Quick Notes: Tools of the Biologist

I. **Compound Light Microscope:**

a. uses light rays to form an image of the specimen
b. used to view microscopic, somewhat transparent specimens
c. has 2 magnifying lenses – one in ocular, the other in the objective
d. **total magnification:** ocular (eyepiece) x objective
e. **object**=specimen; **image**=what you view in the microscope
f. **field of view:** area viewed through the ocular
g. Image is **upside down and backwards** from the object
h. **Size of field of view: magnification** – indirect relationship (field of view decreases, magnification increases) You see less of the specimen but more magnified
i. **magnification: brightness of the field of view** – indirect relationship (as field of view decreases) field gets darker because the image becomes more magnified and takes up more space
j. **Focusing**: focus under low power, use the coarse adjustment, then make image clearer by using the fine adjustment.
k. **Focusing under high power:** focus under low power, move to the high power objective, then use fine adjustment. **NEVER** use coarse adjustment – you can break the slide and/or damage the objective.
l. **Center image under low power:** If the image is not centered, you will not be able to find it under high power. Field gets smaller and if not centered, there is a good chance that the image will **NOT** be in the field of view.
m. **Resolving Power (resolution)** is the limiting factor of the microscope: ability of the microscope to distinguish between two images close together in the field of view. Useful magnification is limited by resolution of the compound microscope.
   - **Example:** if you cross two threads, one white and one red on a slide and focus under high power on the red thread, how can you now view the white thread? Use the fine adjustment to adjust focus to the white thread. Resolution permits the microscope to define the small distance between the red and white threads so that you can focus on each one separately.
n. **1 mm = 1,000 µm** -- to measure the length of a cell in the field of view, estimate how many cells fit along the diameter, then divide that number into the diameter to get the length of one cell.
o. move the slide to the left, image moves to the right; move the slide up, image moves down; and so on....
p. when you draw your diagrams of what you view in the microscope, draw your diagrams in a field of view (circle)
q. Remember, if the field of view decreases, the magnification increases by the same power and the number of cells you view also decreases. If the field of view increases, the magnification decreases by the same power and the number of cells increases too.

II. Dissecting Microscope:

a. used to examine small, opaque objects or organisms
b. binocular – create a 3-D image of object
c. object and image are in the same orientation.
d. Move object to left, image moves to the left, etc....

III. Ultracentrifuge:

a. used to separate small particles or materials by **density**
b. spins the contents of test tubes at very high speeds so that particles within the test tube samples fall toward the bottom of the test tubes based on their densities
c. layers of particles form in the test tubes that can easily be collected and examined
d. used to separate blood into layers of cells and plasma or cells into layers of their component parts.

VII. Stains:

a. used to make colorless parts of cells more clearly visible.