Making Professional Quality Scientific Figures: Part II – Advanced Image Editing

RESOURCES:

http://www.people.fas.harvard.edu/~draft/thesisworkshop/

- PDF of this presentation
- PDF of instructions for image manipulation
- Sample images used in the demos
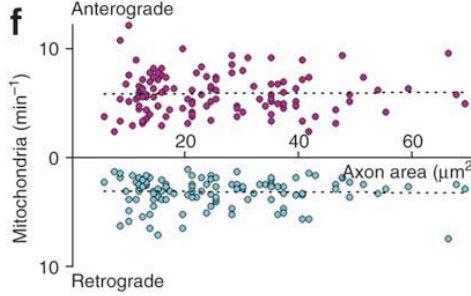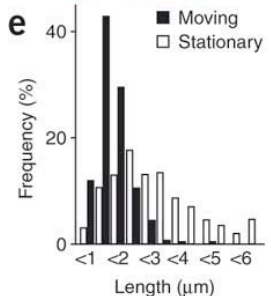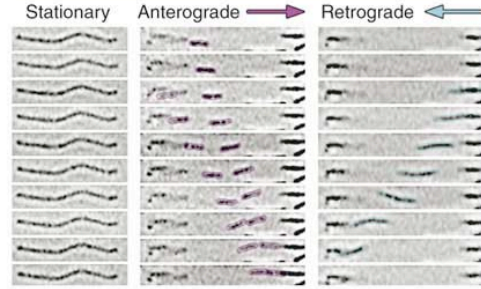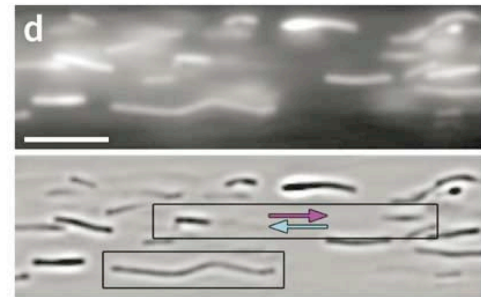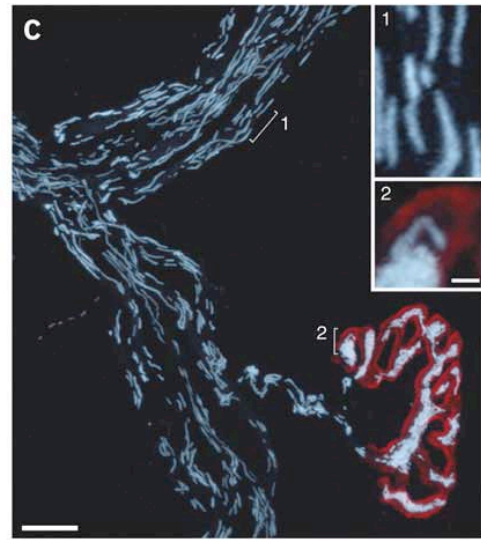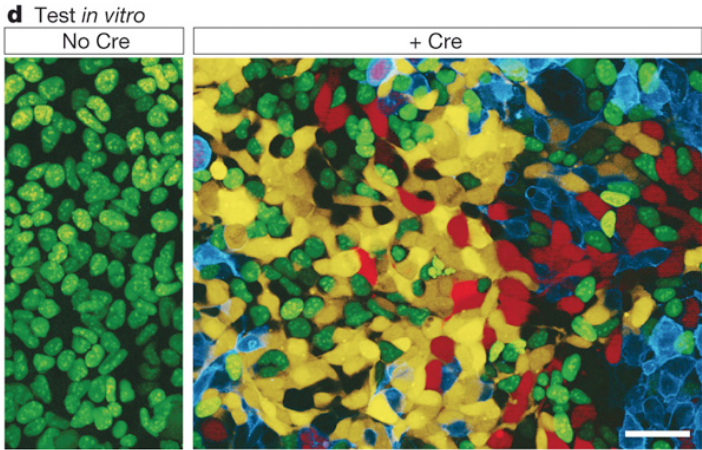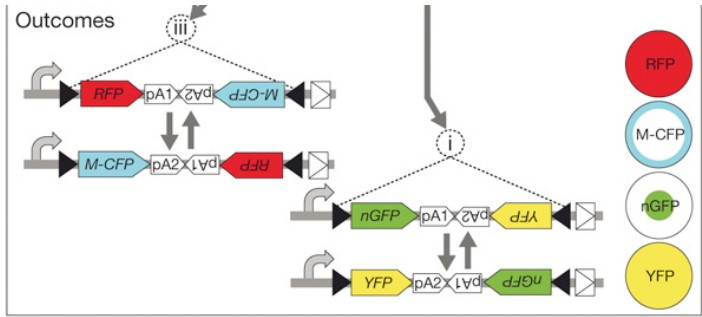
Tips on Raster File Formats

- TIF, PNG – "lossless" compression
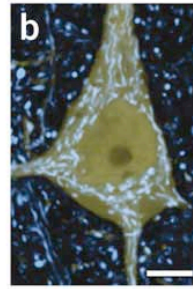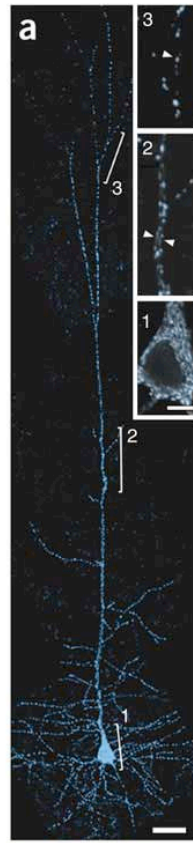   - Use TIFF for your master file (original)
    - Save a new copy as TIF or PNG each time you edit/manipulate
- JPEG – "lossy" compression
    - smaller file size (~ 10 fold) with high quality compression
    - Final PDF will automatically convert images to JPG by default
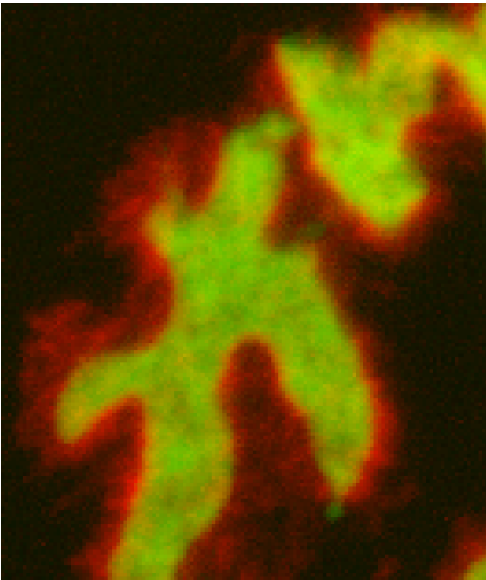
Original PNG
178 KB

High quality JPG
11 KB

Low quality JPG
5 KB

Editing Image Files

A pixel is a block with a grayscale intensity value (0-255 for an 8-bit image)

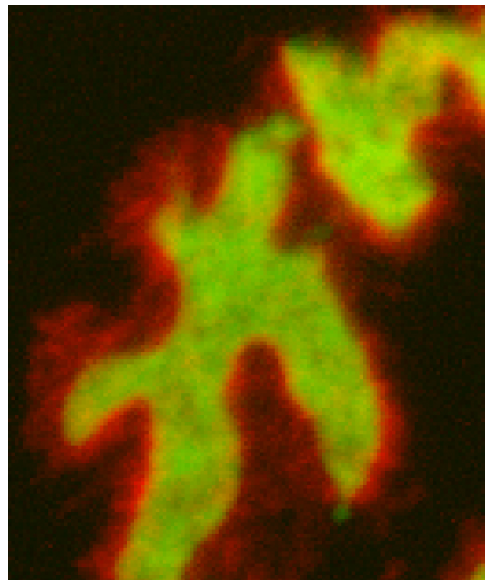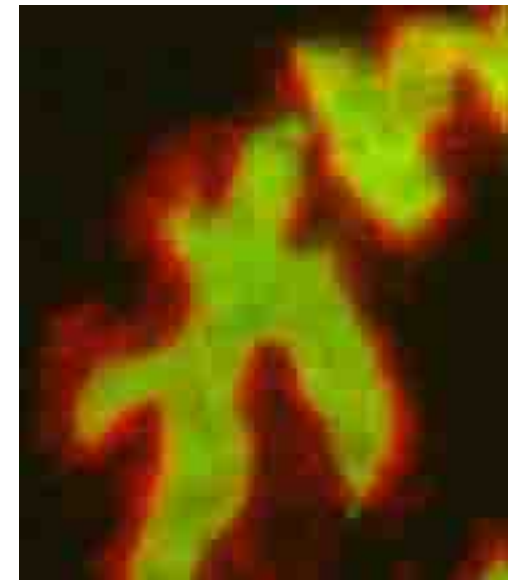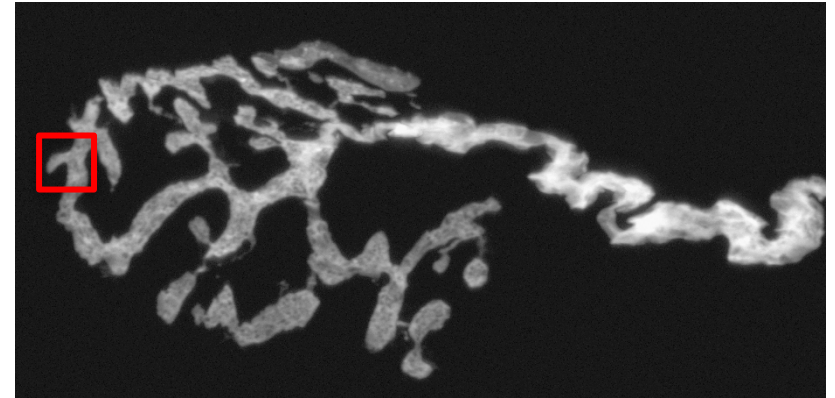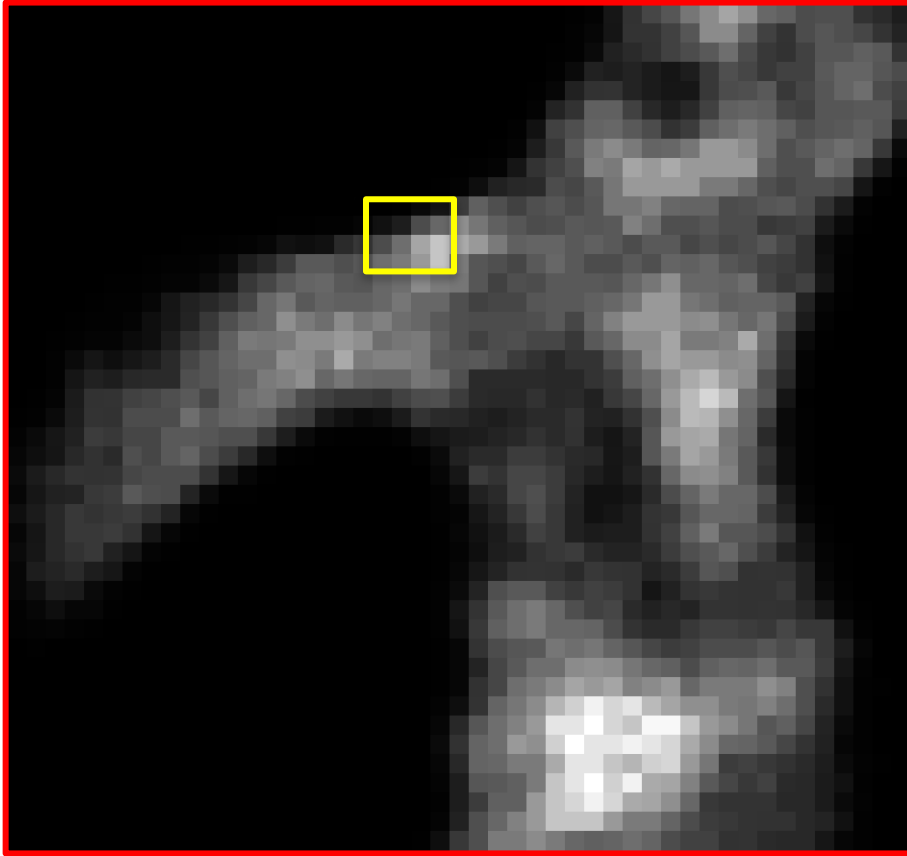| 0	0	0	1	2	4	7	13
0	2	2	5	9	20	28	43
3	5	5	9	16	40	51	68
7	15	23	28	36	51	85	98
11	16	24	40	59	74	81	121
11	20	36	47	74	99	95	99
20	29	51	65	78	87	87	121

Fill the Dynamic Range

We can view a graph of all the pixel values (pixel histogram)

Stretch the pixel value range to cover the entire display range

pixels with that value

pixel intensity values

0   255

pixels with that value

pixel intensity values

0   255
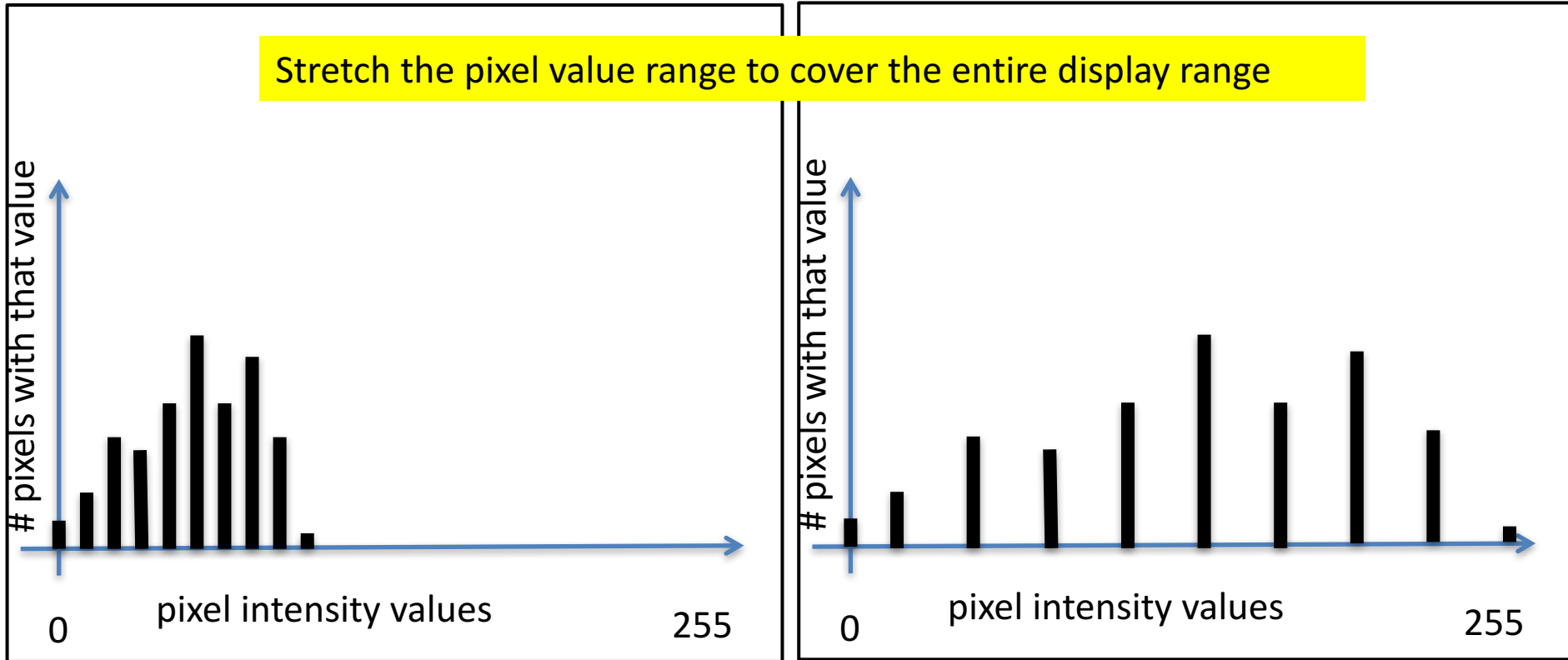
We can adjust the how the pixel values to help the viewer see more 'information'

A raster image is simply a grid of pixels

We make it easier for the eye to distinguish differences in the data
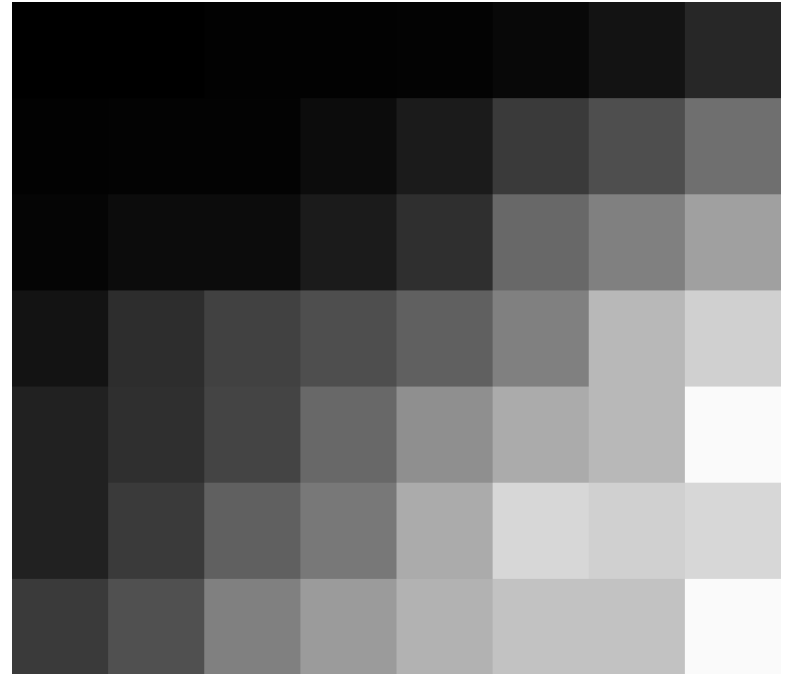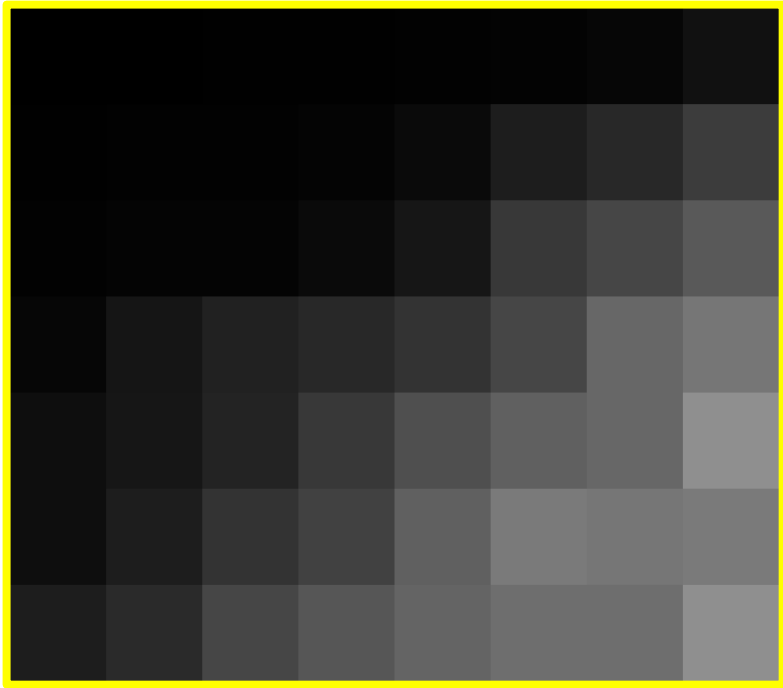
How to adjust the levels:

TIPS:
1) Leave some background (non-black) to show the relative brightness.
2) Don't saturate pixels/objects you care about (information would be lost).
3) For multicolor images, work on each color separately.

Open the image in Photoshop or GIMP
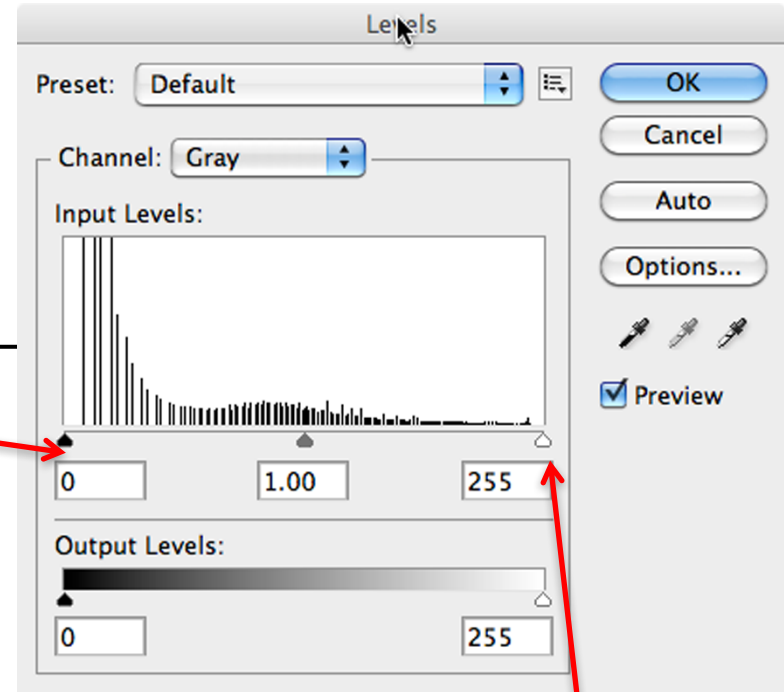
Move triangle right to set '0' value
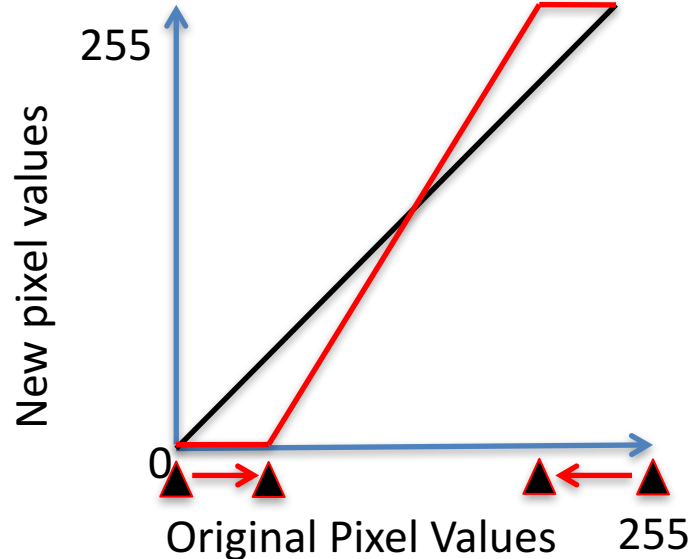
Move triangle left to set '255' value

Quantify original image, not manipulated image. This is for display purpose only

255

New pixel values

0

Original Pixel Values   255

The third triangle: Gamma

Move triangle
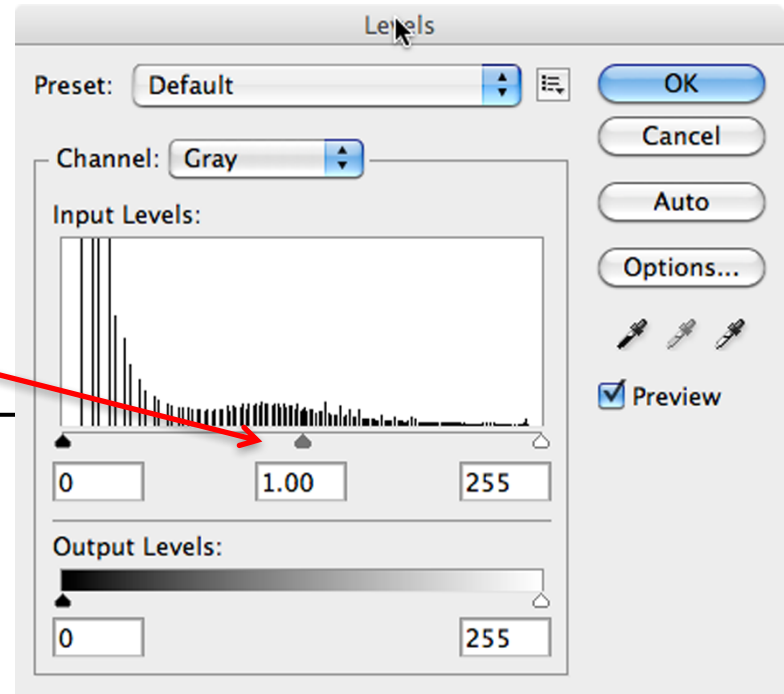
"Bring out the mid-tones"

DEMO
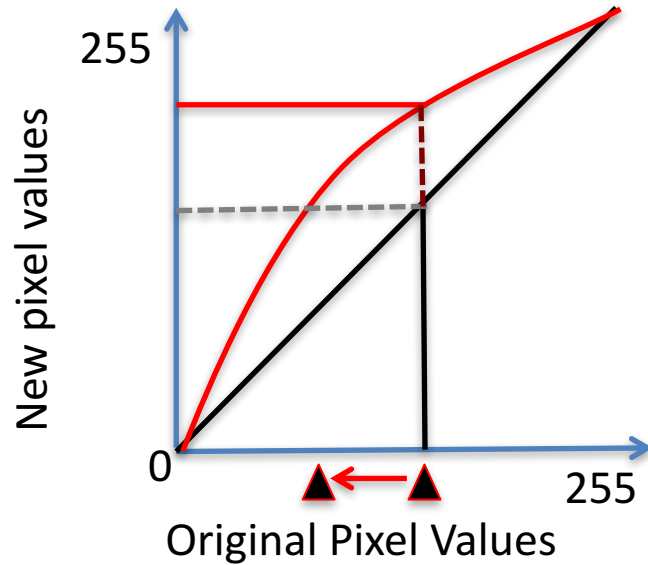
How to I Ensure My Images are 220 ppi?

- Normal printer: **220 ppi/dpi** (pixels/dots per inch)
- Slideshows (projects/monitors) 72 ppi
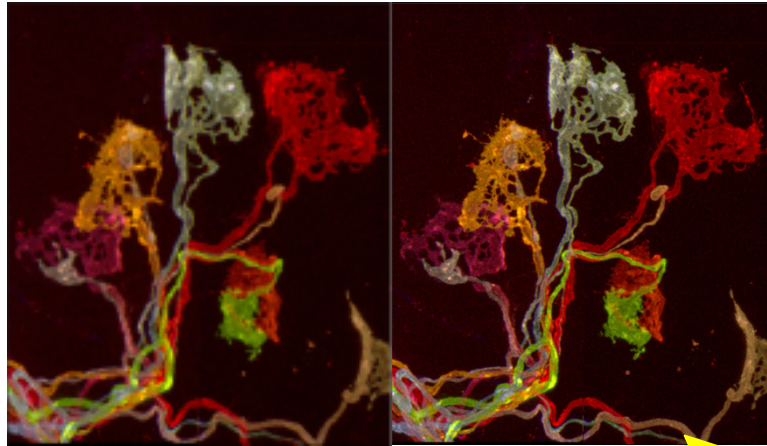
Easy as 1-2-3

STEP 1: Adjust image resolution to 220 ppi and determine the size of your image

1 inch

1 inch

1 inch

1 inch

10 px/in

100 px/in

100 px (10 x 10)

100 px (10 x 10)

- Changes in ppi = changes in image dimensions.
- NO CHANGE the pixel number

DEMO

STEP 2: Insert 220 ppi Image into PPT
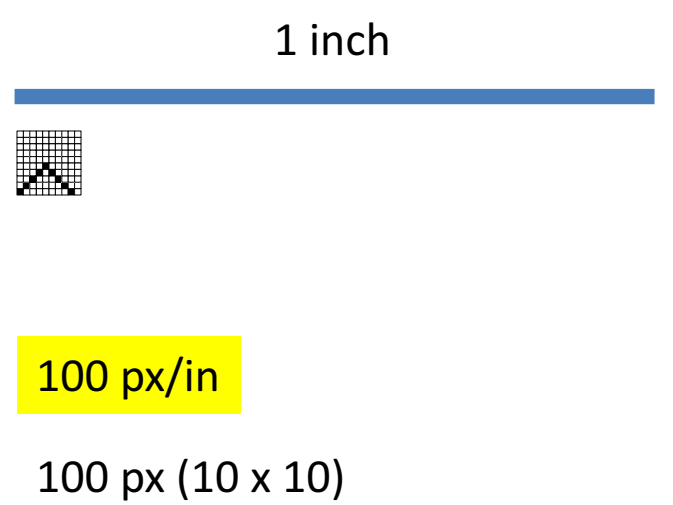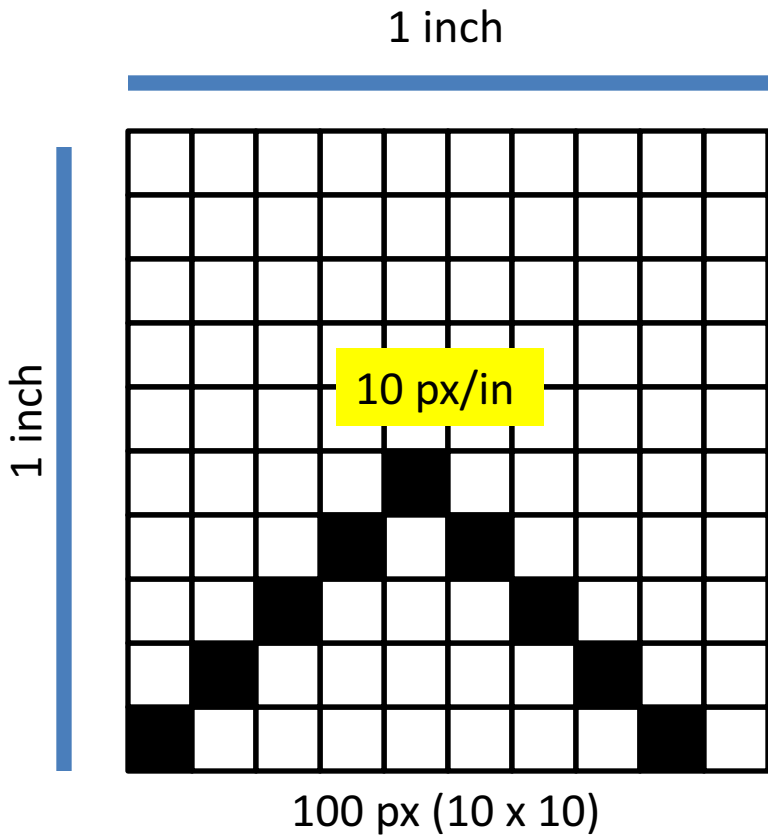
Word Doc: 8.5 x 11

Use 9 inches

Use 6.5 inches

Figure Legend
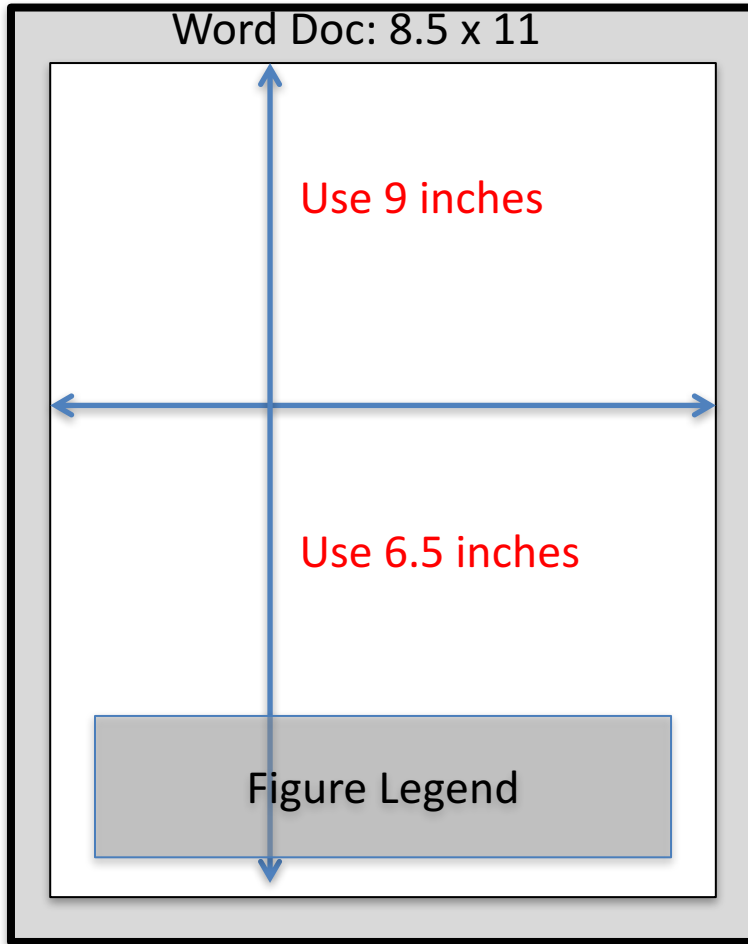
That will give you a 1 inch border in final document

Insert or drag your 220 ppi image into PPT (don't copy/paste!)

- The image will appear at proper printing resolution and dimensions
  - If the image is bigger than you need, see step 3 option A
  - If the image is smaller than you need, see step 3 option B

STEP 3-A: Image is too big

Decrease the Image Dimension by removing pixels

Actual: 10 px/ in; 1in x 1 in

1 inch

Target: 10 px/ in; 0.5 in x 0.5 in

1 inch

1 inch

10 px/in

100 px (10 x 10)
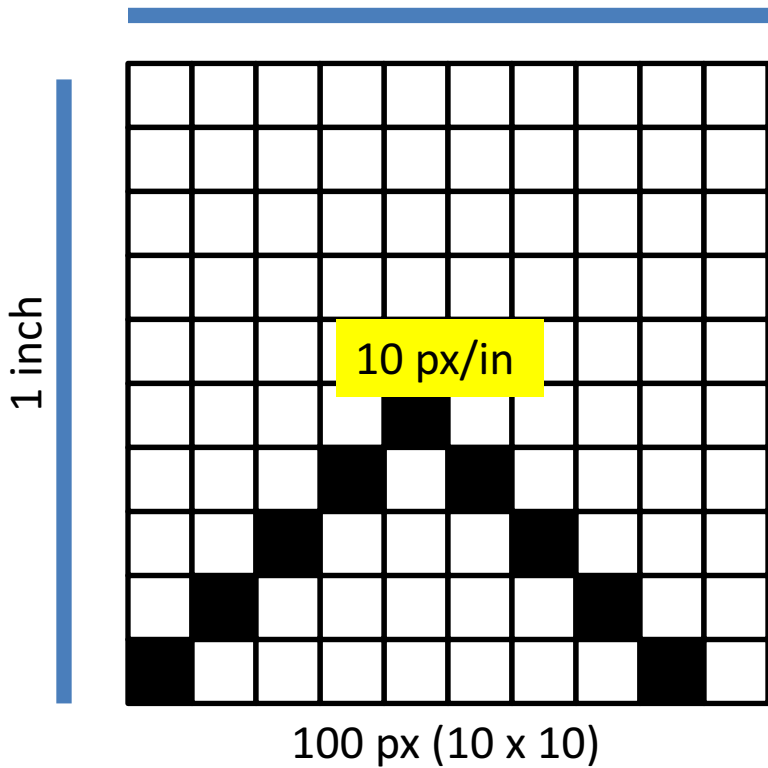
1 inch

Easy way:

- Drag/resize in powerpoint (using the bounding box)

STEP 3-A: Image is too big

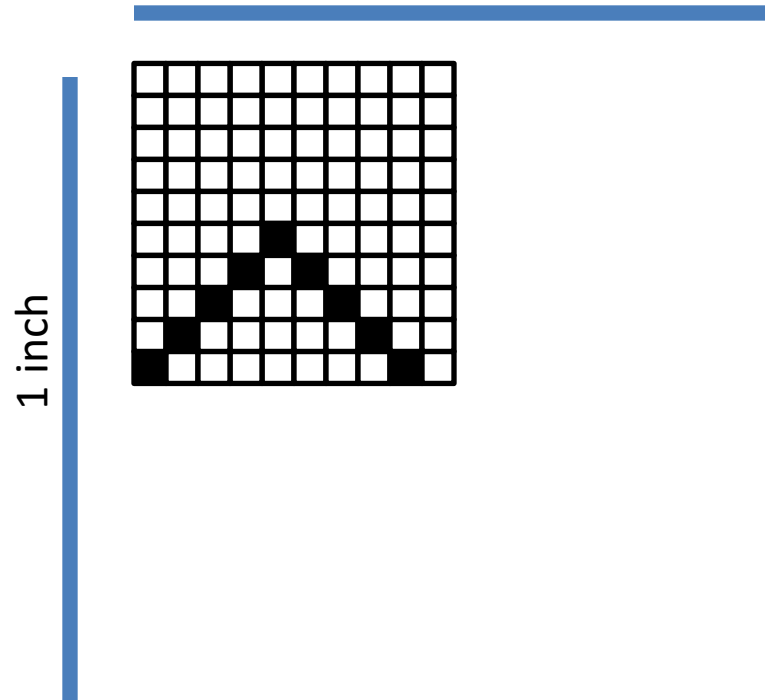## Decrease the Image Dimension by removing pixels

Actual: 10 px/ in; 1in x 1 in

Target: 10 px/ in; 0.5 in x 0.5 in

1 inch
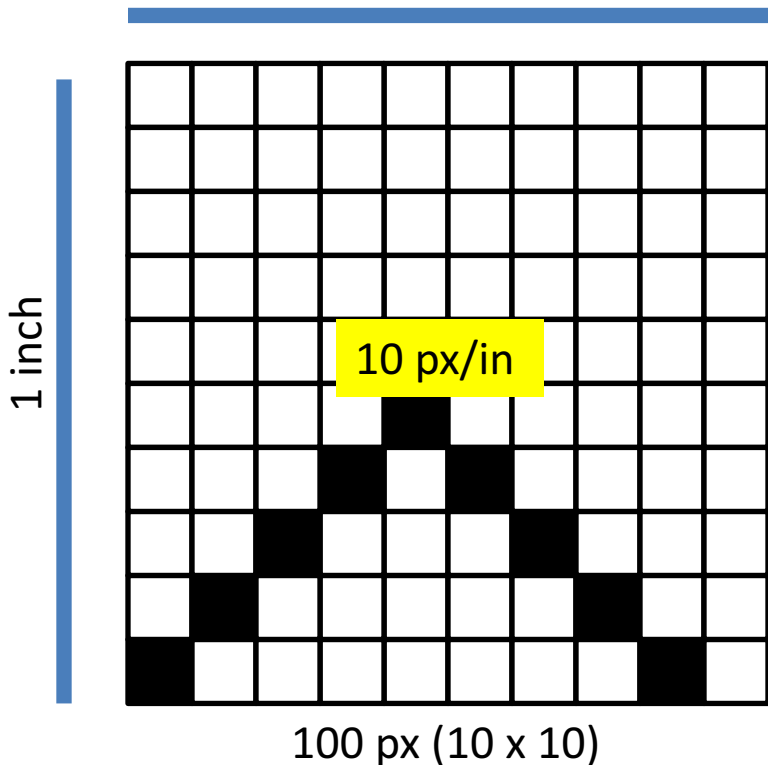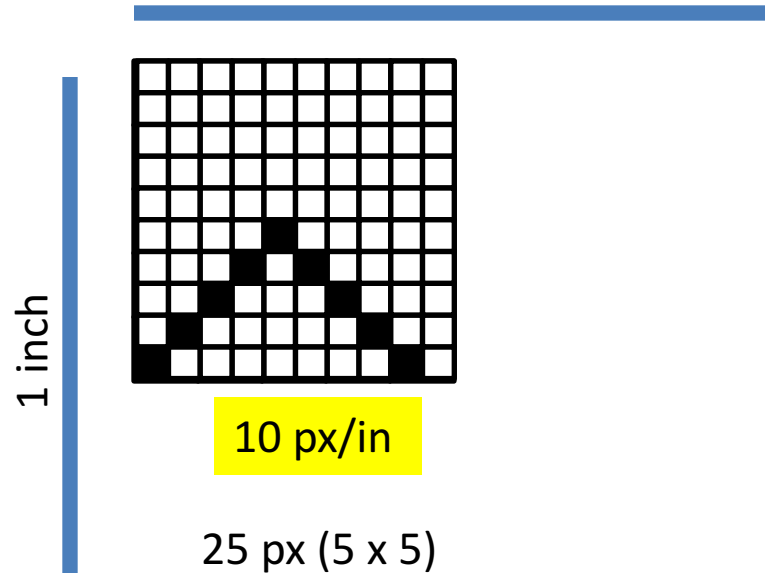
1 inch

1 inch

1 inch

10 px/in

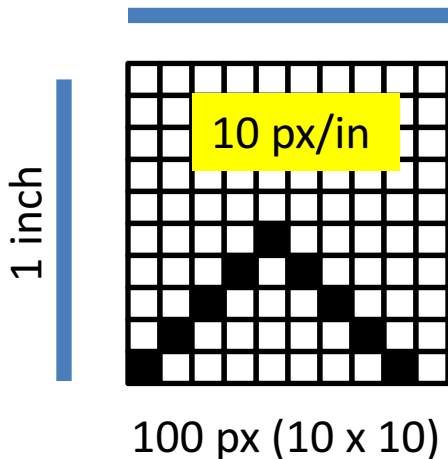10 px/in

100 px (10 x 10)

25 px (5 x 5)

Easy way:
- Drag/resize in powerpoint (using the bounding box)
- Click 'Format Picture' > 'Compress' > 220 (printing), selected picture only

STEP 3-B: Image is too small

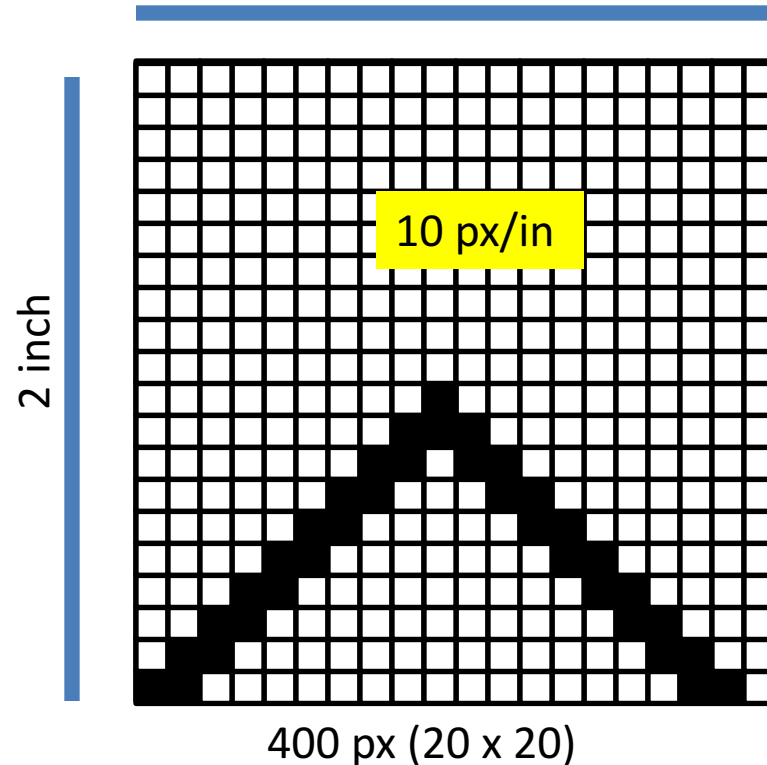## Increasing the Image Dimensions – need to 'add' pixels

Actual: 10 px/ in; 1in x 1 in

1 inch

1 inch

10 px/in

100 px (10 x 10)

Target: 10 px/ in; 2 in x 2 in

2 inch

2 inch

10 px/in

400 px (20 x 20)

Note: If you are trying to add pixels to give your image better clarity/resolution (like a CSI-Miami zoom-in), its not going to work. Either recapture the image, or make the pixelated image bigger (see next step), which can be useful to see details that are there.

Step 3-B: Adding Pixels

If you're enlarging microscope pictures, don't add fake pixel information ("interpolate") your image when enlarging – you want to show the real data!

- **CAUTION**: Drag/resizing the bounding box in powerpoint will interpolate your image!

GOOD – pixelated – real information

BAD – blurred: 'information' added
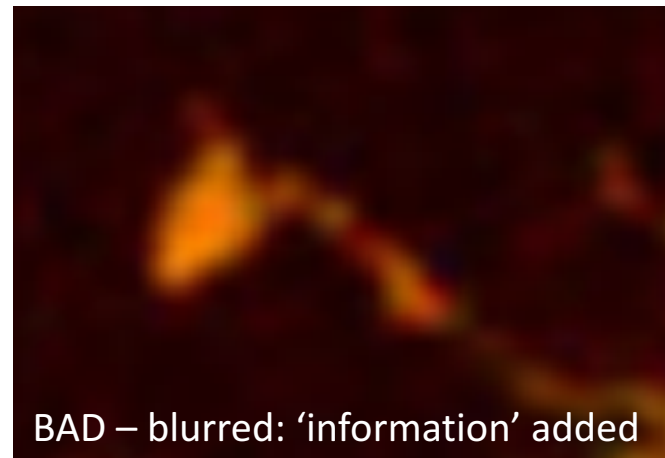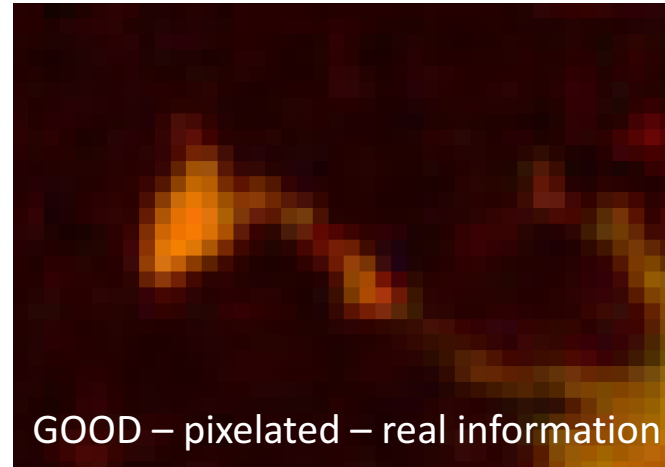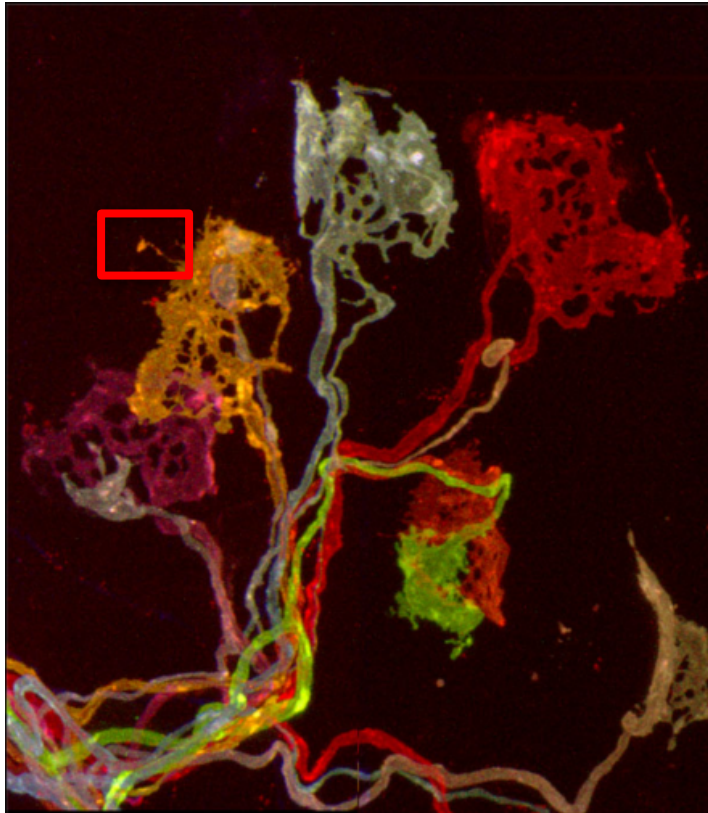
- Use 'Nearest Neighbor' (Photoshop) or 'No Interpolation' (GIMP) to add pixels without blurring the image.
- Reinsert the image into PPT.

DEMO

Done.

- **Summary**
    - Use Photoshop or GIMP to adjust your image levels.
    - Check/set the resolution of your image in Photoshop or GIMP
    - Insert picture into Powerpoint (DO NOT COPY AND PASTE!)
    - Scale your image down if you like (compress afterwards to remove excess pixels).
    - If necessary, make your image bigger by adding pixels without interpolation in Photoshop or GIMP.