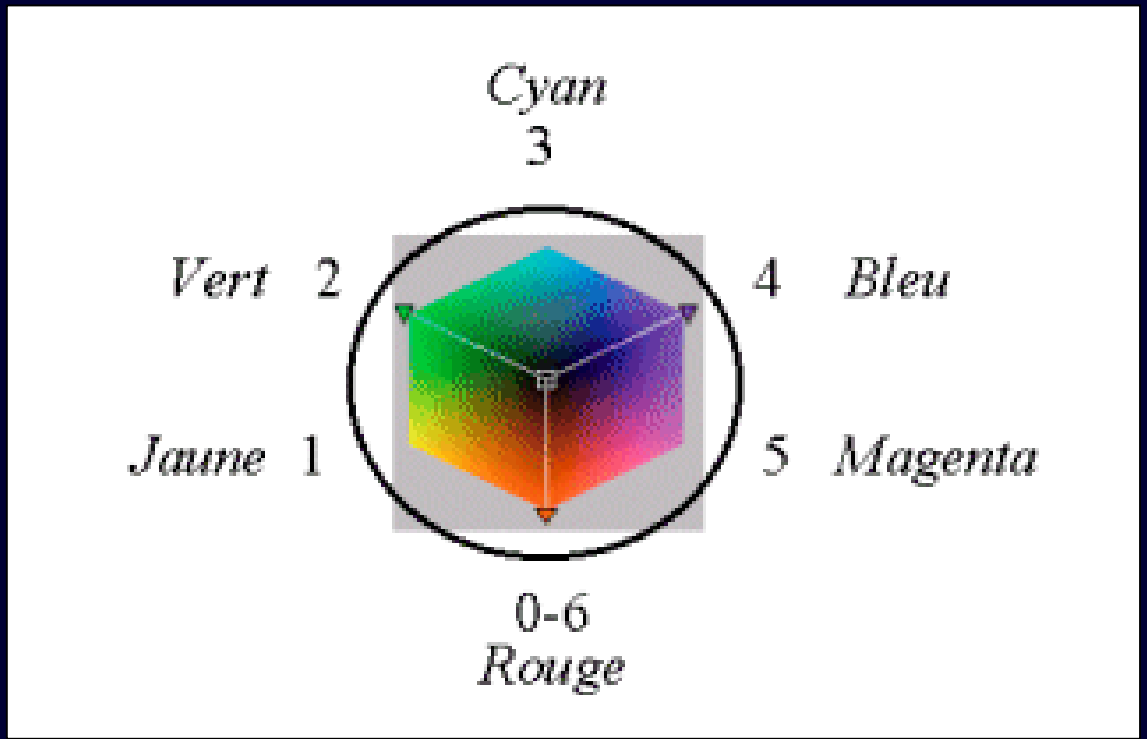
Image→Color→Split Channels...

Décomposition HSI

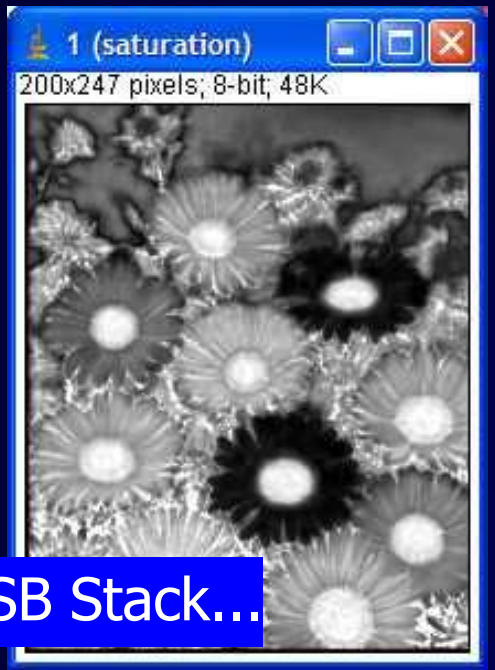
la Teinte ou Hue se référant à la couleur
codée de 0 à 6 correspond à une distribution cyclique des couleurs
le noir, le blanc et les nuances de gris sont codés à 0, comme le rouge

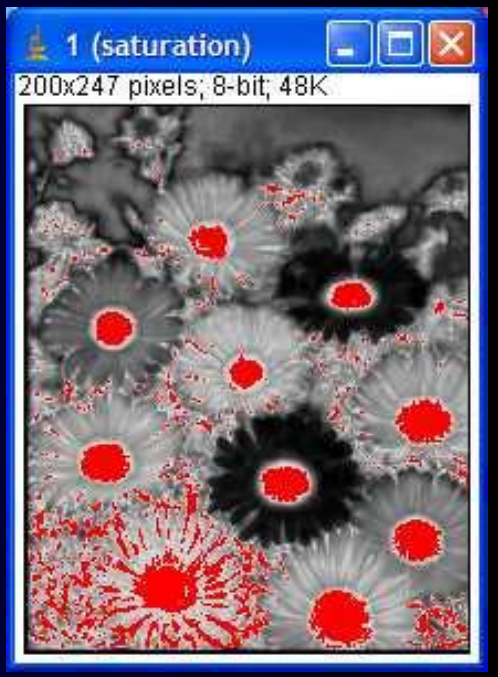
la Saturation : mesure de l'absence de blanc dans une couleur
le " rouge pompier " étant une couleur saturée et le rose une couleur non saturée

l'Intensité ou Luminance : mesure de l'intensité d'une couleur, distinction entre clair et foncé



Couleur et segmentation séparation HSI





Image→Type→HSB Stack...

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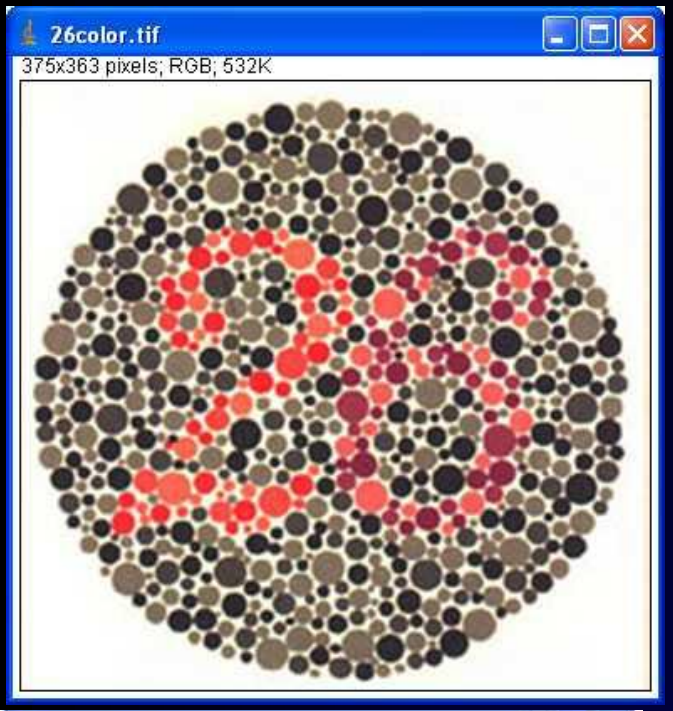
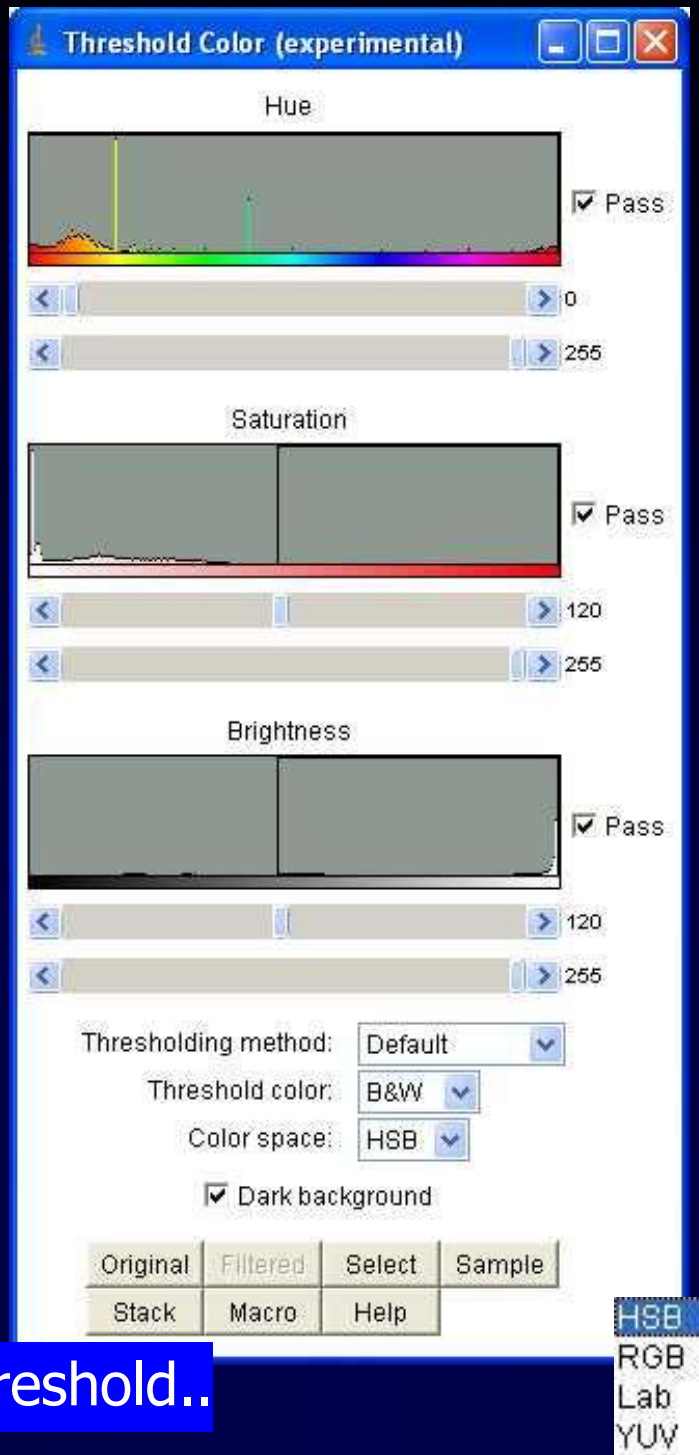
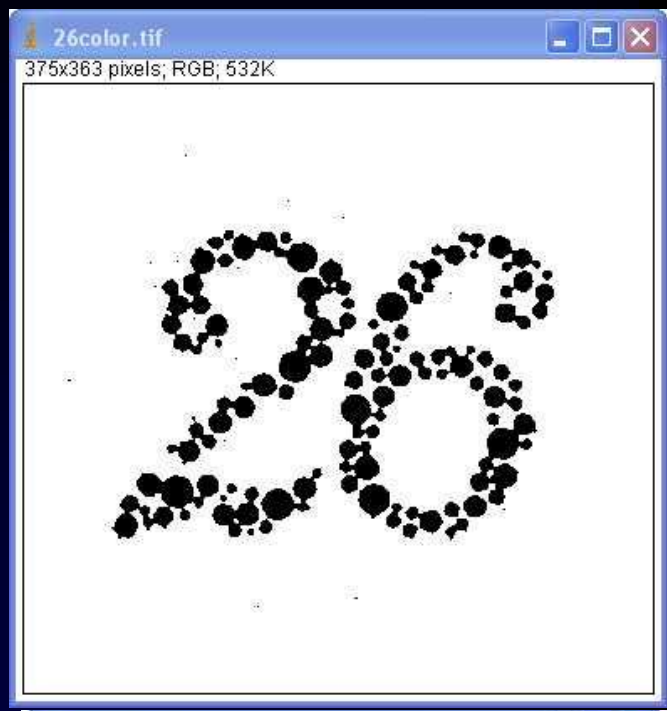
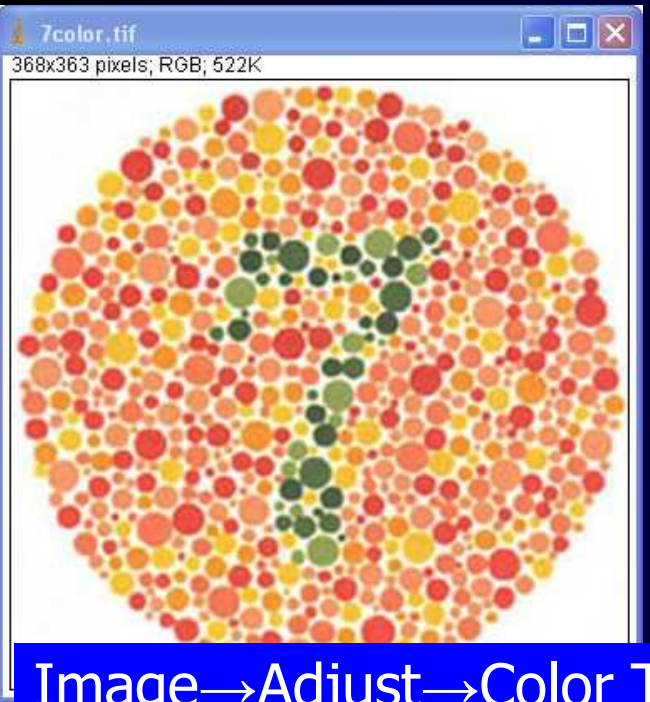
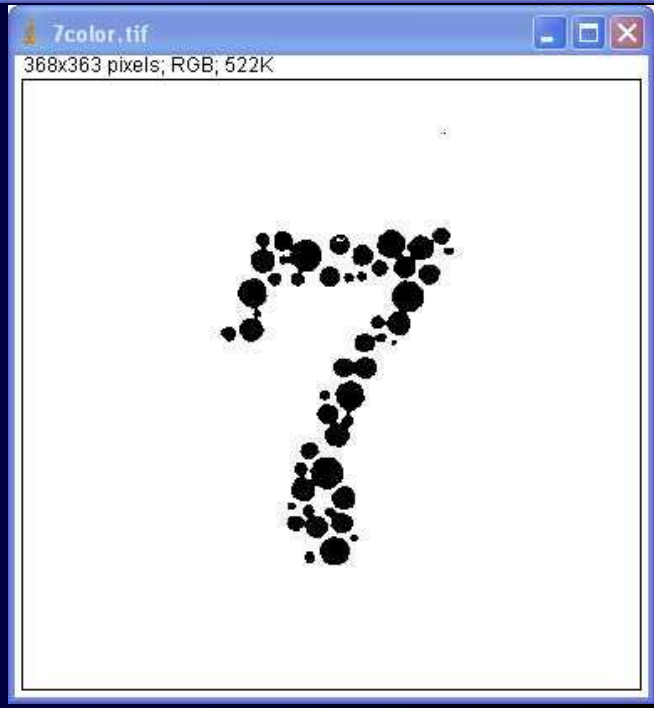
Seuillage couleur





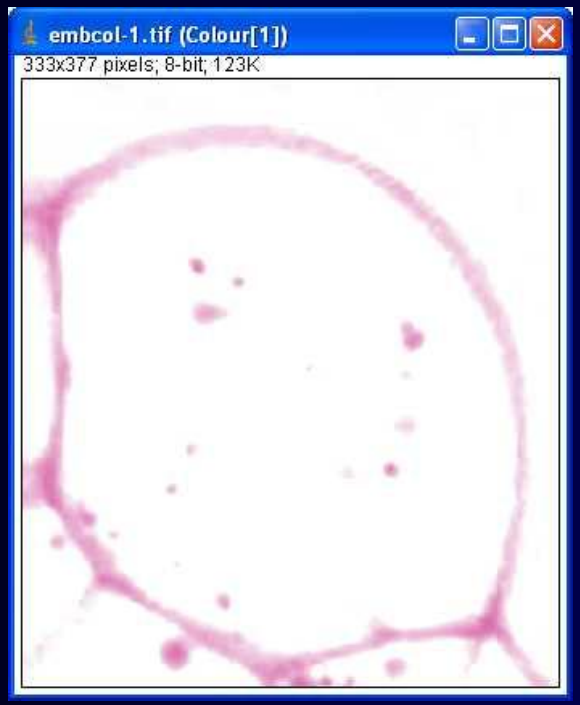






Image→Adjust→Color Threshold..

Plugin Colour Deconvolution



Topic 08 – Segmentation

L’image numérique

Les Prétraitements

La Segmentation

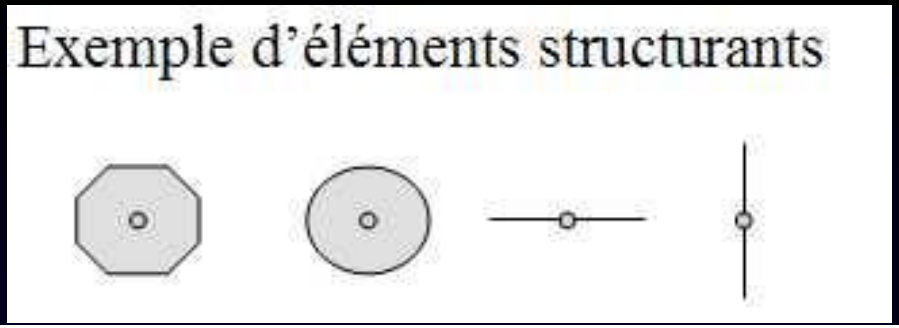
Les Post-traitements

Transformations de morphologie mathématique

La Quantification

Principe

Elément structurant

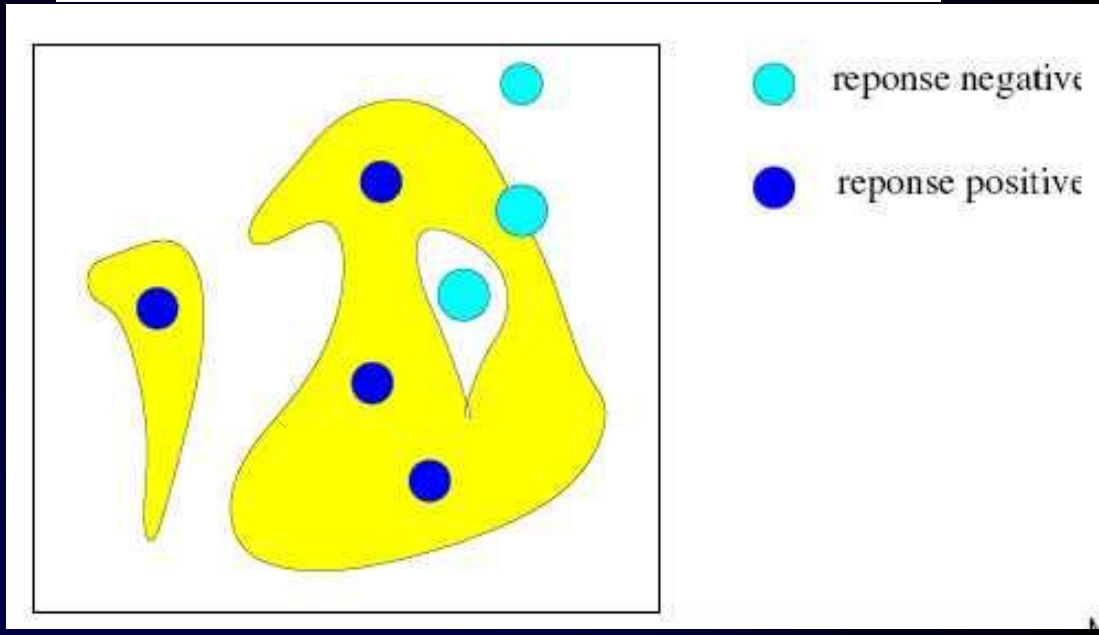


On déplace l'élément structurant sur toute l'image

Le pixel sera noir si:

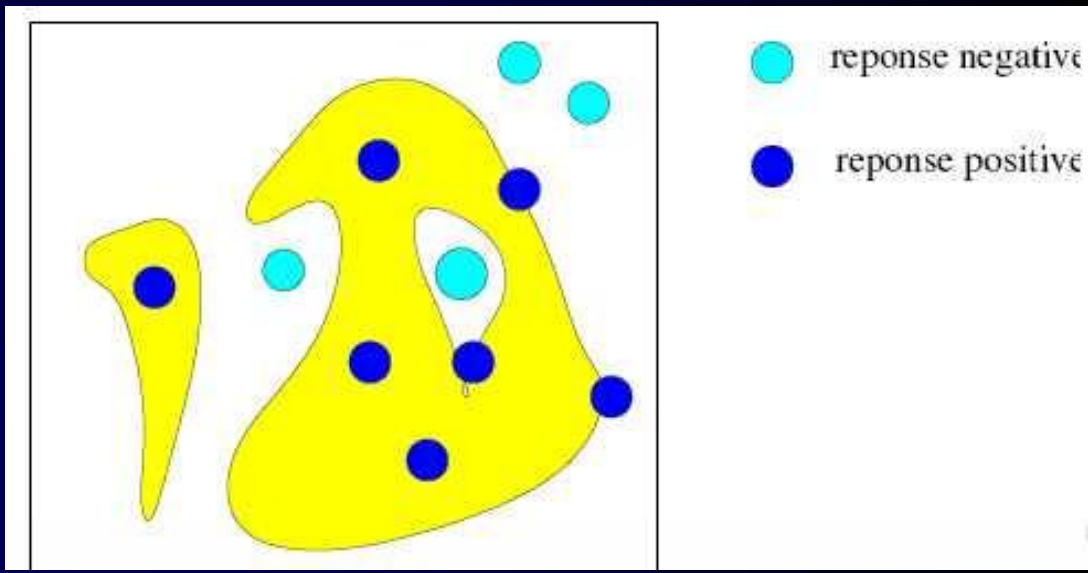
l'élément structurant est inclus dans un objet de l'image

→EROSION



l'élément structurant touche un objet de l'image

→ DILATATION



Morpho_math


panda.tif
286x258 pixels; 8-bit; 72K

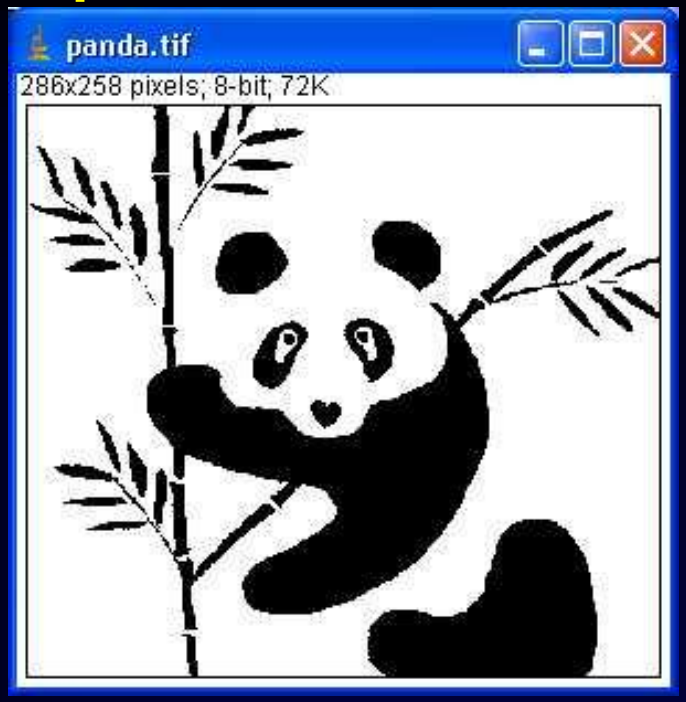

erosion
286x258 pixels; 8-bit; 72K

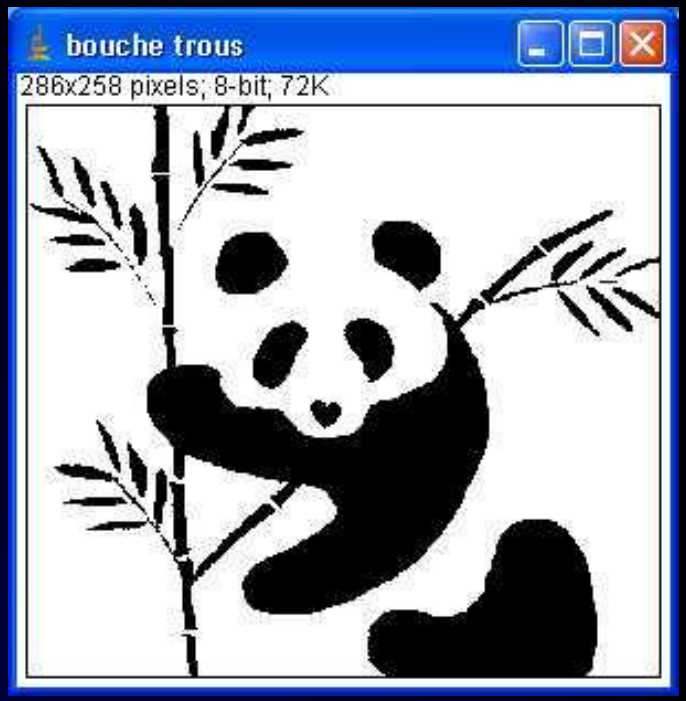

dilatation
286x258 pixels; 8-bit; 72K

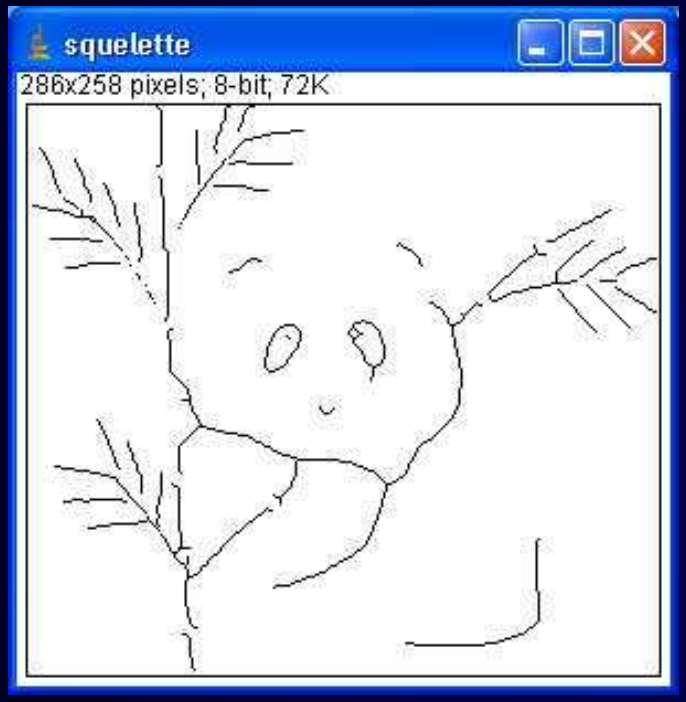

ouverture
286x258 pixels; 8-bit; 72K


fermeture
286x258 pixels; 8-bit; 72K

Morpho_math

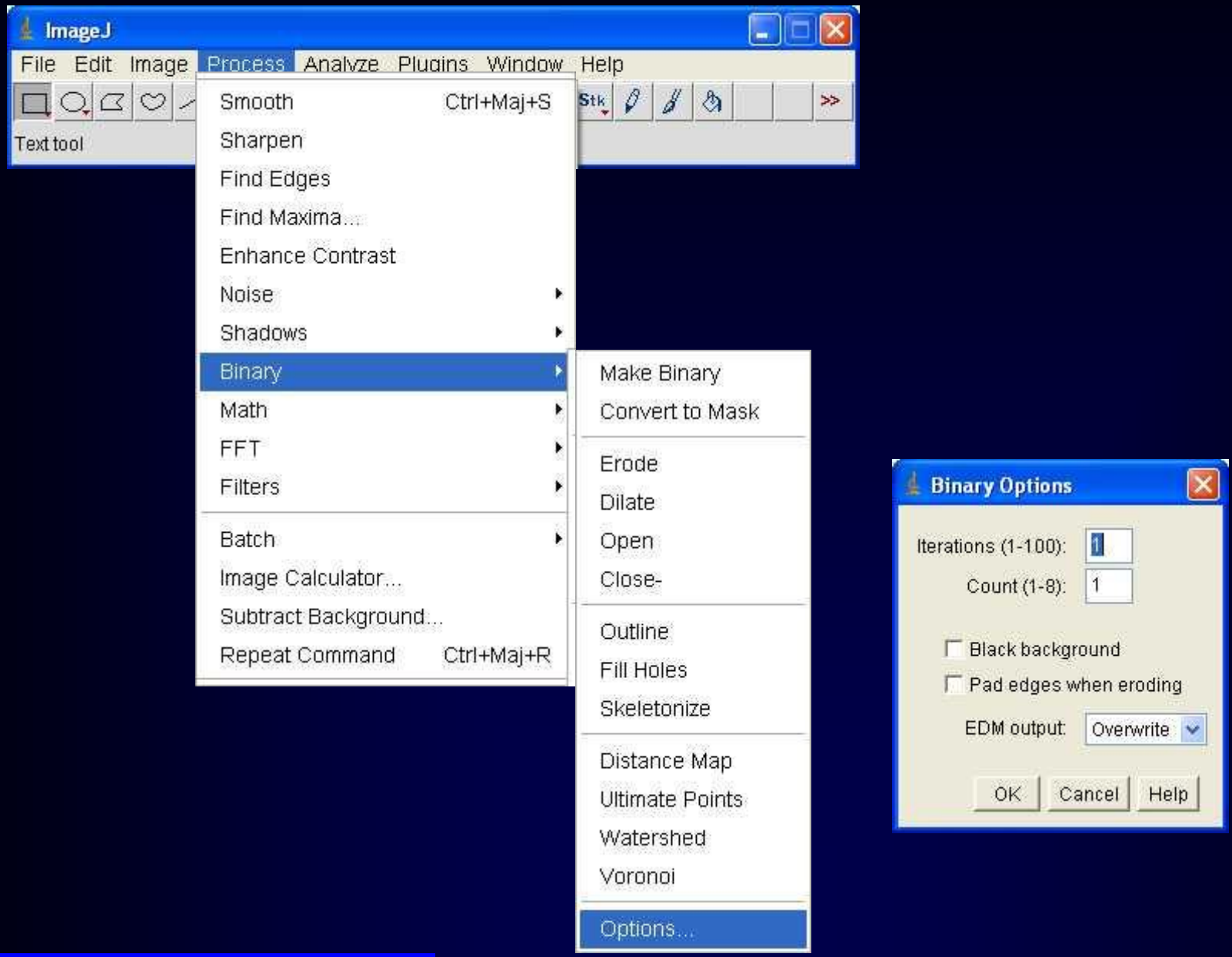

panda.tif
286x258 pixels; 8-bit; 72K


bouche trous
286x258 pixels; 8-bit; 72K


squelette
286x258 pixels; 8-bit; 72K


carte des distances
286x258 pixels; 8-bit; 72K

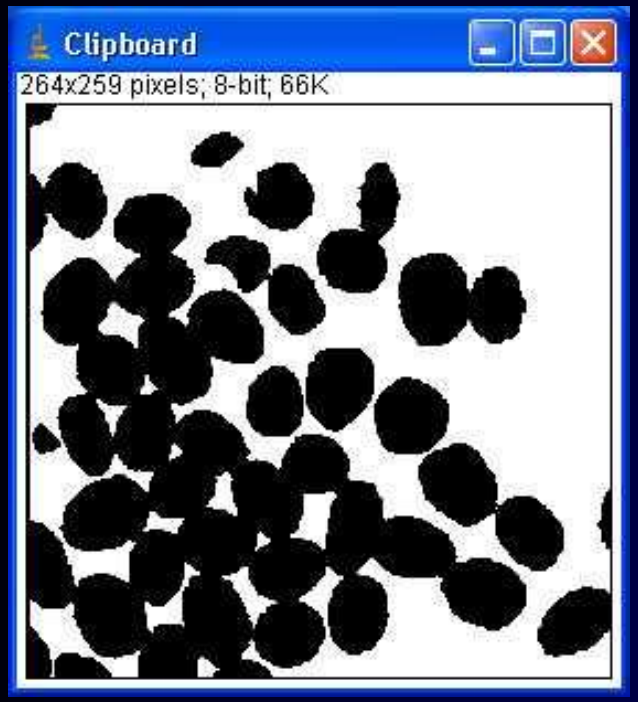
Menu Binary

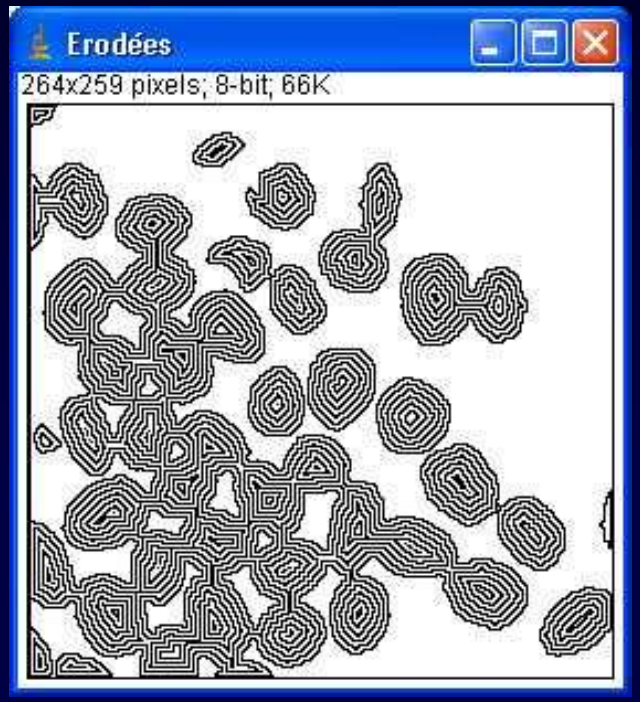


Process→Binary→Options

Erodé Ultime

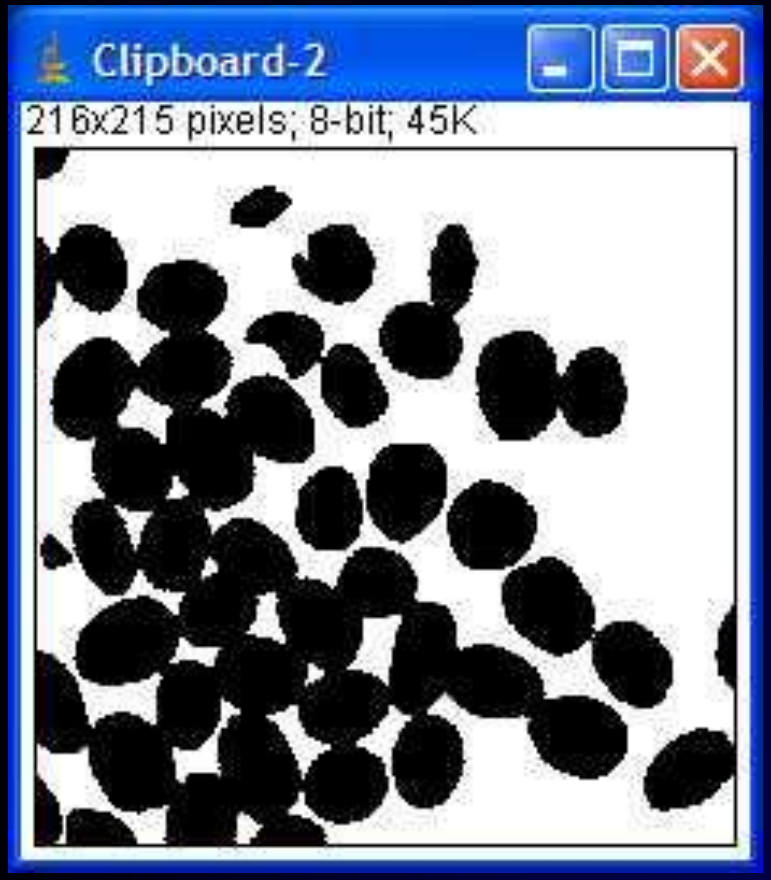
L’**érodé ultime** : la dernière fraction de l ’objet restant avant sa disparition lors d’érosions répétées.

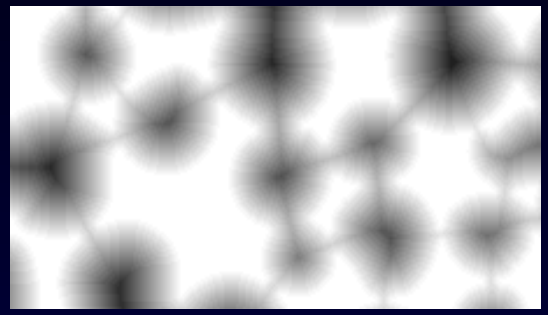


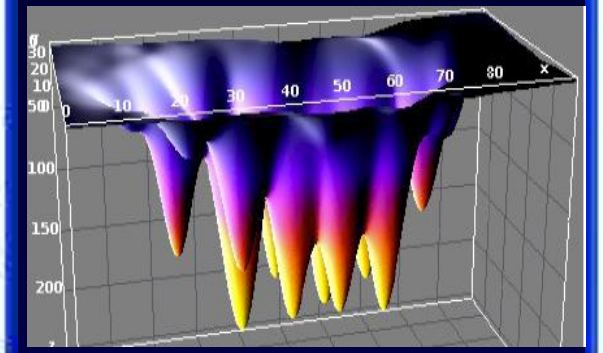


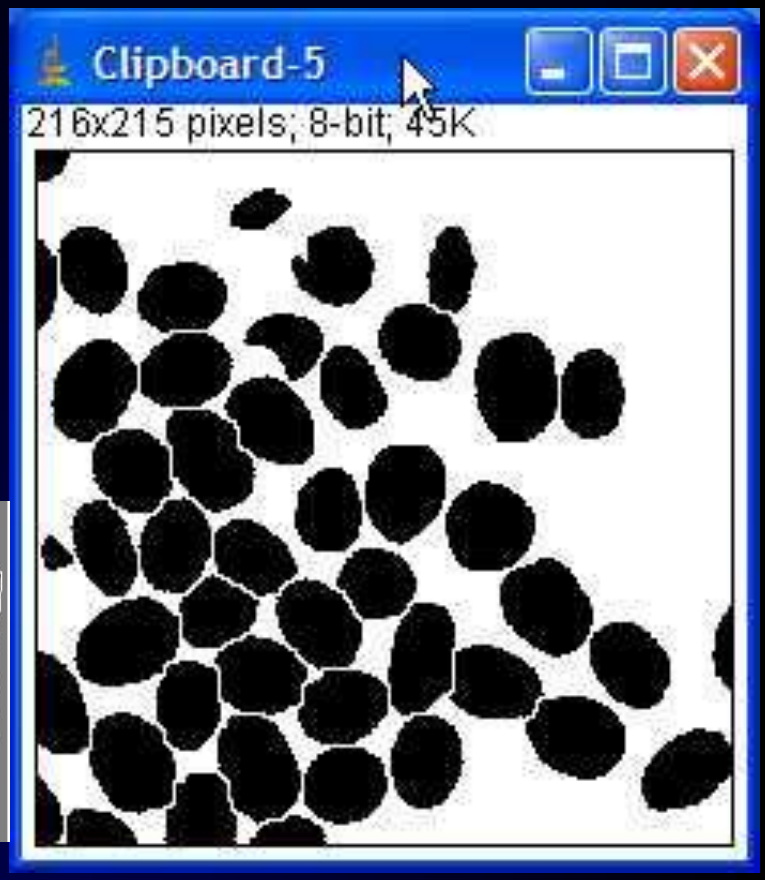
Process→Binary→Ultimate Points

La ligne de partage des eaux : watershed







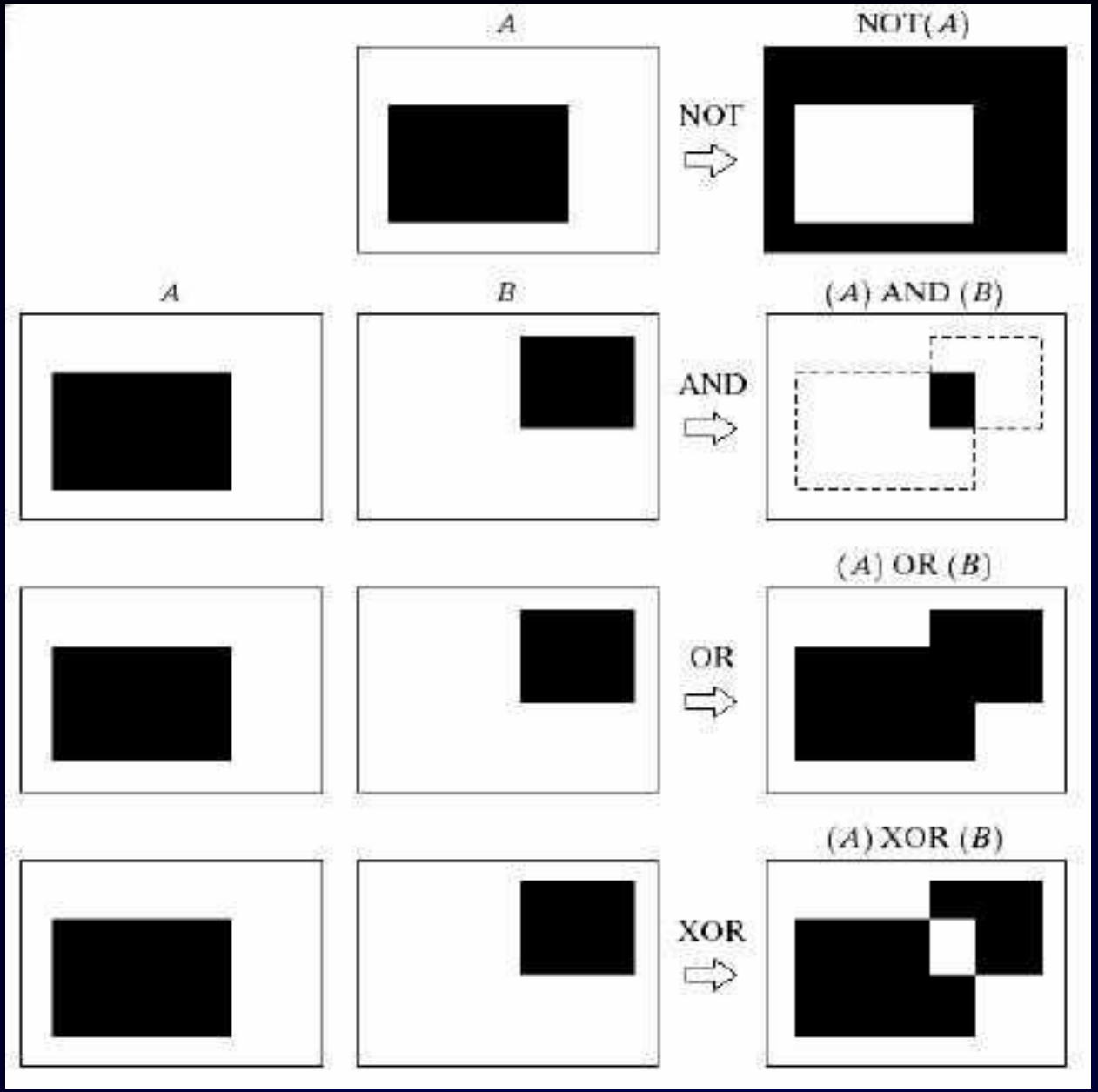


Cette transformation morphologique est la principale méthode de segmentation d'images proposées par la morphologie mathématique.

Process→Binary→Watershed

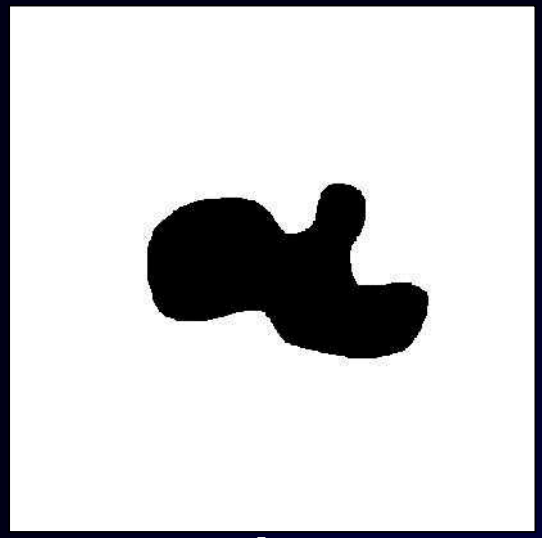
Volker BAECKER - Marc LARTAUD

Opérations logiques

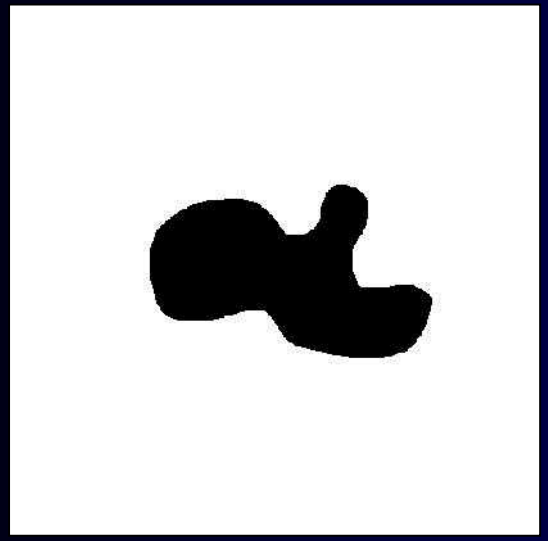


Process→Image Calculator...

Construction d'une fonction contour

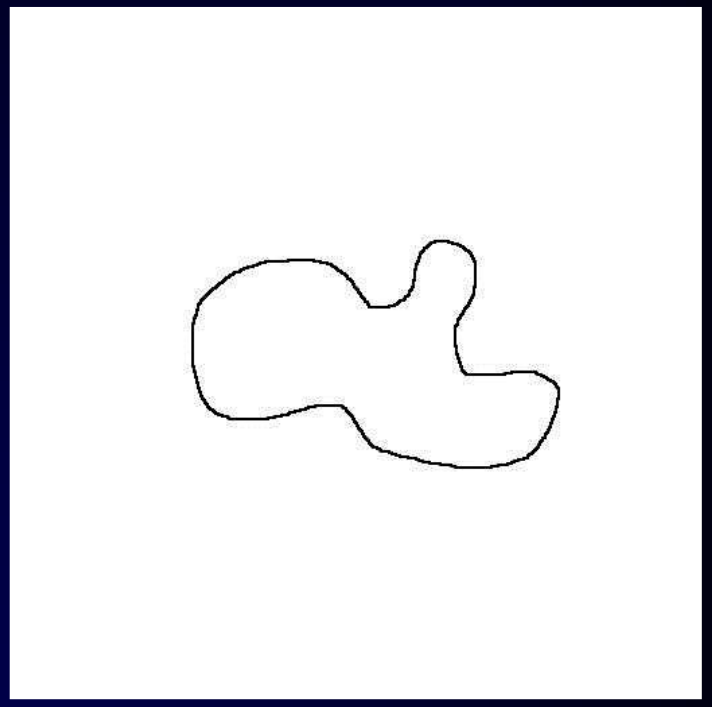


Erosion 1

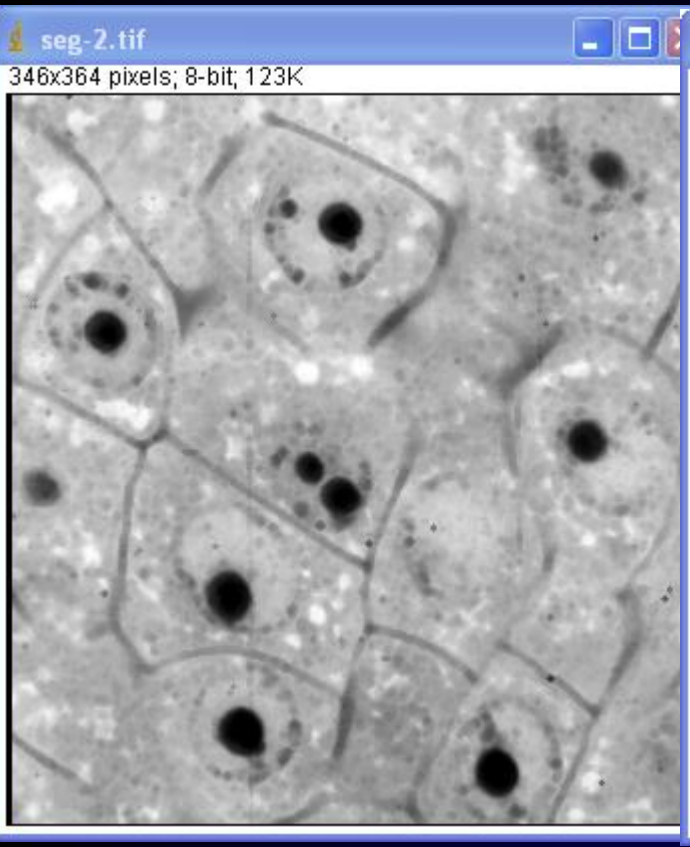


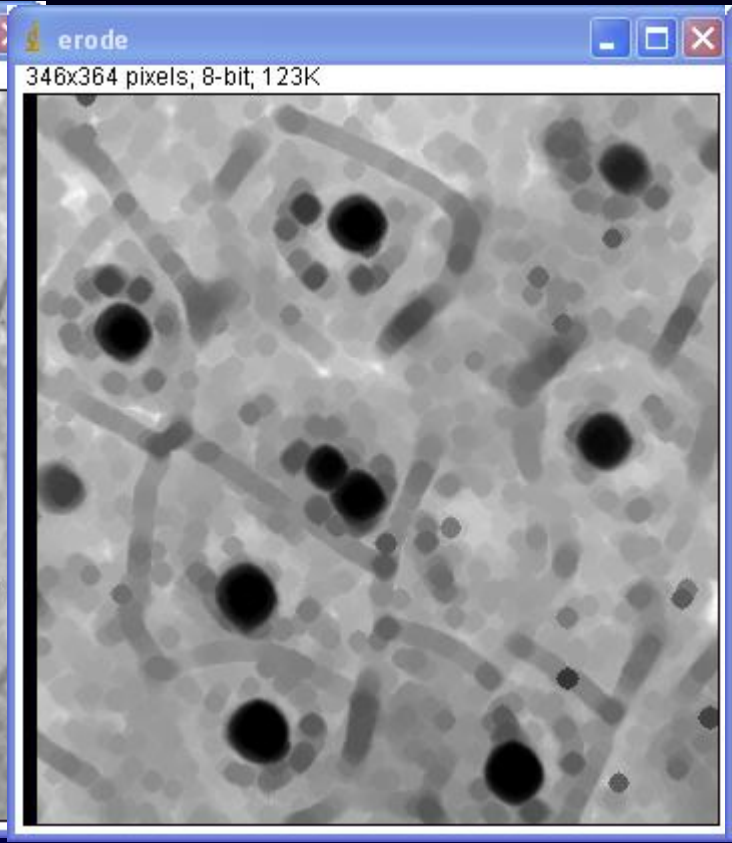
XOR

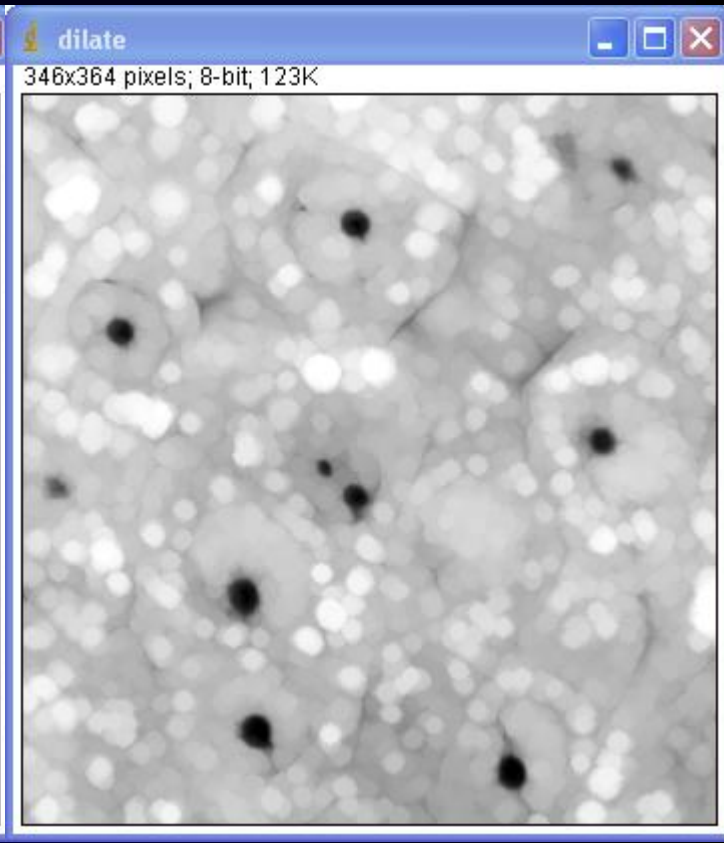
Contour



Morpho_math en niveaux de gris







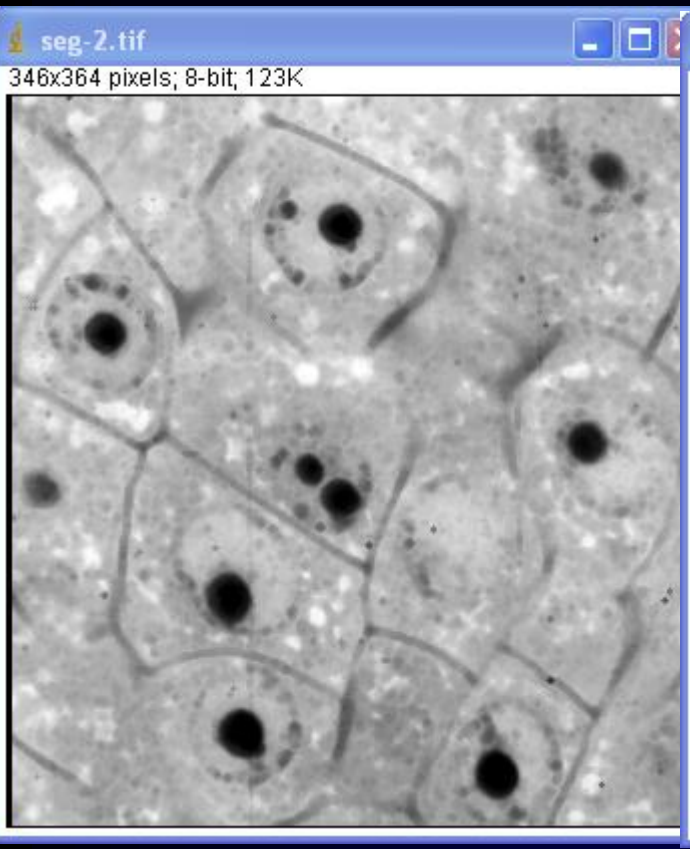
Plugin
Grayscale Morphology

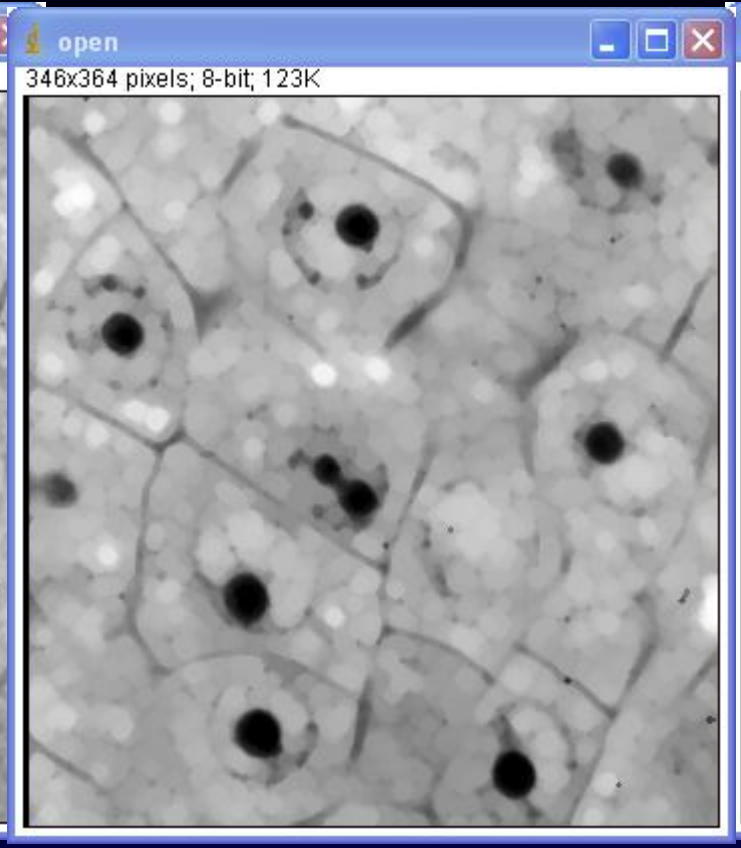
Erosion
agrandit les zones sombres

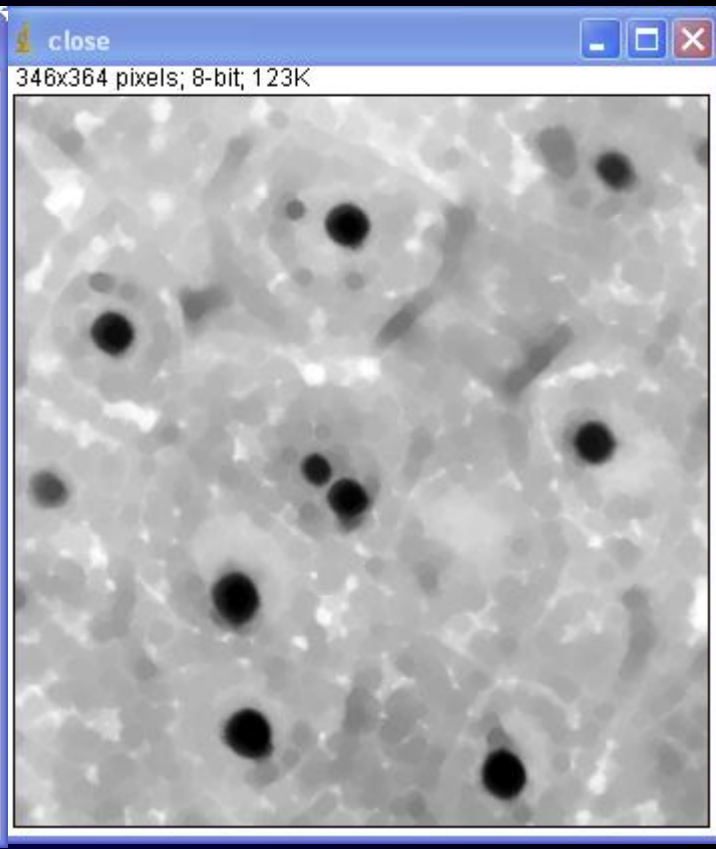
Dilatation
agrandit les zones claires

Plugins→Morphology→Gray Morphology

Morpho_math en niveaux de gris







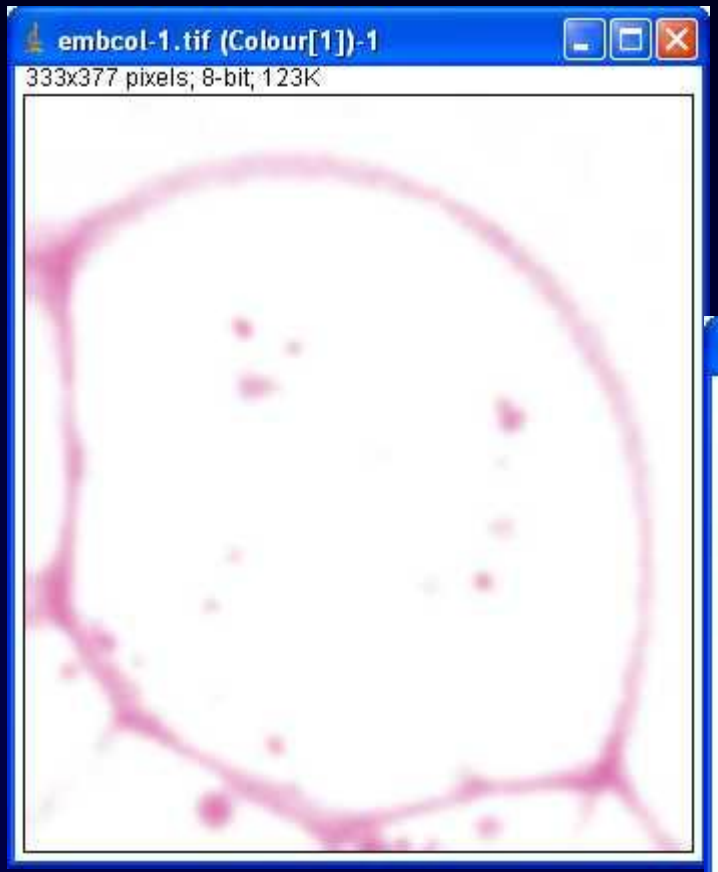
Ouverture
Erosion puis
Dilatation
supprime les petites
zones claires

Fermeture
Dilatation puis
Erosion
supprime les petites
zones sombres

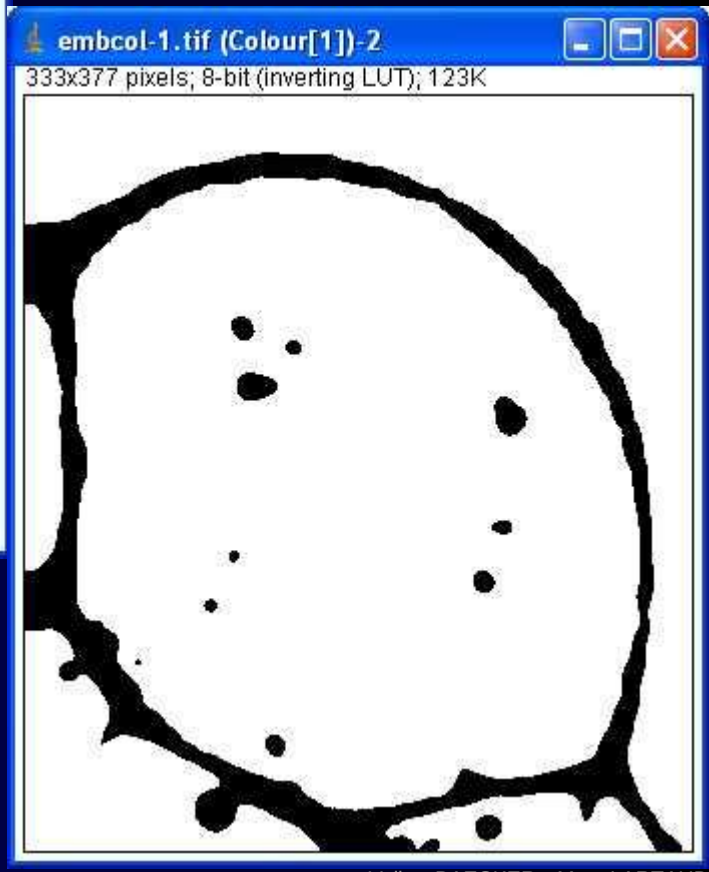
Plugins→Morphology→Gray Morphology

Exemple

Colour Deconvolution

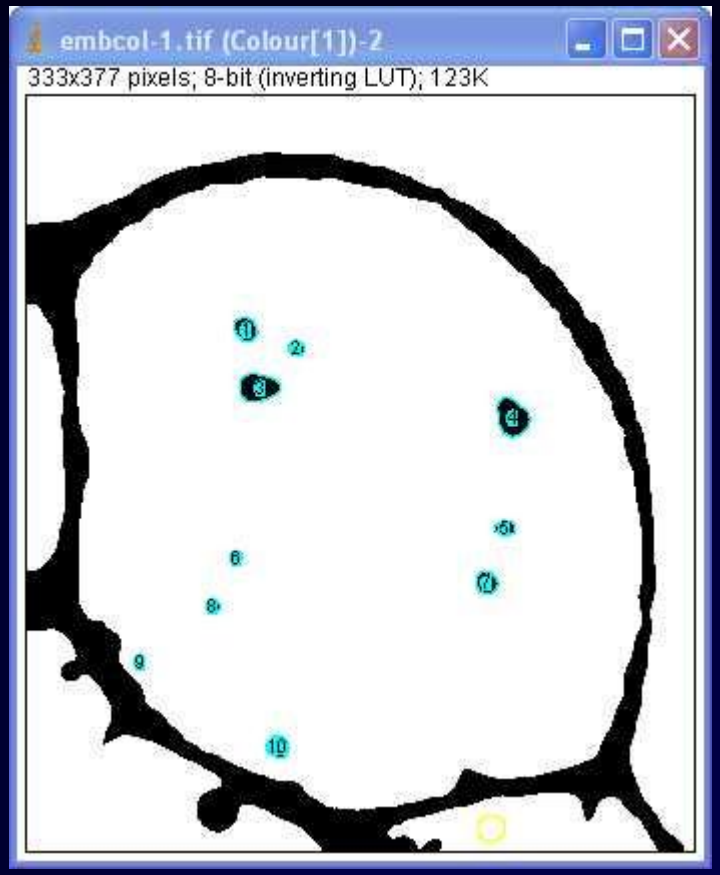


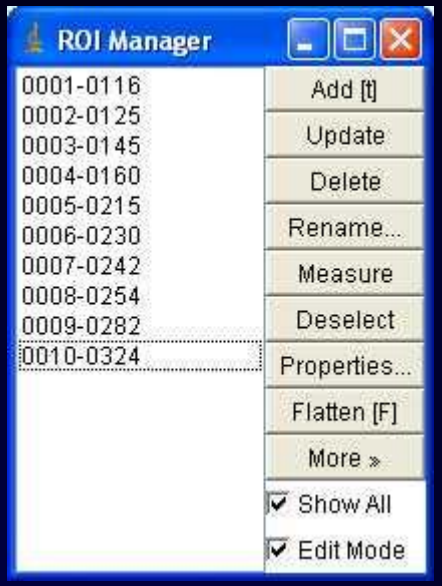
Seuillage



Exemple

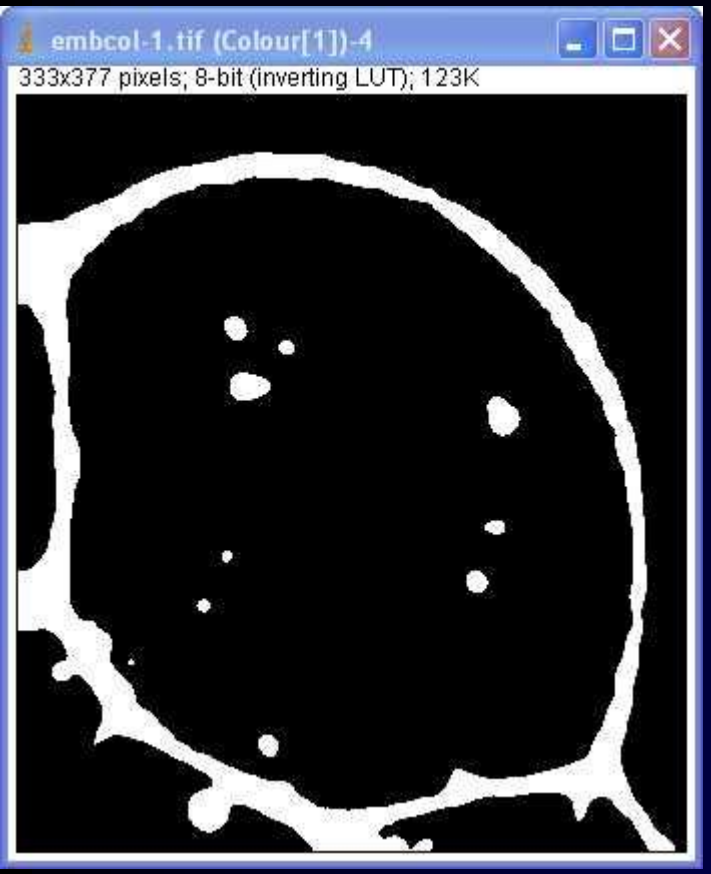
Analyse particules → ROI Manager





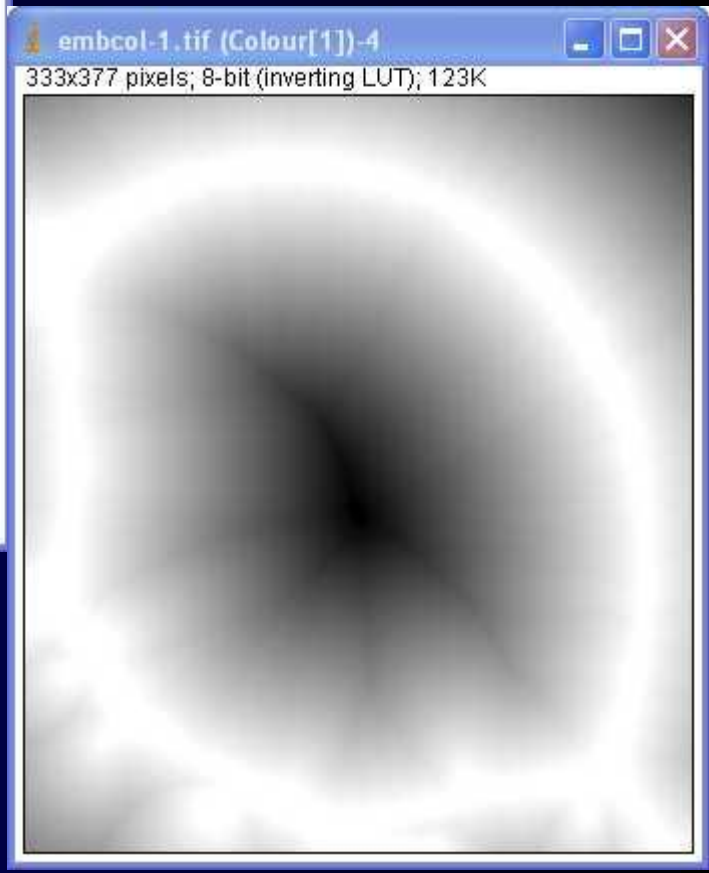
Exemple

Inversion



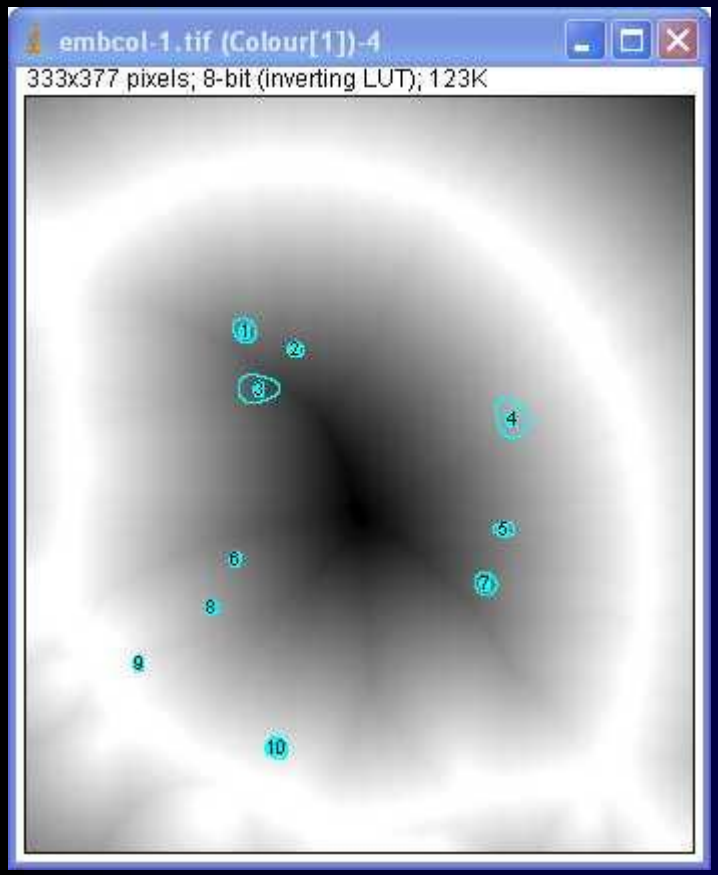
Boucher les trous

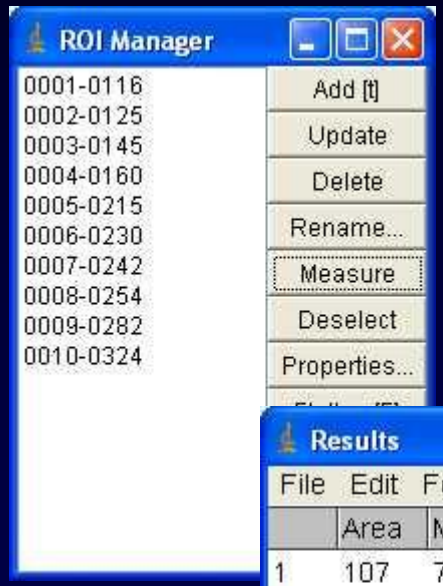
Carte des distances

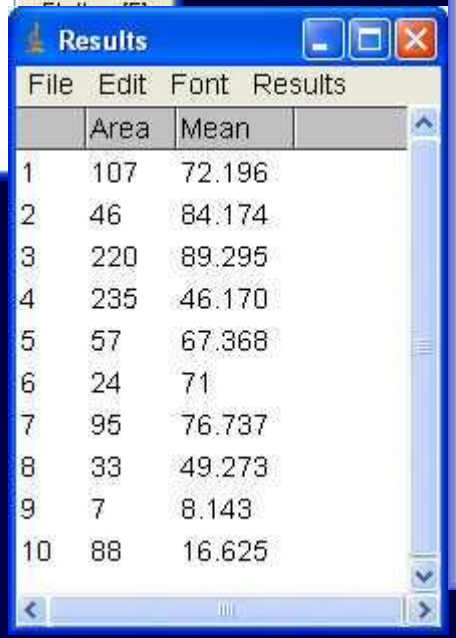


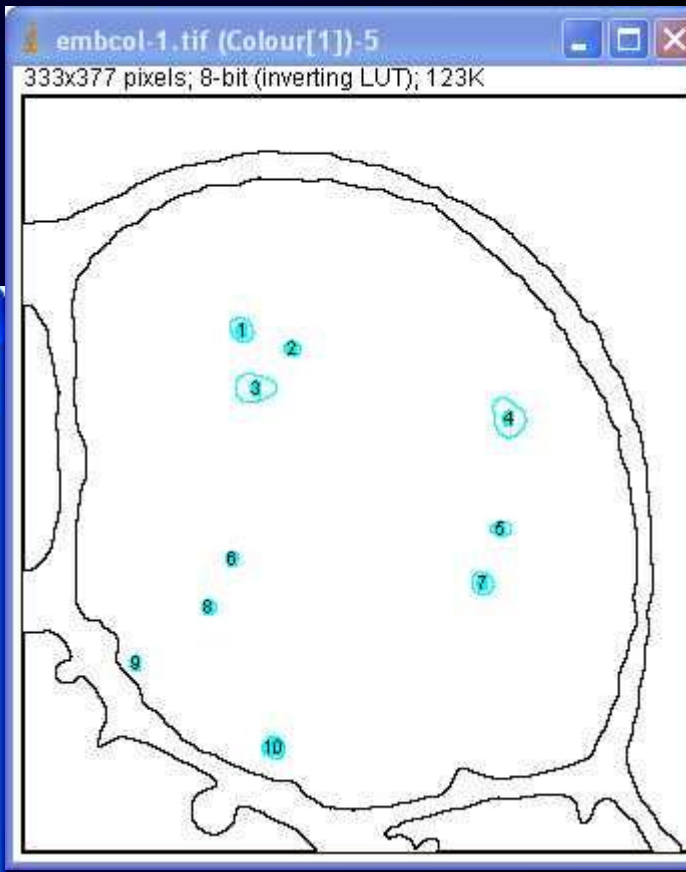
Exemple

Mesures des moyennes de niveaux de gris sur la carte des distances →
Estimation de la position des grains d'amidon dans la cellule









Topic 09 – Matematical Morphology

L’image numérique

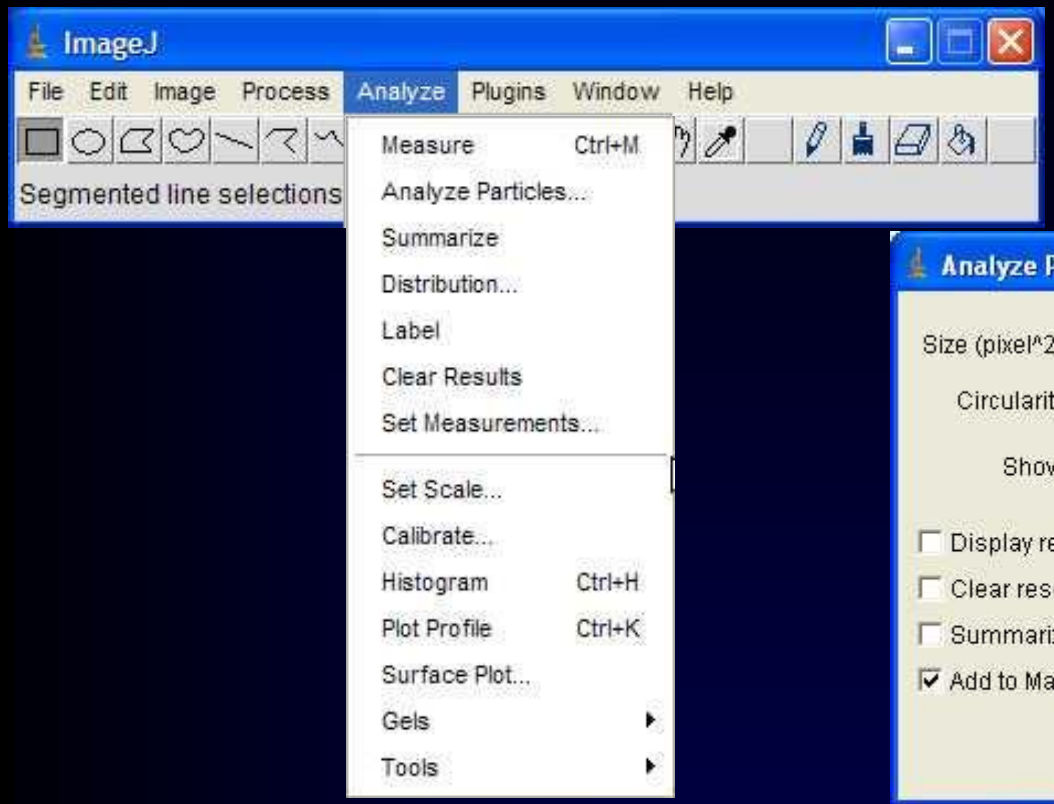
Les Prétraitements

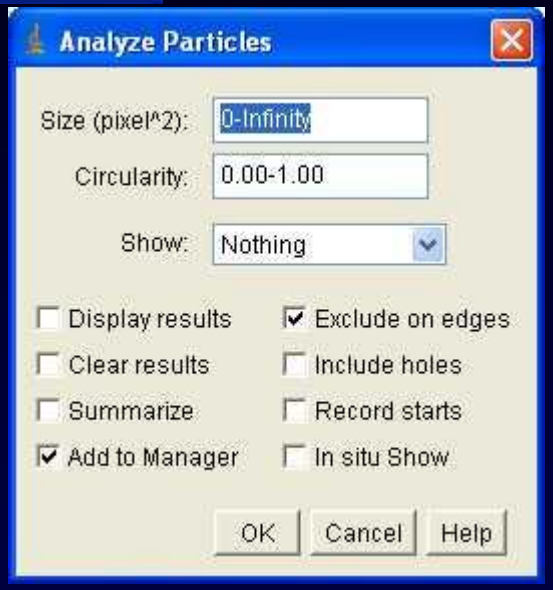
La Segmentation

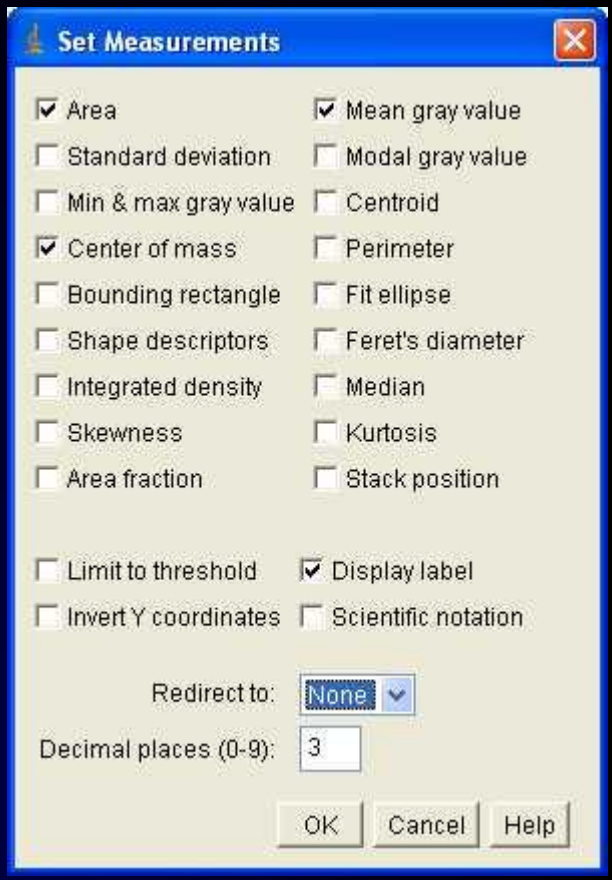
Les Post-traitements

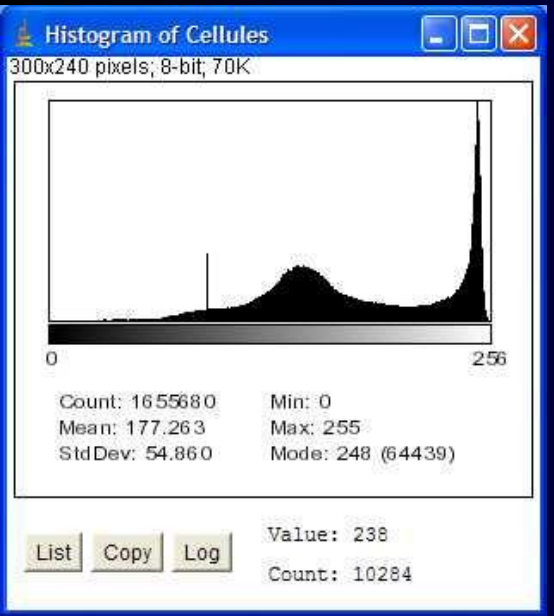
La Quantification

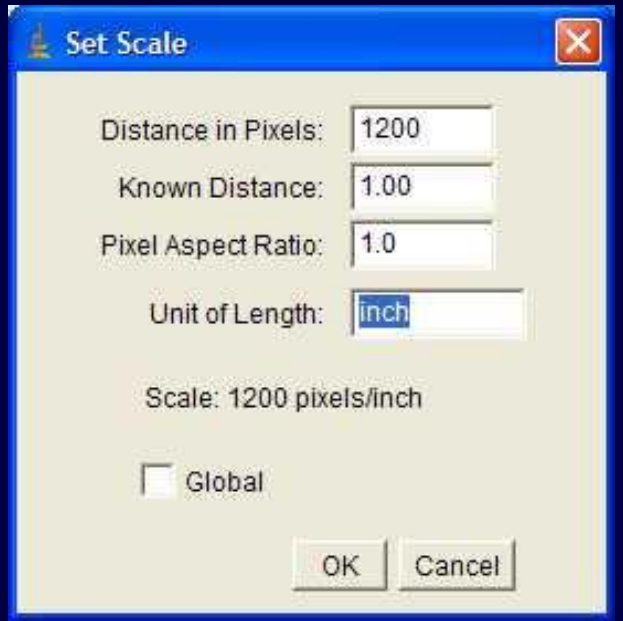
Mesures

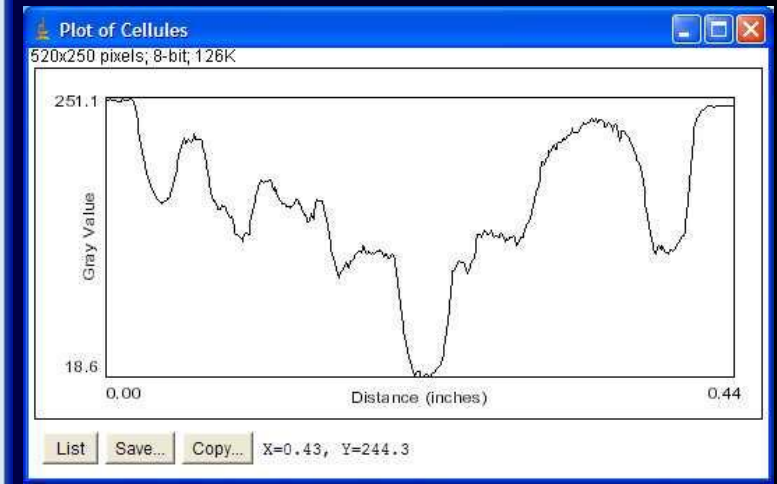

ImageJ
File Edit Image Process Analyze Plugins Window Help
Segmented line selections
Measure Ctrl+M
Analyze Particles...
Summarize
Distribution...
Label
Clear Results
Set Measurements...
Set Scale...
Calibrate...
Histogram Ctrl+H
Plot Profile Ctrl+K
Surface Plot...
Gels
Tools


Analyze Particles
Size (pixel^2): 0-Infinity
Circularity: 0.00-1.00
Show: Nothing
Display results
Clear results
Summarize
Add to Manager
Exclude on edges
Include holes
Record starts
In situ Show
OK Cancel Help


Set Measurements
Area
Mean gray value
Standard deviation
Modal gray value
Min & max gray value
Centroid
Center of mass
Perimeter
Bounding rectangle
Fit ellipse
Shape descriptors
Feret's diameter
Integrated density
Median
Skewness
Kurtosis
Area fraction
Stack position
Limit to threshold
Display label
Invert Y coordinates
Scientific notation
Redirect to: None
Decimal places (0-9): 3
OK Cancel Help


Histogram of Cellules
300x240 pixels; 8-bit; 70K
0
256
Count: 1655680
Mean: 177.263
StdDev: 54.860
Min: 0
Max: 255
Mode: 248 (64439)
List Copy Log
Value: 238
Count: 10284


Set Scale
Distance in Pixels: 1200
Known Distance: 1.00
Pixel Aspect Ratio: 1.0
Unit of Length: inch
Scale: 1200 pixels/inch
Global
OK Cancel


Plot of Cellules
520x250 pixels; 8-bit; 126K
251.1
18.6
Gray Value
0.00
Distance (inches)
0.44
List Save... Copy... X=0.43, Y=244.3

Mesures

- Longueur
- Surface
- Périmètre
- Moyenne des valeurs de niveaux de gris
- Niveau de gris le plus fréquent (sommet de l'histogramme)
- Min et Max des niveaux de gris
- Centroid : moyenne des x,y
- Center off mass : moyenne des x,y pondérée par les intensités de niveaux de gris
- Circularité : $4pi(surface / périmètre^2) = 1$ pour un cercle
- Etc ...

Topic 10 – Quantification

Les étapes du traitement de l'analyse d'image

La capture → image brute

Prétraitement → niveaux de gris

Segmentation → image binaire

Post-traitement → régions d'intérêts

Quantification → données

Amélioration

Publication

Ethique de l'édition d'images

Règles de base sur la retouche des images

-Les images numériques sont des données liées au système d'acquisition. Elles ne correspondent pas exactement à la réalité

- Sur une même figure les images doivent avoir subi le même traitement

-Les mesures d'intensité doivent être faites sur les images originales calibrées (attention aux variations de fluorescence!)

-Conserver l'image originale avant retouche

-Ajustements raisonnables sur l'image entière (luminosité, contraste.....)

-Recadrer une image

Ethique de l'édition d'images

Règles de base sur la retouche des images

-Retouches spécifiques à une zone de l'image

-L'utilisation de filtres pour améliorer la qualité n'est pas recommandée

-Dupliquer des parties d'images est contraire à l'éthique, éviter de nettoyer l'image, ne pas ajouter d'objet !

-Ne pas compresser les images dans des formats qui changent les valeurs de pixel comme jpeg

-Faire attention a l’échantillonnage à l'acquisition, choisir un pas trois fois plus petit que la résolution du microscope

-Faire attention en changeant la taille (en pixel) de l'image, les pixels ajoutés ont des valeurs interpolées (artefacts) !

Guidelines

Guidelines for Best Practices in Image Processing

Please click on each guideline for further details. Also, see the guidelines demonstrated in **Photoshop Videos**.

Treating Images as Data: Digital scientific images should be treated as data

Filters Degrade Data: Use of software filters to improve image quality is usually not recommended for biological images.

Saving the Original: Manipulations of digital images should always be done on a copy of the raw image data. The original must be retained.

Cloning Degrades Data: Cloning objects into an image or from other parts of the image is very questionable.

Making Simple Adjustments: Simple adjustments to the entire image are usually acceptable.

Making Intensity Measurements: Intensity measurements of digital images should be performed on raw data and the data should be calibrated to a known standard.

Cropping is usually OK: Cropping an image is usually acceptable.

Lossy Compression Degrades Data: Avoid the use of lossy compression.

Comparing Images: Digital images that will be compared to one another should be acquired under identical conditions.

Issues With Magnification: Magnification and resolution issues are important.

Manipulating the Entire Image: Manipulations that are specific to one area of an image and are not performed on other areas are

Issues With Pixels: Be careful when changing the size (in pixels) of a digital image.

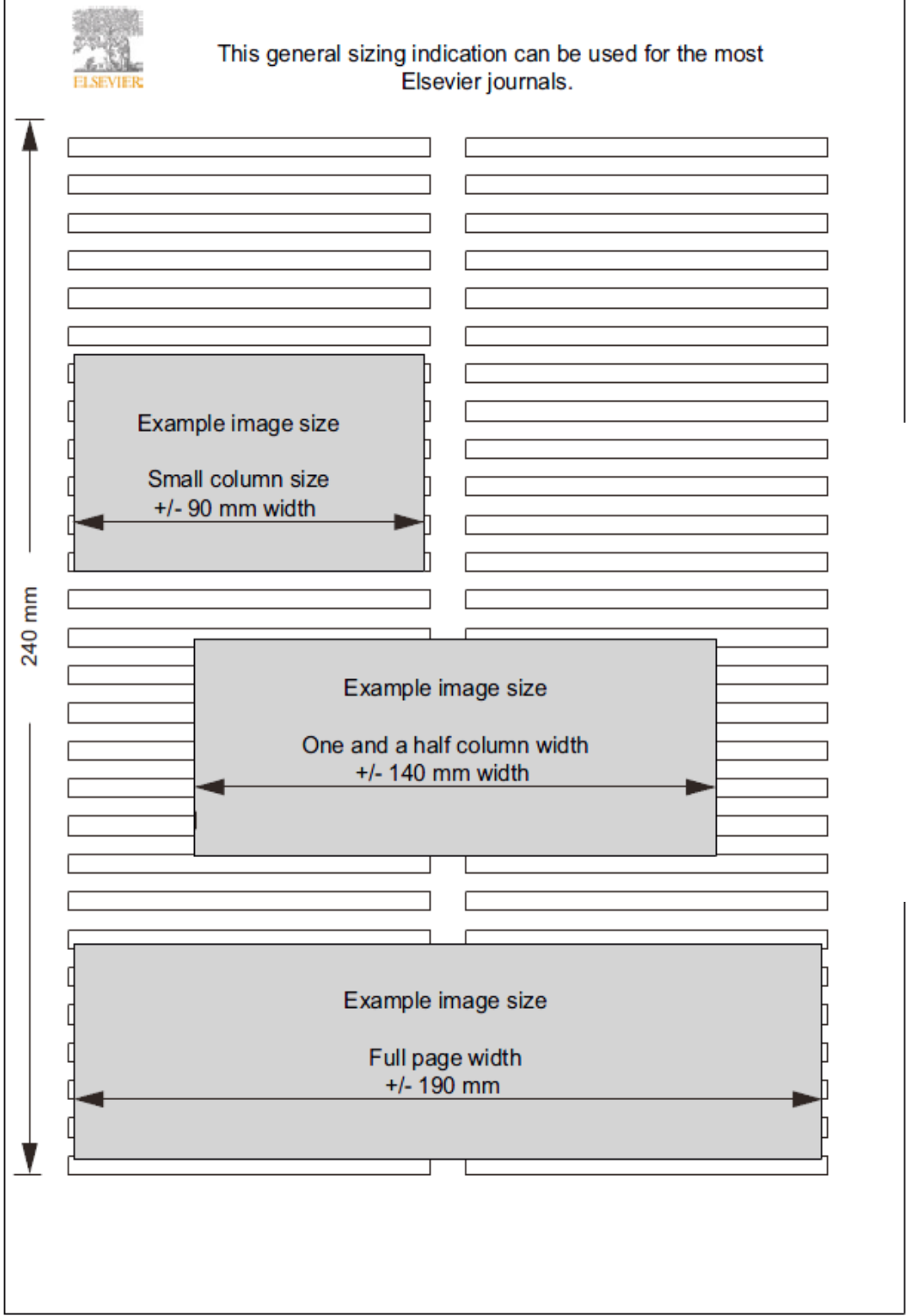
Guides aux auteurs

-Format des fichiers :
TIFF pour les photos (compression LZW)
EPS pour les dessins vectoriel
PDF pour tout

-Polices :
Arial, Helvetica, Courier, Symbol, Times

-Résolutions :
Photos 300 dpi
Graphiques 600-1000 dpi

Mise en page



Résolutions :
Largeur mini en pixel

	image width	A	B	C
Minimal size	30 mm	354	591	1181
Single column	90 mm	1063	1772	3543
1.5 column	140 mm	1654	2756	5512
Full width	190 mm	2244	3740	7480

A: 300 dpi > Halftone images Gray/RGB
B: 500 dpi > Combination art Gray/RGB
C: 1000 dpi > Line art

FigureJ

Installation du plugin

Installation details for ImageJ

Update to the latest version of ImageJ.

The following files need to go to the ImageJ/plugins/ folder:

- figurej_101b3.jar

→ get it from this link.

- imagescience.jar

→ get it from Eric Meijering website http://www.imagescience.org/meijering/software/download/imagescience.jar

- loci_tools.jar

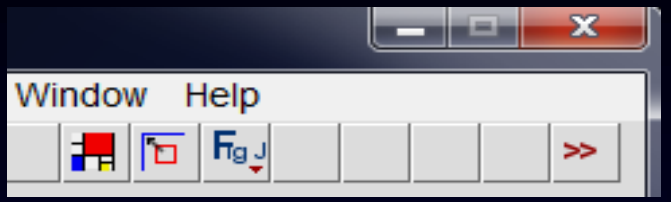
→ get it from the LOCI website at http://loci.wisc.edu/bio-formats/downloads

- LSM_Reader.jar

→ get it from http://imagejdocu.tudor.lu/lib/exe/fetch.php?media=plugin:inputoutput:lsm_reader:lsmplugins2012_07_23.zip

FigureJ

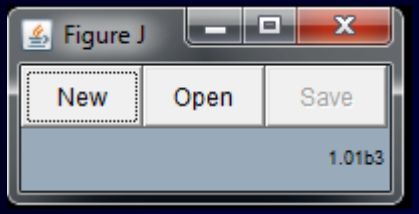
Lancer le plugin



FigureJ

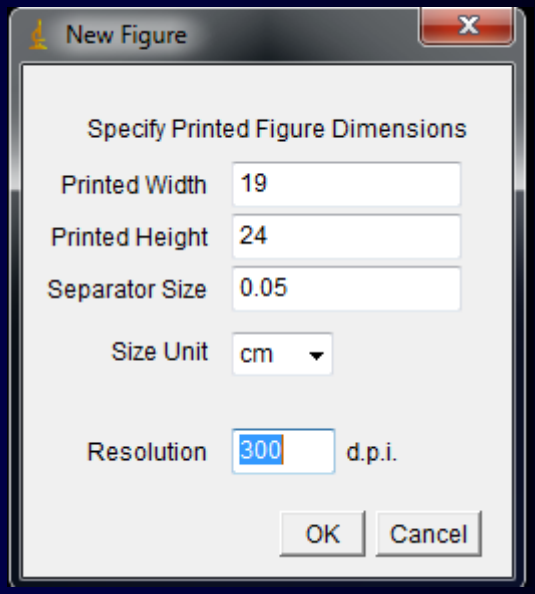
Insets Menu

panel sticking Tool



Determiner la taille de la figure

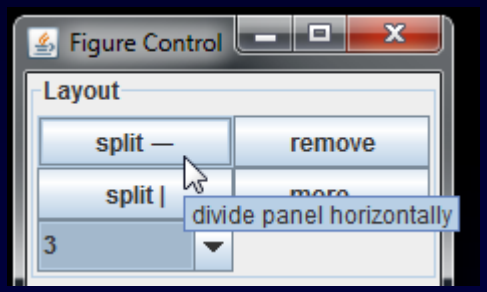
ainsi que sa résolution



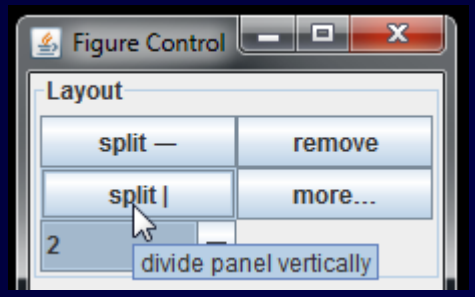
FigureJ

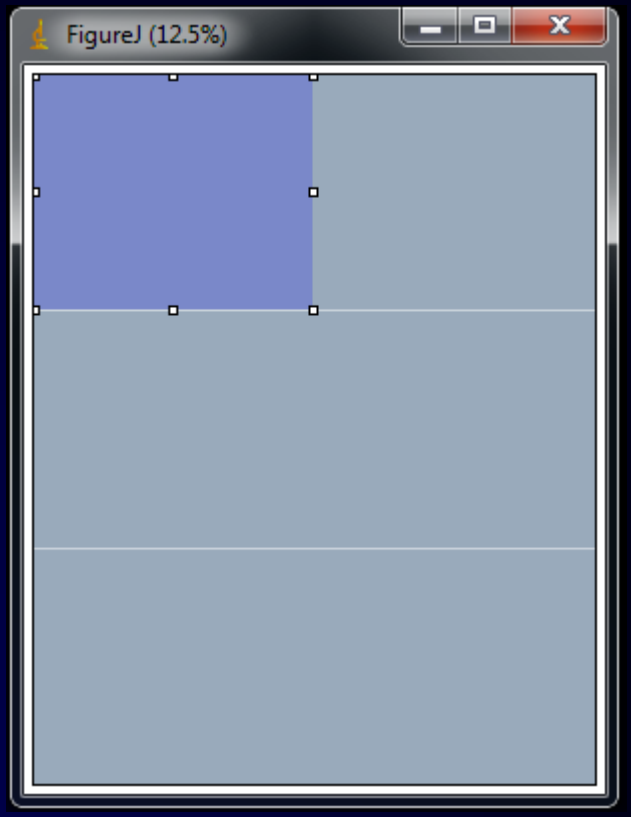
Maquette avec zones réservées aux photos
Le bouton agit sur la zone sélectionnée (en mauve)

Découpage horizontal



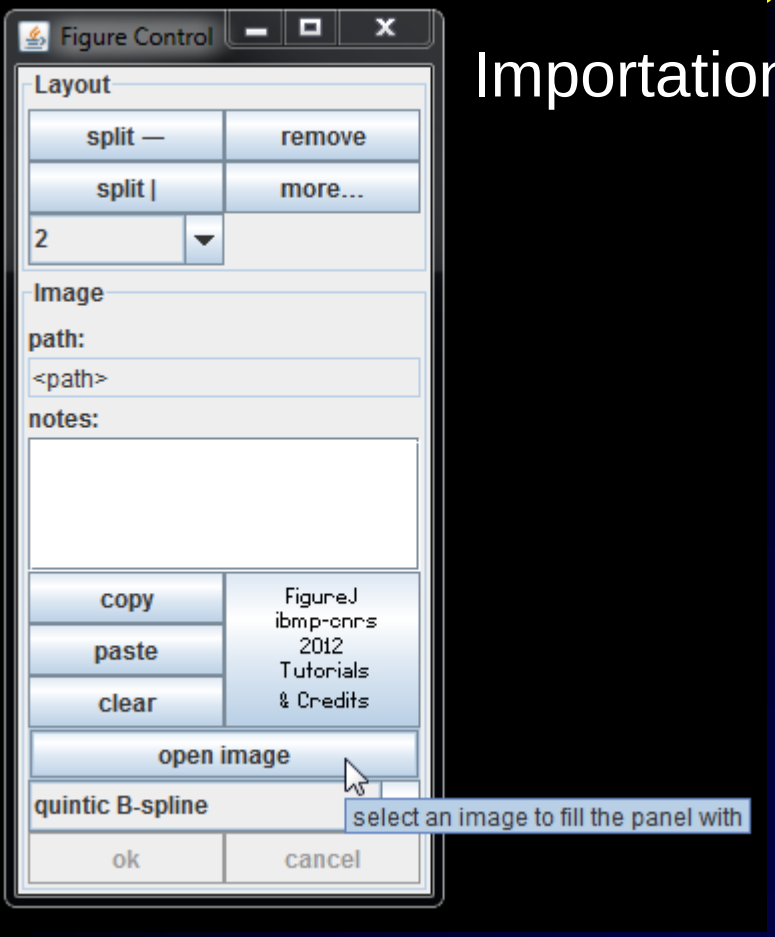
Découpage vertical

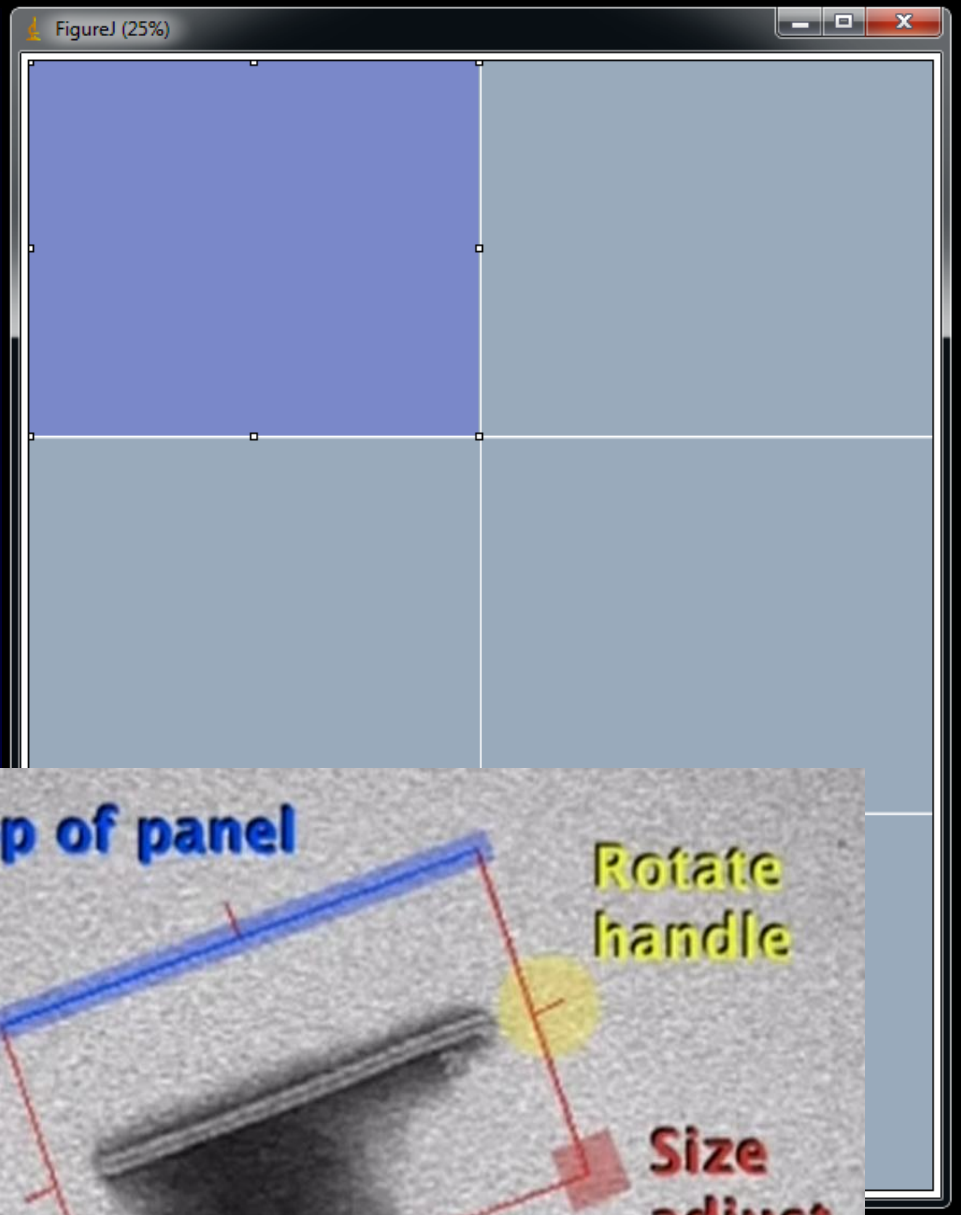


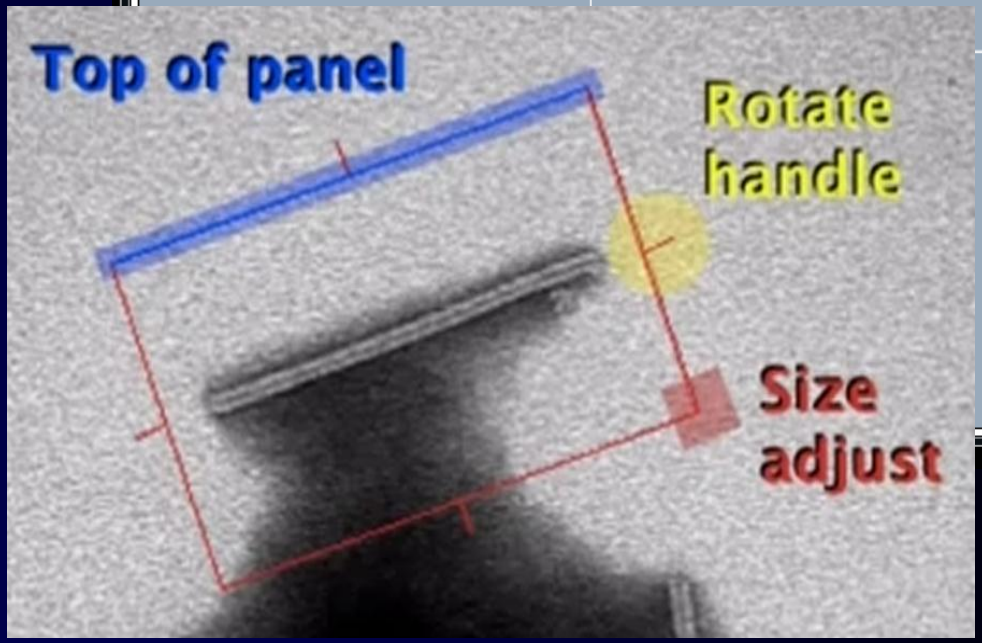


FigureJ

Importation des photos



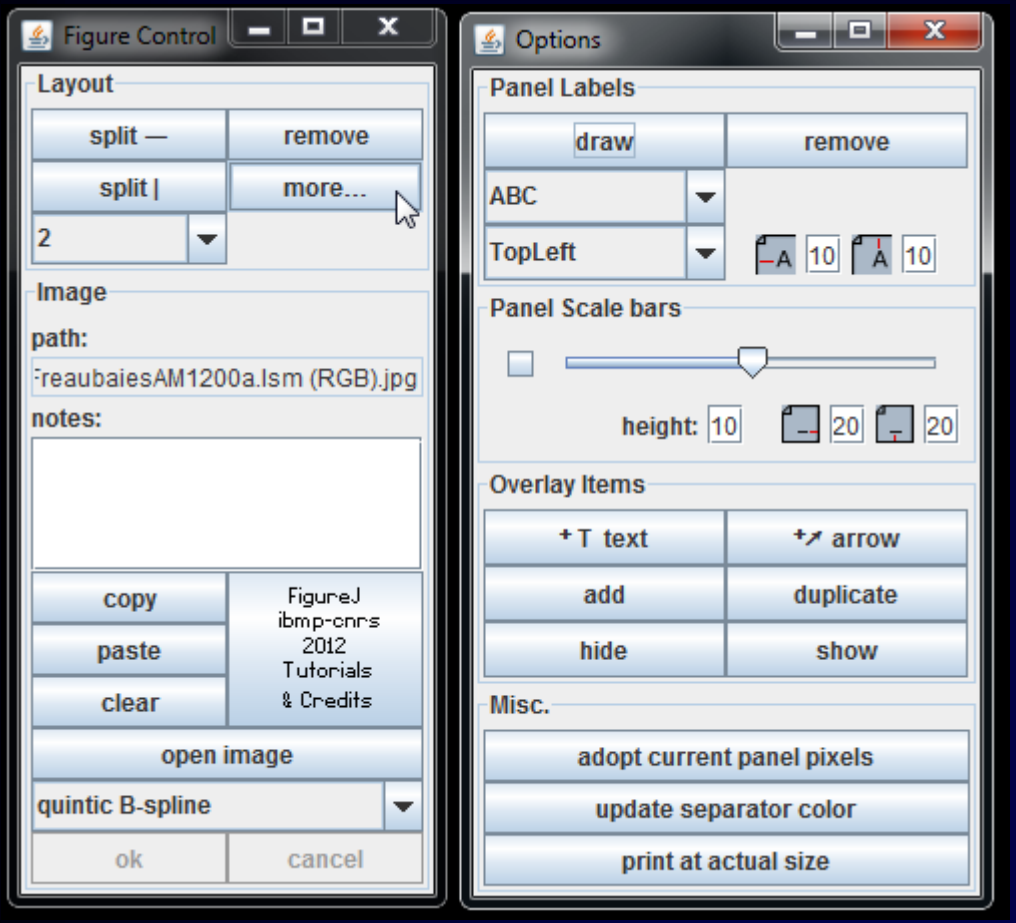


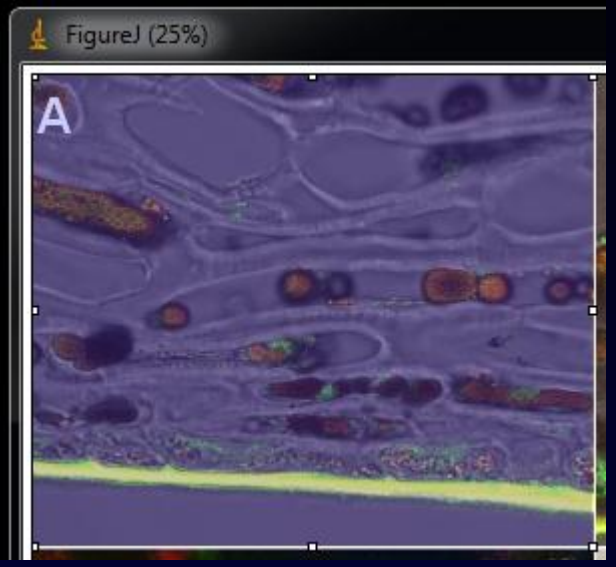


Choix de la zone à importer
Agrandissement par les poignées en coin
Rotation par les poignées des cotés

FigureJ

Lettrage ou numérotation





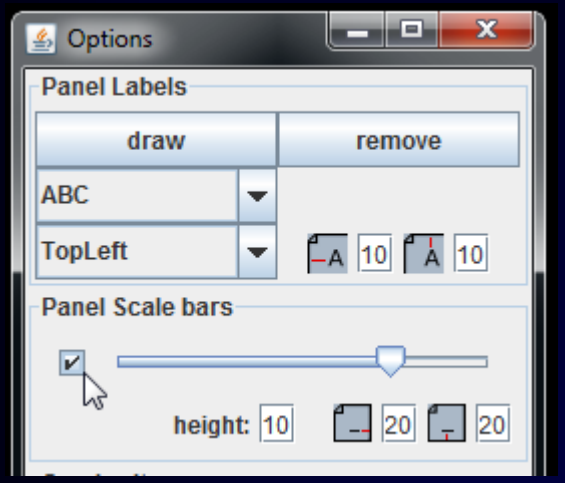
Choix de la couleur

Choix de la police

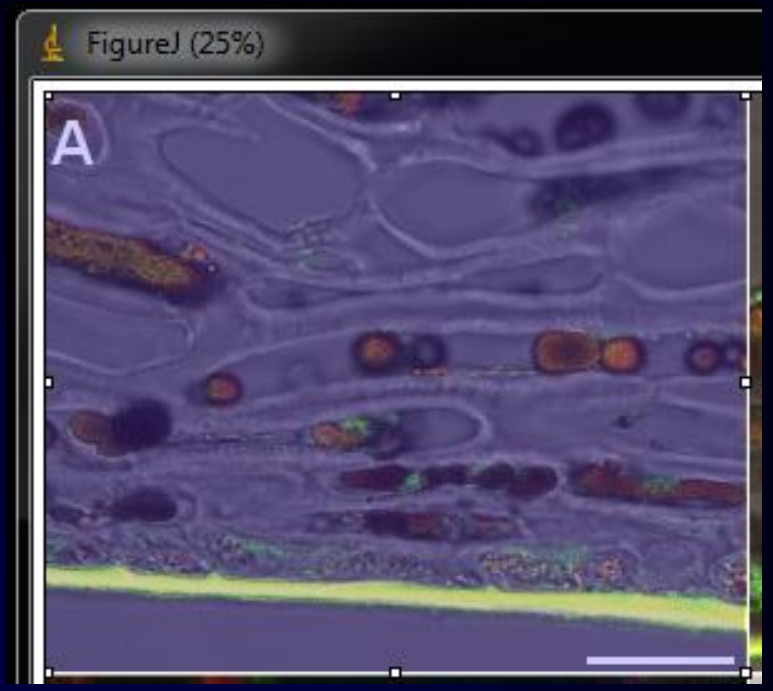
Pour remettre a zéro « *alt+draw* »

FigureJ

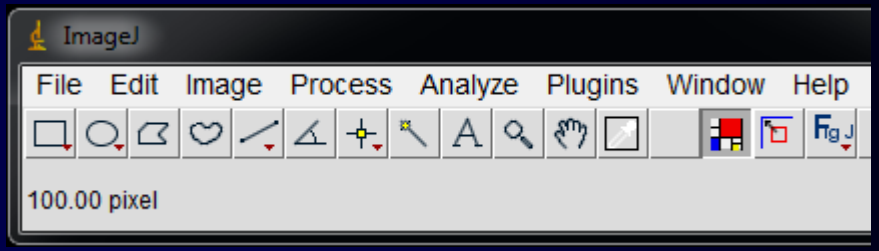
Barre d'échelle pour
sur photos calibrées



Choix de l a taille

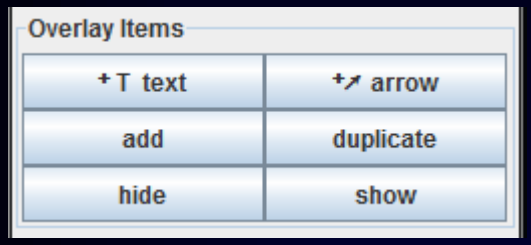


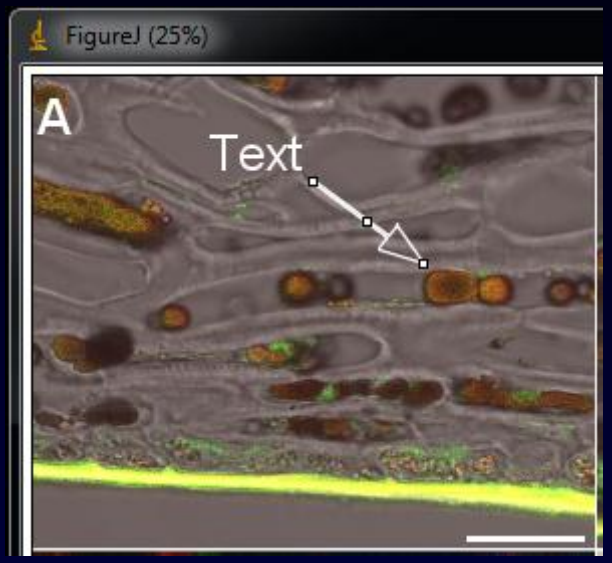
Affichage de la taille
dans la barre d'état

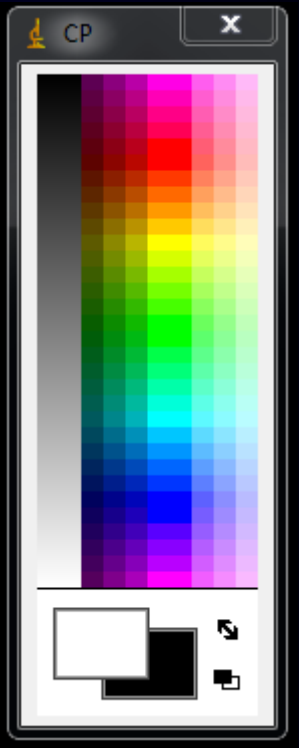


FigureJ

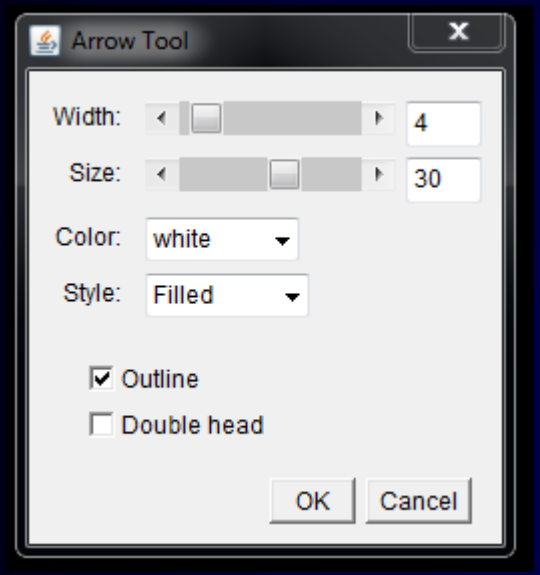
Ajout de texte
Et de flèches







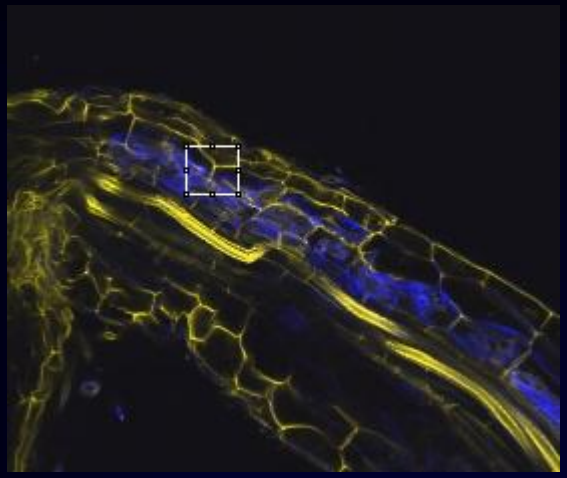
Paramètres pour les flèches

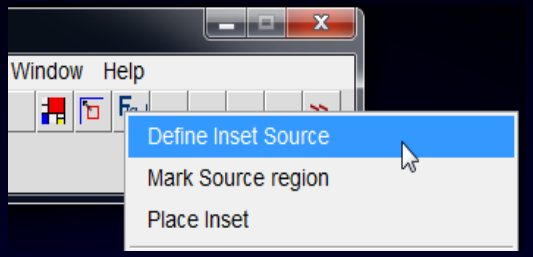


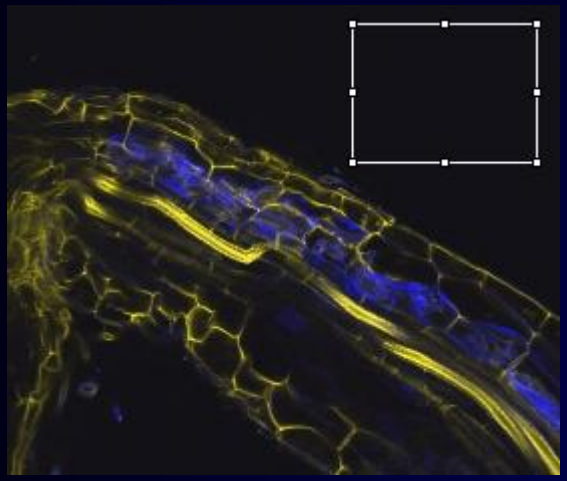
Paramètres pour le texte

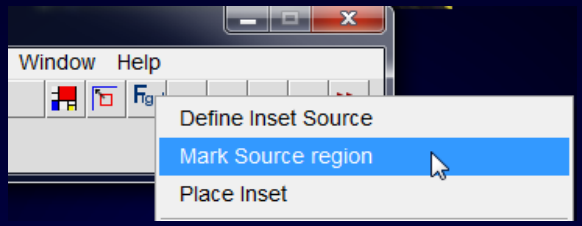
Astuce : mettre tout dans le ROI Manager
puis overlay from ROI Manager

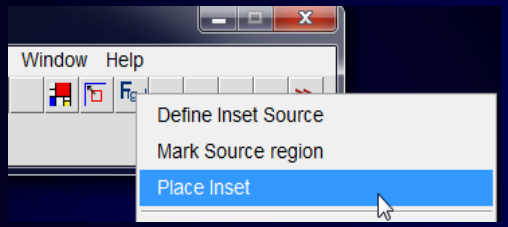
FigureJ Inset

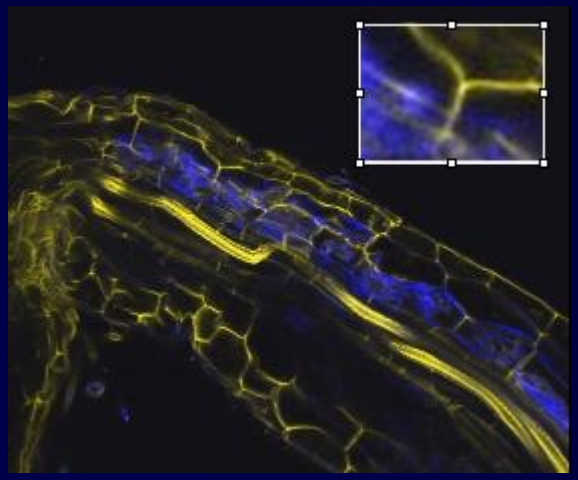


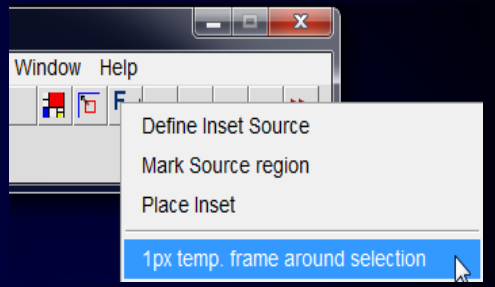




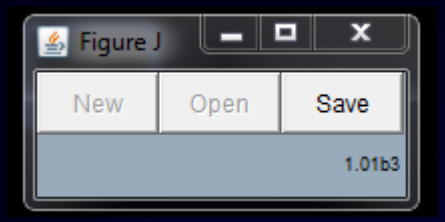








FigureJ



Dossier de sauvegarde

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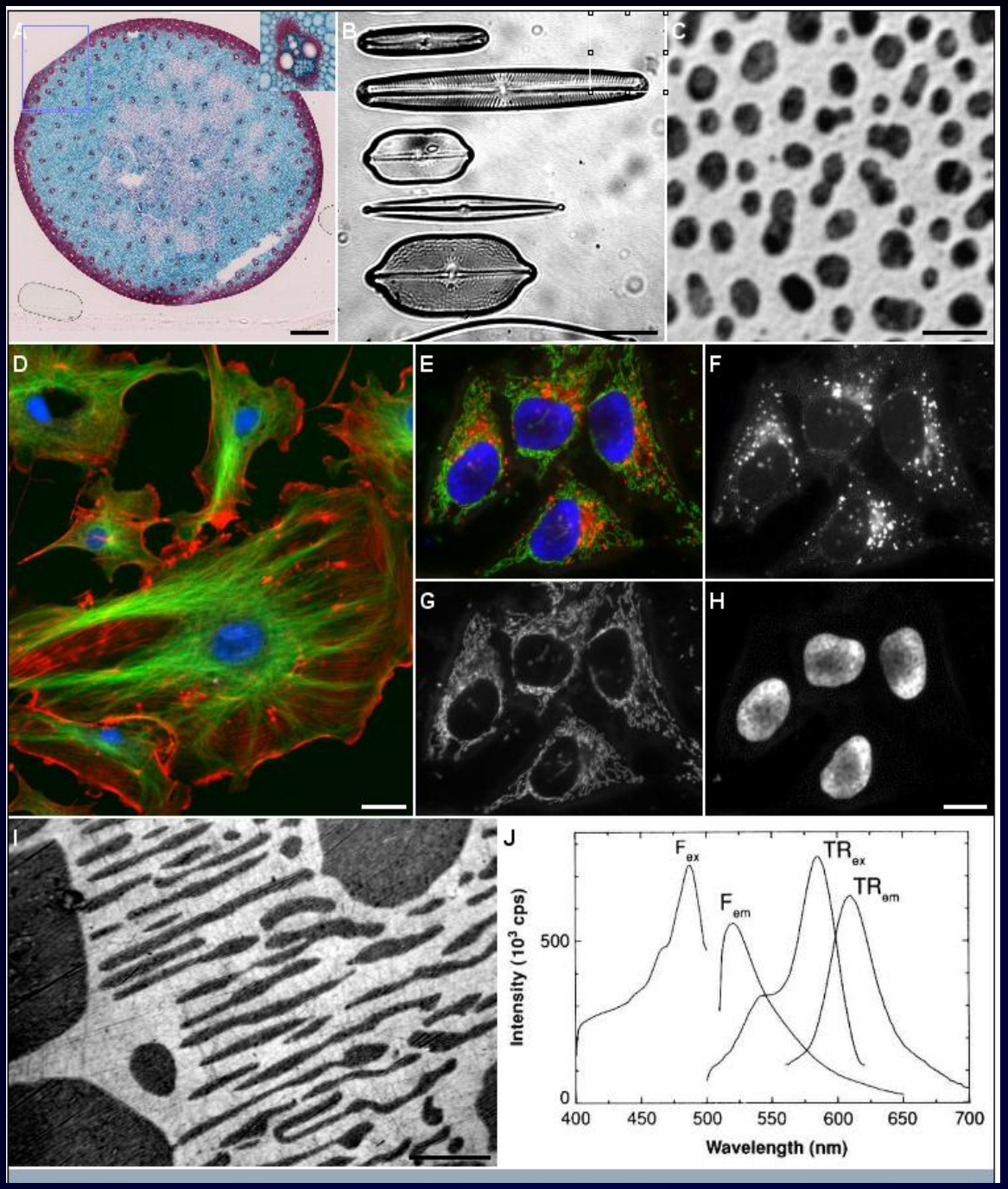
A
B
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D
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G
H
I
J
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TR_{ex}
TR_{em}
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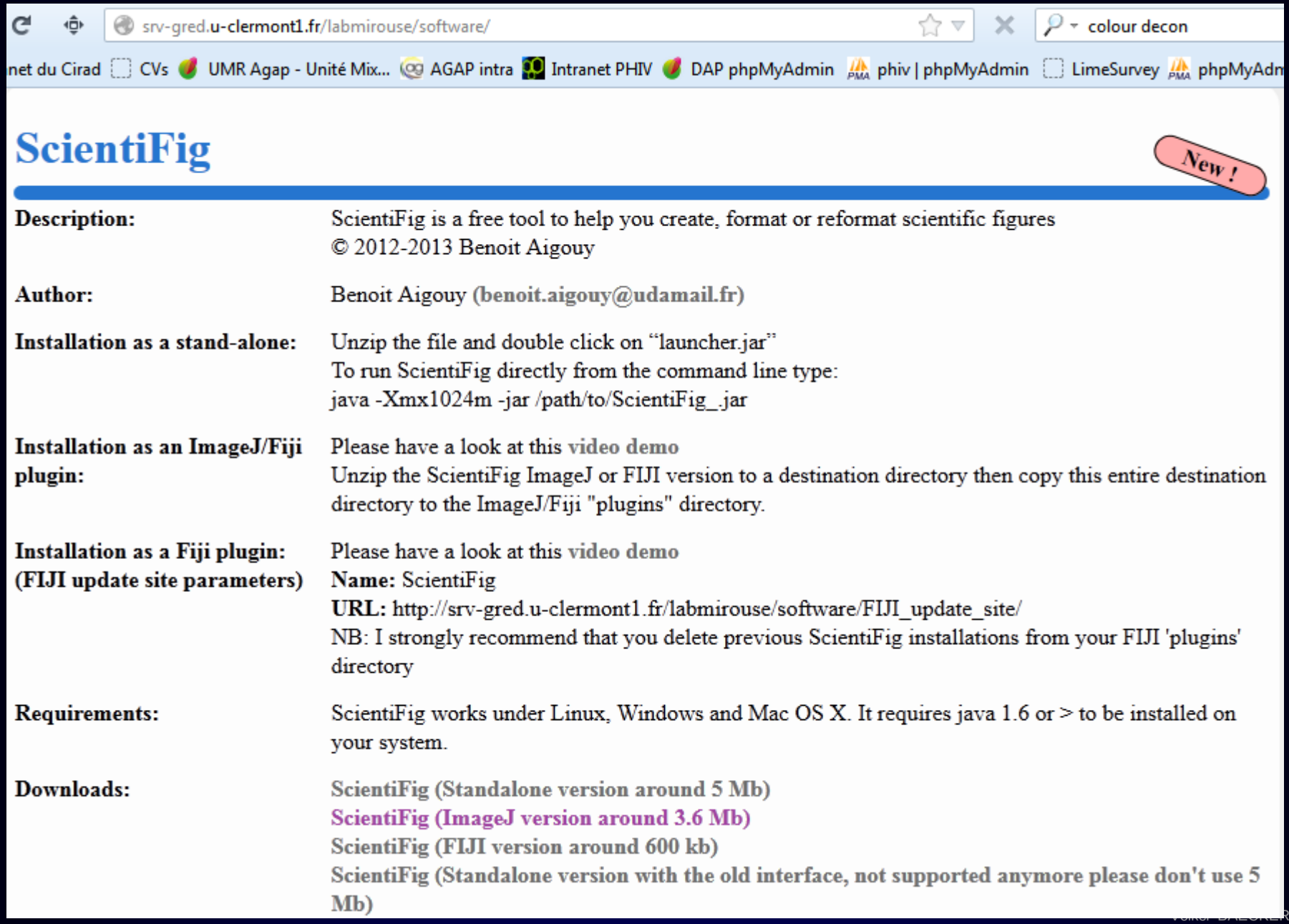
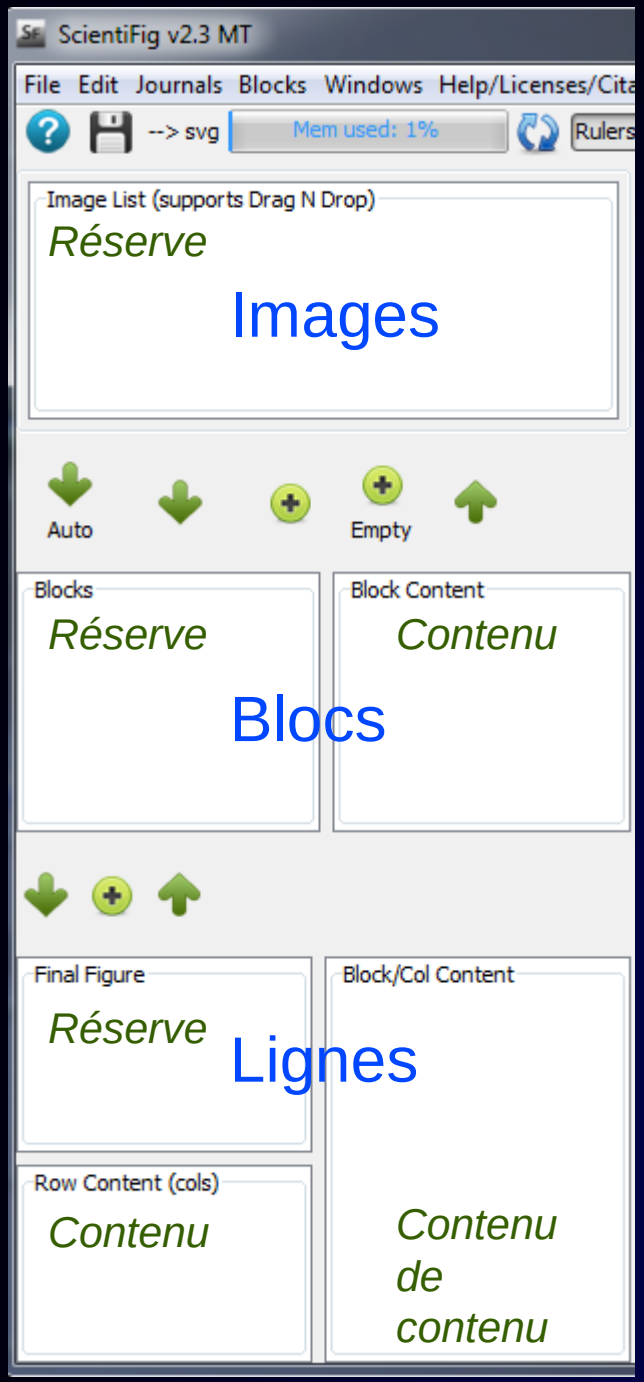
Wavelength (nm)

ScientiFig

Installation du plugin



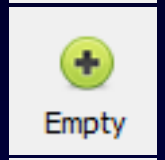
ScientiFig Maquette



Crée un bloc pour chaque image de la liste

Crée un bloc pour l'image sélectionnée

Ajoute une image au bloc actif



Ajoute un espace blanc au bloc actif

Détruit le bloc et remet les images en réserve

Crée une ligne avec le bloc sélectionné

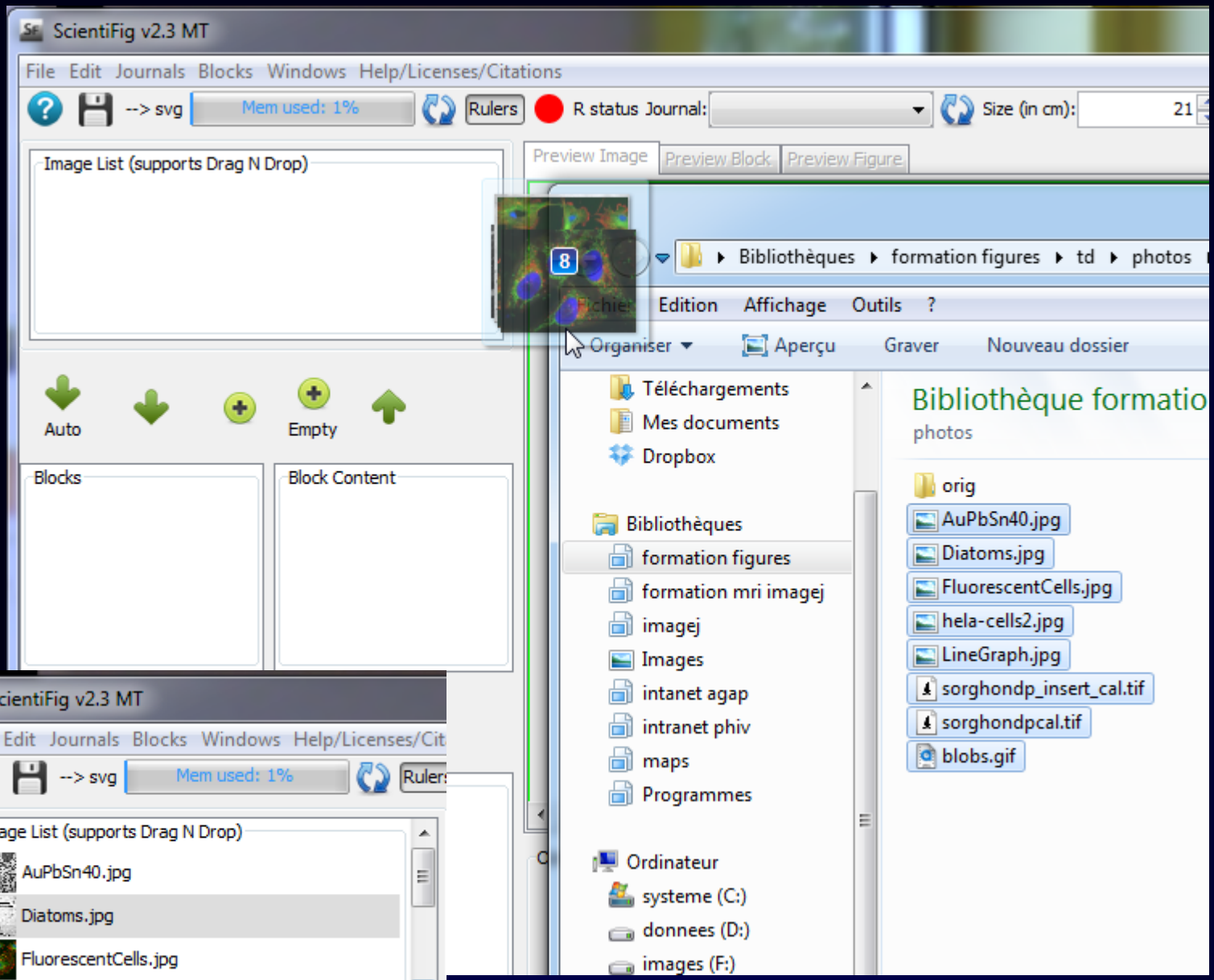
Ajoute un bloc à la ligne active

Enlève la ligne et remet les blocs en réserve

Volker BAECKER - Marc LARTAUD

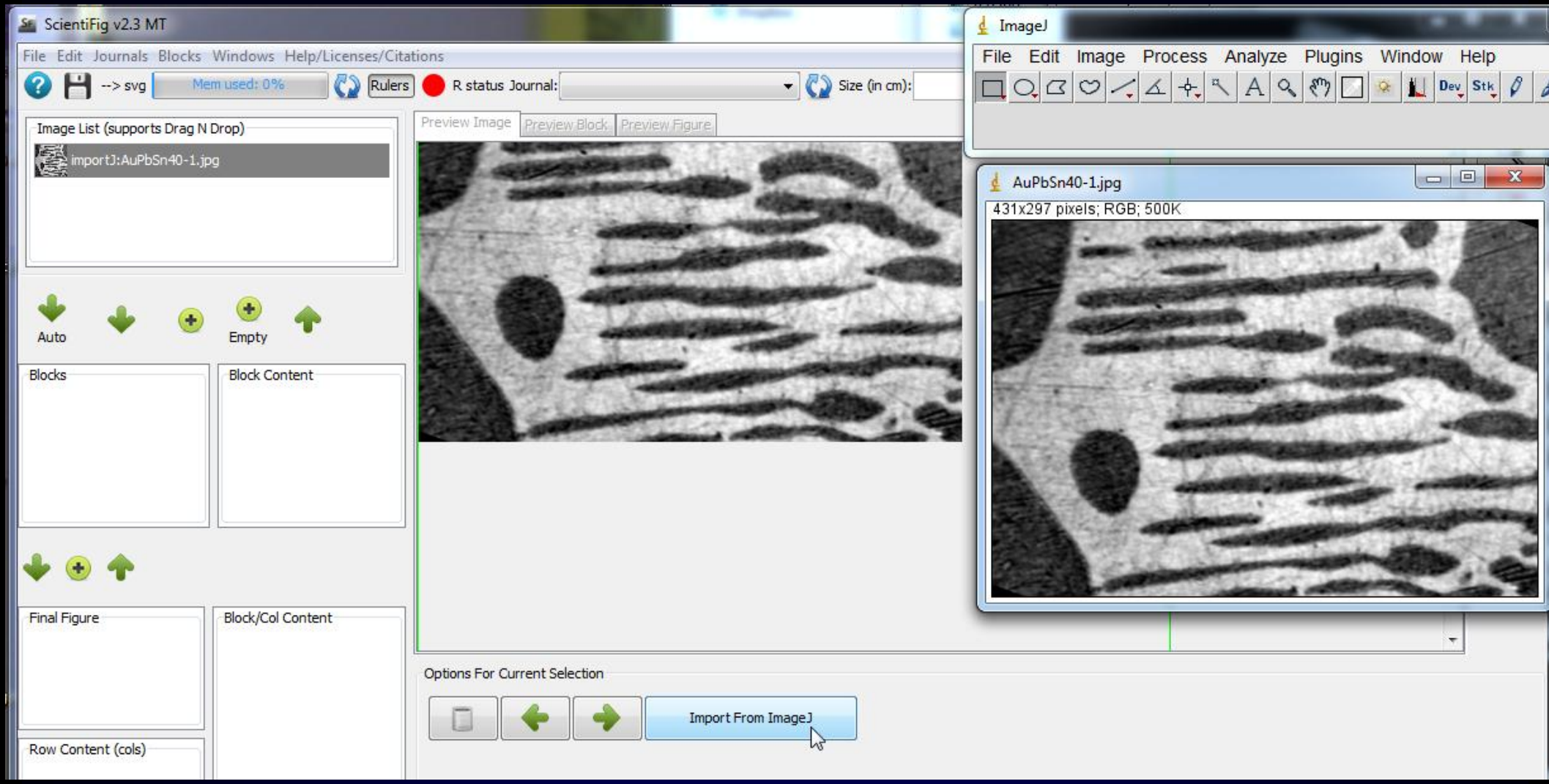
ScientiFig

Import images par drag and drop

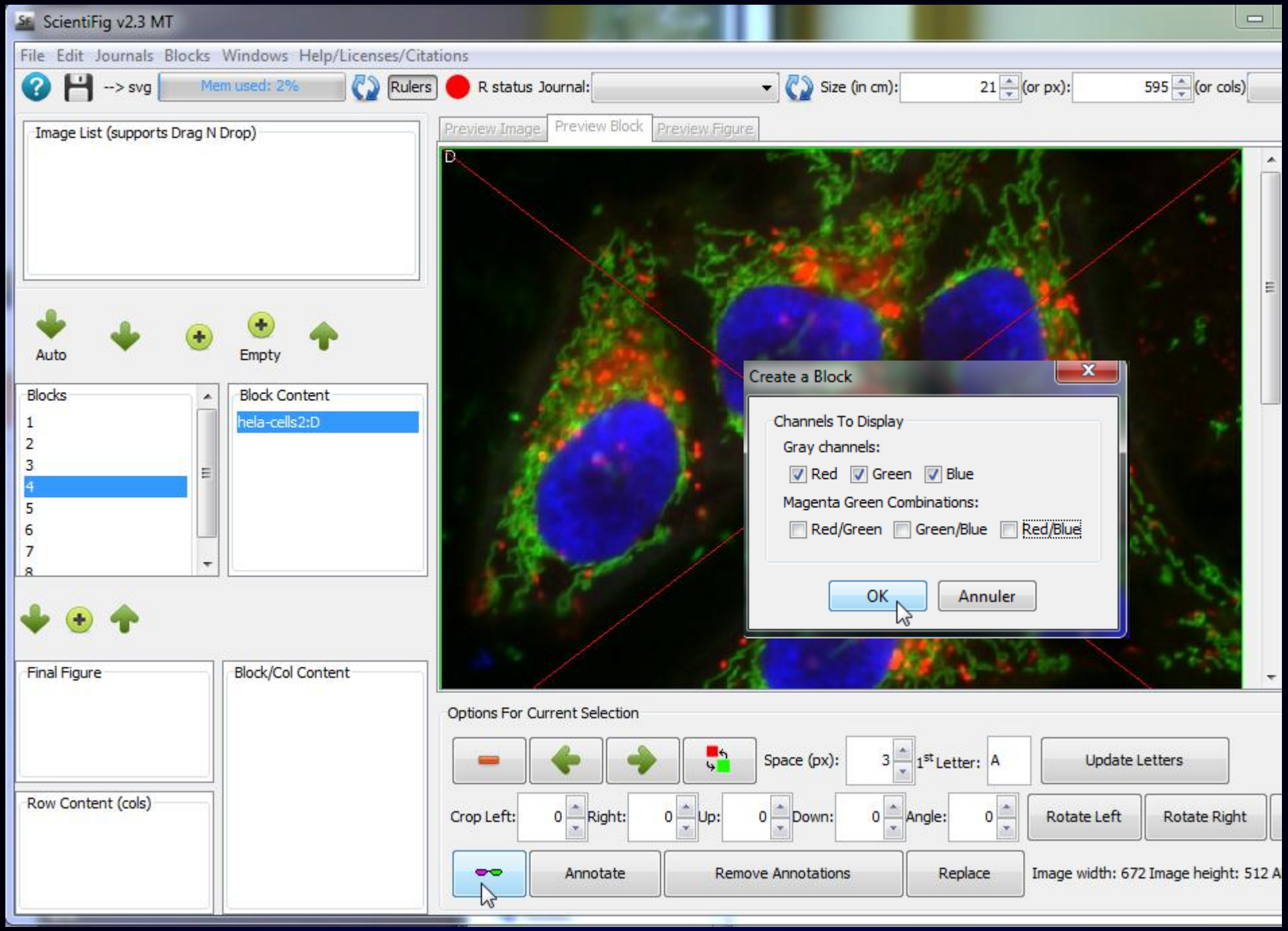


ScientiFig

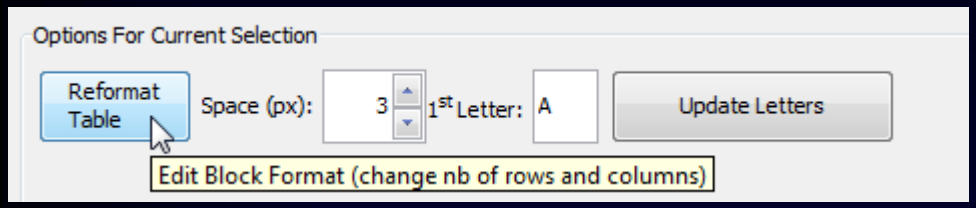
Import de l'image active d'ImageJ (après recadrage et rotation)

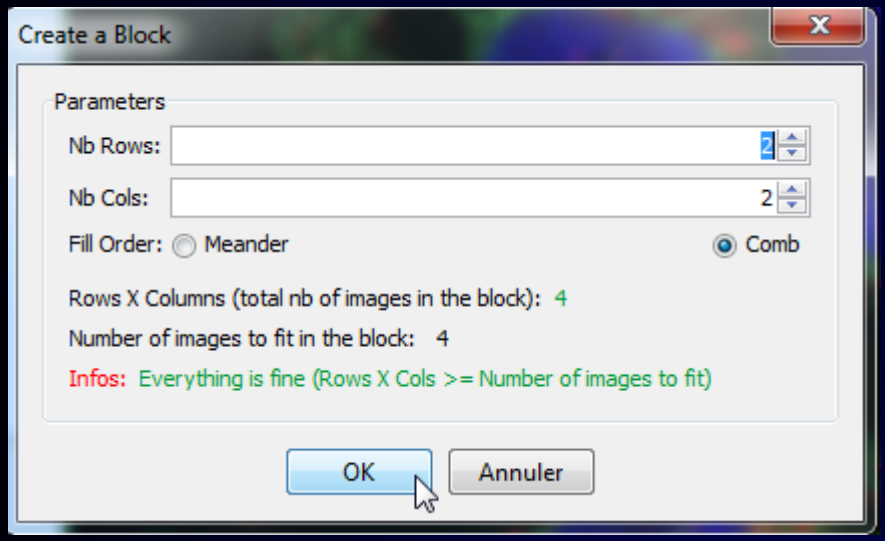


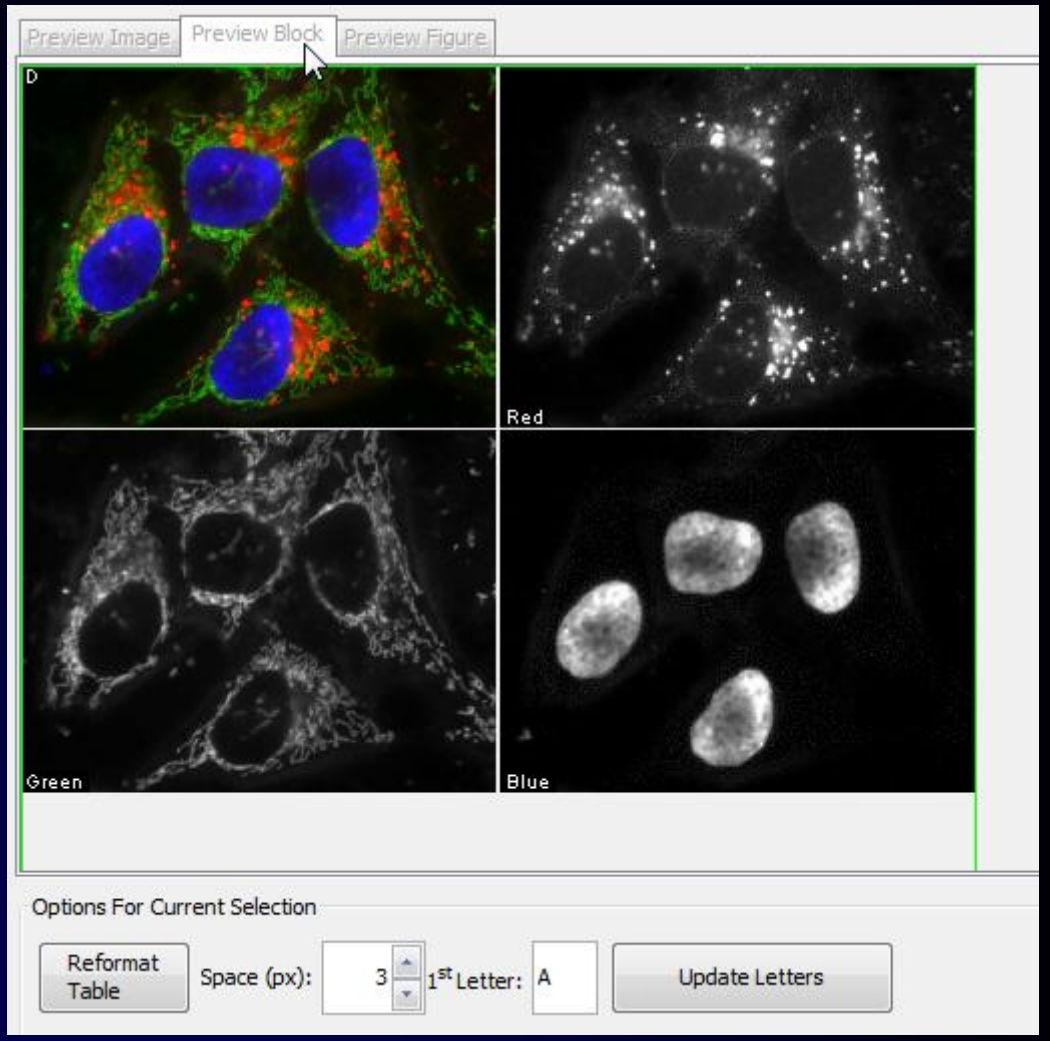
ScientiFig Séparation des canaux



ScientiFig Séparation des canaux







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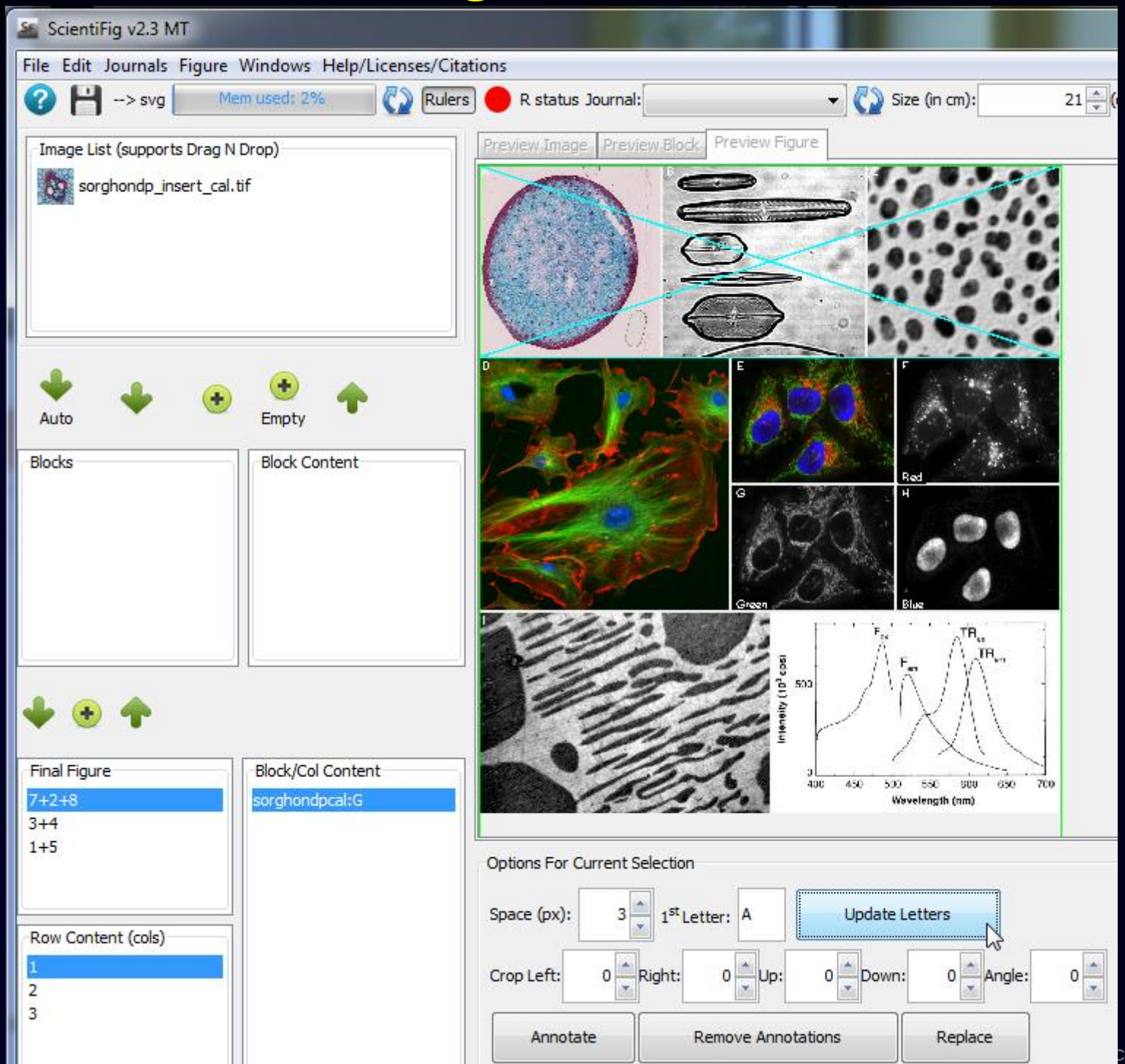

ScientiFig

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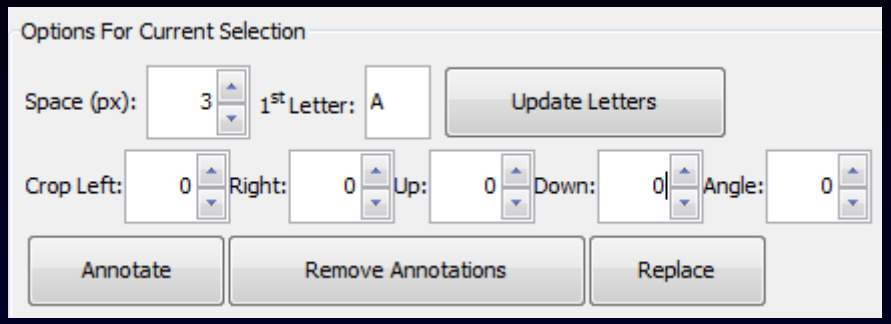
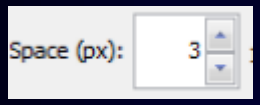
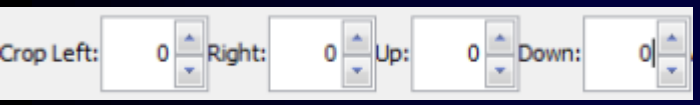


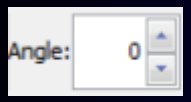


Largeur des espaces entres les images

Choix de la première lettre et remise à jour du lettrage



Recadrage de l'image active



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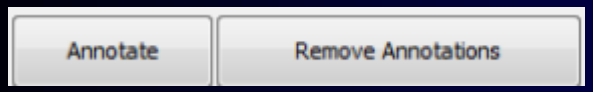
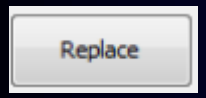


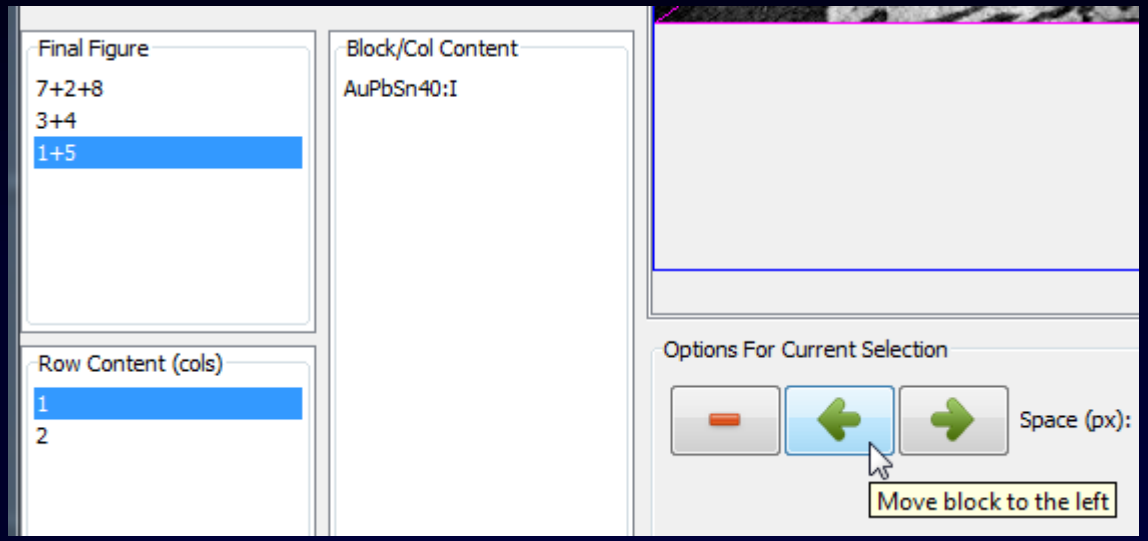
Annotations : création et annulation

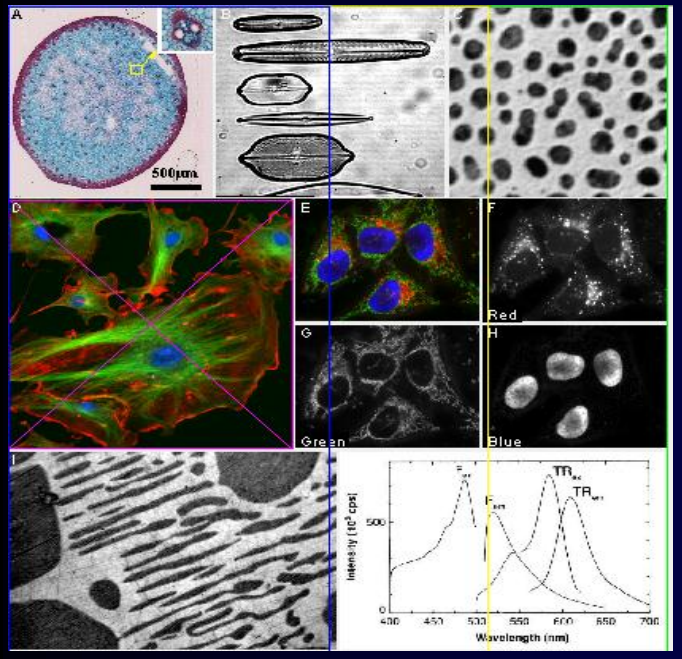


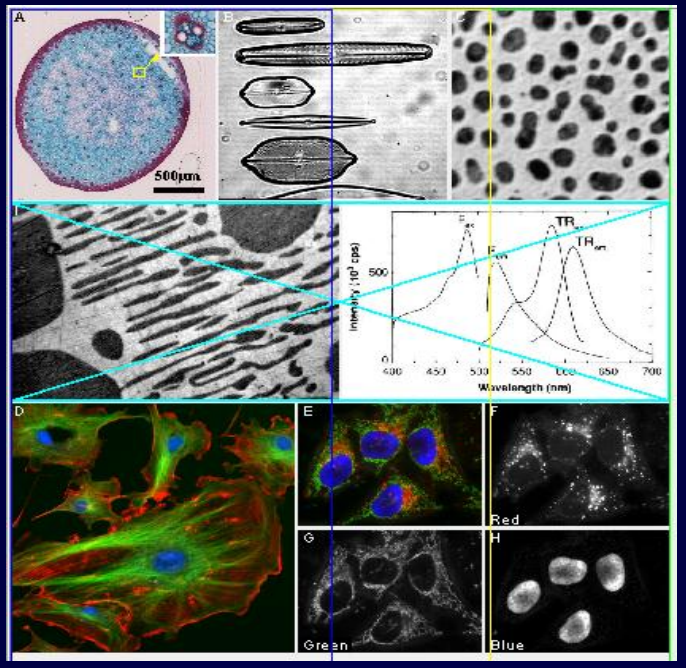
Remplace l'image active

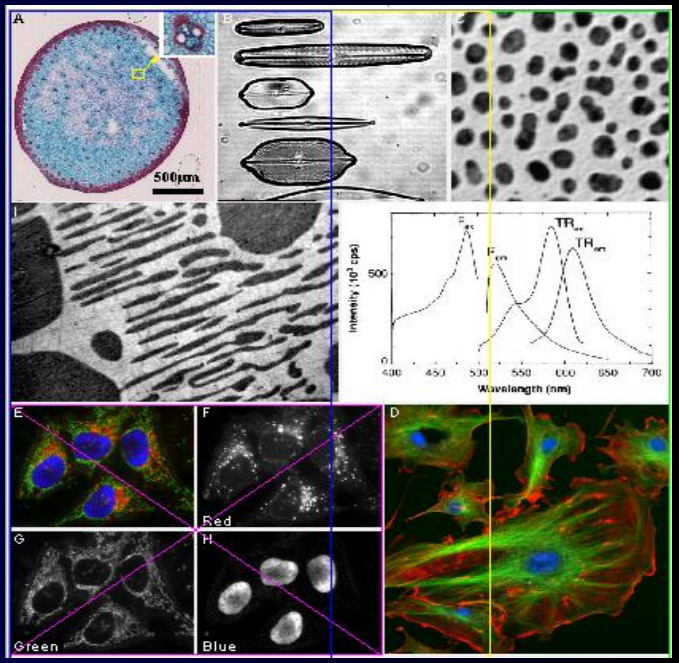
ScientiFig

Déplacement des des lignes ou blocs actifs









ScientiFig

Edition image active

Lettrage

Barre d'échelle

Texte

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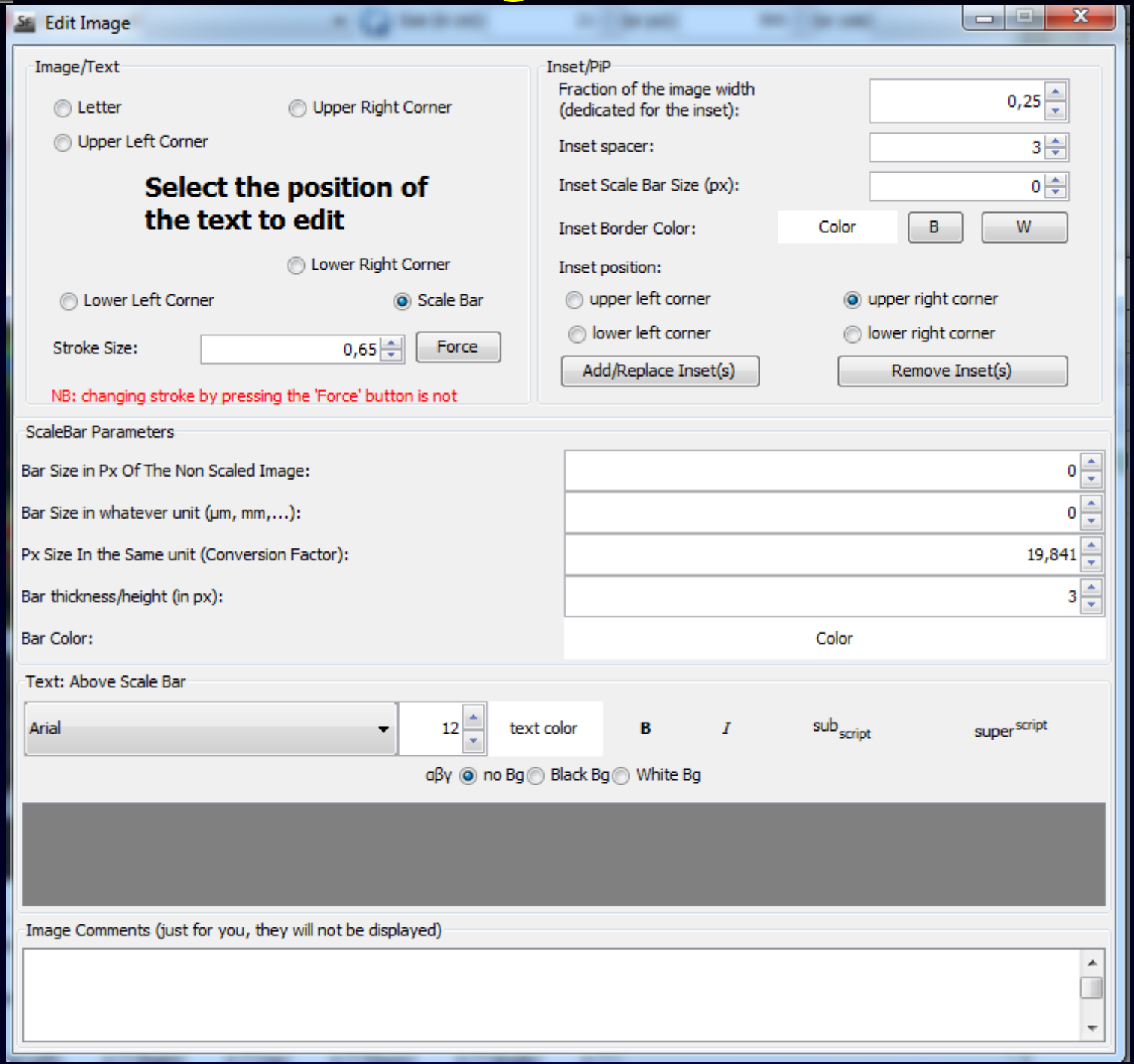

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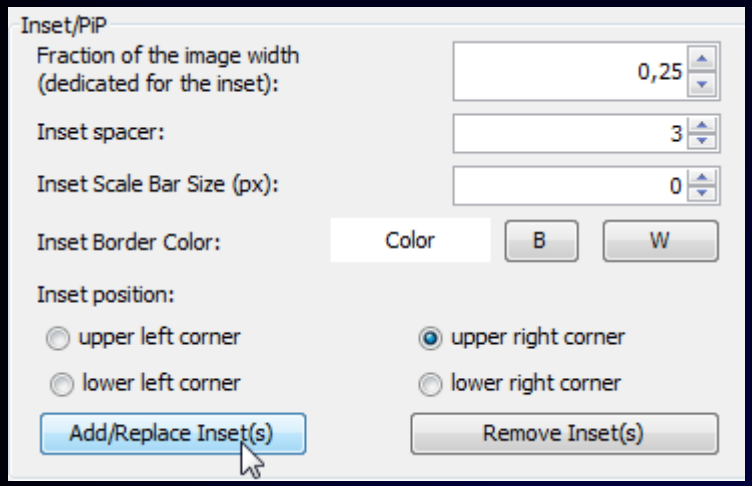
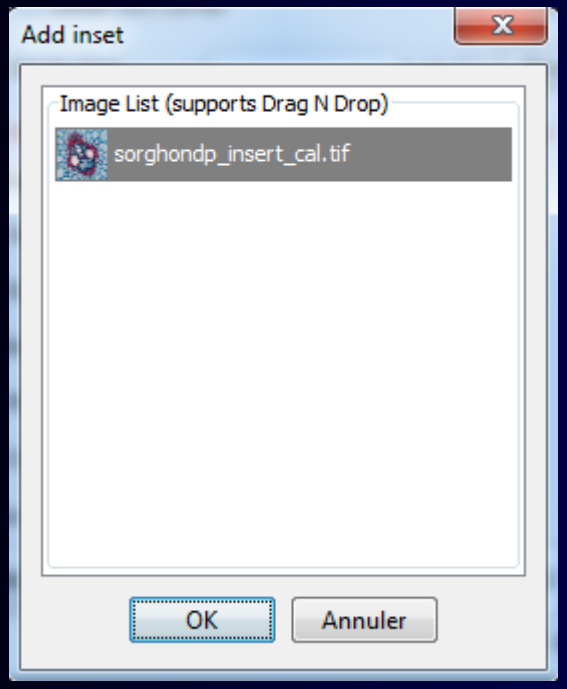
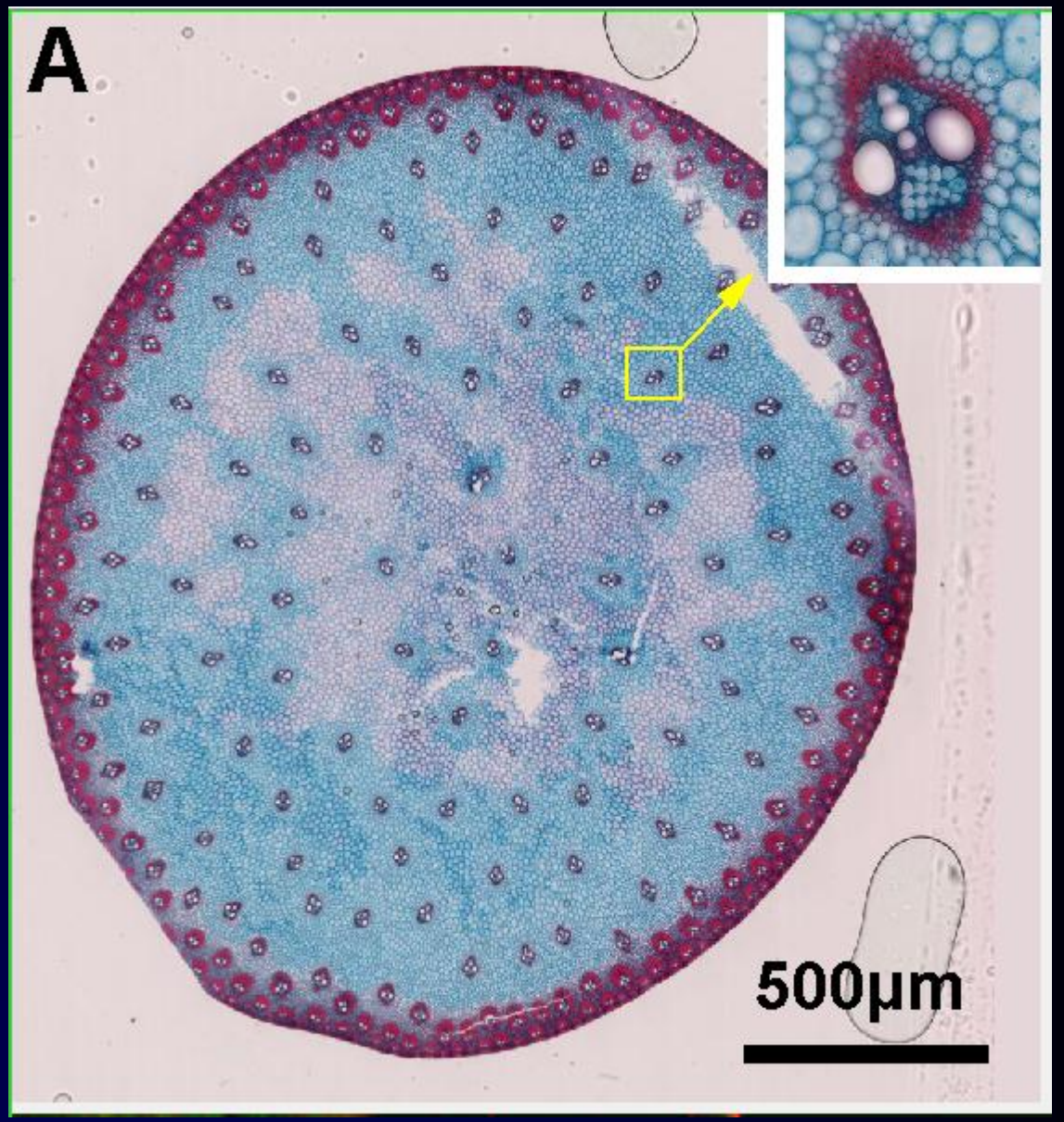
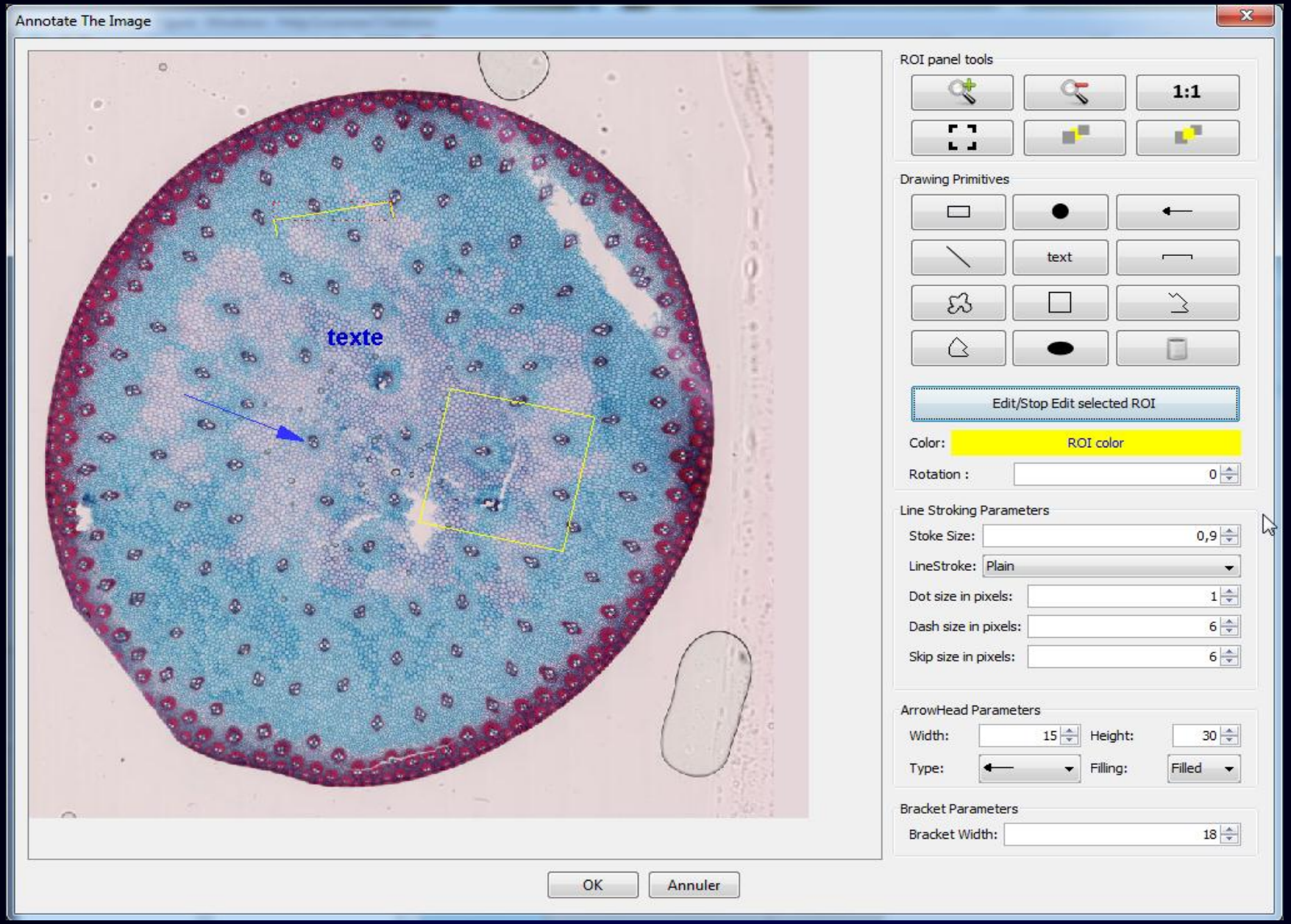






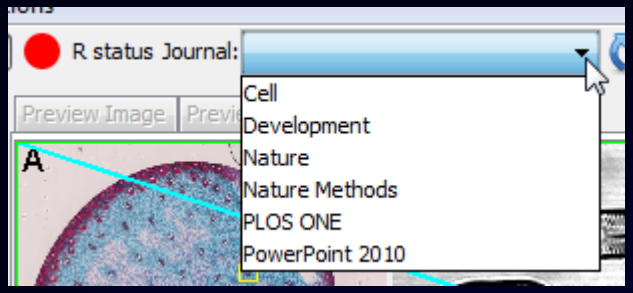
ScientiFig

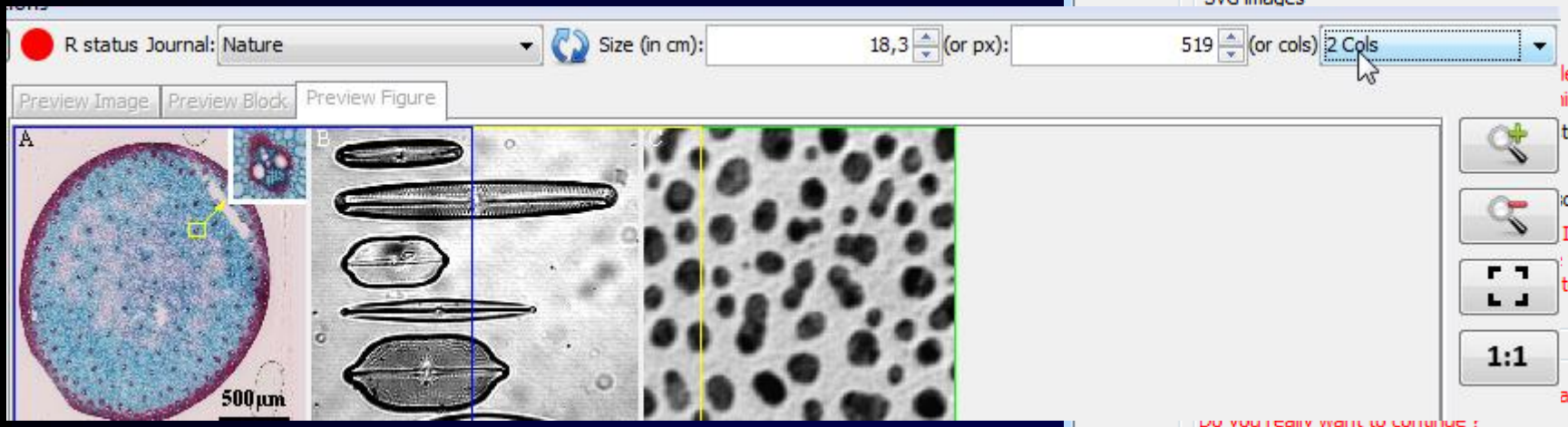
Annotations

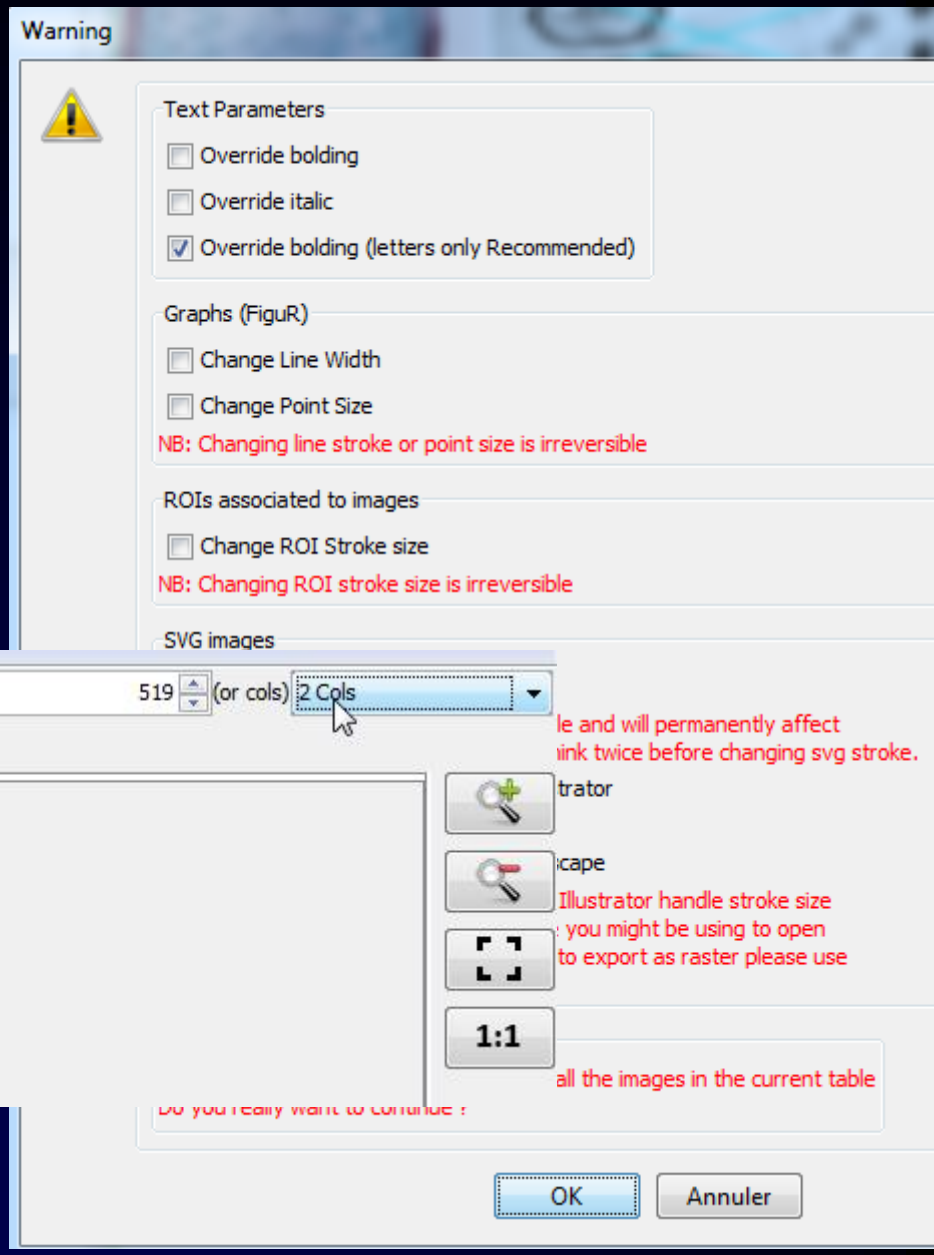


ScientiFig

Choix du journal







ScientiFig

Graphe R dans FiguR

FigurR v0.7 beta

File Journals Data Themes Legend Facets Intercepts Axes About/Citations

Journal Style :

R status Mode : Safe (use most likely factors) Unsafe (any column can be a factor)

Parameters

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Main Title: TEST

Legend Title: essai

x Axis Title x

y Axis Title y

Select A Plot style then click on + Histogram/Barplot Edit

Plots List

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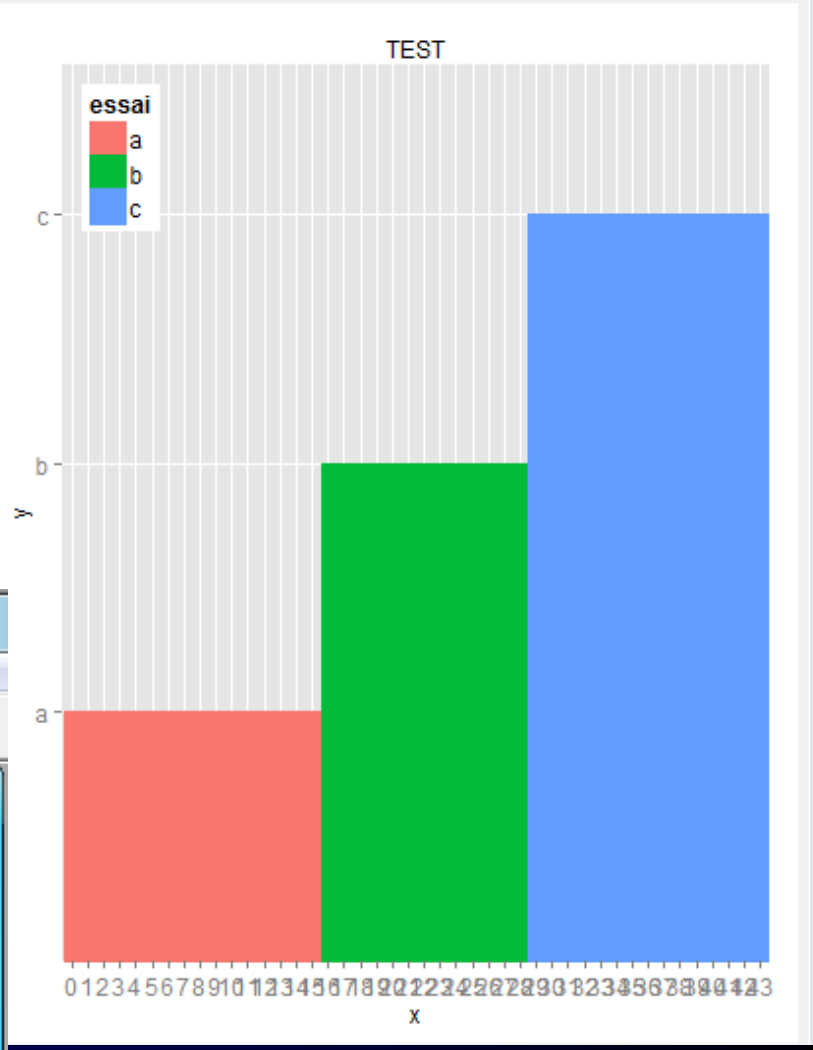
Colors:

"Color" Colors

Preview



RGui (64-bit)

Fichier Edition Voir Misc Packages Fenêtres Aide

R Console

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> Rserve(args='--vanilla')
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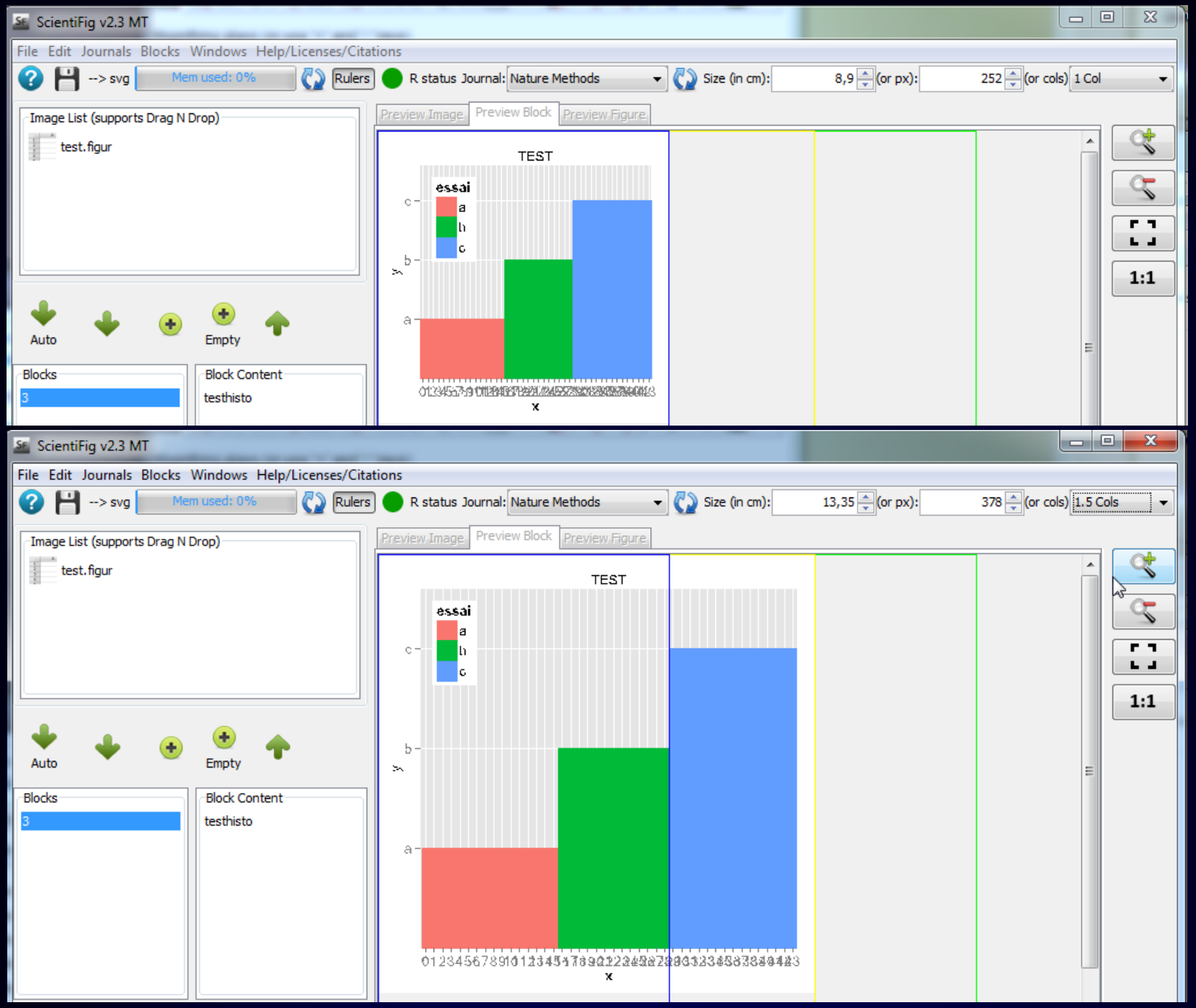
ScientiFig

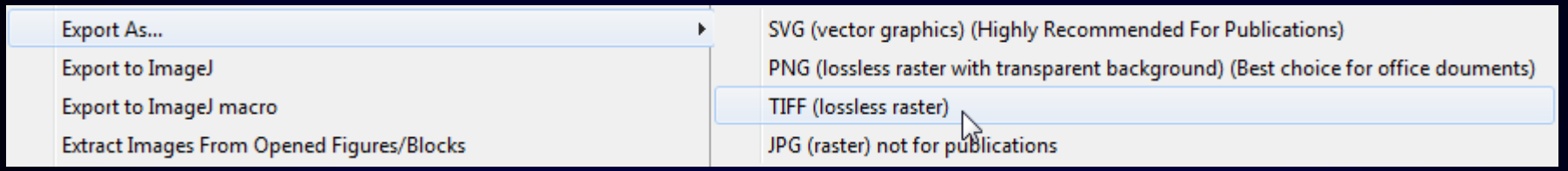
Graphe R dynamique

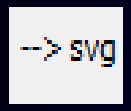


ScientiFig

Sauvegarde et exports

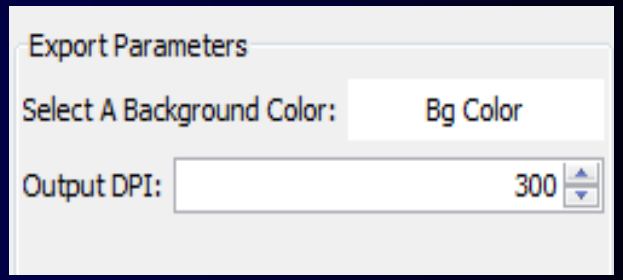
Au format ScientiFig .yf5m





Au format vectoriel SVG

Au format TIFF avec le choix de la résolution



FigureJ / ScientiFig

Maquette	Rapide	Modifiable
Import photos	Recadrage et rotation	
Lettrage		Automatique
Barre d'échelle		Option texte
Annotations		Objets
Inset		Facile
Lien graphique	(R)	R dynamique via FiguR
Style		Journal
Export	Tiff	Tiff SVG

Logiciels libres lisant le format vectoriel SVG : Scribus, Inkscape