



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

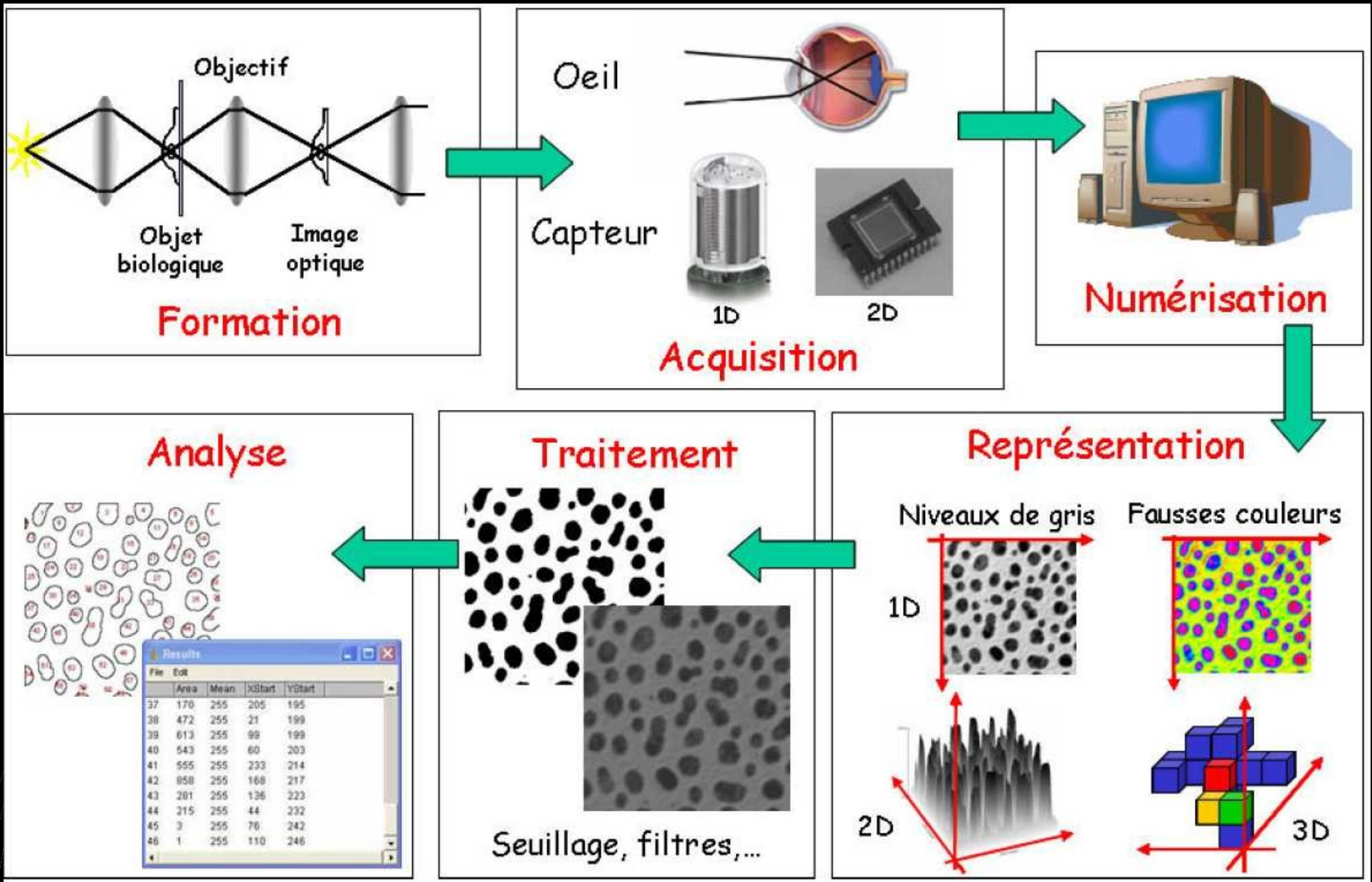
Quantification → données

Amélioration

Publication

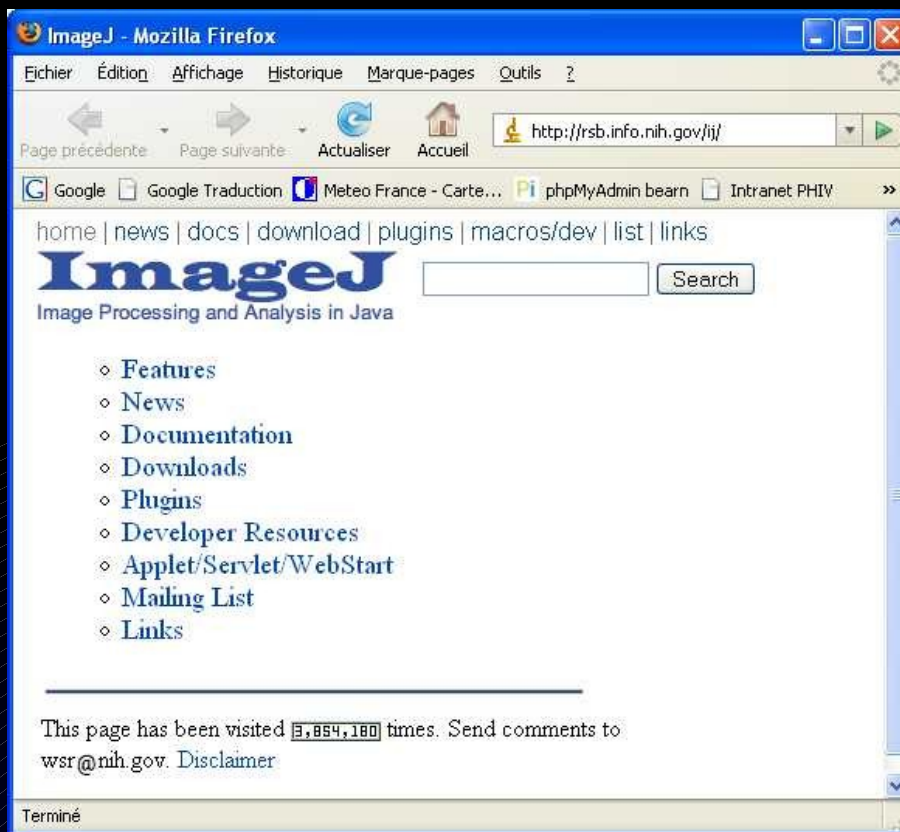


Le traitement et l'analyse d'images





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/index.html>



Installation

Download - Mozilla Firefox

Fichier Édition Affichage Historique Marque-pages Outils ?

Page précédente Page suivante <http://rsb.info.nih.gov/ij/download.html> Actualiser Accueil

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

Download

JAR File (Upgrade or Unix)

To upgrade to v1.38 or install ImageJ on a Java-enabled machine, download ij138 (2MB) and extract the ImageJ directory. Includes Mac and Windows launchers. Upgrade page has pre-release versions.

Mac OS X

Download ImageJ 1.38 (1.7MB) as a double-clickable Mac OS X application. (Instructions)

Linux x86

Download ImageJ 1.38 (35MB) for Linux x86. Includes the Sun Java 1.5.0_09 runtime and the ImageJ source code. (Instructions)

Windows

Download ImageJ 1.38 bundled with Java 1.6.0_02 (21MB) or without Java (1.7MB). (Instructions)

Mac OS 9

Download ImageJ 1.36 (2.1M) as a double-clickable Mac OS 9 application. (Instructions)

<http://rsb.info.nih.gov/ij/download/win32/ij138-jdk6-setup.exe>

Ouverture de ij138-jdk6-setup.exe

Vous avez choisi d'ouvrir

 **ij138-jdk6-setup.exe**
qui est un fichier de type : Application
à partir de : <http://rsb.info.nih.gov>

Voulez-vous enregistrer ce fichier ?

Enregistrer le fichier Annuler



Installation

Welcome to the ImageJ Setup Wizard

This will install ImageJ 1.44p on your computer.

It is recommended that you close all other applications before continuing.

Click Next to continue, or Cancel to exit Setup.

Next > Cancel

Select Destination Location

Where should ImageJ be installed?

Setup will install ImageJ into the following folder.

To continue, click Next. If you would like to select a different folder, click Browse.

F:\ImageJ Browse...

At least 106,8 MB of free disk space is required.

< Back Next > Cancel

Select Start Menu Folder

Where should Setup place the program's shortcuts?

Setup will create the program's shortcuts in the following Start Menu folder.

To continue, click Next. If you would like to select a different folder, click Browse.

ImageJ Browse...

Don't create a Start Menu folder

< Back Next > Cancel

Select Additional Tasks

Which additional tasks should be performed?

Select the additional tasks you would like Setup to perform while installing ImageJ, then click Next.

Additional icons:

- Create a desktop icon
- Create a Quick Launch icon

< Back Next > Cancel

Ready to Install

Setup is now ready to begin installing ImageJ on your computer.

Click Install to continue with the installation, or click Back if you want to review or change any settings.

Destination location:
F:\ImageJ

< Back Install Cancel

Installing

Please wait while Setup installs ImageJ on your computer.

Extracting files...

F:\ImageJ\jre\lib\charsets.jar

[Progress bar]

Completing the ImageJ Setup Wizard

Setup has finished installing ImageJ on your computer.

Click Finish to exit Setup.

Launch ImageJ

Finish



Configuration

Welcome to ImageJ



The program will now be auto-configured. You may be prompted to input the locations of various files that can not be auto-detected. Please consult the installation instructions for further assistance.

OK

ImageJ Configuration



A configuration file was successfully created as:

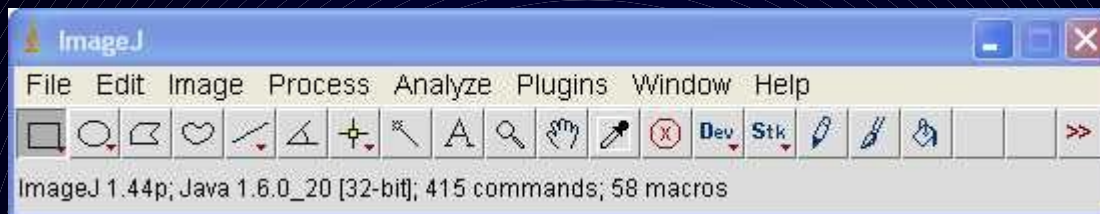
F:\ImageJ\ImageJ.cfg

with the following parameters:

Line 1- .
Line 2- jre\bin\javaw.exe
Line 3- -Xmx640m -cp ij.jar ij.ImageJ

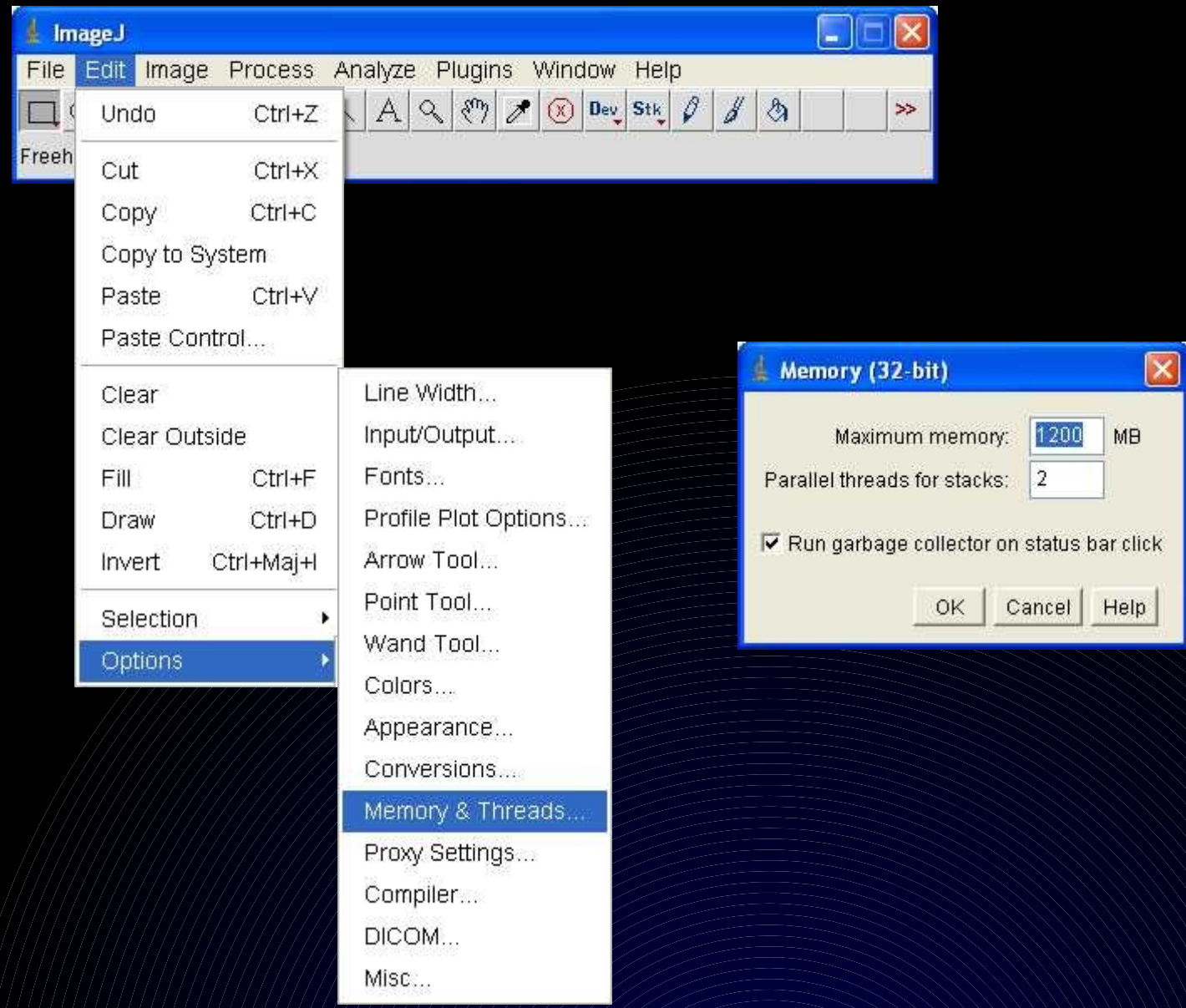
Please consult the installation instructions for further details.

OK



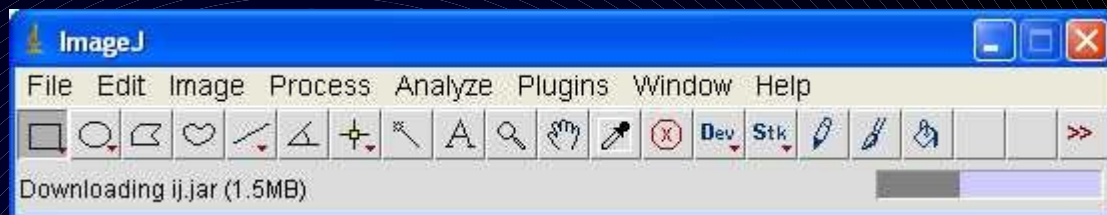
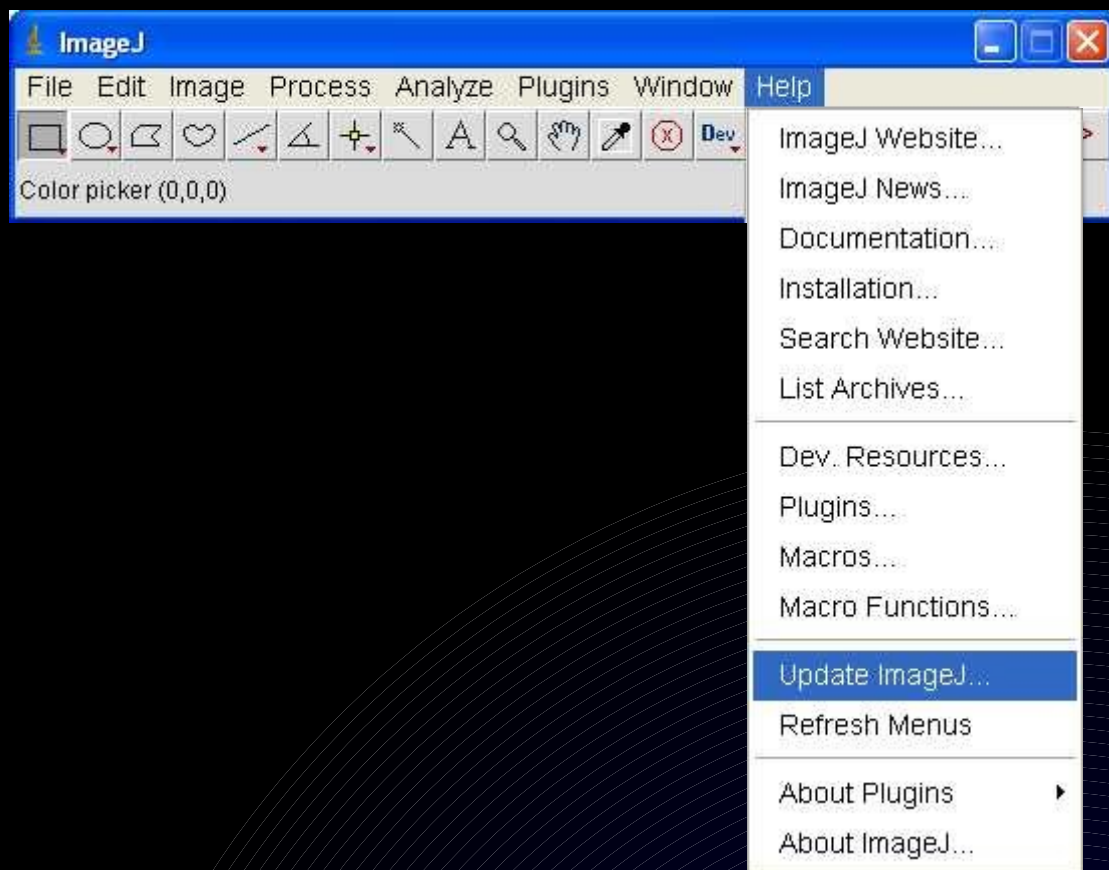


Configuration



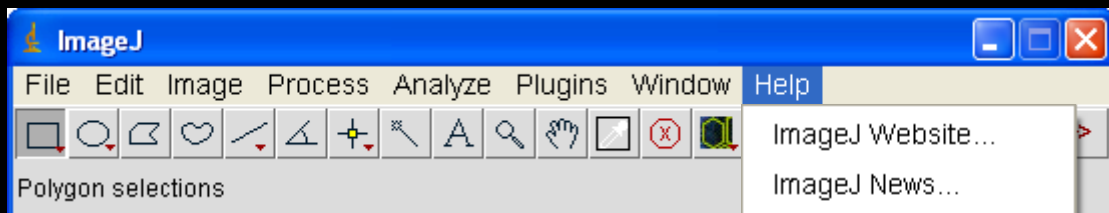
Edit → Option → Memory & Treads...

Mise à jour



Help → Update ImageJ...

Installation de Plugins



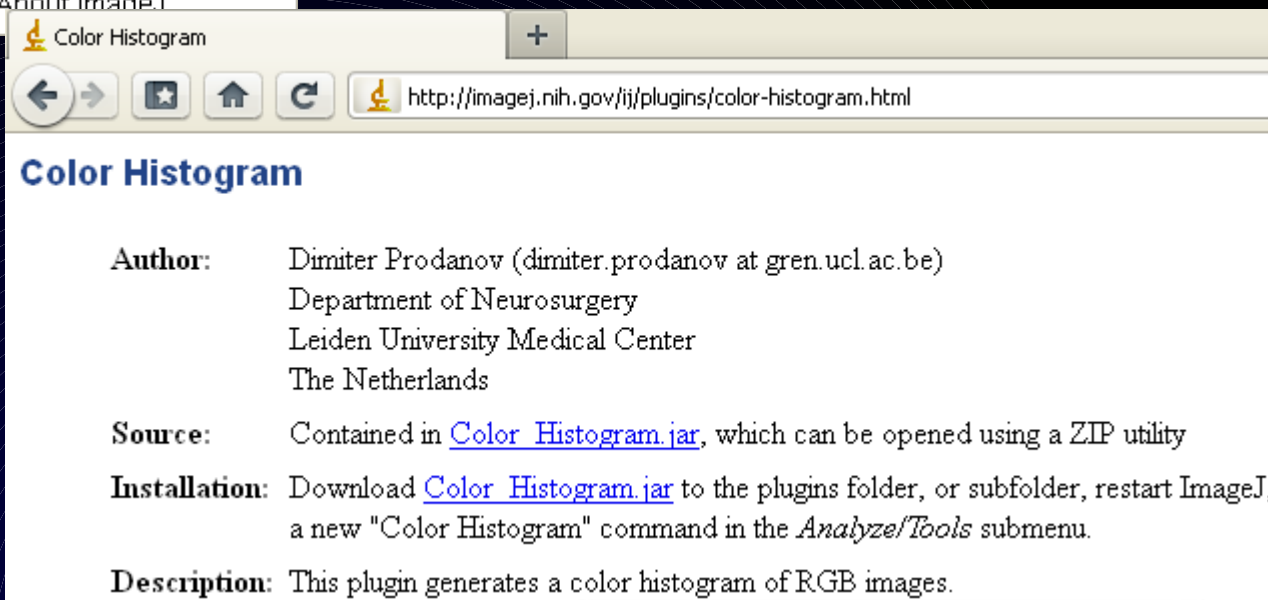
- Recherche des plugins
Sur internet
Help-->Plugins...

- 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

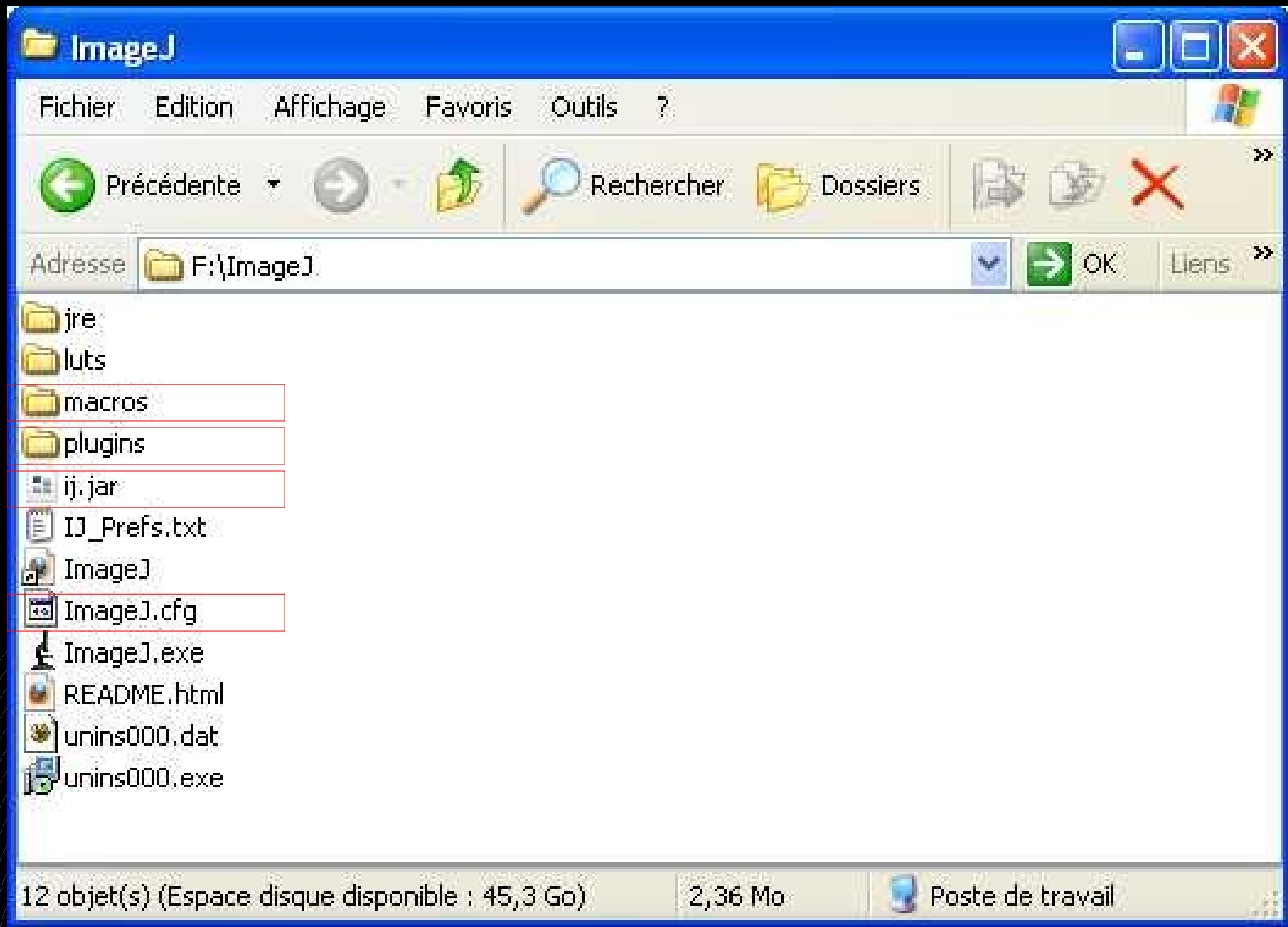


Help→ Plugins...

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



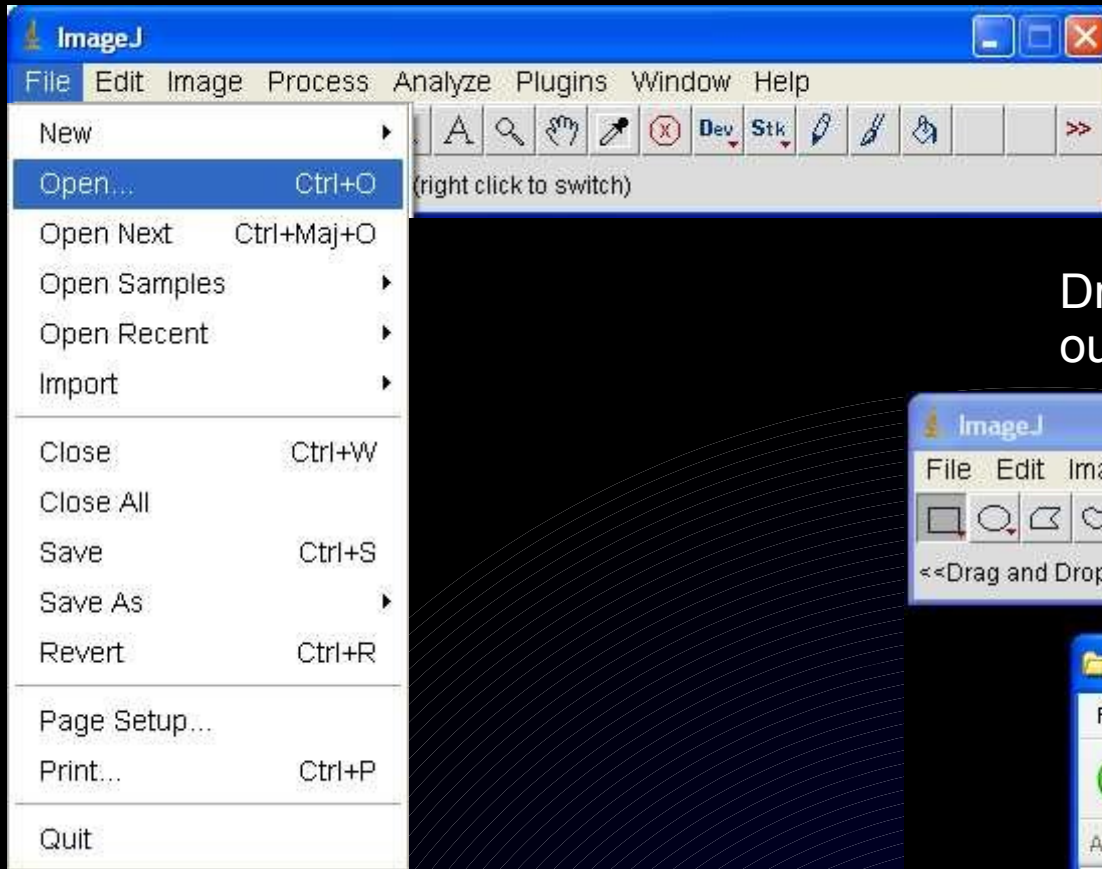
Barre d'état



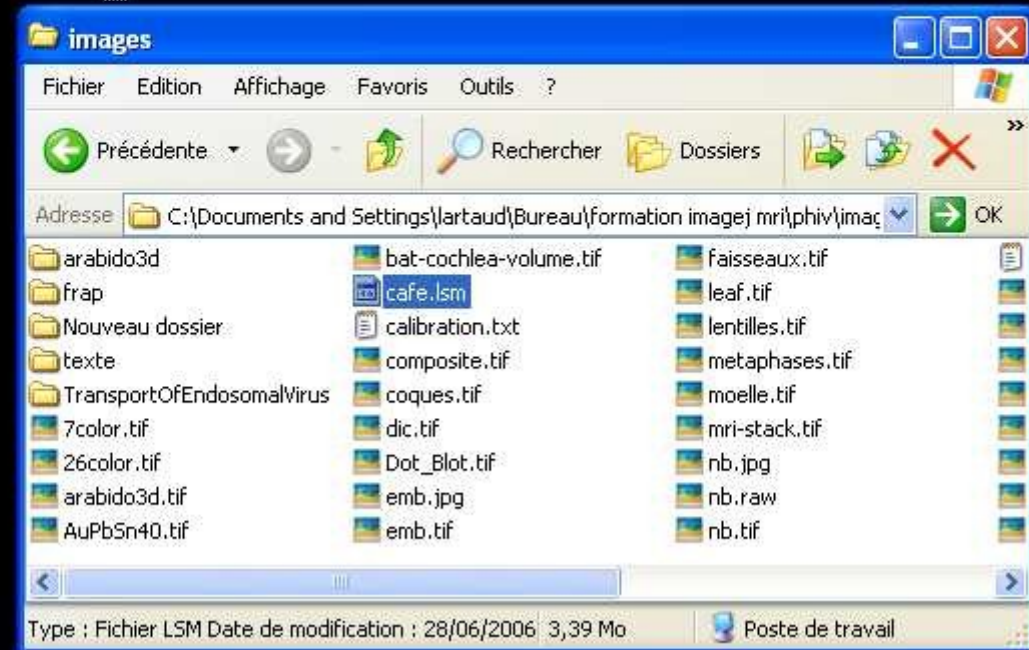
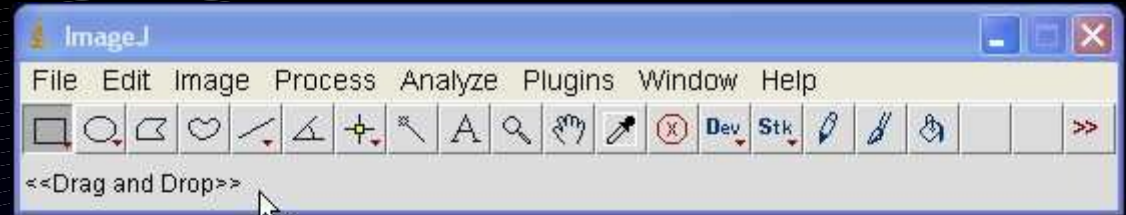


Ouvrir une image

File → Open...



Drag and Drop sur la fenêtre
ou l'icône

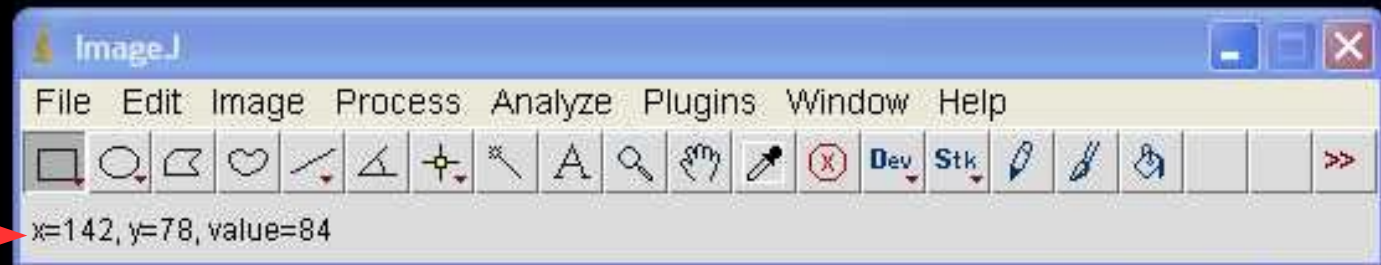


File → Open ...

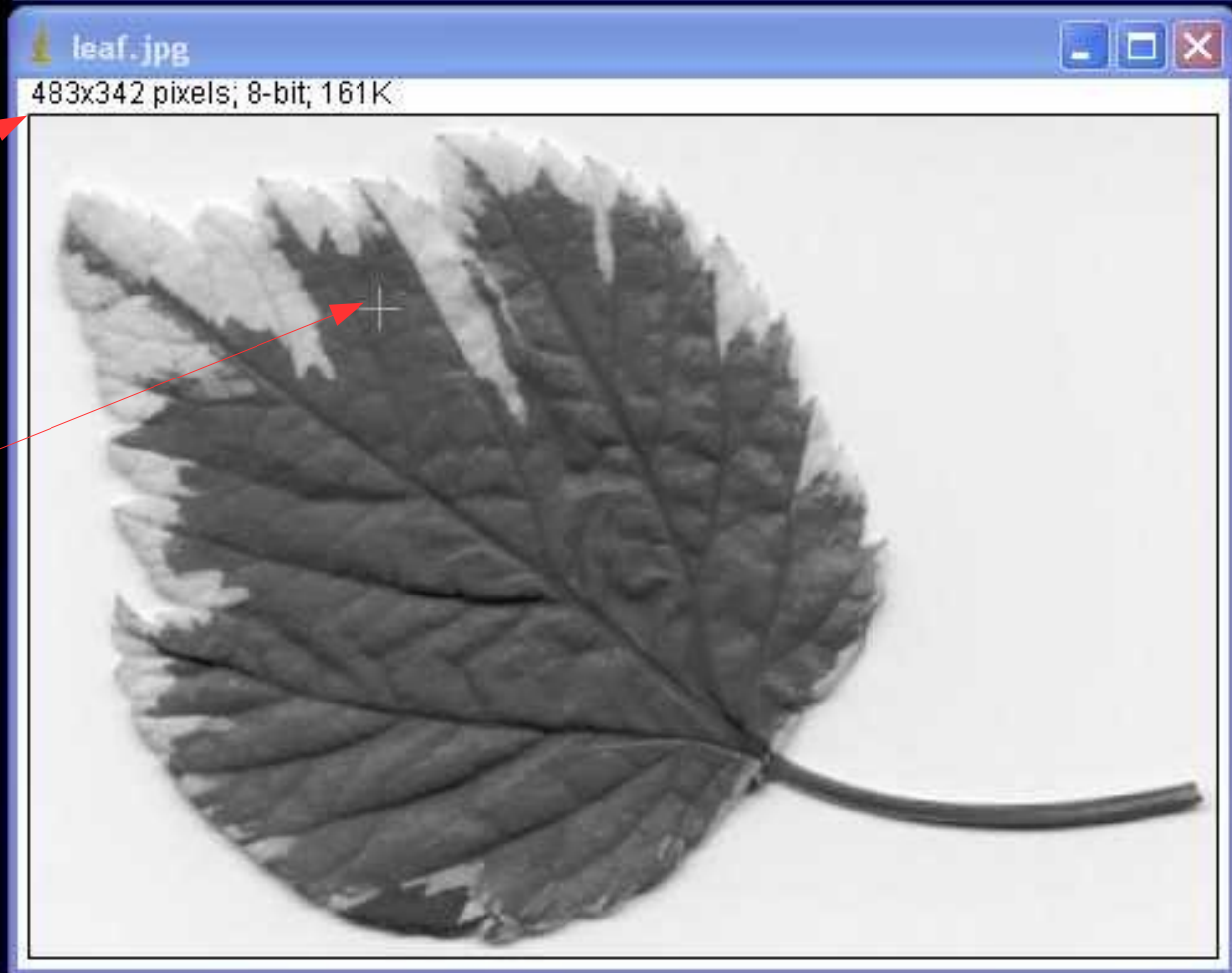


Informations pixel

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



Informations image

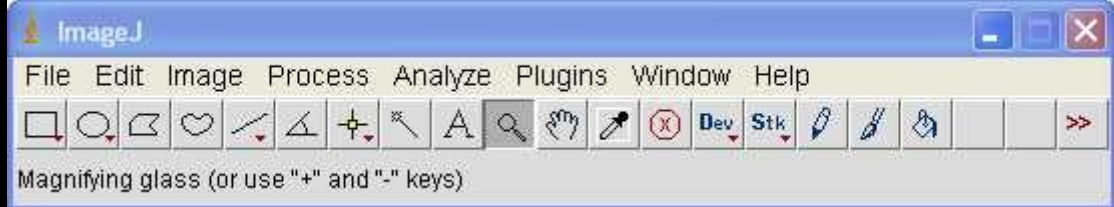


Curseur de souris



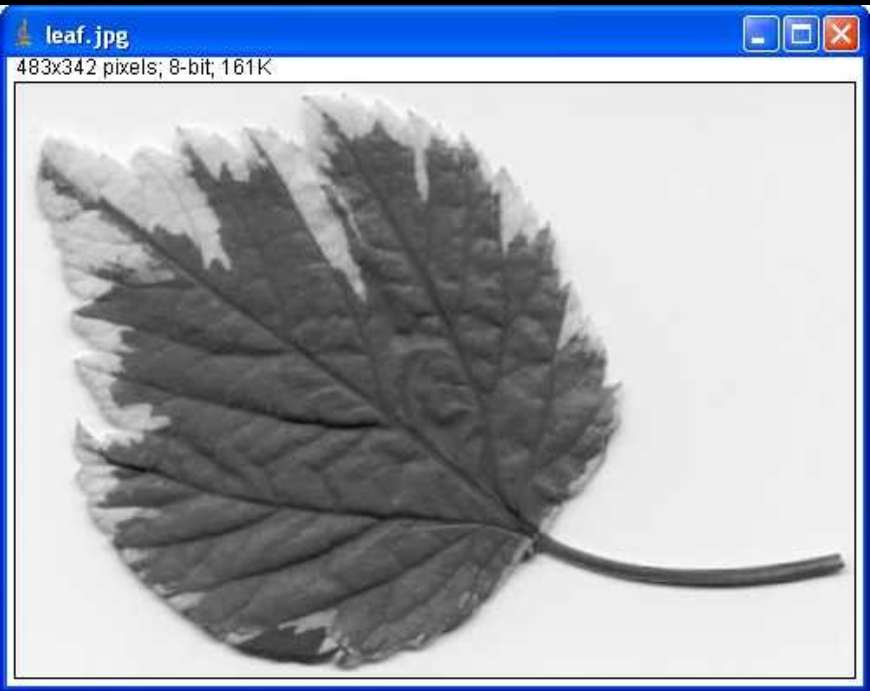
Zoom

Touche « - »



Zone affichée

Touche « + »



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





Outils de sélection (ROI)

Rectangle

Polygone

Ligne

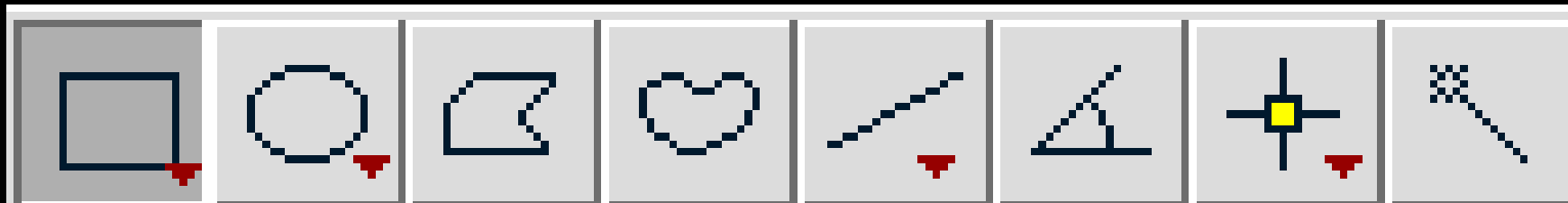
Point

Ovale

À main levée

Angle

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

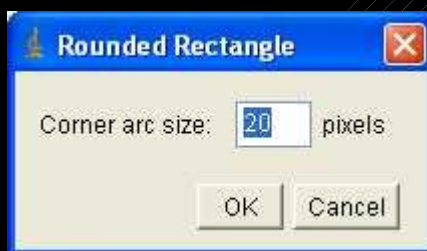
Freehand Line

Arrow tool

✓ Point Tool

Multi-point Tool

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



Ajouter à la sélection : Maj-clic

Supprimer de la sélection : Alt-clic

Retrouver la sélection : **Edit → Selection → Restore Selection**



ROI Manager

ImageJ

File Edit Image Process Analyze Plugins Window Help

Magnifying glass (or use "+" and "-")

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

Save XY Coordinates...

Fractal Box Count...

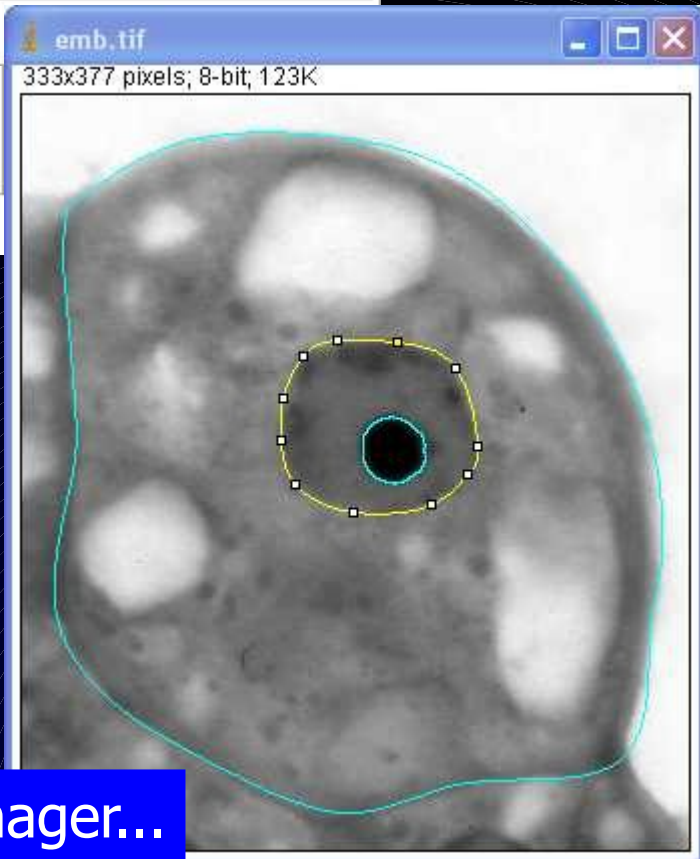
Analyze Line Graph

Curve Fitting...

ROI Manager...

Scale Bar...

Calibration Bar...



ROI Manager

Cellule	Add [t]
Noyau	Update
Nucléole	Delete
	Rename...
	Measure
	Deselect
	Properties...
	Flatten [F]
	More »
<input checked="" type="checkbox"/> Show All	
<input type="checkbox"/> Edit Mode	

Open...

Save...

Fill

Draw

AND

OR (Combine)

XOR

Split

Add Particles

Multi Measure

Sort

Specify...

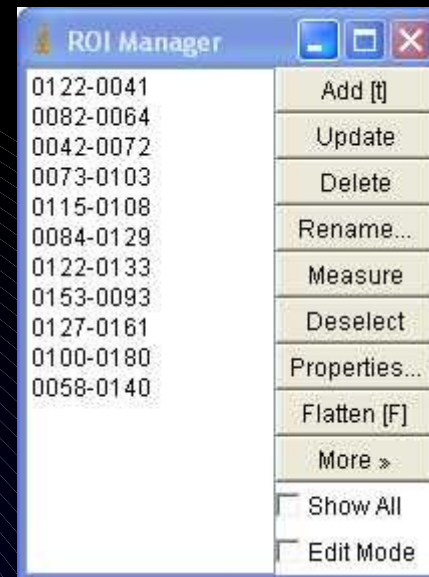
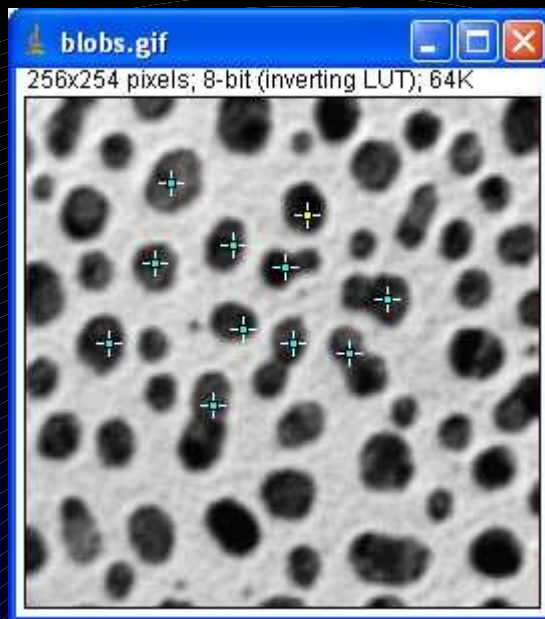
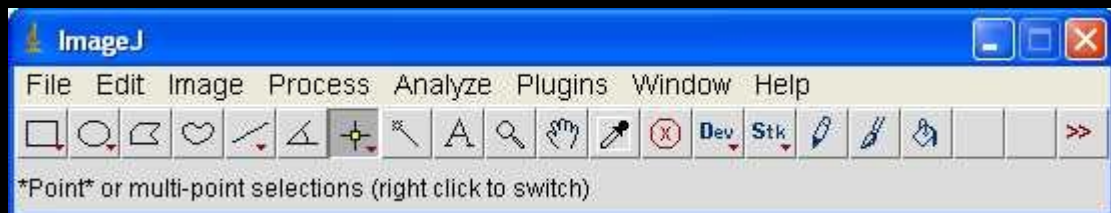
Remove Slice Info

Help

Options...

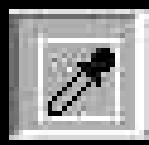
Analyse → Tools → ROI Manager...

Outil Point pour le comptage





Dessin

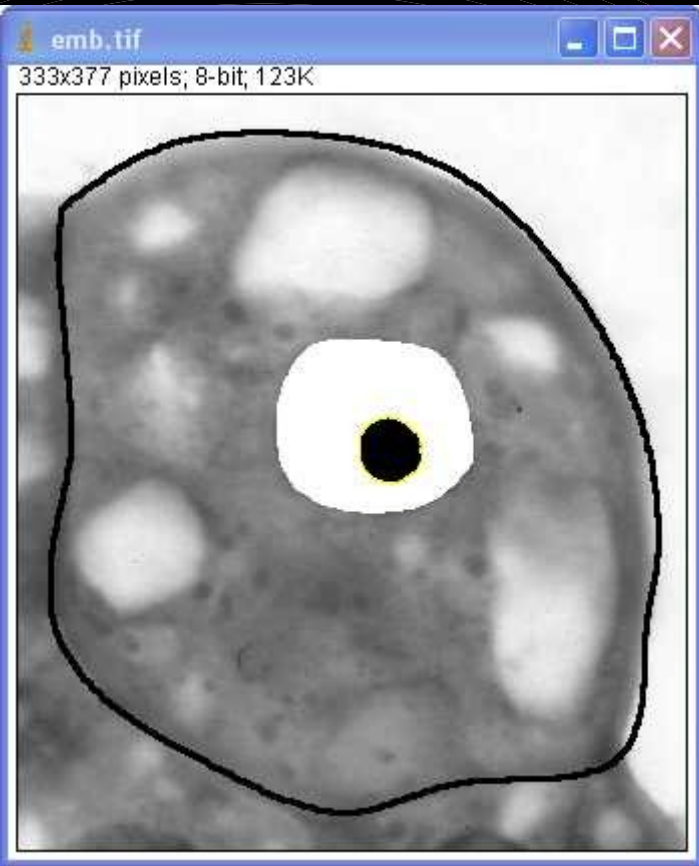


ImageJ

File Edit Image Process Analyze Plugins Window Help

- Undo Ctrl+Z
- Cut Ctrl+X
- Copy Ctrl+C
- Copy to System
- Paste Ctrl+V
- Paste Control...
- Clear**
- Clear Outside
- Fill Ctrl+F
- Draw Ctrl+D
- Invert Ctrl+Maj+I
- Selection ▶
- Options ▶

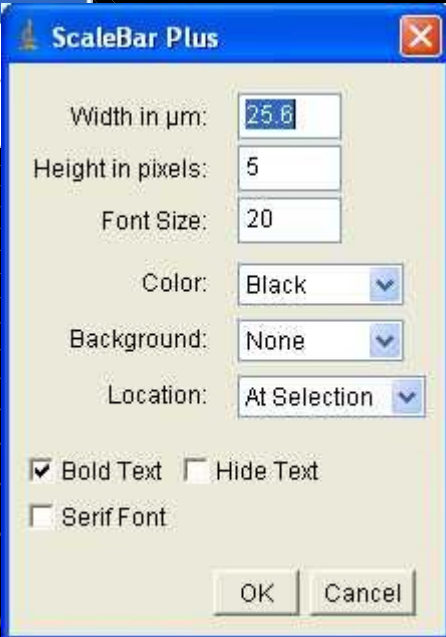
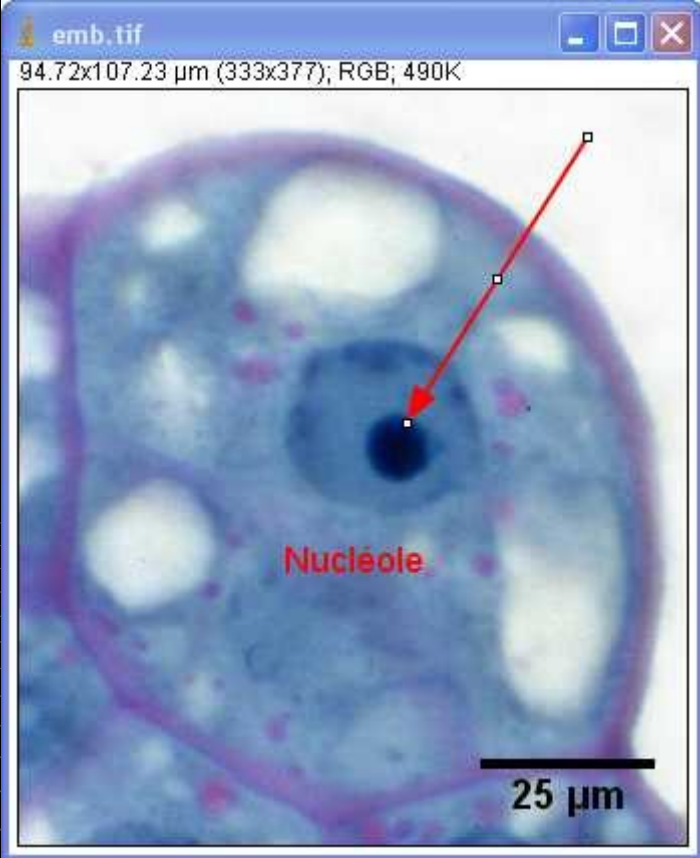
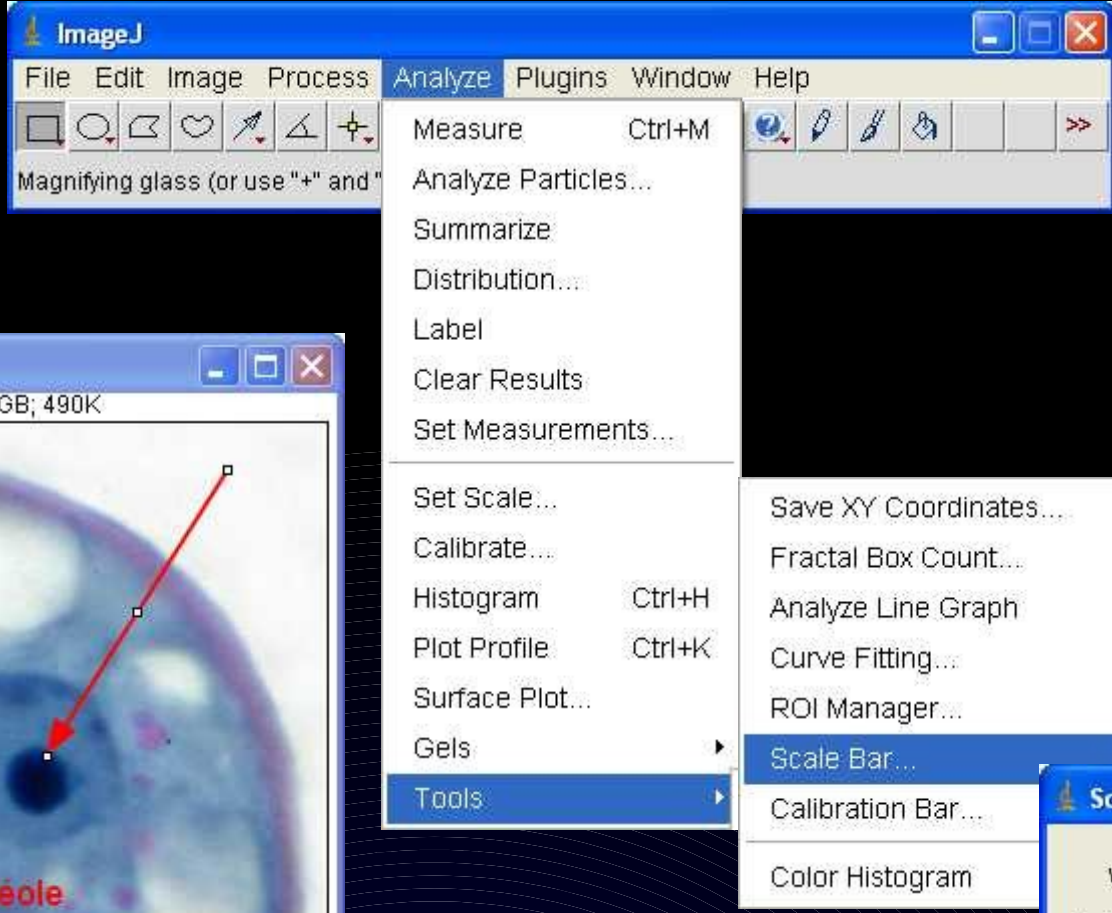
Clear → Noyau
 Fill → Nucléole
 Draw → Cellule



Edit → Clear...



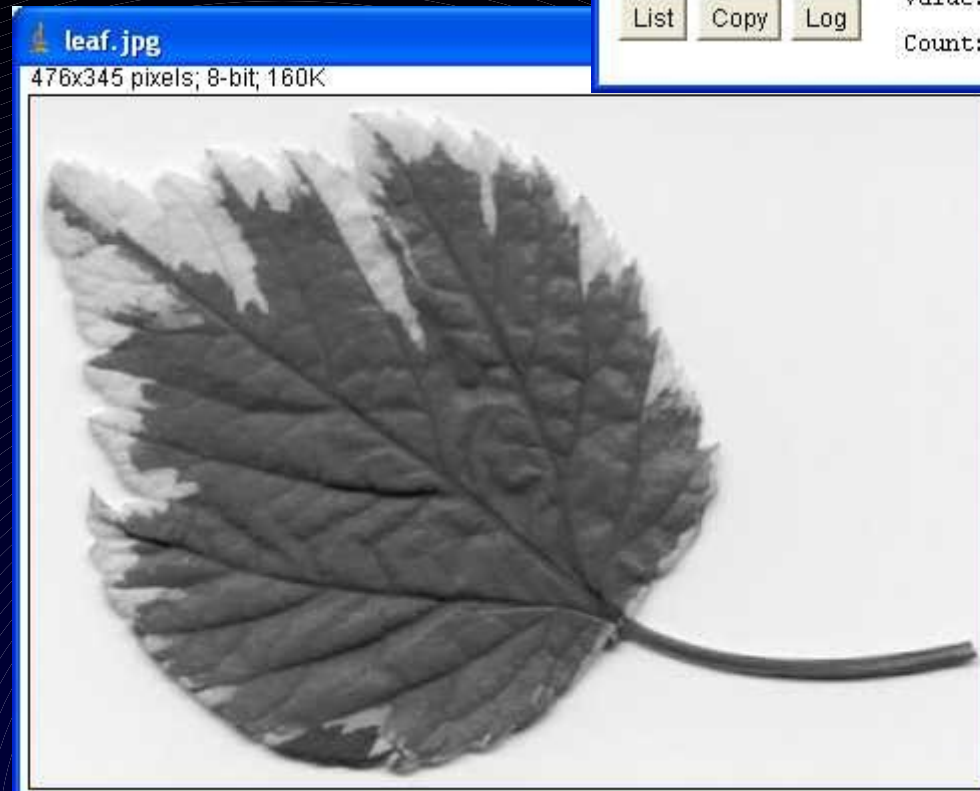
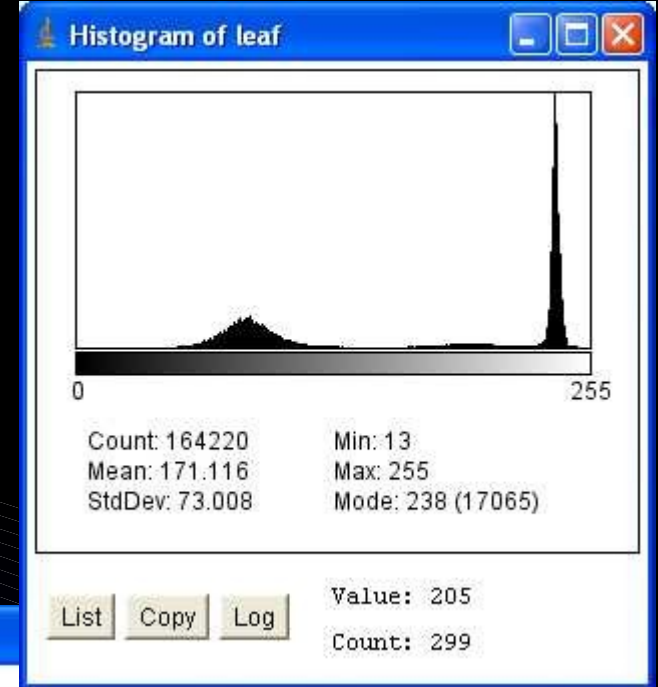
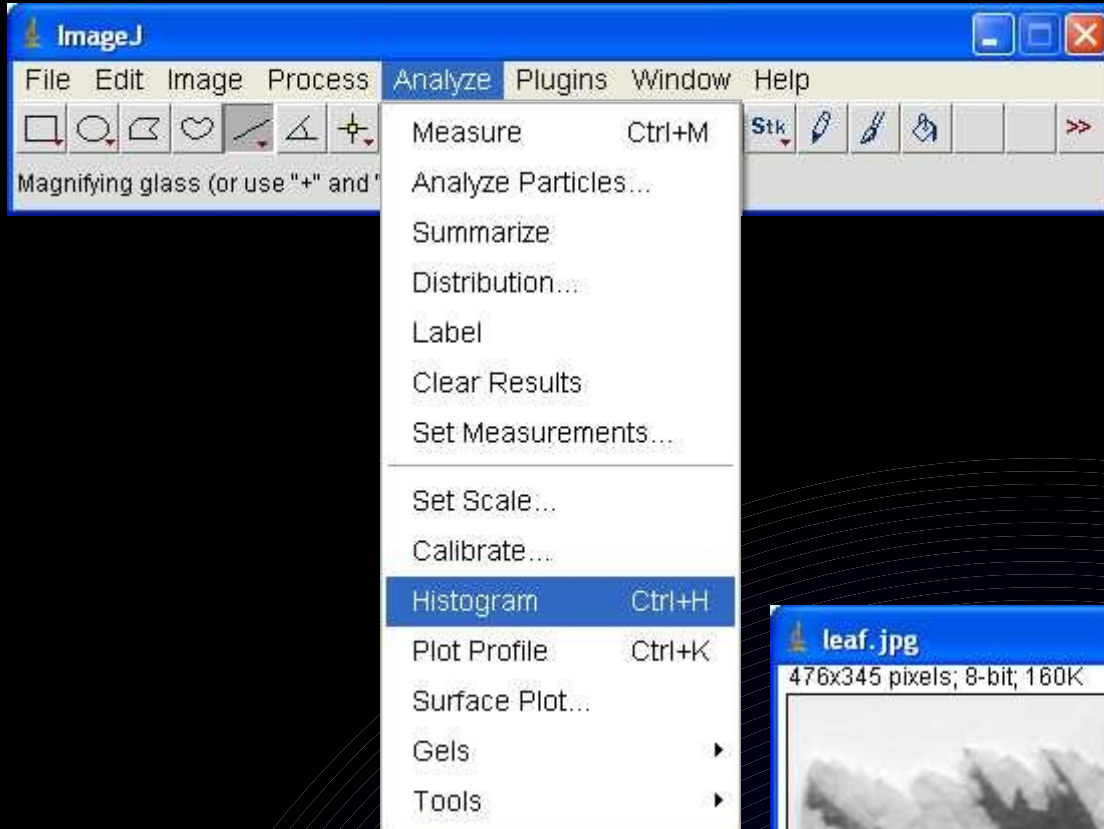
Annotations



Analyse→Tools→Scale Bar...



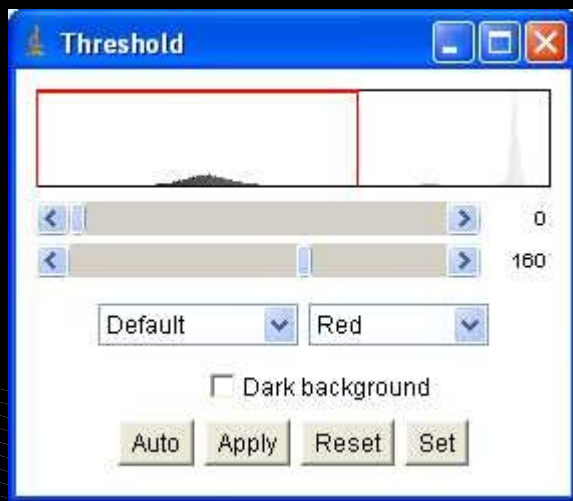
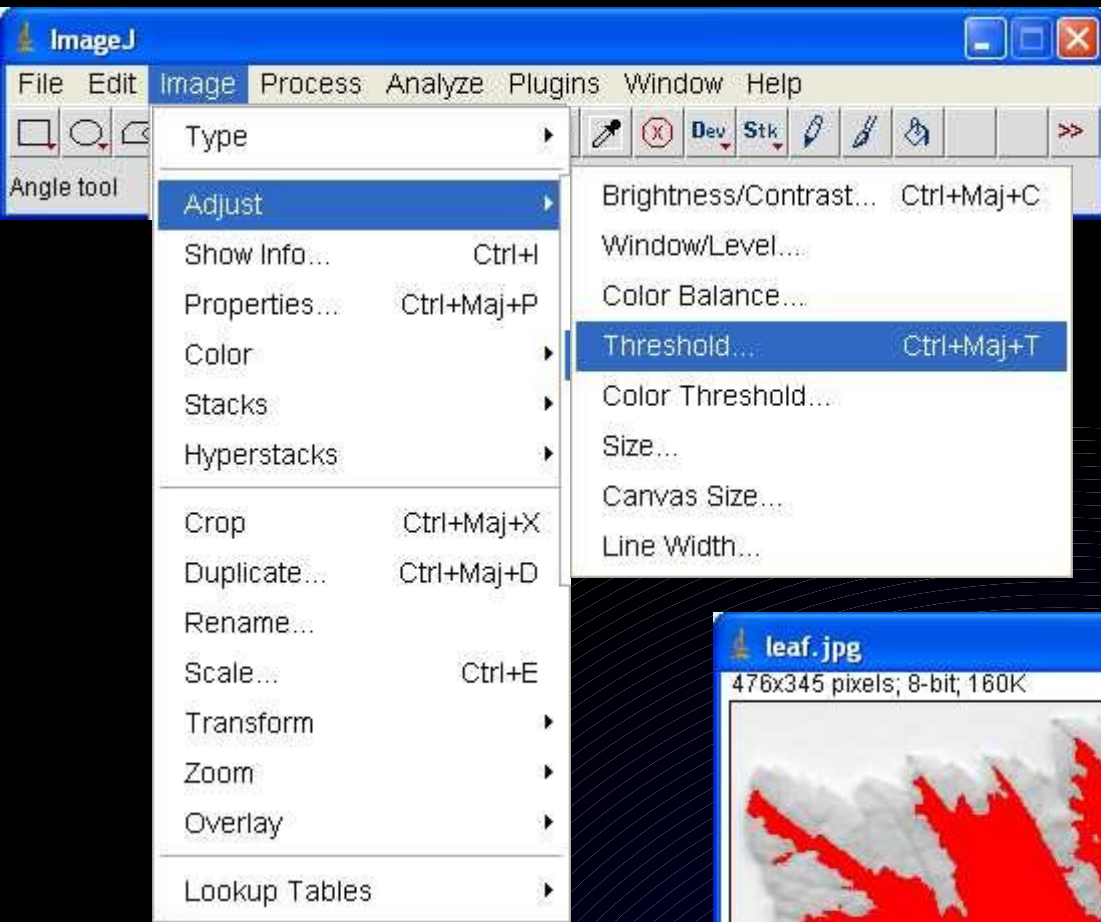
Histogramme



Analyse → Histogram



Seuillage



Image→Adjust→Threshold...



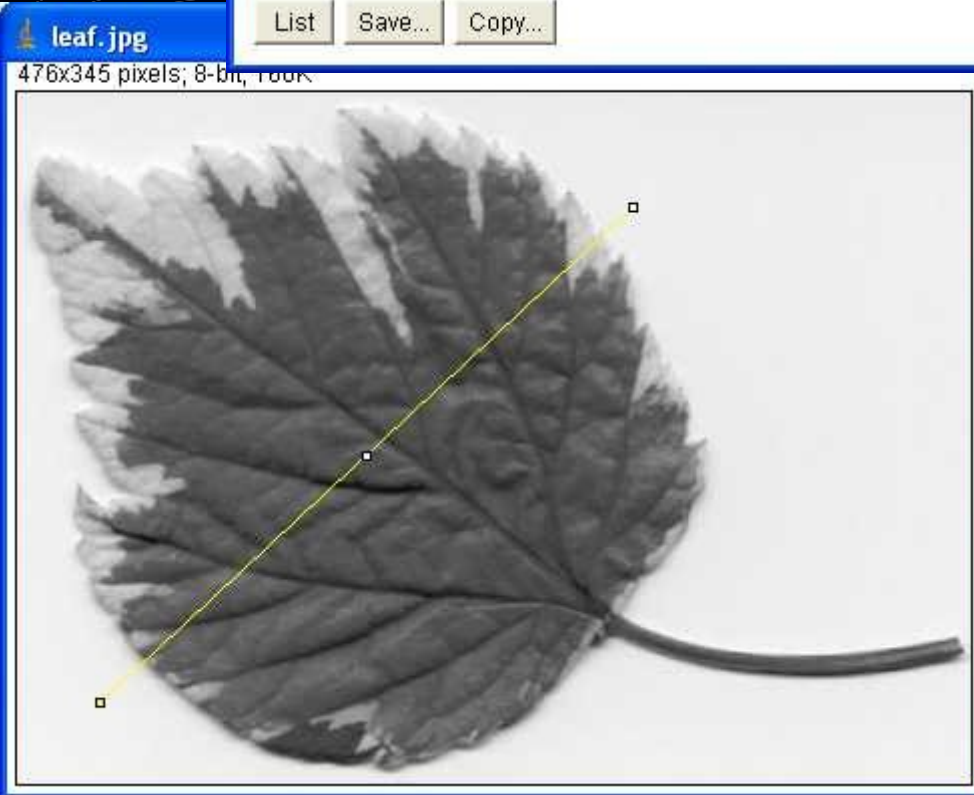
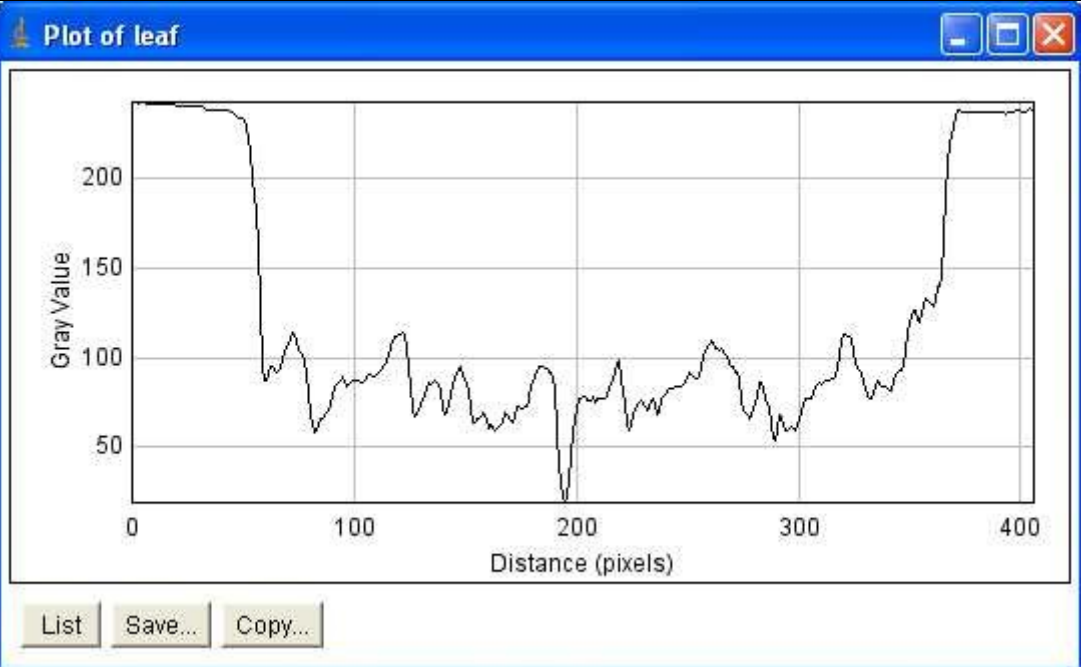
Plot Profile

ImageJ

File Edit Image Process Analyze Plugins Window Help

Magnifying glass (or use "+" and "-")

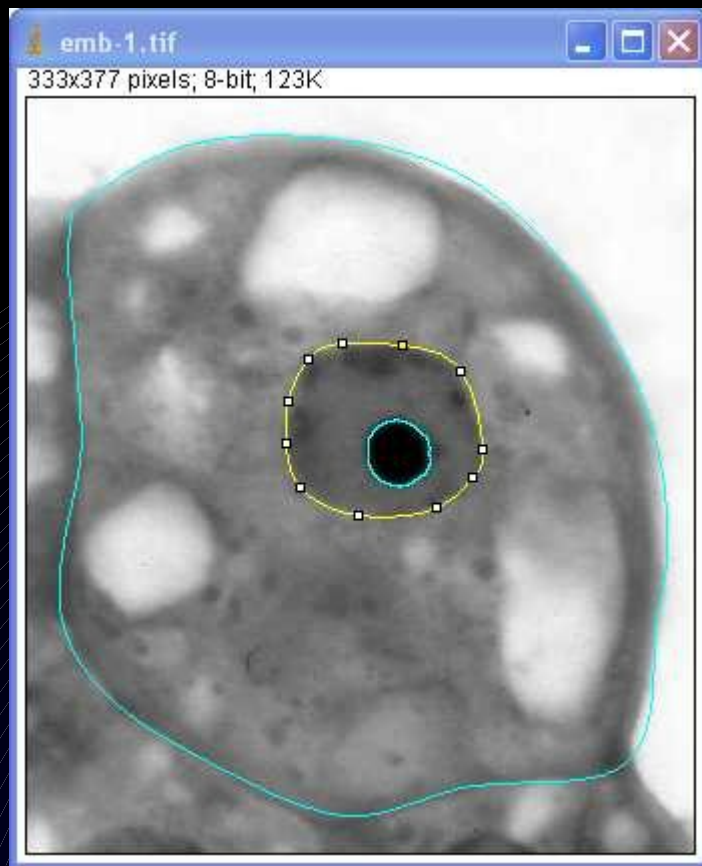
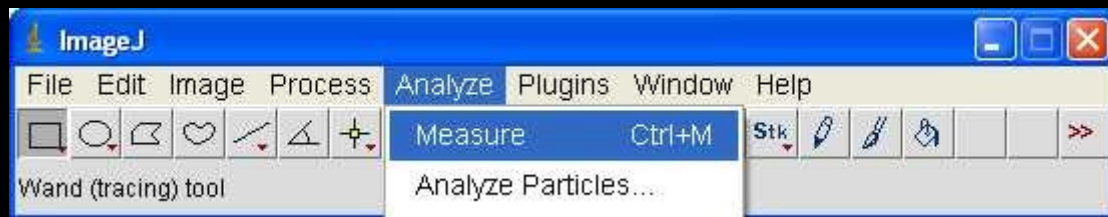
- Measure Ctrl+M
- Analyze Particles...
- Summarize
- Distribution...
- Label
- Clear Results
- Set Measurements...
- Set Scale...
- Calibrate...
- Histogram Ctrl+H
- Plot Profile Ctrl+K**
- Surface Plot...
- Gels ▶
- Tools ▶



Analyse → Plot Profile



Mesures de sélection



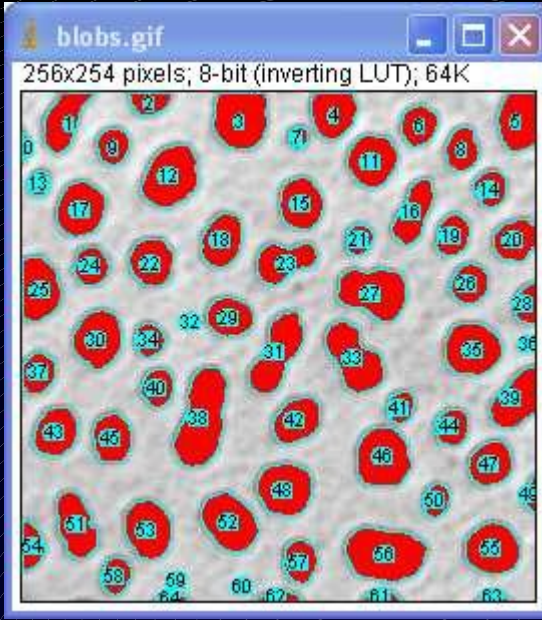
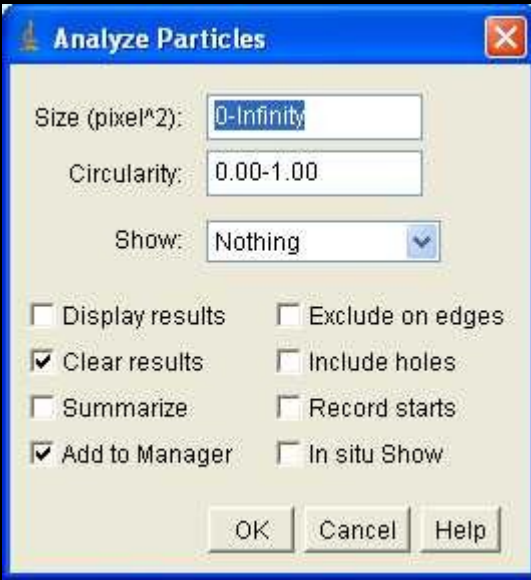
Results

File	Edit	Font	Results	
	Area	Mean	Min	Max
1	7154	81.665	0	141

Analyse → Measure



Mesures d'objets

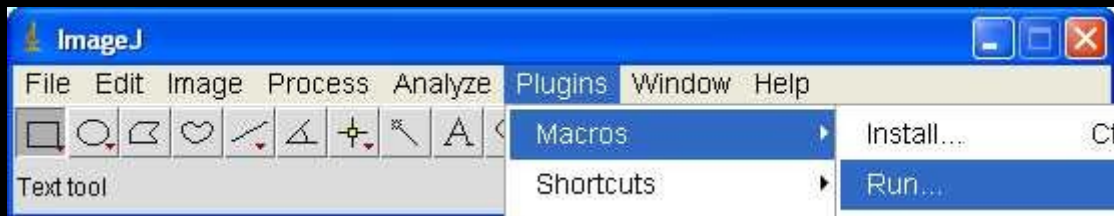


File	Area	Mean	Min	Max
1	433	190.855	128	232
2	185	179.286	128	224
3	658	205.617	128	248
4	434	217.327	128	248
5	477	212.143	128	248
6	285	204.295	128	248
7	81	161.481	128	200
8	278	174.848	128	224

Analyse → Analyze Particles...



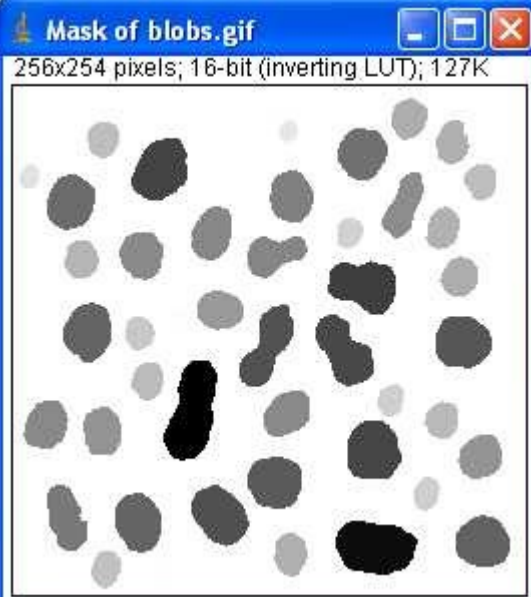
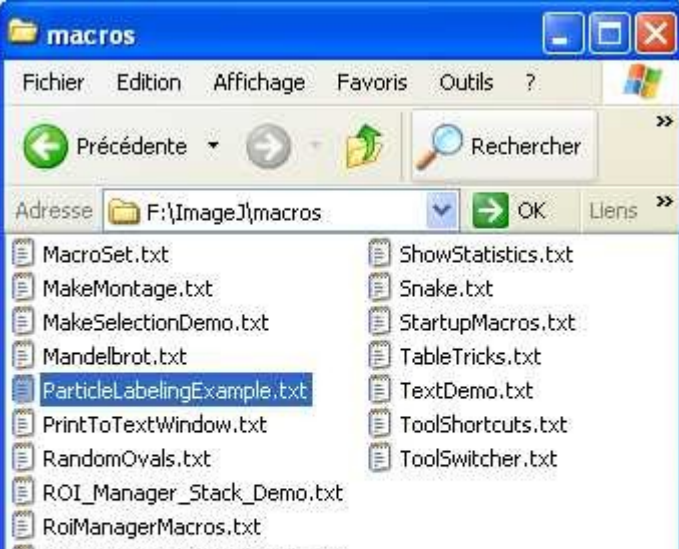
Macro



```

ParticleLabelingExample.txt
File Edit Font Macros Debug
// This macro labels the blobs from the 'Blobs' test image
// according to their area.

run("Set Measurements...", "area center redirect=None decimal=3");
run("Blobs (25K)");
setThreshold(125, 248);
run("Analyze Particles...",
    "minimum=1 maximum=999999 bins=20 show=Masks display exclude");
selectWindow("Mask of blobs.gif");
run("16-bit");
for (i=0; i<nResults; i++) {
    doWand(getResult("XStart", i), getResult("YStart", i));
    setColor(getResult("Area", i));
    fill();
}
    
```

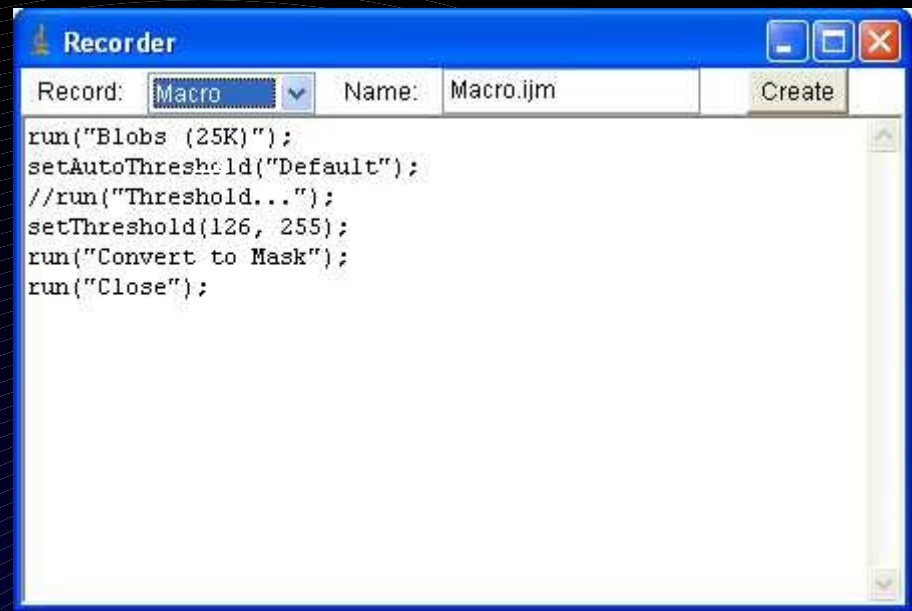
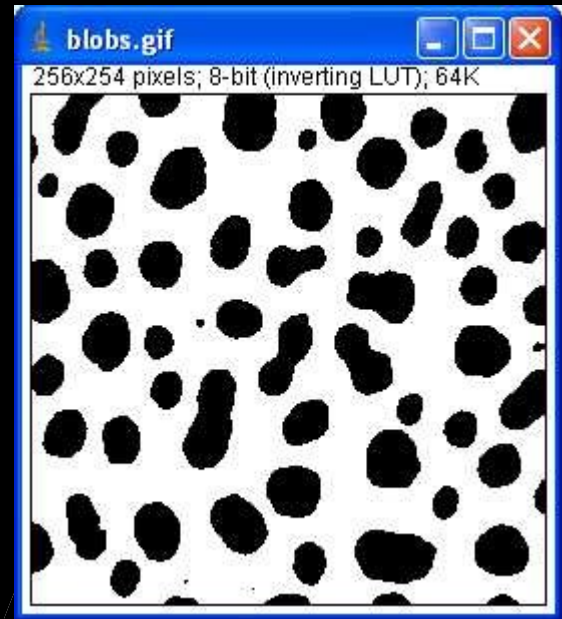
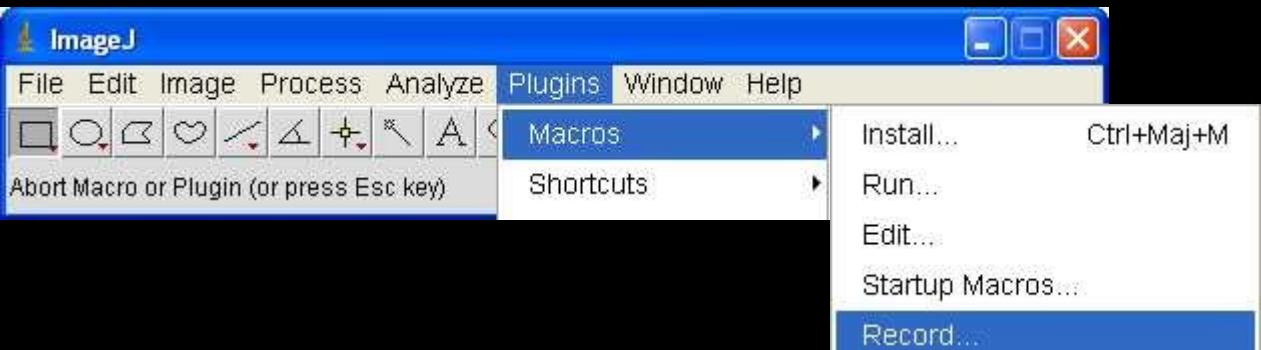


	Area	XM	YM	XStart	YStart
37	170	206.414	203.488	205	195
38	472	26.319	215.160	21	199
39	613	103.332	214.269	99	199
40	543	62.664	217.835	60	203
41	555	234.522	227.816	233	214
42	858	180.452	230.218	168	217
43	281	138.466	233.655	136	223
44	215	46.542	240.989	44	232
45	3	76.827	242.827	76	242
46	1	110.500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

Plugins → Macros → Run



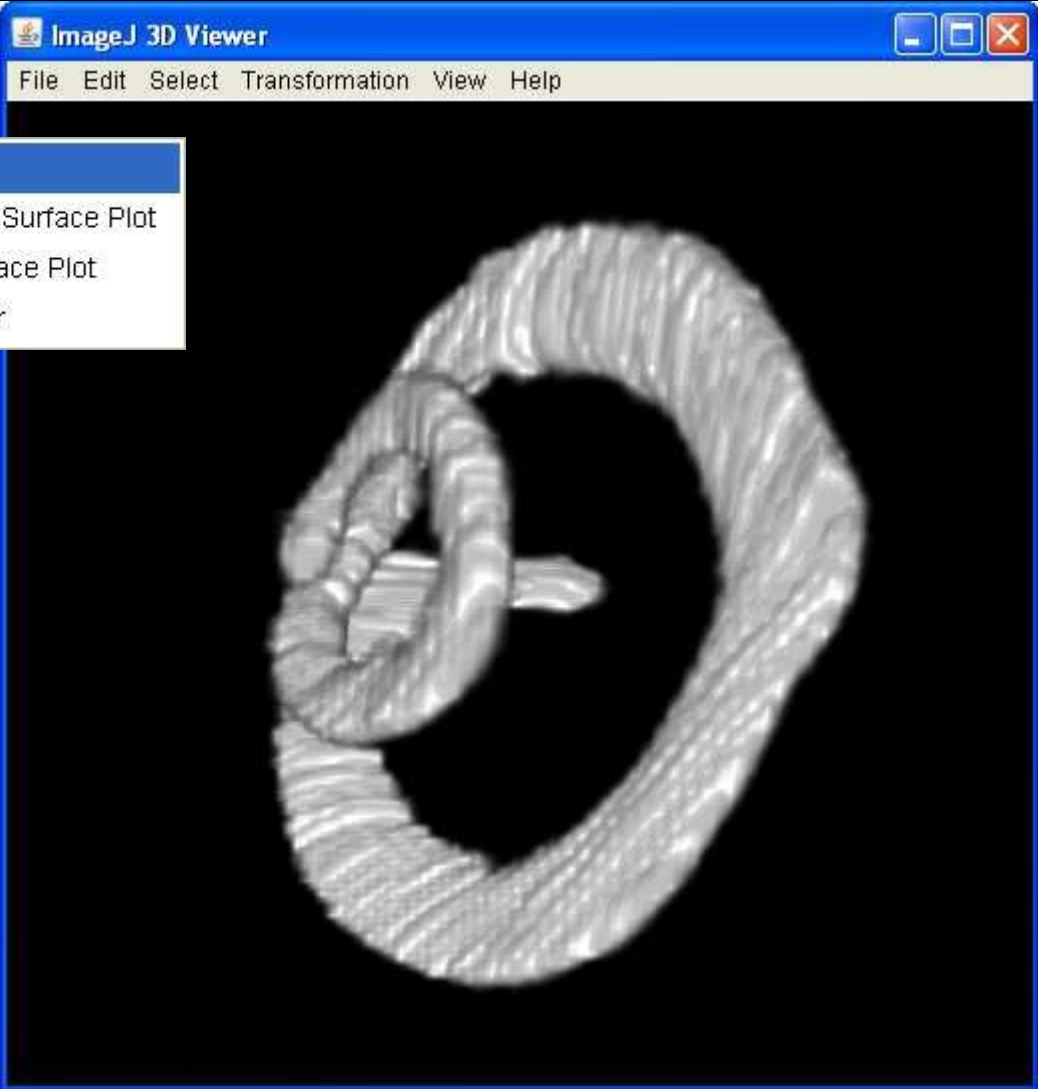
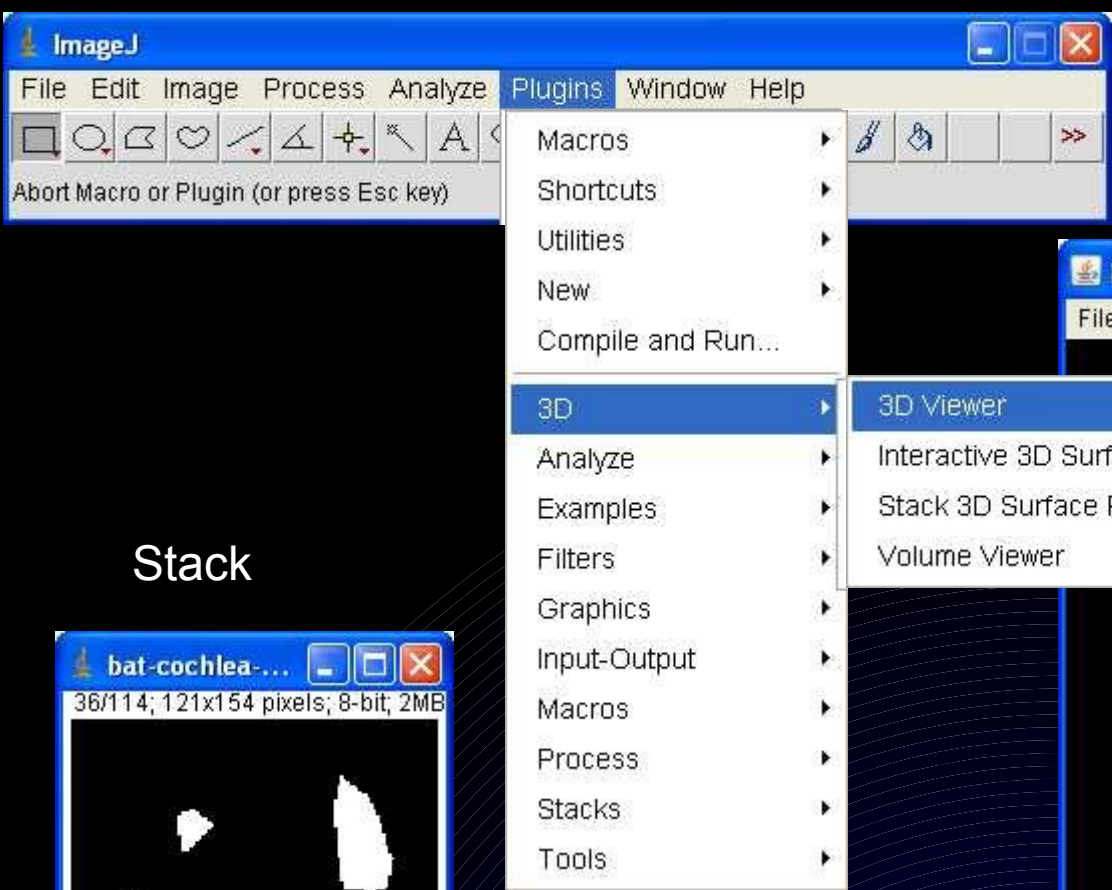
Enregistrement de macro



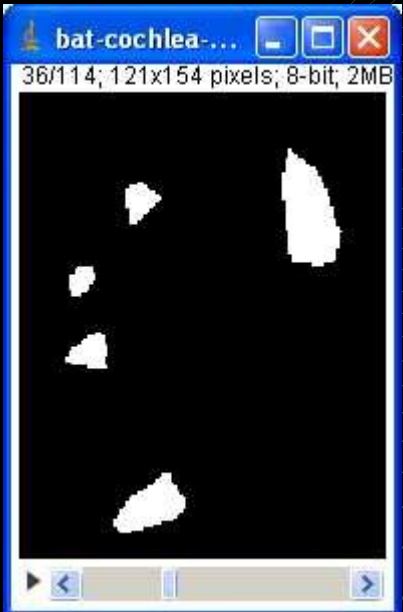
Plugins→Macros→Record...



Plugins



Stack



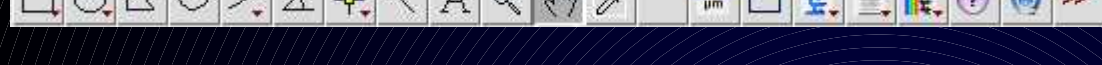
Plugins→3D→3D Viewer



Barres d'outils

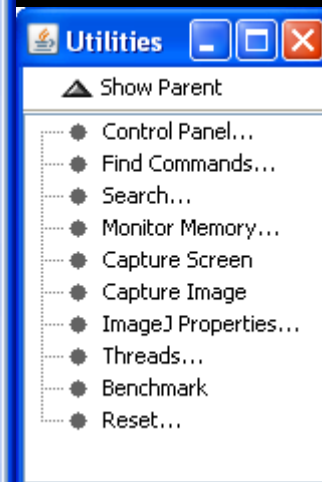
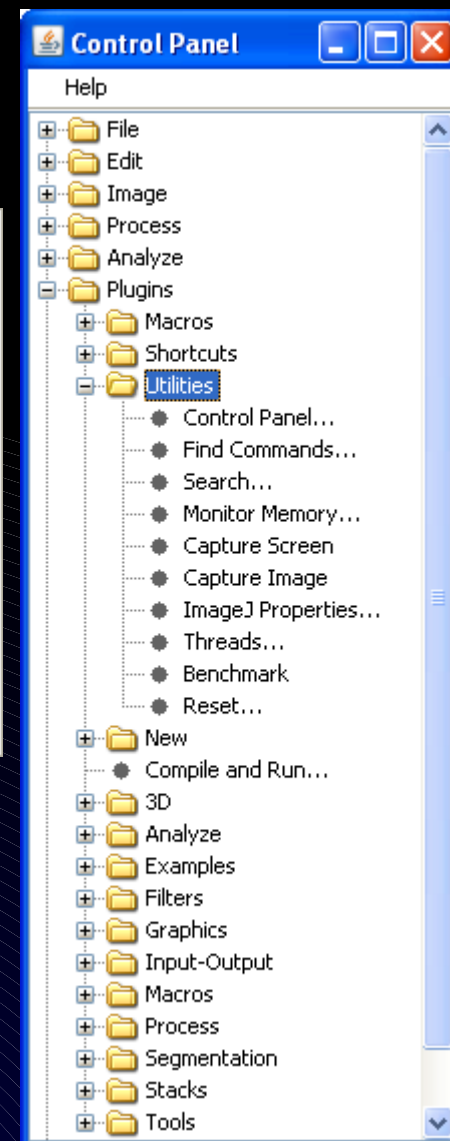
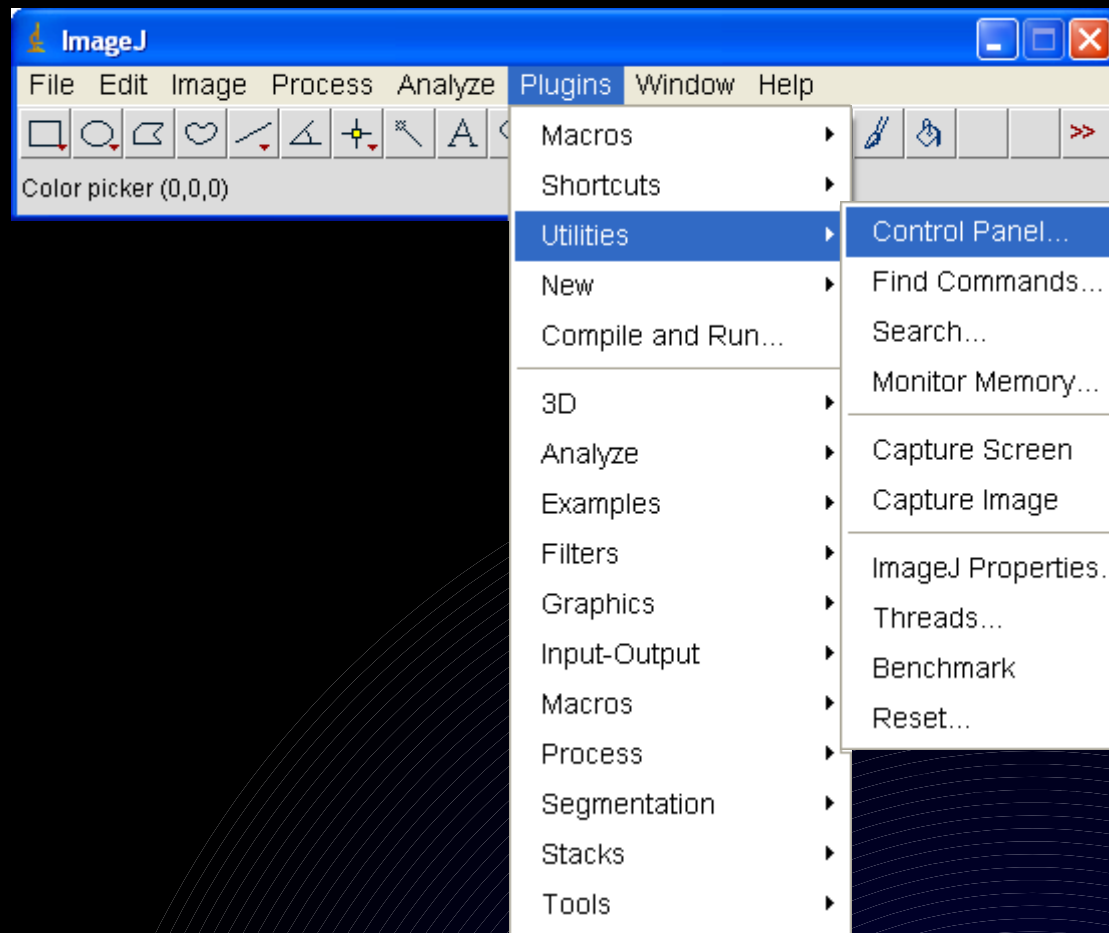


- ✓ Startup Macros
- Arrow Labelling Tools
- Drawing Tools
- Example Icons
- Lookup Tables
- Luts Macros and Tools Updater
- Magic Montage
- Plugins
- Scale Bar Tools for Microscopes
- Stack Tools
- Toolset Creator
- Help...





Panneaux de commandes



Plugins→Utilities→Control Panel



Topic 02 – Basic tools 1

Topic 03 – Basic tools 2

L'image numérique

Les Prétraitements

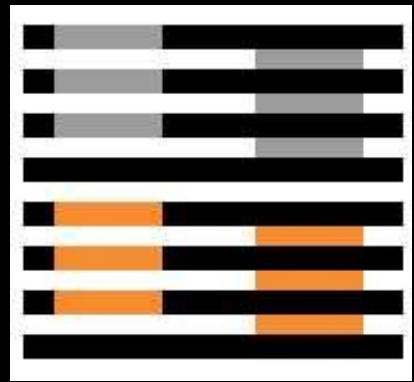
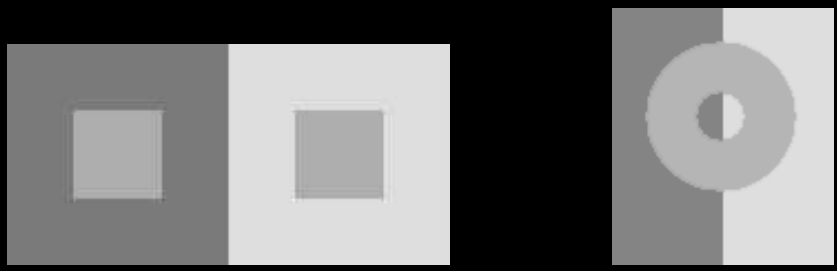
La Segmentation

Les Post-traitements

La Quantification



Image et perception



Checker-shadow illusion:
The squares marked A and B
are the same shade of gray.

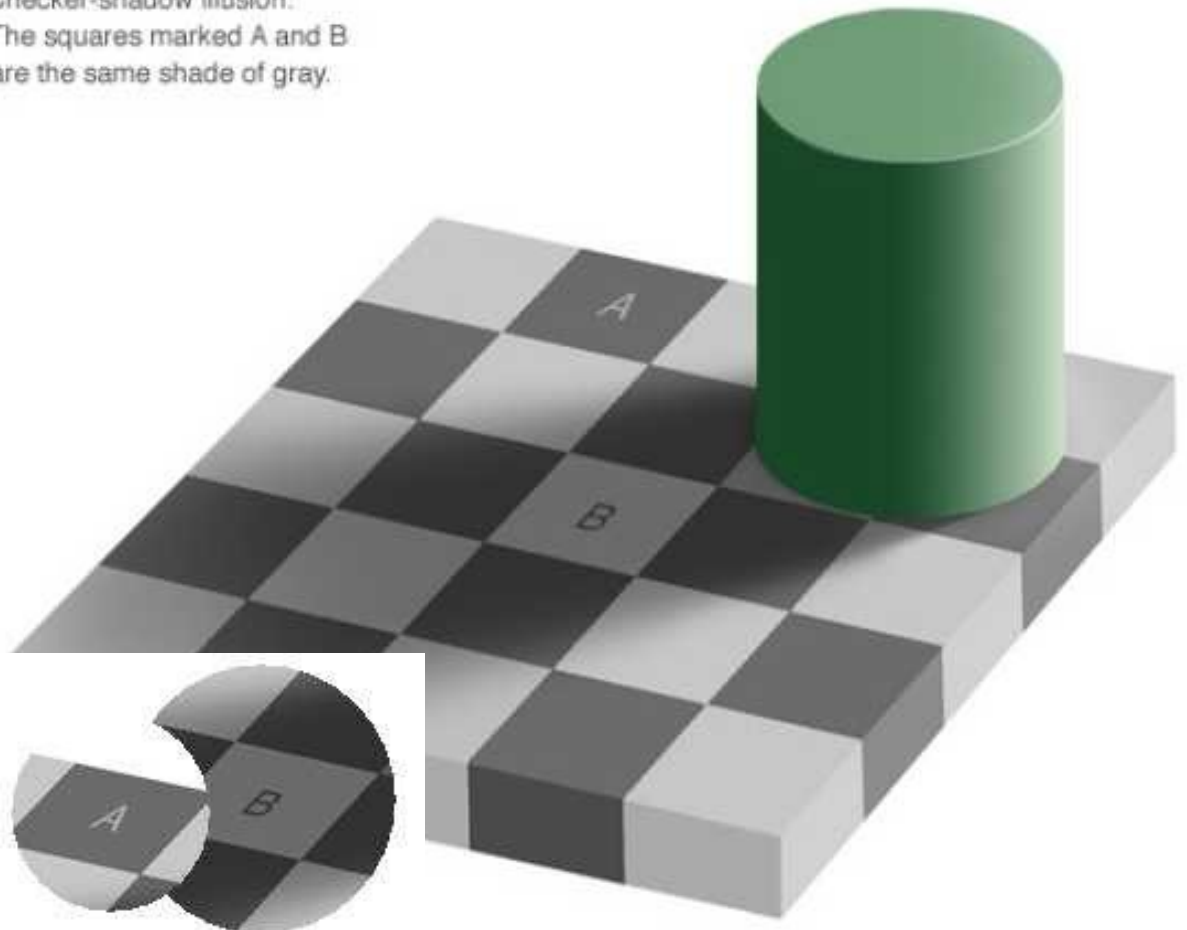
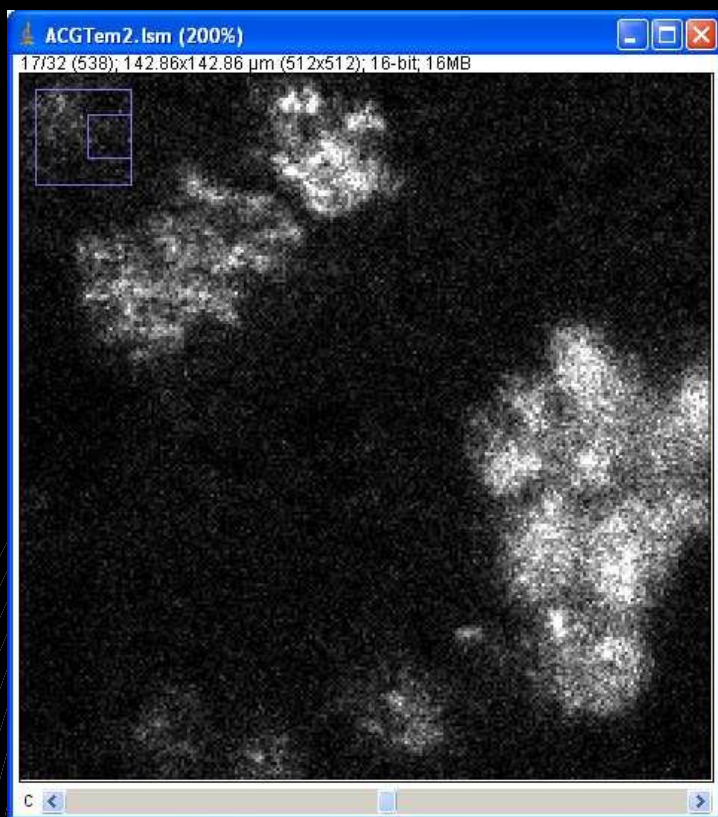




Image et déformations

Bruit



PSF

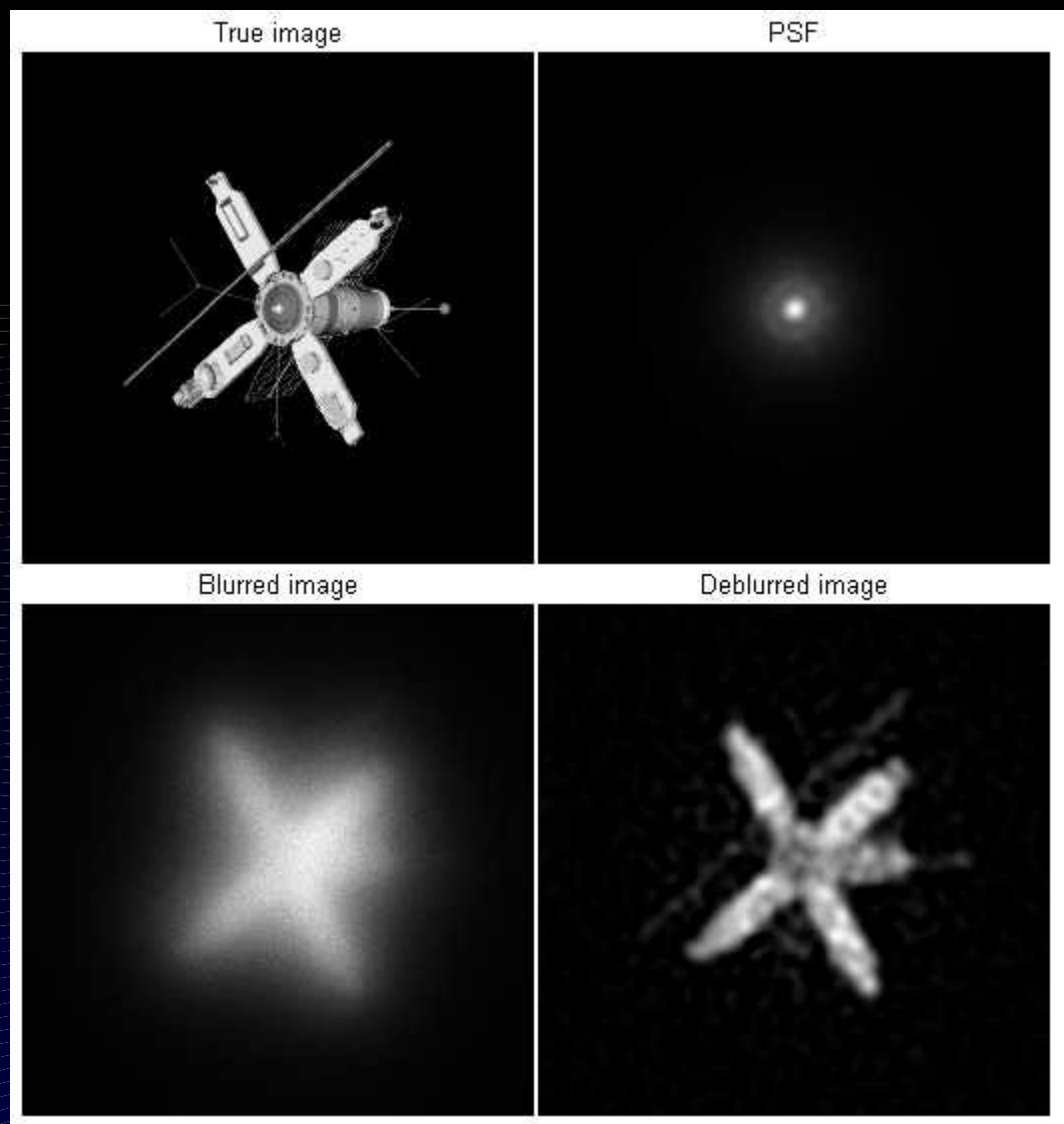




Image numérique = tableau de pixels



Détail = Affichage * 6

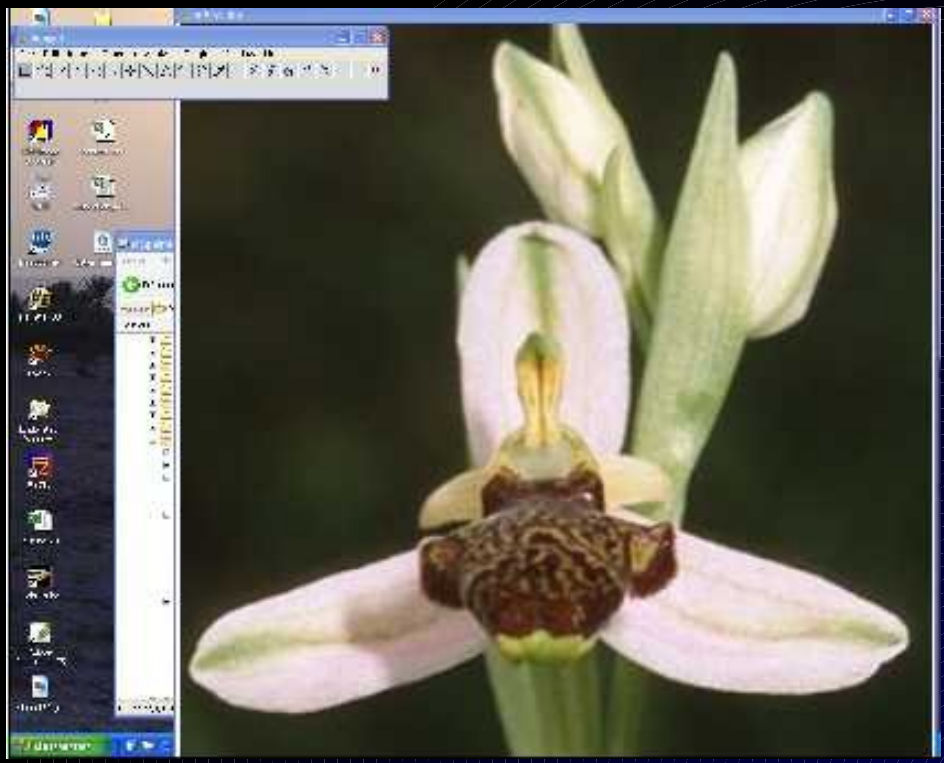


Résolutions : Nombre de pixels par pouce à l'affichage

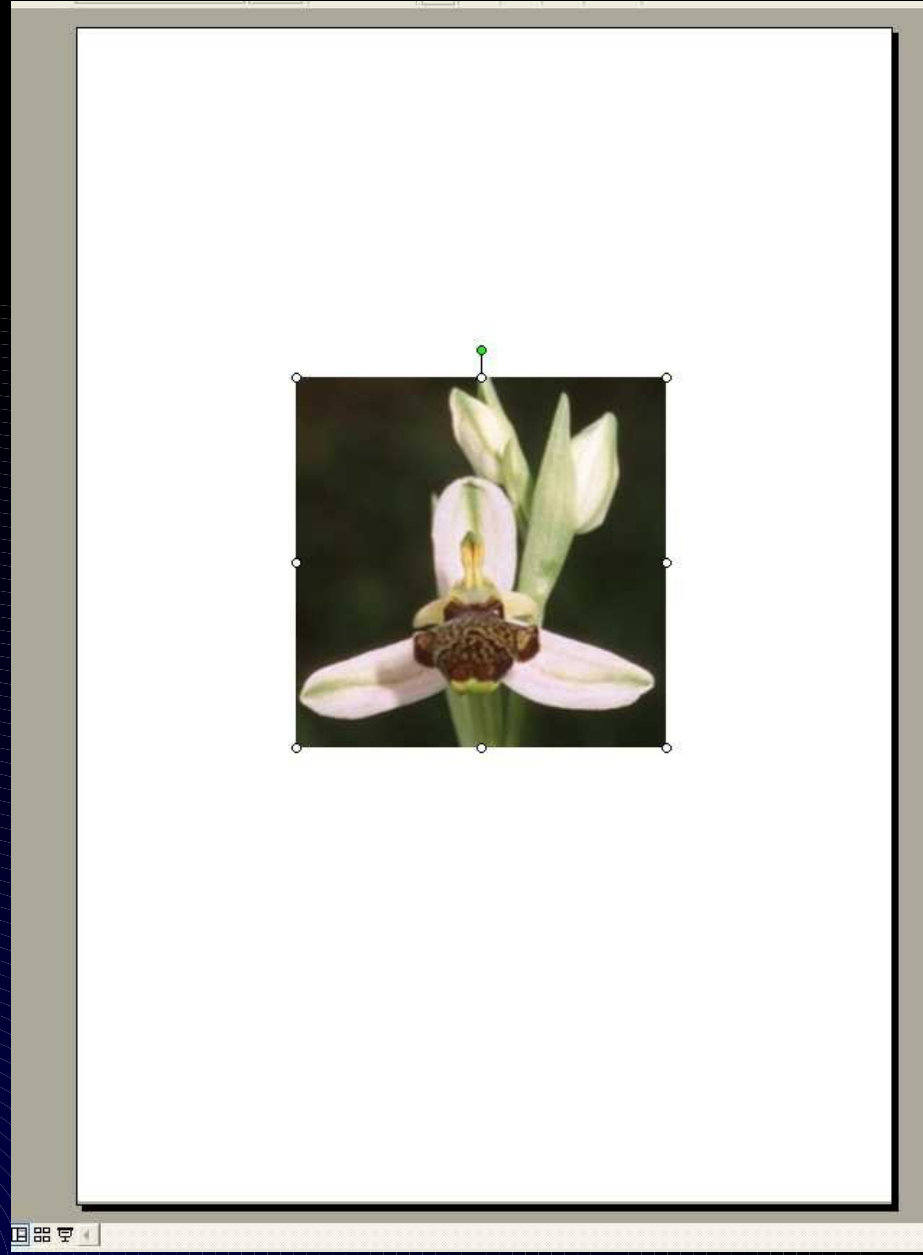
1024*1024
1 Mega pixels



Ecran 72 dpi

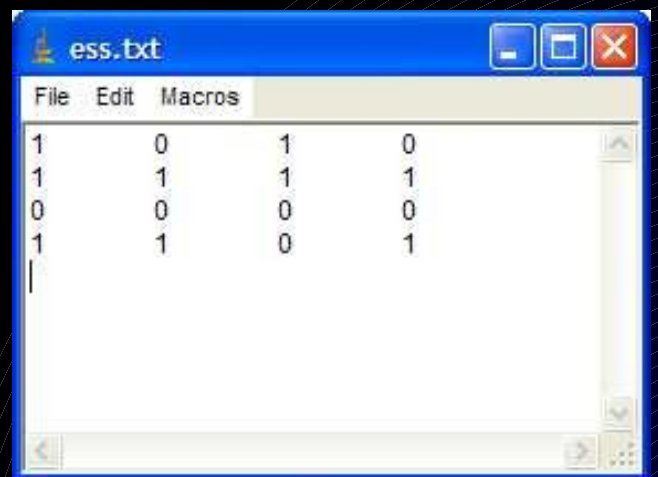
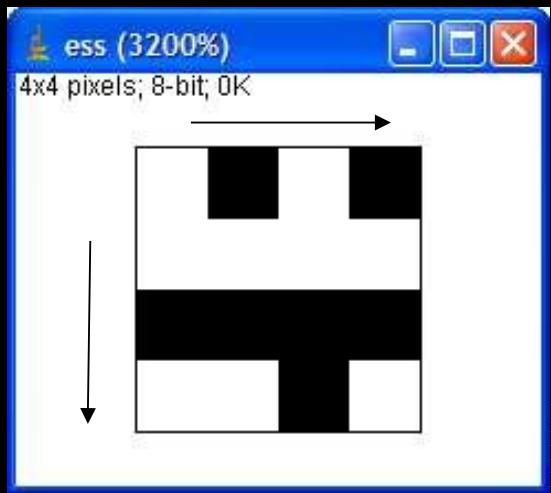


Impression 300 dpi





Codage binaire



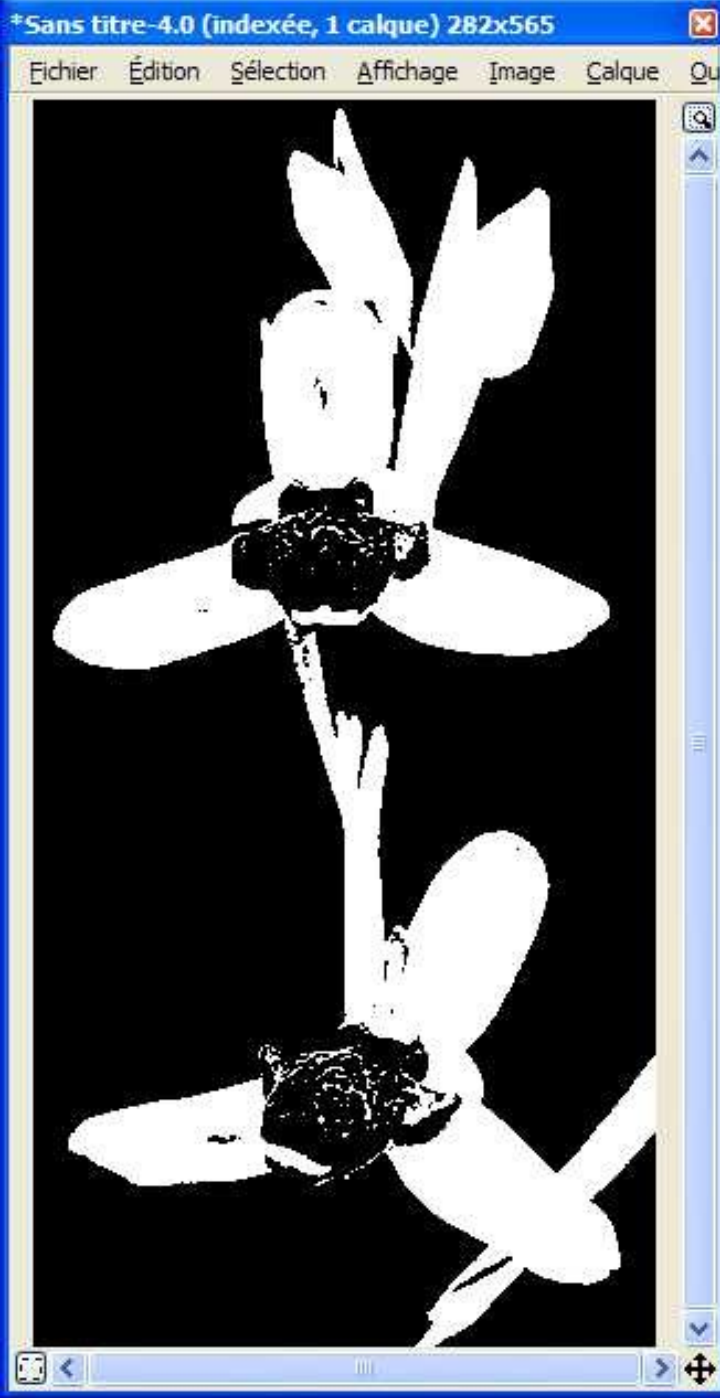


Codage

1bit \rightarrow 2 valeurs

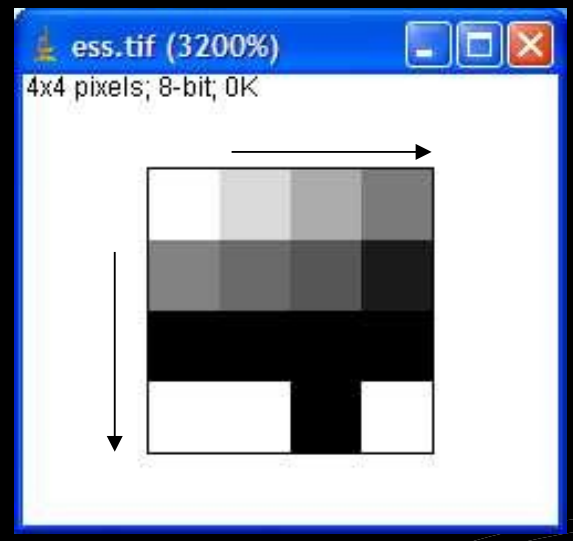
3bits \rightarrow 8 valeurs

5bits \rightarrow 32 valeurs

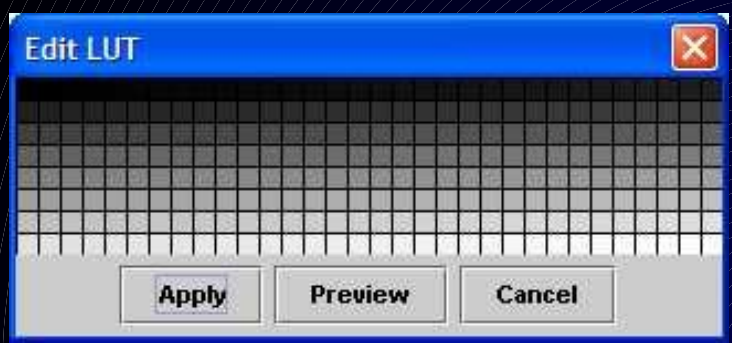




Codage 8 bits 0→255 Valeurs de Niveaux de gris

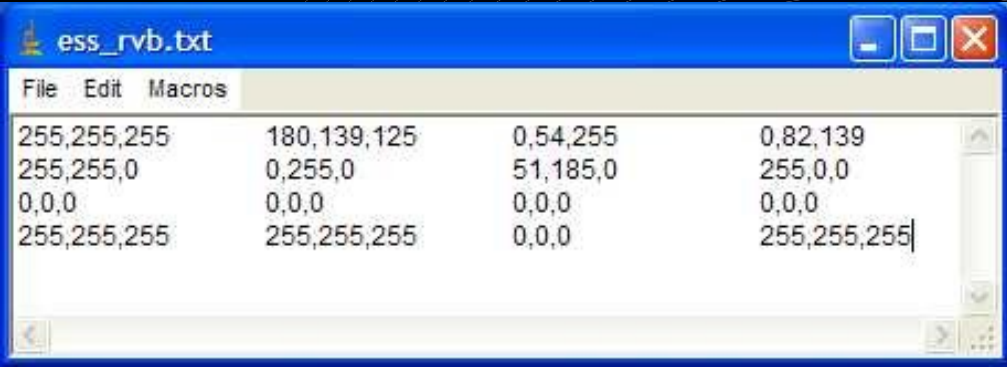
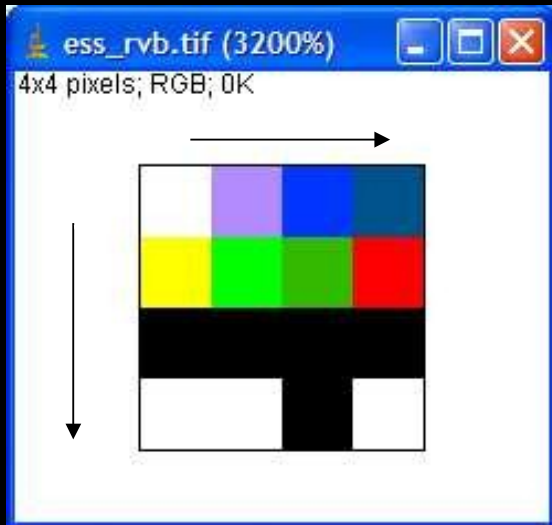


File	Edit	Macros		
255	217	172	123	
130	106	87	27	
0	0	0	0	
255	255	0	255	



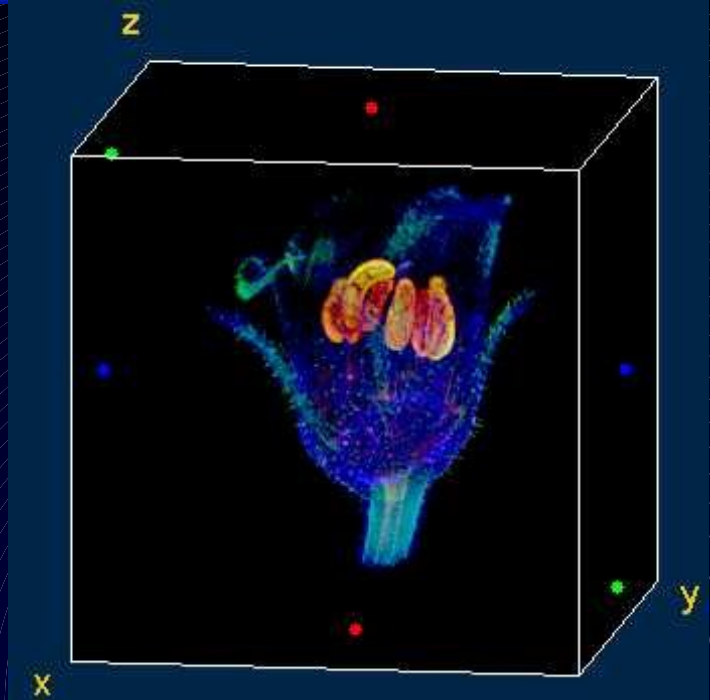
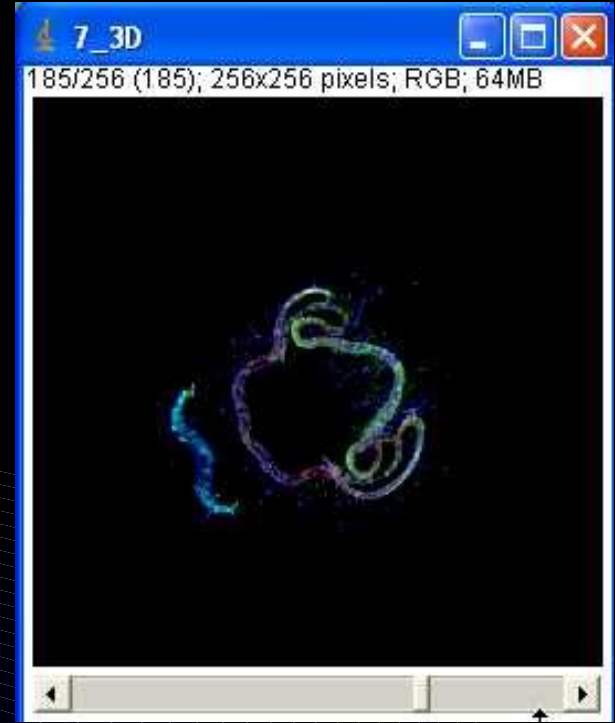
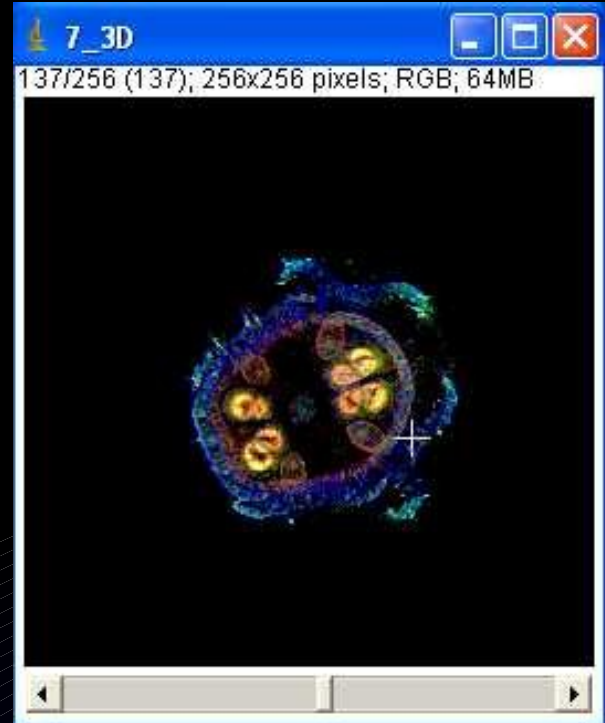


Codage couleur 24 bits RVB





Piles d'images : Stack





Format d'image

8bit, 16bit, 32bit, 8bit color

RGB

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

ophrys-1.jpg

364x584 pixels; 8-bit; 207K



ophrys-2.jpg

364x584 pixels; 8-bit; 207K



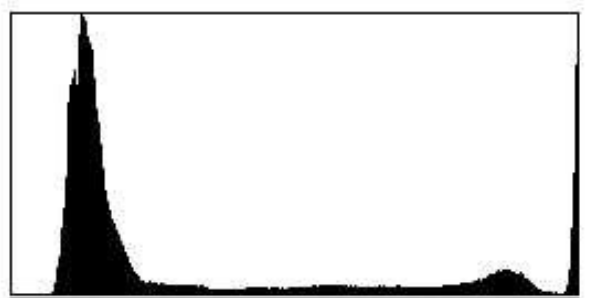
ophrys-2.jpg

364x584 pixels; 8-bit; 207K



Histogram of ophrys-1

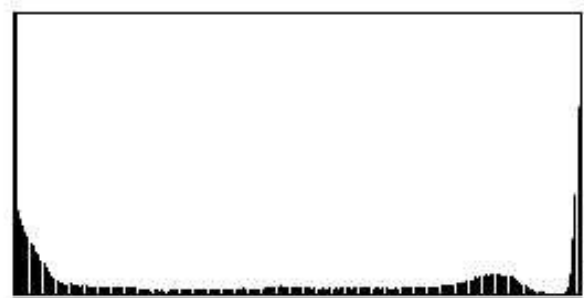
300x240 pixels; 8-bit; 70K



0 256

Histogram of ophrys-2

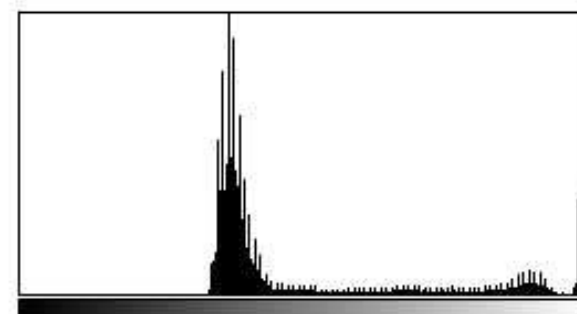
300x240 pixels; 8-bit; 70K



0 256

Histogram of ophrys-2

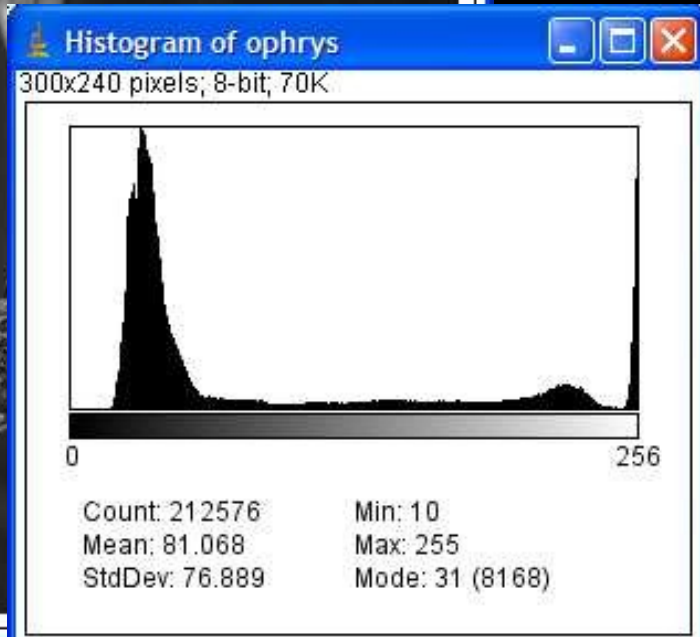
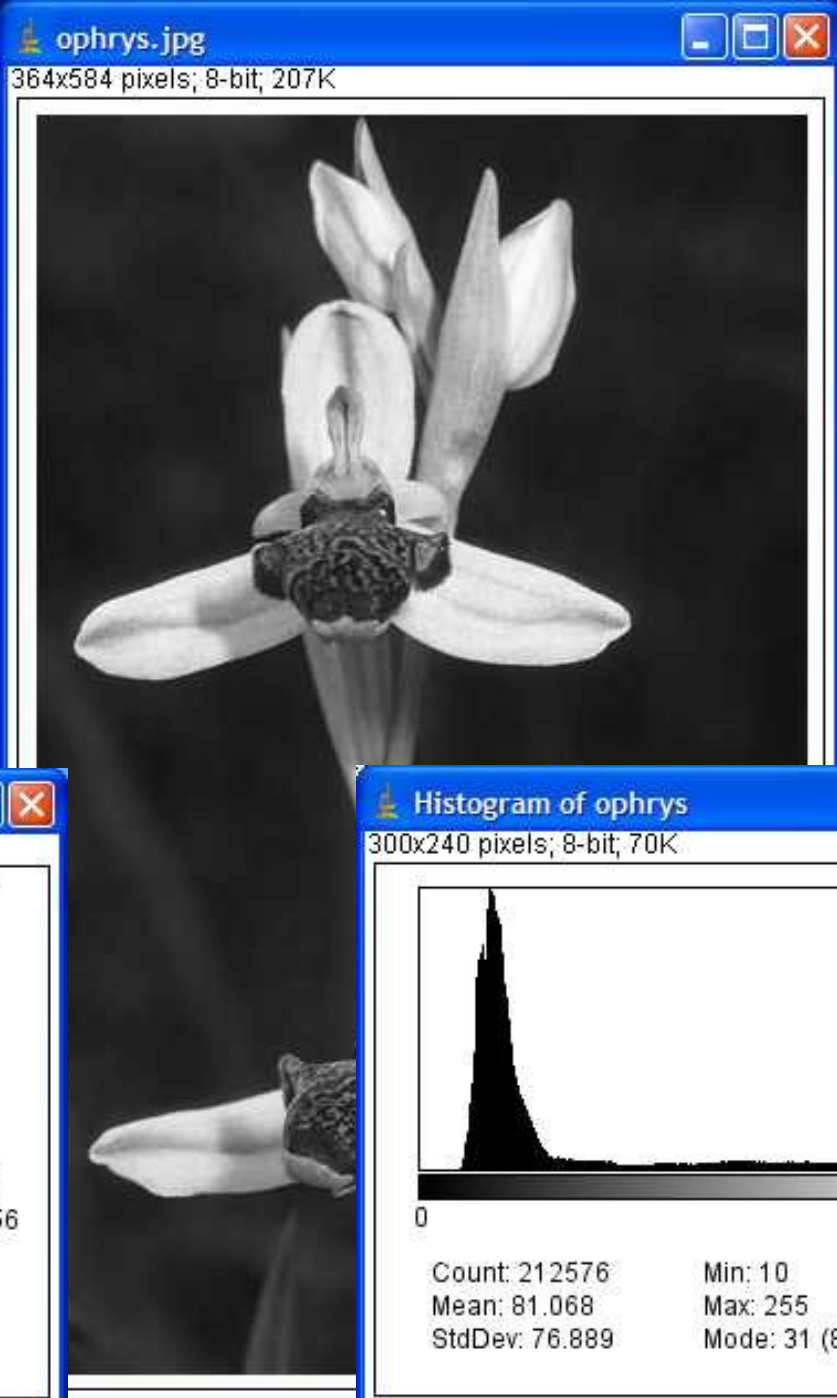
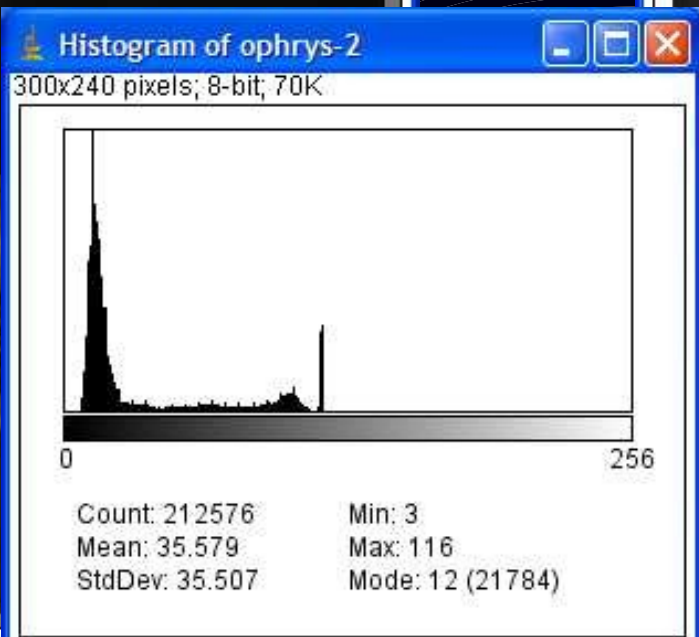
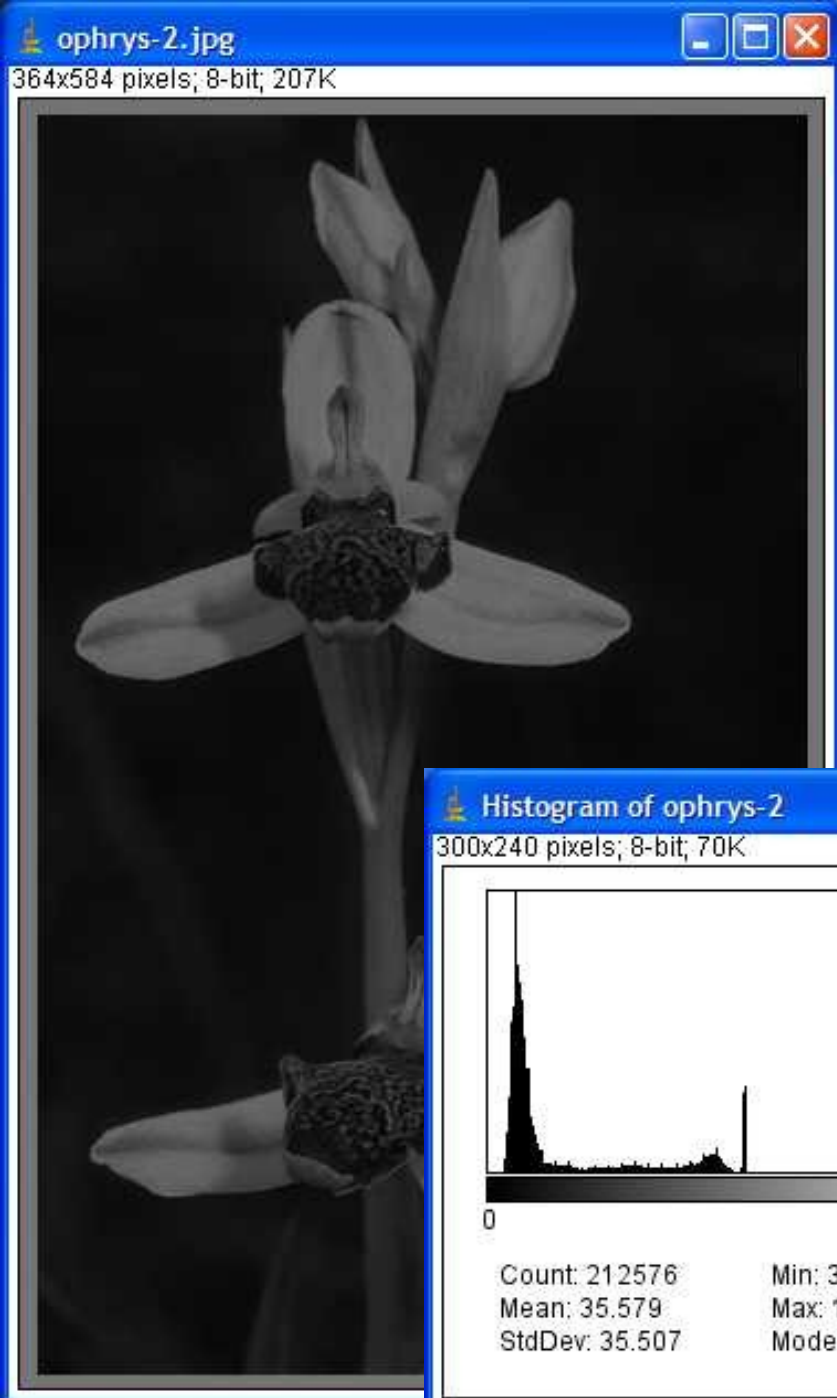
300x240 pixels; 8-bit; 70K



0 256

Correction de la dynamique de l'image

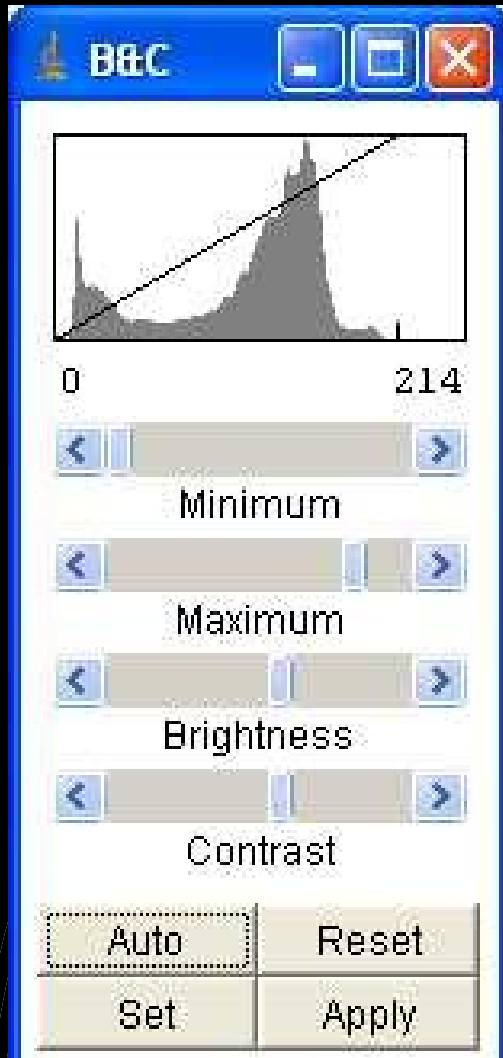
Dynamique = [valeur_mini , valeur_maxi]





Corrections linéaires

Luminosité Contraste



Mini

Maxi

Luminosité

Contraste

Niveaux

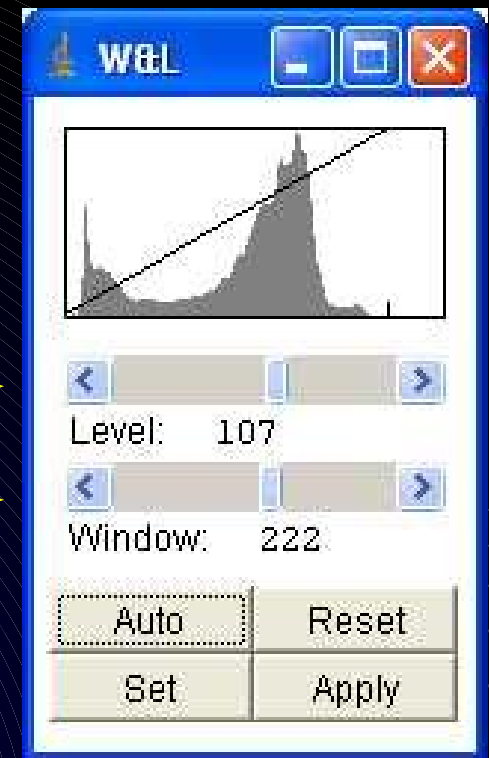


Image → Adjust → Brightness/Contrast...



Correction non linéaire : Egalisation de l'histogramme

Densité de probabilité normalisée pour aplatir l'histogramme



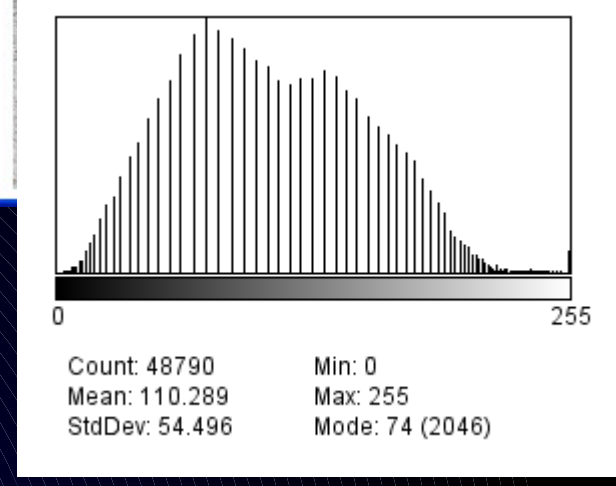
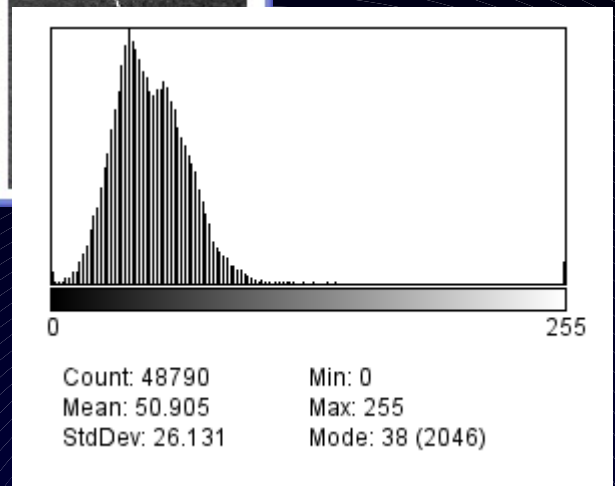
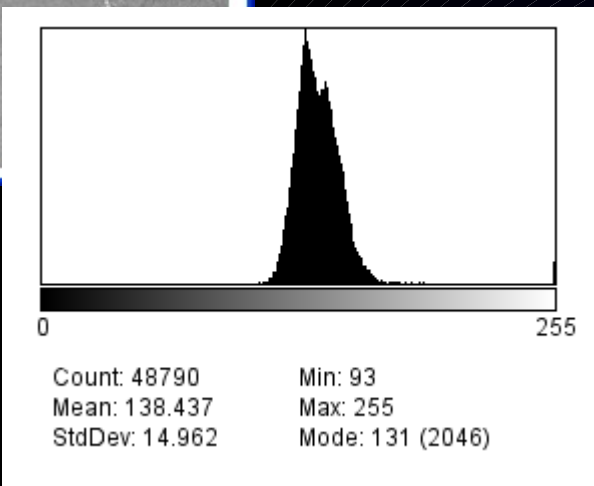
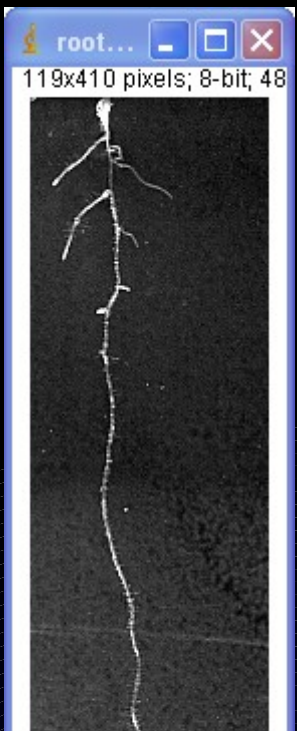
Enhance Contrast

Saturated Pixels: 0.4 %

Normalize

Equalize Histogram

OK Cancel



Normalisation

Egalisation

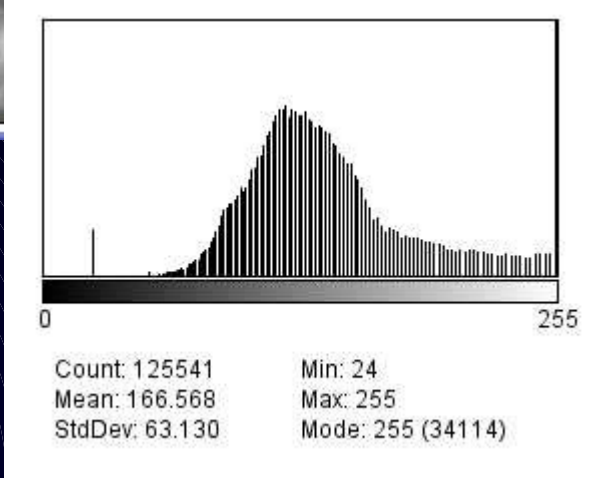
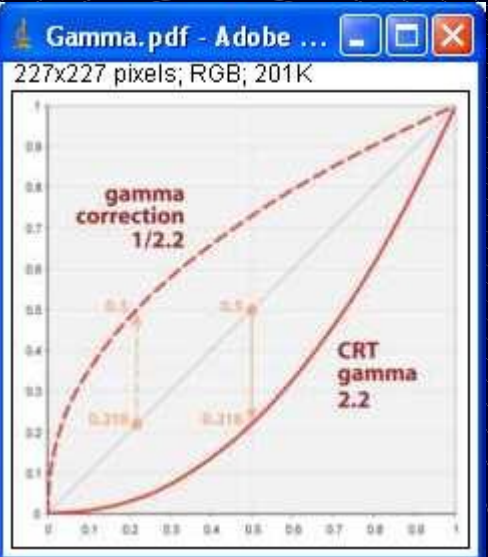
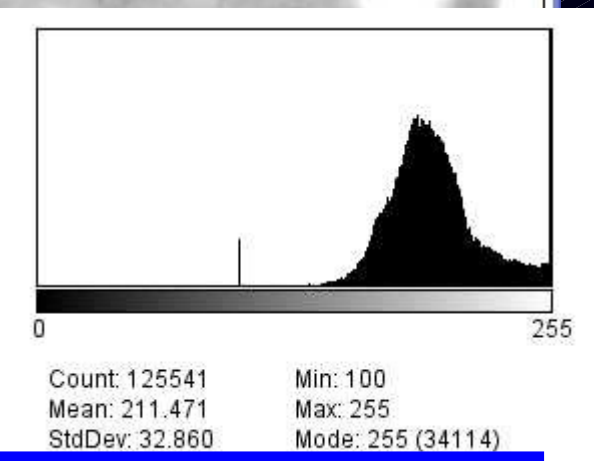
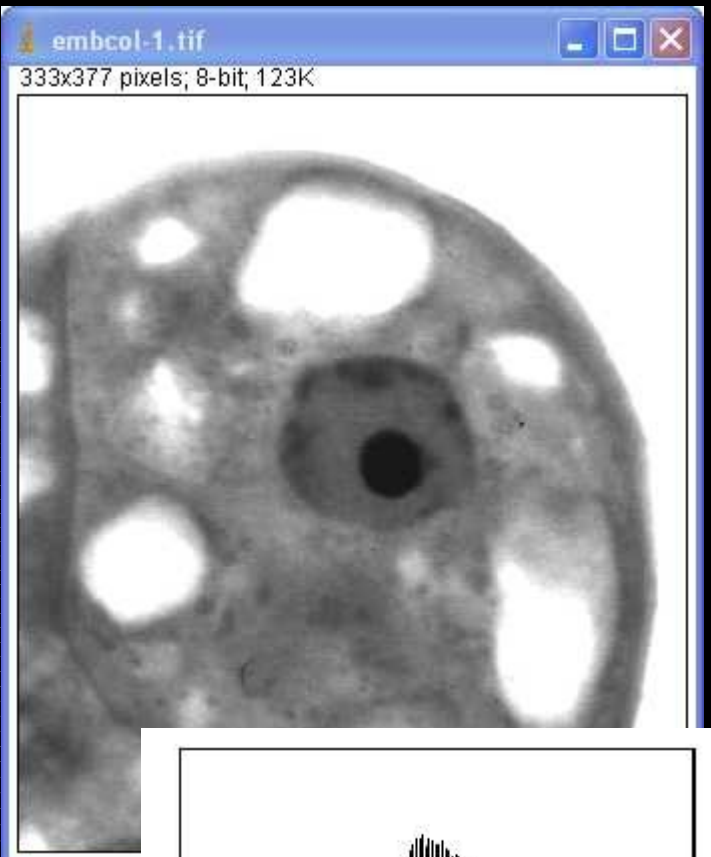
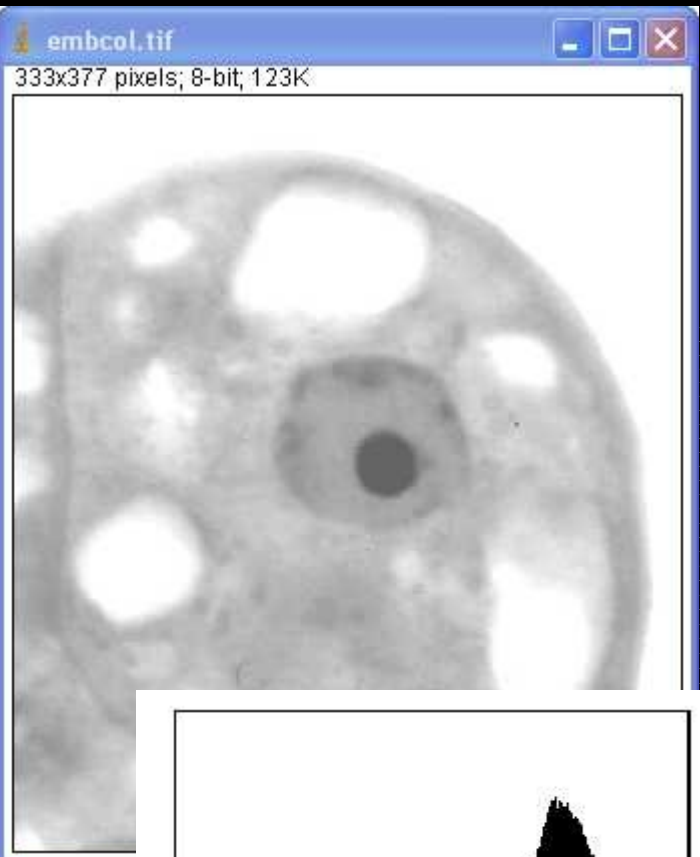
Process → Enhance Contrast



Correction non linéaire du Gamma

$$y = \text{range} * (x / \text{range}) ^ \gamma$$

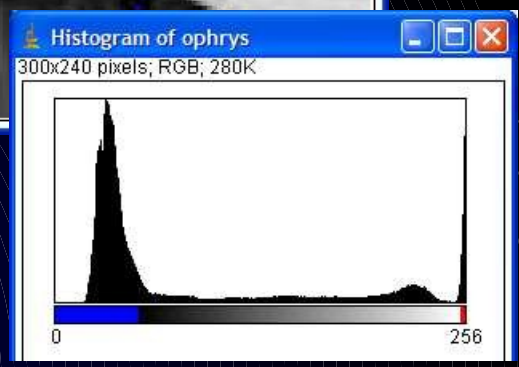
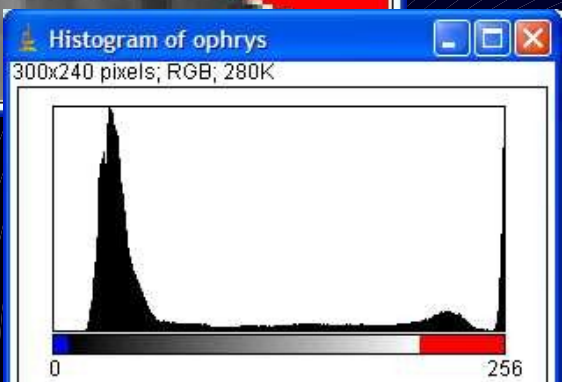
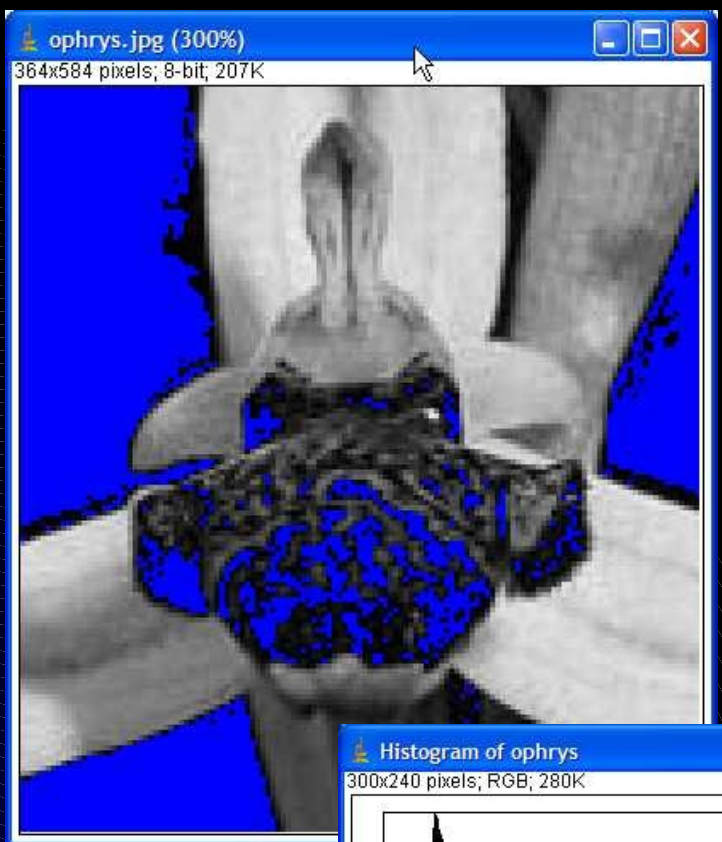
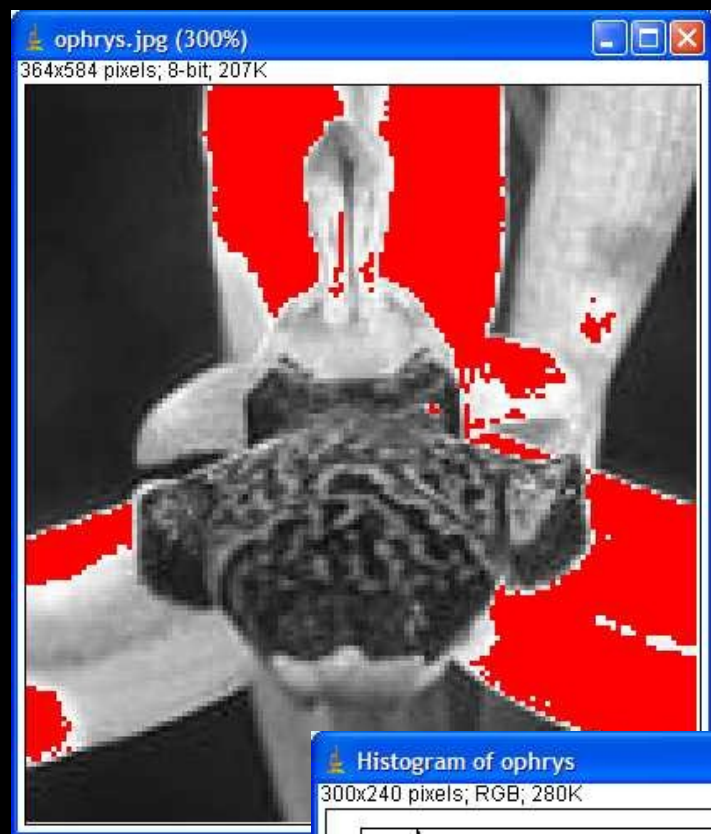
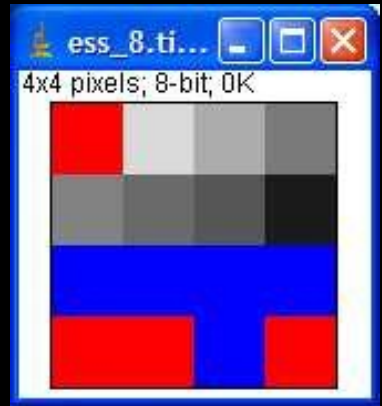
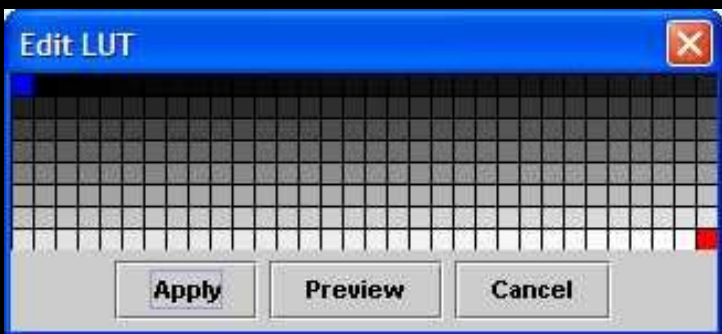
range = gamme de valeurs des pixels de l'image



Process → Math → Gamma...

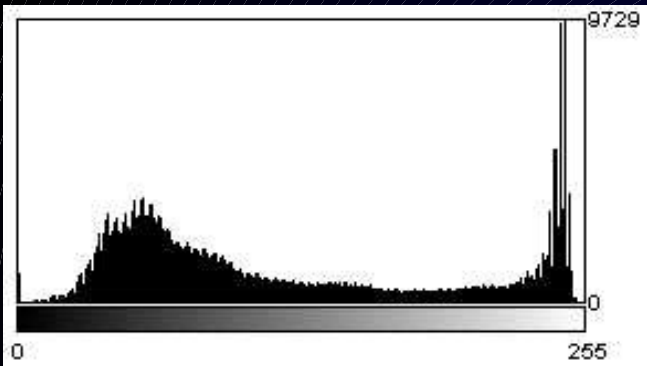
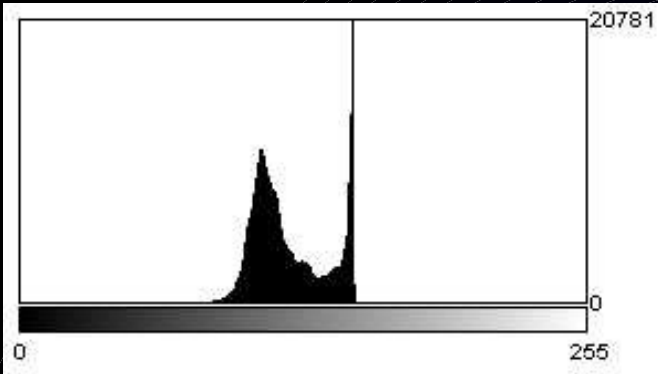


Réglages avec la LUT Hi Lo

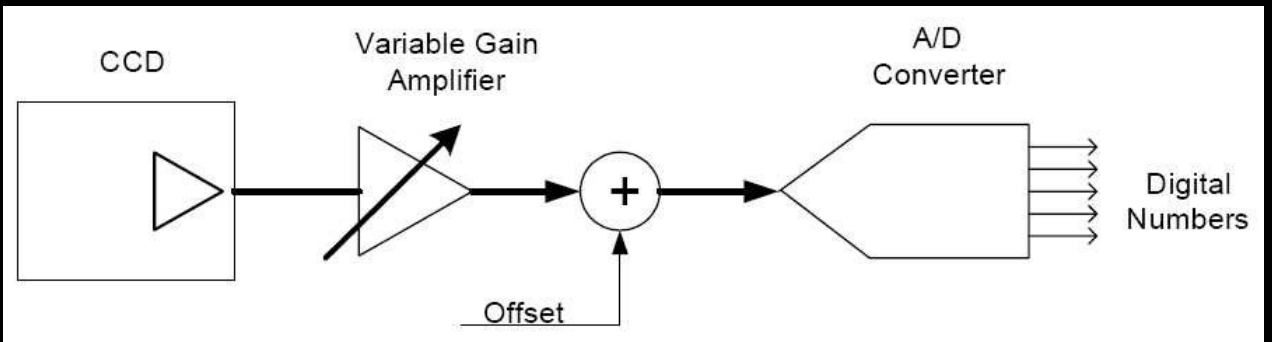
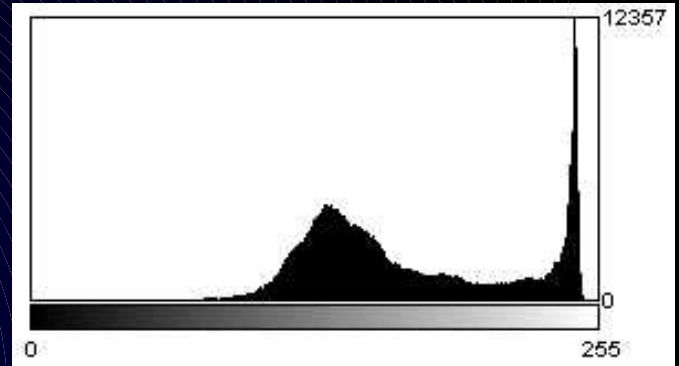
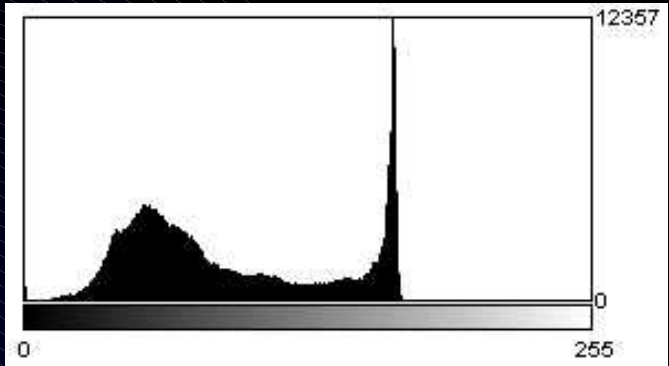


Gain Offset

Le gain (contraste) joue sur la dynamique de l'histogramme

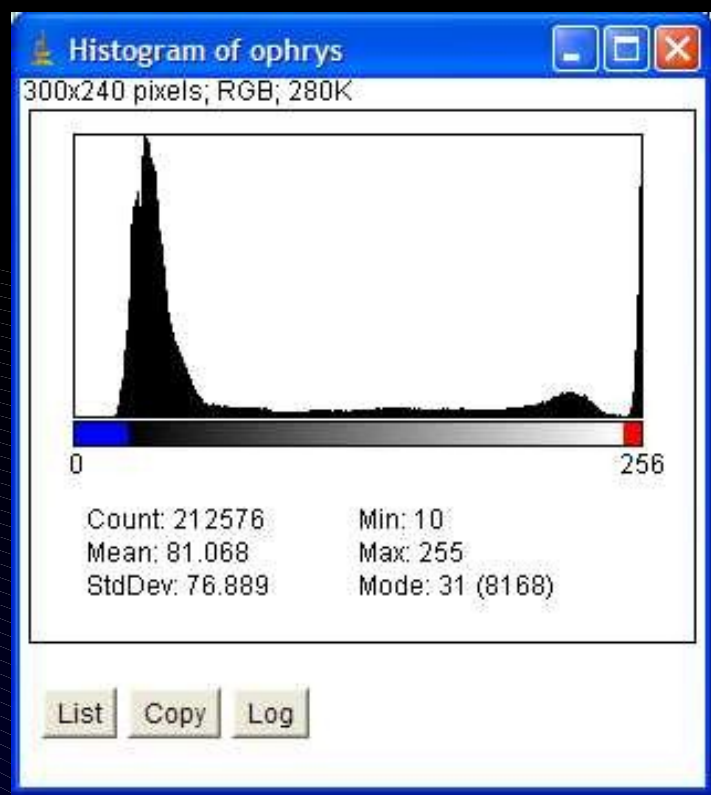


L'offset (luminosité) déplace l'histogramme



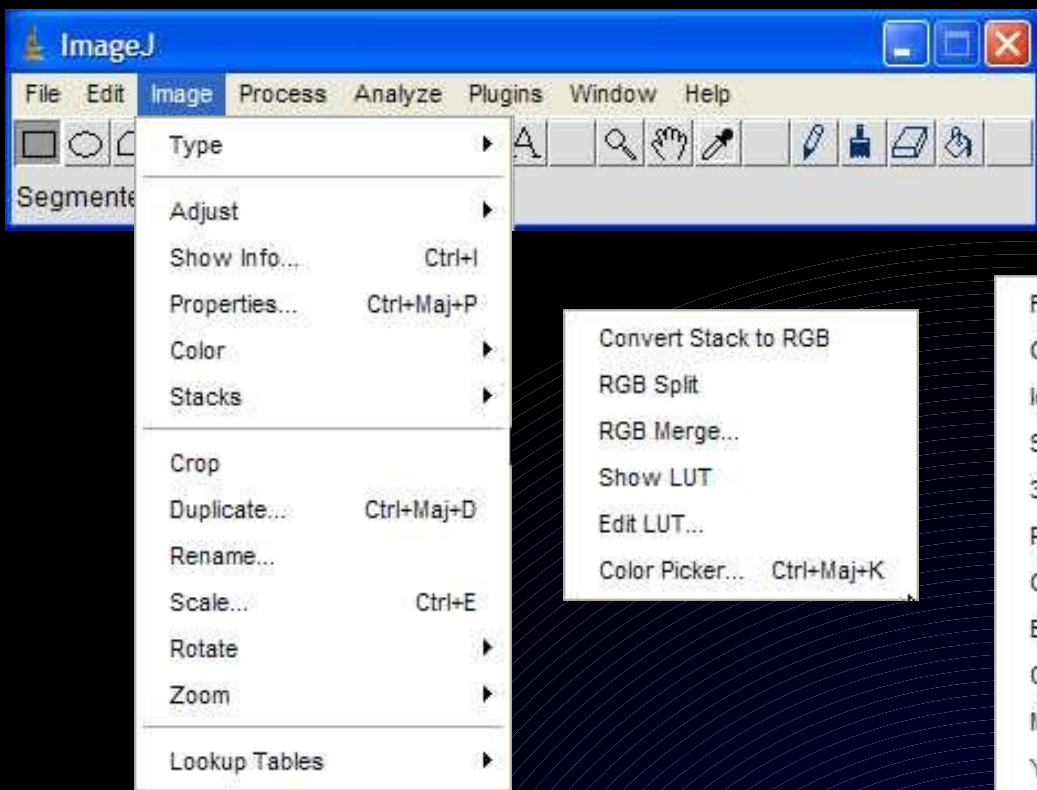


Réglages avec la LUT Hi Lo





Outils LUT dans ImageJ



Réglages d'images composites

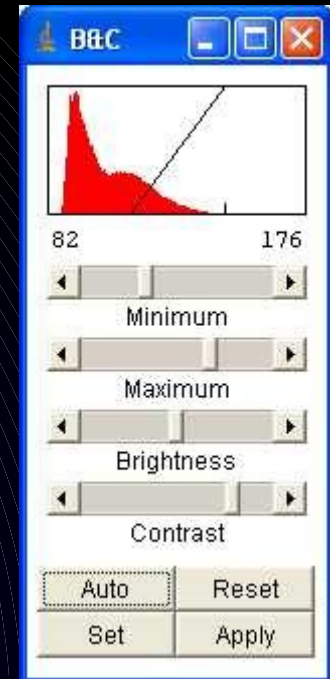
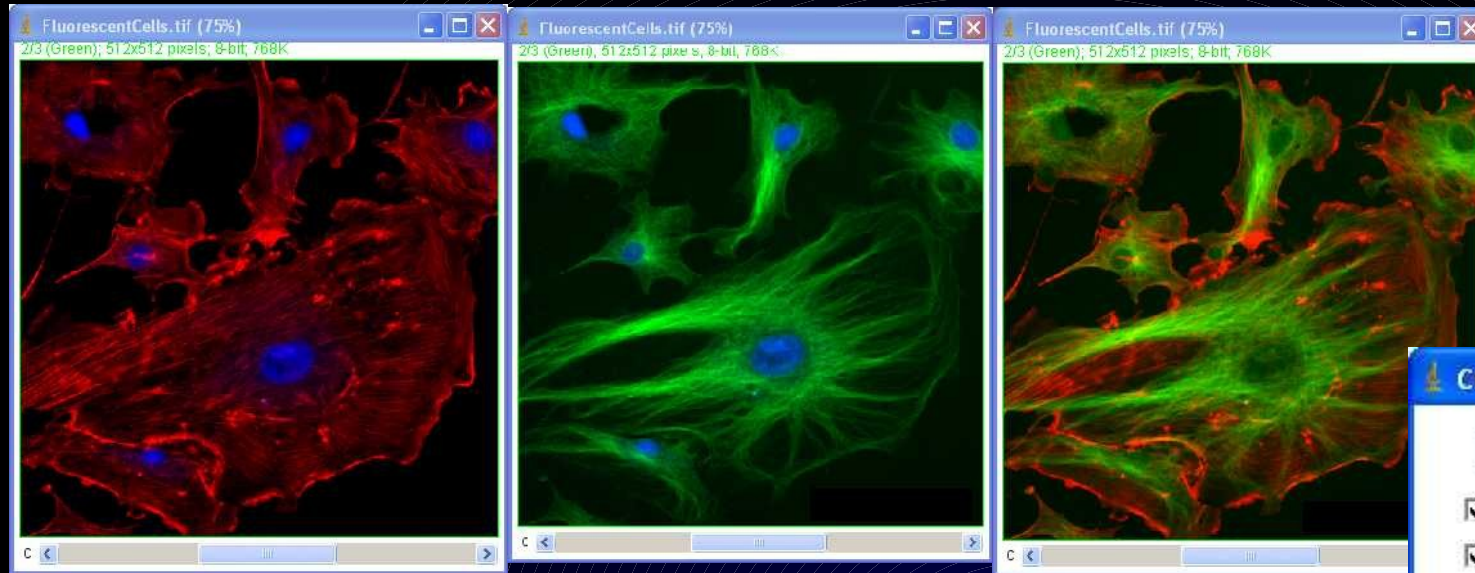
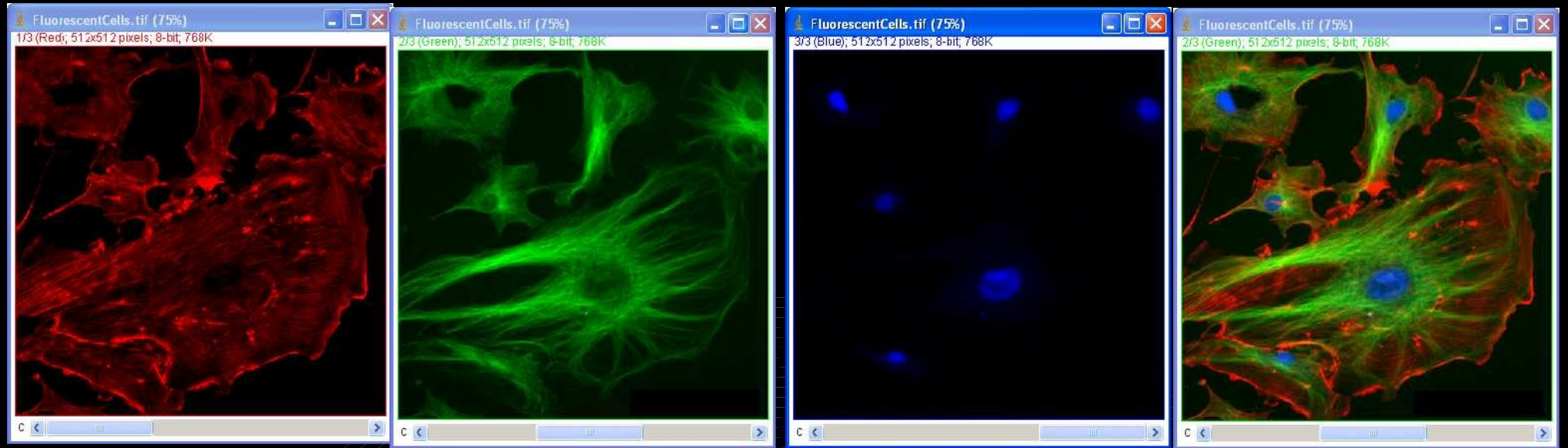


Image → Color → Make Composite



Topic 05 – Brightness and Contrast Adjustment

L'image numérique

Les Prétraitements

Amélioration de la visualisation
Filtres et opérations

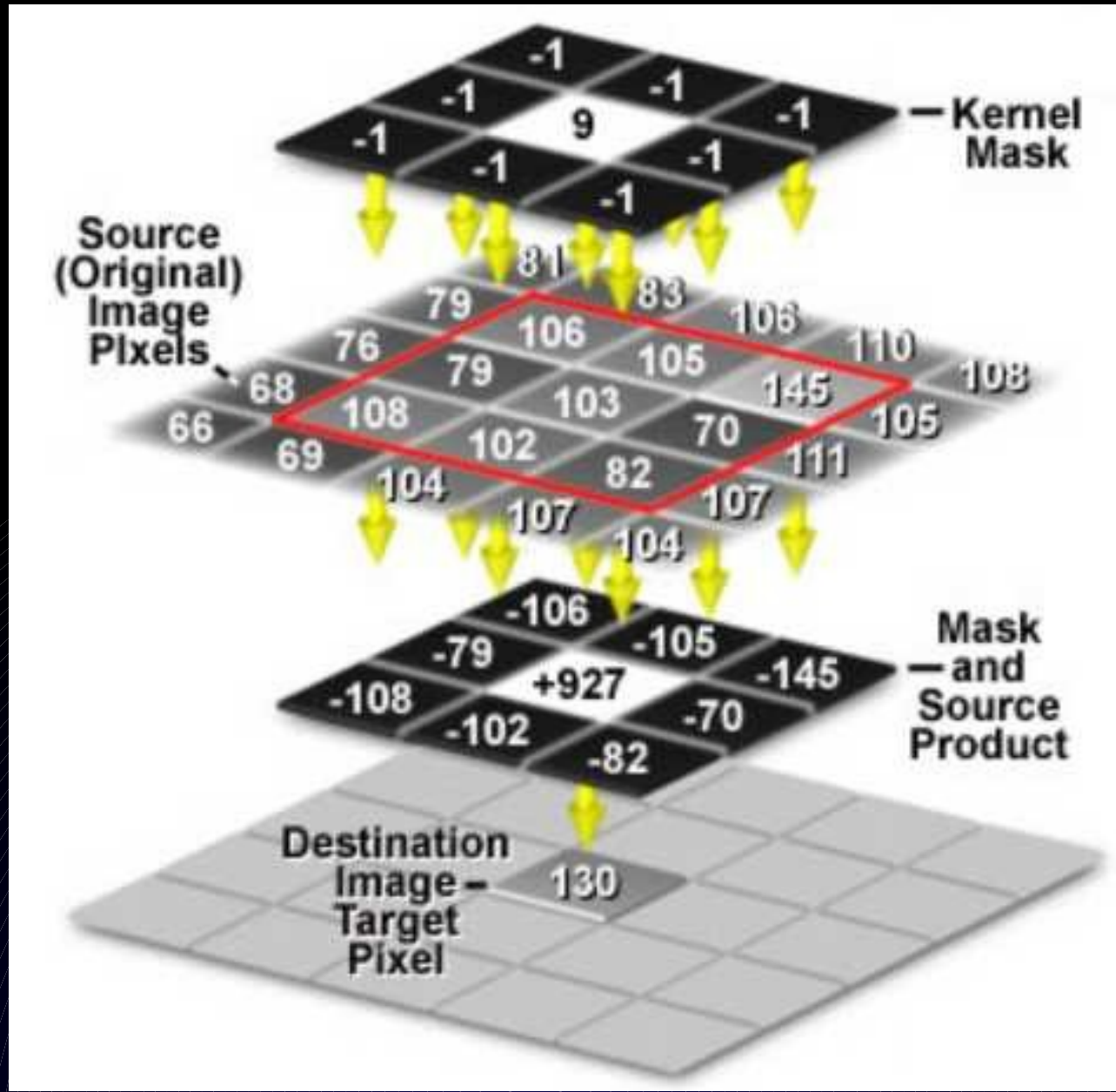
La Segmentation

Les Post-traitements

La Quantification



Filtres de convolution





Filtres de convolution

Image source

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

Noyau

1	1	1
1	4	1
1	1	1

*

=

Image résultante

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



Filtres de convolution

Image source

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

Noyau

1	1	1
1	4	1
1	1	1

Image résultante

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

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

Noyau

1	1	1
1	4	1
1	1	1

Image résultante

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

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

Noyau

1	1	1
1	4	1
1	1	1

Image résultante

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

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

Noyau

1	1	1
1	4	1
1	1	1

Image résultante

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

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

Noyau

1	1	1
1	4	1
1	1	1

Image résultante

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

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

Noyau

1	1	1
1	4	1
1	1	1

Image résultante

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

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

Noyau

1	1	1
1	4	1
1	1	1

Image résultante

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

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

Noyau

1	1	1
1	4	1
1	1	1

Image résultante

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

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

Noyau

1	1	1
1	4	1
1	1	1

Image résultante

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

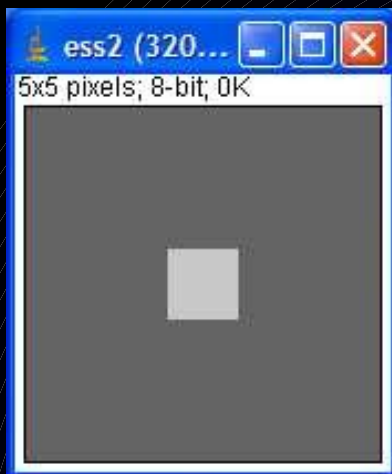
100	100	100	100	100
100	100	100	100	100
100	100	200	100	100
100	100	100	100	100
100	100	100	100	100

*

1	1	1
1	4	1
1	1	1

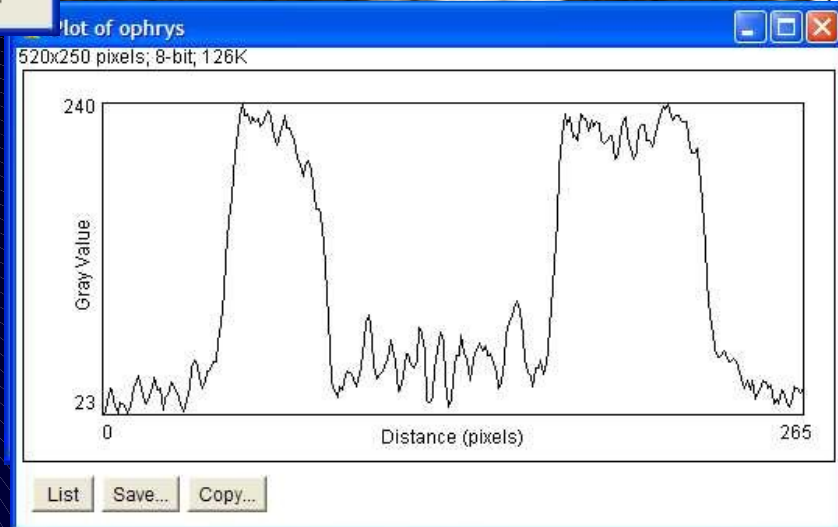
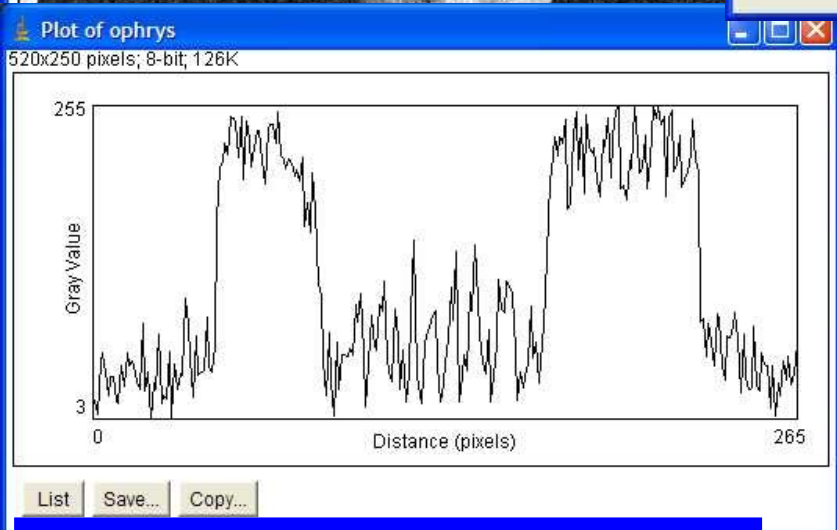
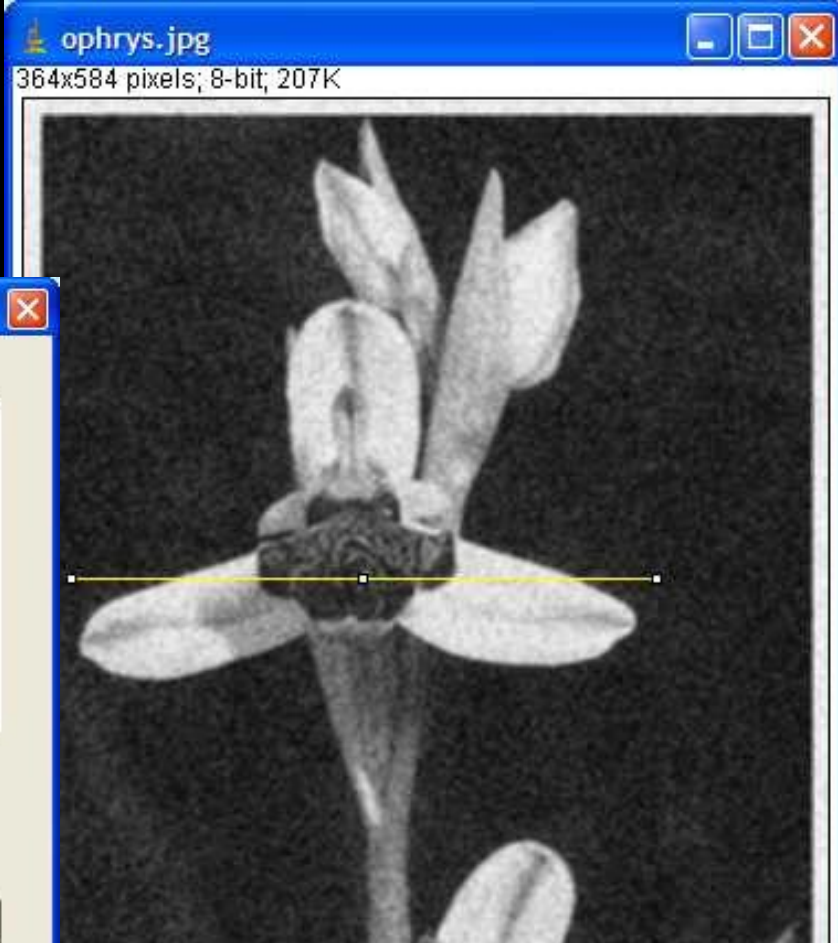
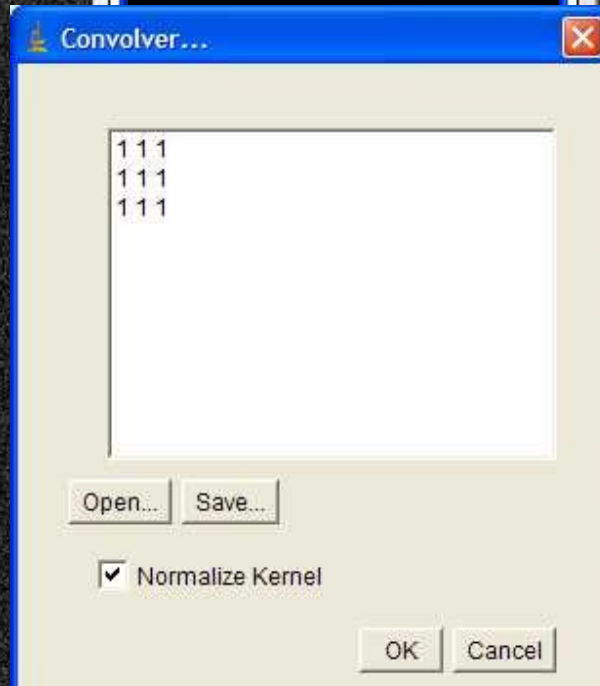
=

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**.

Filtre passe-bas moyenneur




Process → Filters → Convolve...



Filtre médian

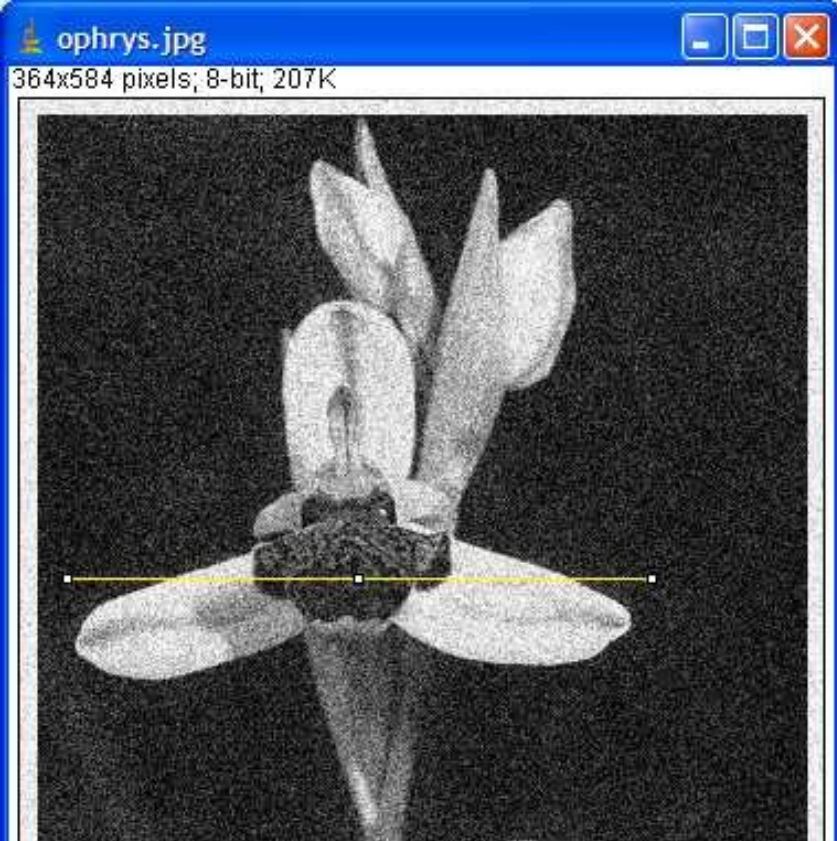
Un filtre médian non linéaire affecte au pixel central la valeur médiane de la série; ce qui nous donne, dans le cas de notre exemple, la série de pixels suivante :

15	18	14
29	27	13
12	19	21

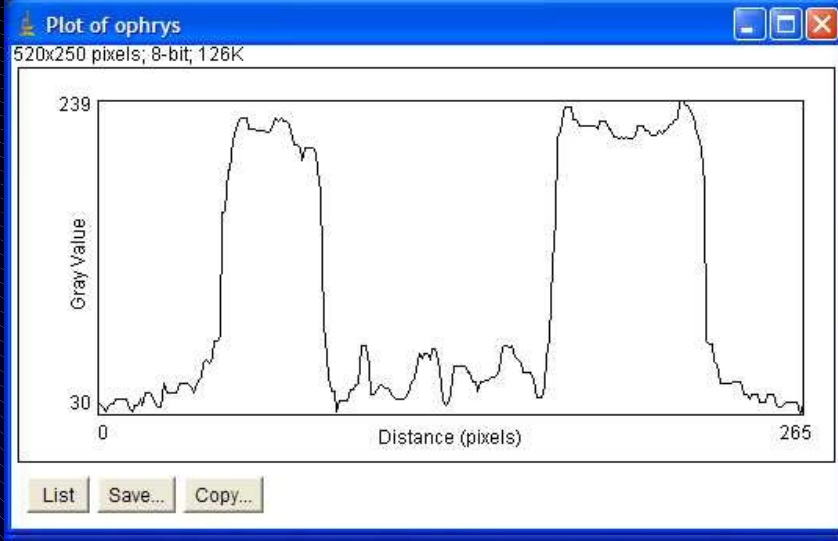
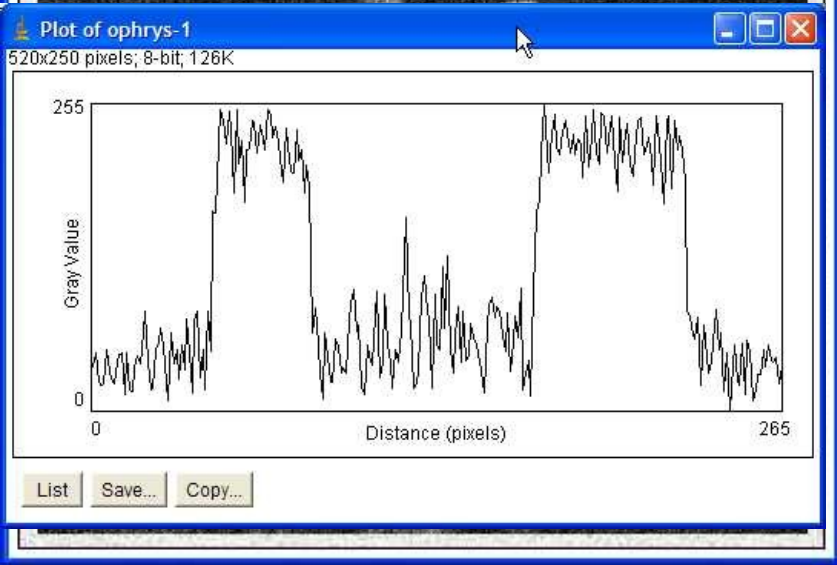
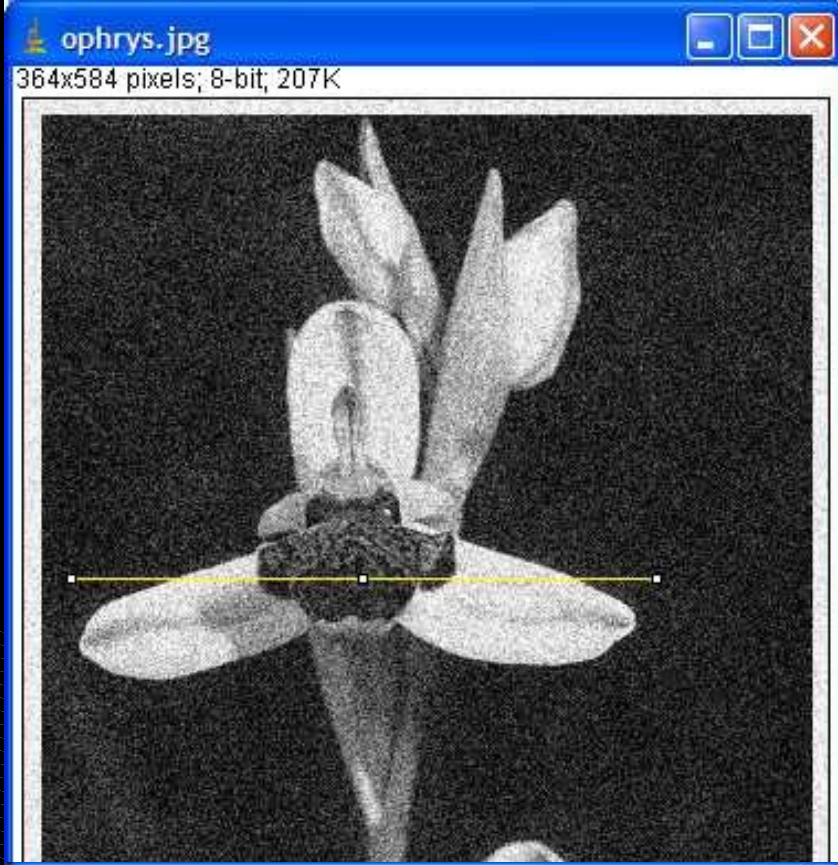


15	18	14
29	18	13
12	19	21

En effet, la médiane de : 12,13,14,15,18,19,21,27,29 est 18.

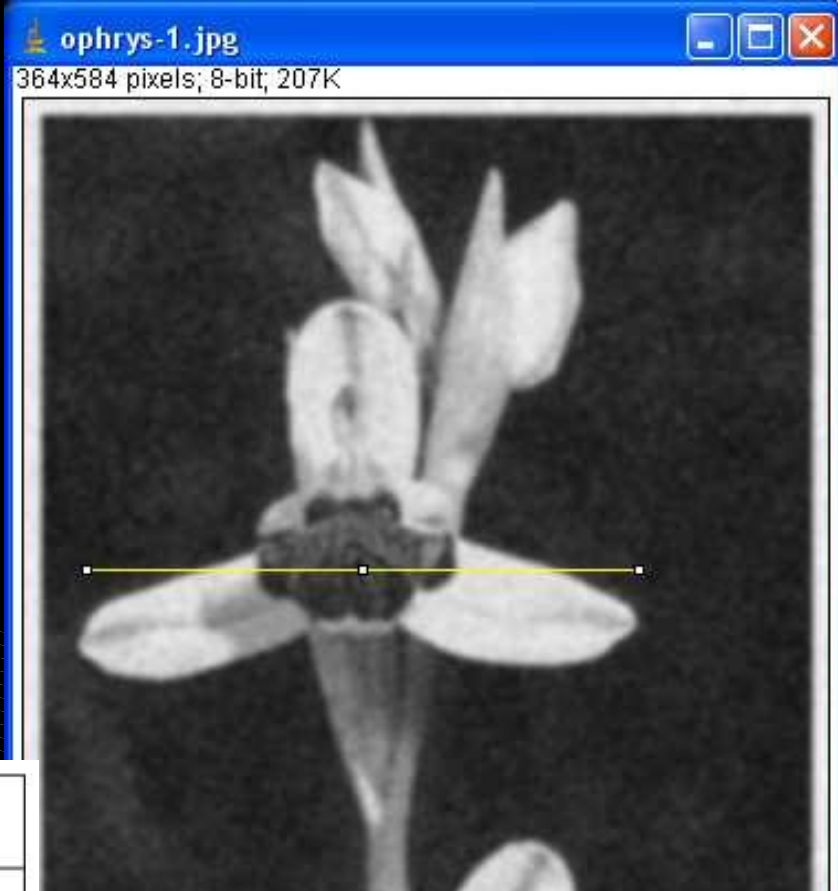
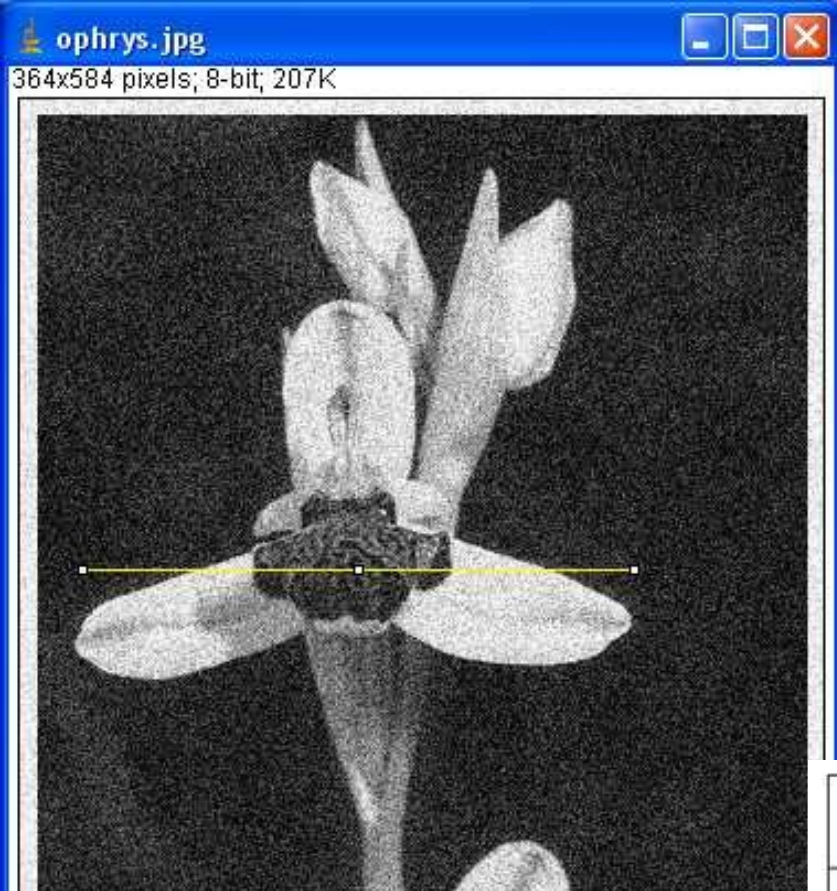


Filtre médian

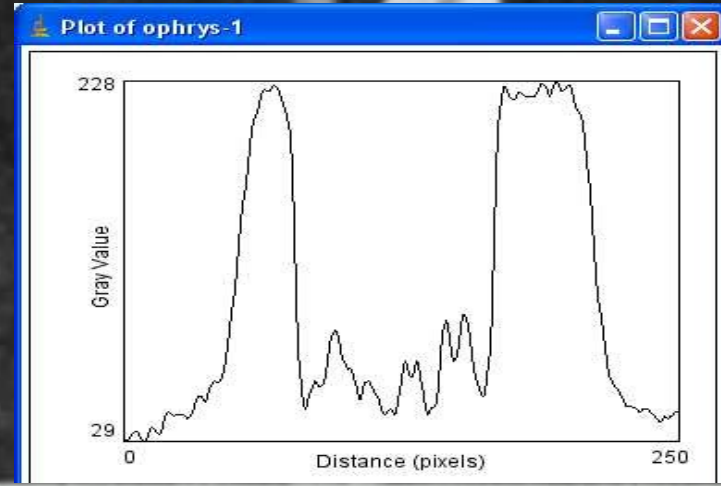
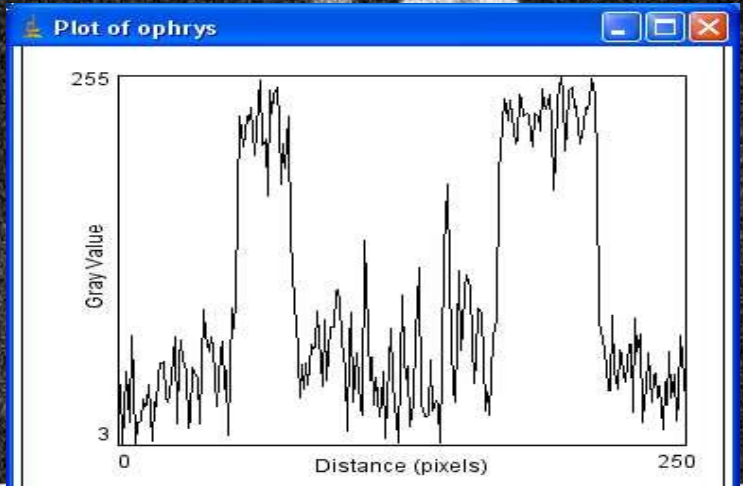


Process → Filters → Median...

Filtre Gaussien



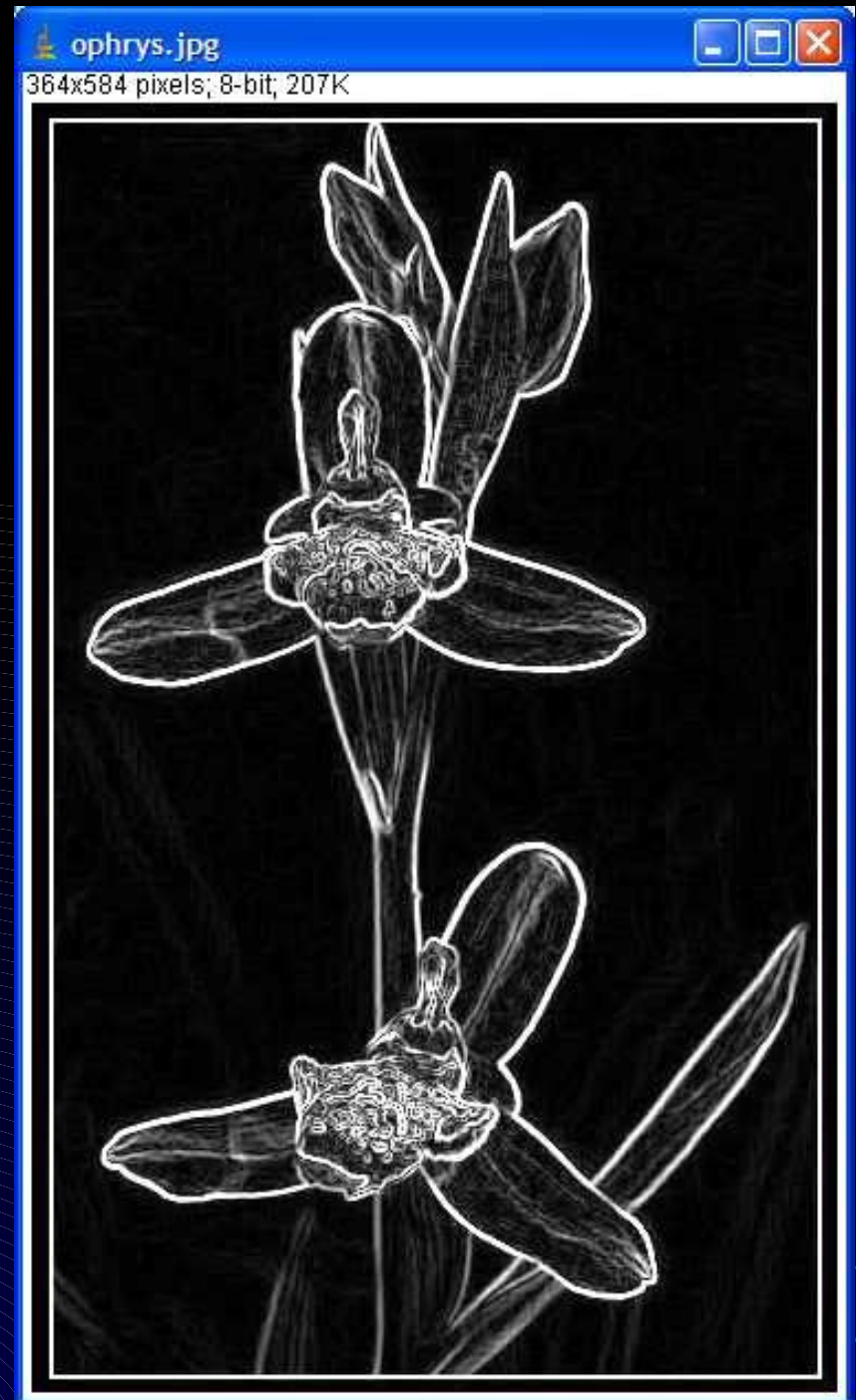
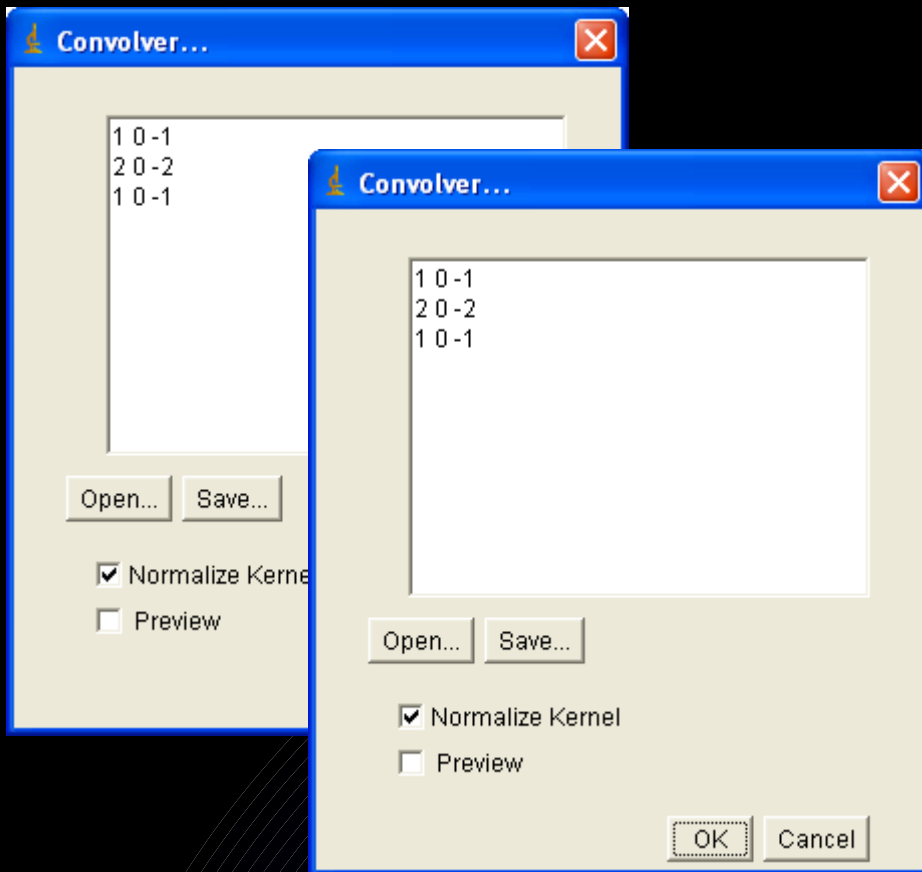
0	0.6	1.7	0.6	0
0.6	13	36	13	0.6
1.7	36	100	36	1.7
0.6	13	36	13	0.6
0	0.6	1.7	0.6	0



Process → Filters → Gaussian Blur...



Filtre Détection de bords

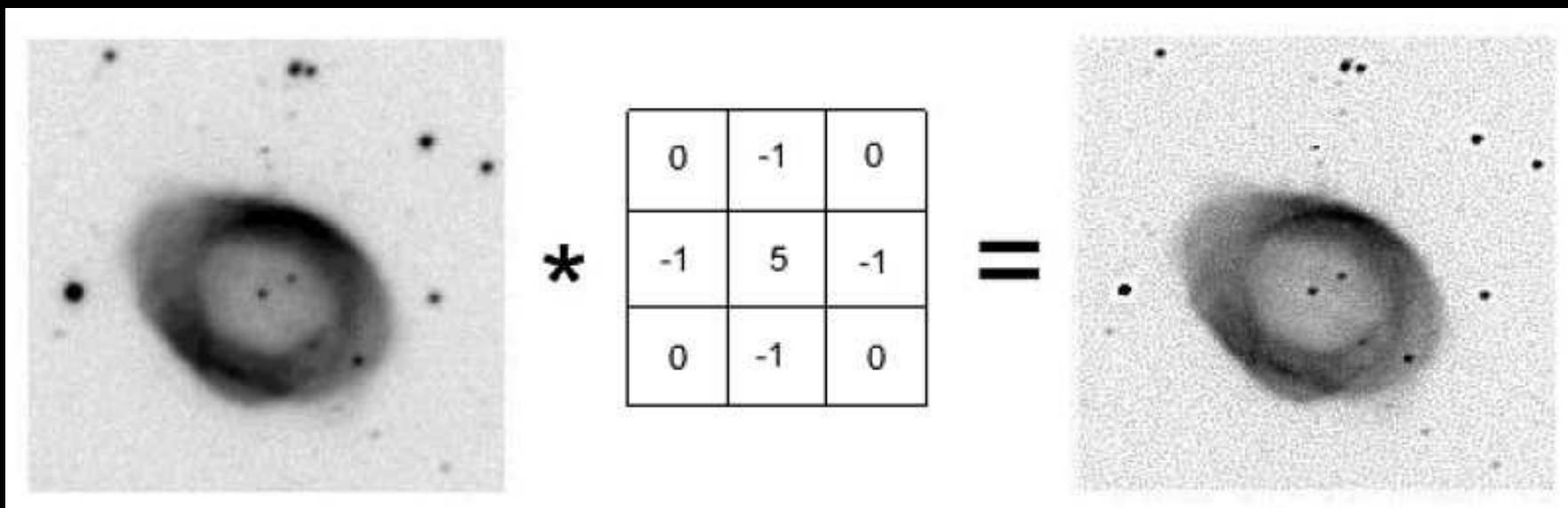


Les images sont convoluées
par les filtres de Sobel
Le résultat est la racine carrée
de la somme des carrés des images

Process → Finds Edges



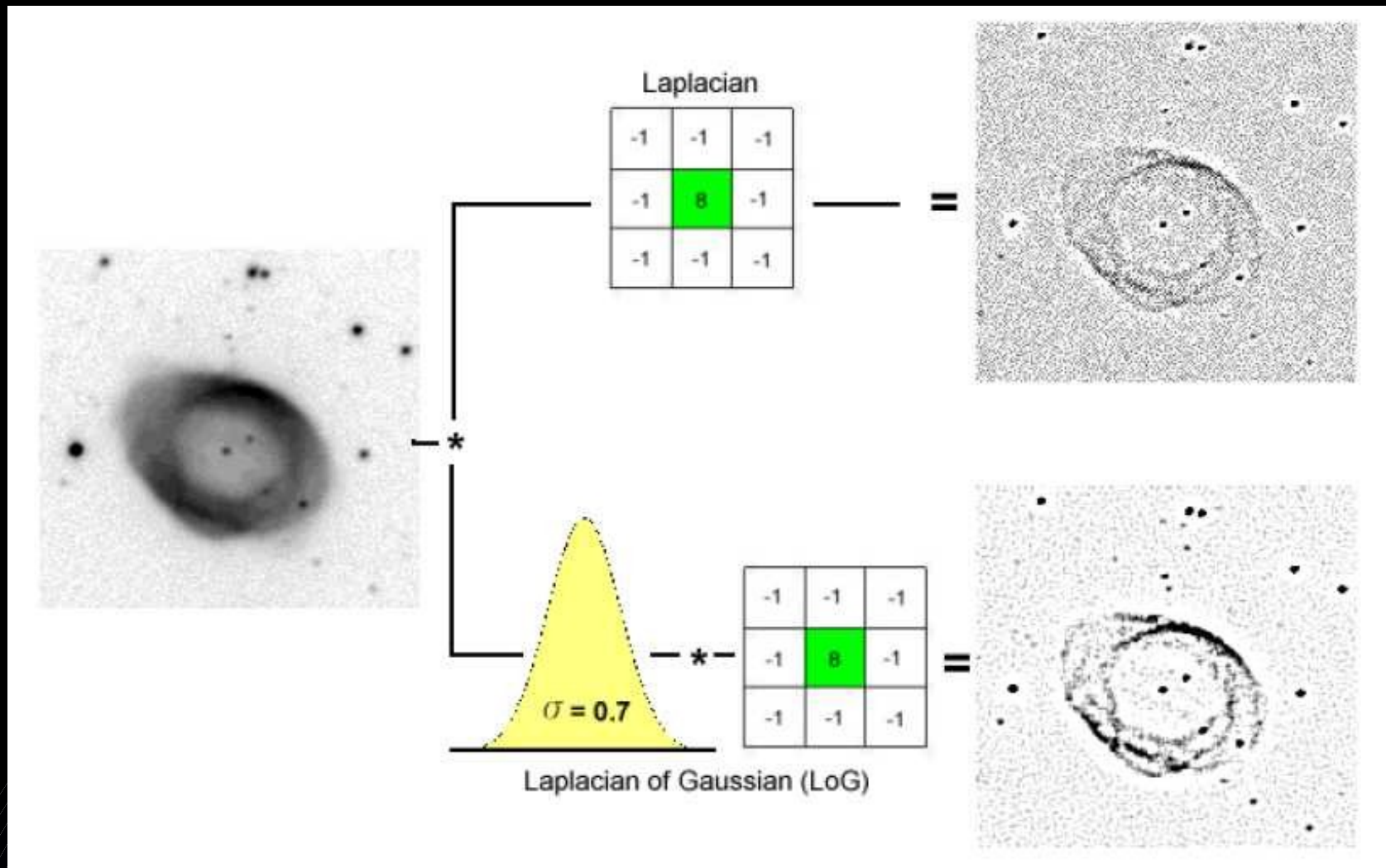
Filtres Passe-haut



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



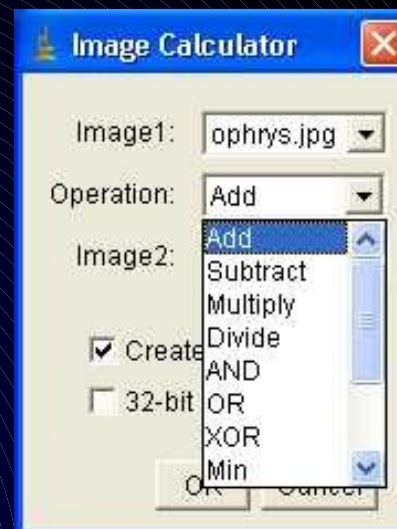
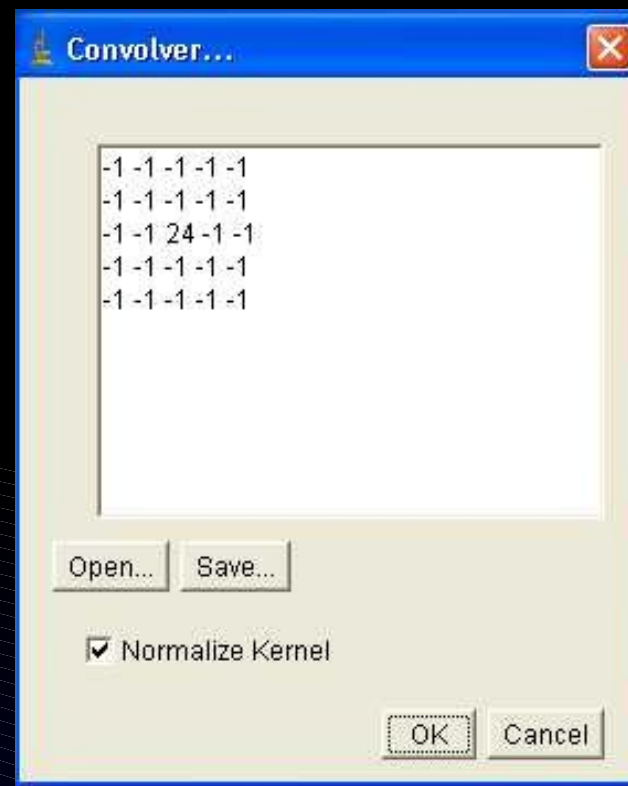
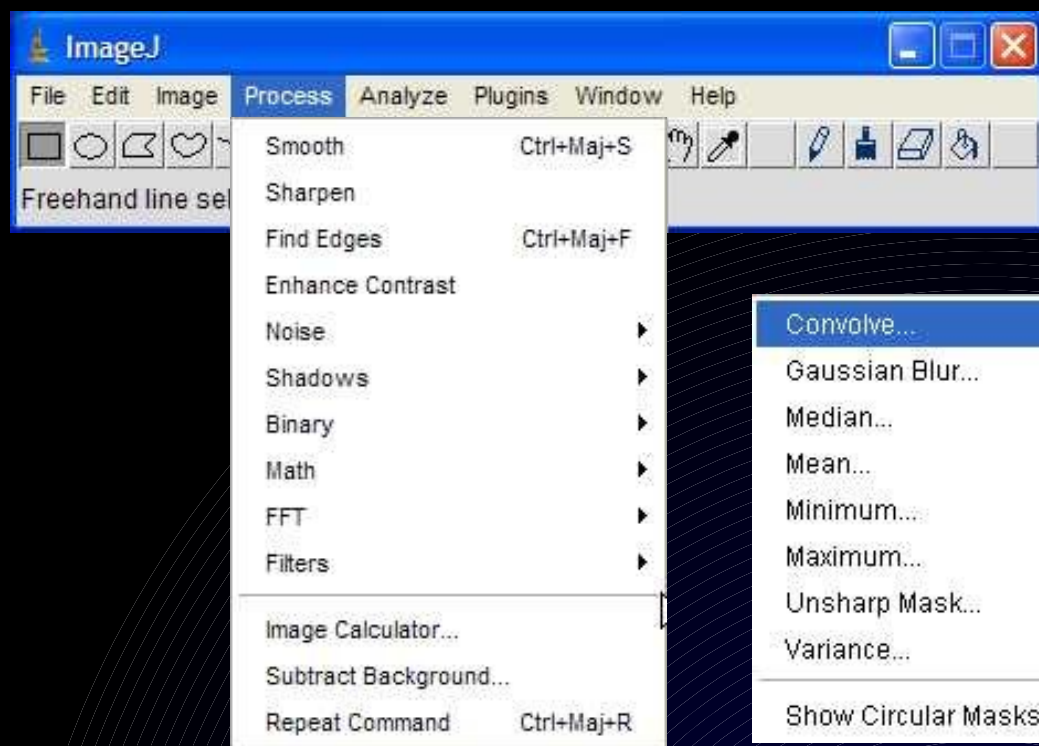
Combinaison Gaussien Laplacien



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

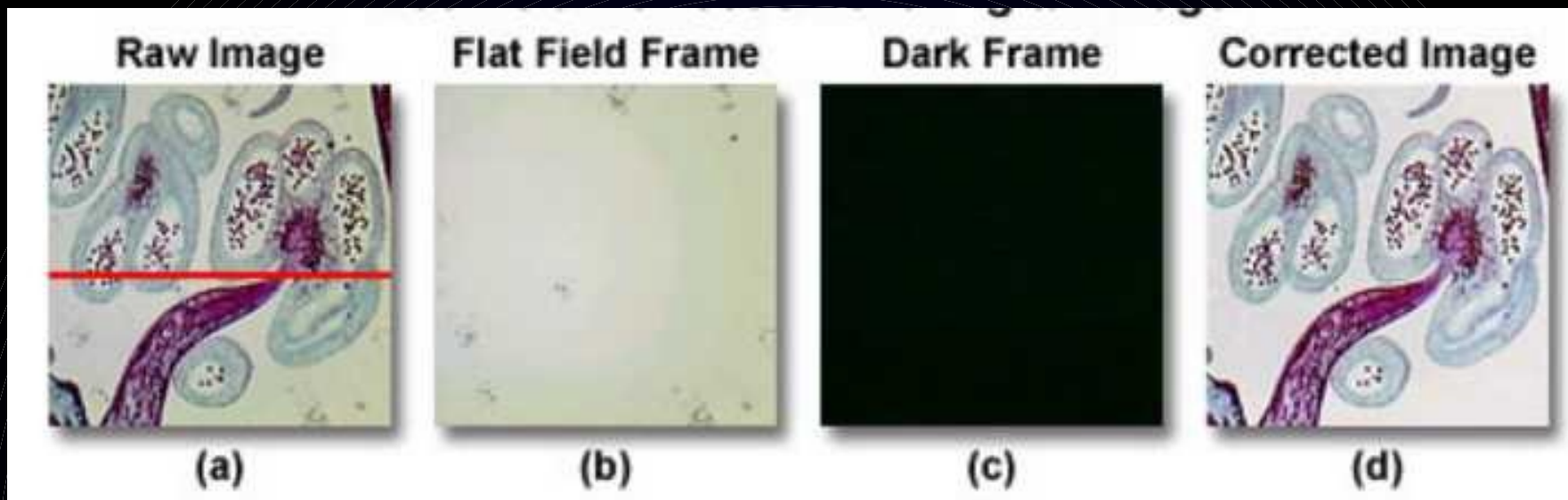
- Bruits de la caméra: bruit aléatoire, «pixels chauds», bruits périodiques
- Illumination non-homogène

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 = $(\text{échantillon} - \text{CN}) / (\text{CC} - \text{CN}) * 255$





Correction du fond

Correction après la capture

Bruit aléatoire : filtre gaussien ou médian mais perte de détail

Pixels chauds : filtrer les pixels saturés isolés

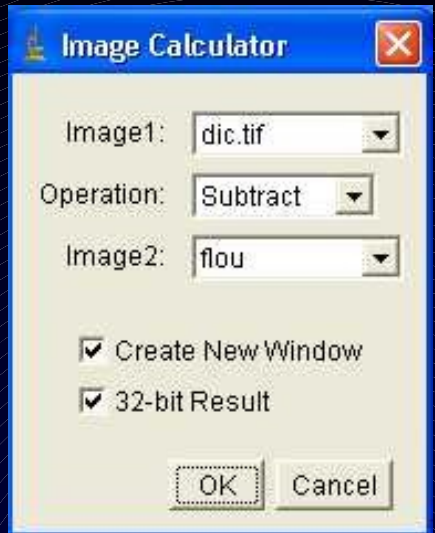
Bruit périodique : filtre de Fourier

Illumination non-homogène :

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



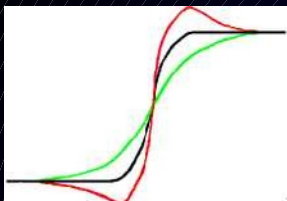
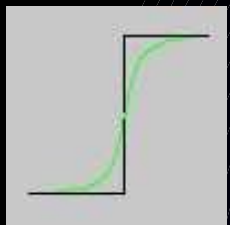
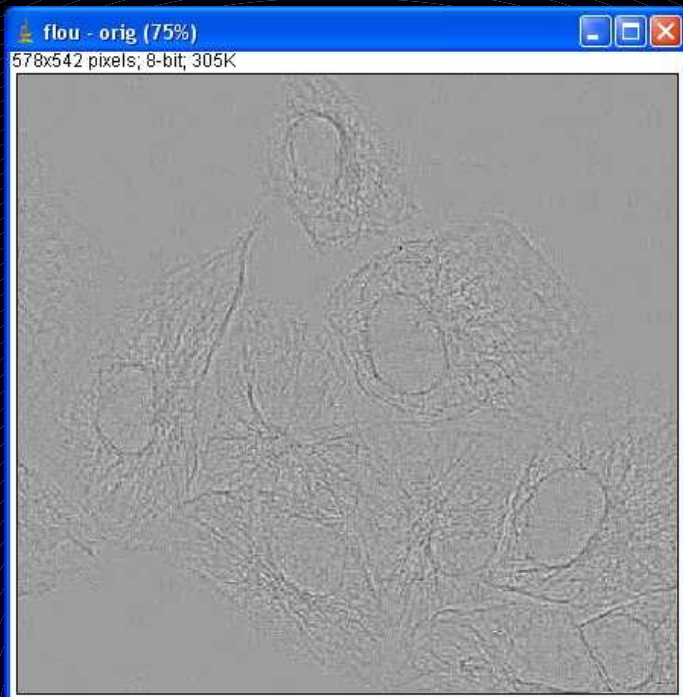
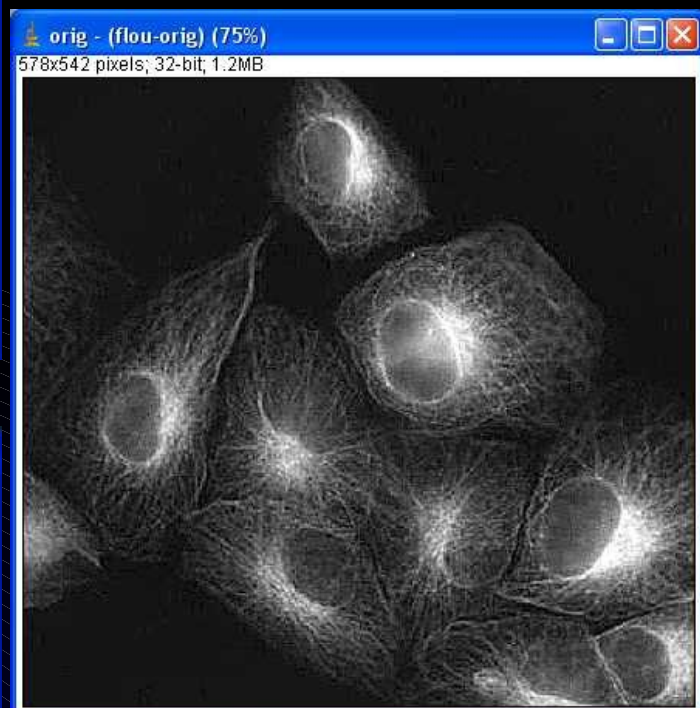
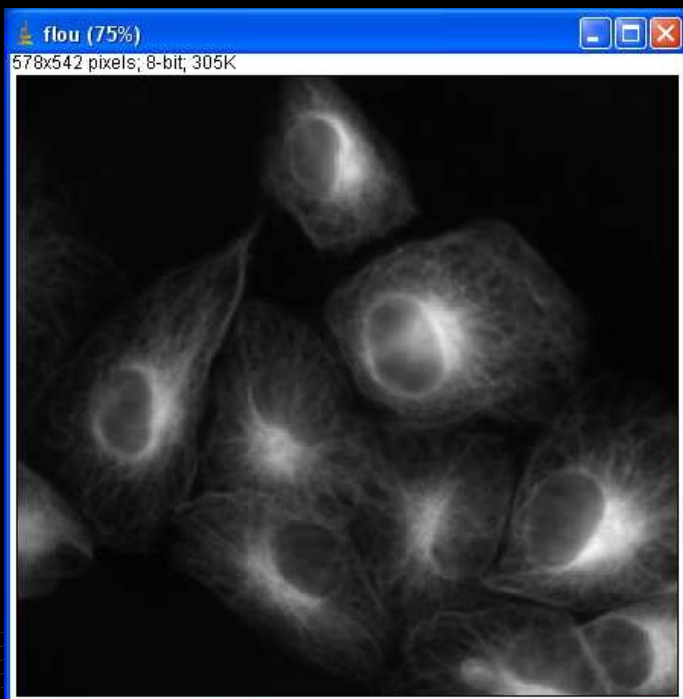
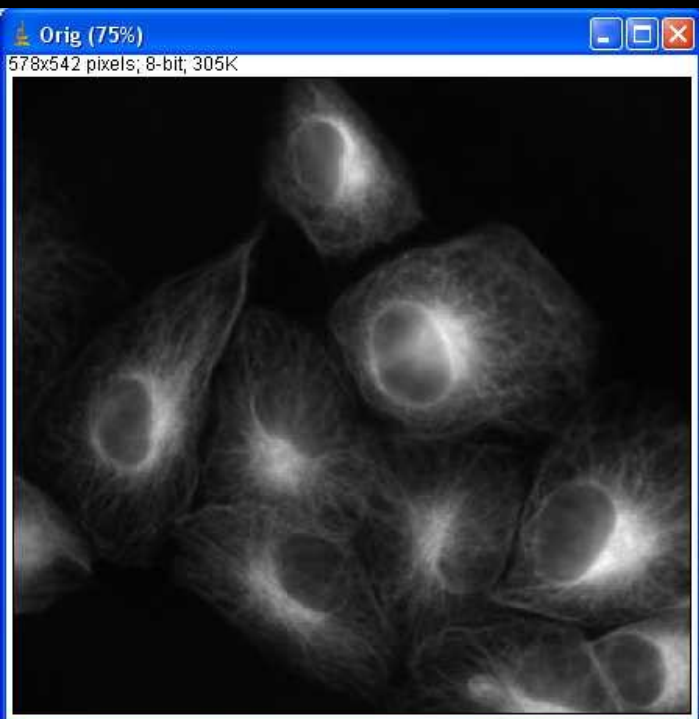
Masquer le fond





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

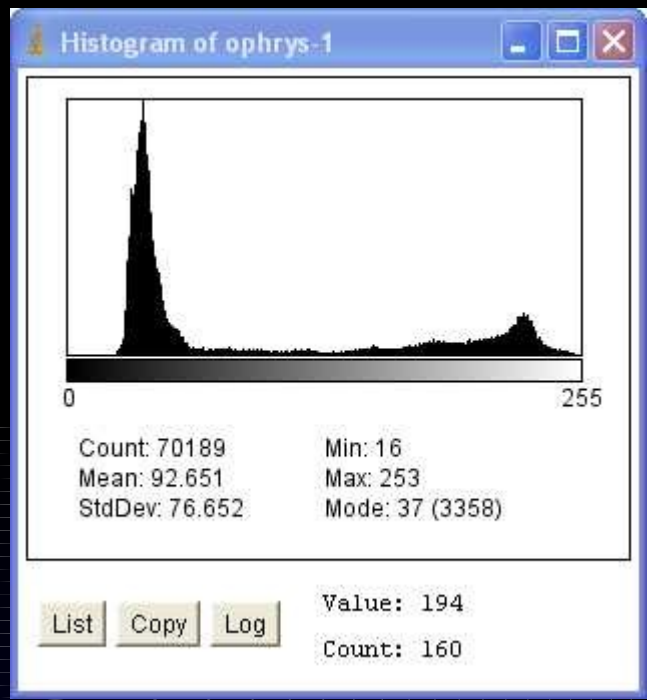
Permet de séparer les régions d'intérêt du fond.

Les Post-traitements

La Quantification



Le Seuillage automatique



Threshold

Default Red

Dark background

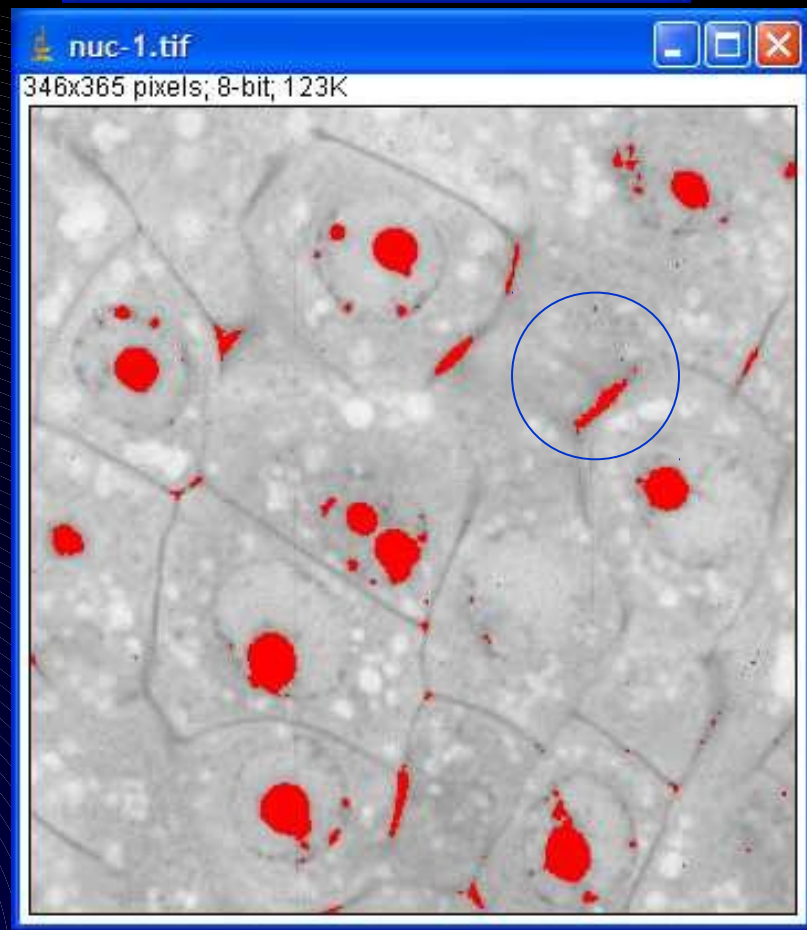
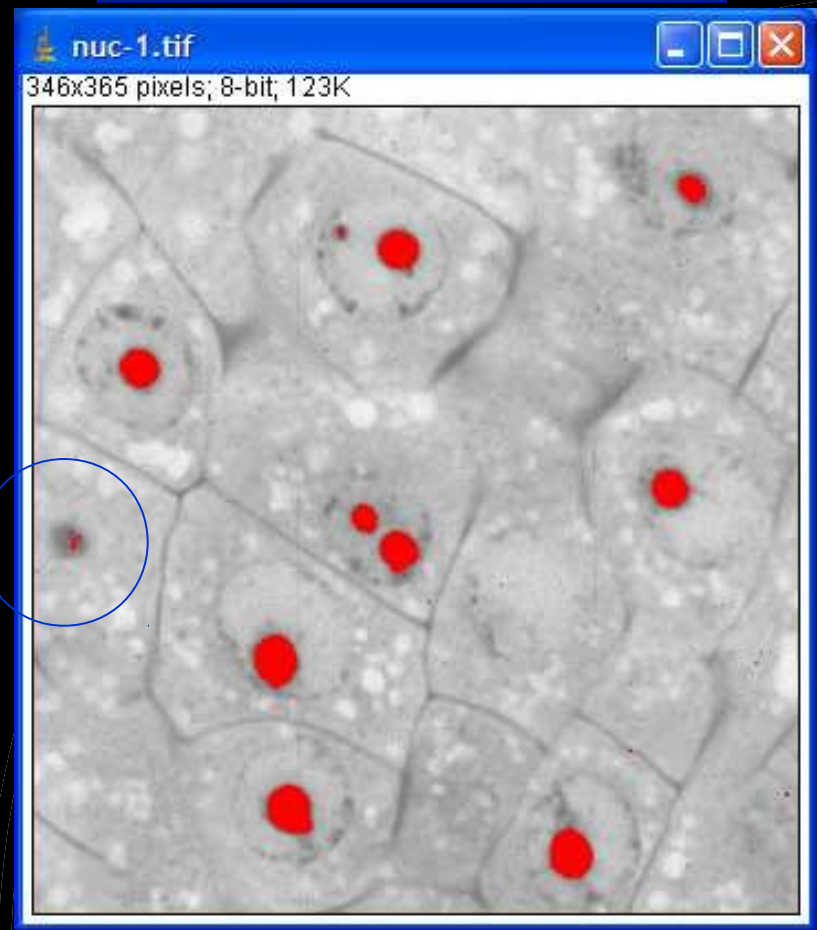
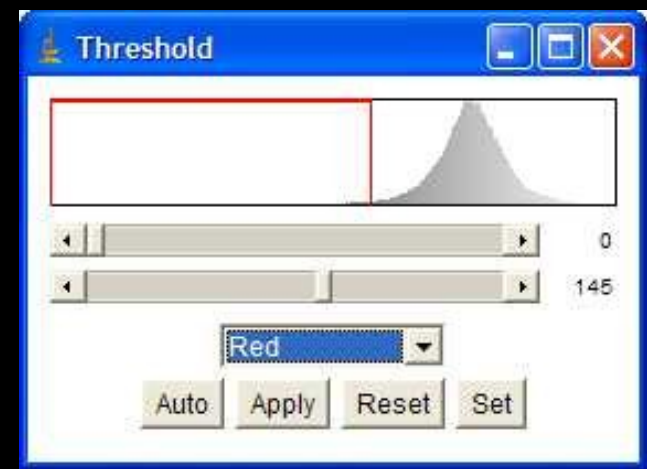
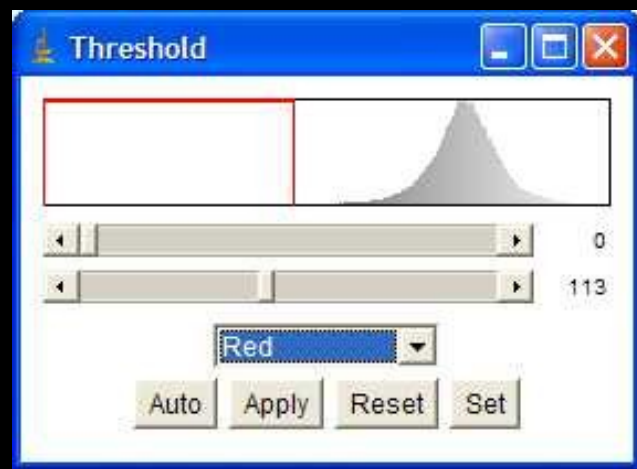
Auto Apply Reset Set

- Default
- Huang
- Intermodes
- IsoData
- IJ_IsoData
- Li
- MaxEntropy
- Mean
- MinError
- Minimum
- Moments
- Otsu
- Percentile
- RenyiEntropy
- Shanbhag
- Triangle
- Yen

Image → Adjust → Threshold...

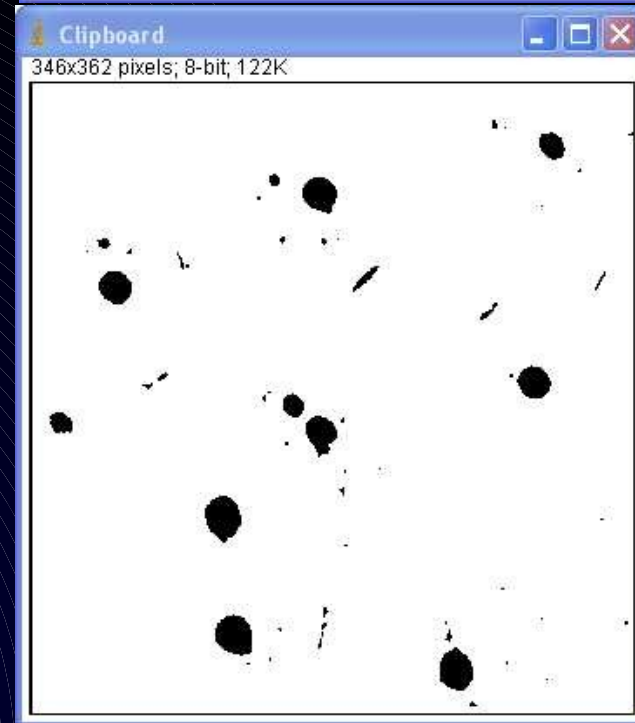
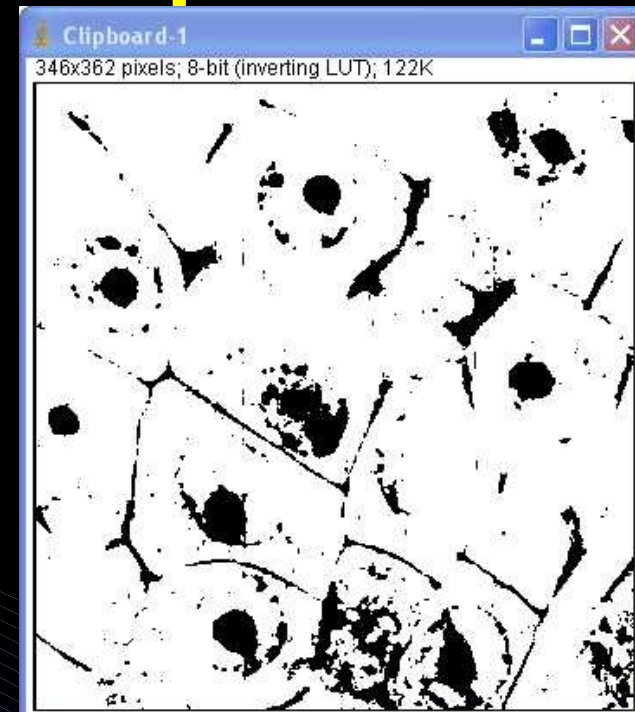
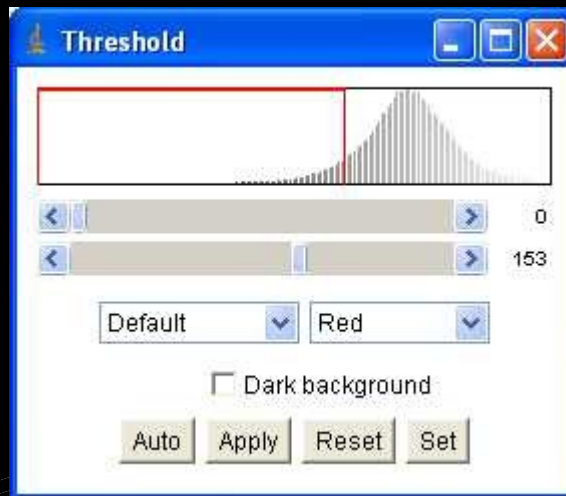
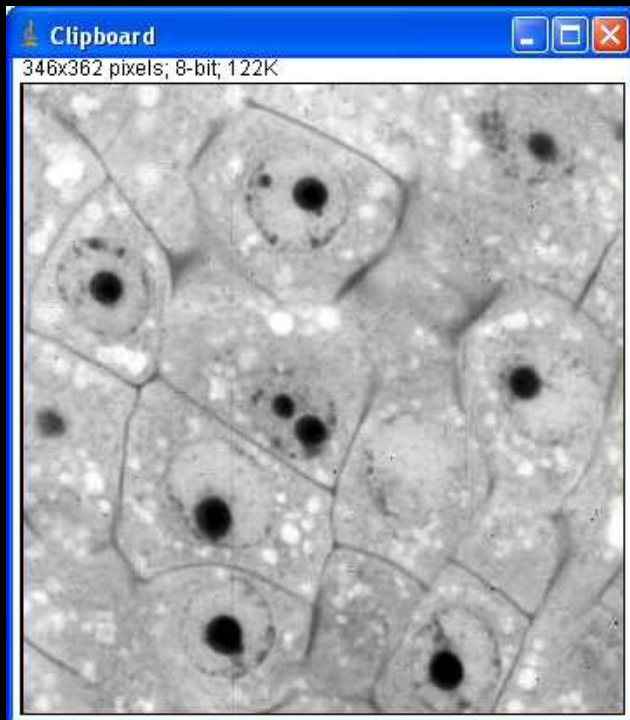


Le Seuillage manuel



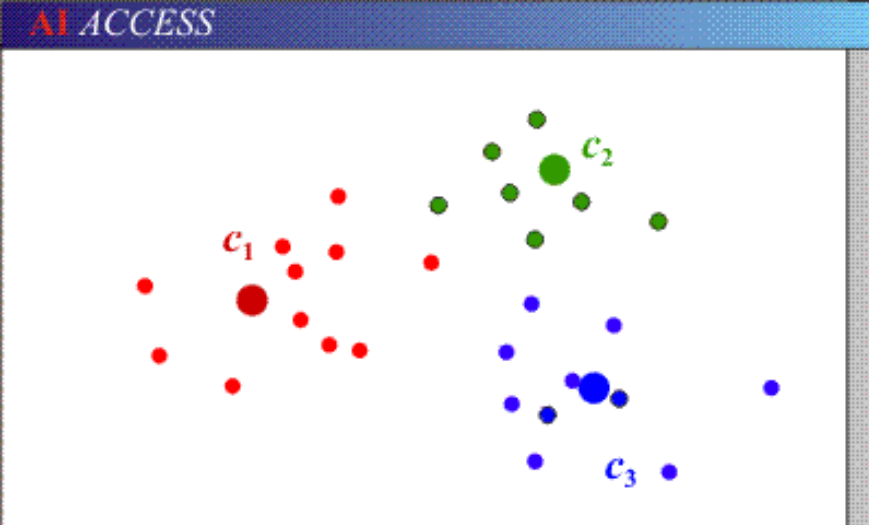
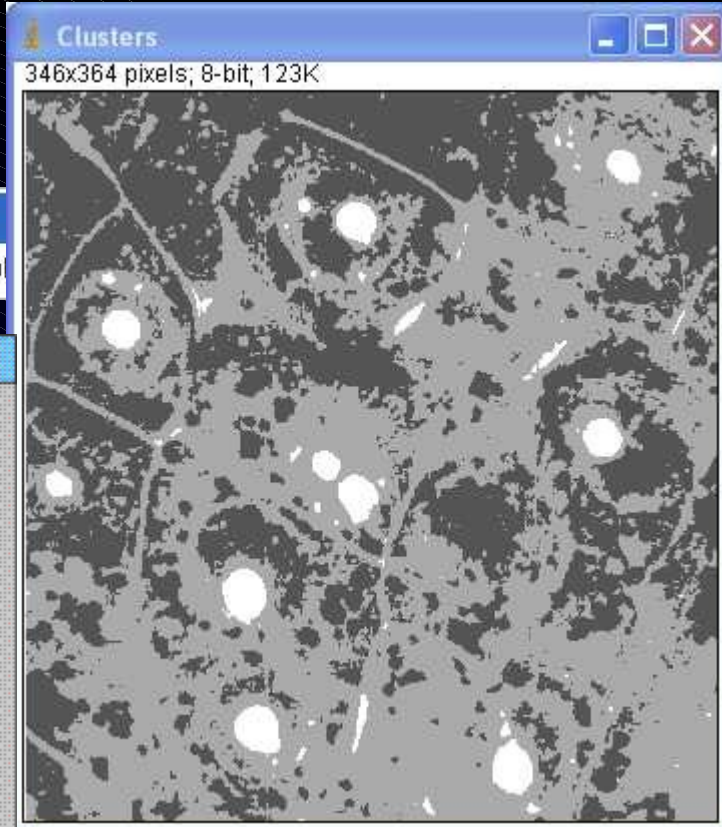
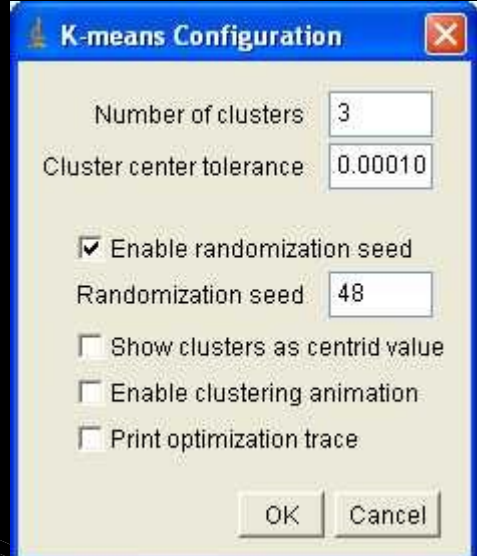
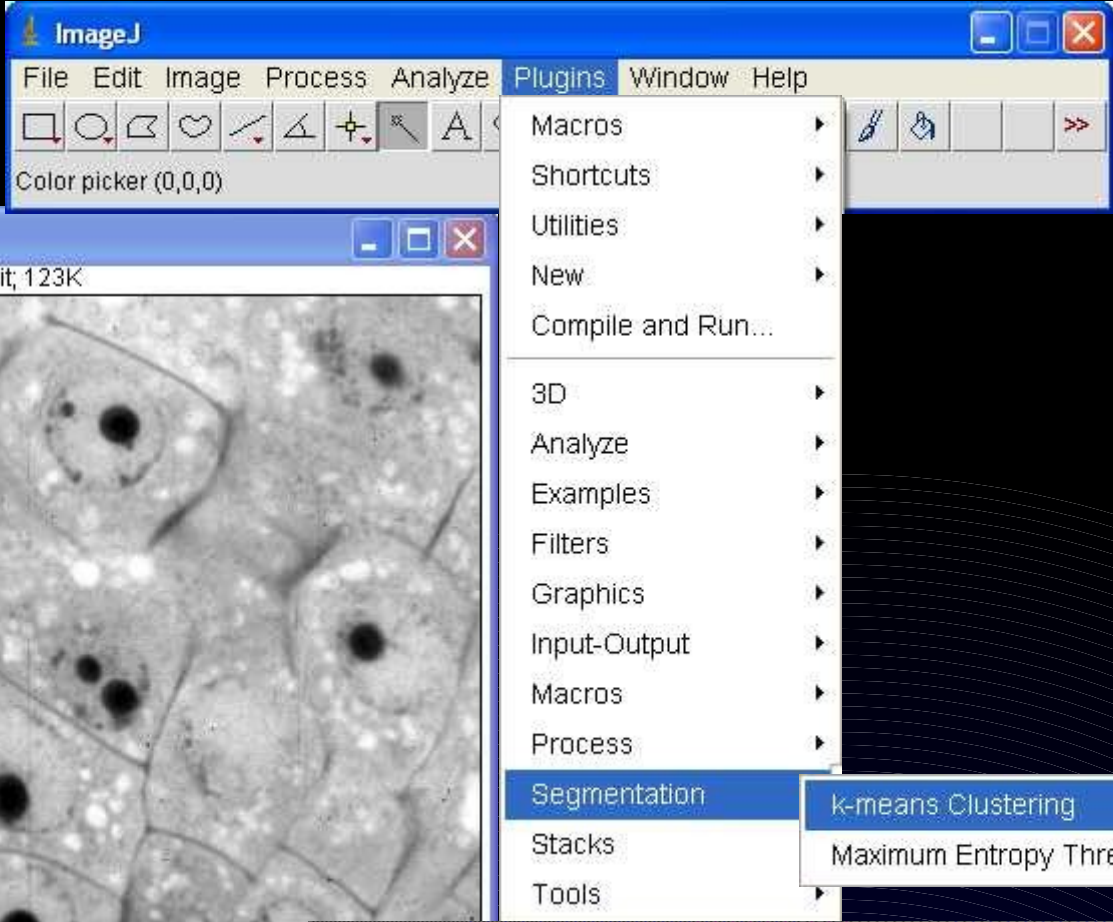


Seuillage local automatique



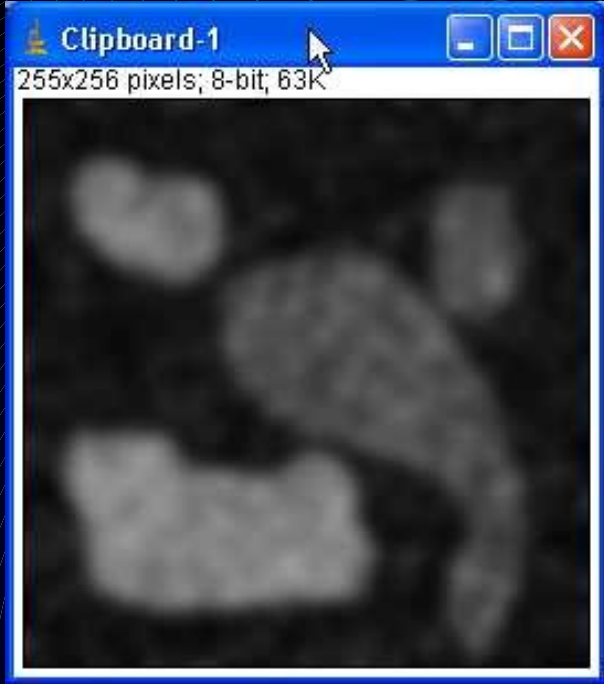
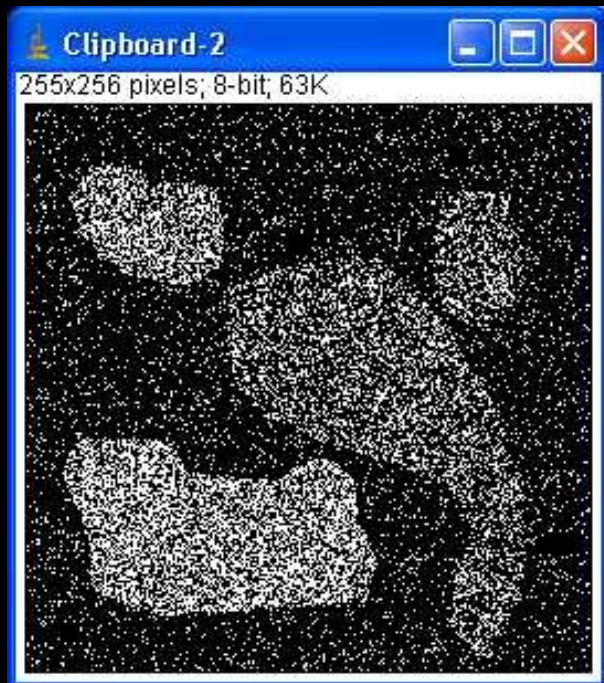


Plugin k-mean clustering



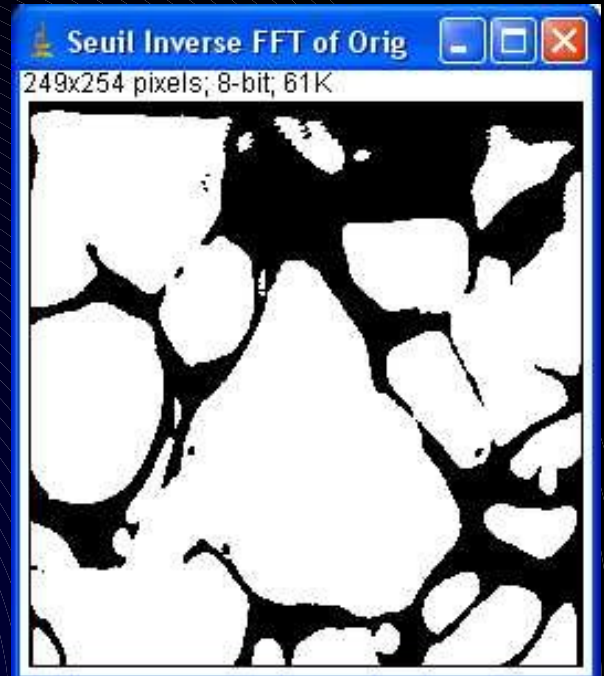
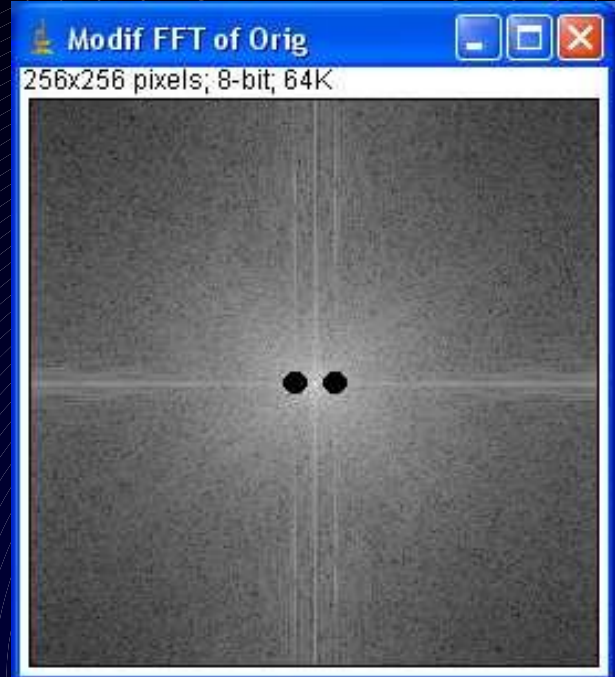
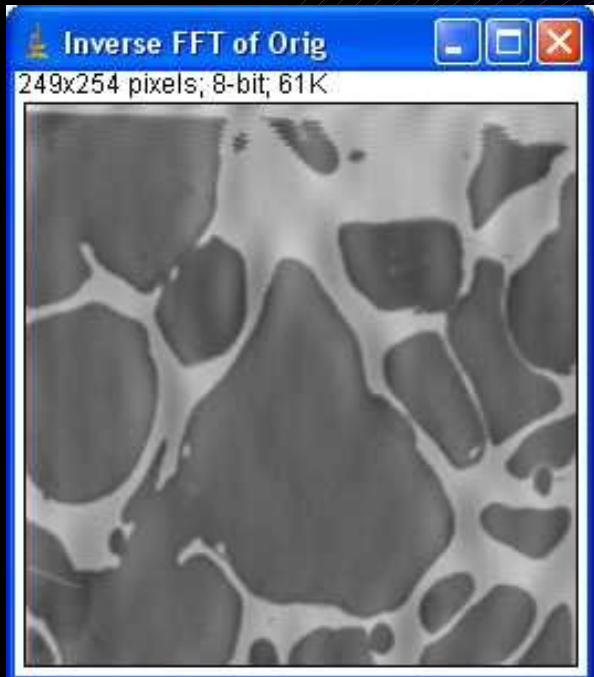
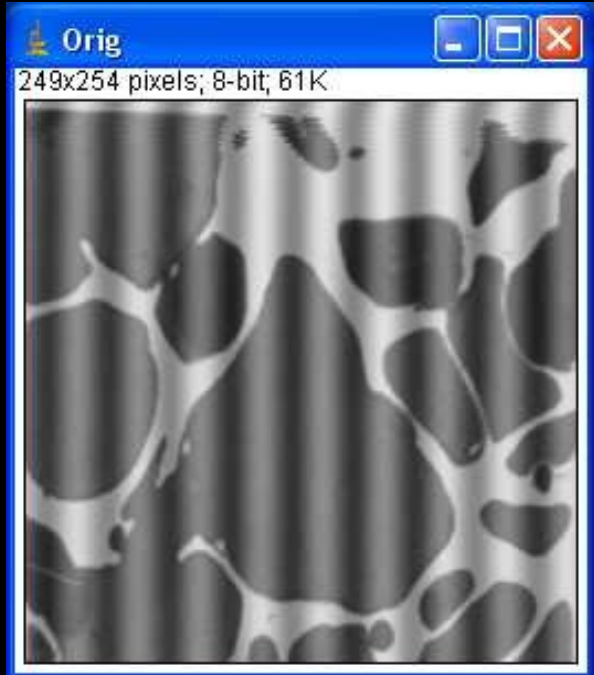


Filtrage avant le seuillage





FFT filtres dans le domaine de Fourier



Couleur et segmentation séparation RGB

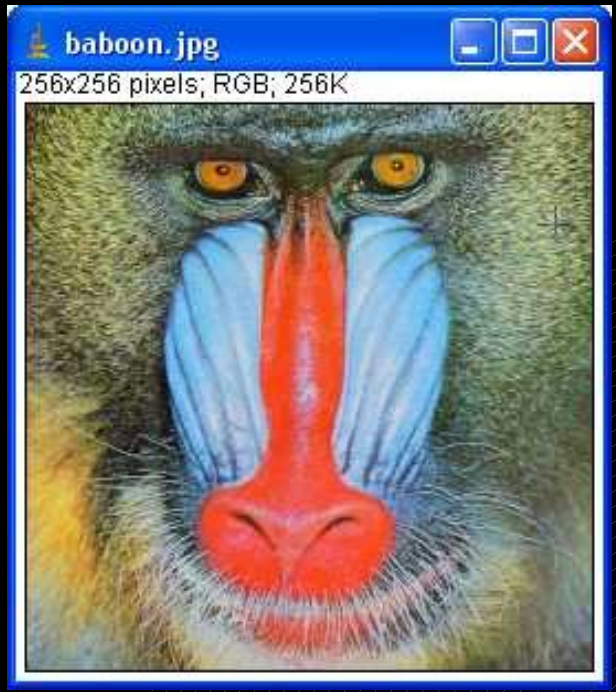


Image → Color → Split Channels...



Décomposition HSI

la Teinte ou Hue se référant à la couleur

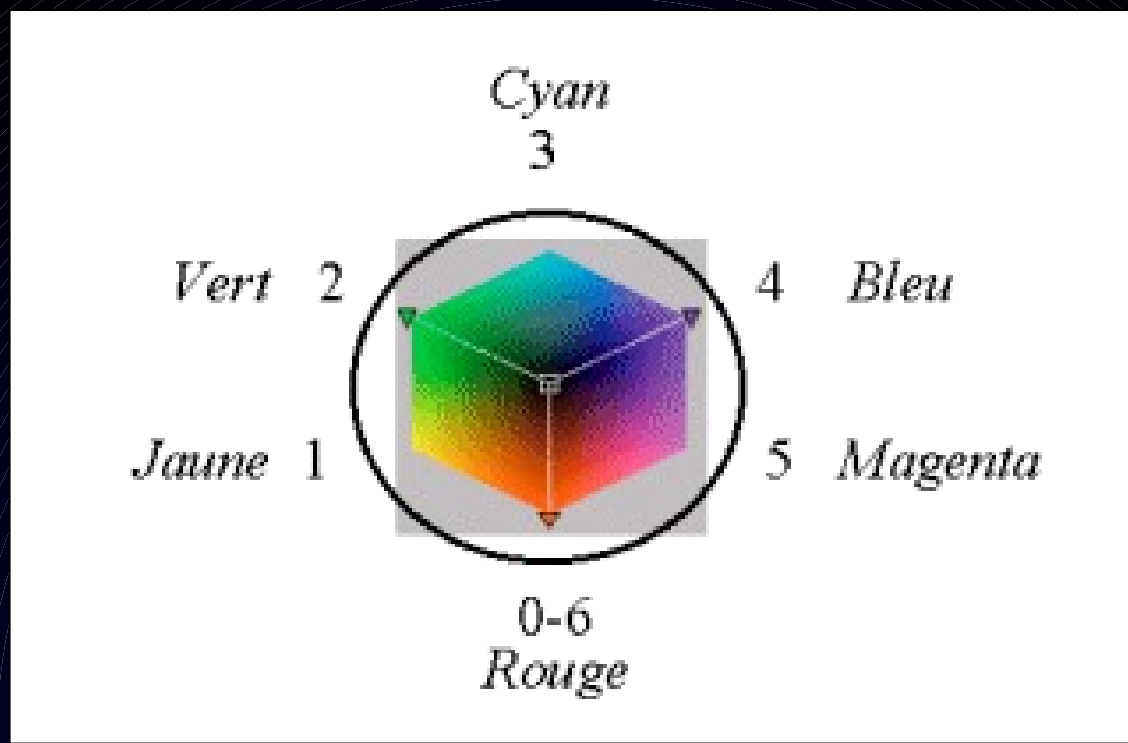
codée de 0 à 6 correspond à une distribution cyclique des couleurs

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

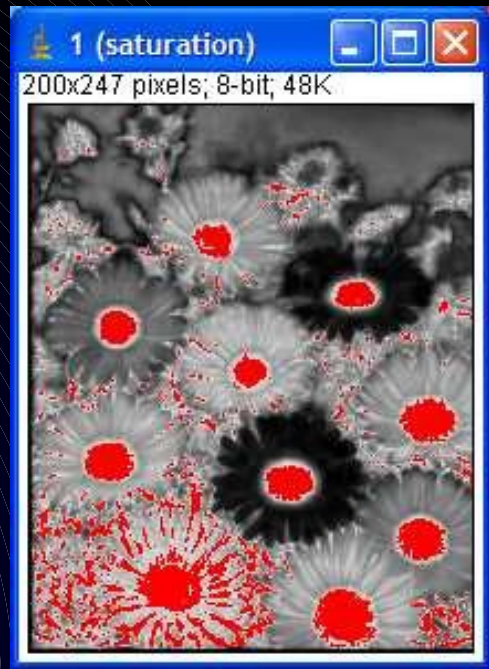
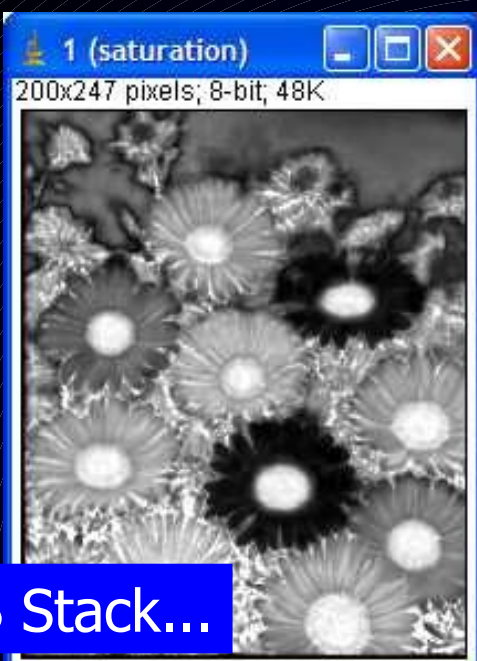
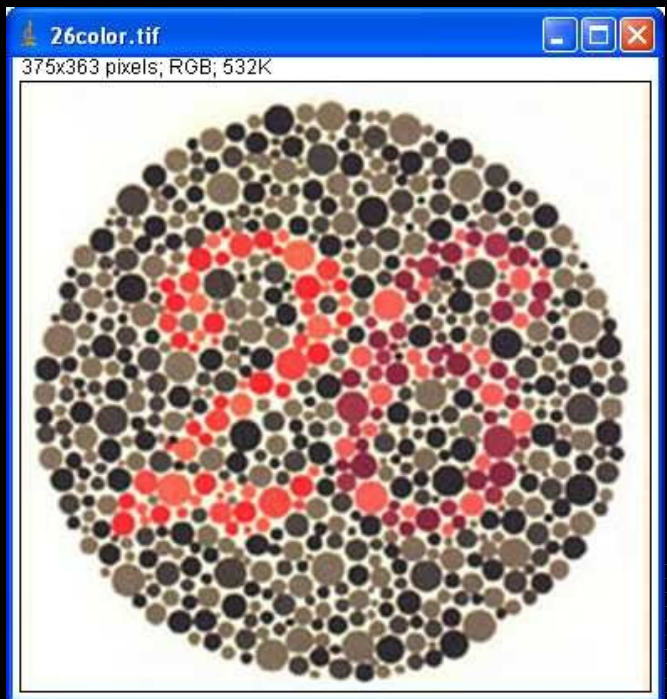


Image → Type → HSB Stack...

Seuillage couleur



Threshold Color (experimental)

Hue

Saturation

Brightness

Thresholding method: Default

Threshold color: B&W

Color space: HSB

Dark background

Original Filtered Select Sample

Stack Macro Help

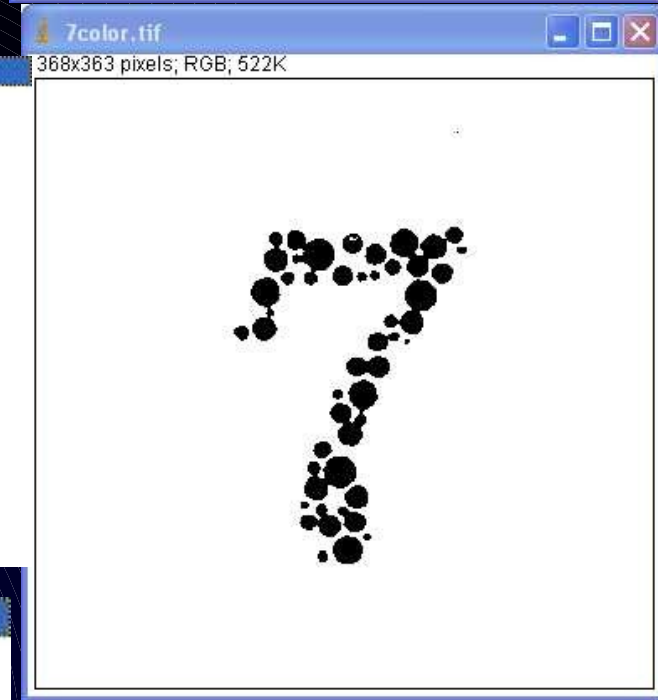
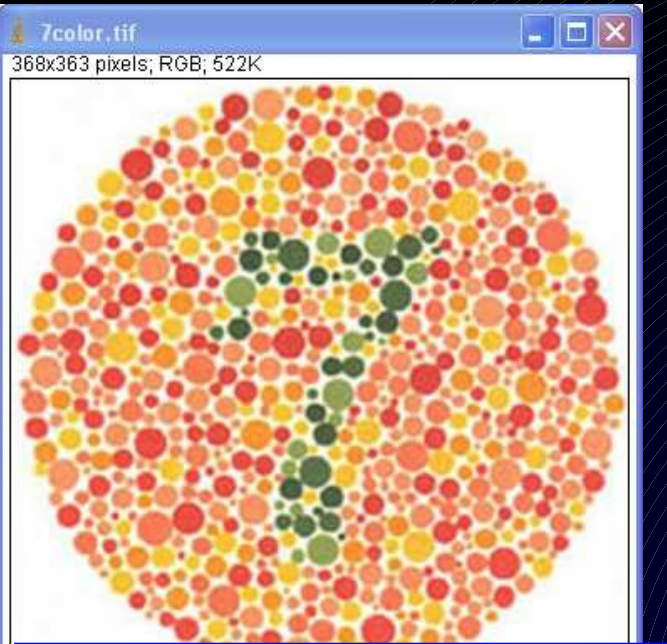
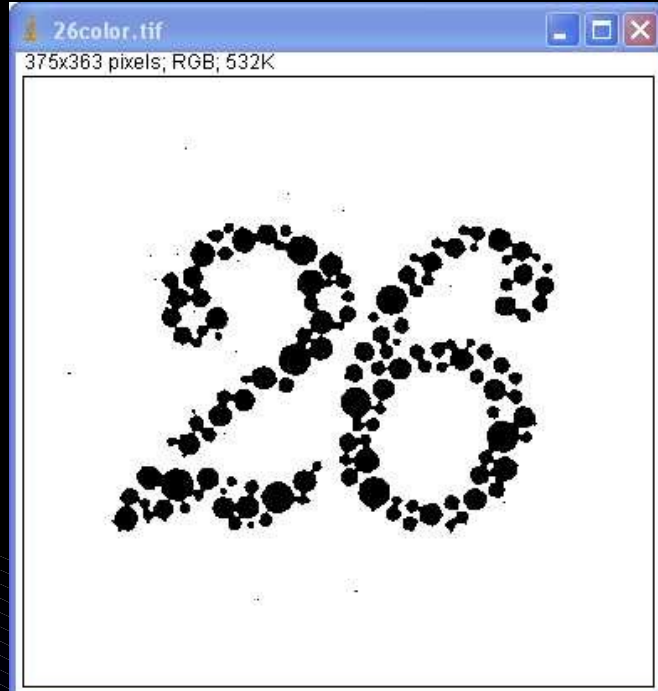
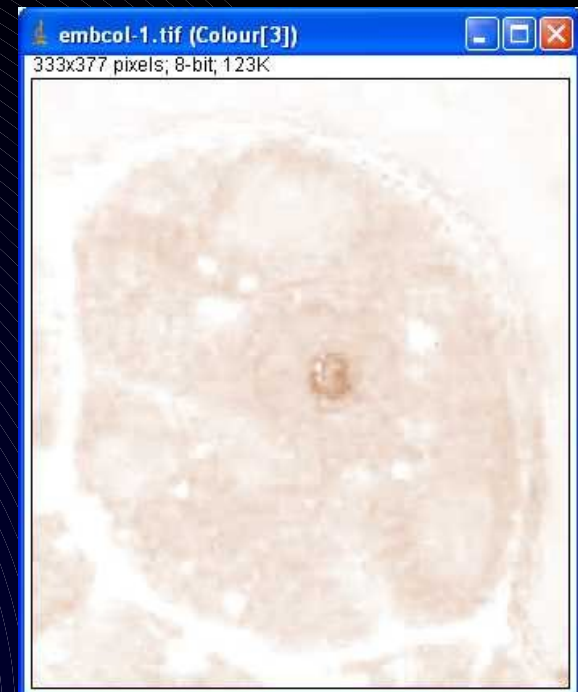
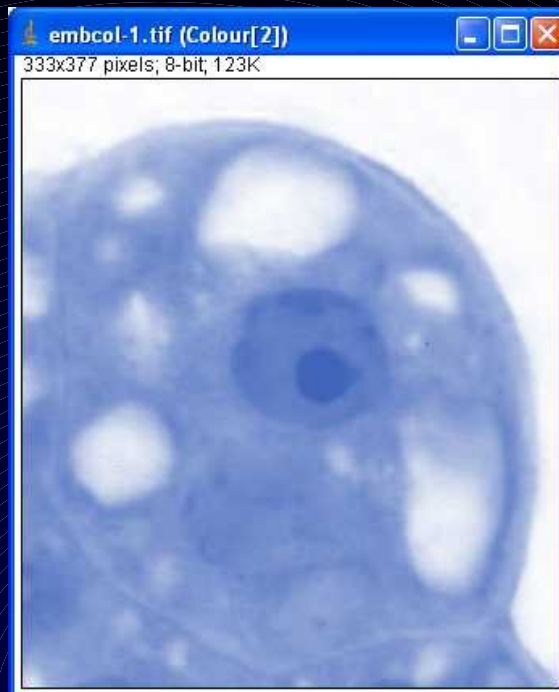
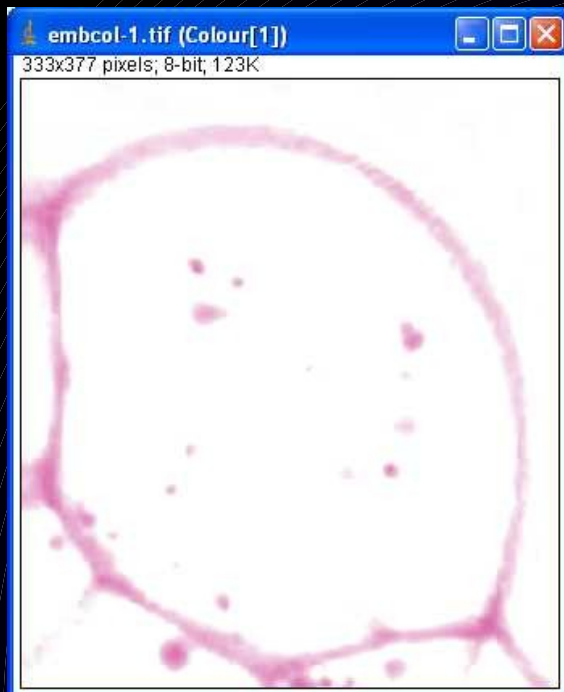
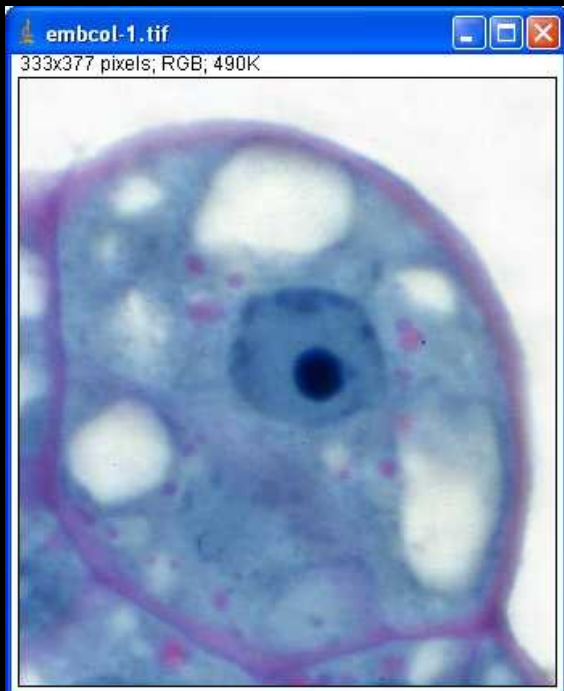


Image → Adjust → Color Threshold..

- Default
- Huang
- Intermodes
- IsoData
- IJ_IsoData
- 1Li
- MaxEntropy
- 2Mean
- MinError
- Minimum
- Moments
- Otsu
- Percentile
- RenyiEntropy
- Shanbhag
- Triangle
- Yen
- HSB**
- RGB
- Lab
- YUV



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:

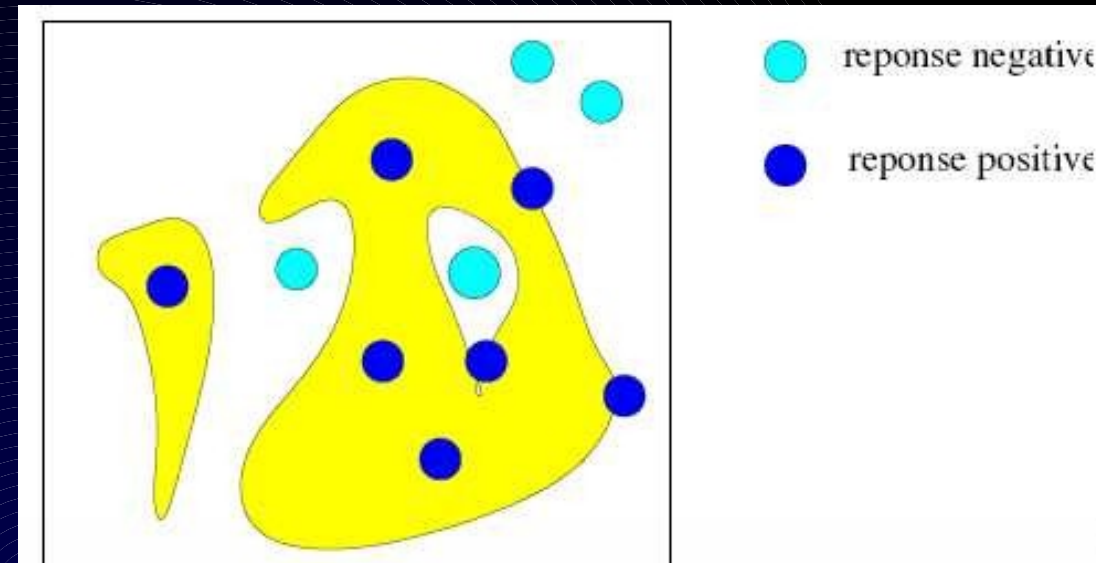
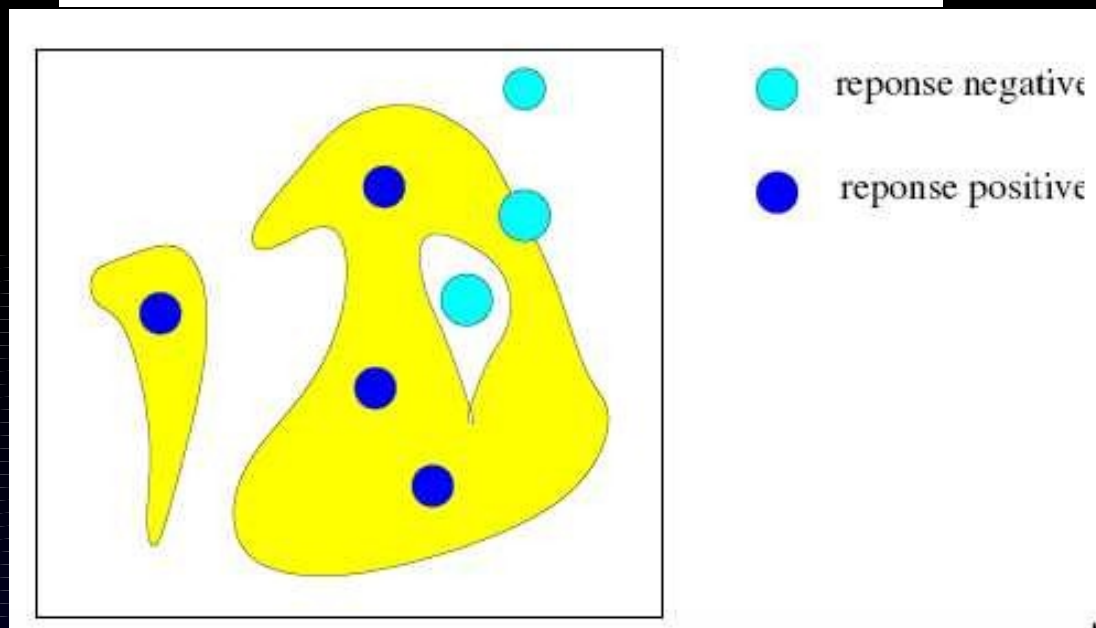
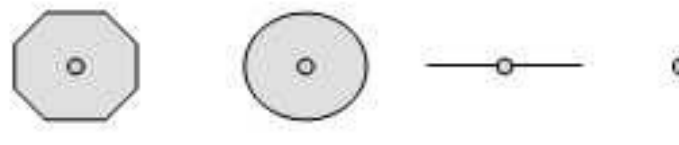
l'élément structurant est inclus dans un objet de l'image

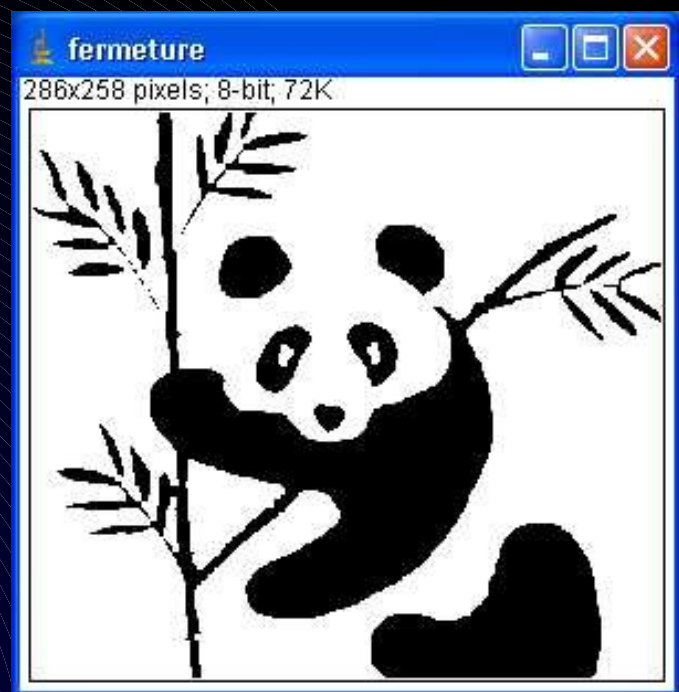
→ EROSION

l'élément structurant touche un objet de l'image

→ DILATATION

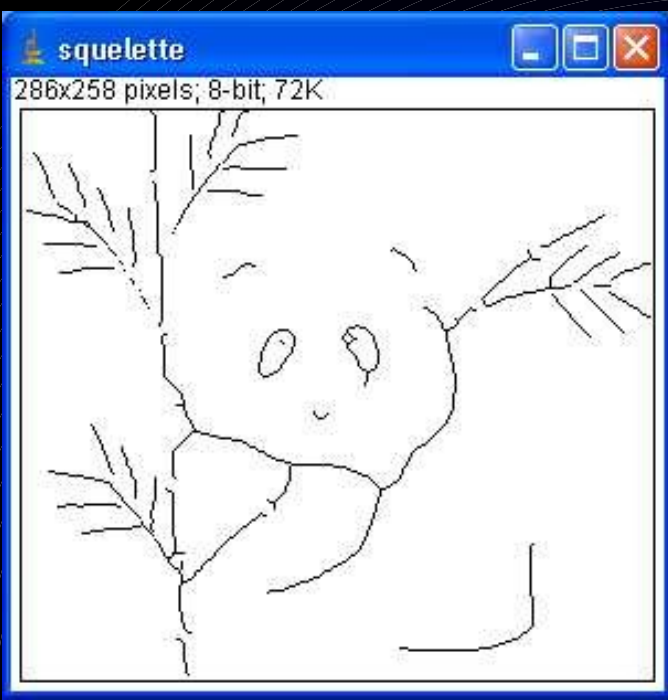
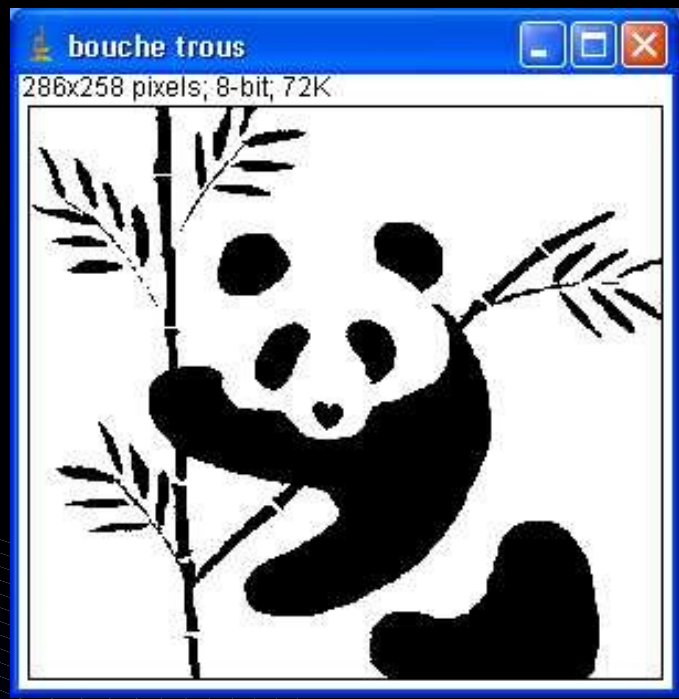
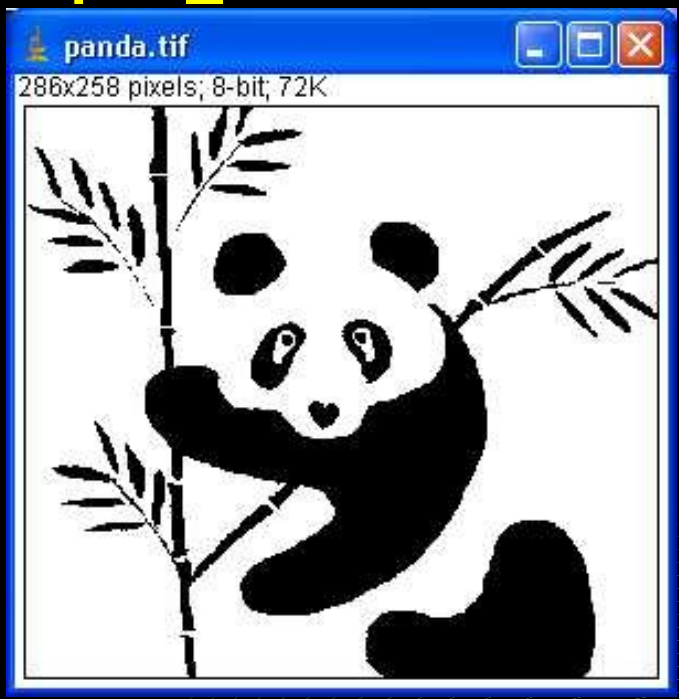
Exemple d'éléments structurants





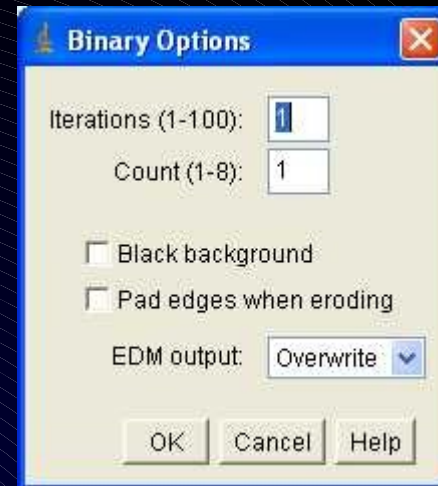
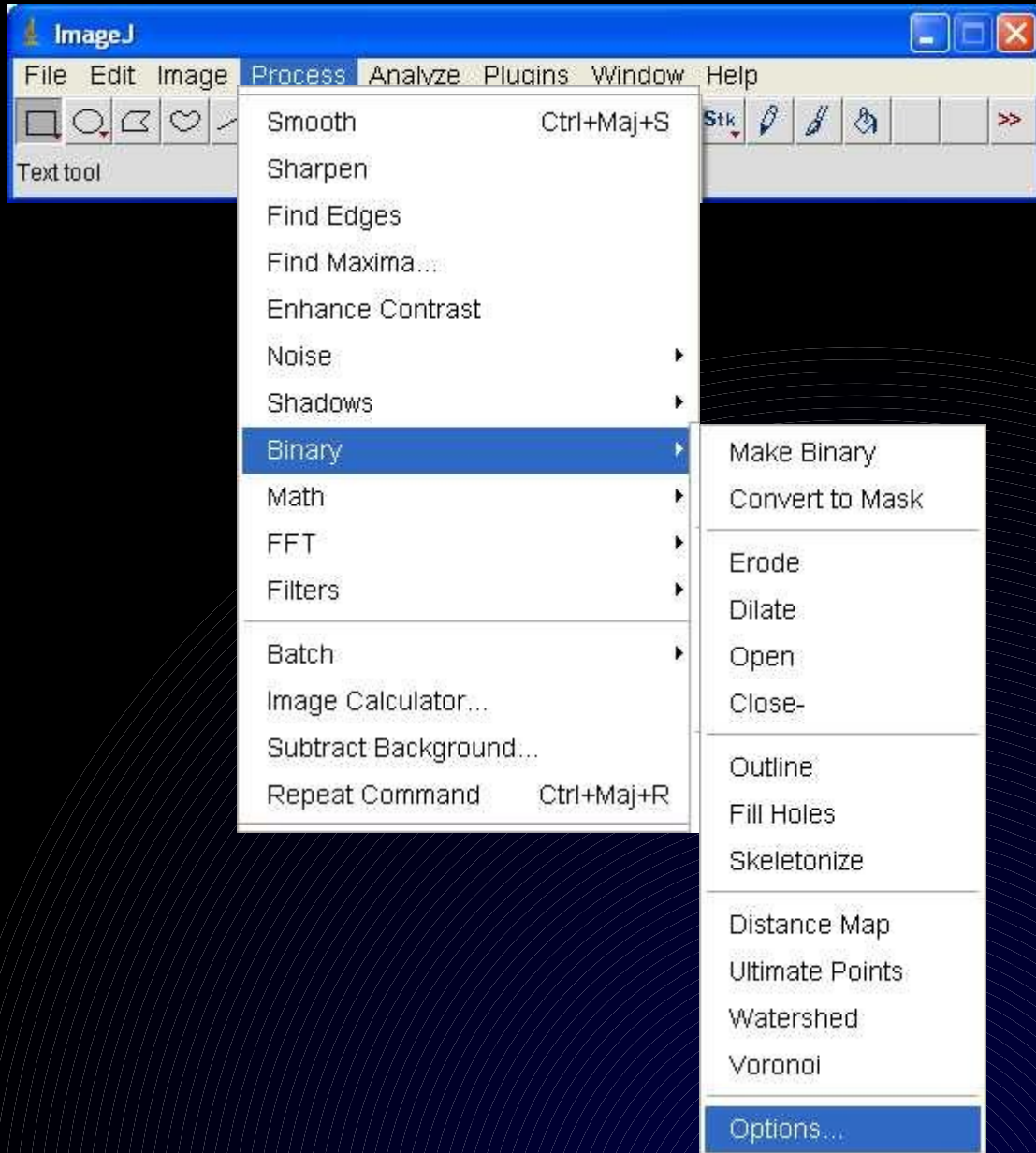


Morpho_math





Menu Binary

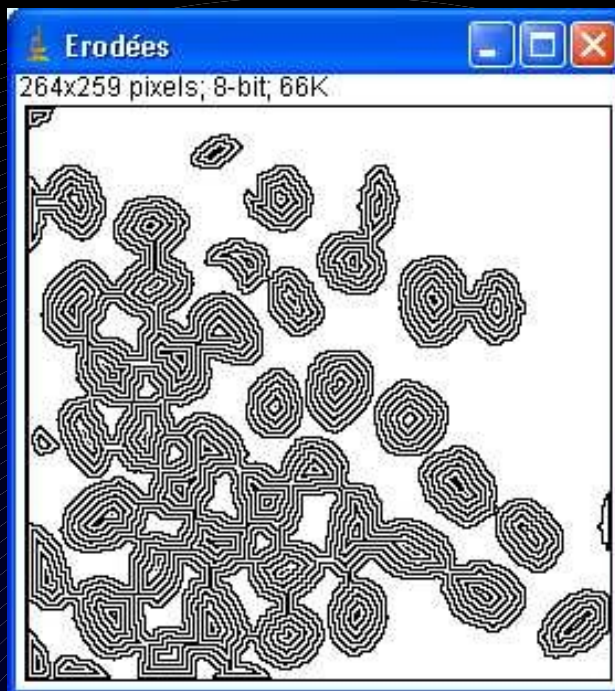
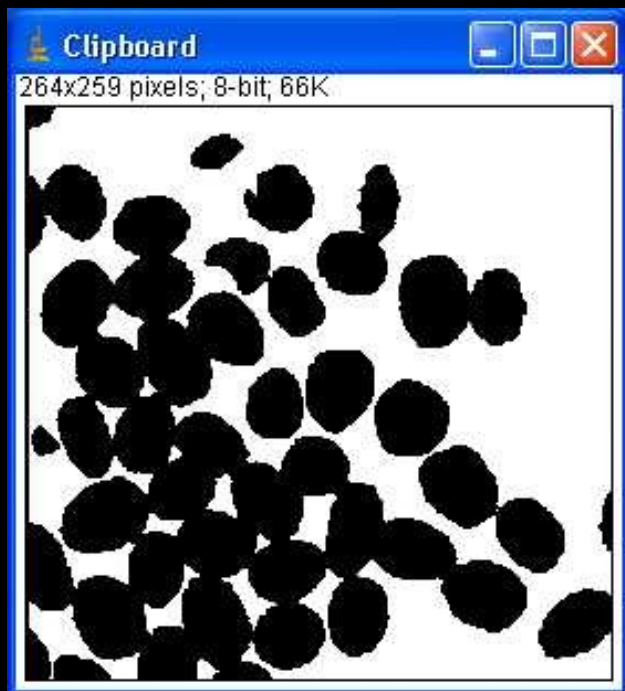


Process→Binary→Options



Erodé Ultime

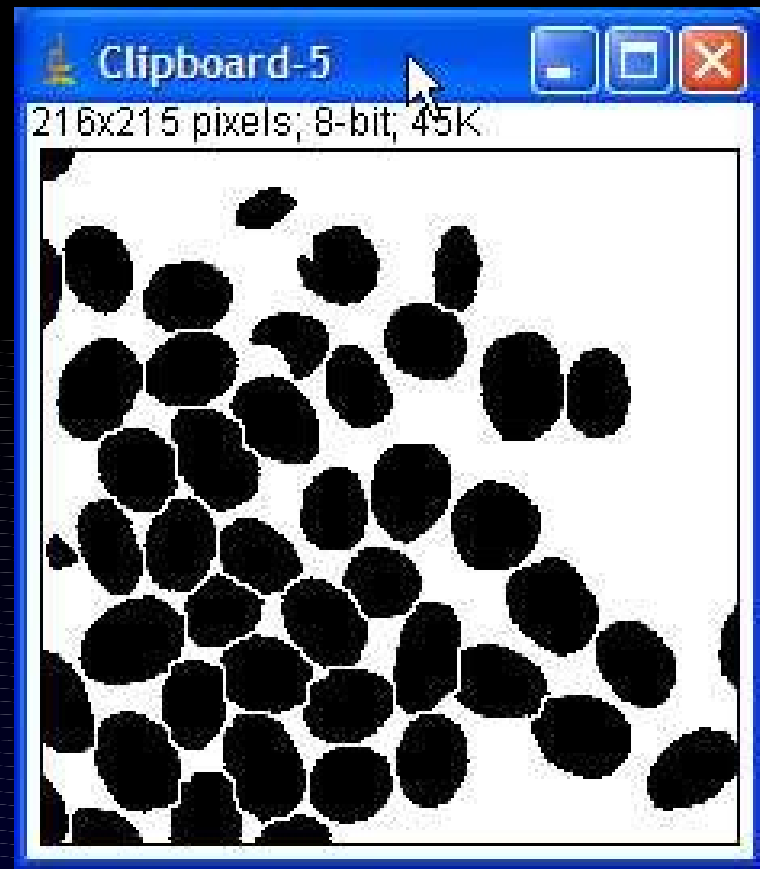
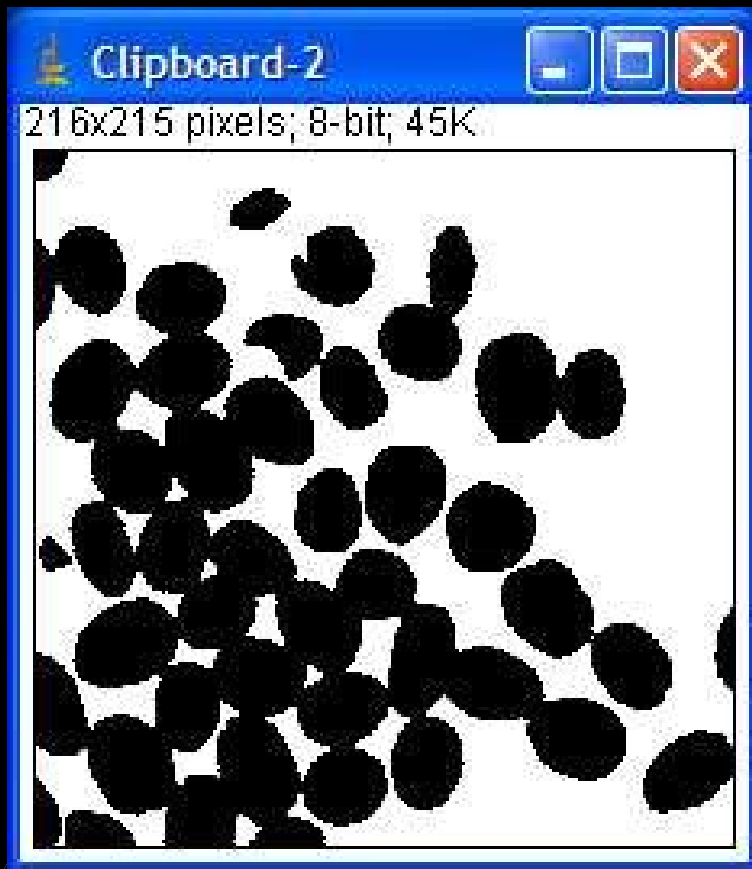
L'érodé ultime : la dernière fraction de l'objet restant avant sa disparition lors d'érosions répétées.



Process → Binary → Ultimate Points



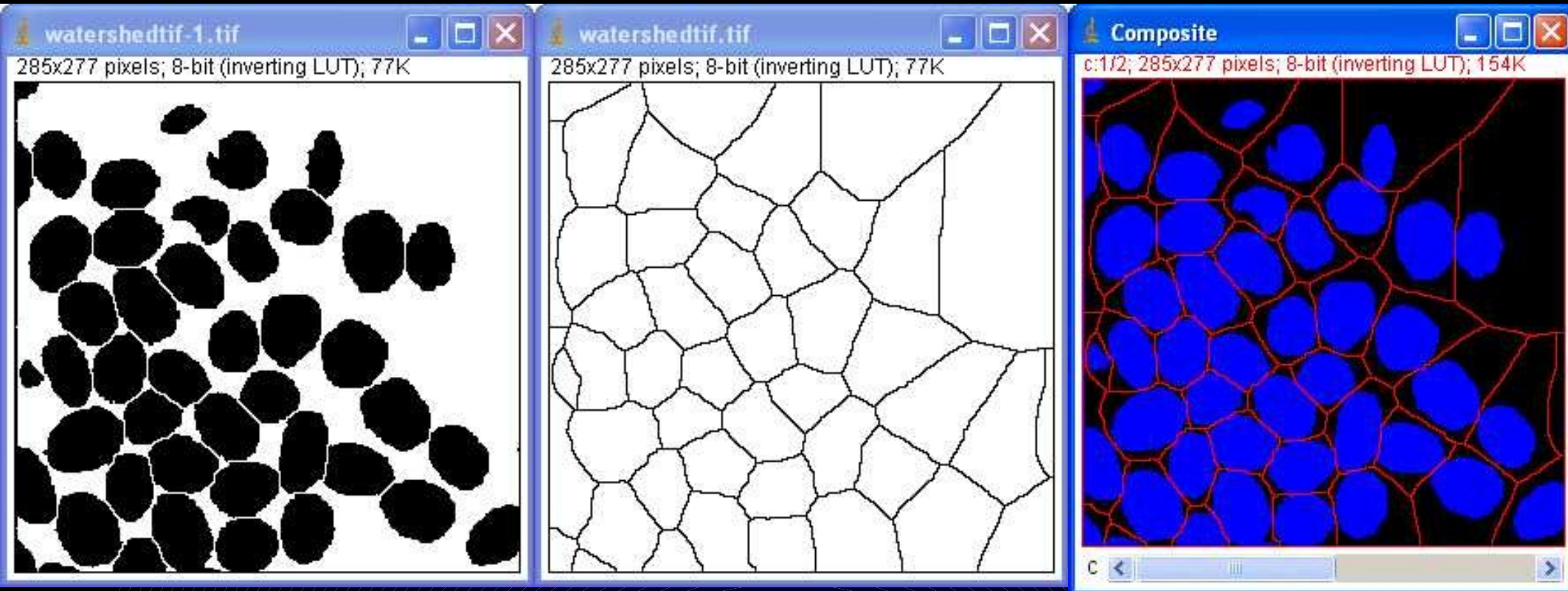
La ligne de partage des eaux : watershed



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

Process→Binary→Watershed

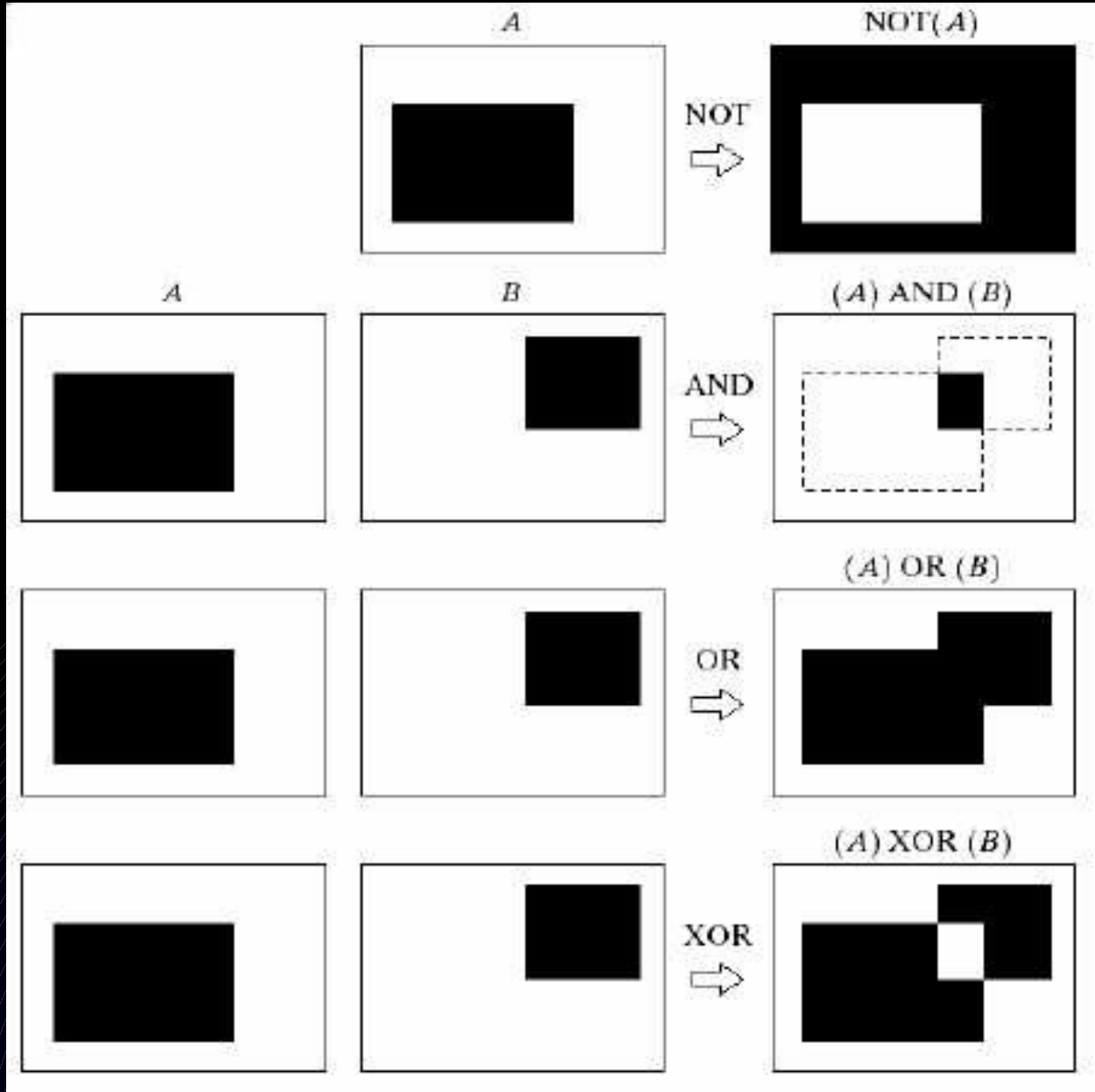
Diagramme de Voronoï



Process → Binary → Voronoï



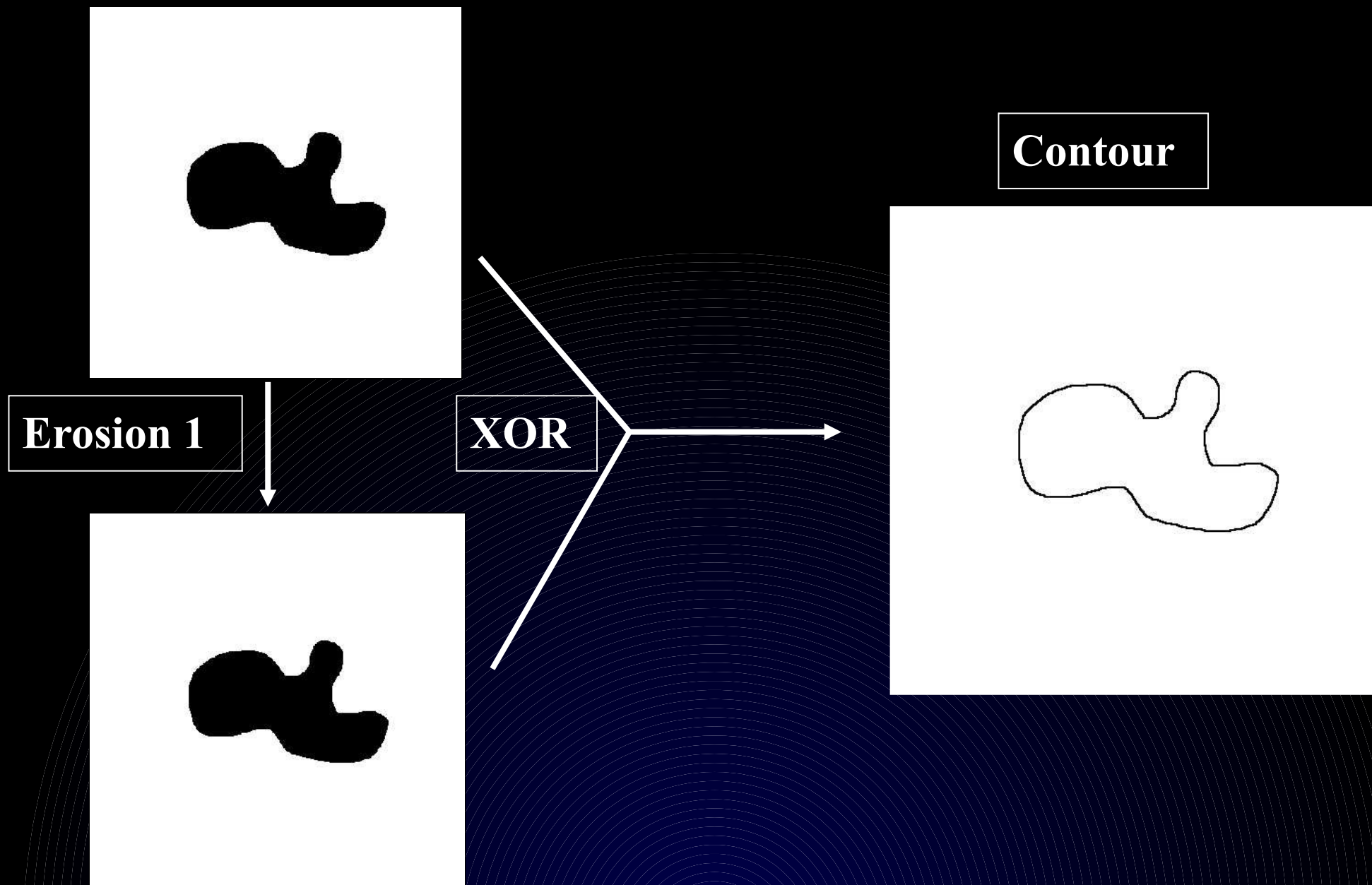
Opérations logiques

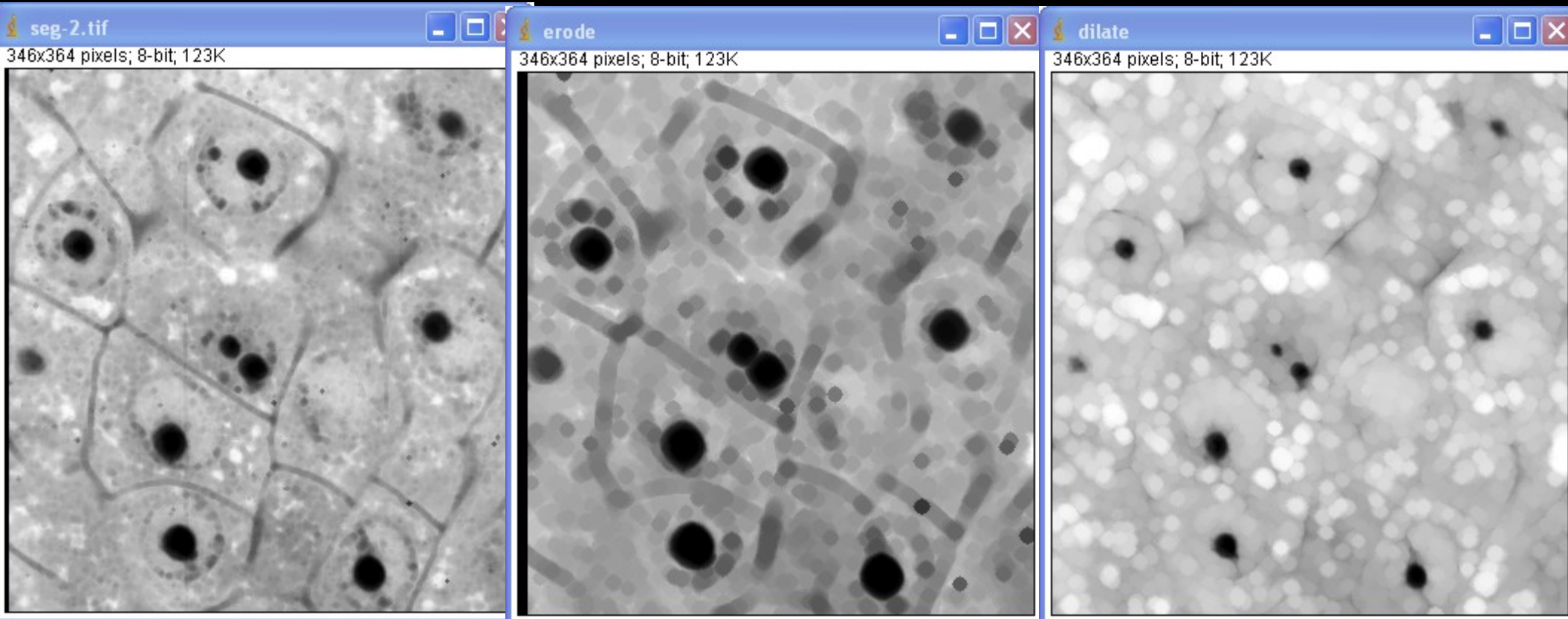


Process→Image Calculator...



Construction d'une fonction contour





**Plugin
Grayscale Morphology**

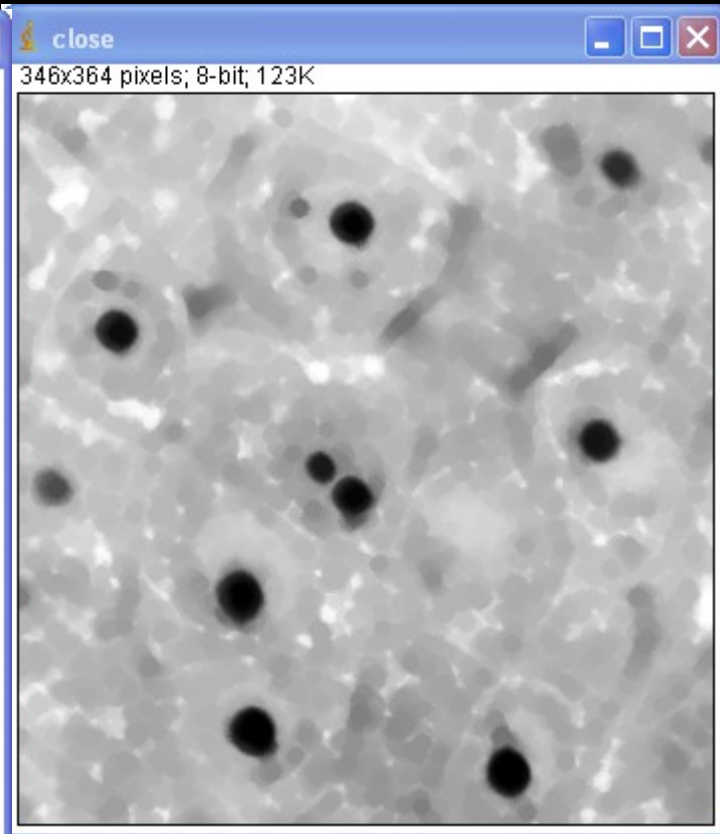
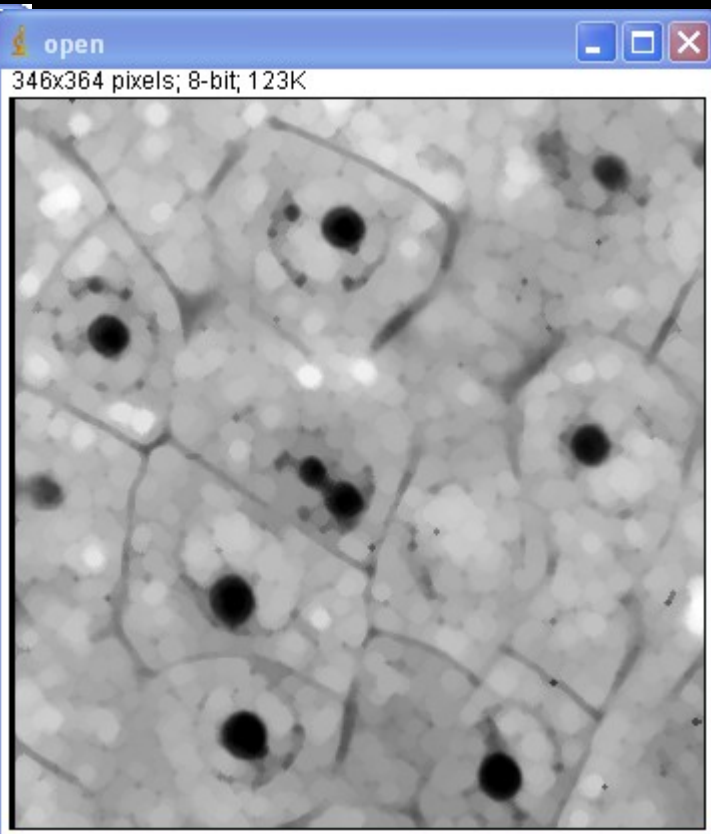
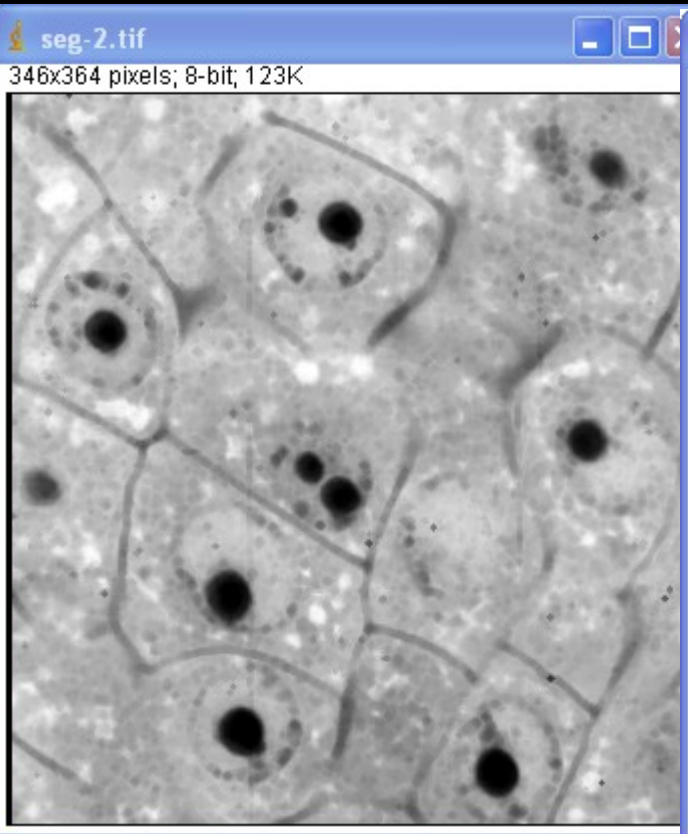
**Erosion
Valeur inferieure
Image<-> élément
structurant**

**Dilatation
Valeur supérieur
Image<-> élément
structurant**

Plugins→Morphology→Gray Morphology



Morpho_math en niveaux de gris



Ouverture
Erosion puis
Dilatation

Fermeture
Dilatation puis
Erosion

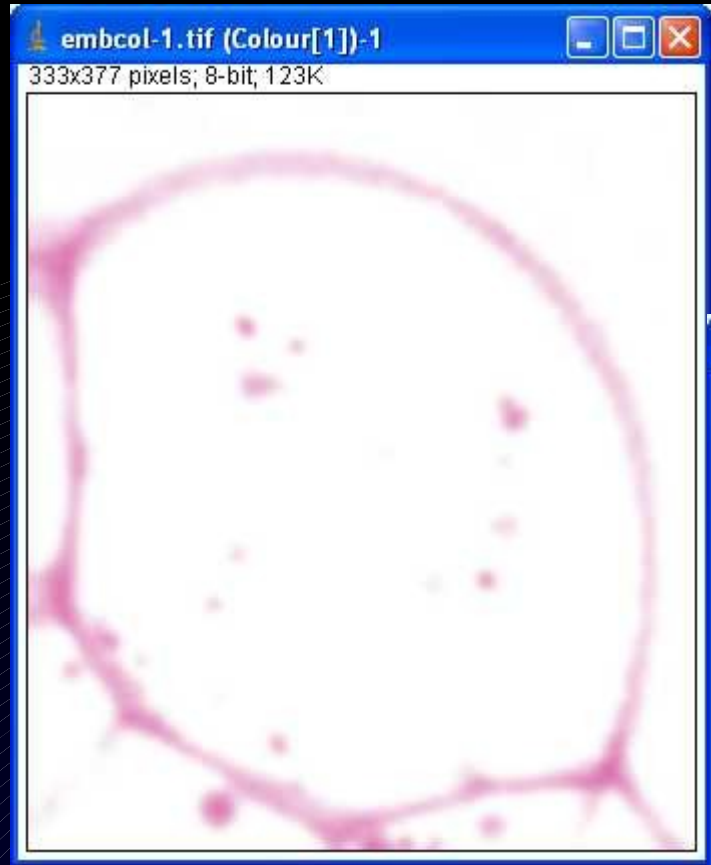
Plugins → Morphology → Gray Morphology



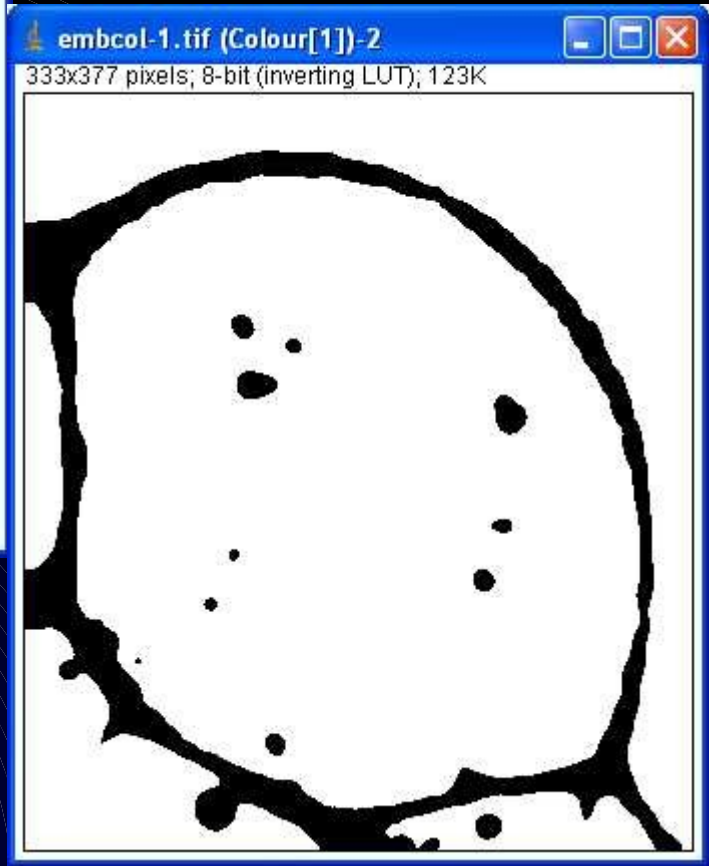
Exemple



Colour Deconvolution



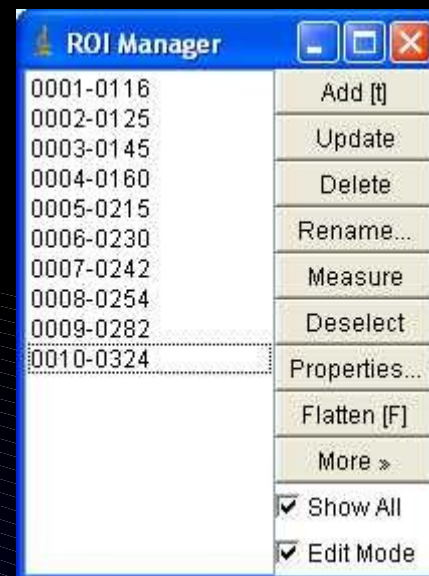
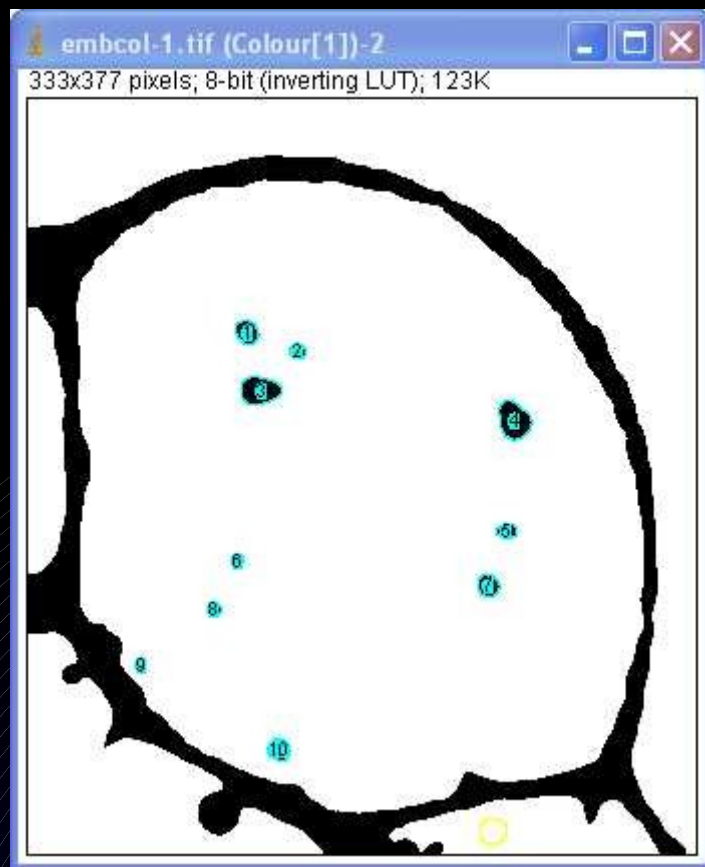
Seuillage





Exemple

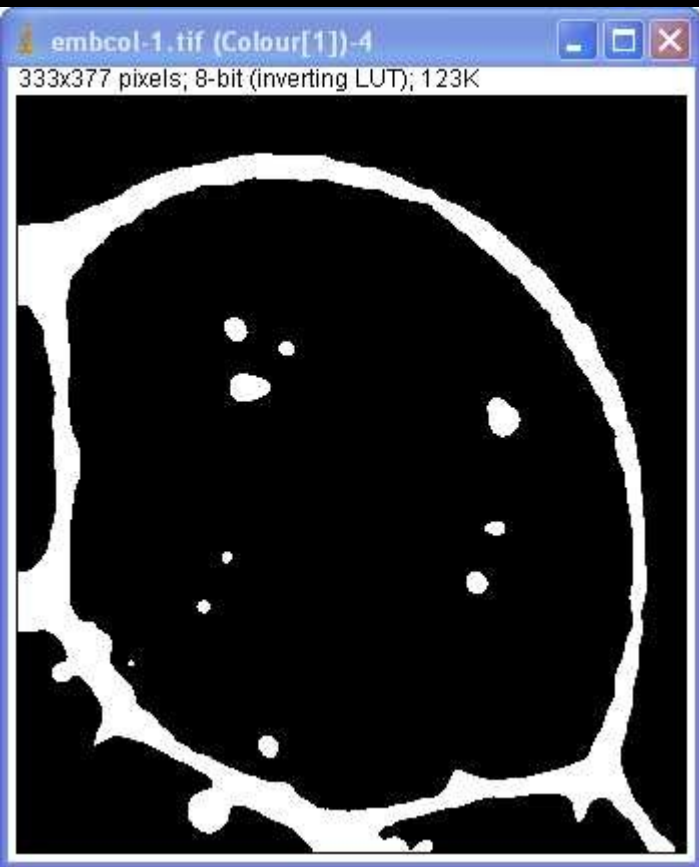
Analyse particules → ROI Manager



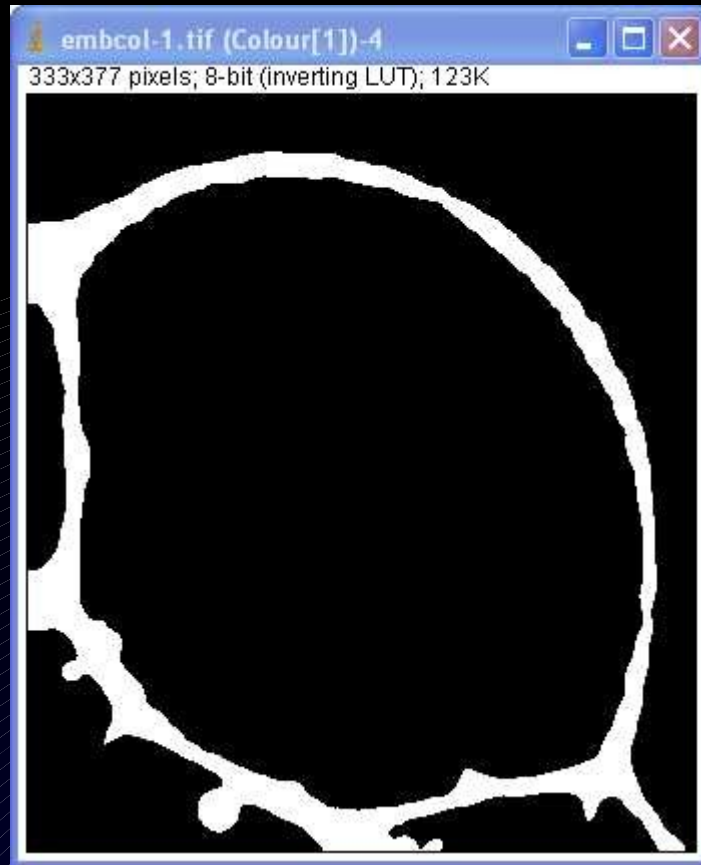


Exemple

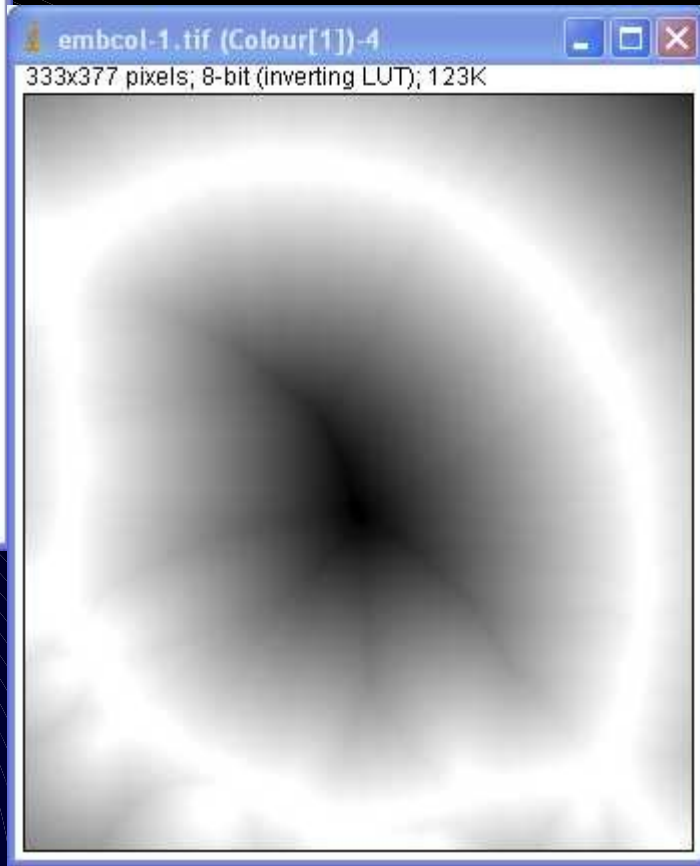
Inversion



Boucher les trous



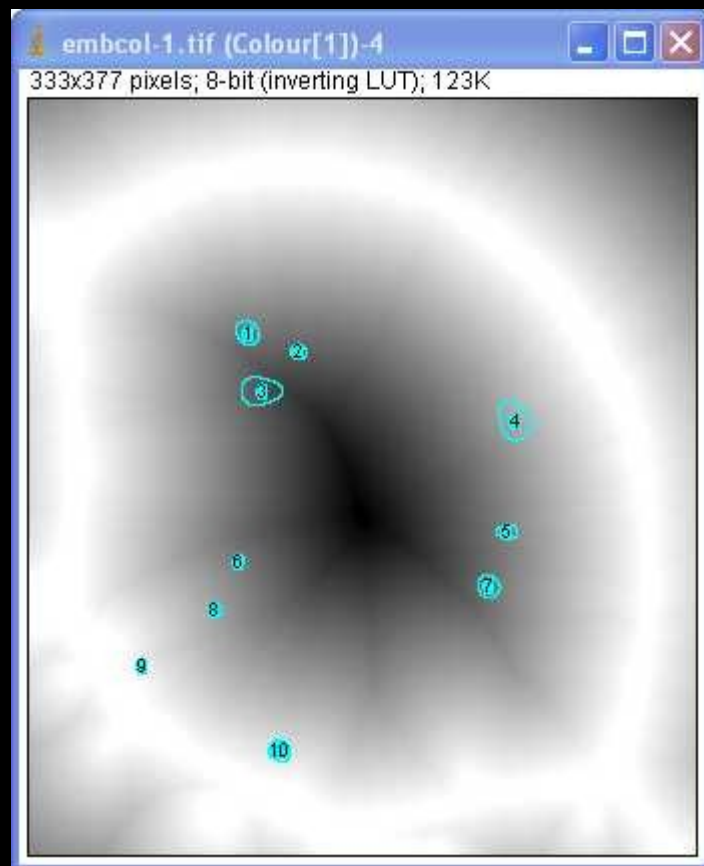
Carte des distances





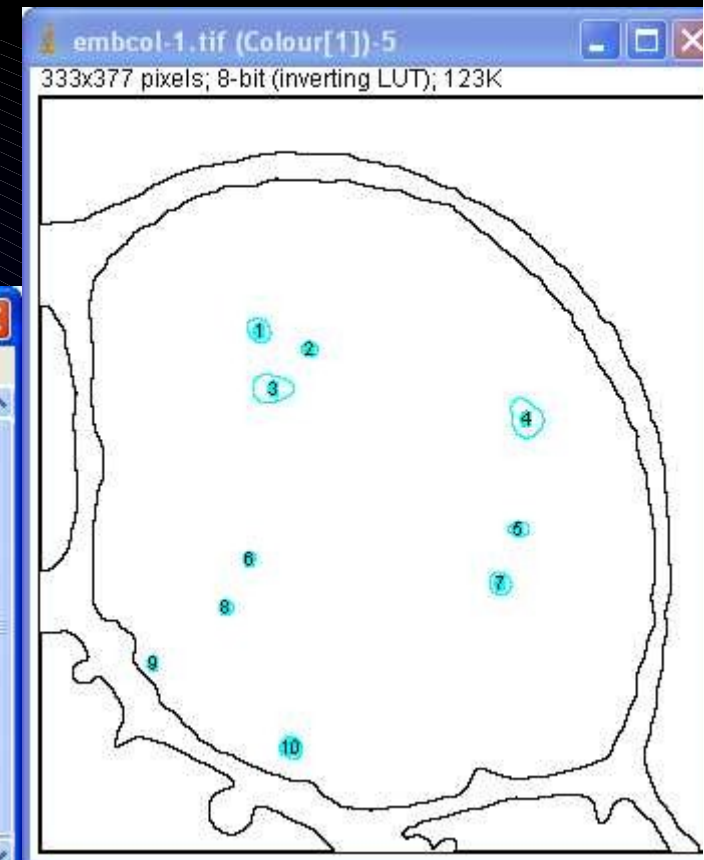
Exemple

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



ROI ID	Bounding Box
0001	0116
0002	0125
0003	0145
0004	0160
0005	0215
0006	0230
0007	0242
0008	0254
0009	0282
0010	0324

File	Edit	Font	Results
	Area	Mean	
1	107	72.196	
2	46	84.174	
3	220	89.295	
4	235	46.170	
5	57	67.368	
6	24	71	
7	95	76.737	
8	33	49.273	
9	7	8.143	
10	88	16.625	





Topic 09 – Mathematical Morphology



L'image numérique

Les Prétraitements

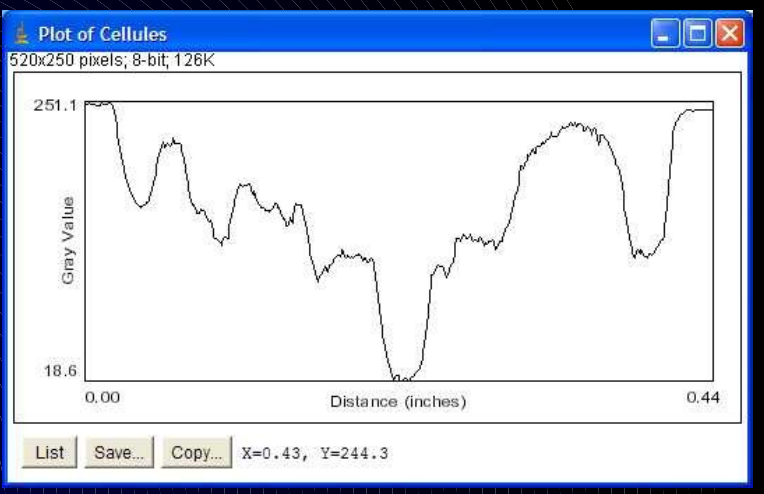
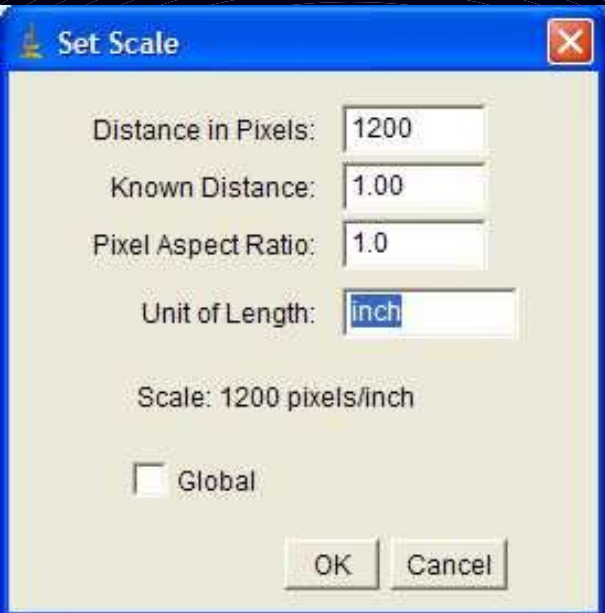
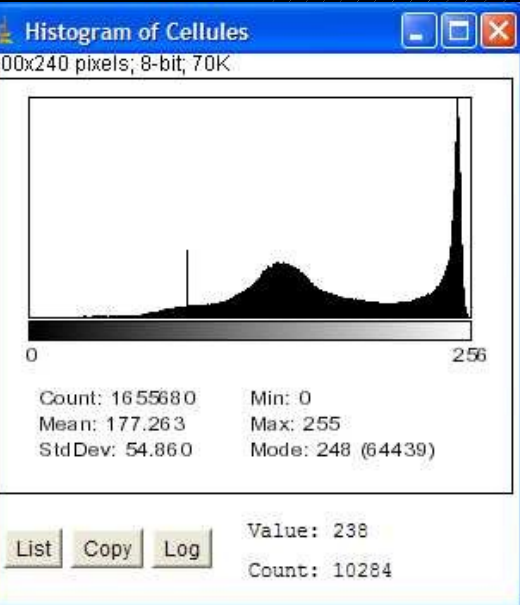
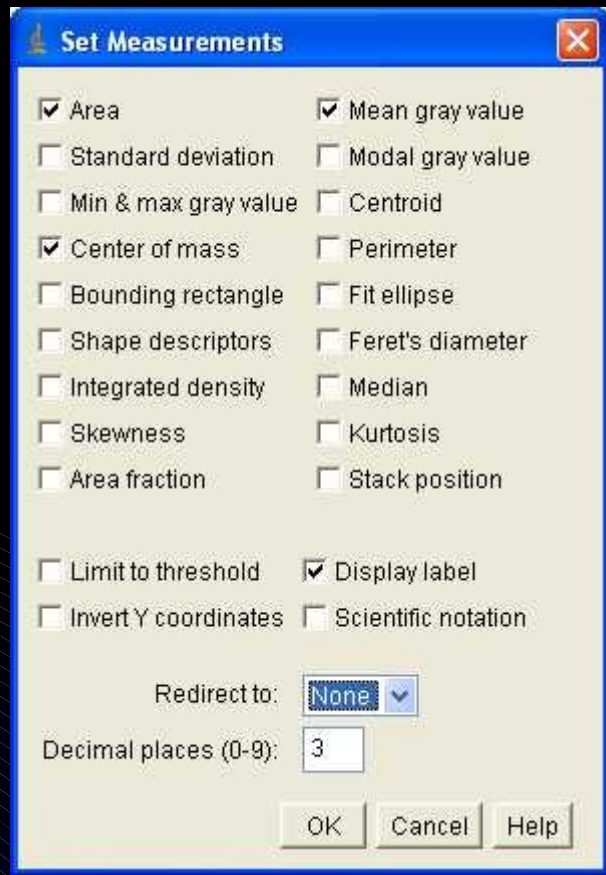
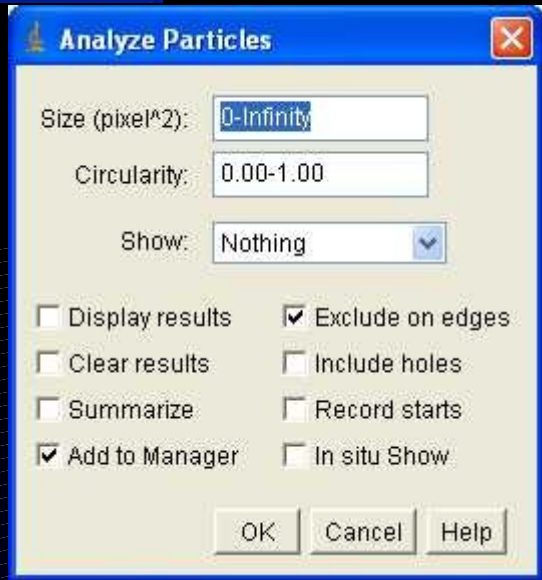
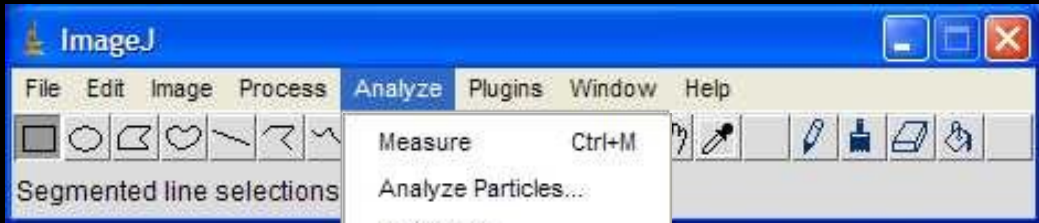
La Segmentation

Les Post-traitements

La Quantification



Mesures



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 : $4\pi(\text{surface} / \text{périmètre}^2) = 1$ pour un cercle
- Etc ...



Topic 10 – Quantification