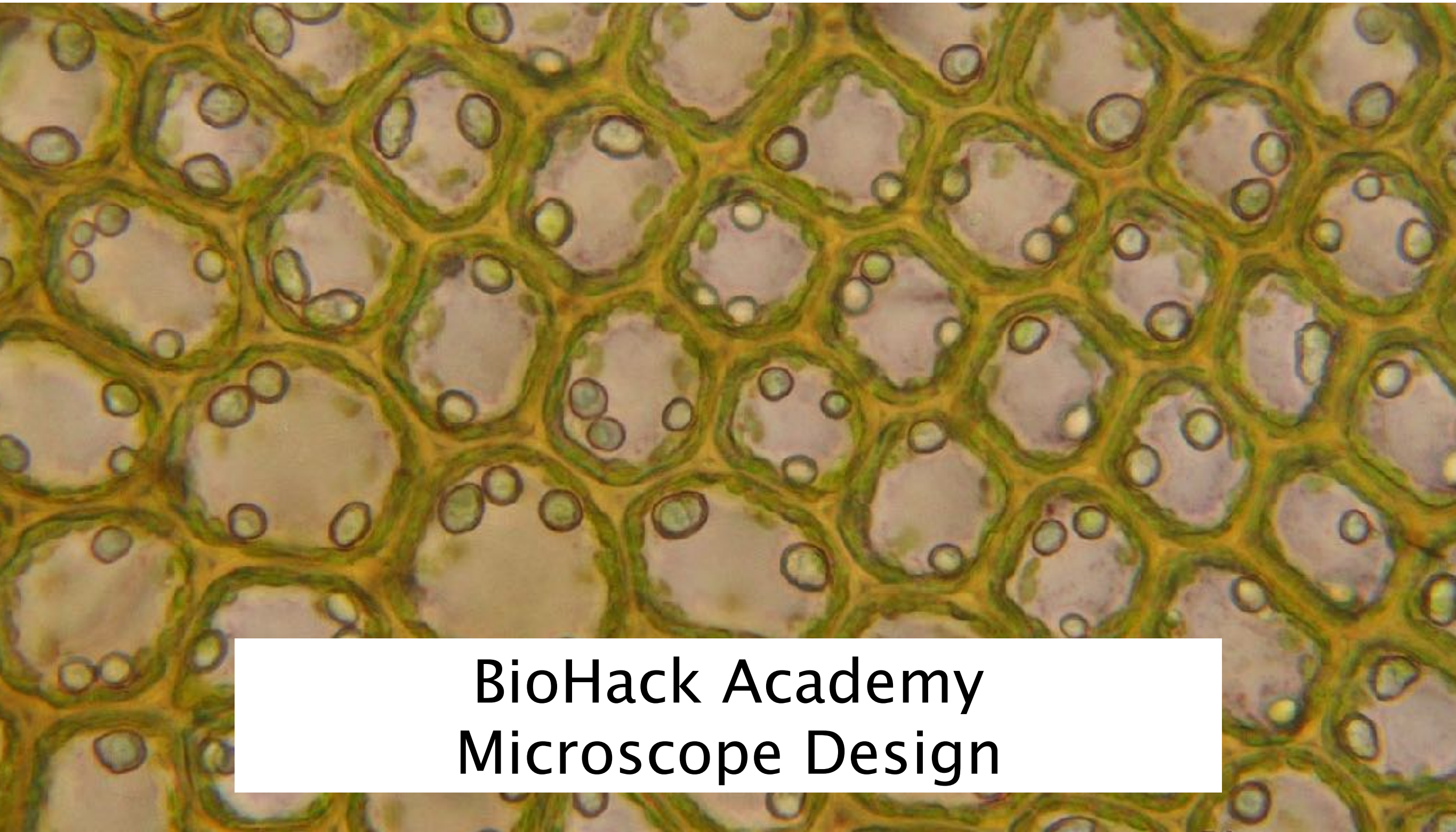




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# BioHack Academy Microscope Design



# Why we need a microscope

- Morphological identification of microbes
- To check the purity of a culture





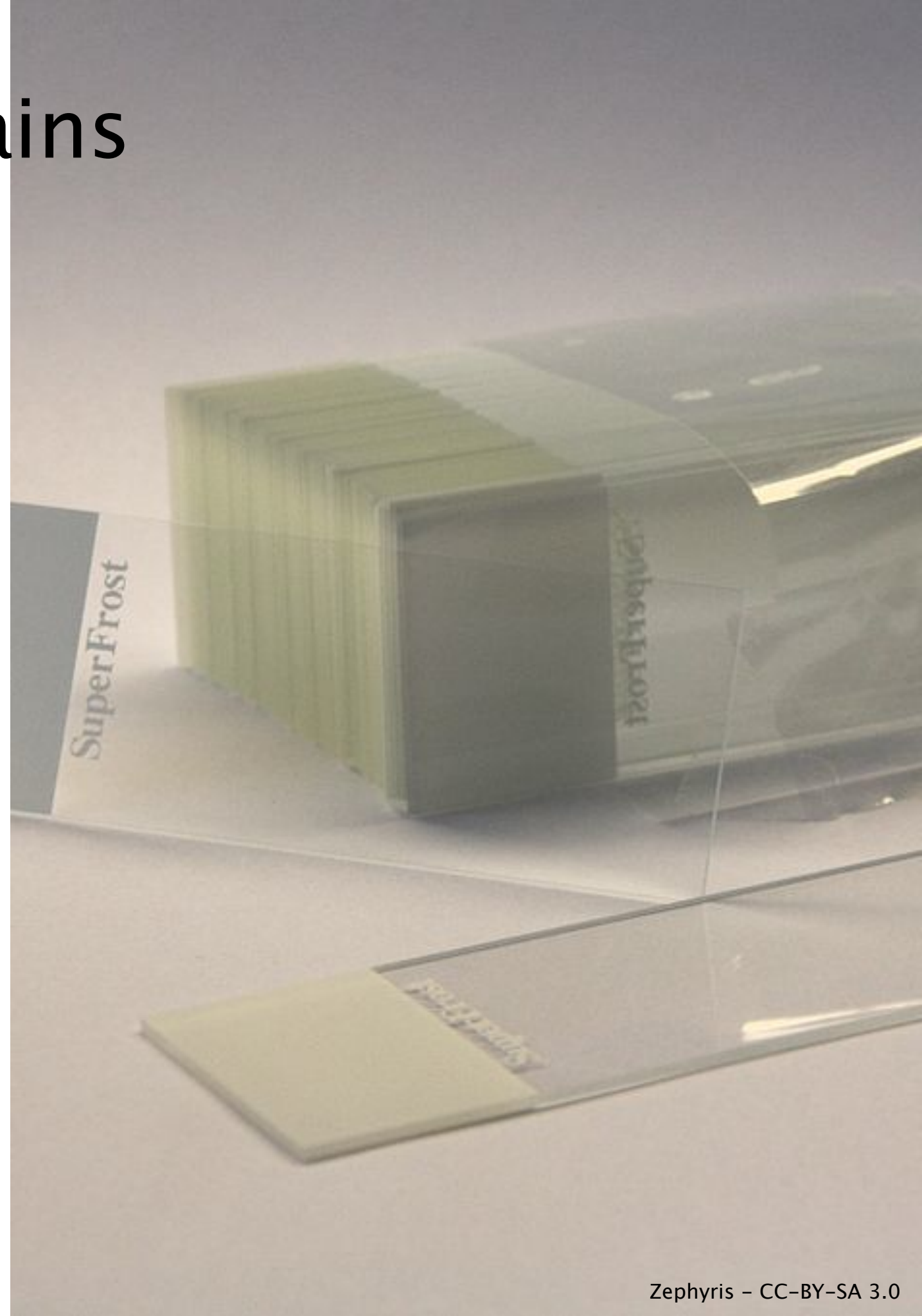
# Industry Standard





# Design Constrains

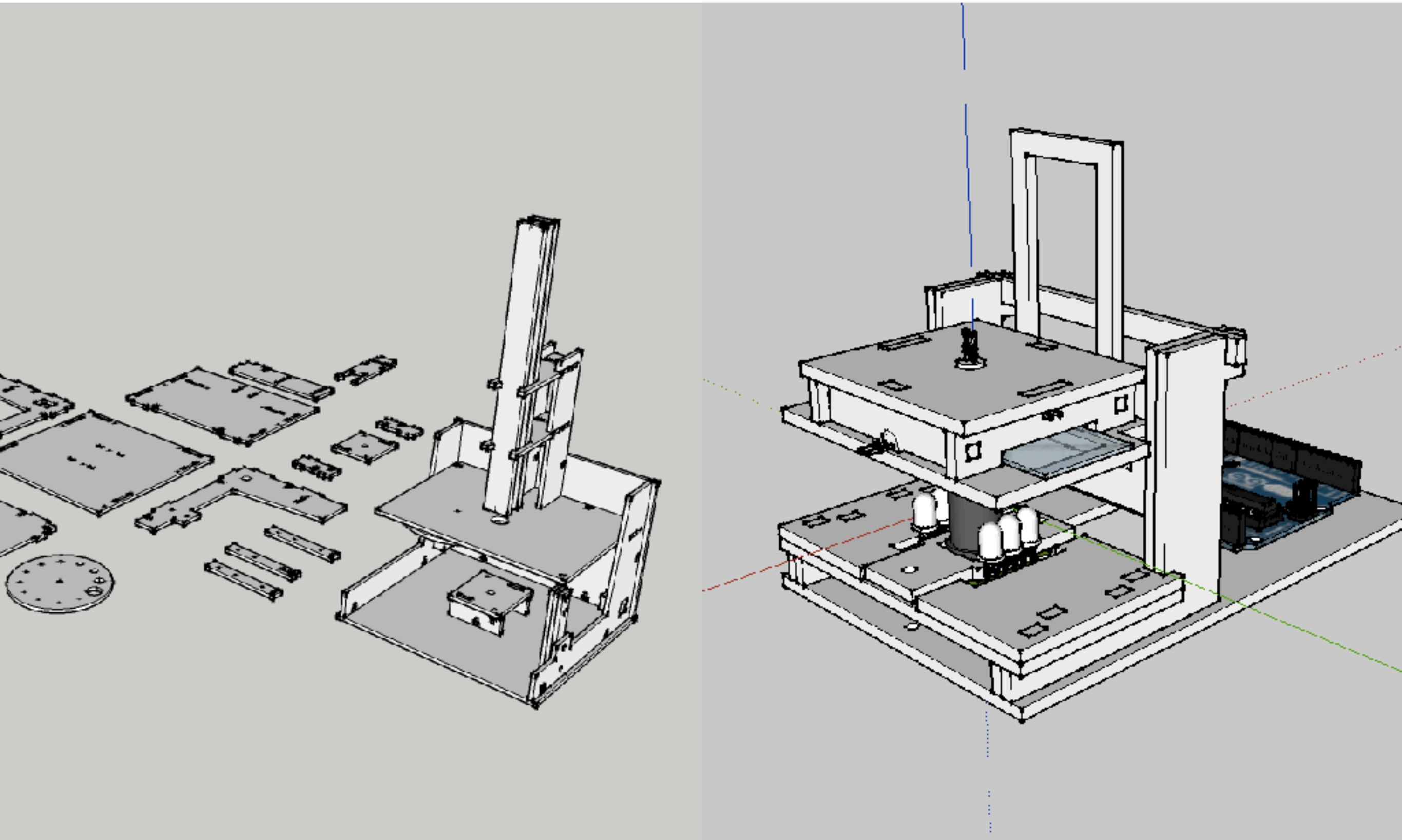
- Microscope slide
  - Make sure these fit in your design





# Biohack Academy Designs

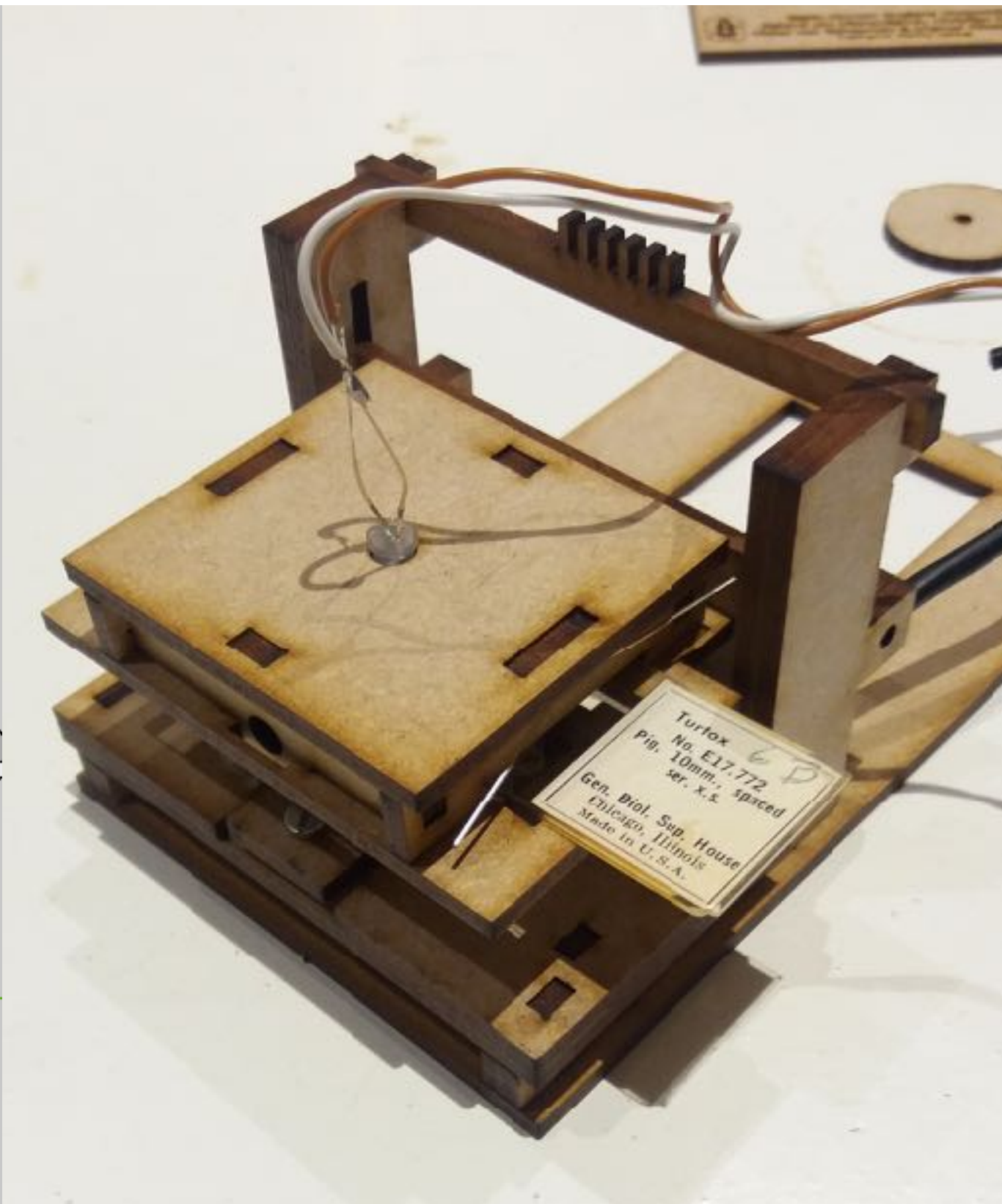
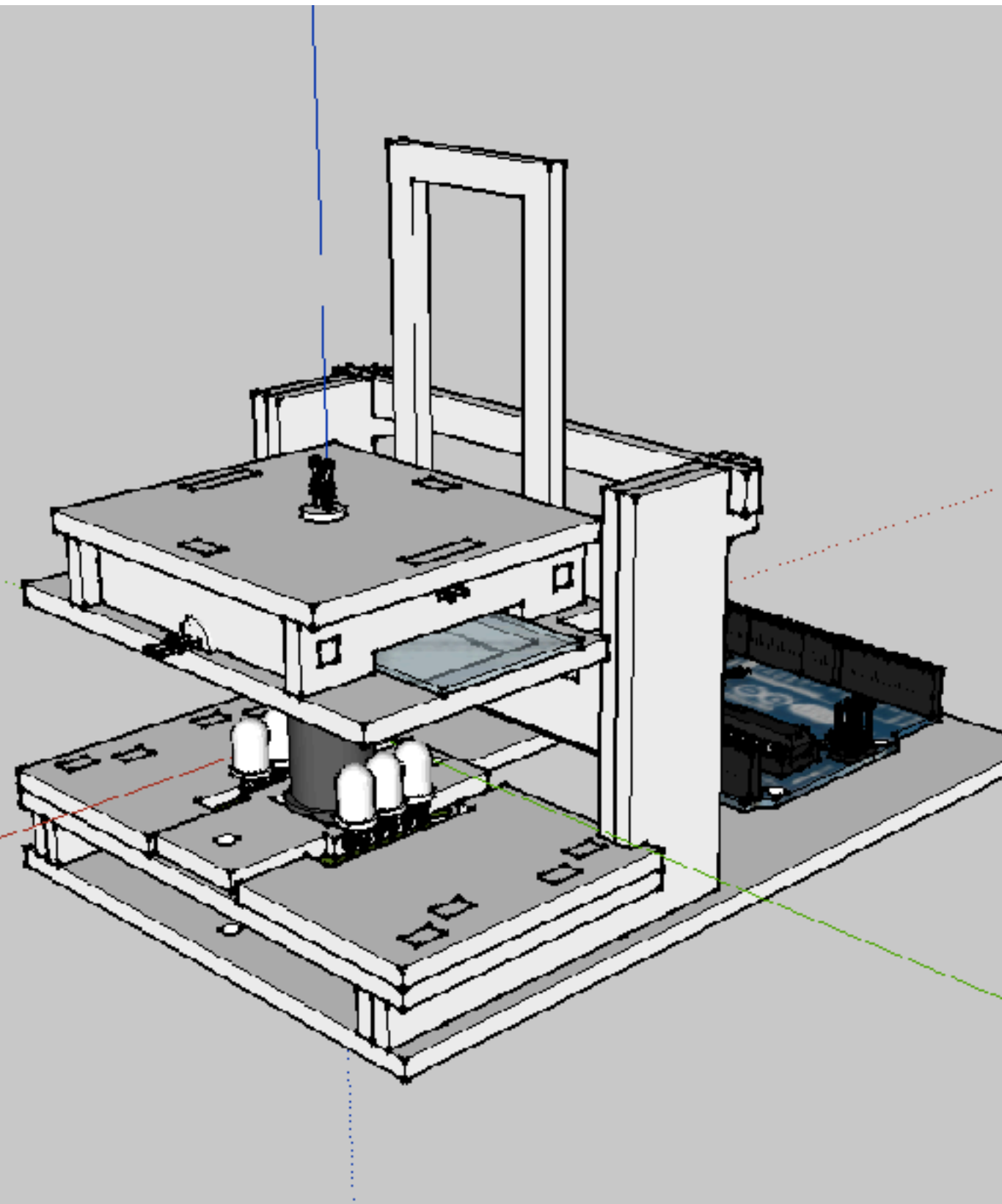
You may choose which one to build







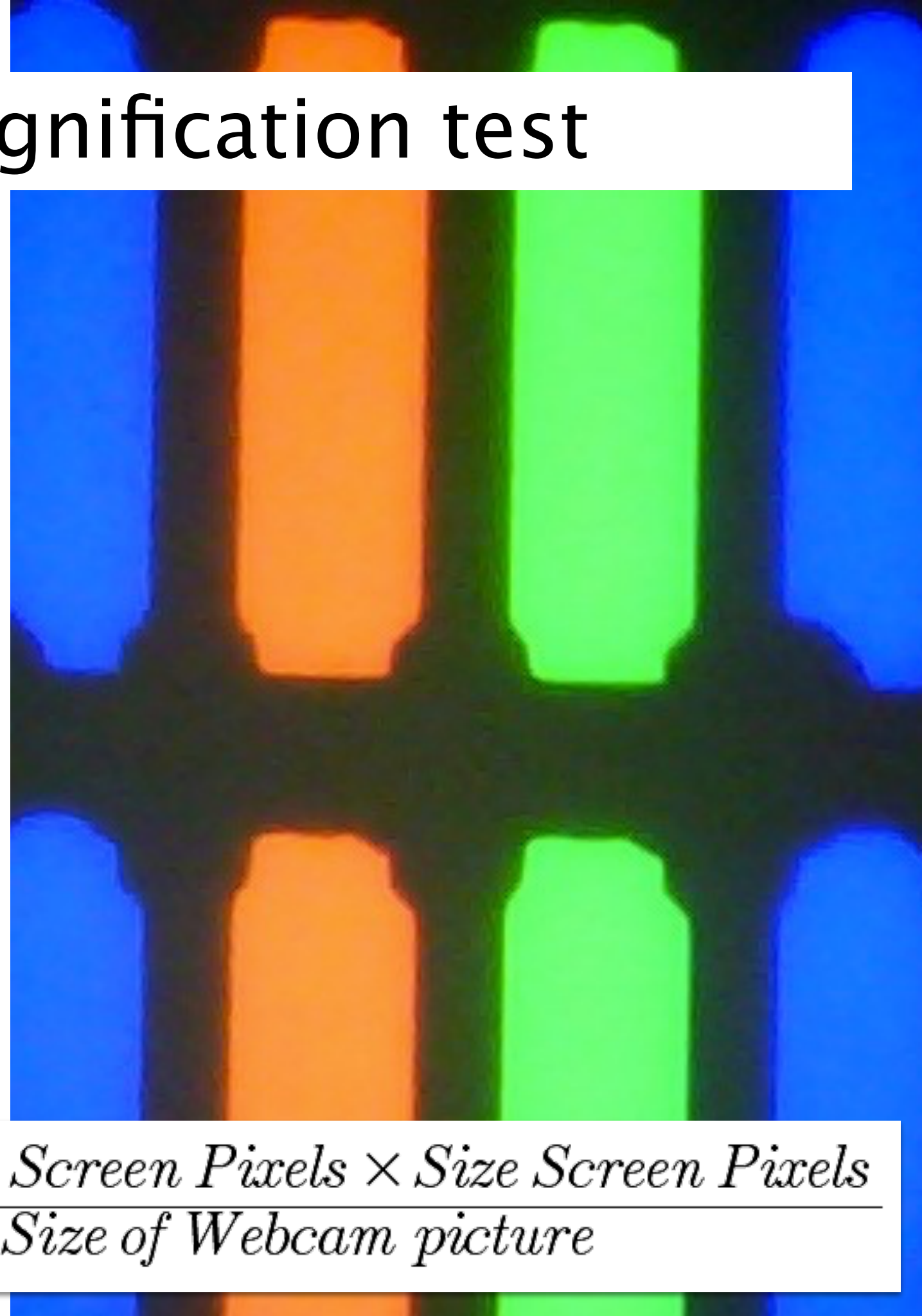
# Webcam Microscope





# Pixel Based Magnification test

- Take a picture of your screen up close
- Count the number of pixels in the frame
- Calculate the magnification



$$\text{Magnification } M = \frac{\text{Number of Screen Pixels} \times \text{Size Screen Pixels}}{\text{Size of Webcam picture}}$$





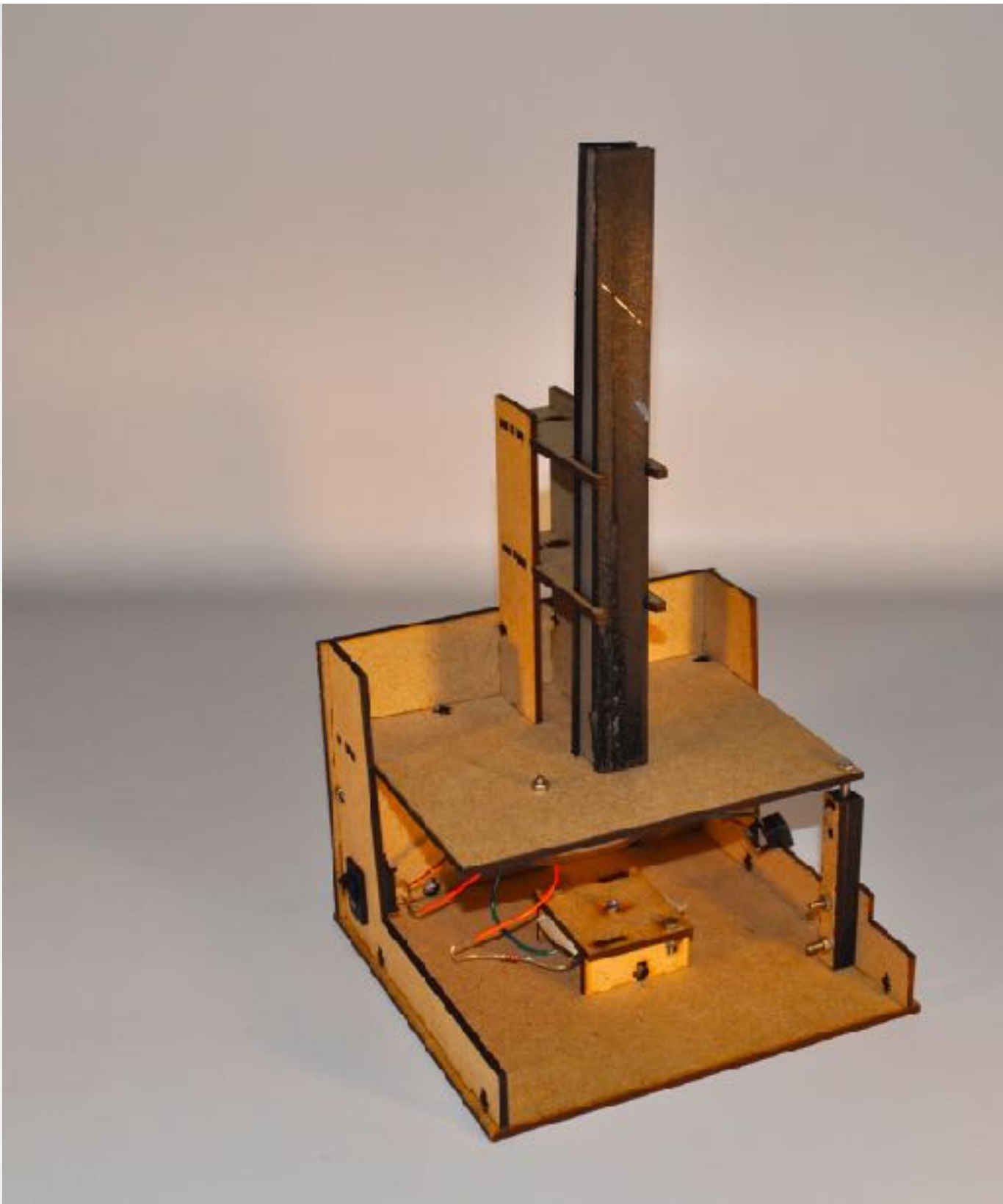
# Spirulina by webcam microscope





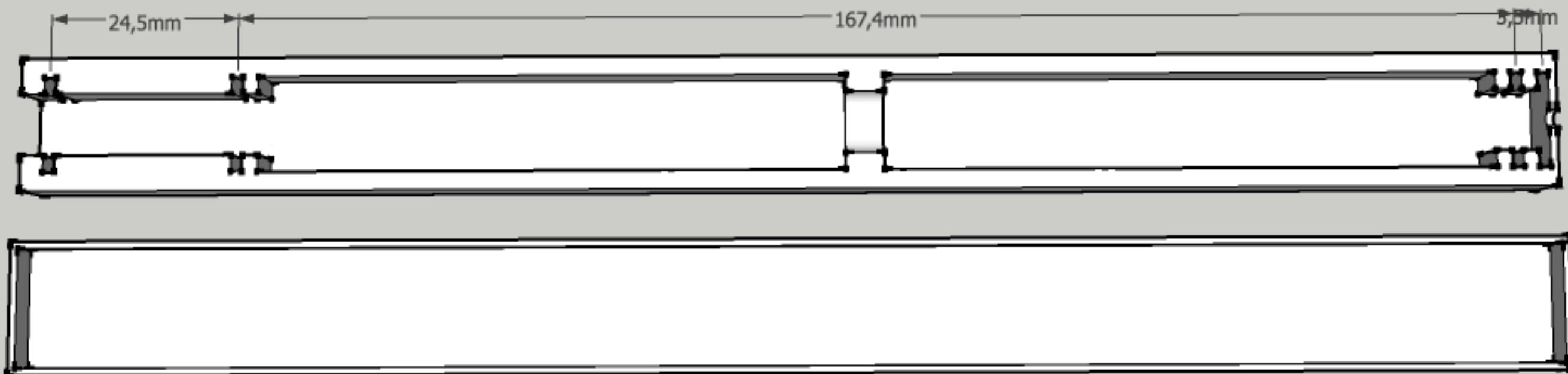


# Compound microscope





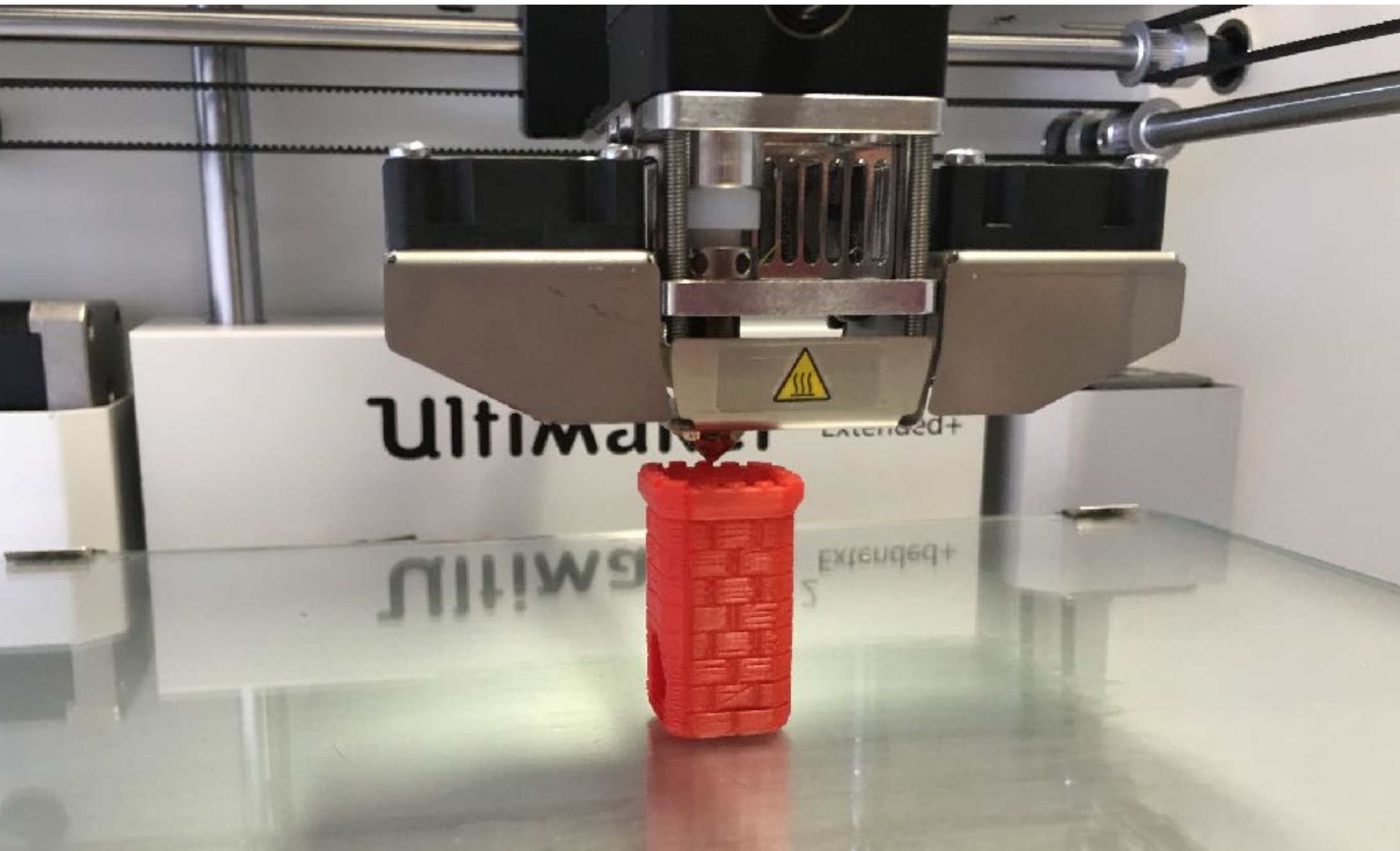
# Dimensions





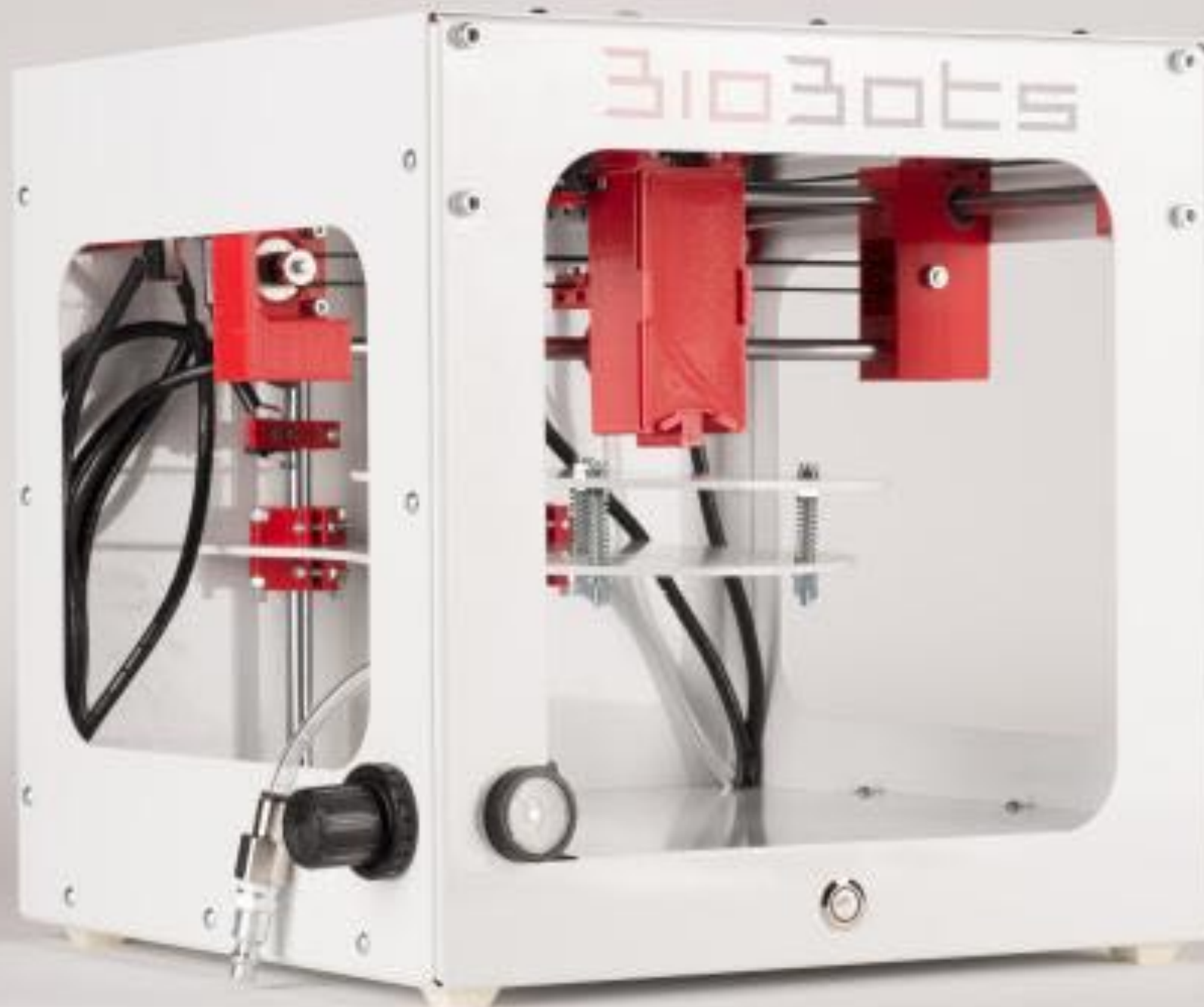


# 3D printing





# Bioprinting







# Syringe extruder

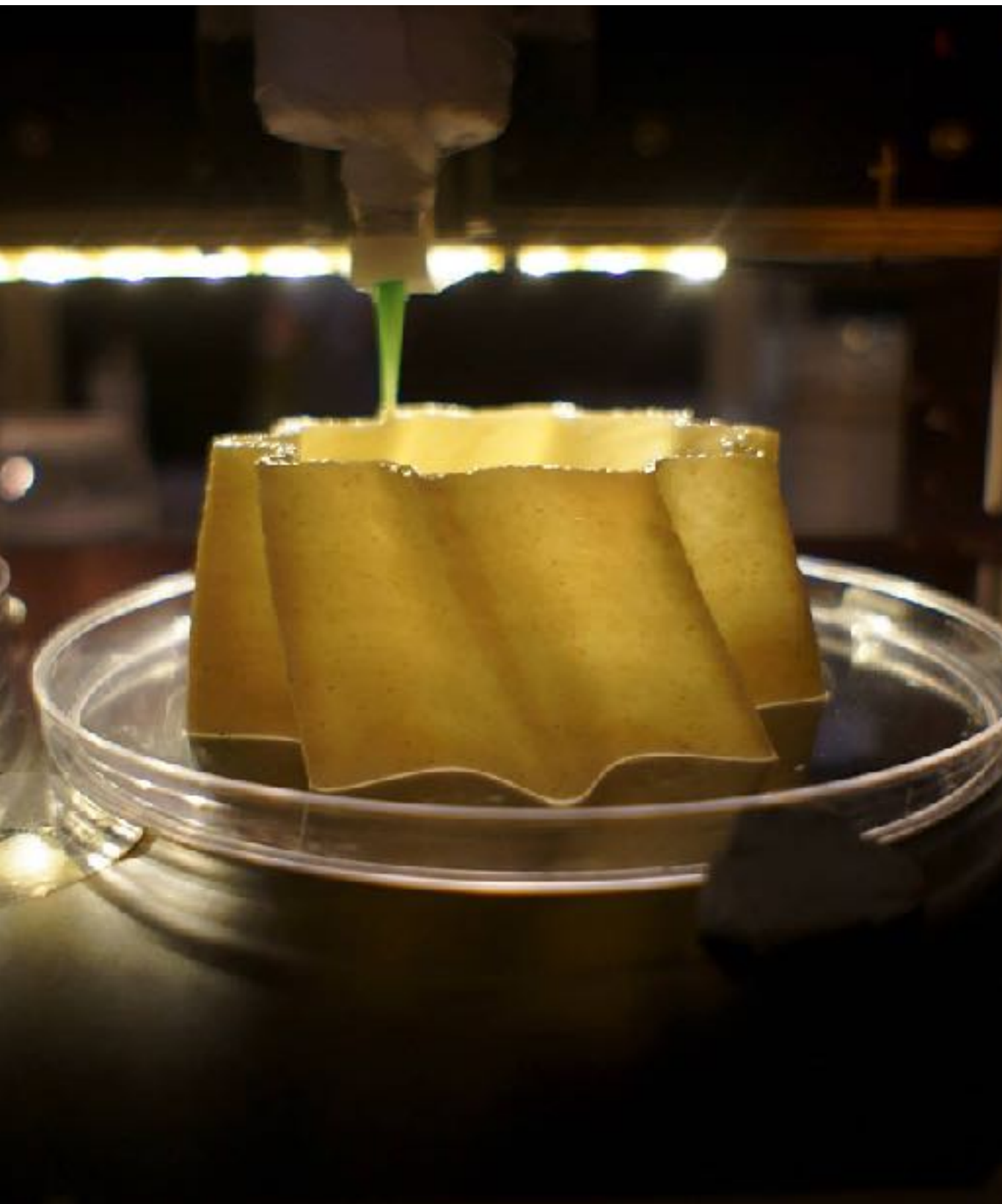


<http://www.thingiverse.com/thing:21302>





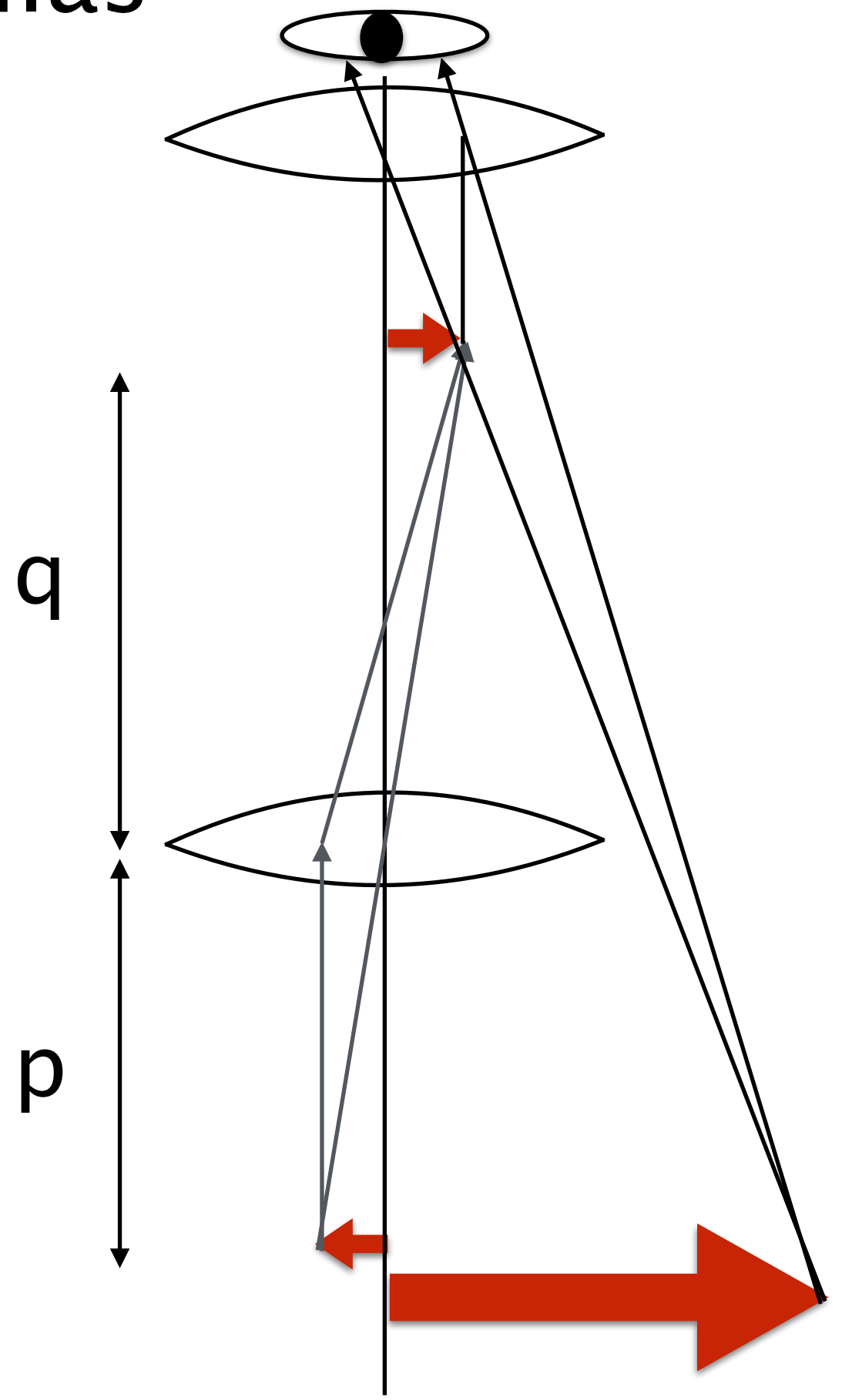
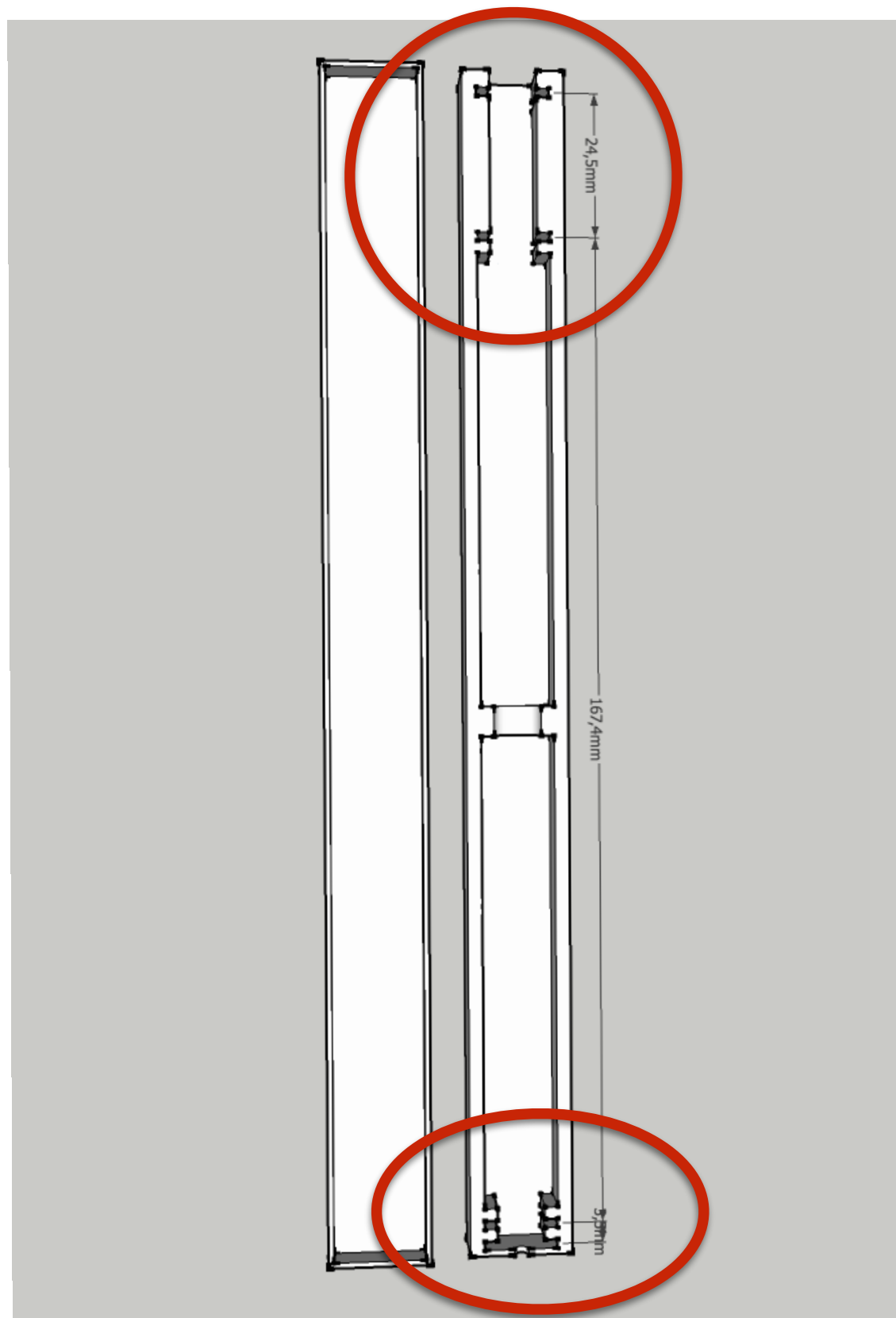
# Bio-logic workshop Waag







# Microscope formulas





# Magnification Objective

- Focal length of objective
  - $f_a = f_b = 35 \text{ mm}$
  - distance = 3.2 mm
  - $f_{ab} = 18.3 \text{ mm}$
- Objective-specimen distance
  - $q = 167.4 \text{ mm}$  (given)
  - $p = 20.6$  (calculated)
- Magnification power objective
  - $M_{ob} = 167.4 / 20.6$
  - $M_{ob} = 8.1$

$$f_{ab} = \frac{f_a \times f_b}{f_a + f_b - d}$$

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$$

$$M_{ob} = \frac{p}{q}$$





# Magnification Eyepiece

- Focal length eyepiece
  - $f_a = f_b = 35 \text{ mm}$
  - distance = 24.5 mm
  - $f_{ab} = 26,92 \text{ mm}$
- $M_{ep} = 250 / 26.92$
- $M_{ep} = 9.3$

$$f_{ab} = \frac{f_a \times f_b}{f_a + f_b - d}$$

$$M_{ep} = \frac{250}{f_{ab}}$$



# Magnification Microscope

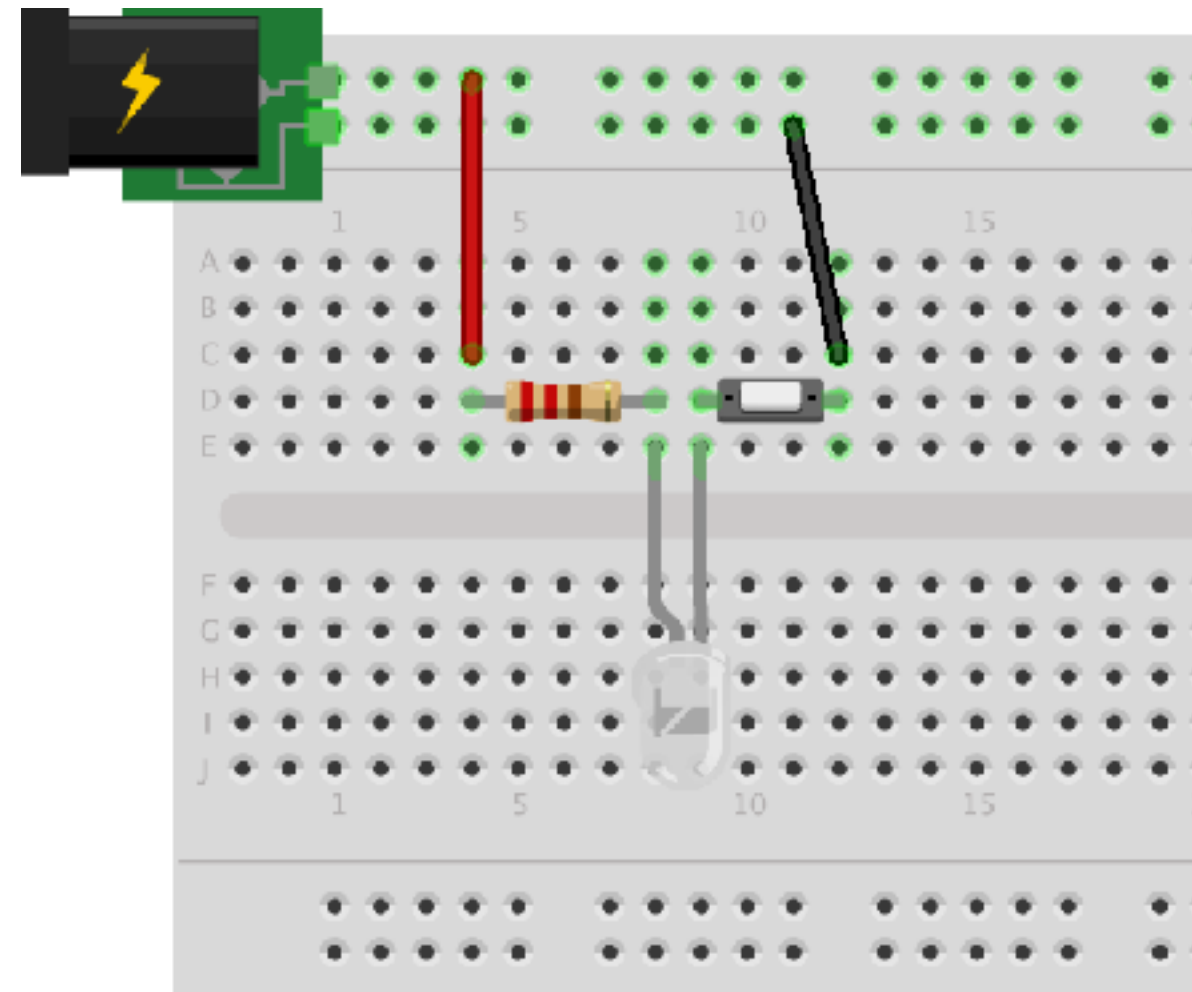
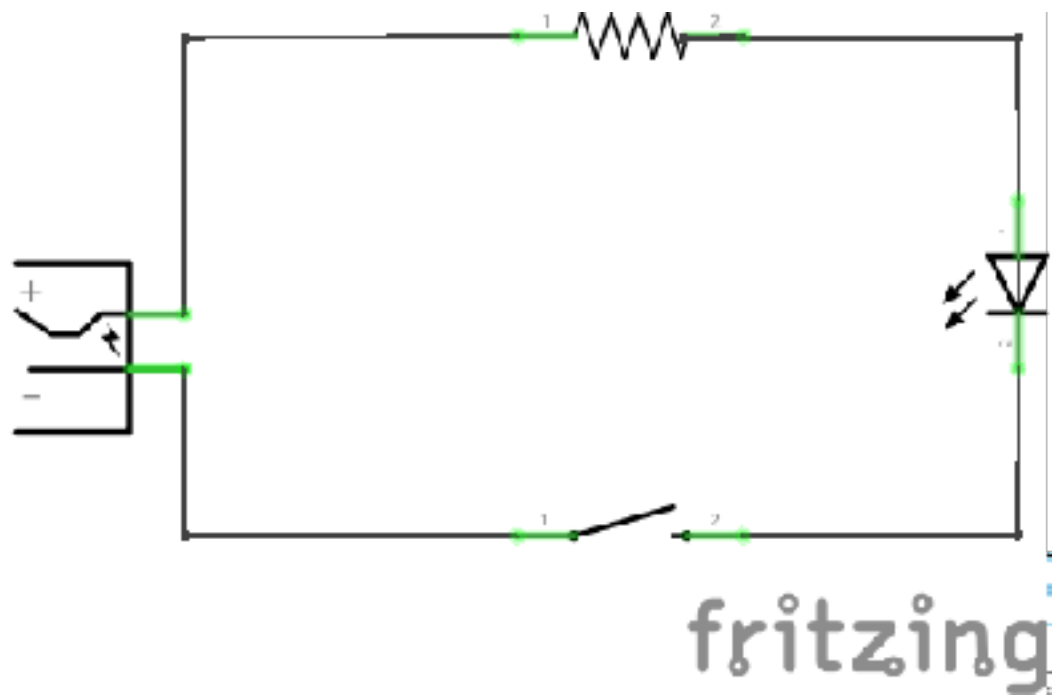
- $M_{mic} = 8.1 \times 9.3$
- $M_{mic} = 75.5$

$$M_{mic} = M_{ob} \times M_e$$





# Wiring





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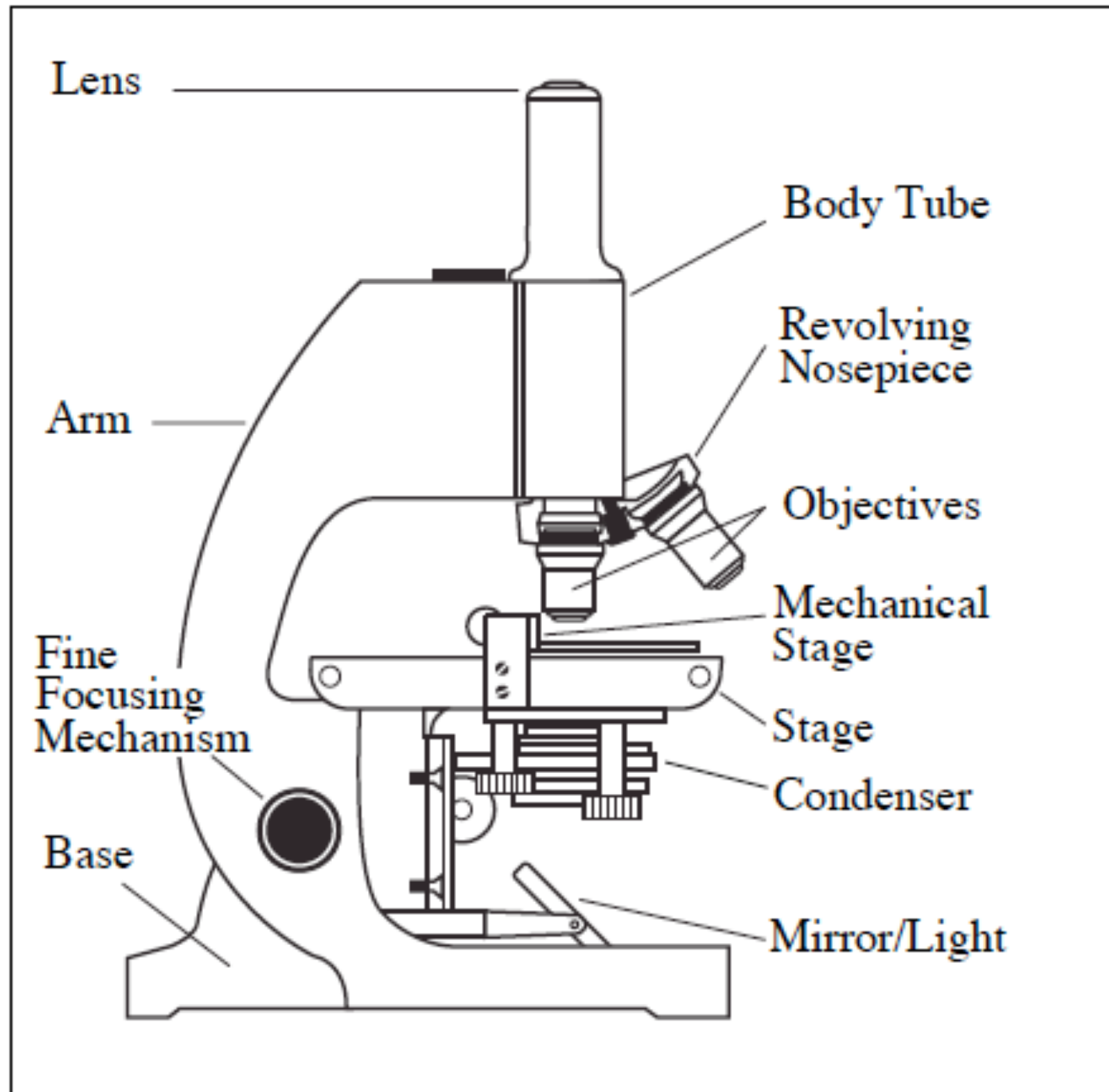
# Practicals





# Anatomy of a microscope

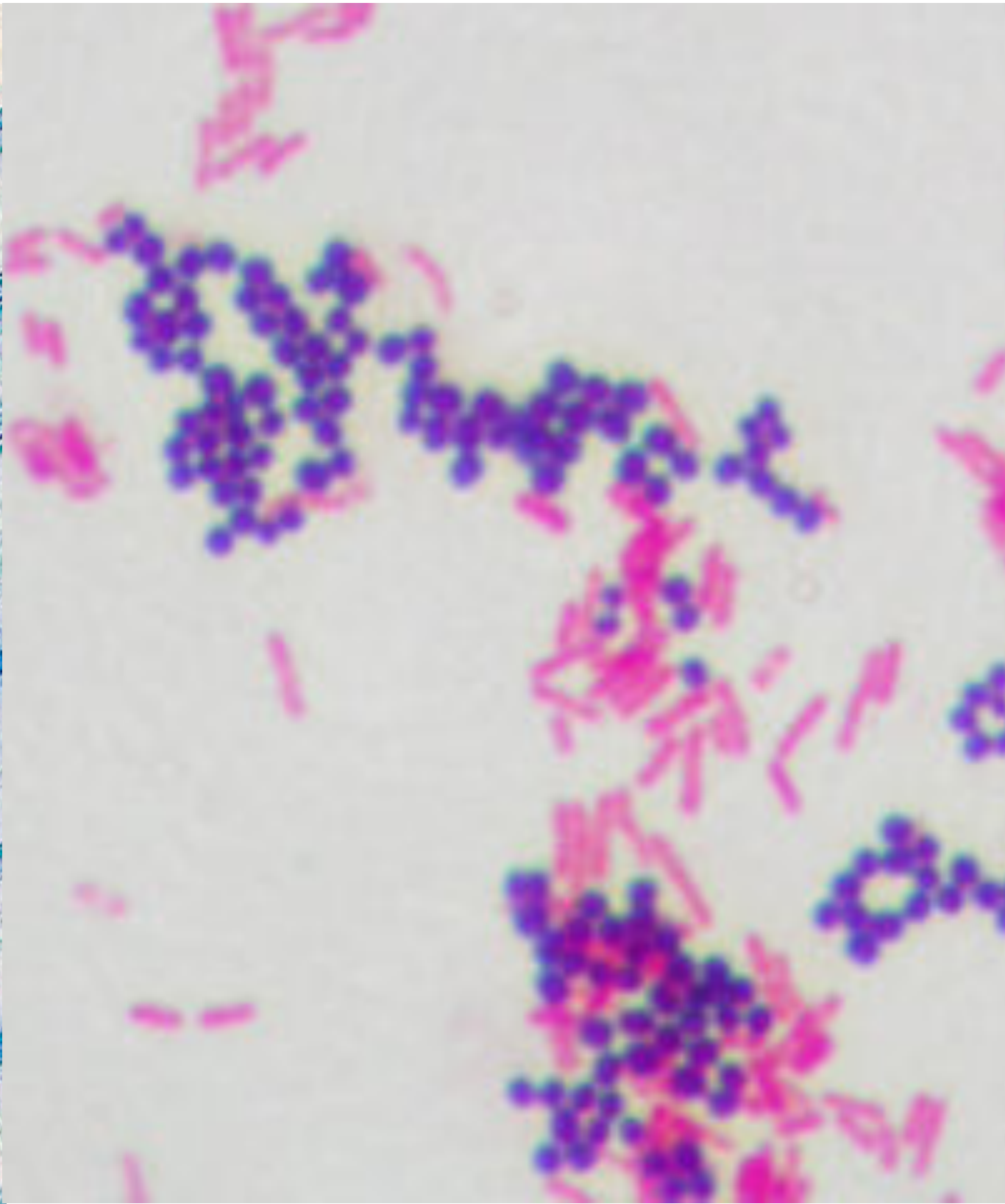
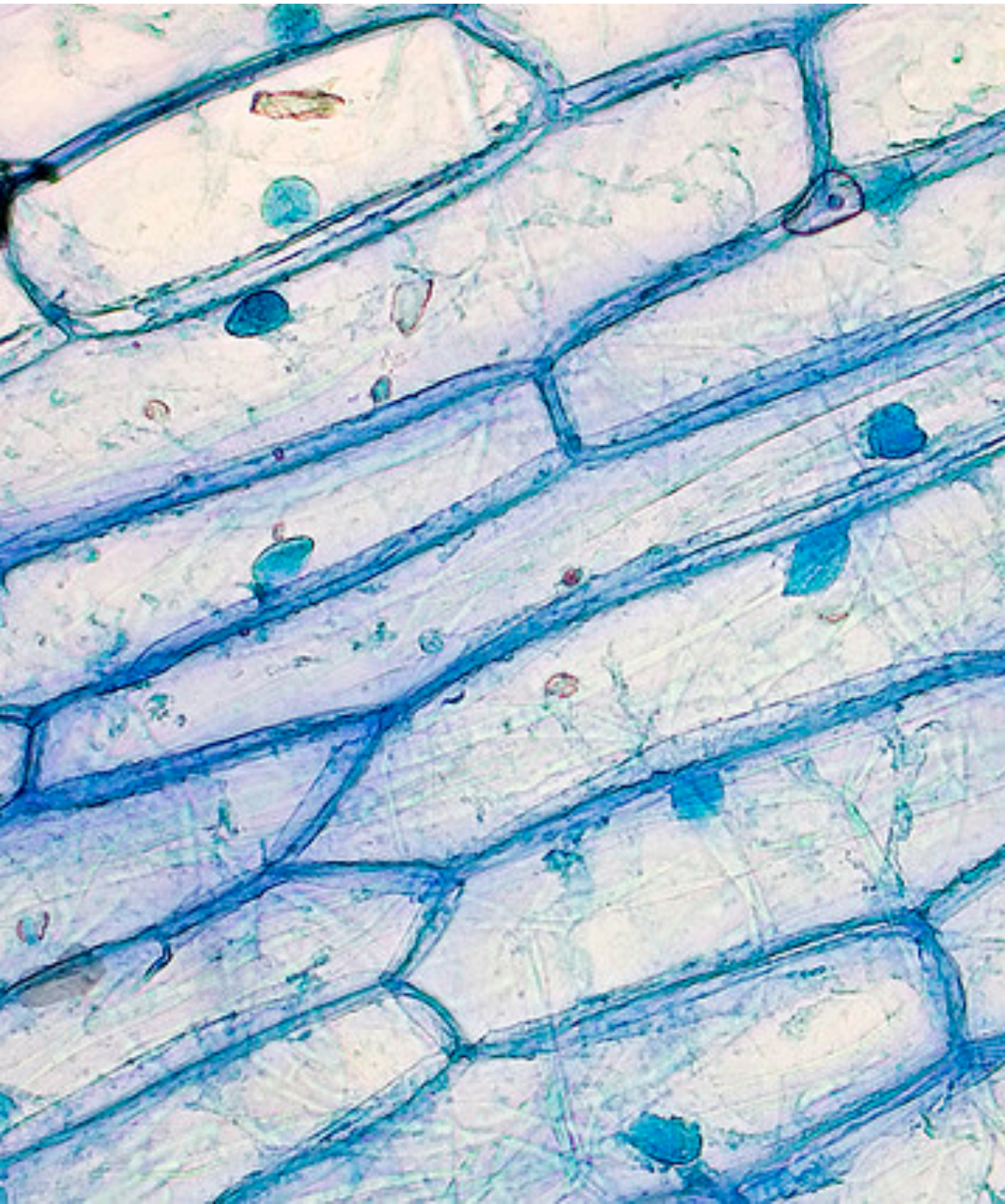
You will learn how to operate a microscope







# Gram & Loeffler staining







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