Scientific Digital Imaging Portfolio

By Jennifer A. Lentz

Artifact Correction

Artifact Correction

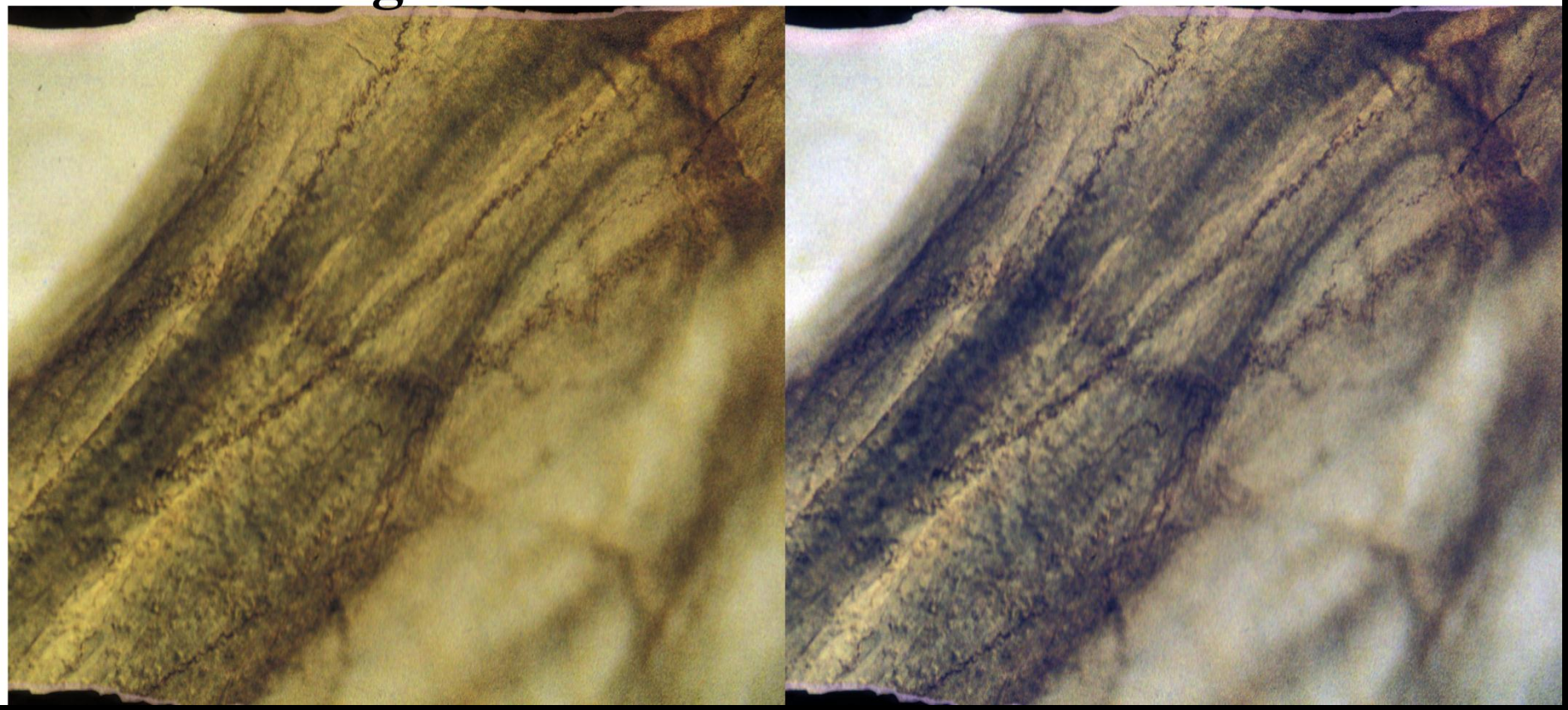
Batt Slide

Original **Processed**

Artifact Correction

Chrysemys mesentery slide

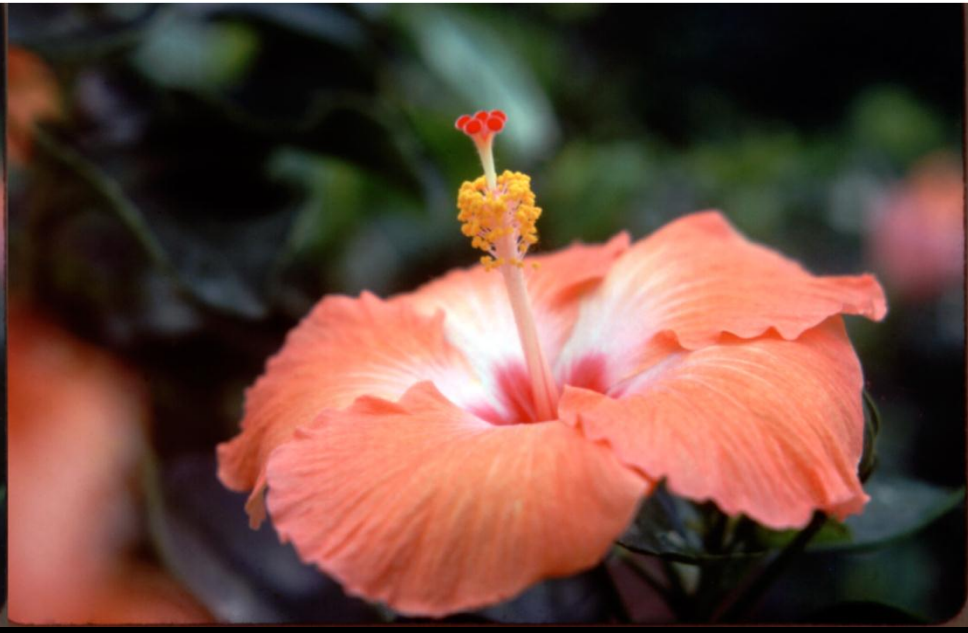
Original **Processed**



Artifact Correction

Original

Processed



Artifact Correction

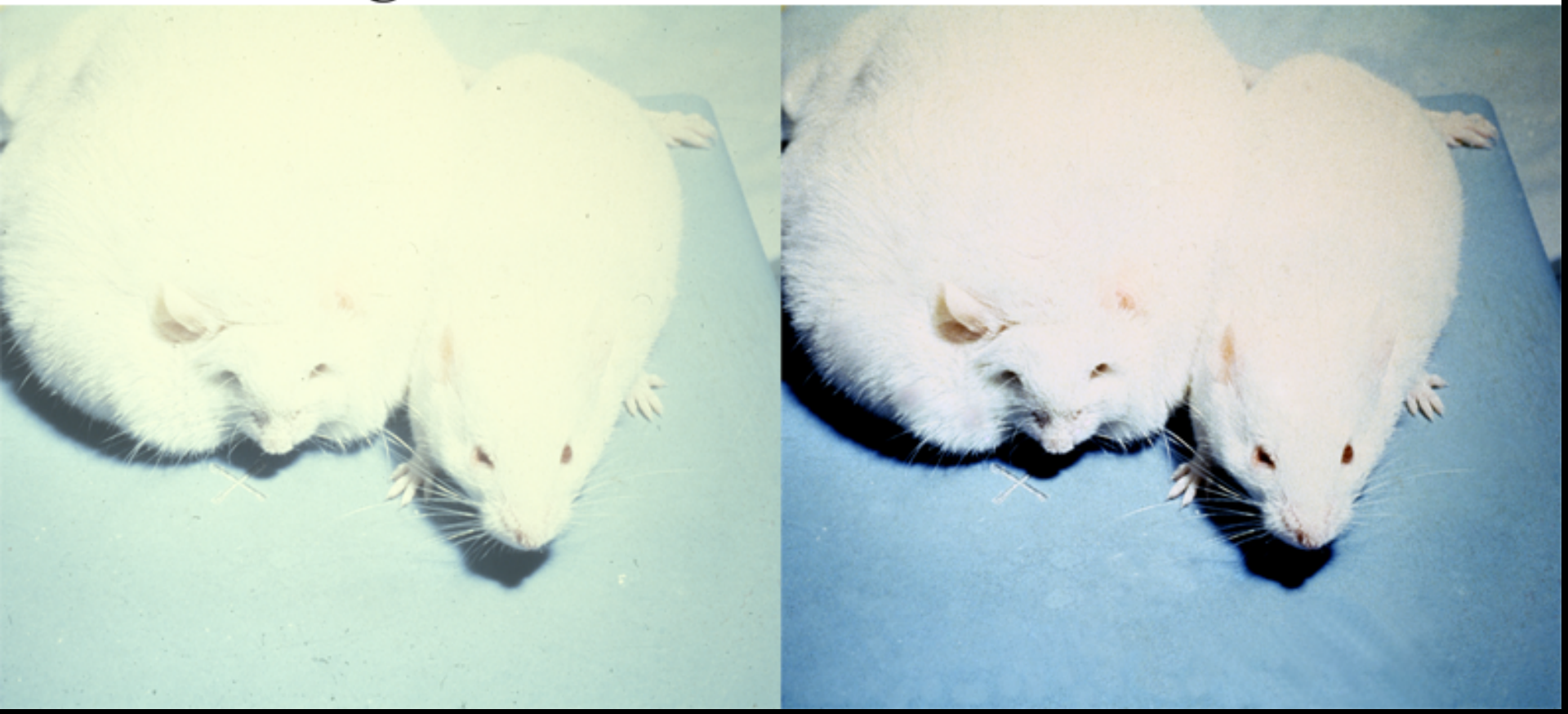
Red-Eye Removal

Original **Processed**

Artifact Correction

White Mice slide

Original **Processed**



Background Removal

Original

Processed

Original

Processed

Original

Processed

Original

Processed

Color Projects

Color Variation Corrections

Original Foxes

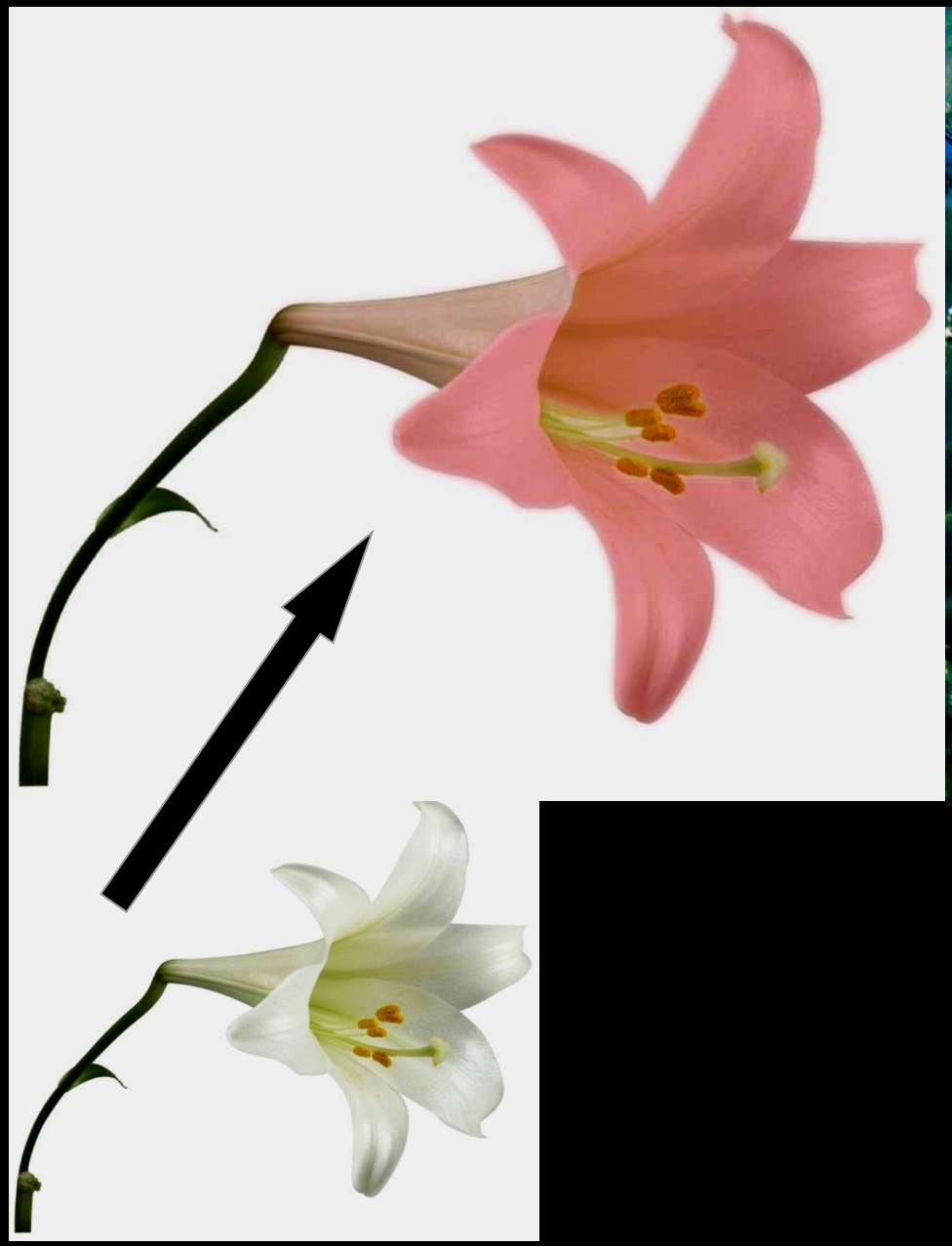
Processed Foxes

Replacing Colors

Original Geko

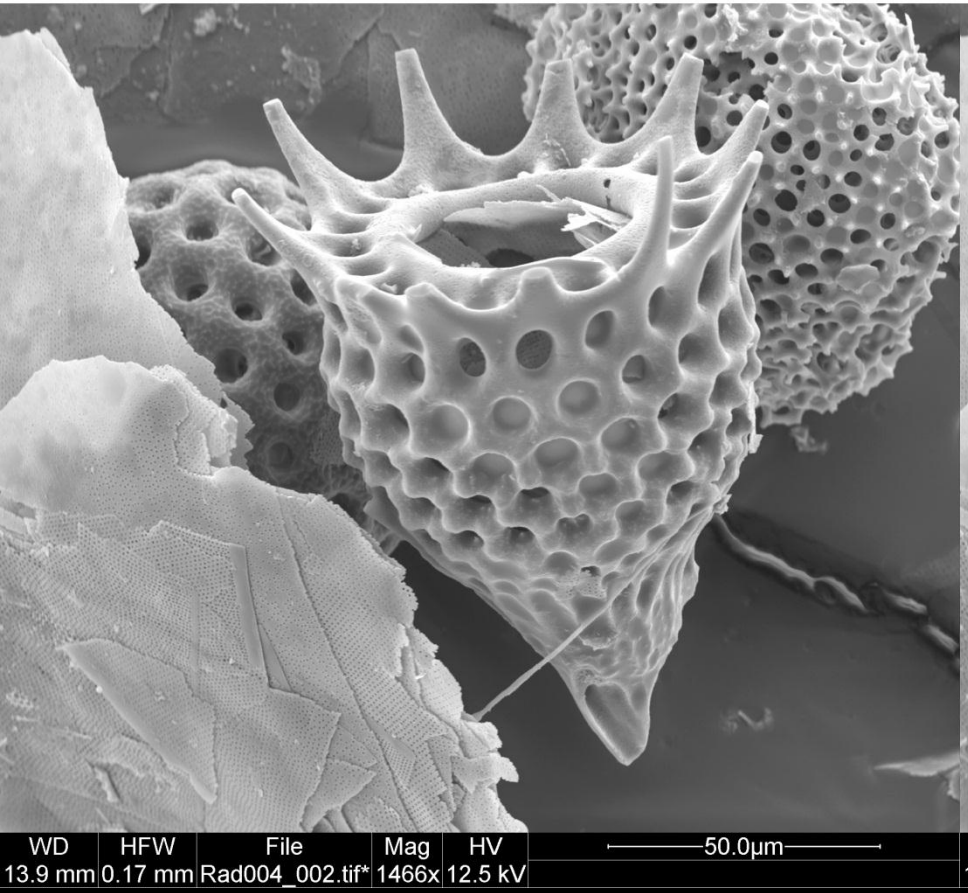
Processed Geko

Pseudo-colored Images

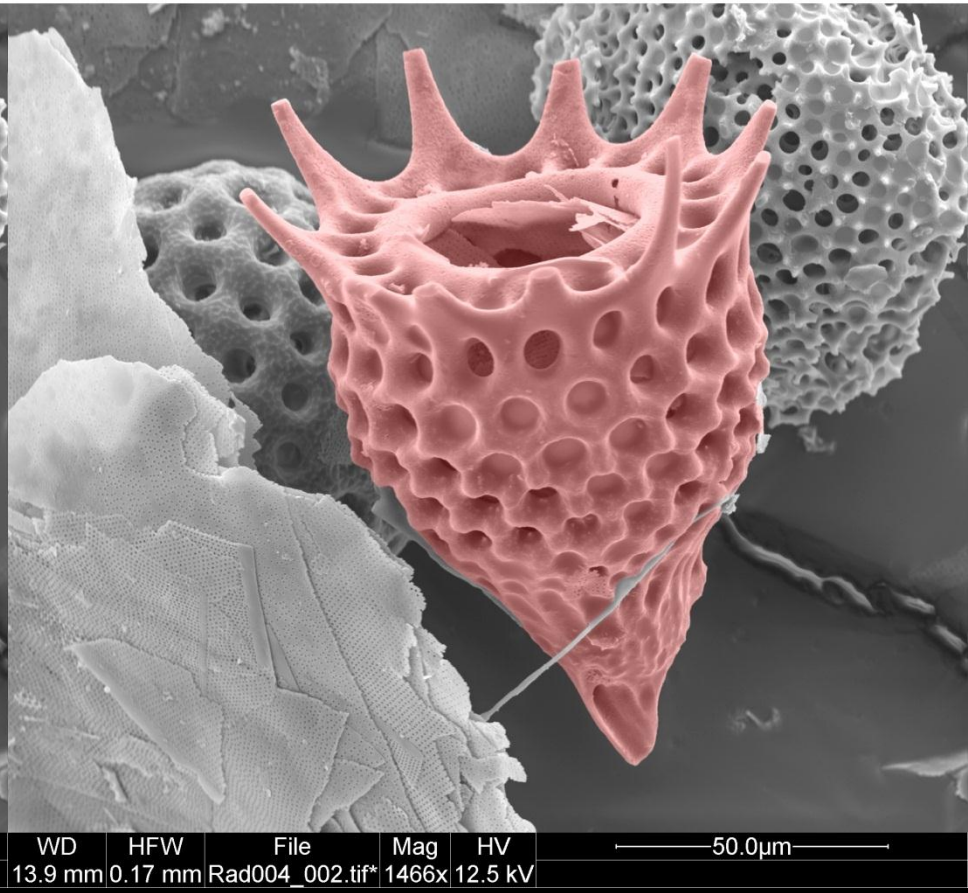


Pseudo-coloring specific areas of a gray scale Image
Using the Magnetic Lasso Selection Method

Original Radiolarian

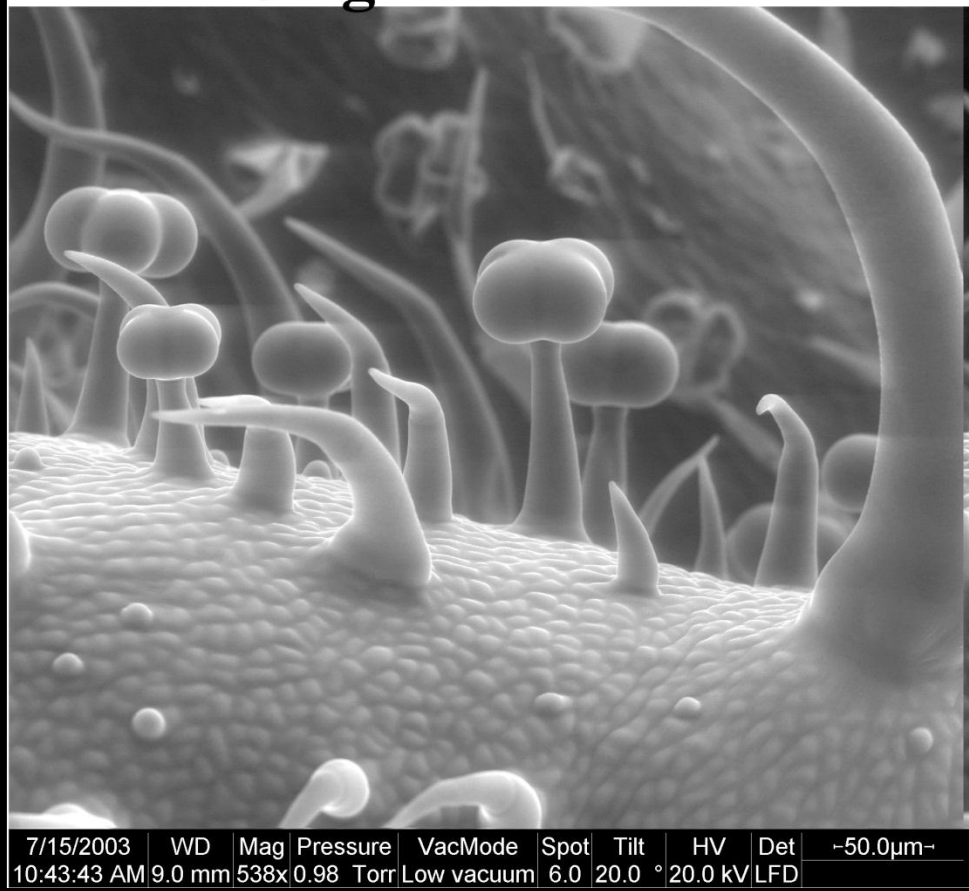


Processed Radiolarian

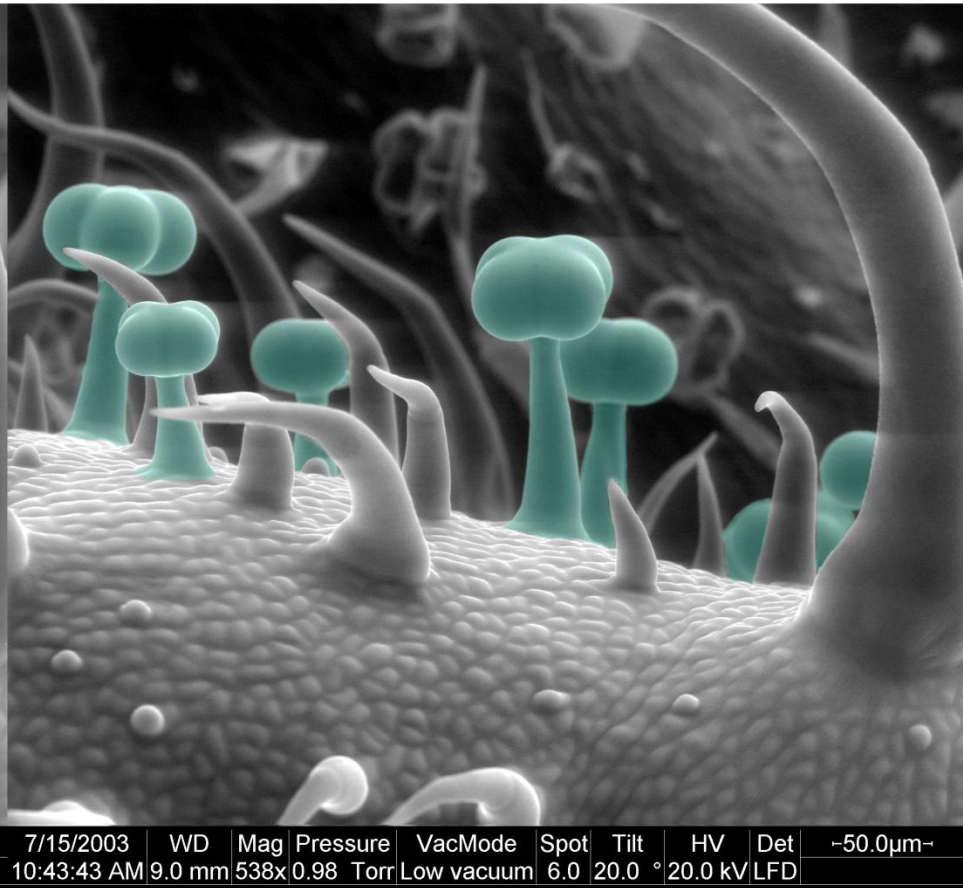


Pseudo-coloring specific areas of a gray scale Image
Using the Quick Mask Method

Original Tomato

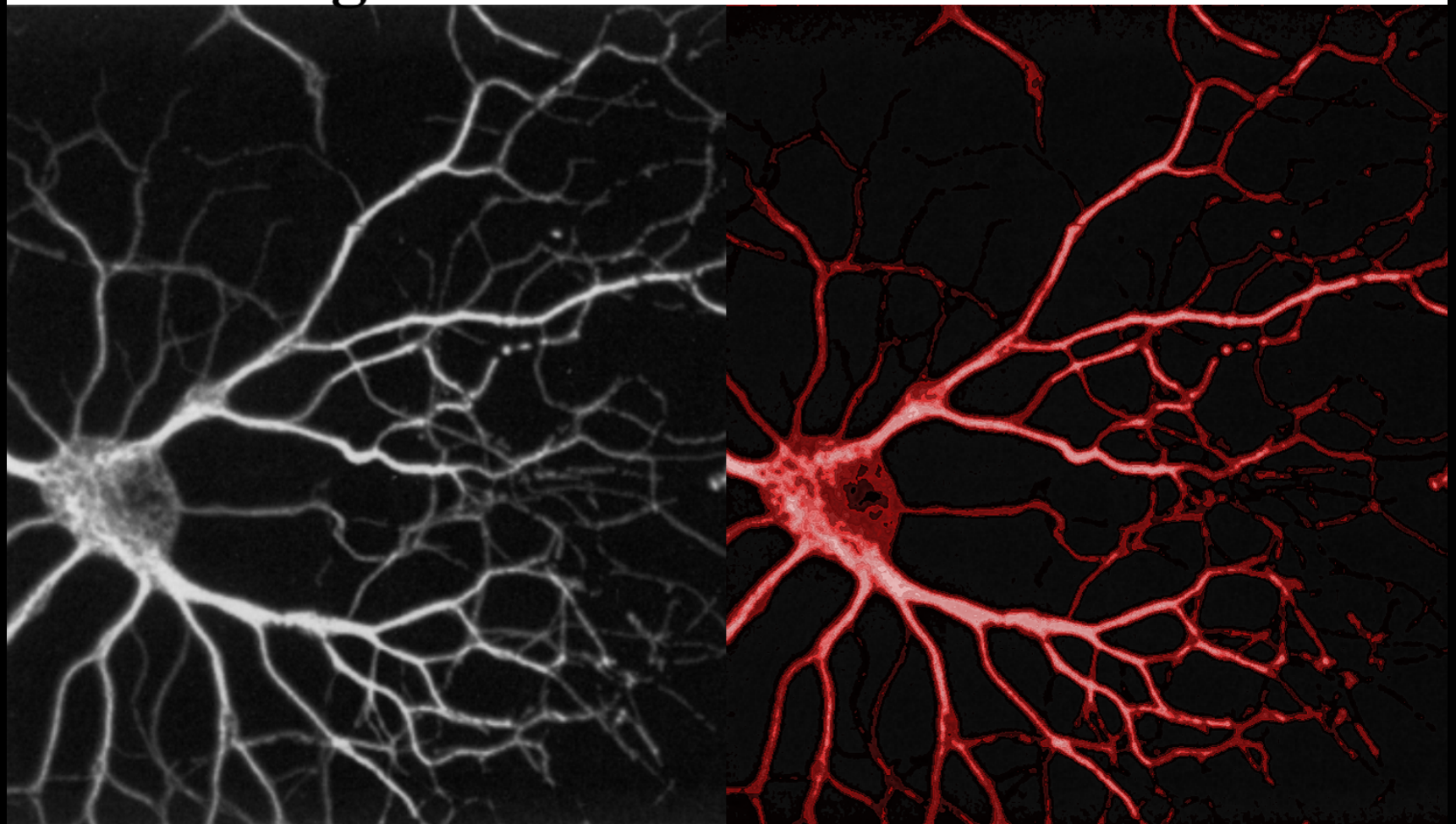


Processed Tomato



Selective Colorization
with a Color Table

Original **Processed**



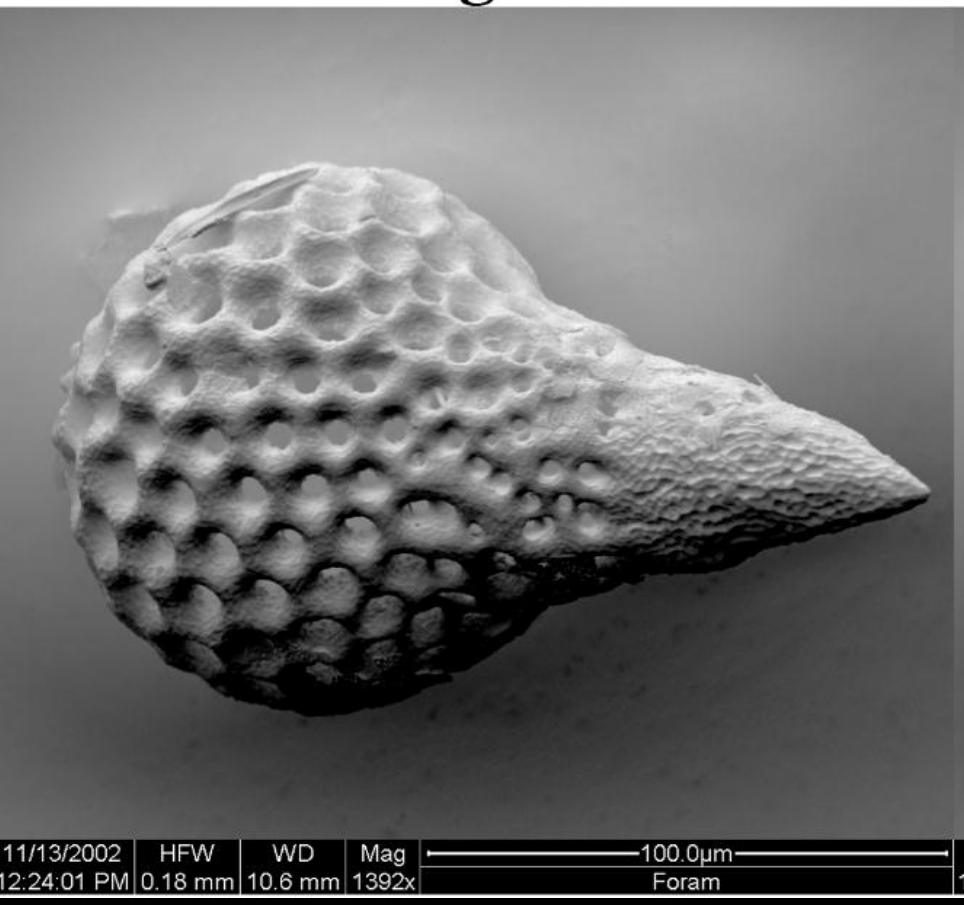
Selective Colorization
with a Color Table

Original **Processed**

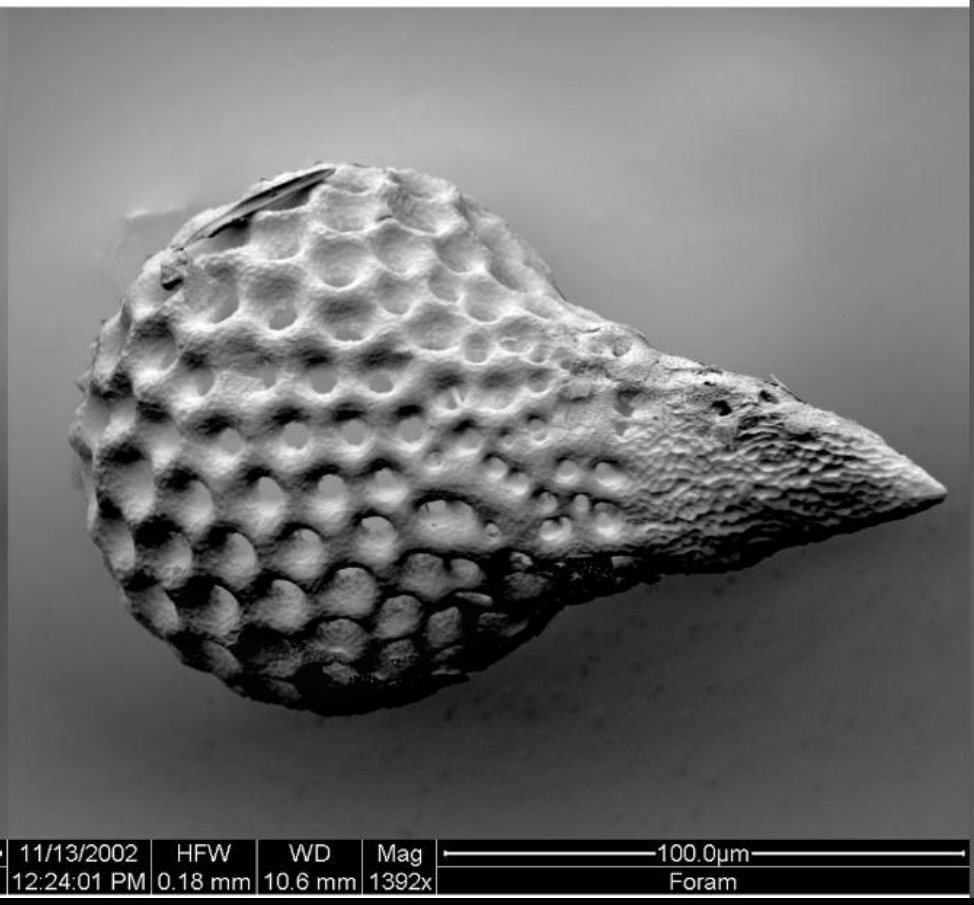
Exposure Correction

Saturation Correction

Original

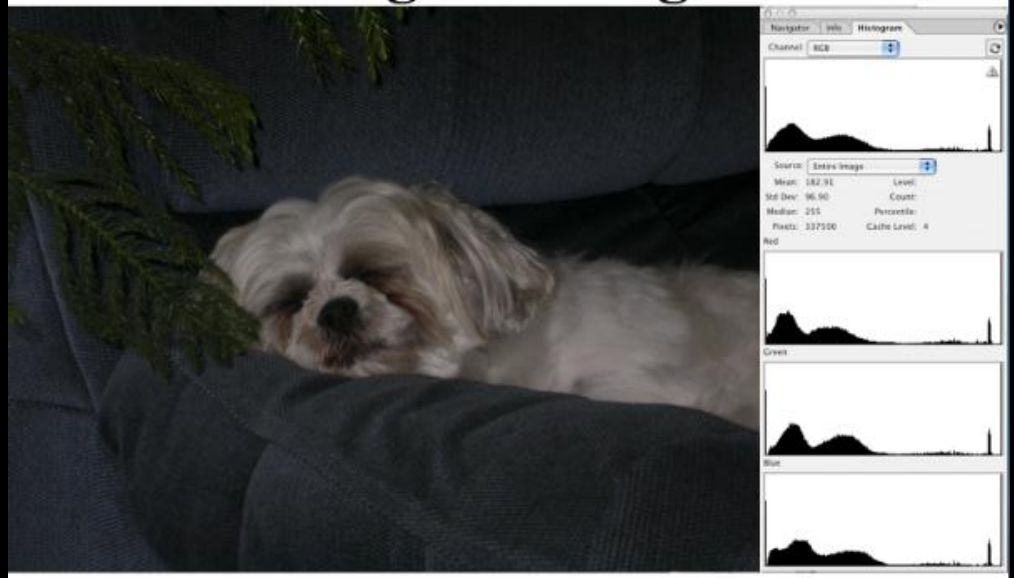


Processed

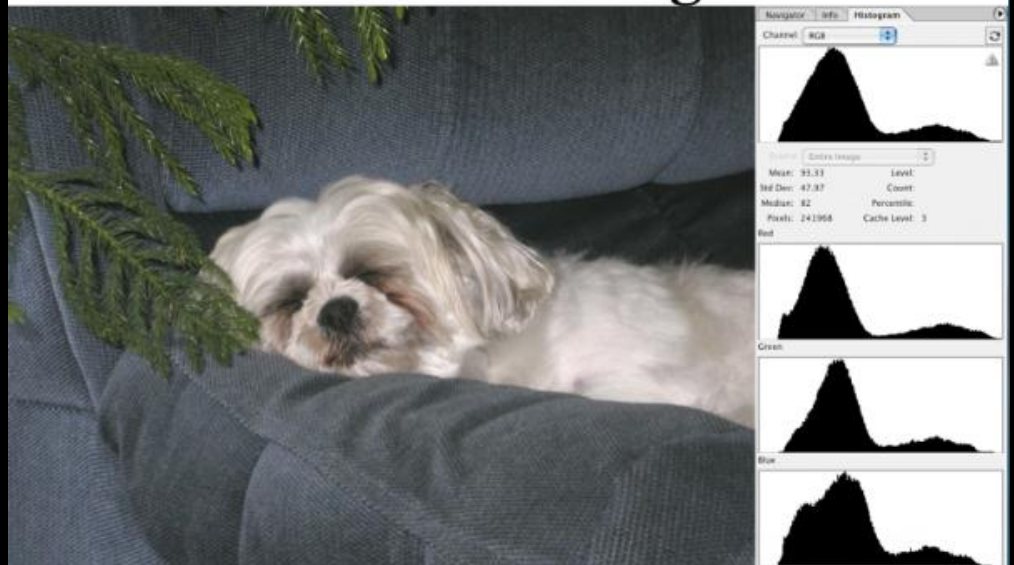


Underexposure Correction

Original Image



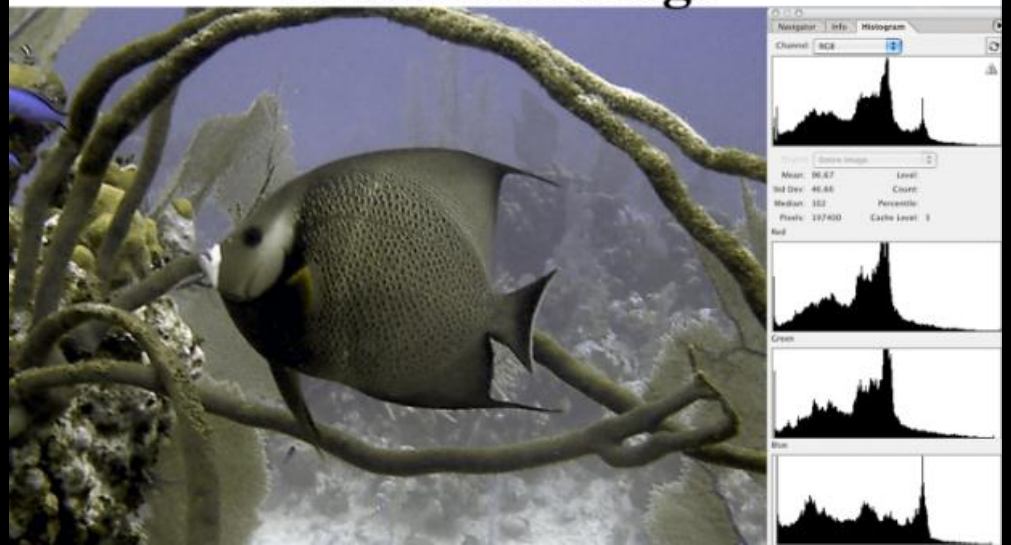
Processed Image



Exposure Correction

Original Imge

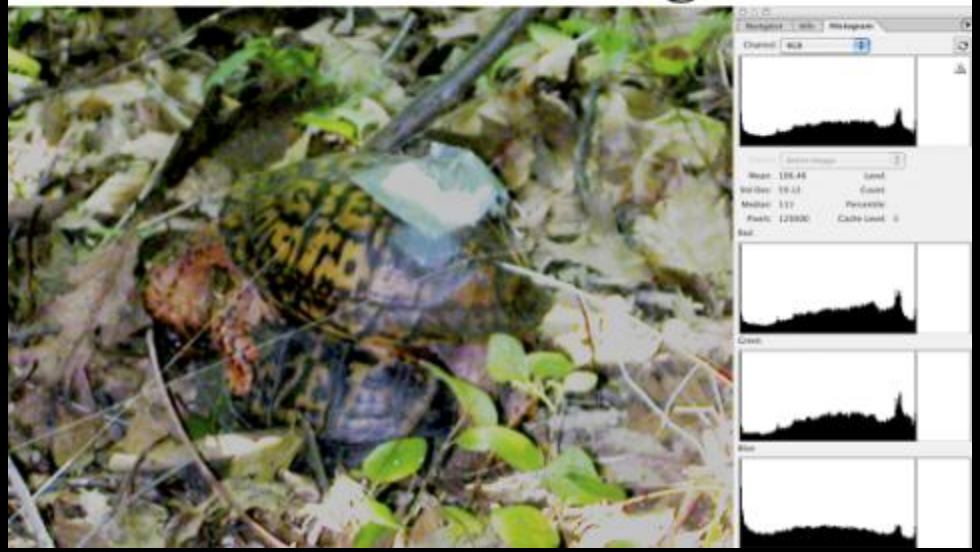
Processed Image



Exposure & Saturation Correction

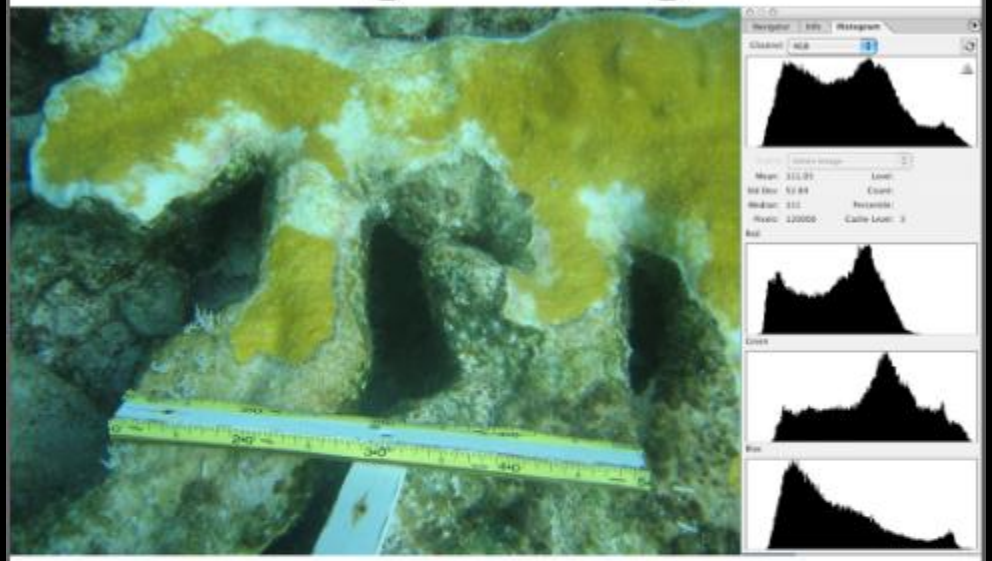
Original Image

Processed Image



Exposure Correction

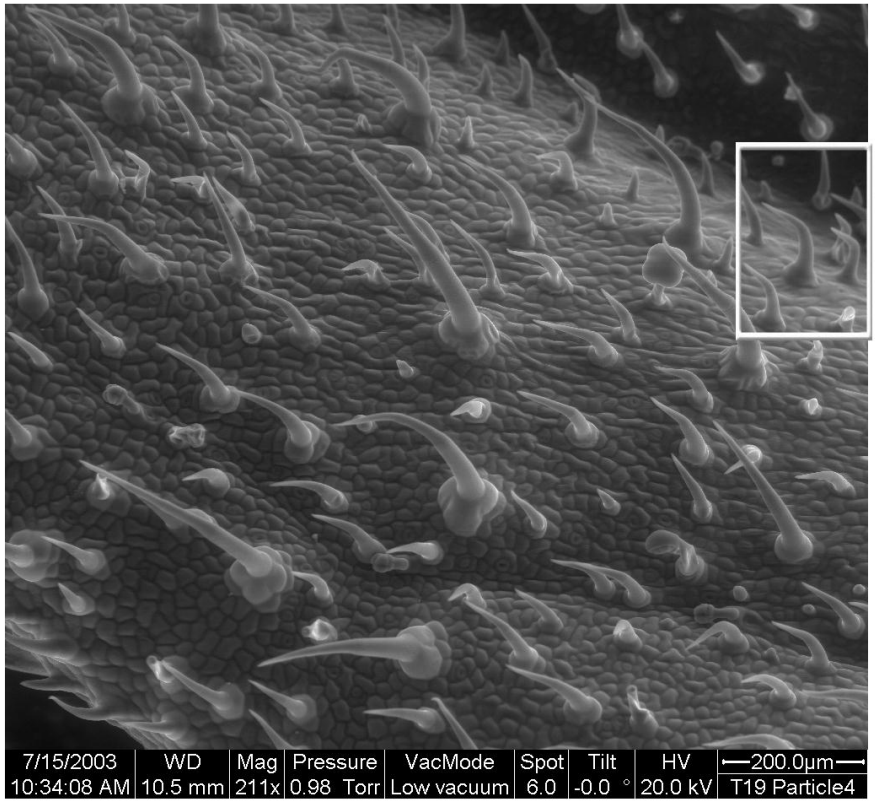
Original Image



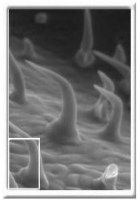
Processed Image

Interpolation Project

Original Image



Croped Selection



Processed Images

Scaled up 4x (400%)

Nearest Neighbor

Bilinear

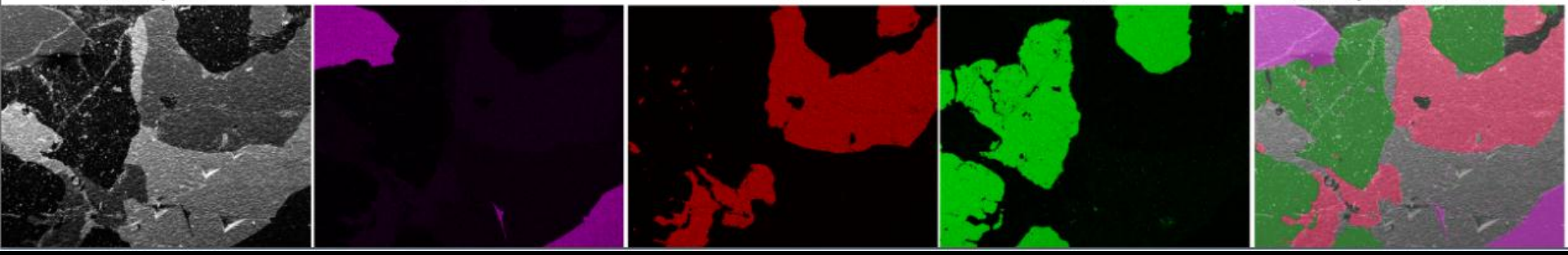
Bicubic

Wavelet

Merge Project

Original Sulfite2 Hi Rez Maps

SEM Gray Scale | FeK | ZnL | SiK



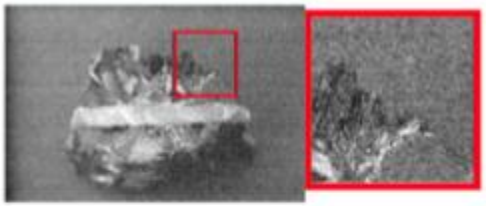
Merged Sulfite2 Hi Rez Map

(SEM Gray Scale + FeK+ZnL+SiK)

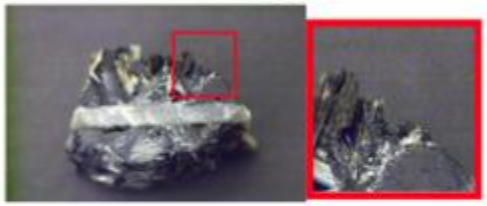
Noise Project

Manual Noise Removal
through the Blue Channel

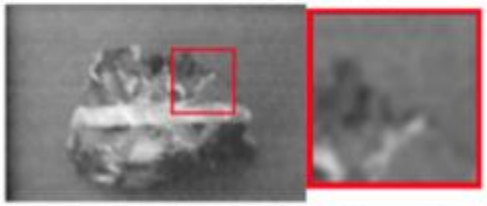
Original Image
Blue Channel



RGB



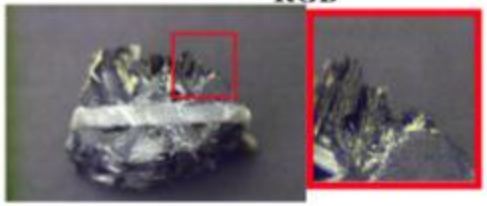
Processed Image
Blue Channel



Explanation of Protocol

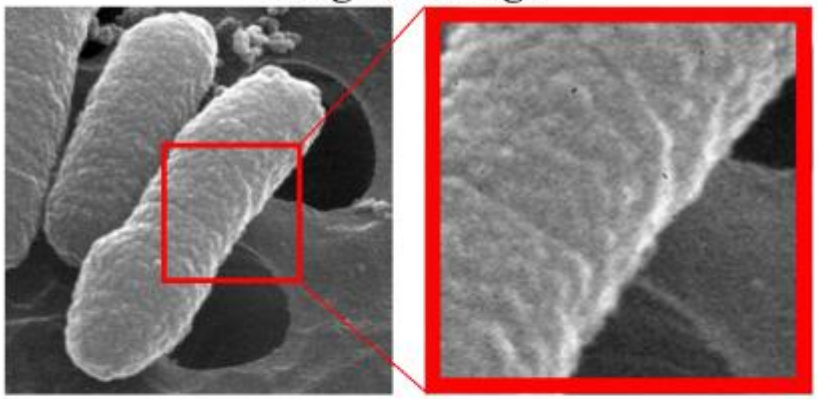
First Despeckle the Image (Filter: Noise: Despeckle), then go to I set the Gaussian Blue to 8.3 (Filter: Adjustments: Gaussian Blur), then last set the median Noise to 9 pixels (Filter: Noise: Median). **Result:** slight improvement, but any more blurring in the blue channel would have caused noticable distortions in the RGB image

RGB



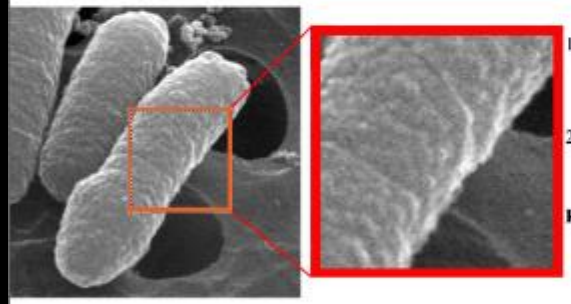
Manual Noise Reduction

Original Image



Processed Images

Method 1

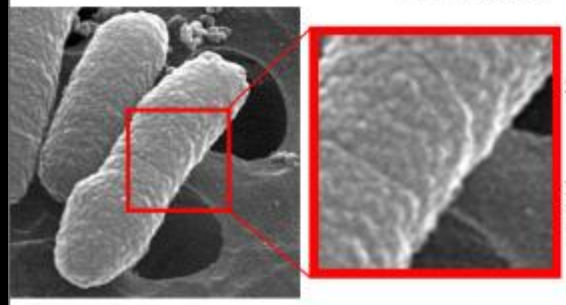


Explanation of Protocol

1) Select the "Healing Brush" from the toolbar check the "Normal Mode" box, set the Diameter to 5 pixels, the Hardness to 65%, and the Spacing to 51%.
2) Zoom into the image and go through and correct for each instance of noise (dark pixels that are noticeably out of place)

Result: While some noise is undoubtedly missed the image maintains its original sharpness and clarity, this is the best noise reduction method, it just takes longer.

Method 2



Explanation of Protocol

1) Select the "Gaussian Blur" Filter & set it to 3.7 pixel radius (Filter: Blur: Gaussian Blur)
2) Select the "Unsharp Mask," set the Amount to 500%, the Radius to 2.5 pixels, and the Threshold to level 0.
(Filter: Sharpen: Unsharp Mask)

Result: Some noise is still apparent and the image now has an overall blur to it, despite the Unsharp Mask.

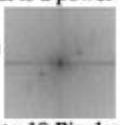
Periodic Noise Reduction

Using Fast the Fourier Transform (FFT) Method

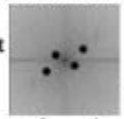
Original **Processed**

Explanation of Protocol

1) Crop the image to 256 x 256 pixels, or any square that is a power of two, (Image: Image Size)

2) Go to FFT-Forward (Filter: IP Fourier:FFT Forward) 

3) Select the Paint Brush Tool, set the Master Diameter to 19 Pixels with a hardness of 75%

4) Paint over each high frequency dot 

5) Invert the image (Image: Adjustments:Invert) 

6) Apply a Gaussian Blur of 0.9 pixels to the image (Filter: Blur: Gaussian Blur) 

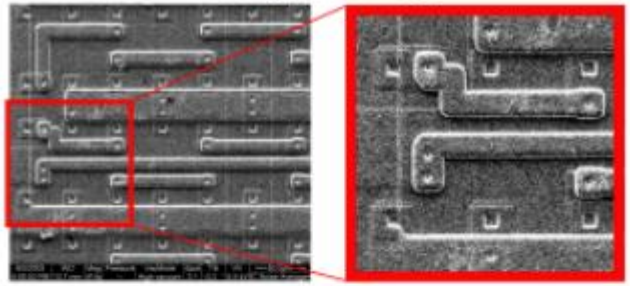
7) Adjust the threshold until only the painted dots are visible 

8) Go to Apply Filter and FFT (Filter: IP Fourier: Apply Filter and FFT)

Result. The FFT method yeilds substantially improved images; however, there is still some periodic noise around the edges of the image. Correcting for this is more difficult unless working with a larger image in whcih you can do multiple power of 2 crops and FFT transforms and then overlay the resulant images.

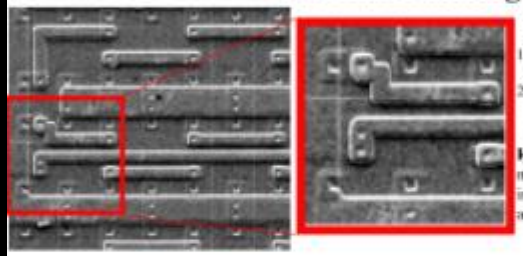
Random Noise Reduction

Original Image



Processed Images using different techniques

Median Filtering

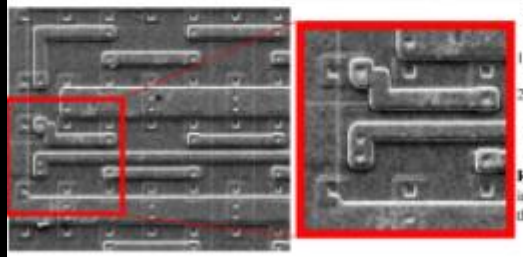


Explanation of Protocol

1) First the "Despeckle" filter was applied to to the image (Filters: Noise: Despeckle)
2)To further improve the image the "Median" filter with a pixel radius of 3 was applied to the image next (Filters: Noise: Median)

Result: The grainular appearance of the noise is lessened, resulting in a smoother image; however, there is pixel blocking and an overall fuziness about the image

Conditional Filtering

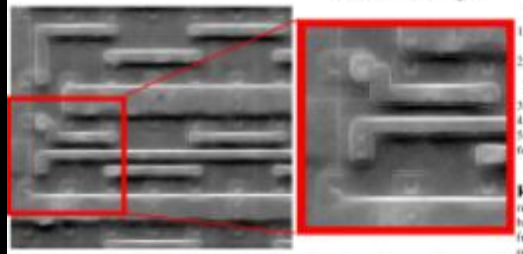


Explanation of Protocol

1) First the "Blur" filter was applied to to the image (Filters: Blur: Blur)
2)To further improve the image the "Conditional Smoothing" filter with a Mean N'borhood Radius of 3 and a Threshold of 83 (Filters: IP Process: Conditional Smoothing)

Result: there is more pixel blocking than in the Median Filtering method; however, the resultant image is more crisp.

Noise Ninja



Explanation of Protocol

1) Within the advanced controls, check the "Filter very coarse noise," "Turbo mode,"& "Suppress Halos" boxes
2)Set the "Luminance" Strength & Smoothness all the way to the right (20), then set the Contrast all the way to the left (-20)
3) Leave the "Colors" controls at "0"
4) Set the "Sharpening" Amount to 10% & Radius to 3.0
5) Run Steps 1-4 four times
6) Adjust the Input "Levels" in Photoshop to 37, 1.28, 210 (Image: Adjustments: Levels)

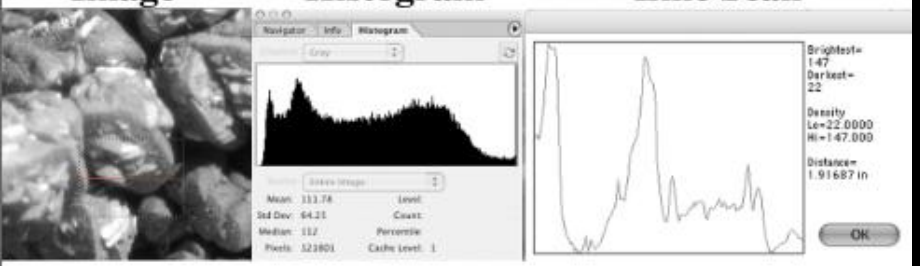
Result: This is the smoothest/least grainy of the three reduction processes, with little to no pixel blocking. however, even with levels adjusted the image still has a fuziness or glow about it, this can be lessened by repeating the noise reduction steps fewer times, but the grainular quality will return

Sharpening Project

Sharpening Project

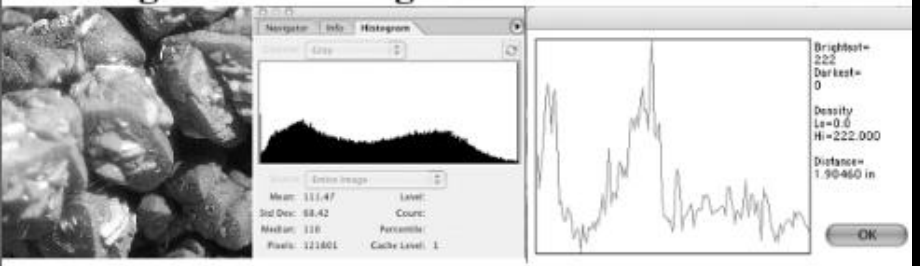
Original Image

Image | Histogram | Line Scan



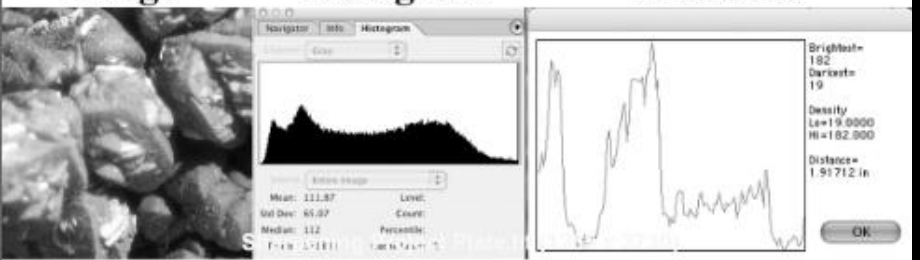
Custom Filter

Image | Histogram | Line Scan



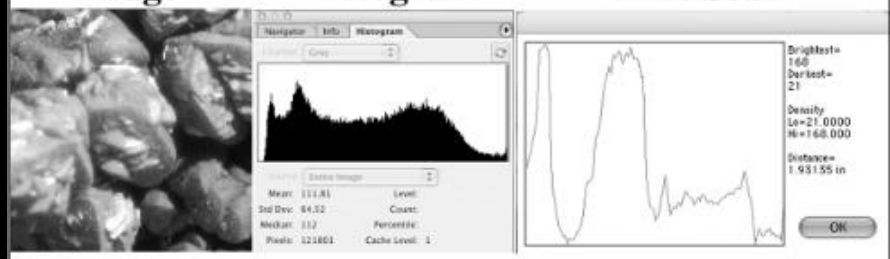
Sharpen Filter

Image | Histogram | Line Scan



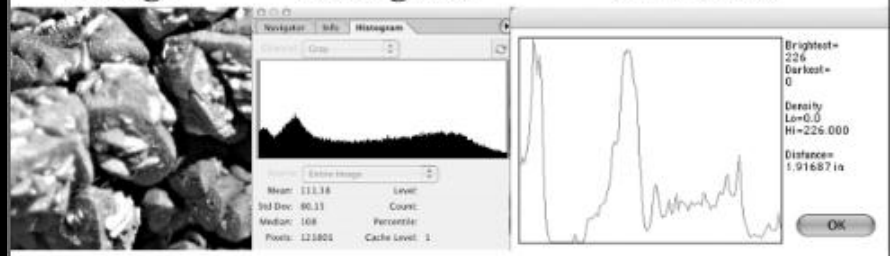
Sharpen Edges Filter

Image | Histogram | Line Scan



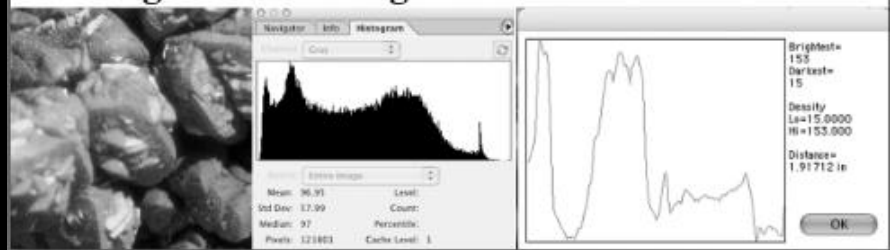
Unsharp Mask Filter

Image | Histogram | Line Scan



DOG (Difference of Gaussians) Filter

Image | Histogram | Line Scan



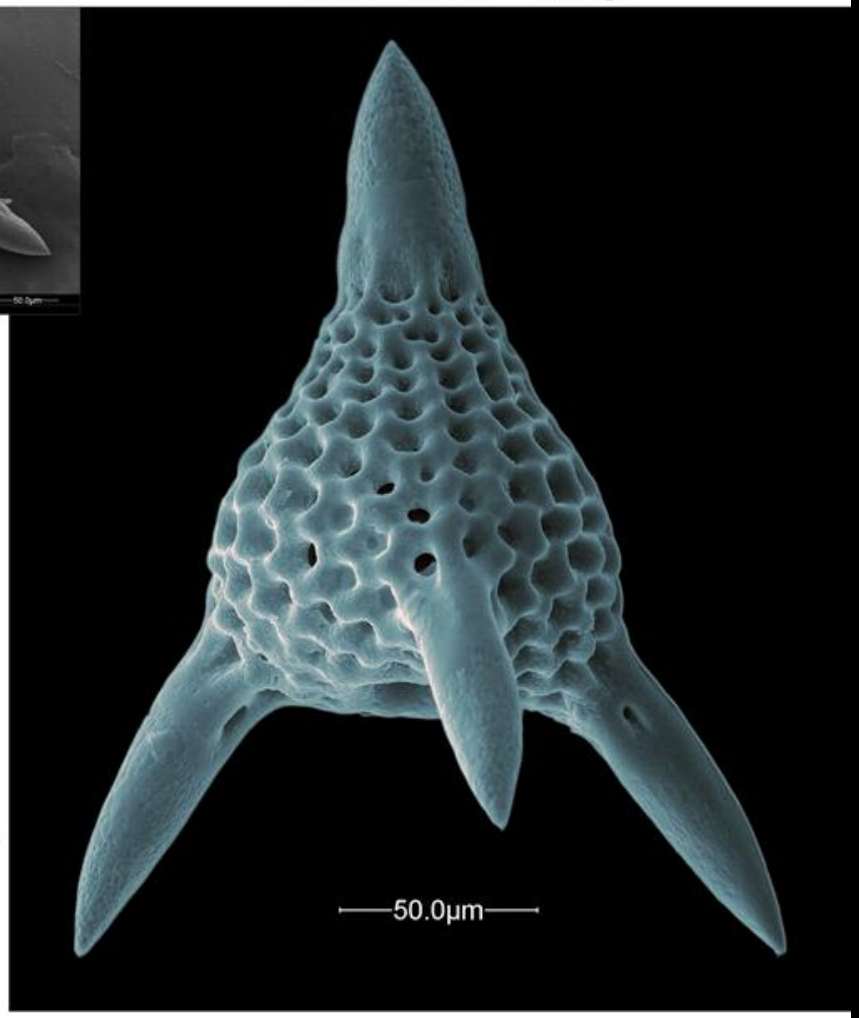
Printed Projects

Colorized Foram

by Jenny Lentz

Original

Processed Image



Within Photoshop

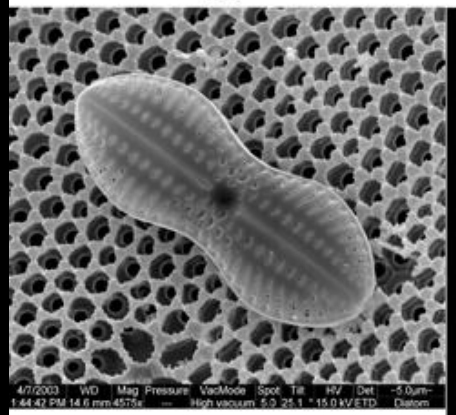
- The distracting background was removed
- The foram was rotated
- The levels were adjucted
- The foram was pseudo-colored
- The scale bar was added back in

Biology 200 : Scientific Digital Imaging

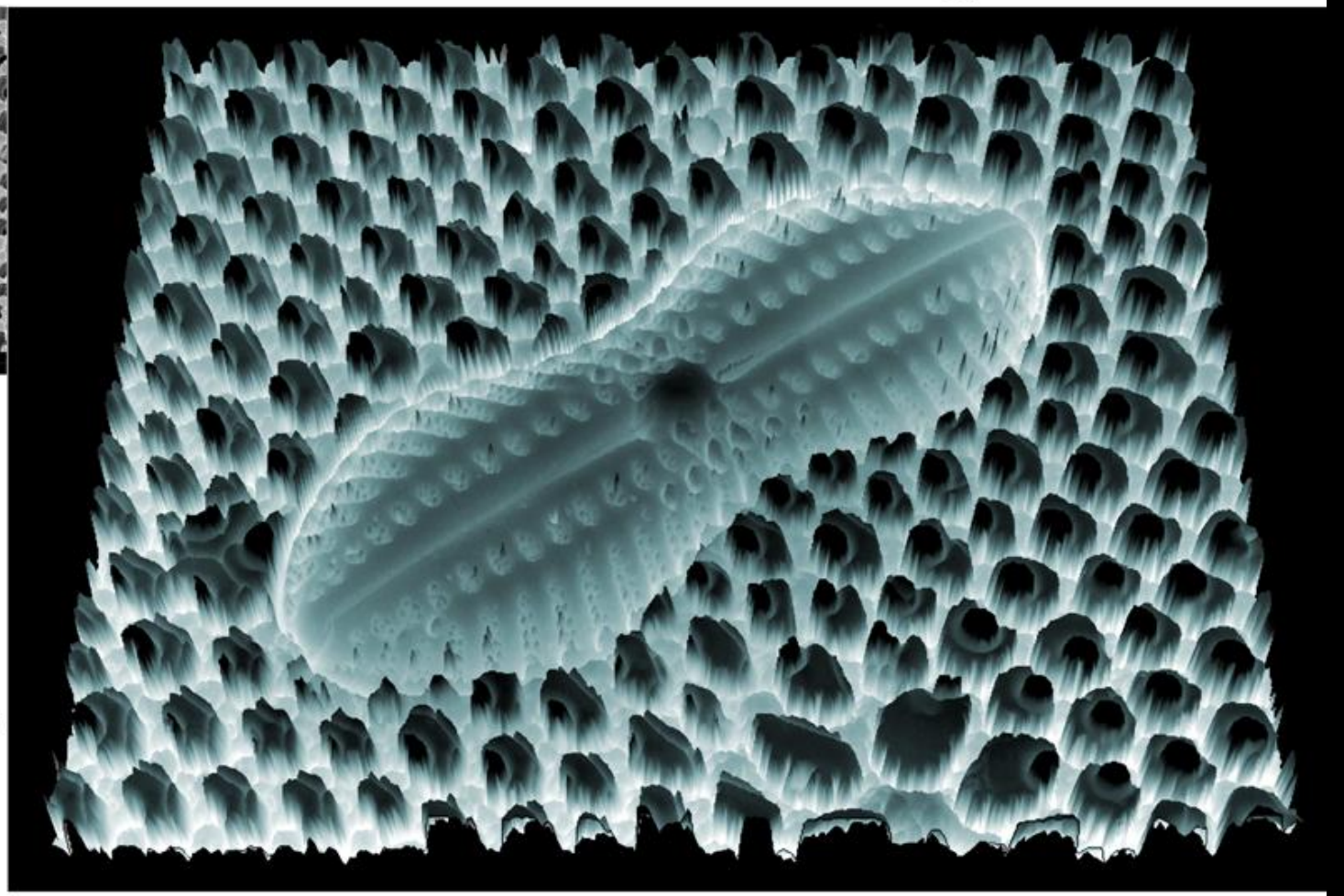
Diatom in 3D!

by Jenny Lentz

Original



Processed 3D Model Image

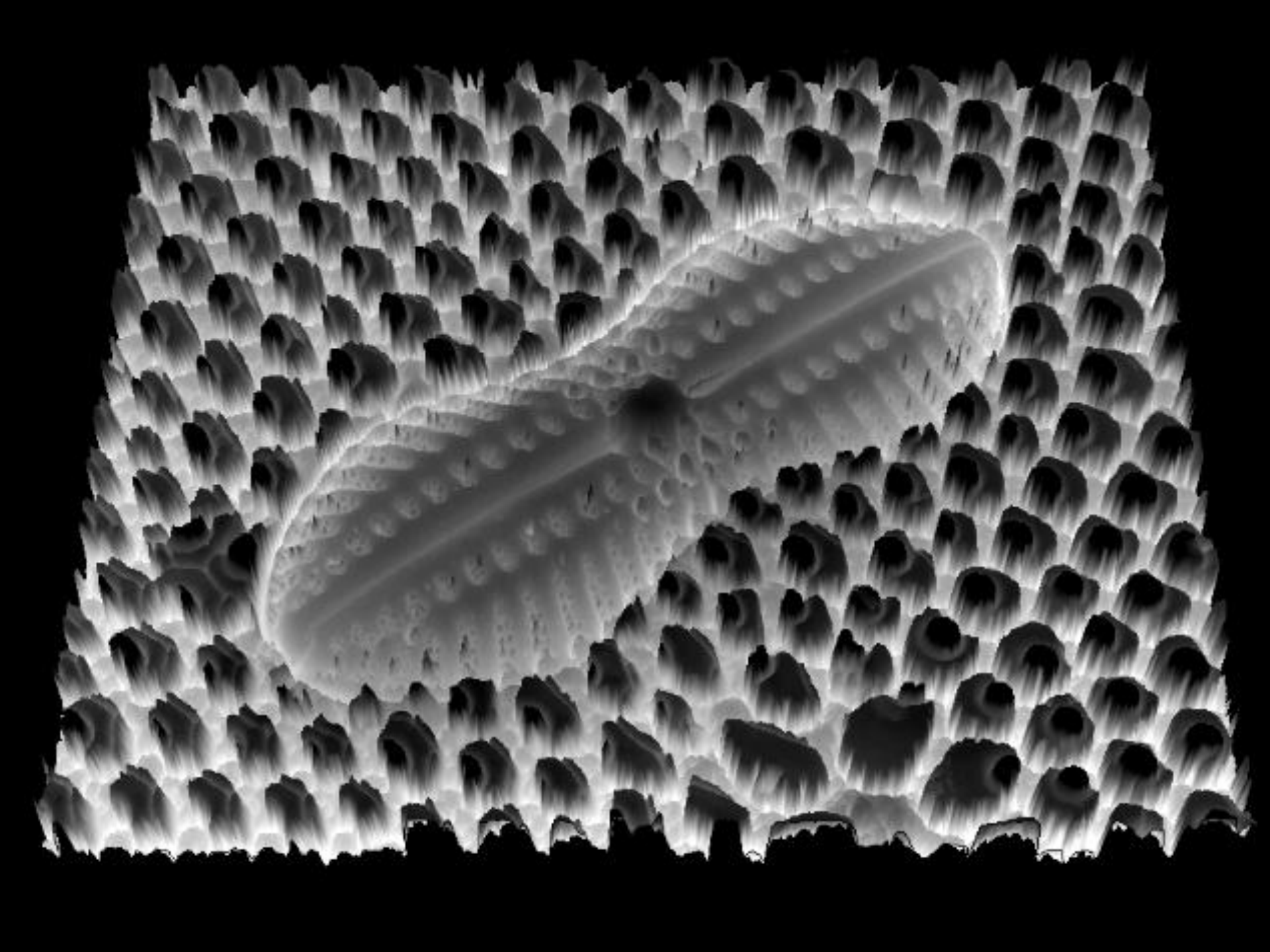


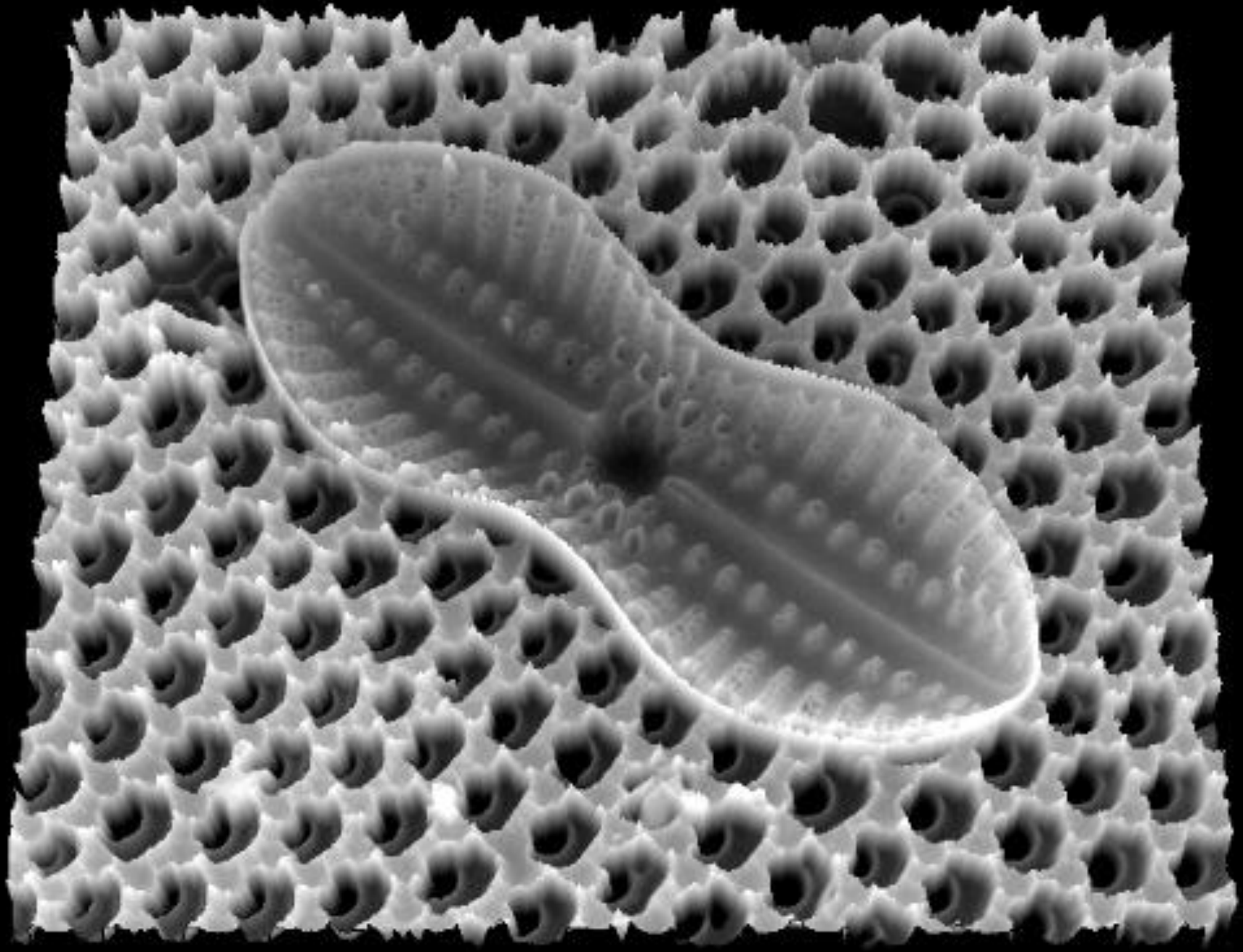
The Processed Image was captured while using a 3D animation program (XT Docu)

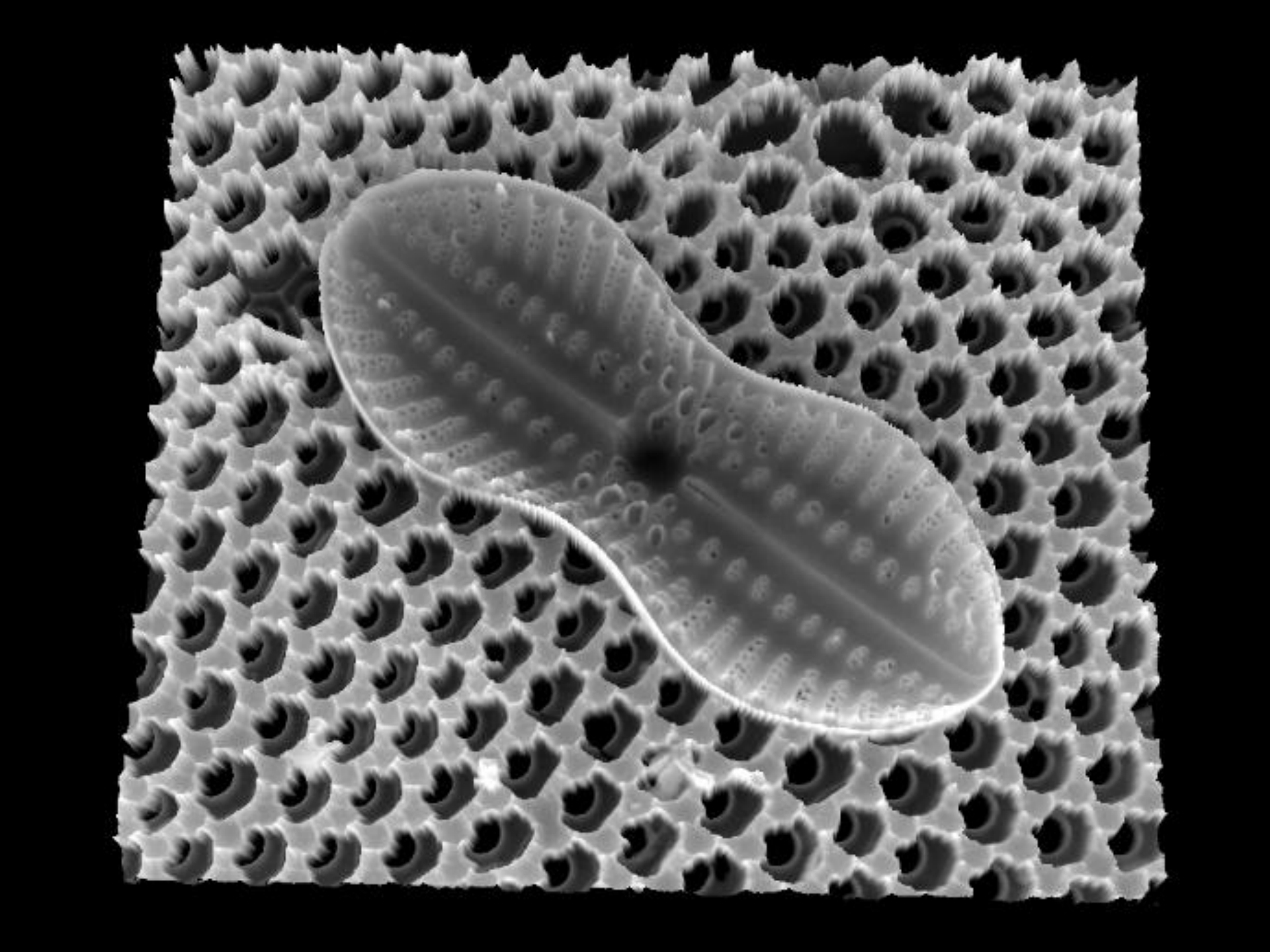
The image was then cropped, the levels were adjusted, and it was pseudocolored within Adobe Photoshop

Biology 200 : Scientific Digital Imaging

3D Rendering Project



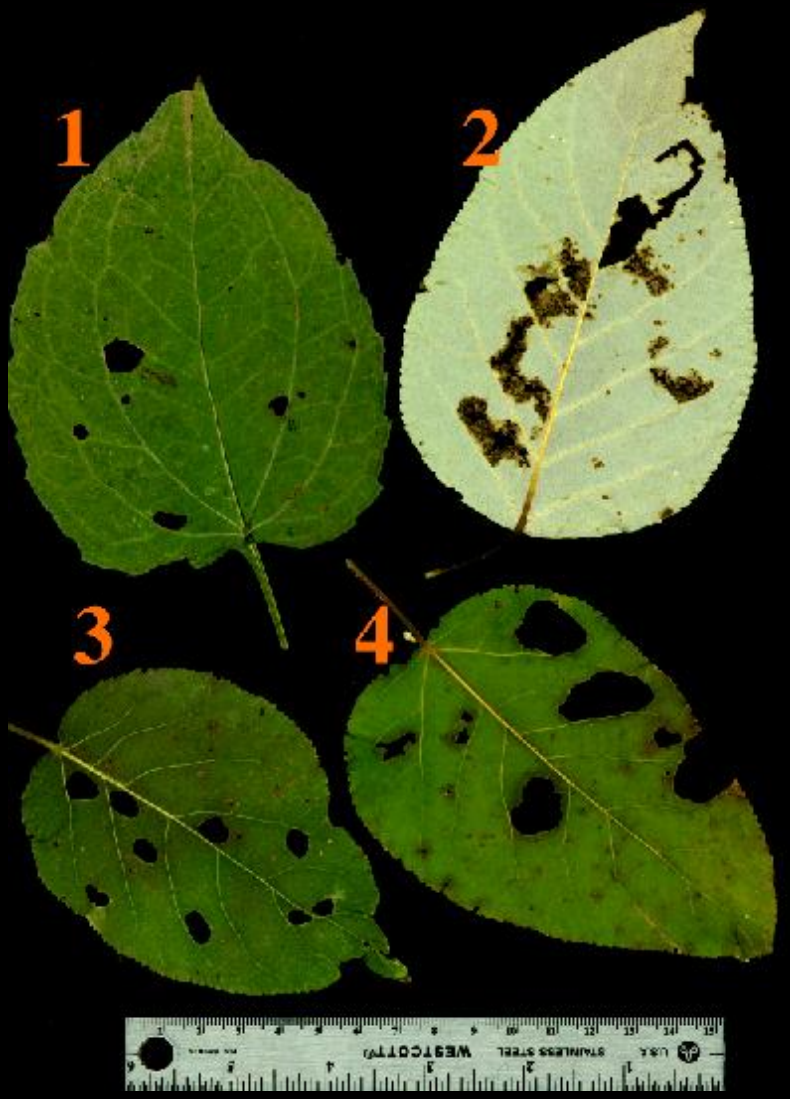


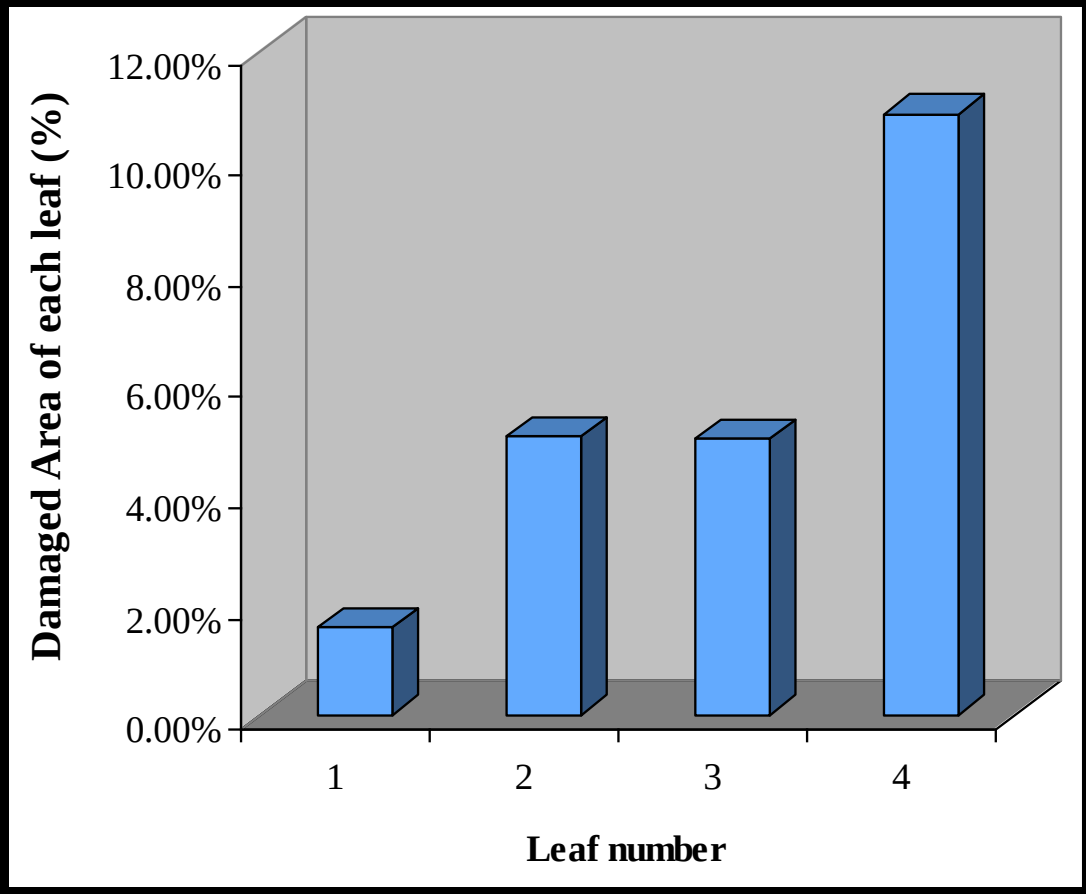


Simple Measurements Projects

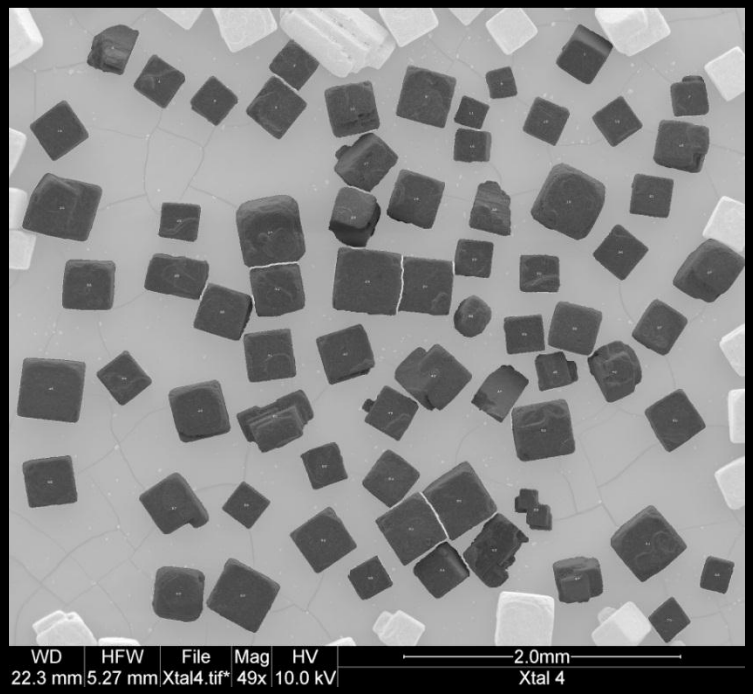
1. Insect damage to leaves

Poplar Leaves

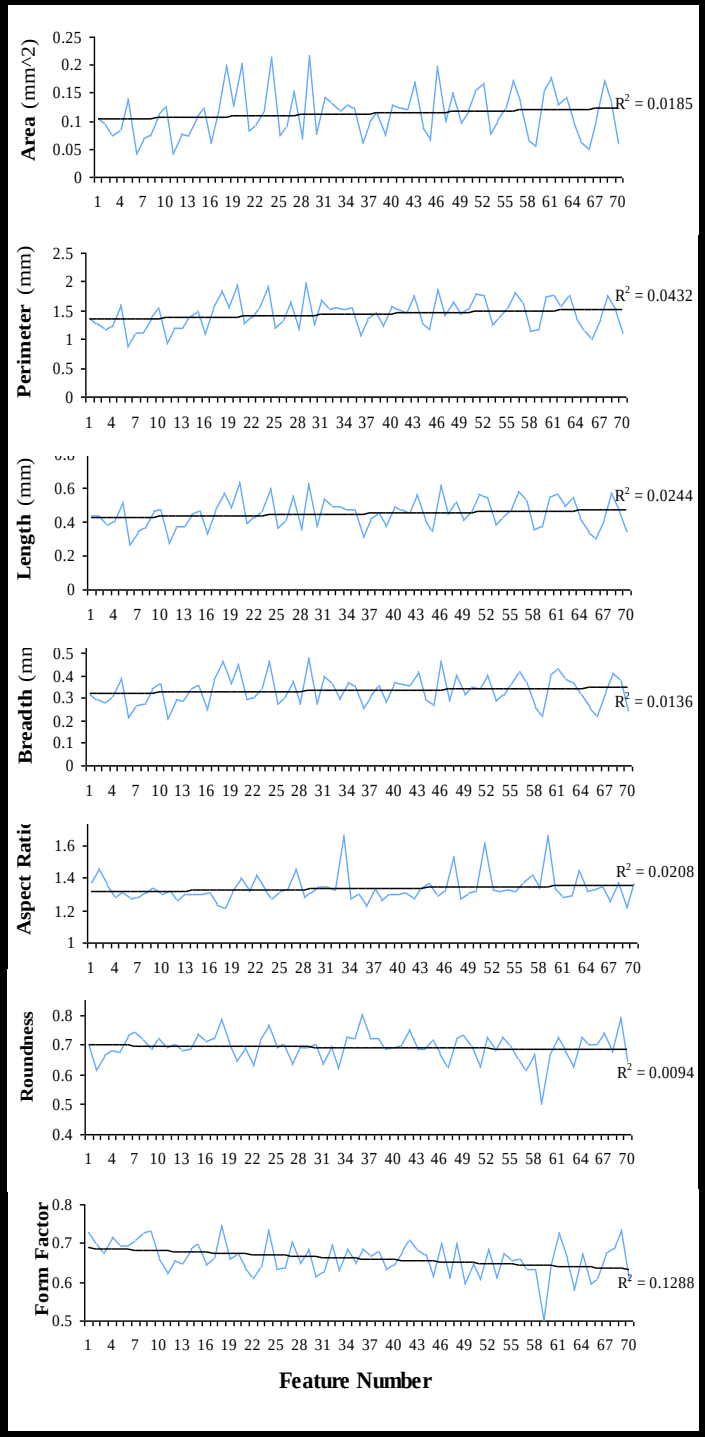




2. Measure Regions of Interest
a) *Xtal4 copy*

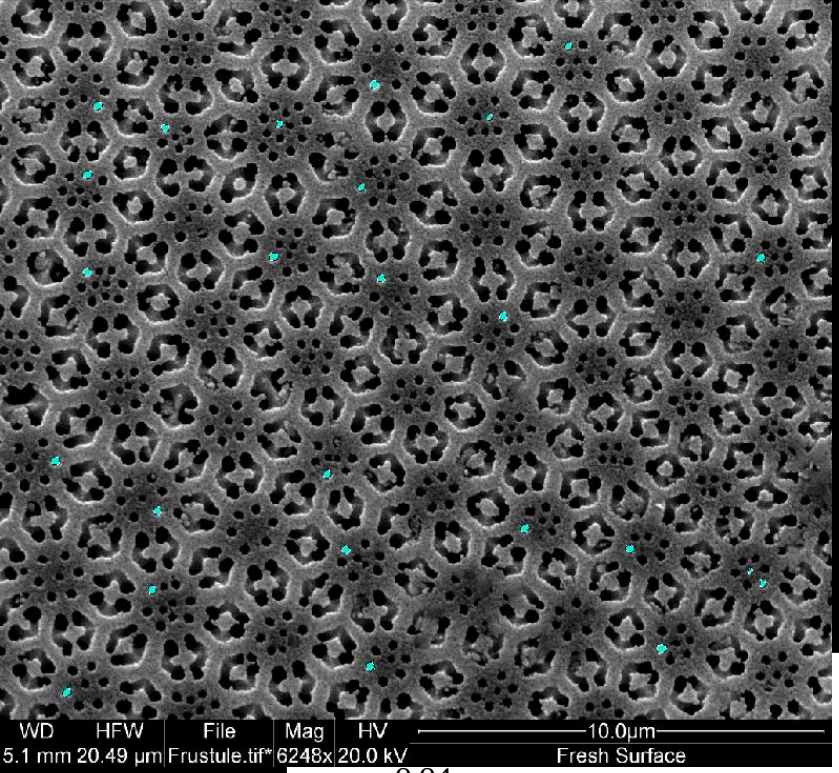


N=70	Mean	Max	Min	SD
Area (mm²)	0.113	0.217	0.041	0.043
Perimeter (mm)	1.440	1.995	0.862	0.262
Length (mm)	0.449	0.635	0.268	0.088
Breadth (mm)	0.337	0.481	0.210	0.066
Aspect Ratio	1.334	1.661	1.211	0.087
Roundness	0.692	0.805	0.502	0.047
Form Factor	0.662	0.747	0.500	0.044

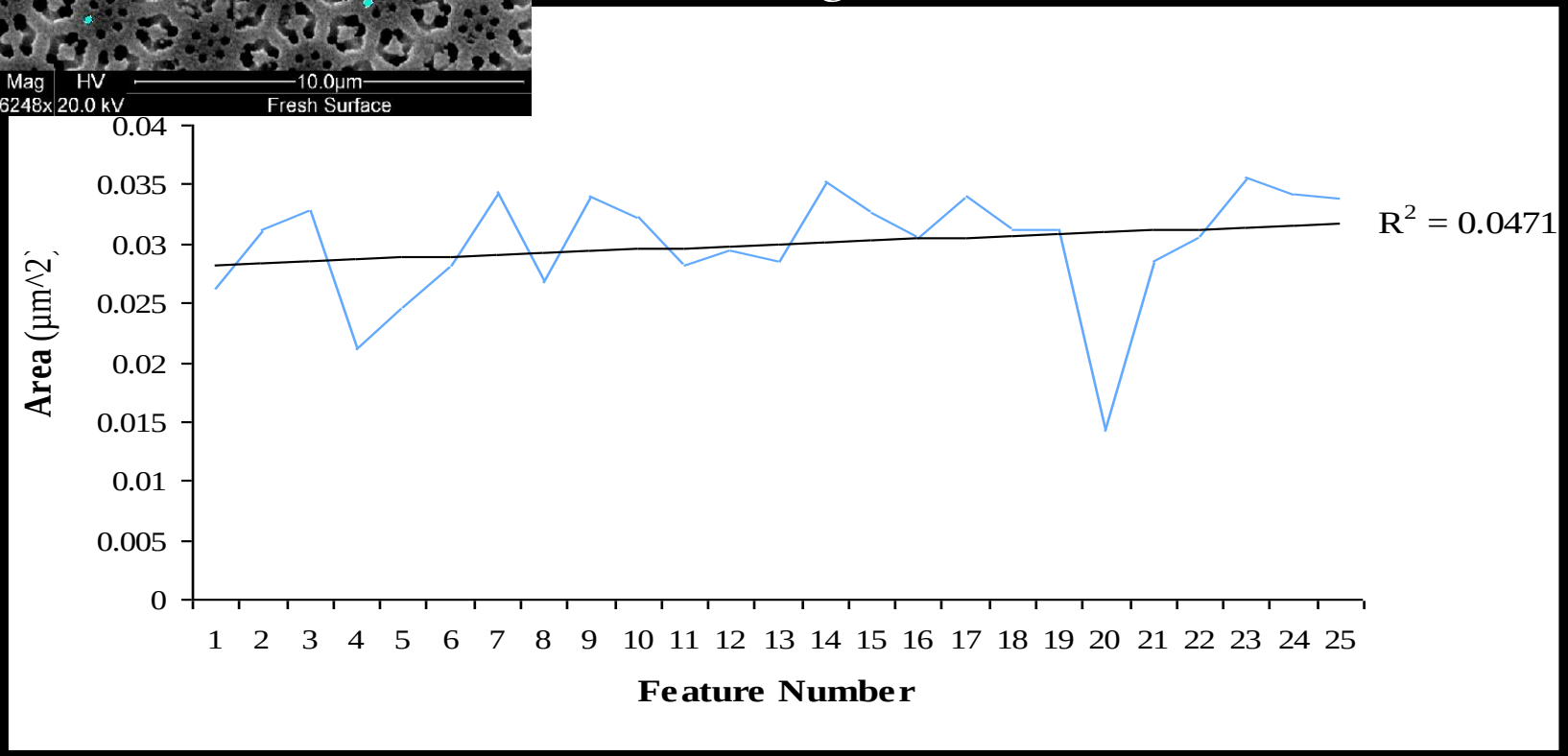


2. Measure Regions of Interest

b) *Frustule*

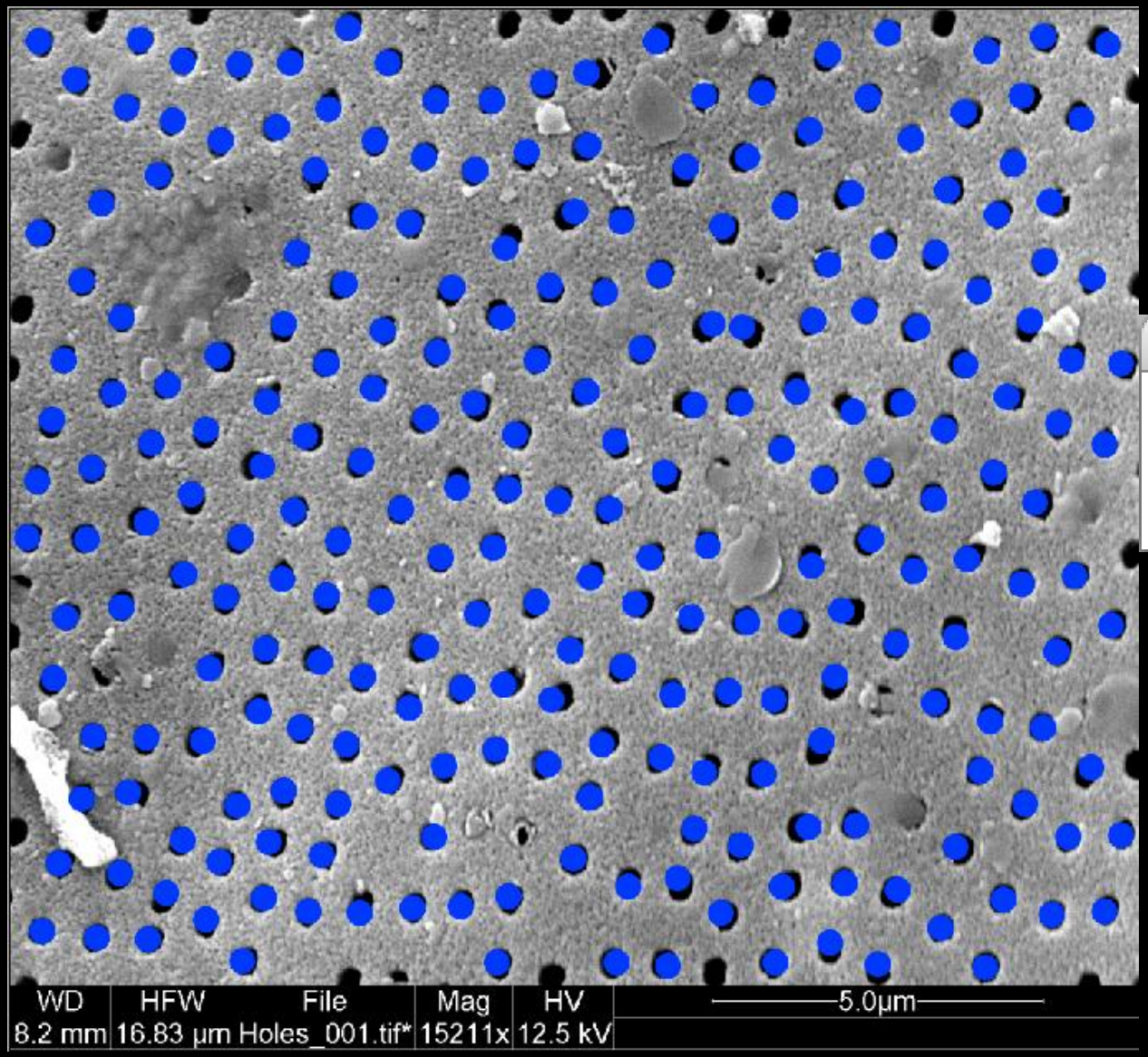


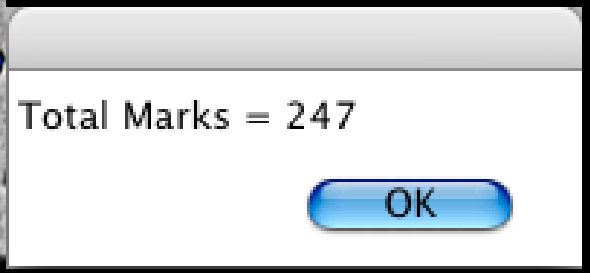
Average Area: 0.0162556 mm²



3. Simple Count

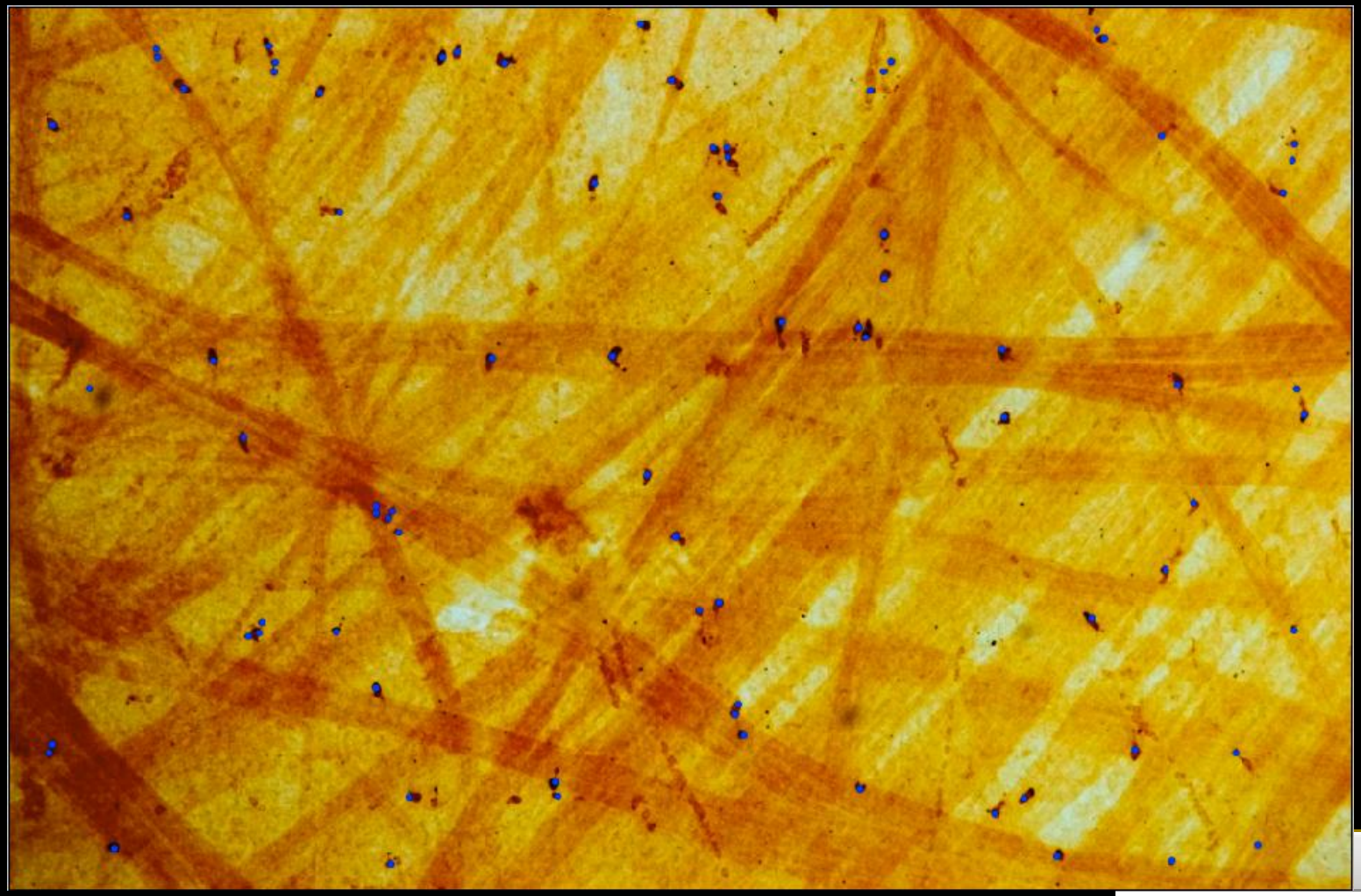
Holes 001





4. Simple Counting/Difficult Specimens

TurtleBladder1

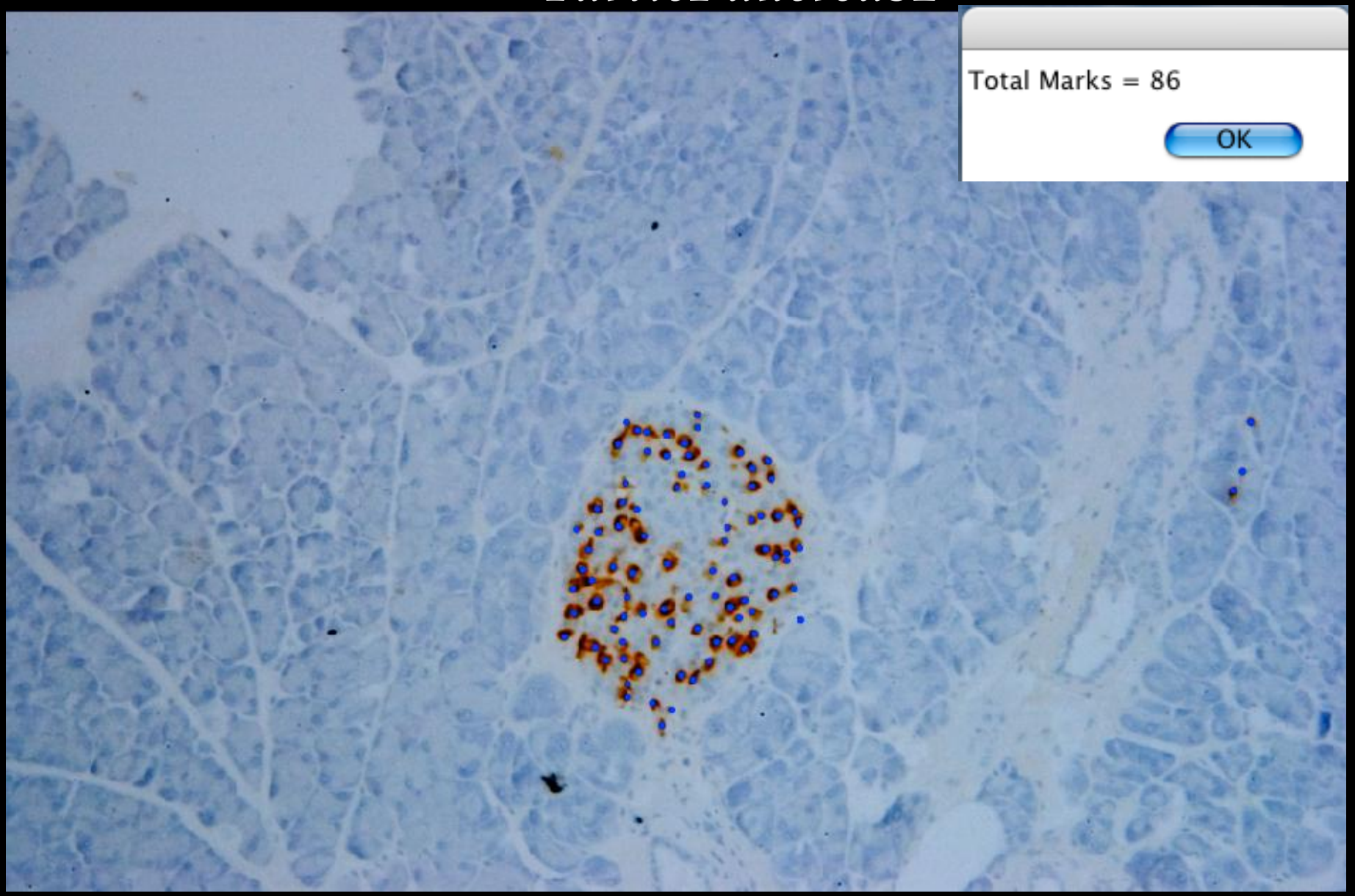


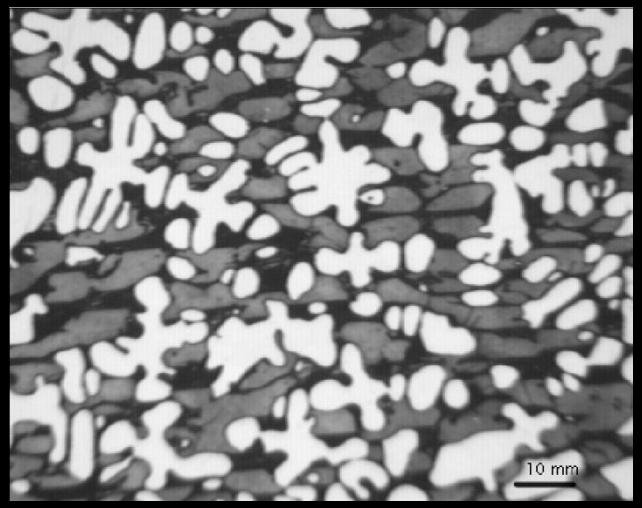
Total Marks = 75

OK

4. Simple Counting/Difficult Specimens

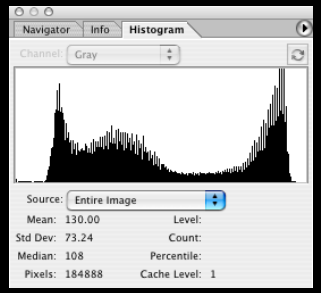
TurtlePancreas1

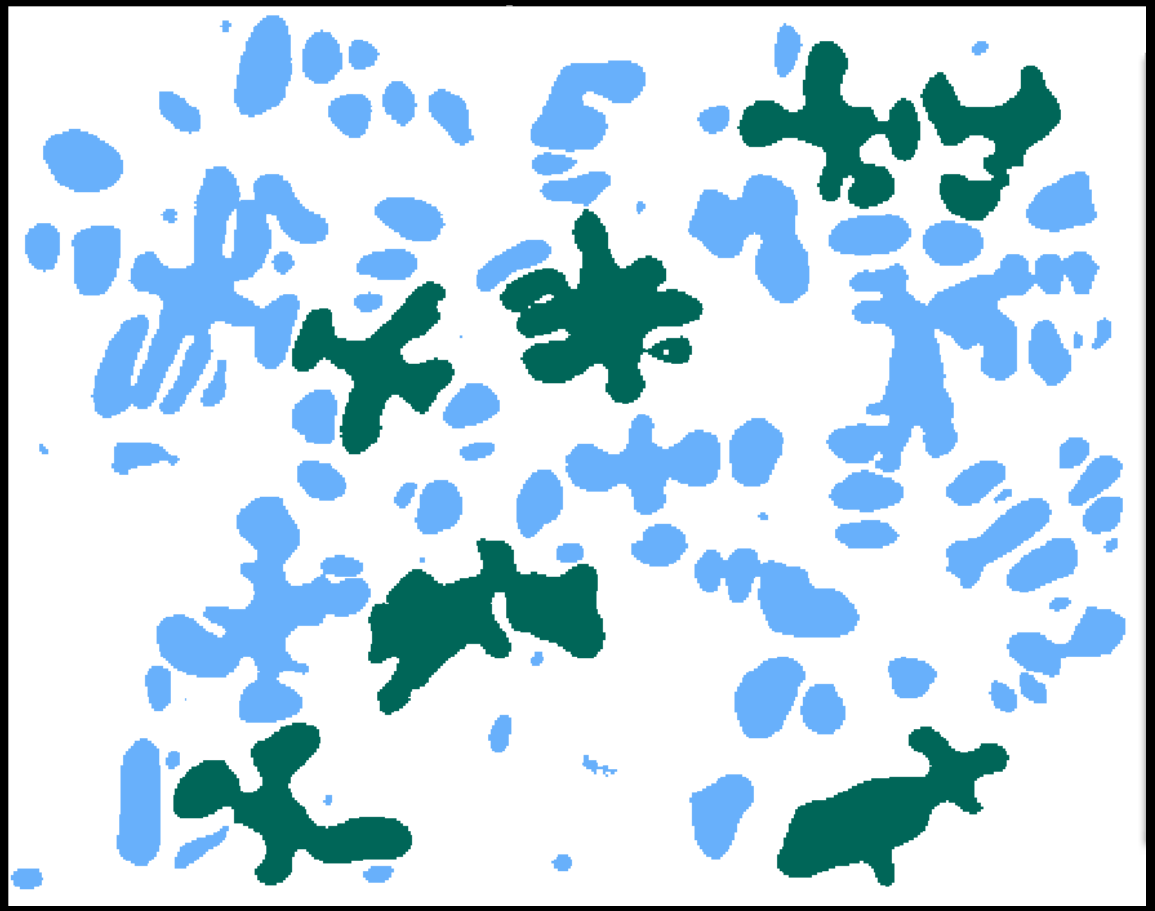


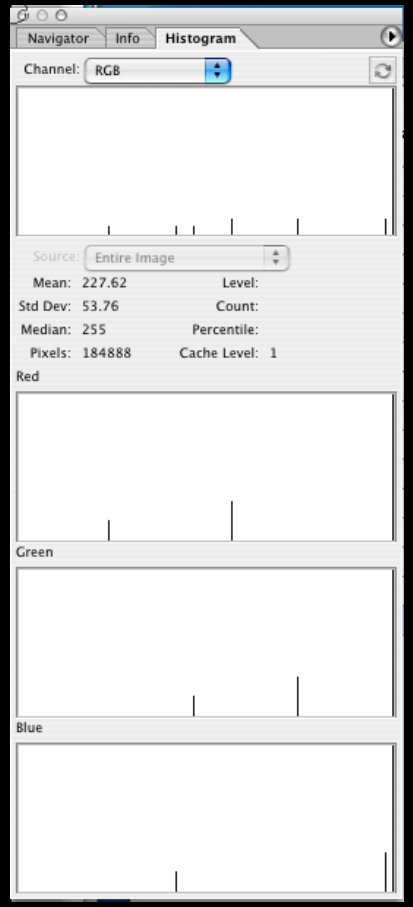


5. Feature Selection and Quantification

Dendrite2



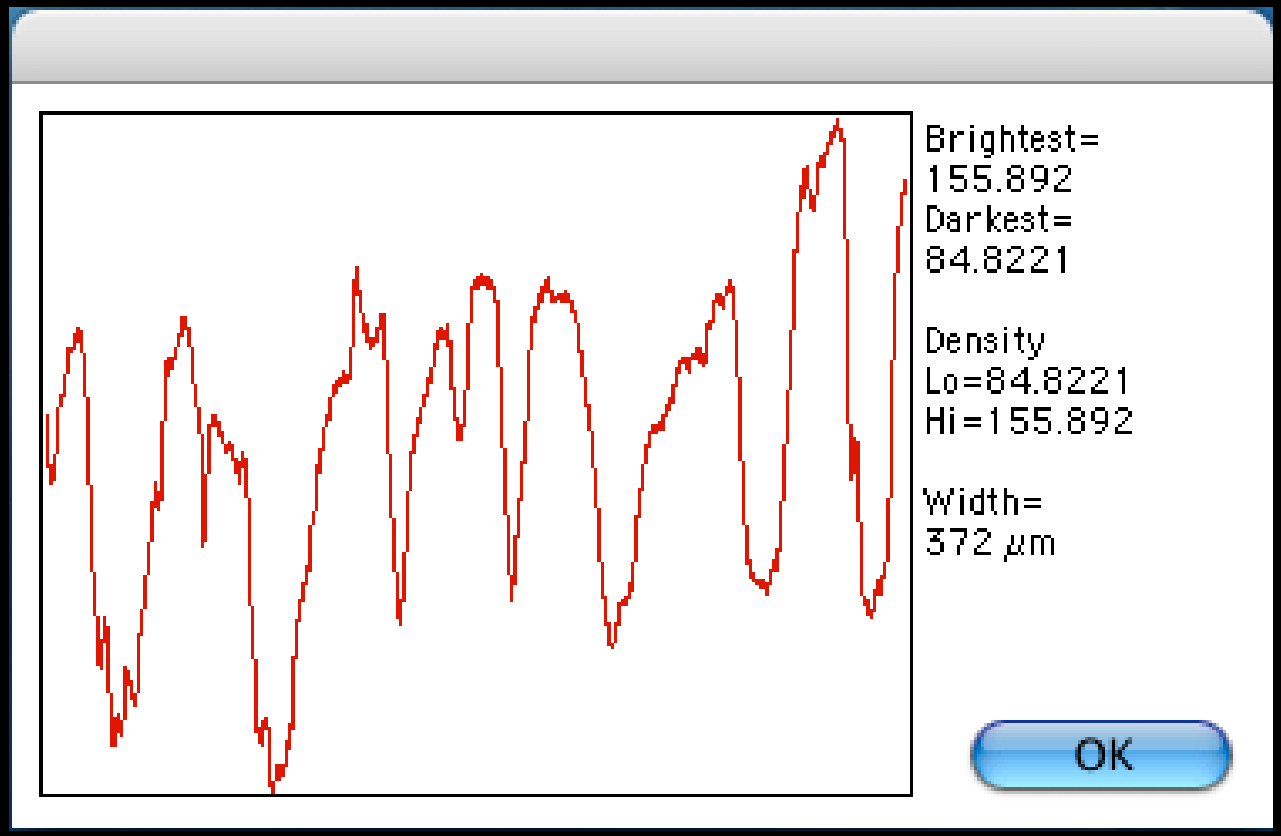


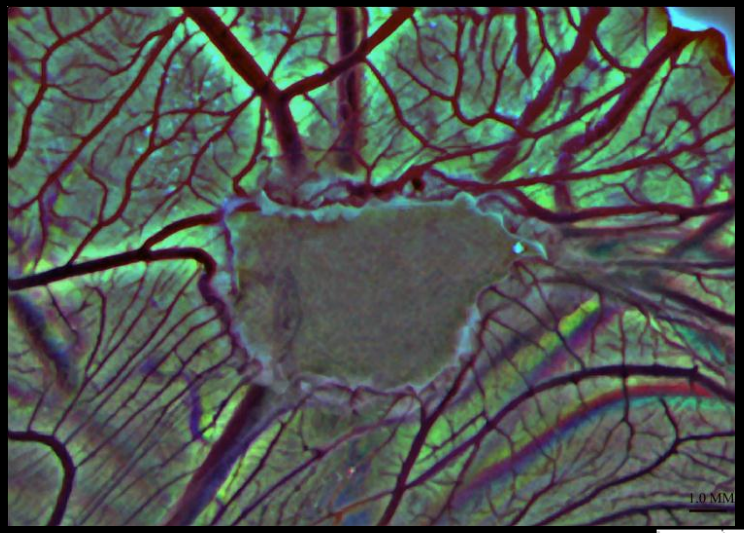


Complex Measurements Projects

1. Line Intensity Profile

Tidal Bundle





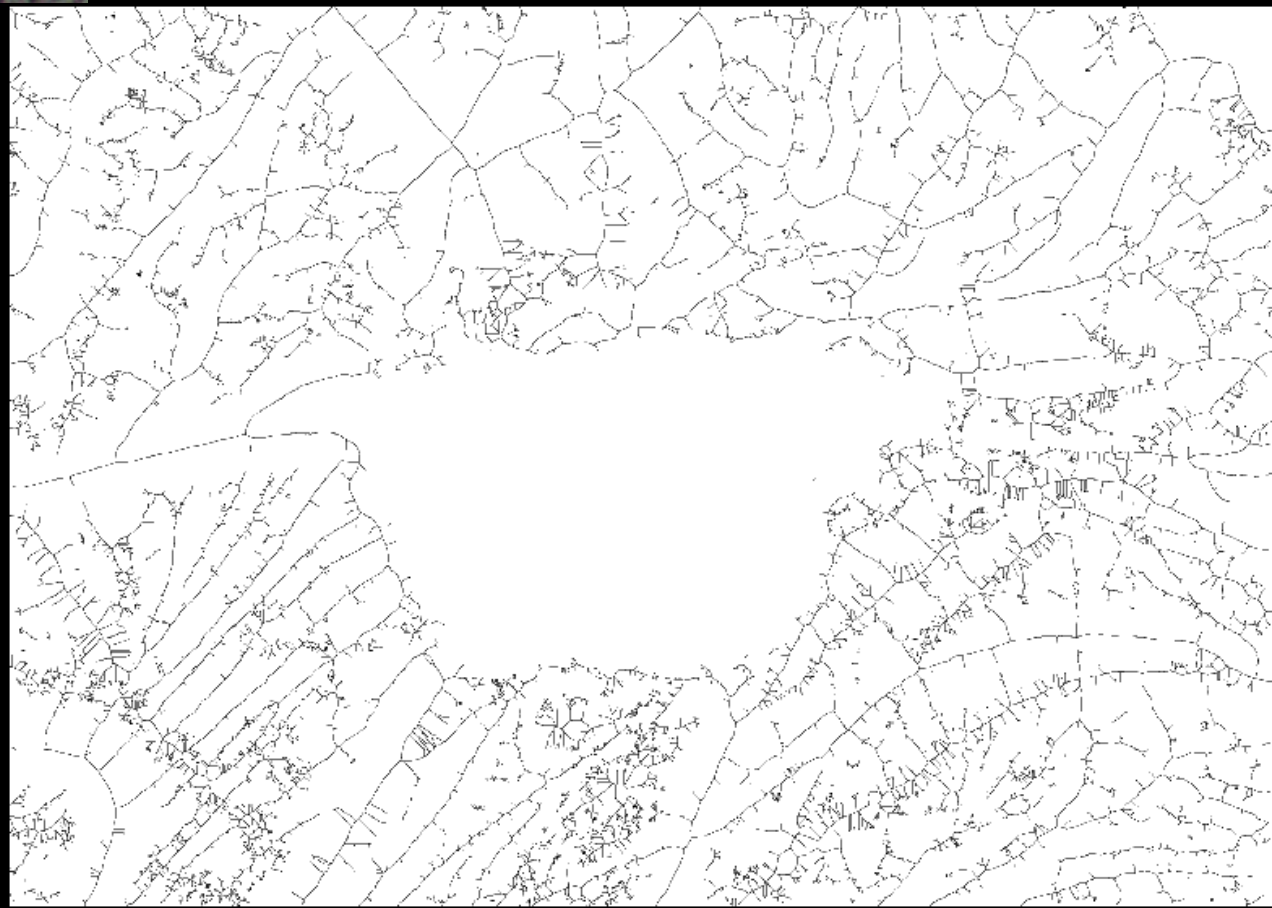
2. Complex Measurements

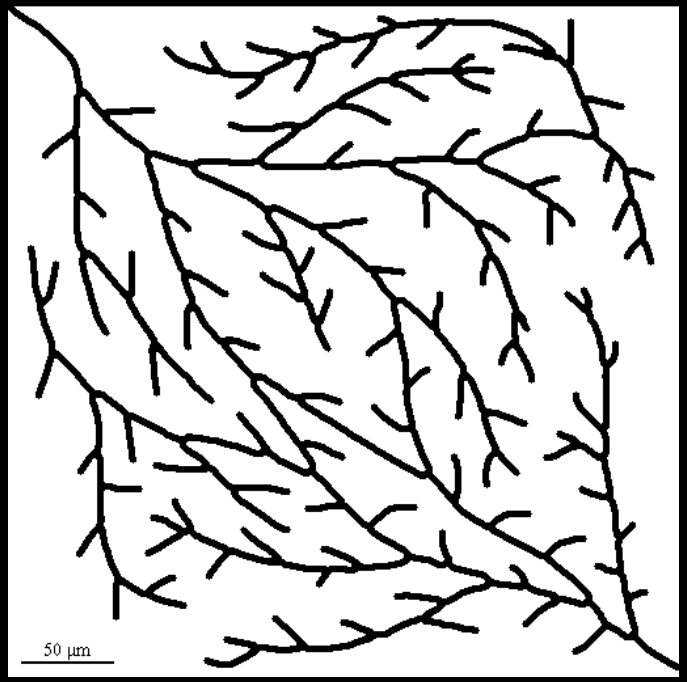
a) *ChickCapillary*

Total Length	# of nodes
969.713mm	?

# of end points	# Branch Points
727	484

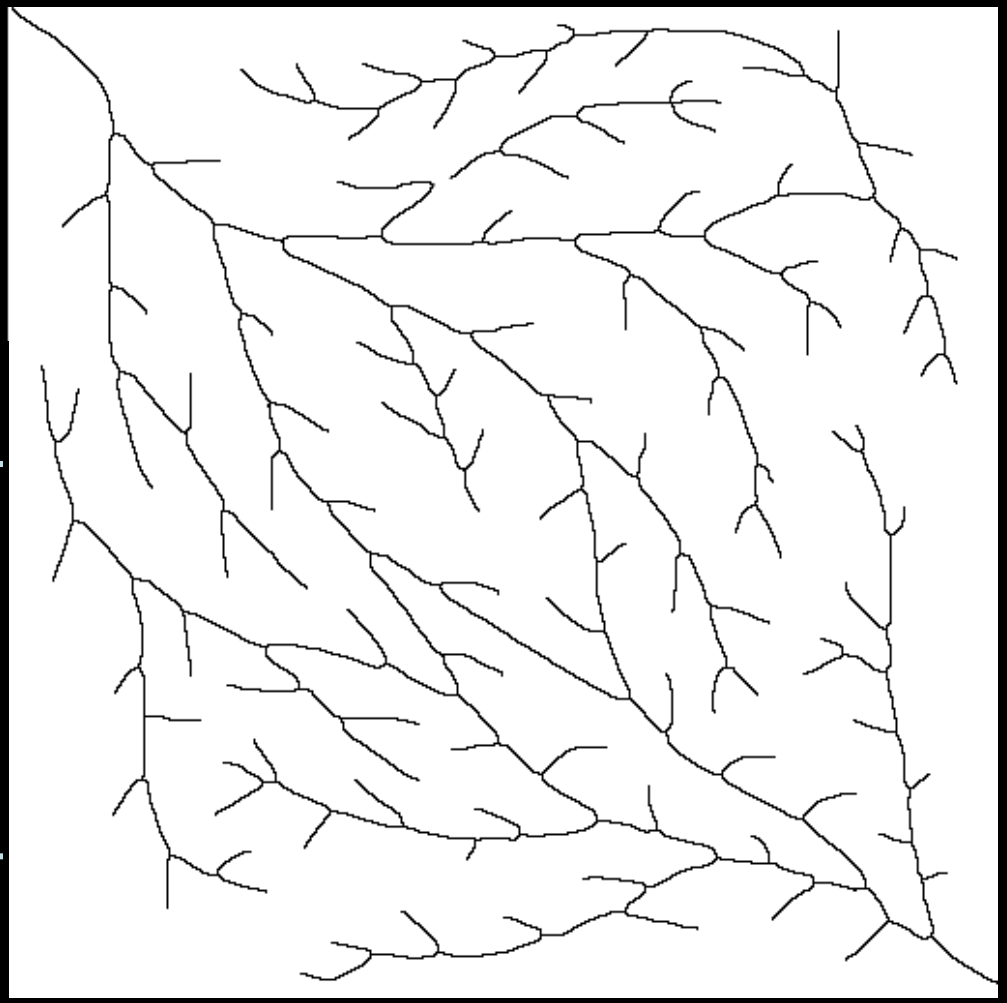
Mean fiber width	Width variation
0.0129mm	0 mm





2. Complex Measuments

a) *Branches2*

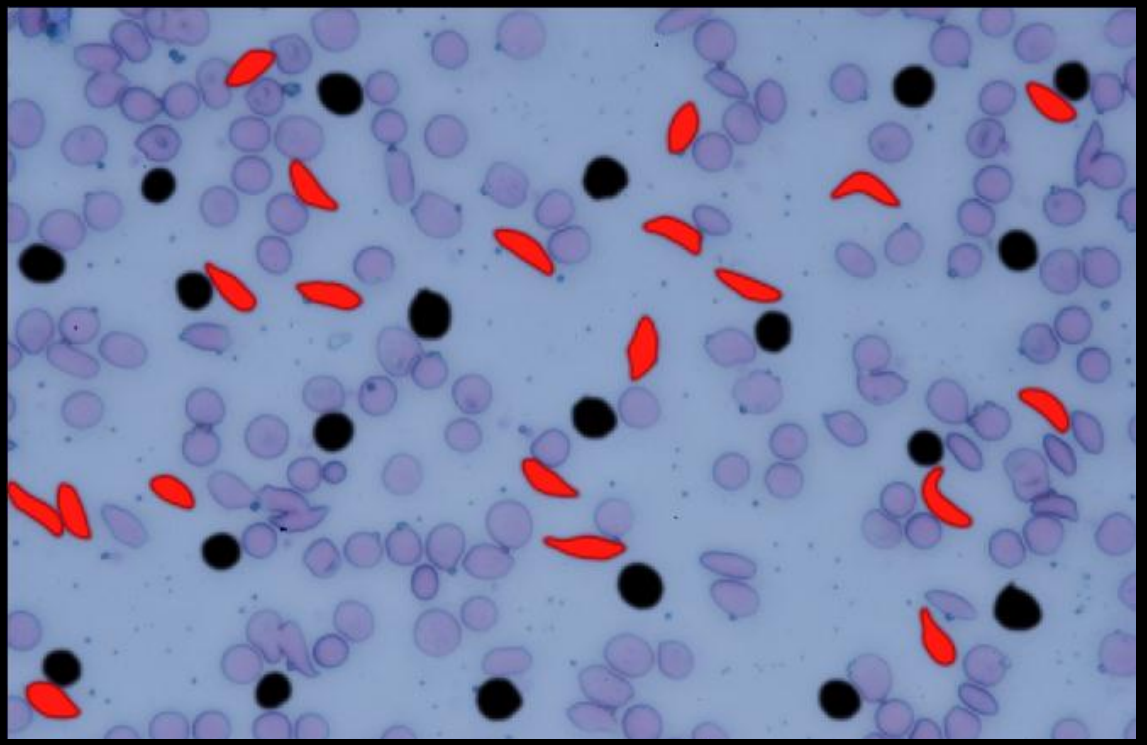


Total Length	# of nodes	# of end points
5233.55µm	113	111

# Branch Points	Mean fiber width	Width variation
3	1.44867µm	0 µm

2. Complex Measurements

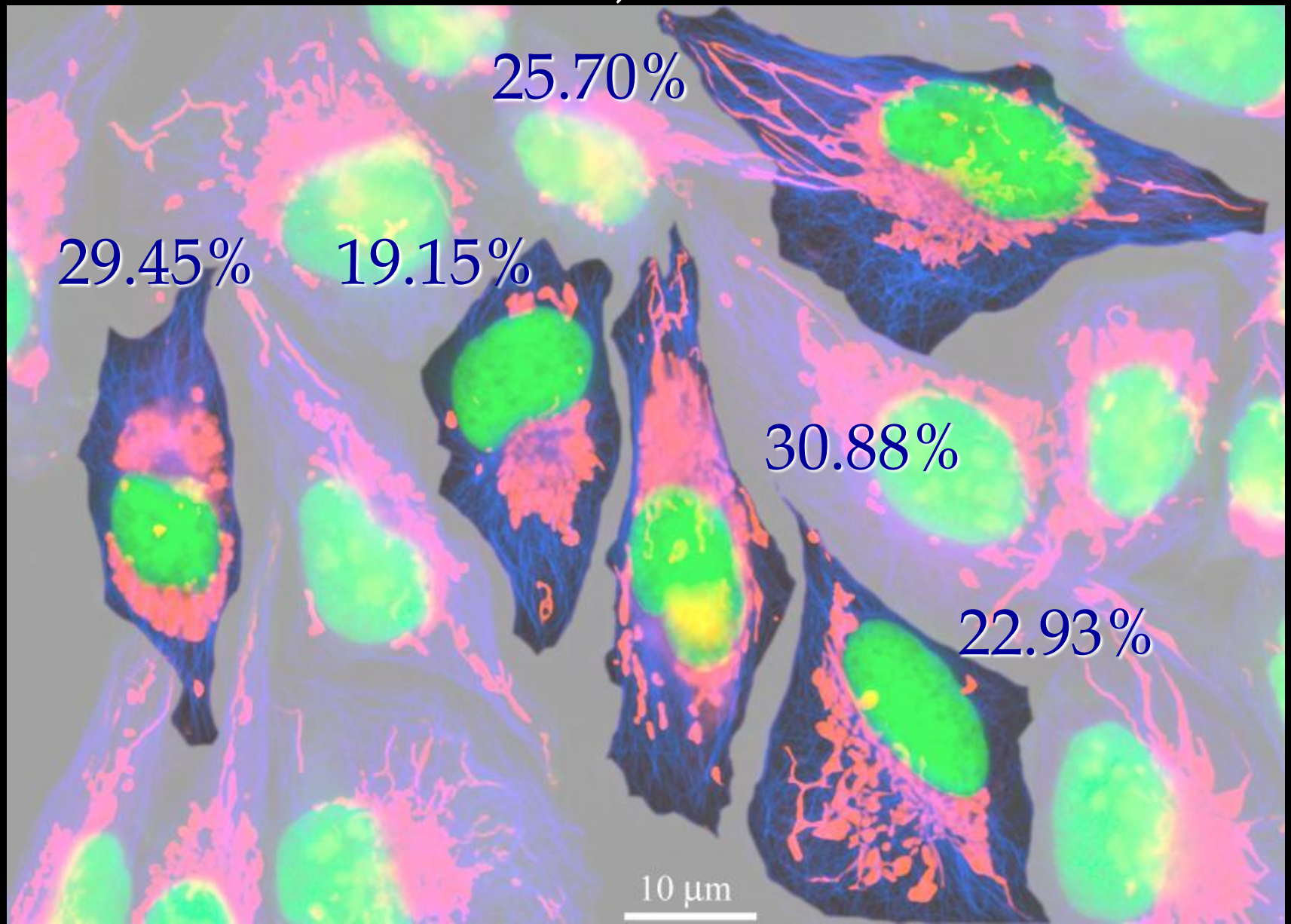
b) *Sickel3*



Cell type	n	Mean diameter	Mean Shape factor	Mean Aspect ratio
Normal	20	7.871	0.919	1.132
Sickel	20	7.104	0.598	2.618

2. Complex Measurements

c) *U-2 OS*

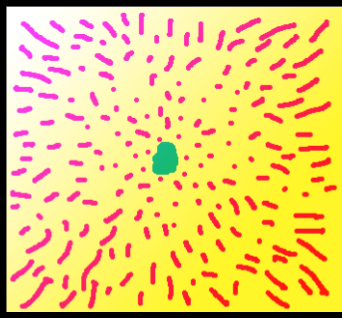


3. Complex Counting Using Cross Correlation

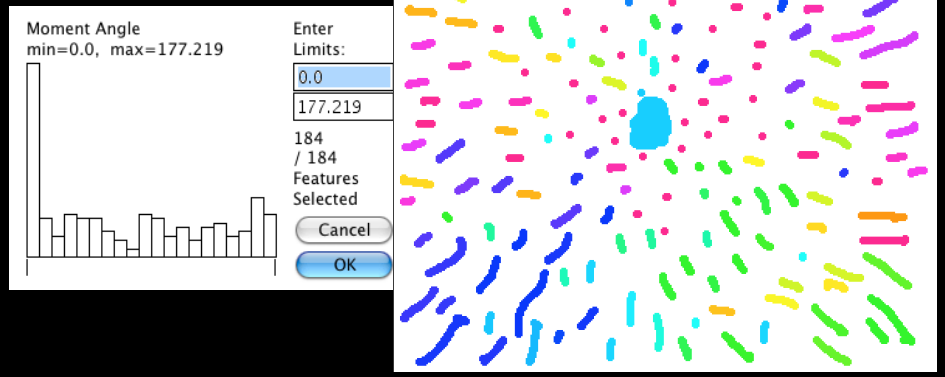
136 trees

4. Use the Color by Value Protocol

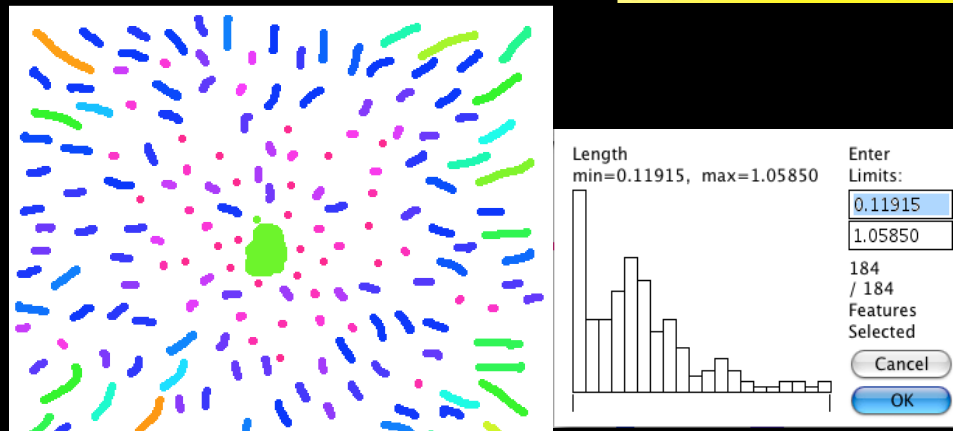
Distanc3



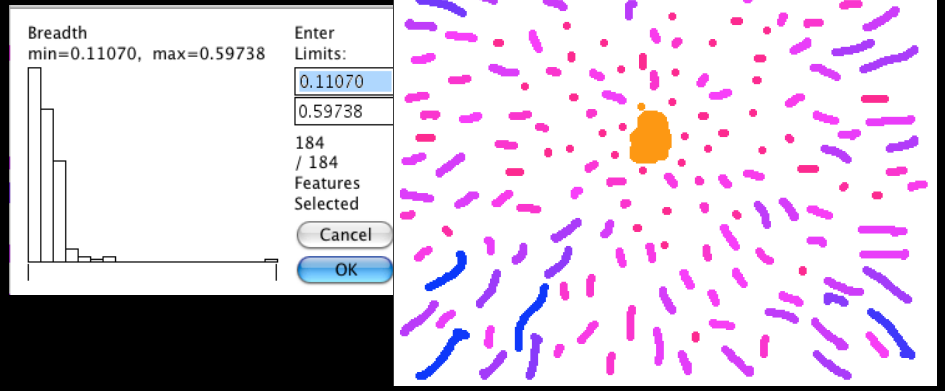
a) Moment Angle



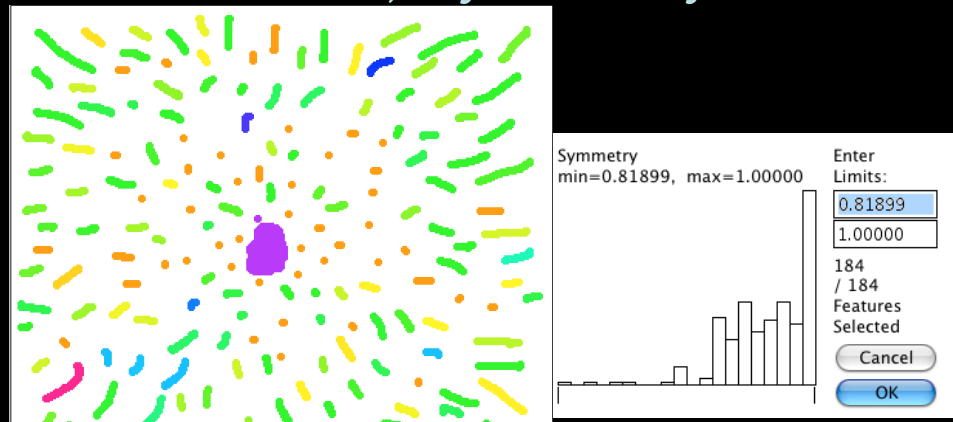
b) Length



c) Breath

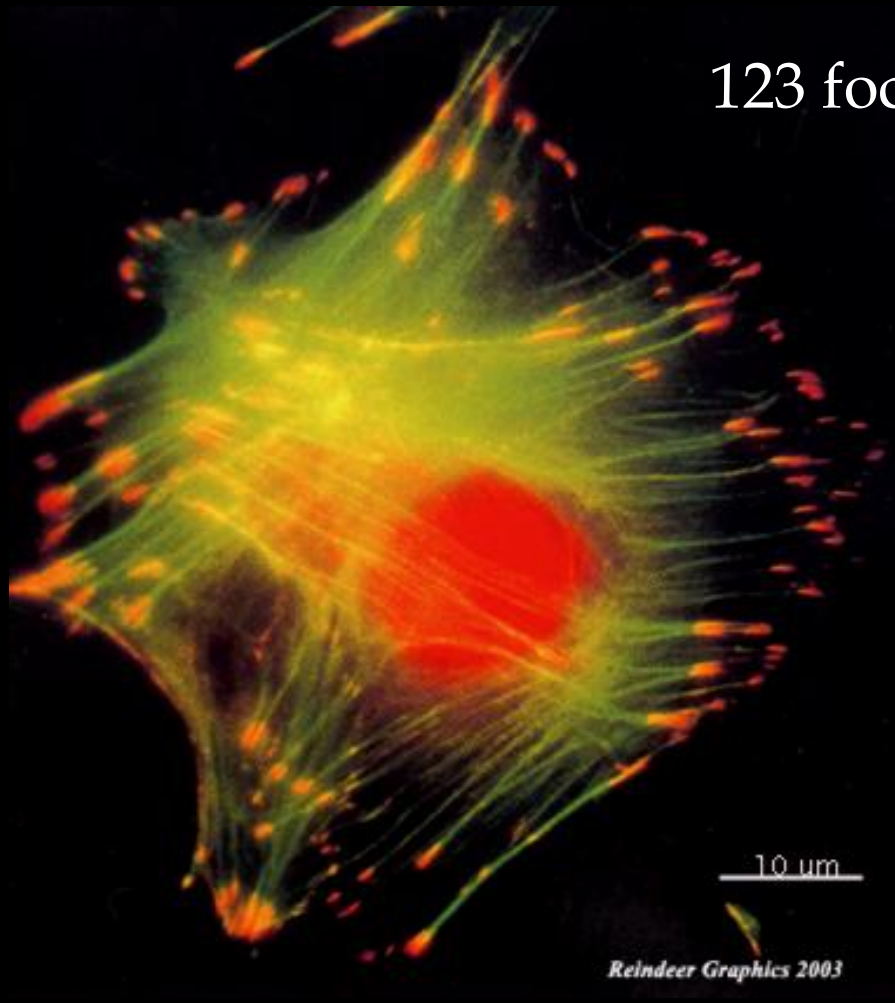


d) Symmetry

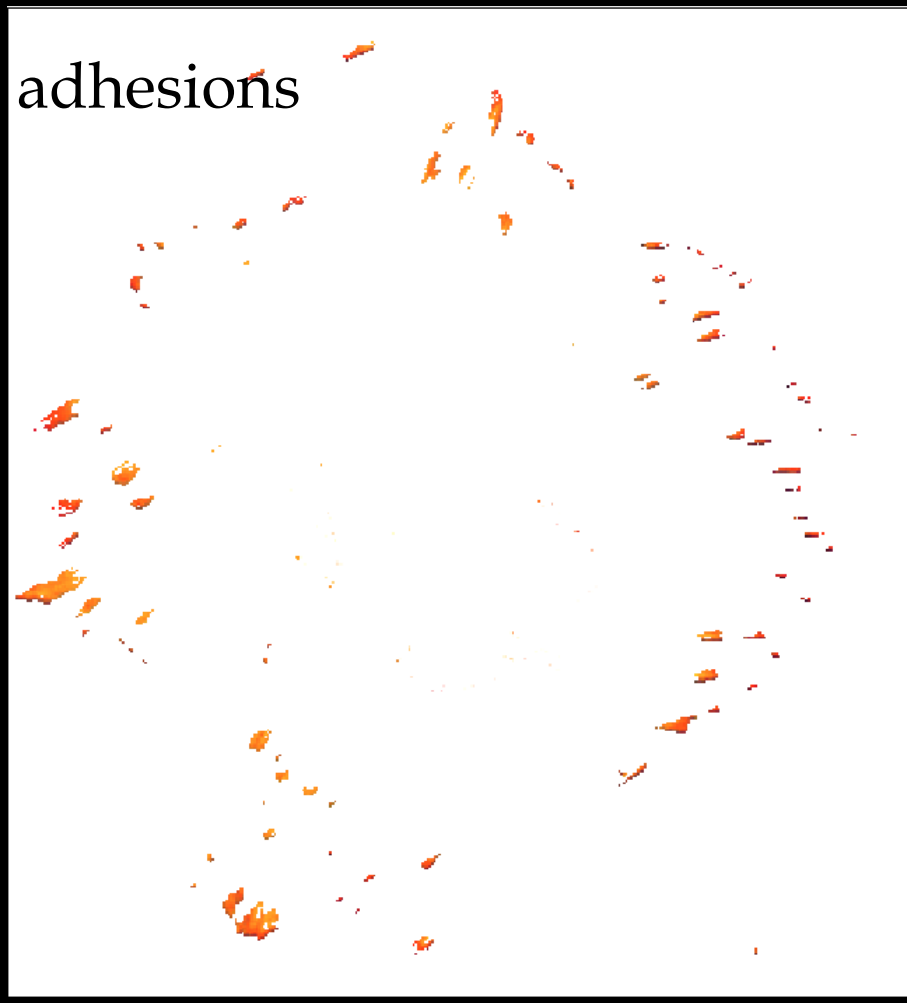


5. Color Segregation

Project 1: *Fibrblas*

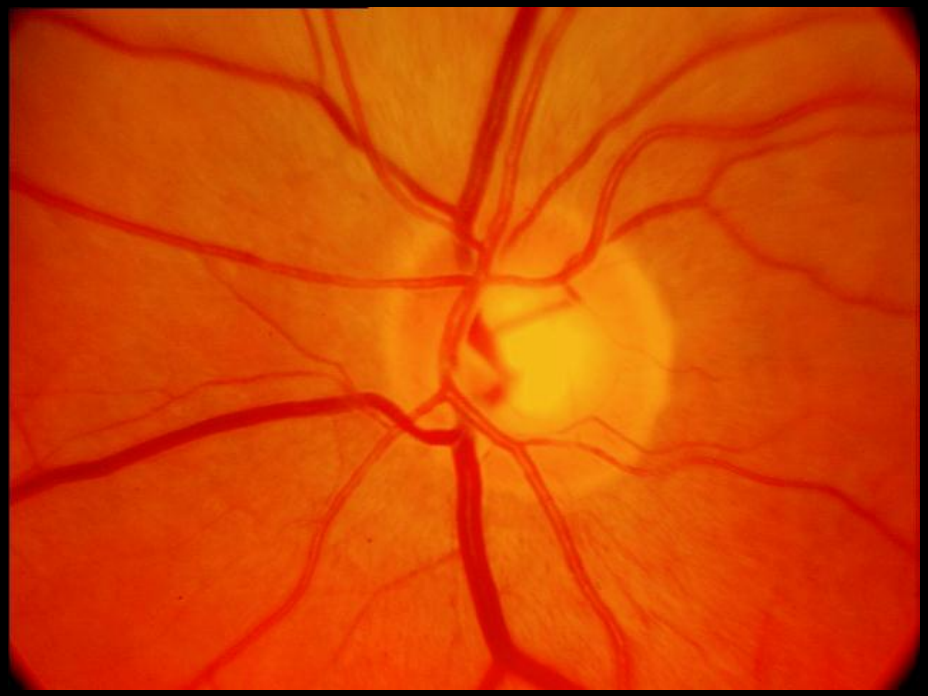


123 focal adhesions



5. Color Segregation

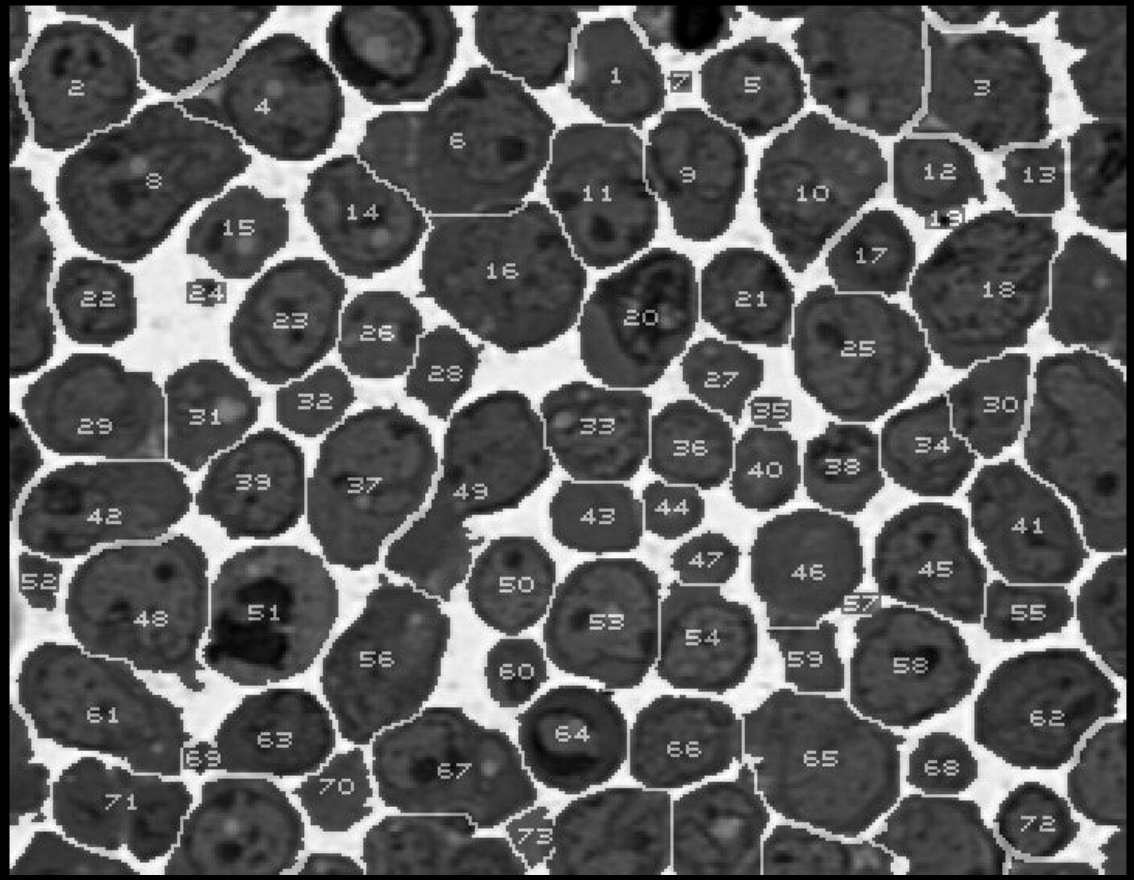
Project 2: *Retina*



Total Vasculature Area = 0.24945381 cm^2

6. Watershed Segmentation

Cells



65 Cells total

0.475 μm² mean area

1.648 μm² Max area & 0.020 μm² Min Area

Cell area (μm^2) by cell #

1	0.38318	23	0.70079	45	0.81971
2	0.57355	24	0.2902	46	0.32446
3	0.63962	25	0.21924	47	0.74141
4	0.65088	26	0.2168	48	0.08368
5	0.37731	27	0.59949	49	0.60732
6	0.98904	28	0.29412	50	0.43653
7	0.02006	29	0.36752	51	0.20554
8	0.96702	30	0.18499	52	0.69639
9	0.50993	31	0.43555	53	1.64823
10	0.65626	32	0.32446	54	0.17373
11	0.61466	33	0.04159	55	0.15856
12	0.18352	34	0.29069	56	0.62983
13	0.4977	35	0.74533	57	1.16473
14	0.32837	36	0.27895	58	0.46051
15	0.90829	37	0.44191	59	0.8481
16	0.27797	38	0.22805	60	0.42136
17	1.13928	39	0.51287	61	0.69688
18	0.62347	40	0.62983	62	0.16101
19	0.36948	41	0.27748	63	0.20603
20	0.29167	42	0.12822	64	0.49868
21	0.53098	43	0.12724	65	0.21533
22	0.03768	44	0.78937		

The End