S1 - S3 Third / Fourth Level

"Bananarama"

Investigating the effect of ripening on starch content of bananas.

SCN 3.13a: Using a microscope, I have developed my understanding of the structure and variety of cells and of their functions.

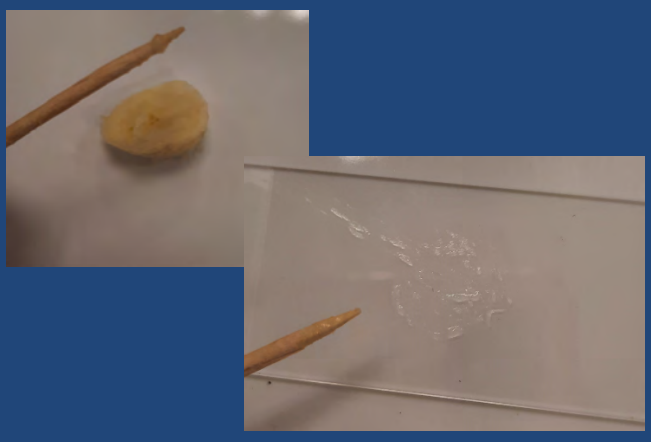
Bananas are one of the most popular fruits around the world and, during development, build up large amounts of starch (15-35% of their fresh mass). During ripening, this starch is gradually converted to sugars. Microscopy provides a glimpse of these starch grains and offers the opportunity to compare the starch content of unripe and ripe bananas. This protocol has been adapted from an MRC Laboratory of Molecular Biology experiment [1].

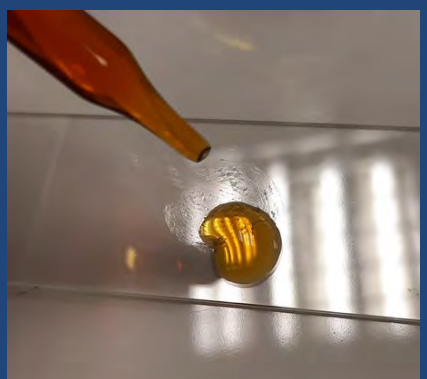
Materials

- Light microscope
- Glass microscope slide
- Coverslip
- Paper towels
- Cocktail stick or mounted needle
- Ripe and unripe banana.
- Iodine or Lugol's Iodine

Iodine (in potassium iodide) is suitable for use from S1-5 with no significant hazards. Lugol's iodine is the stain originally recommended for this protocol; however, is should be restricted to S5-6 users as it is harmful.

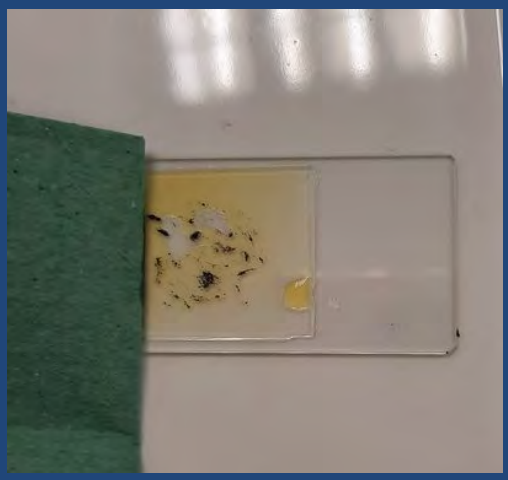
1. Using a cocktail stick or mounted needle, smear a very small sample of banana across a microscope slide, taking time to rub the cells apart.





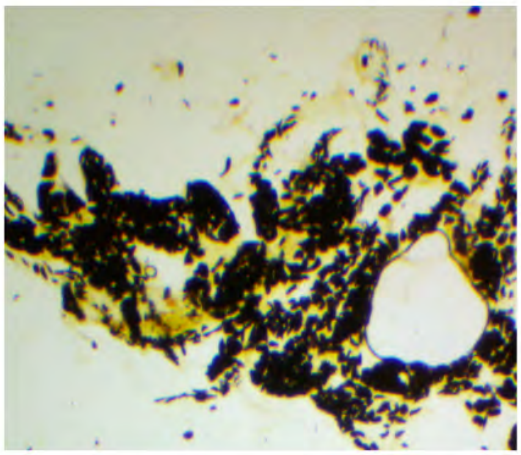
2. Add a drop of Iodine on top of the banana smear.

3 Place a coverslip on top, gently lowering it onto the sample using a mounted needle or cocktail stick. Use a folded paper towel to remove excess stain

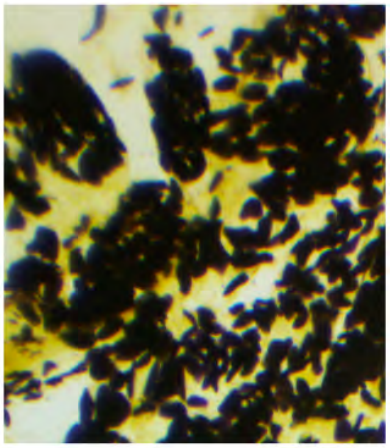


4 View the specimen using a light microscope at x40 magnification, before increasing the magnification.

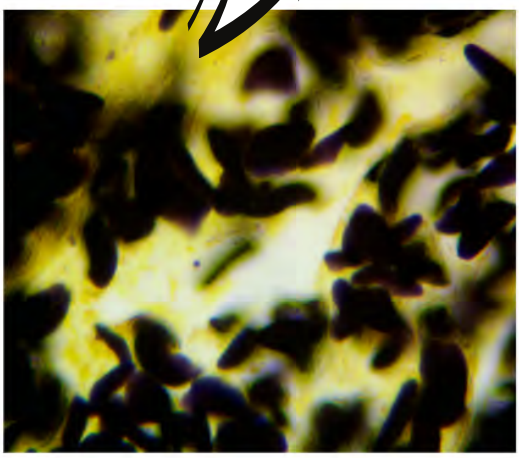
Now try to digitally process your images. You can do this using a smartphone over the eyepiece lens or with a Veho digital microscope.



Unripe banana, x40 magnification
Starch grains stained black with Gram's iodine.



Unripe banana, x100 magnification.

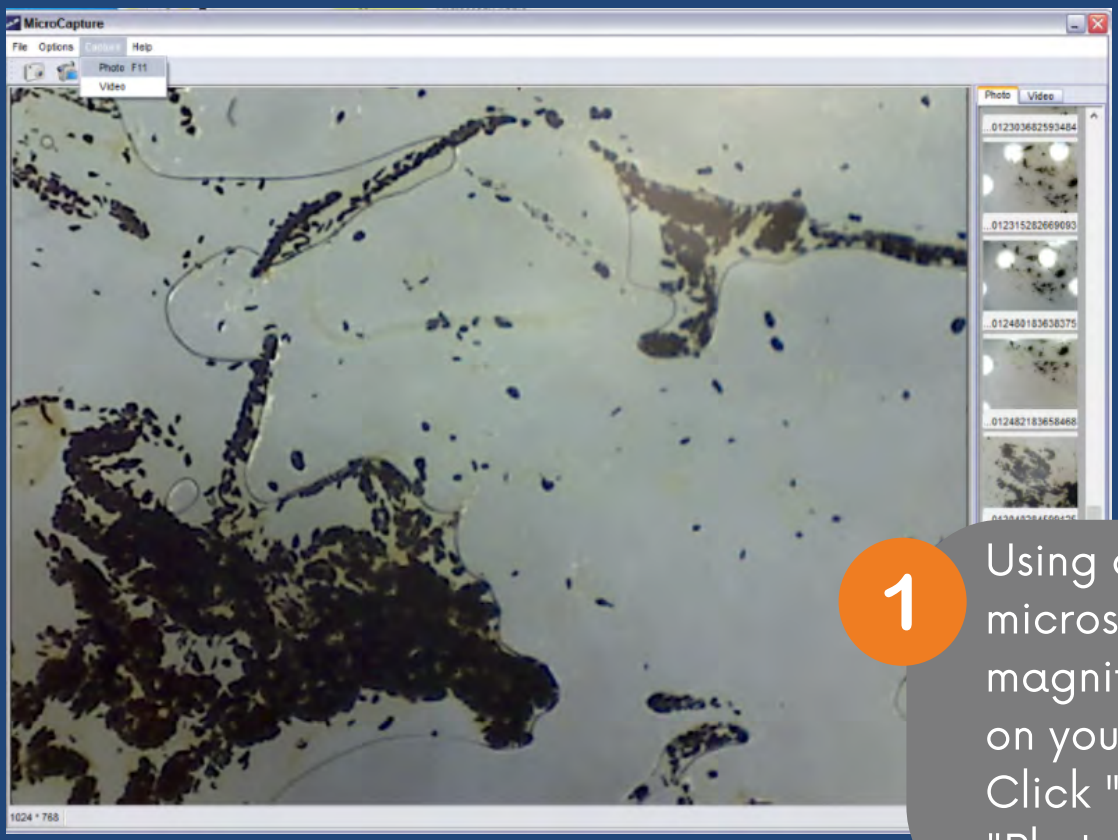


Unripe banana, x400 magnification.

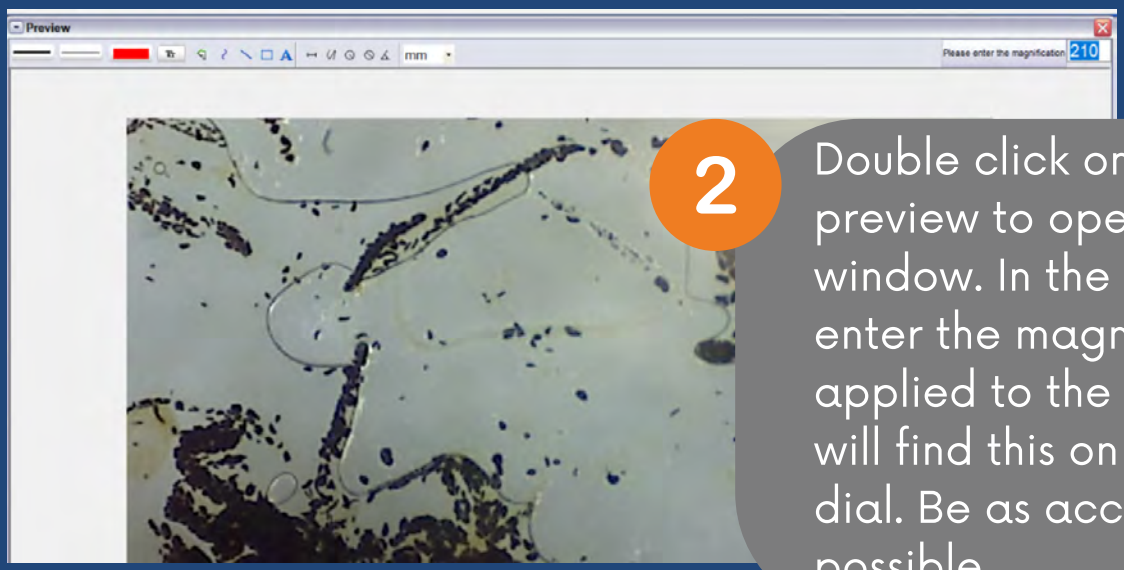
Repeat steps 1-4 using the ripened banana. Process and present your images with details of total magnification applied to the specimen.

How do the starch grains compare over the ripening process? Do the size and/or number vary?

Using a Veho digital microscope with accompanying software, you can take measurements of cells and their intracellular structures [2]. Let's look at this with the banana specimen.



1 Using a Veho digital microscope at x200 magnification, focus on your specimen. Click "Capture" then "Photo".

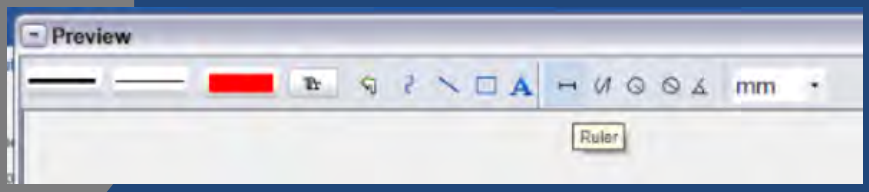


2

Double click on your image preview to open it in a new window. In the top right corner, enter the magnification applied to the specimen. You will find this on the microscope dial. Be as accurate as possible.

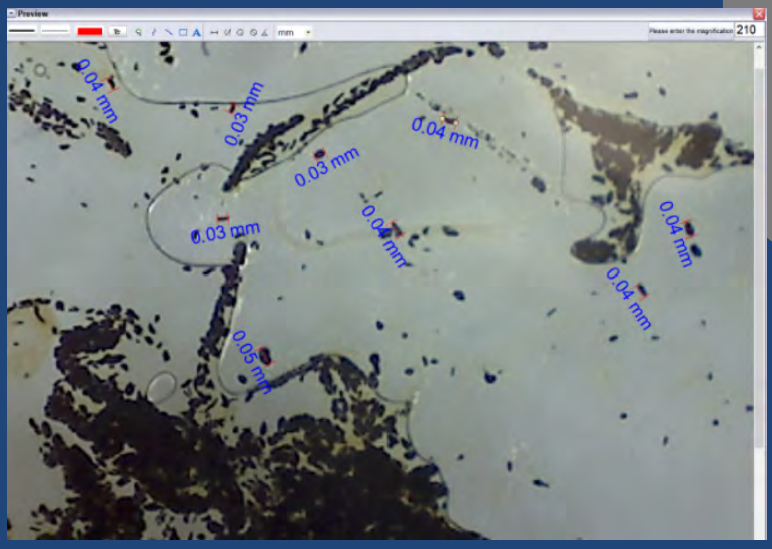
3

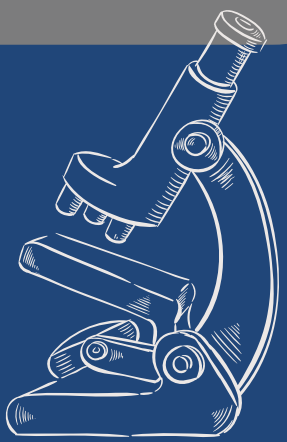
Along the top panel, click on the horizontal line for "ruler". You can adjust the units of measurements as appropriate.



4

Click on the left side of a starch grain, and drag the mouse to the right-side boundary - then release the mouse. A measurement value will appear, taking account of the magnification value you entered.





5 Once you have established the approximate length of the starch grains, you might feel it is more appropriate to adjust the units to micrometres.

What is the average length of a starch grain?

In a field of view, how many starch grains are present in a ripe versus unripe banana?

Do the size of the starch grains change over the ripening process?

Do any other foods contain starch grains?

Microscopes in the World of Work

Microscopy is often used in the food industry to support the work of food technologists in developing complex new food products [3].

My World of Work

Click on the icons here to access more information in this area of work.

References

[1] MRC Laboratory of Molecular Biology - "Microscopes for Schools" - weblink here.
[2] Veho World - DX1 Digital Microscope 2MP manual
[3] My World of Work - Food scientist or technologist - weblink here.