



## Cambridge Biology Lab Workshop

Johanna Bauman  
Jackie Insalaco  
Nadine Kalajian  
Kristin King  
Carlia Vaughn

## Cambridge Biology Lab Workshop

Purpose: To gain practical experience with the Cambridge laboratory procedures and troubleshoot problems

Hypothesis: Instructors are daunted by Cambridge labs due to abstruse lab methods. We need time to practice the labs and resolve any issues prior to students performing the experiments

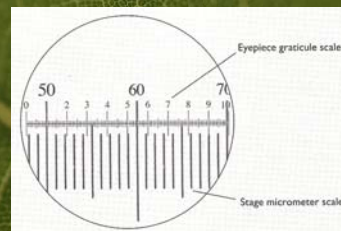
## Cambridge Biology Lab Workshop

Materials: 5 Cambridge Biology Instructors, AICE Lab Manual, 10 years of Lab Practical exams, various chemicals and equipment

Methods: Perform the following experiments, noting necessary lab supplies, procedure modifications, calculations, and results...

## Size/Scale of Microscopic Tissues

- Students should be able to calibrate a microscope using an eyepiece graticule (a.k.a. reticule) and stage micrometer
- Calibration allows the student to use the eyepiece graticule to measure specimens on the slide



# Size/Scale of Microscopic Tissues

- Students need to be able to utilize the following equation to calculate actual size of photomicrograph specimens and their component parts...

$$\text{Magnification} = \frac{\text{Image size}}{\text{Actual size}}$$

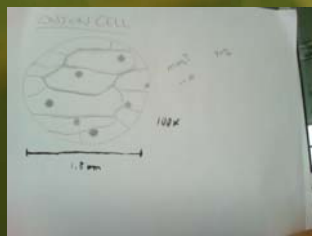
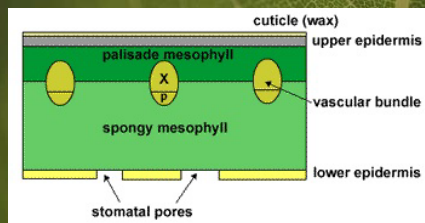
Fig. 2.3 is a photomicrograph of a transverse section through a leaf of a different plant species.



Fig. 2.3

(c) The actual length of line Y is 785 μm. Use this measurement to calculate the magnification of Fig. 2.3. You may lose marks if you do not show your working or if you do not use appropriate units.

# Observation of Cells & Tissues



- Plan Diagrams show tissues, but no cells. Students may be required to identify and label specific tissue types
- Collection of specific number of cells showing observable cell parts. Students may be required to label certain cellular structures

## ID of Biochemicals in Solutions

- Sugar indicated by color change (blue to orange) (Benedict's)
- Starch indicated by purple-black color change (Iodine)
- Protein indicated by formation of purple precipitate (Biuret's)
- Lipids indicated by emulsion formation and residue on brown paper



## Carbohydrate Metabolism in Yeast



- Metabolism of various sugars by yeast to form  $\text{CO}_2$  and  $\text{H}_2\text{O}$  indicated by reduction of methylene blue to clear liquid
- Yeast solution= 3-4g dry yeast in 50 ml  $\text{H}_2\text{O}$
- Requires 24 hours to complete reaction

## Effect of pH on Enzymes



- Manometer measures gas pressure
- Peroxide (catalase)  $\rightarrow$   $O_2 + H_2O$
- At optimum pH, reaction rate is highest and  $O_2$  gas displaces water in tube at highest rate

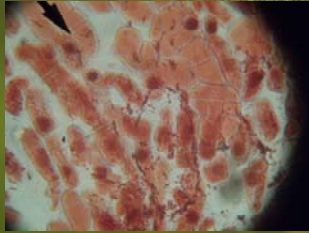


## Temp & Membrane Permeability



- Beet cores heated at different temperatures caused pigments to pass through membranes
- Higher temperatures yield greater pigment release
- Problem: Need working spectrophotometer...

## Onion Root Tip Squash



- Followed all directions, but used a green onion instead of a broad bean (I did this successfully in high school).
- Lab did not work...
- HELP!

## Wind Speed & Transpiration

- Potometer measures the rate at which plants take up water
- Available for \$50-200 commercially, but you can make your own!
- Use different variables like wind speed, temperature, humidity



## Wind Speed & Transpiration



- Measured transpiration rates as a function of wind speed
- Difficult to eliminate all air from potometer - fill with water in a water-filled basin
- Difficult to seal stem in potometer tubing - use petroleum jelly

## Lab Practical Components

### Microscopy

- Draw a plan diagram, labeling specified tissues
- Drawing of adjacent cells, labeled by type
- Calculate magnification as a function of image size and actual size
- Prepare chart to compare slide specimen to given photomicrograph

### Wet Lab

- Serial Dilution
- Perform experiment and compare to a given hypothesis, account for error sources, and suggest modifications
- Plot and interpret given data, accounting for outliers and calculating averages

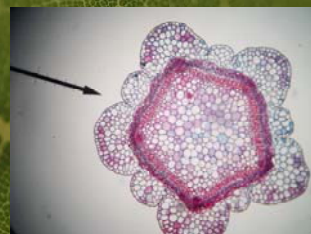
## May/June 2011 Paper 31

- Enzymatic inhibition of amylase by copper sulfate
- Starch (amylase) -> Glucose
- Endpoint: no indication of starch by iodine
- Problem: Students frustrated by short time intervals and poor equipment choices
- Slide of a monocot leaf (t.s.)

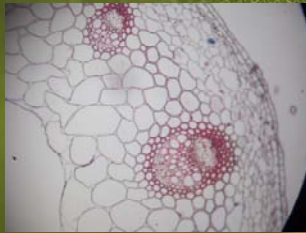


## May/June 2011 Paper 32

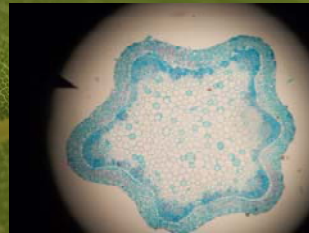
- Benedict's test using qualitative solution (not quantitative) to determine sugar content in unknown solutions - diabetes
- Problem: What is the definition of color change???
- Slide of dicot stem (t.s.) - how do you know it's a xerophyte?



## Previous Lab Exam Slides



May 2008 Paper 32



May 2009 Paper 31



May 2009 Paper 32



May 2010 Paper 31

## Cambridge Biology Lab Workshop

Observations: Cambridge lab exams may be difficult as a function of materials provided and time - requires practice!

Results: 1) Instructors shared resources to help each other with the curriculum  
 2) Instructors can now mix up lab solutions :)  
 3) Students will practice various labs throughout year, first in pairs, then solo to prepare for the lab practical exam

## Cambridge Biology Lab Workshop

Discussion: The Cambridge scope of study is not as wide as AP, but is more in depth . Students need to know biological formulas, laboratory procedures, reaction endpoints, how to draw plan diagrams, graph and tabulate, construct charts, calibrate a microscope, and perform serial dilutions in addition to content material

Conclusion: This was a valuable workshop that enables us to provide a quality lab experience in the classroom and prepare our students for the Cambridge lab practical exam!

## Take Home Message...

Five heads are better than one!

## Cambridge Biology Lab Workshop

### Future Plans:

To apply for another grant to continue working through more Cambridge labs and exam practicals (two weeks?)

To continue the lab workshop for all Brevard science teachers at a future date

To conquer the onion root tip squash!

## Cambridge Biology Lab Workshop

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