

Microscope (Visual Observation) Experiments

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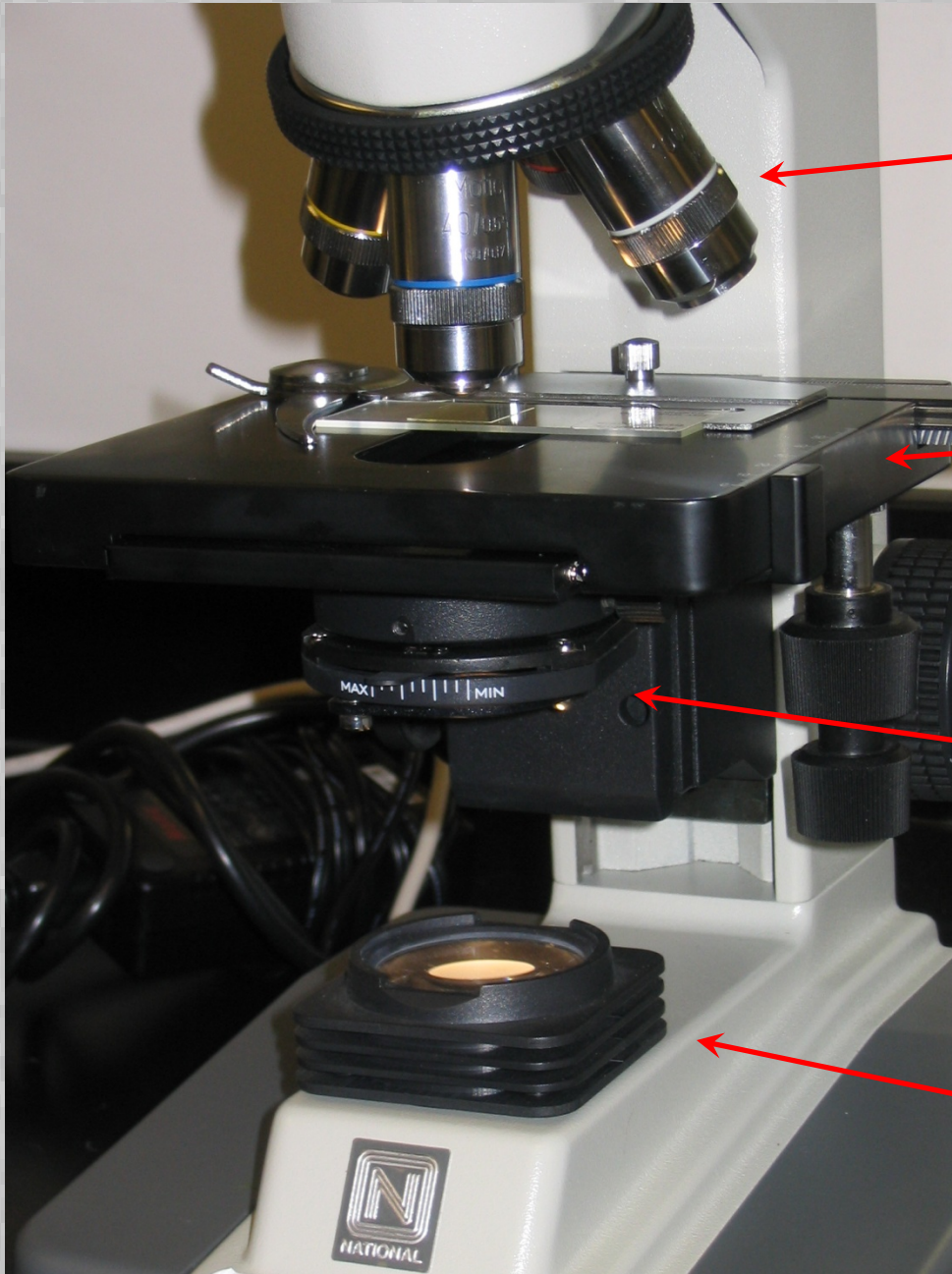
Purpose

- Provide students with the opportunity to practice:
 - the scientific method,
 - use of literature resources
 - record keeping (logbooks),
 - report writing,
 - visual observation and
 - microscope use.

Specific Requirements

- See Microscope Experiment Specific Requirements handout.

Microscope Parts - 1



Objectives

Stage

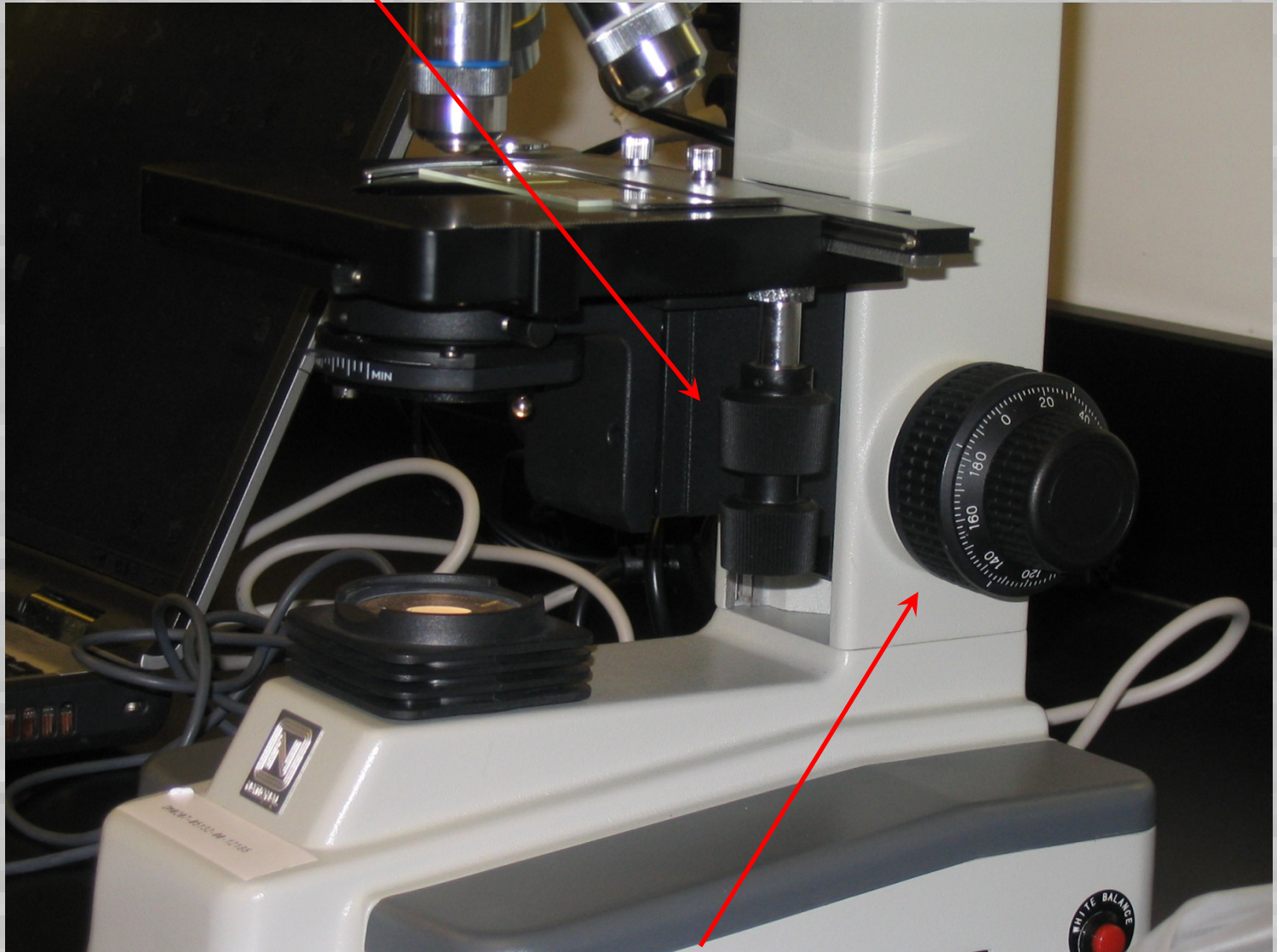
Collimator

Light source

Microscope Parts - 2

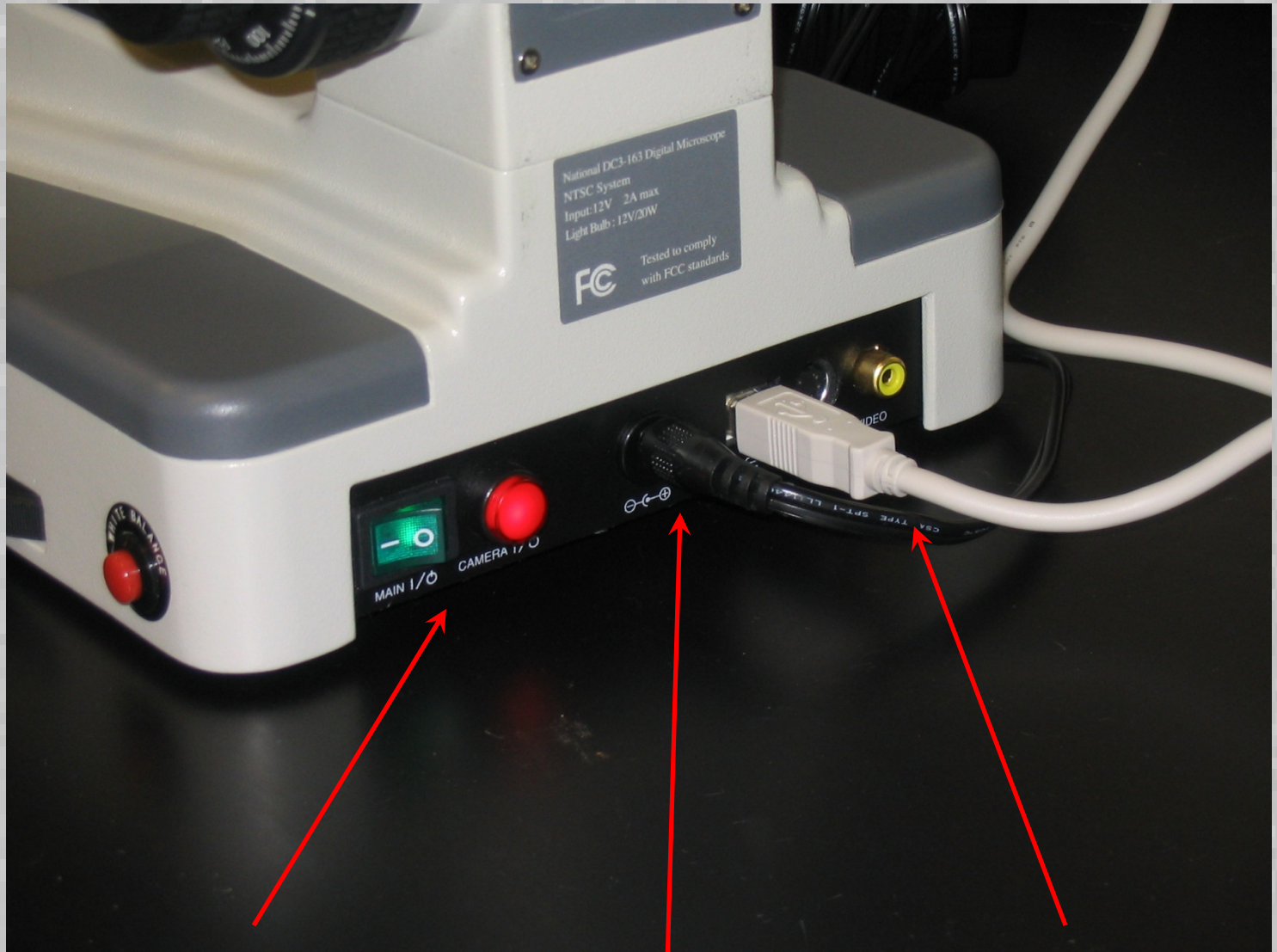


Stage Positioning Knobs



Focus Knobs

Microscope Parts - 4

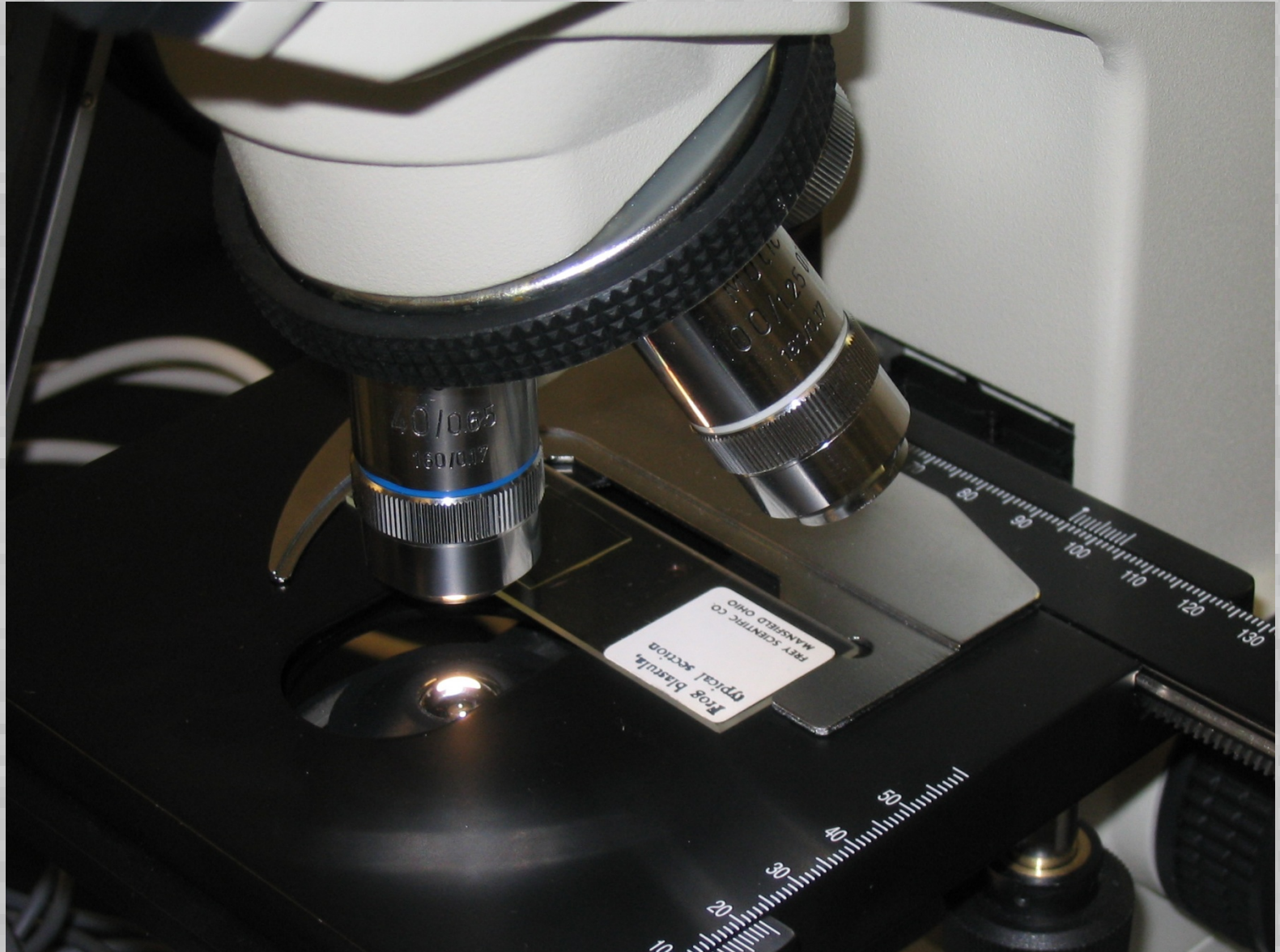


Power Switches

Power Connector

USB Connector

Correctly Orientated Slide



Microscope Handling & Use

Microscopic Dimensions

- The following table compares the size of some common units used in microscopic work.
- $1 \text{ mm} = 10^{-3} \text{ m} = 10^3 \text{ } \mu\text{m}$
- $1 \text{ m} = 10^6 \text{ } \mu\text{m}$ or $1 \text{ } \mu\text{m} = 10^{-6} \text{ m}$
- $1 \text{ nm} = 10^{-9} \text{ m}$ and $1 \text{ } \text{\AA} = 10^{-10} \text{ m}$
- $1 \text{ inch} = 25,380 \text{ } \mu\text{m}$
- Typical human cells are $10 \text{ } \mu\text{m}$ to $20 \text{ } \mu\text{m}$ in diameter.

Corrected 12/10/04

Objectives & Eyepieces

- The visual (with your eye) magnification of a microscope is the product of the objective (4, 10, 40 or 100 x) and eyepiece (10x) magnifications.
- When using the video camera in a microscope, only the objective magnification is relevant.
- Stating magnifications in terms of magnification (x) is meaningless once an image is captured.

Scale Bars (Calibration)

- It is critically important to place **scale bars** on photomicrographs do to the ease with which images can now be resized.
- The Motic microscope software includes features that will provide measures, but I prefer a manual approach.

Calibration Slide

Ø 1.5mm



Ø 0.6mm



Ø 0.15mm

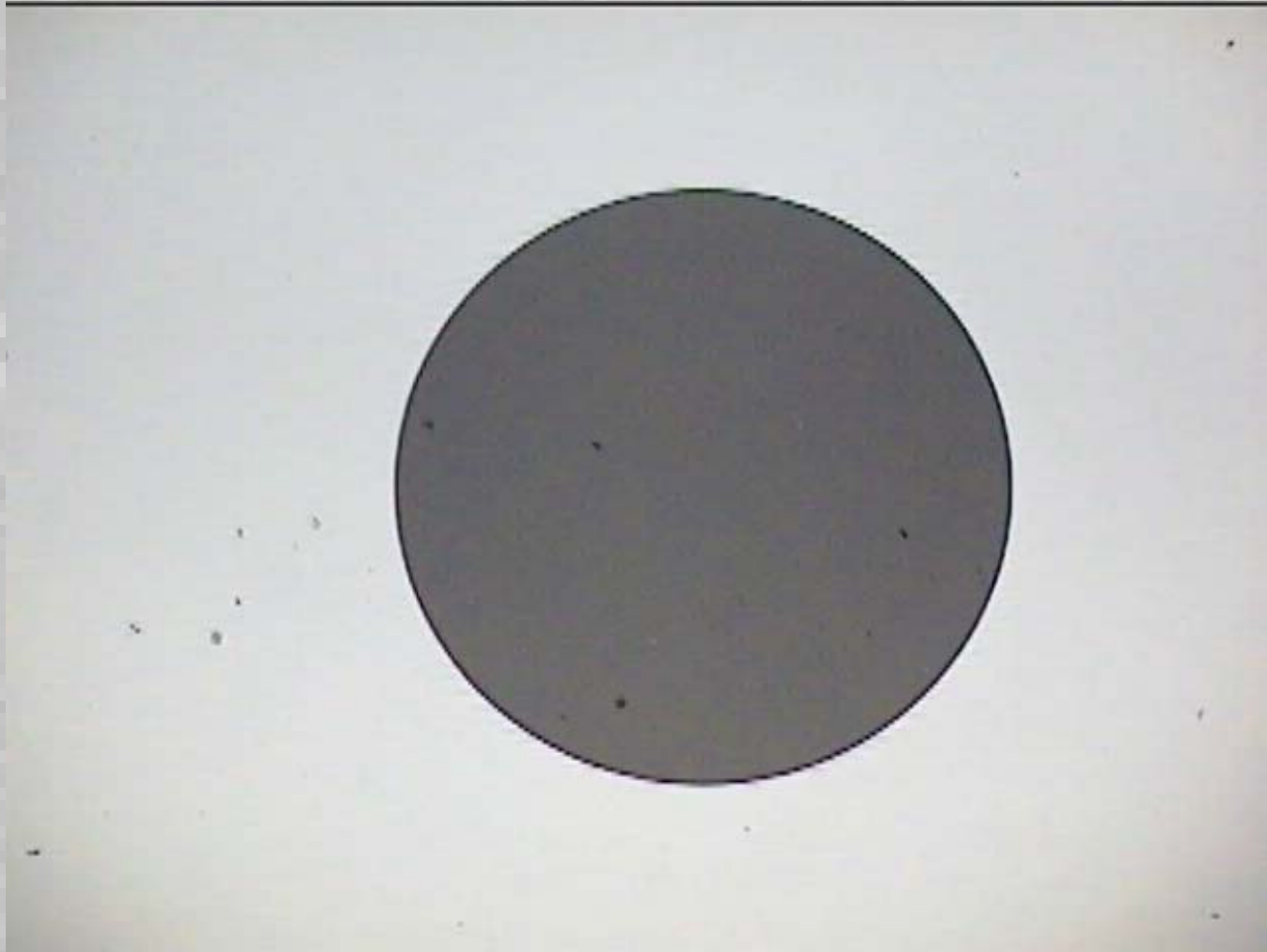
Ø 0.07mm

1 DIV = 0.01mm

Calibration slide

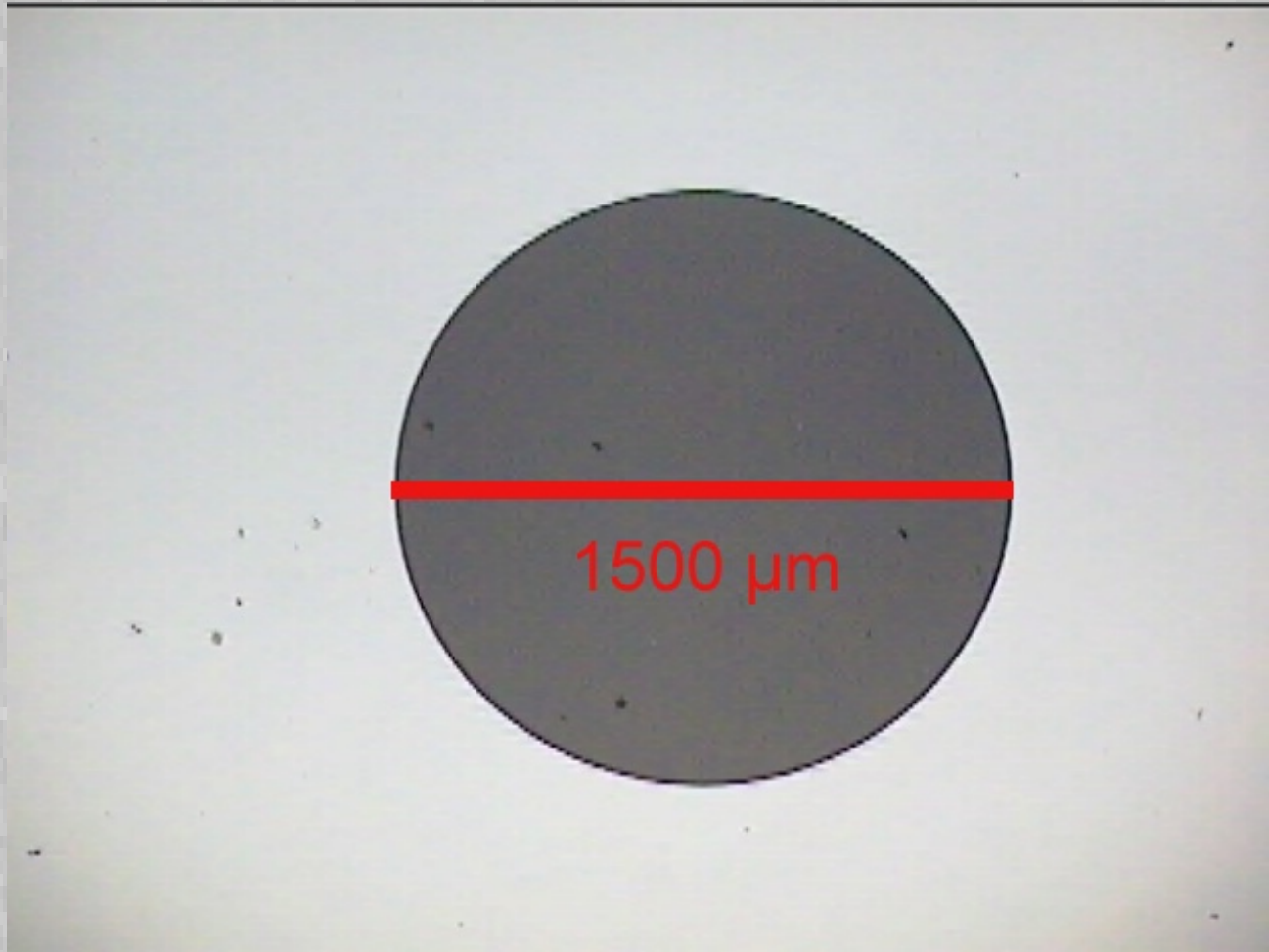
Motic[®]

4x Calibration Image



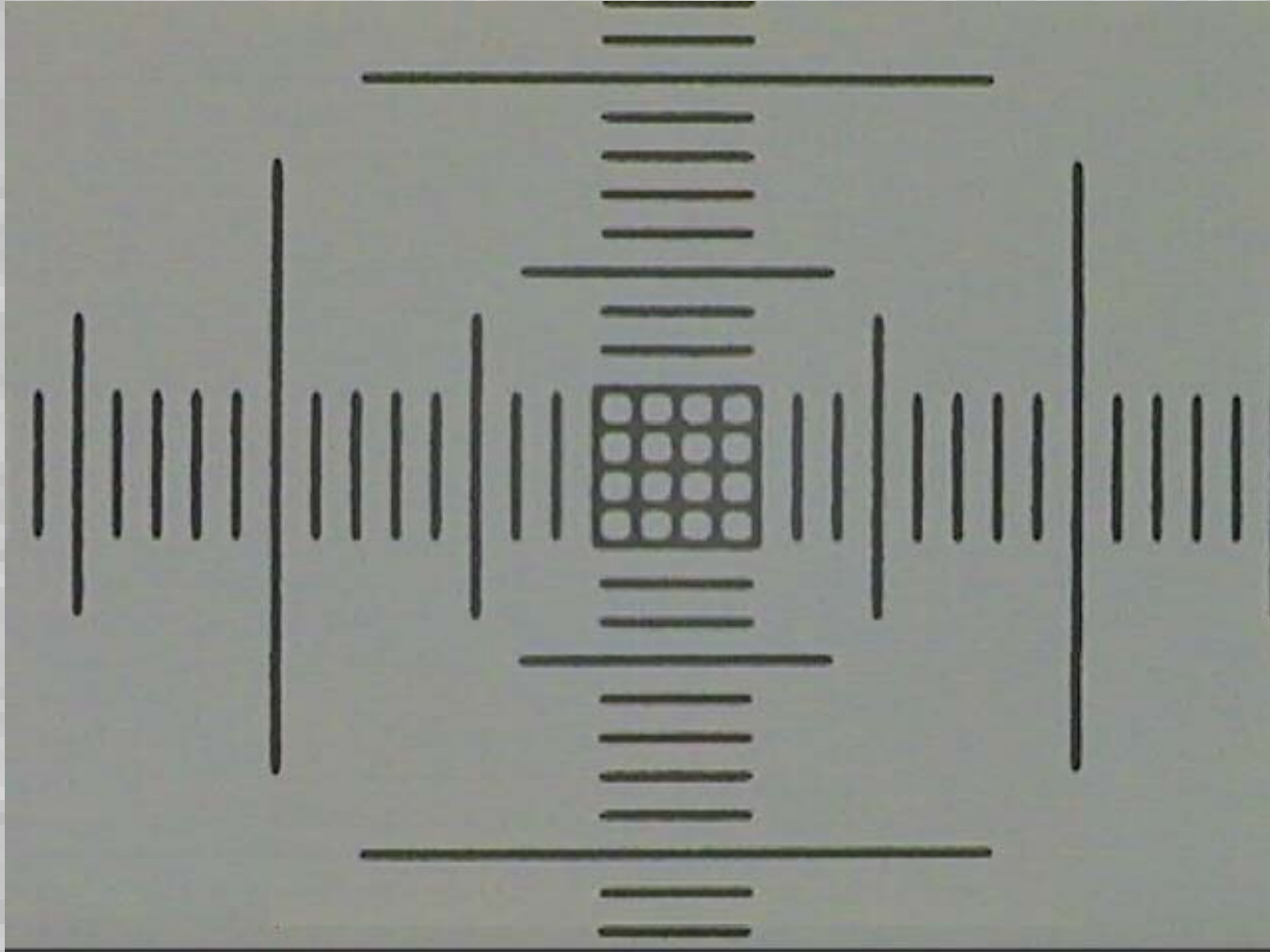
1500 μm circle with 4x objective –
as captured (1500umAt4x.png).

4x Image with Scale Bar



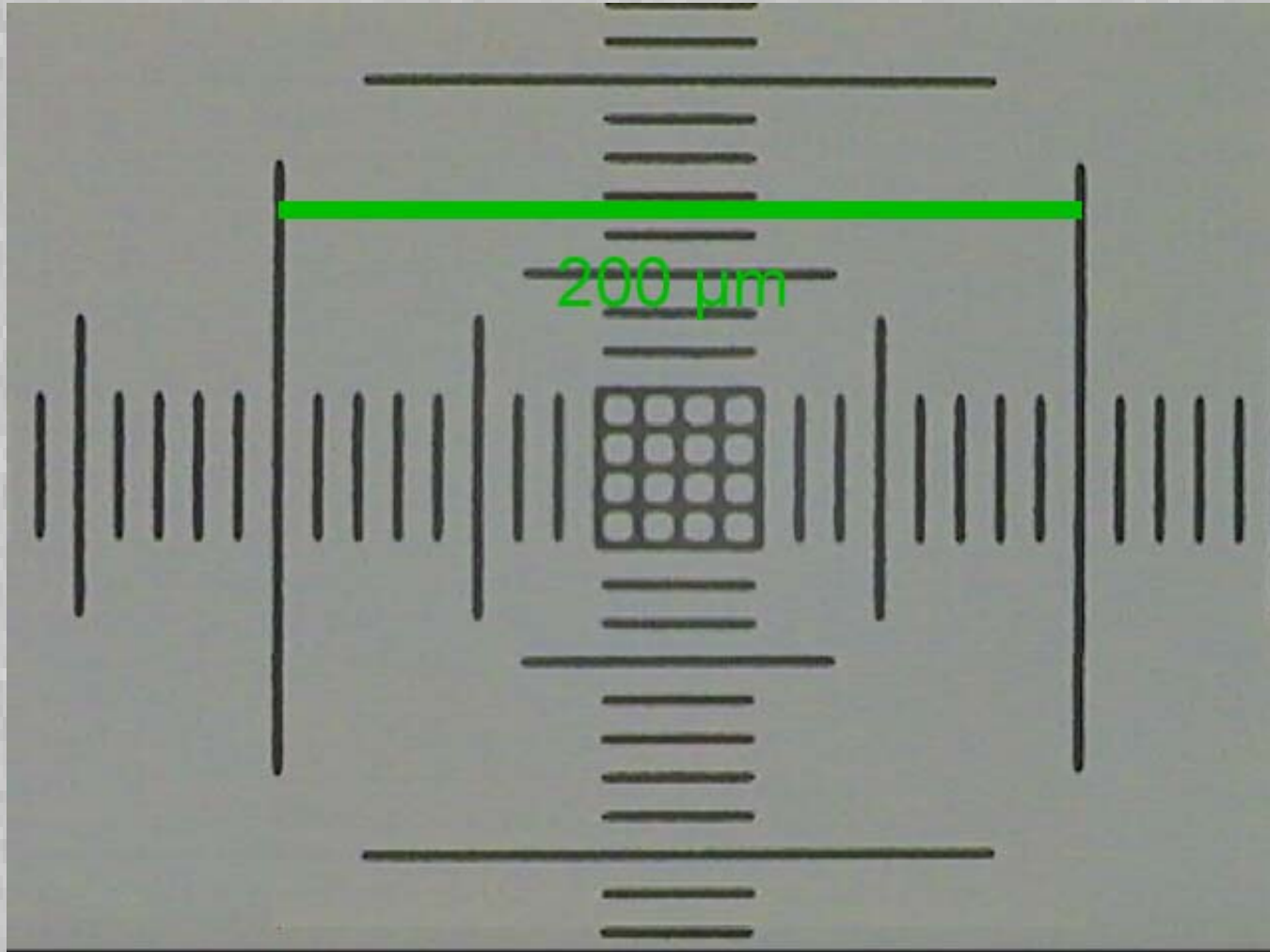
1500 μm circle with 4x objective – with added text and scale bar.

40x Calibration Image



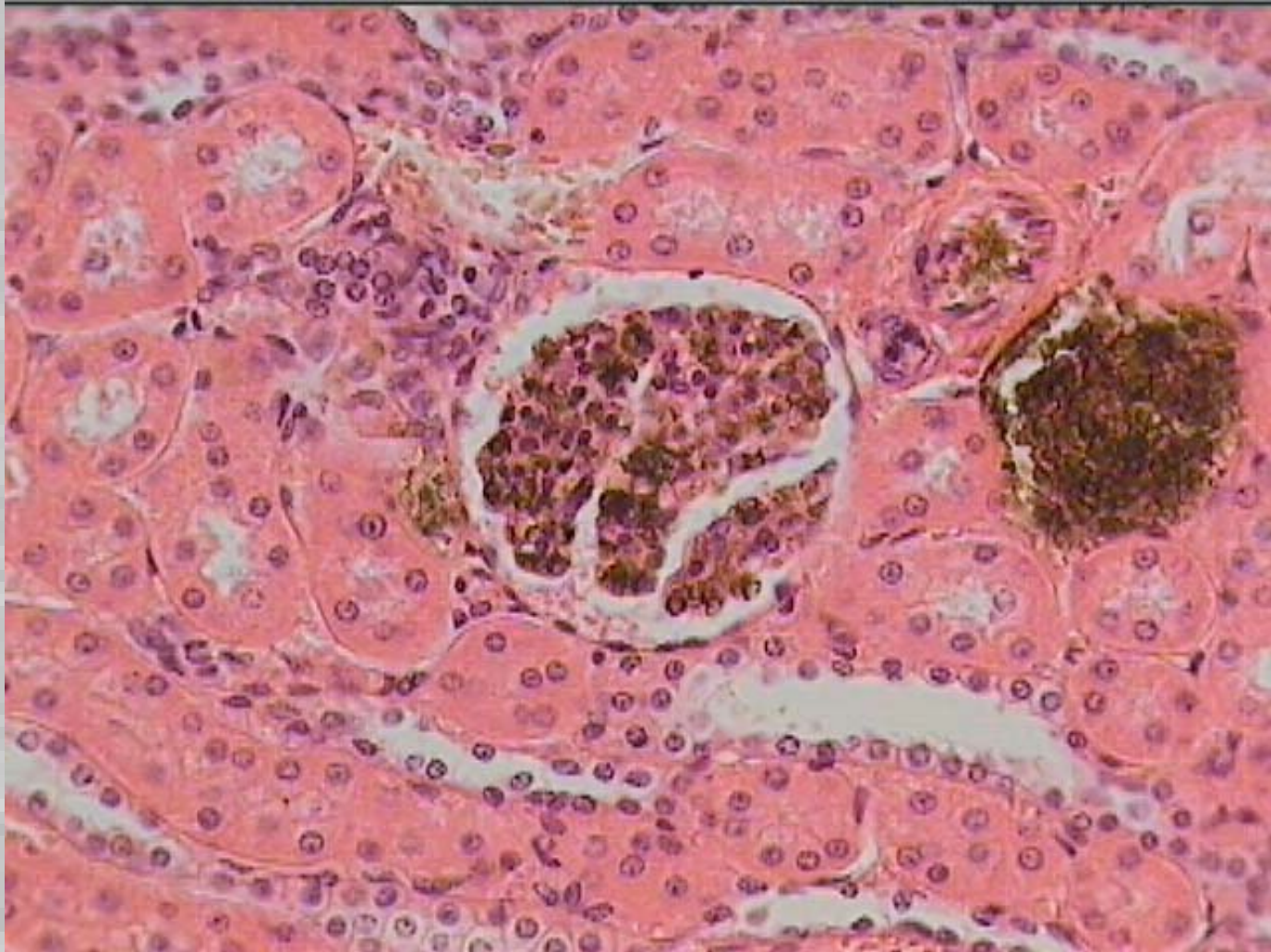
Scale at 40x as captured (40xScaleWOBar.png)

40x Image with Bar



Scale at 40x with Bar (40xScaleWBar.png)

Captured Image



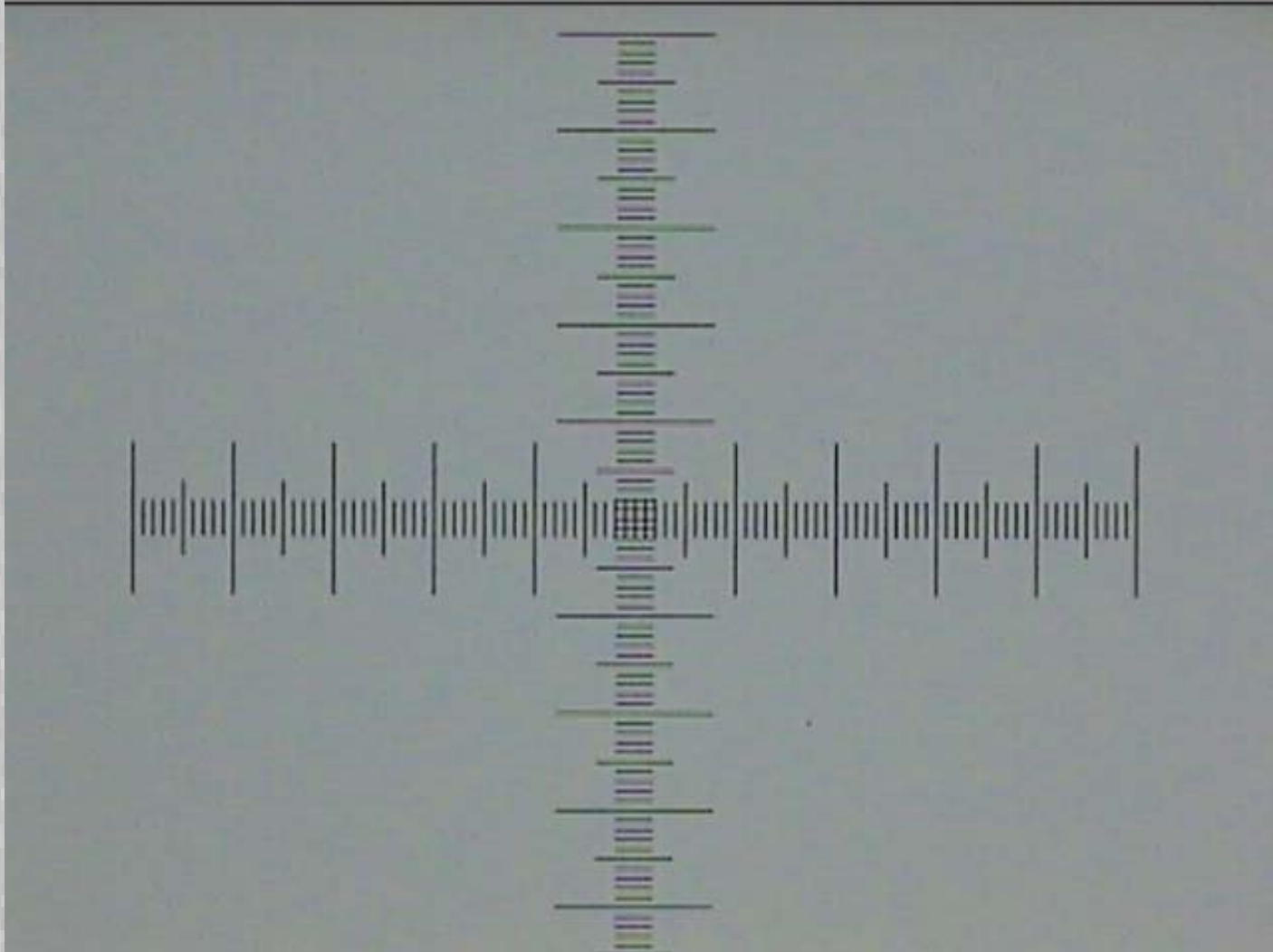
Kidney with 40x Objective (40xKidney.tif)

Captured Image w/Bar

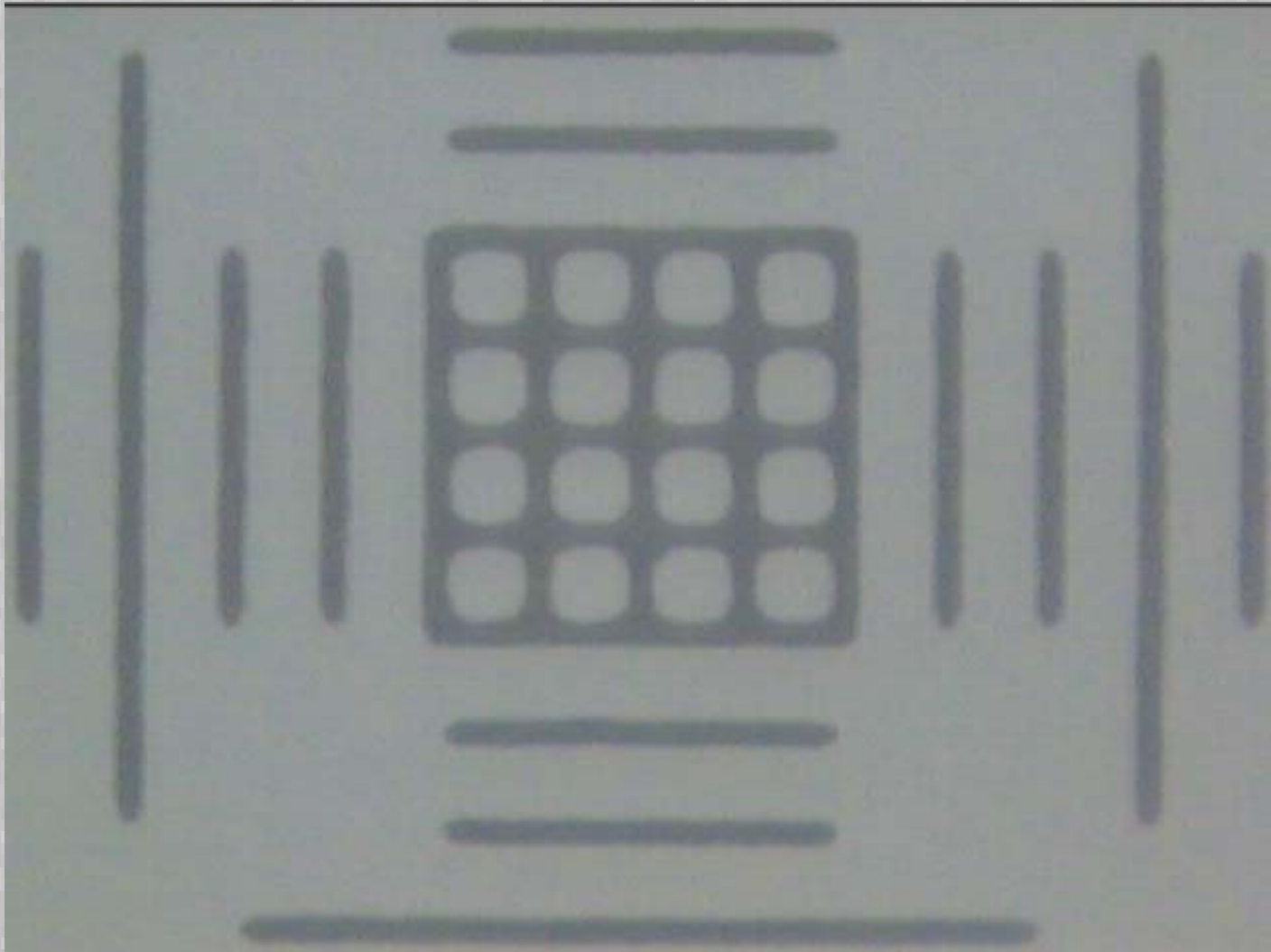


40x Kidney with Scale Bar (40xKidneyWBar.png)

Scale with 10x Objective



Scale with 100x Objective



Saving & Using Motic Images

- The default Motic image format (.img) can not be opened in other software.
- Save images in .tif or .jpg formats using File | Save as...
- Once saved, I generally process images as .jpg or .png files.
- See the [Using Motic Software](#) handout.

Image Editing Software

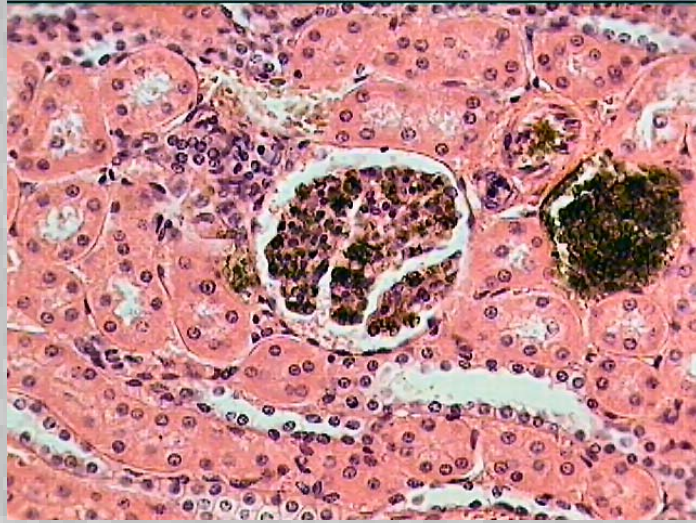
- Microsoft Paint and Photo Editor comes with your computer but are very limited in their features.
- I recommend you use ImageJ (see separate handout).

Power versus Resolution

- In past quarters, students have concluded they needed “higher power” microscopes.
- The 100x objectives on these microscope are about the practical limit for light microscope.
- What is generally needed is more resolution (or resolving power).
- See the examples on the next slide.

Resolution versus Power

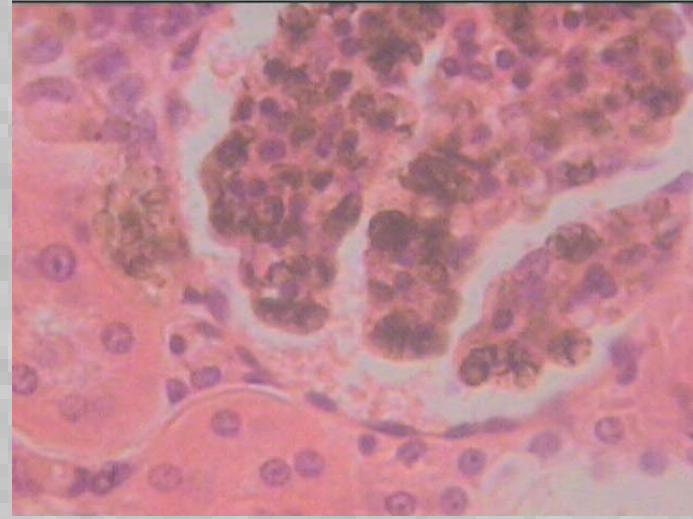
Kidney at 40x with enhanced electronically



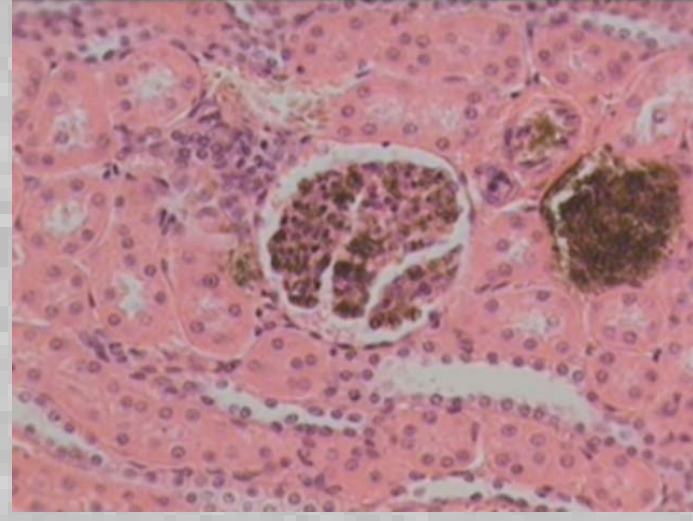
Kidney at 40x



Kidney at 100x



Kidney at 40x with reduce resolution (blurred electronically)



Ethical Enhancement

- There are a number of photo editing programs that allow enhancement (for example changing the brightness and contrast) of images.
- The degree to which scientific images should be enhanced is still a subject of debate.
- If you choose to enhance your images, be sure to disclose this fact in your report and caption.

Other Relevant Handouts

- [Making and Scanning Sketches](#)
- [Using the ImageJ Photo Editor](#)
- [Inserting Figures into Word Documents](#)
- [Installing the Motic Microscope Imaging Software](#)