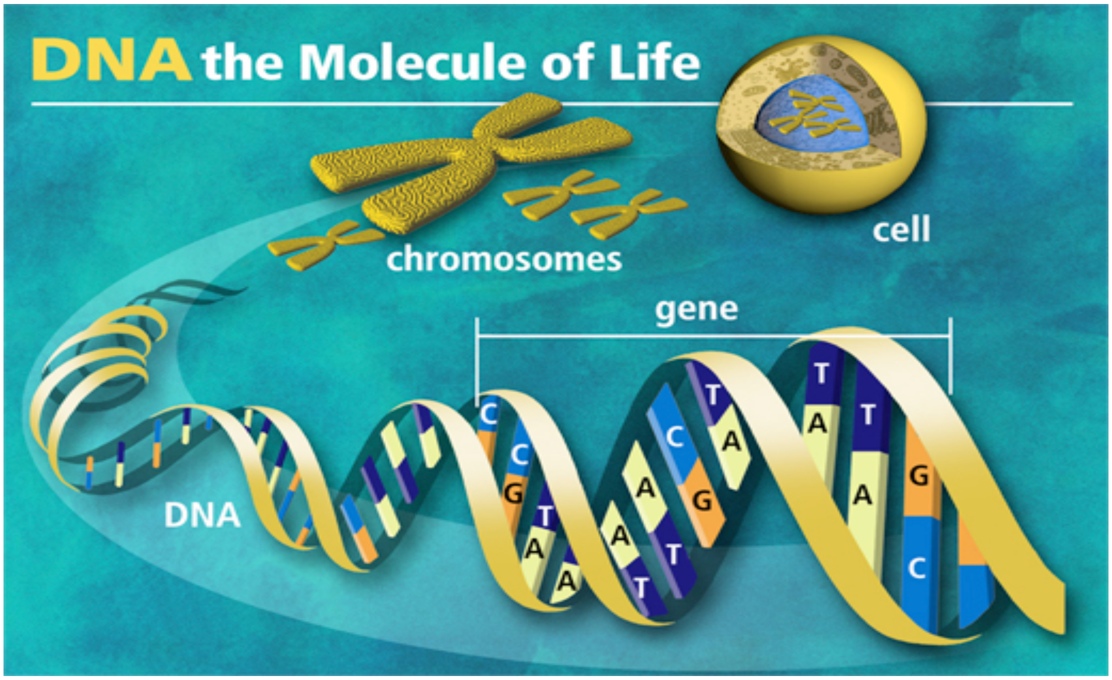
DNA Isolation from wheat germ – work in pairs!



1. Mix 50 ml of hot water and 1.5 g wheat germ in a small cup or beaker.

2. Stir with a wooden skewer.

3. Add 2 pipette squirts of detergent (the detergent dissolves the lipid cell membranes).

4. Add 1.5 of meat tenderizer (the tenderizer contains papin enzyme that breaks down protein. This removes the histone proteins from the DNA).

5. Stir for a couple of minutes.

6. Let the mixture settle for a couple of minutes.

7. Pour the liquid part of the solution into a 50 ml polypropylene tube –<u>leave most of the wheat germ in the cup</u>. The DNA should be in the solution. Fill the tube halfway.

8. Pour ice cold ethanol SLOWLY down the inside edge of the tube you filled in step 7. Fill the tube almost to the top (the ethanol helps the DNA come out of solution).

9. DNA strands will begin to precipitate and form! Yes, they look like snot. Twist the DNA onto the wooden skewer. This is called DNA spooling. DO NOT STIR OR SHAKE!

Human Cheek Cell Station

1. To view cheek cells, gently scrape the inside lining of your cheek with a toothpick. **DO NOT GOUGE THE INSIDE OF YOUR CHEEK!**

2. Gently roll & tap the toothpick onto the center of a glass slide with a single drop of water. Some of the cheek cells will fall onto the slide.

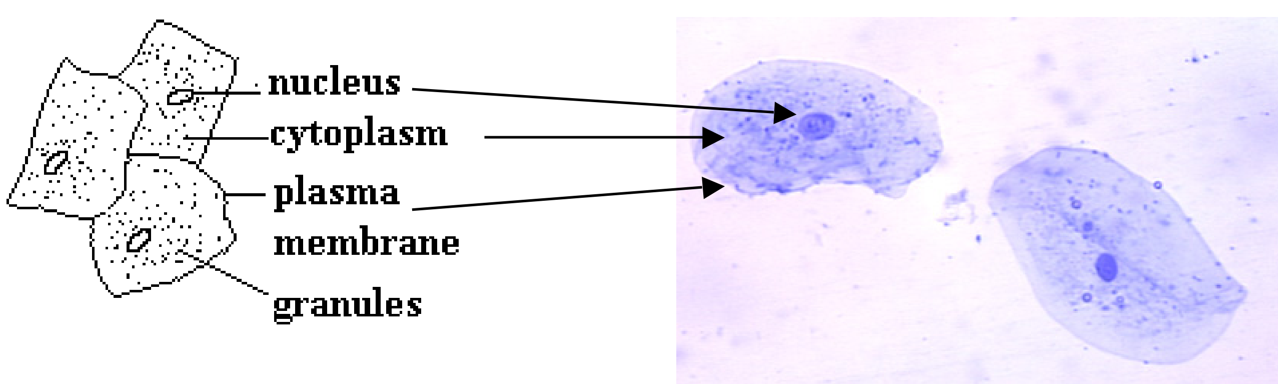
3. Cover with a cover slip using proper procedure.

4. Observe the cheek cells under scanning, low and high power of your microscope.

5. Add a drop of methylene blue stain or iodine. This is done by placing a drop on the side of the cover slip and placing a paper towel on the opposite edge of the cover slip. This should draw the stain through and color the cells.

6. Observe the cheek cells under low and high power of your microscope (at the minimum you should observe the cell membrane, nucleus, and cytoplasm).

Human cheek cells



How does your stomach keep from digesting itself?

Your stomach is a "crescent-shaped hollow organ" about the size of a large melon. The average adult stomach holds about three quarts (three liters) of fluid. Your stomach is made up of a variety of layers, including:

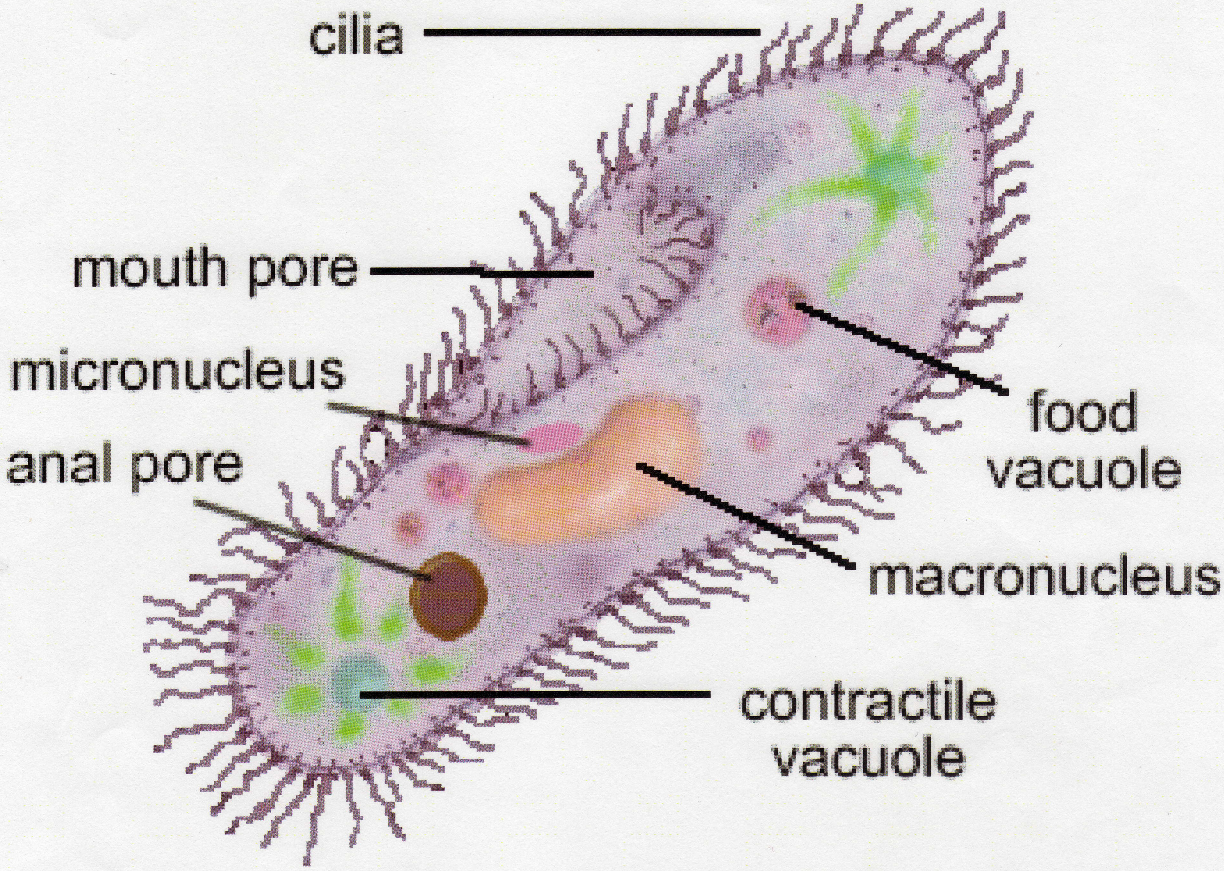
- The **serosa** - the outer layer that acts as a covering for the other layers.
- Two muscle layers - the middle layers that propel food from the stomach into the small intestine.
- The **mucosa** - the inner layer made up of specialized cells, including **parietal cells**, **g-cells** and **epithelial cells**.

Special cells produce **hydrochloric acid**, a strong acid that helps to break down food. The acid in your stomach is so concentrated that if you were to place a drop on a piece of wood, it would eat right through it.

Other cells produce **gastrin**, a hormone that facilitates the production of hydrochloric acid.

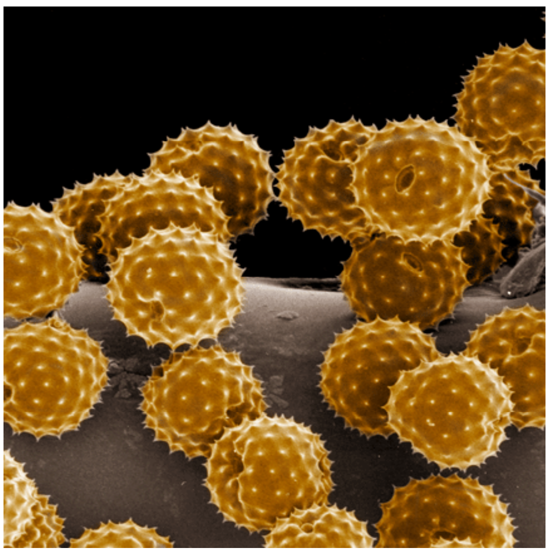
The stomach is protected by the epithelial cells, which produce and secrete a **bicarbonate**-rich solution that coats the mucosa. Bicarbonate is alkaline, a base, and neutralizes the acid. This continuous supply of bicarbonate is the main way that your stomach protects itself from autodigestion (the stomach digesting itself) and the overall acidic environment.

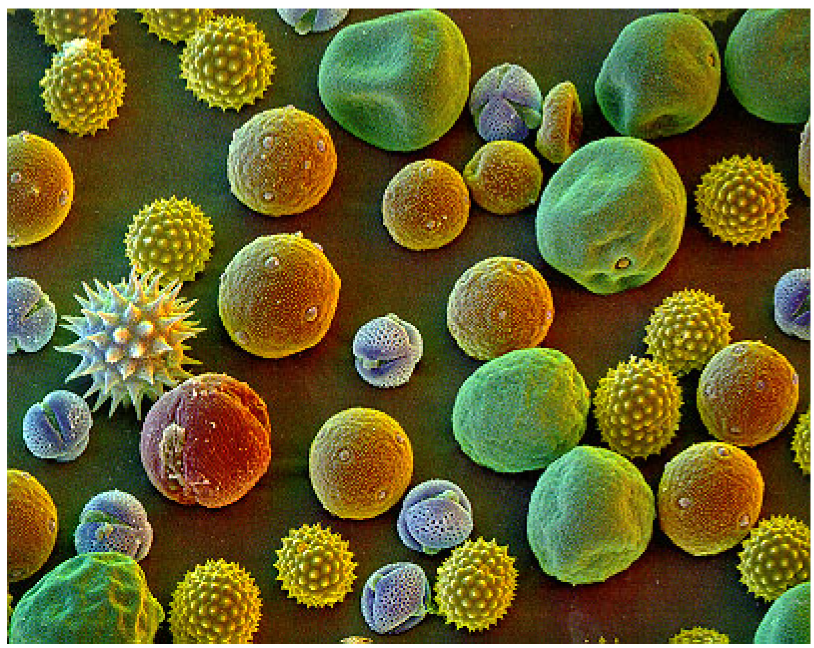
In some individuals, due to impairments in blood supply to the stomach, or to overproduction of acid, this defense system does not work as well as it should. These people can get **gastric ulcers**. There are also specific bacteria, called **Helicobacter pylori**, that may cause impairment of the stomach's defenses and can also be responsible for ulcers.


cilia
mouth pore
micronucleus
anal pore
food vacuole
macronucleus
contractile vacuole

Pollen

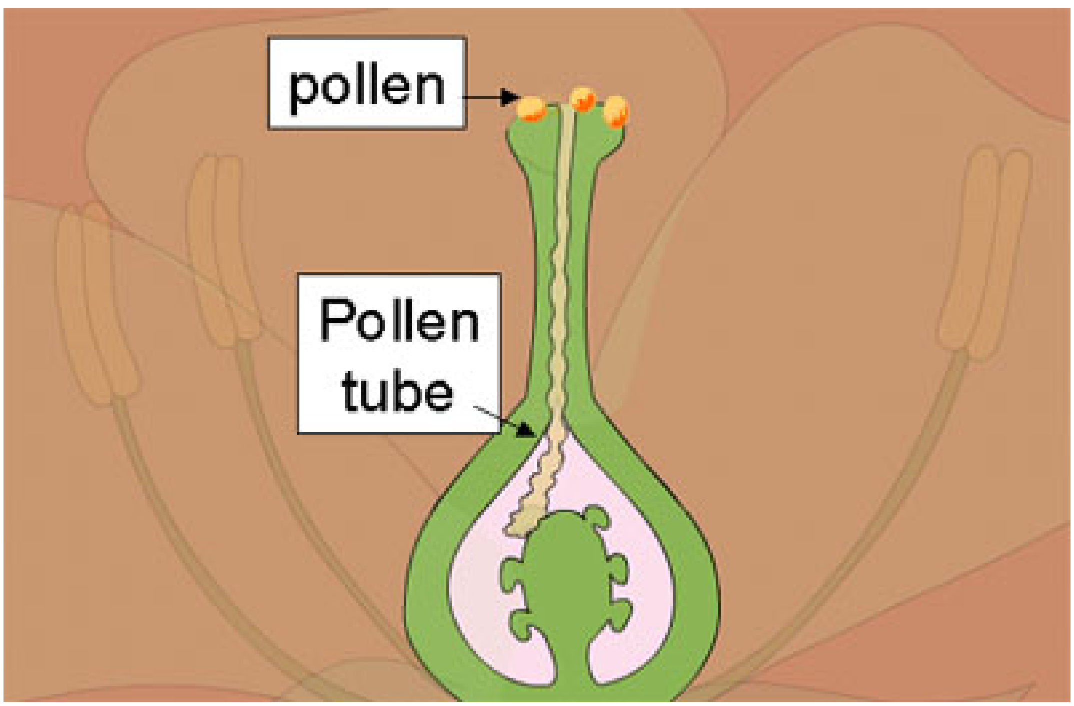
Pollen is the male reproductive cell body produced by anthers of flowers. It is collected and used by honeybees as their source of protein. Pollen typically contains two sperm nuclei capable of fertilizing an egg.





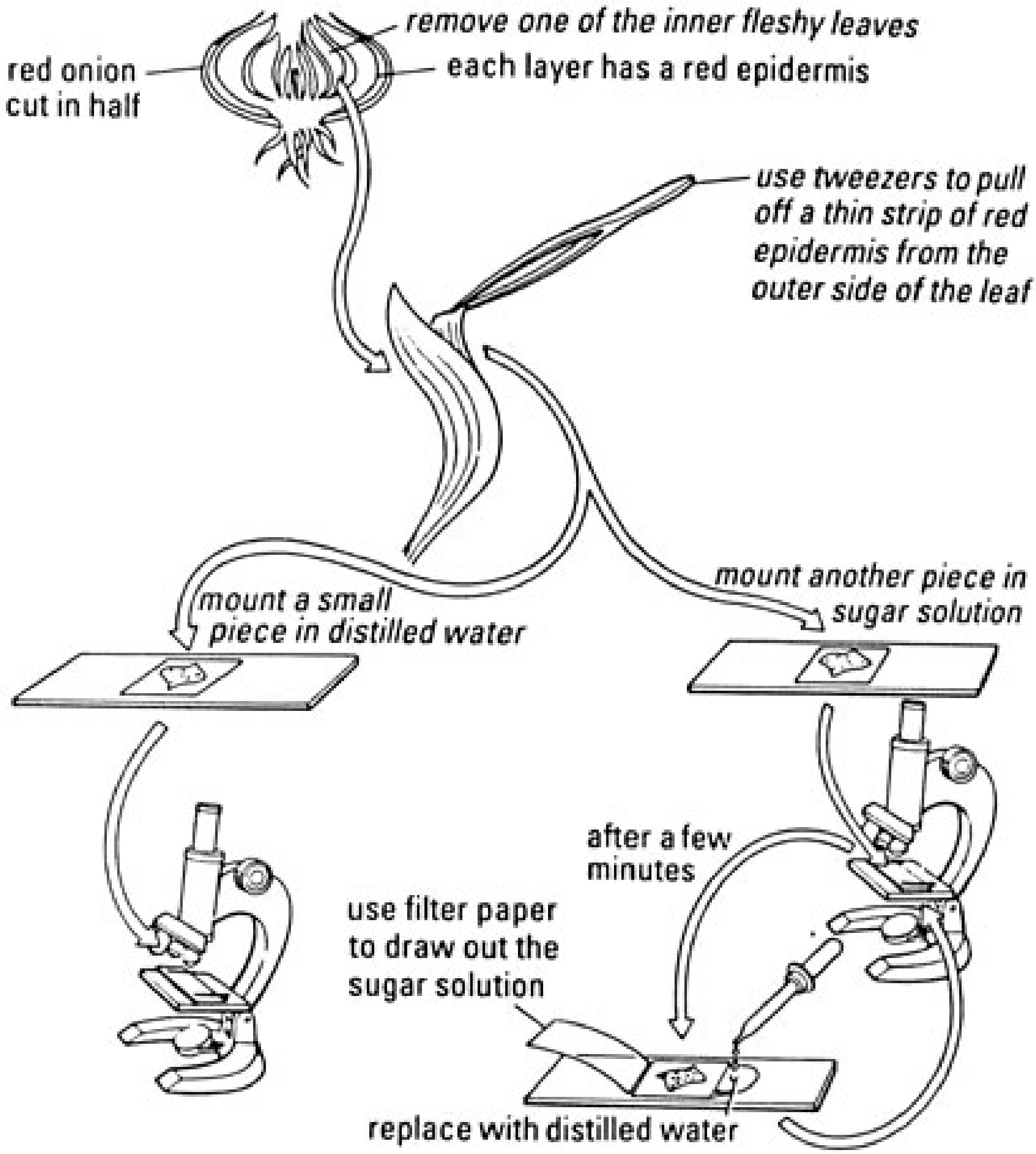
Pollination is the transfer of pollen grains to the surface of a receptive stigma. Wind, insects, birds, or other agents are often required for the transfer. After a pollen grain lands on a stigma, it germinates and a pollen tube forms, creating a path that the two sperm nuclei will follow to the ovule.

Guided by chemical cues, the pollen tube grows through the tissues of the ovary to an ovule. It carries two sperm nuclei. When the pollen tube reaches an ovule, it penetrates the embryo sac and deposits two sperm. The two sperm are released to accomplish double fertilization.



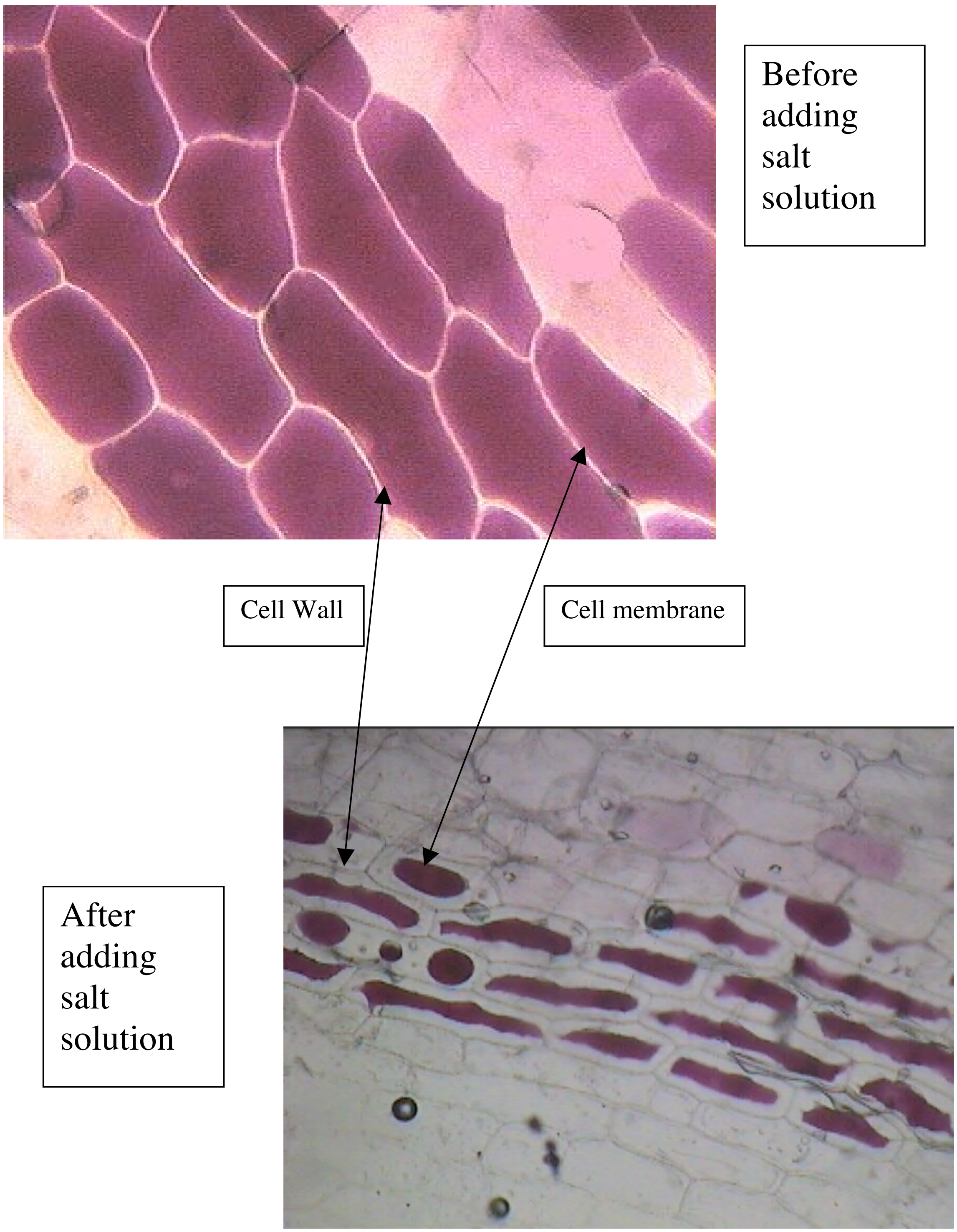
In flowering plants, the pollen grains which reach the mature stigma of a flower will only develop a pollen tube if a certain chemical is present. This means that only the stigma of a flower of the same species as the ones which produced the pollen grains will stimulate the pollen tube to grow towards the ovule.

Red Onion Cell Station



We are using salt solution instead

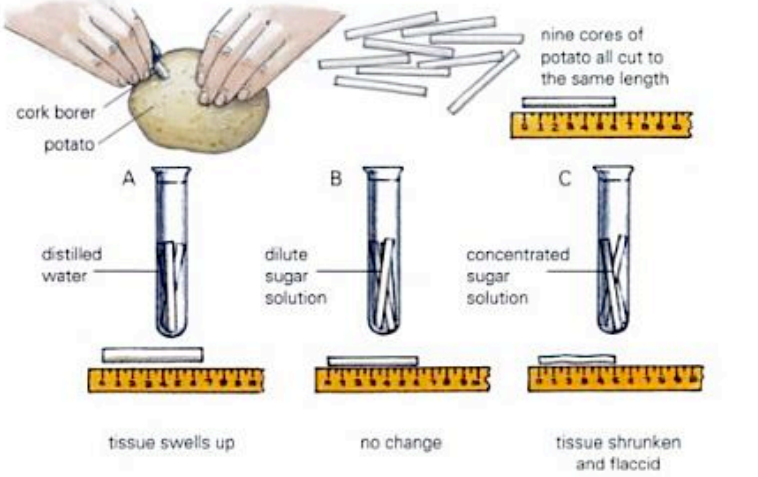
Red Onion Cell – What to expect?



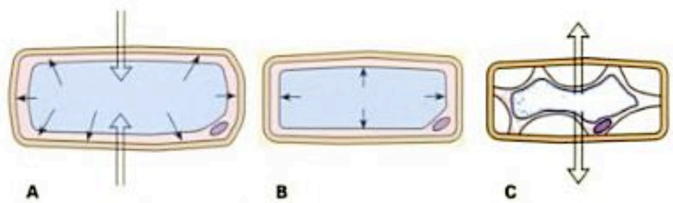
Plant cells and osmosis

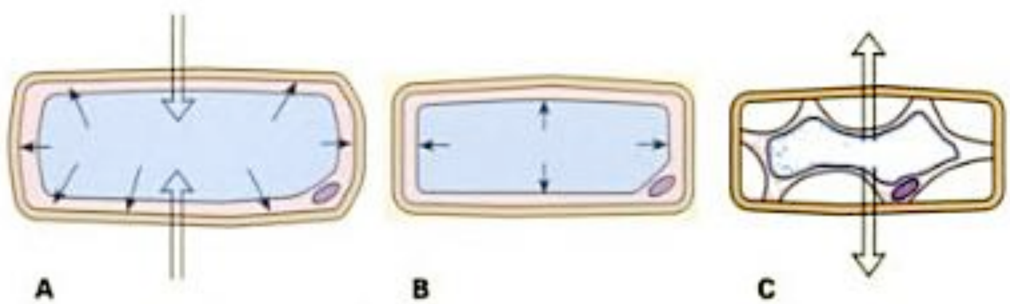
This investigation shows the importance of osmosis to plants. Small pieces of potato of equal size and shape are placed in solutions of distilled water, dilute sugar and concentrated sugar. Changes to their shape and size are noted.

In water plant cells increase in size. Water enters the cells by osmosis causing them to swell a little because the cell wall will stretch slightly (the cells are turgid). The cells do not burst because cell walls are tough and strong. This increase in size is reversible – if the cells are placed into a strong sugar solution they decrease in size. This is because water diffuses out of the cells by osmosis. If the sugar solution is strong enough then the vacuole in the cell shrinks pulling the cell membrane and cytoplasm away from the cell wall, known as **plasmolysis** (the cells are not turgid). If many of the cells are like this then the plant will wilt.



Investigating osmosis in plant tissues.





***A** Absorption of water by osmosis makes cells firm and turgid. They have all increased in mass and lengthened a little.*

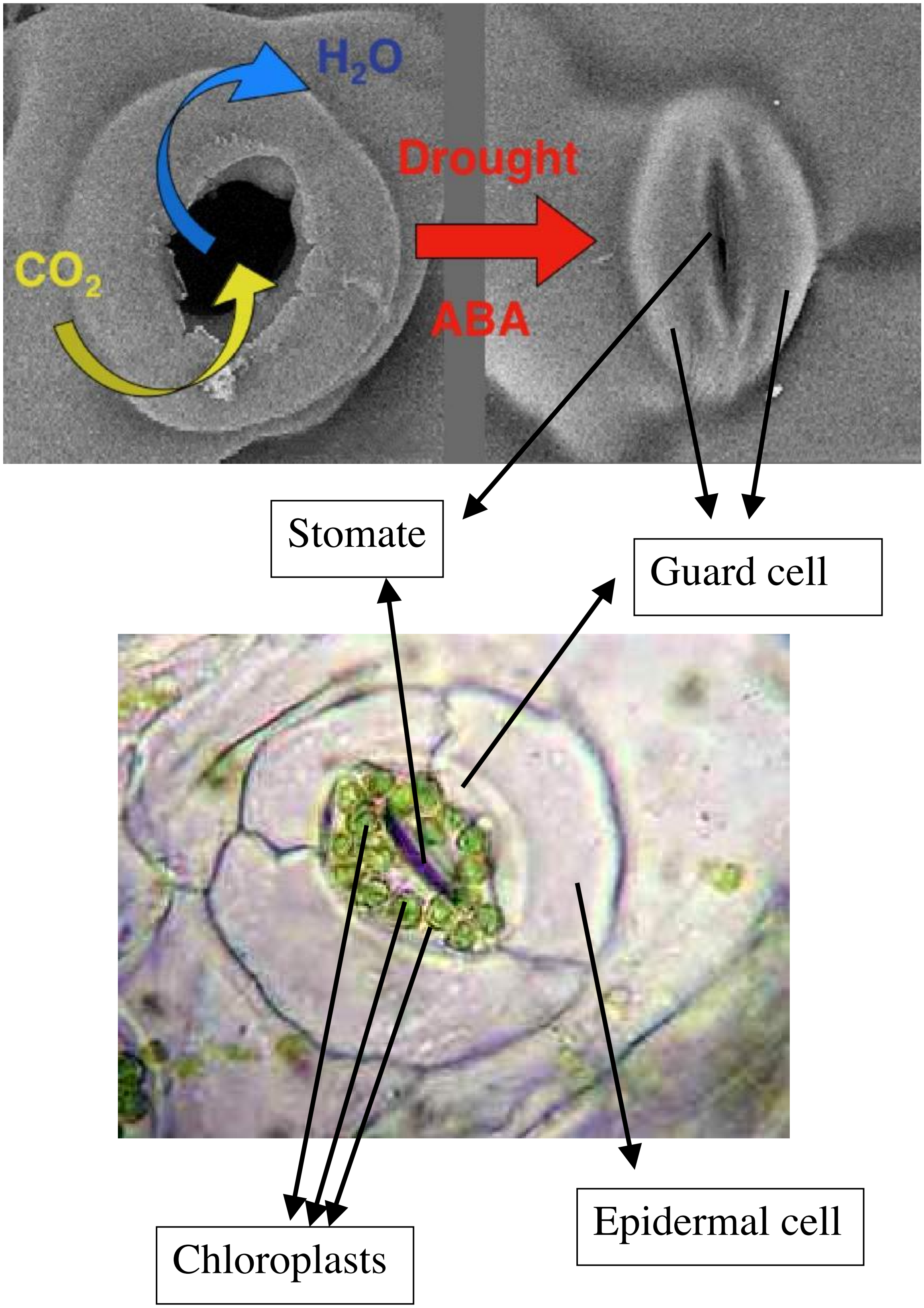
***B** The vacuole contains a solution of salts and other substances. These cells have not gained or lost water. They have not changed in mass or length.*

***C** The cells lose water and become flabby (flaccid). Water has diffused out by osmosis leaving the cells smaller than before.*

key
⟹ diffusion of water
→ pressure exerted by vacuole on cell wall

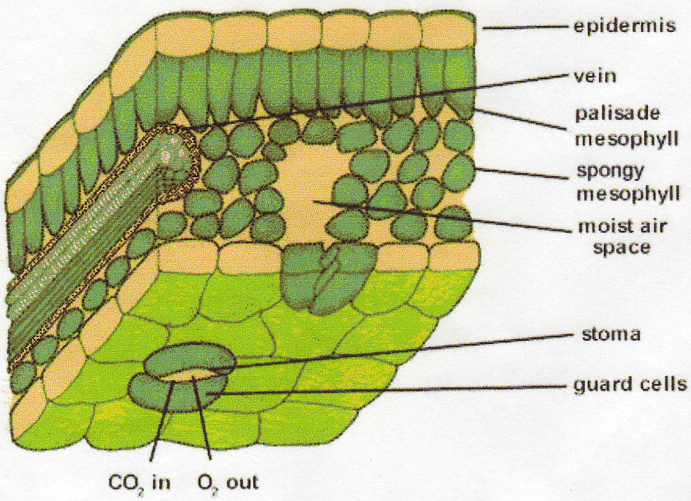
This diagram shows what happens to the cells in the potato cores A, B and C above.

Stomata Station

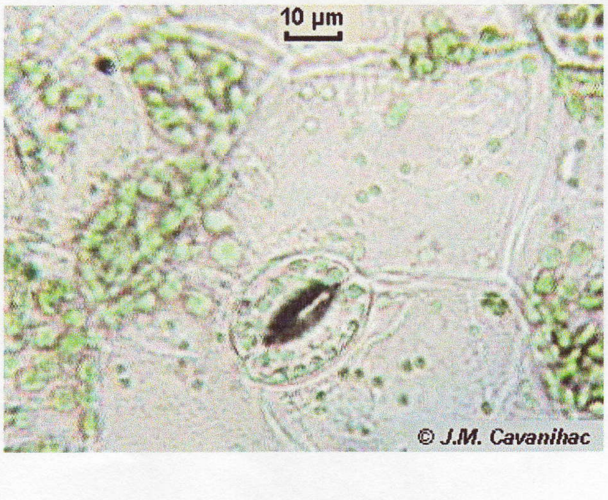


Stomata

This is the structure of a leaf. The 'bottom' layer of a leaf is called the lower epidermal layer. In land plants, stomata are located in this layer. Some floating aquatic plants, like water lilies, have the stomata located on the upper side of the leaf. Submerged aquatic plants do not have stomata.



In botany, a *stomate* (plural **stomata**) is a tiny opening or pore, found mostly on the undersurface of a plant leaf, and used for gas exchange. Air containing carbon dioxide and oxygen enters the plant through these openings where it gets used in photosynthesis and respiration. Waste oxygen produced by photosynthesis exits through these same openings. Also, water vapor is released into the atmosphere through these pores in a process called transpiration.



Star of Africa's Savanna Ecosystems May Be the Lowly Termite: Regularly Spaced Termite Mounds Are Key to Maintaining Ecological Function

ScienceDaily (May 26, 2010) — The majestic animals most closely associated with the African savanna -- fierce lions, massive elephants, towering giraffes -- may be relatively minor players when it comes to shaping the ecosystem.

The real king of the savanna appears to be the termite, say ecologists who've found that these humble creatures contribute mightily to grassland productivity in central Kenya via a network of uniformly distributed colonies. Termite mounds greatly enhance plant and animal activity at the local level, while their even distribution over a larger area maximizes ecosystem-wide productivity.

The finding, published in the journal *PLoS Biology*, affirms a counterintuitive approach to population ecology: Often it's the small things that matter most.

"It's not always the charismatic predators -- animals like lions and leopards -- that exert the greatest control on populations," says Robert M. Pringle, a research fellow at Harvard University. "As E.O. Wilson likes to point out, in many respects it's the little things that run the world. In the case of the savanna, it appears these termites have tremendous influence and are central to the functioning of this ecosystem."

Prior research on the Kenya dwarf gecko initially drew Pringle's attention to the peculiar role of grassy termite mounds, which in this part of Kenya are some 10 meters in diameter and spaced some 60 to 100 meters apart. Each mound teems with millions of termites, who build the mounds over the course of centuries.

After observing unexpectedly high numbers of lizards in the vicinity of mounds, Pringle and his colleagues began to quantify ecological productivity relative to mound density. They found that each mound supported dense aggregations of flora and fauna: Plants grew more rapidly the closer they were to mounds, and animal populations and reproductive rates fell off appreciably with greater distance.

What was observed on the ground was even clearer in satellite imagery. Each mound -- relatively inconspicuous on the Kenyan grassland -- stood at the center of a burst of floral productivity. More importantly, these bursts were highly organized in relation to one another, evenly dispersed as if squares on a checkerboard. The result, says Pringle, is an optimized network of plant and animal output closely tied to the ordered distribution of termite mounds.

"In essence, the highly regular spatial pattern of fertile mounds generated by termites actually increases overall levels of ecosystem production. And it does so in such a profound way," says Todd M. Palmer, assistant professor of biology at the University of Florida and an affiliate of the Mpala Research Centre in Nanyuki, Kenya. "Seen from above, the grid-work of termite mounds in the savanna is not just a pretty picture. The over-dispersion, or regular distribution of these termite mounds, plays an important role in elevating the services this ecosystem provides."

The mechanism through which termite activity is transformed into far-reaching effects on the ecosystem is a complex one. Pringle and Palmer suspect termites import coarse particles into the otherwise fine soil in the vicinity of their mounds. These coarser particles promote water infiltration of the soil, even as they discourage disruptive shrinking and swelling of topsoil in response to precipitation or drought.

The mounds also show elevated levels of nutrients such as phosphorus and nitrogen. All this beneficial soil alteration appears to directly and indirectly mold ecosystem services far beyond the immediate vicinity of the mound.

While further studies will explore the mechanism through which these spatial patterns of termite mounds emerge, Pringle and Palmer suggest that the present work has implications beyond the basic questions of ecology.

"Termites are typically viewed as pests, and as threats to agricultural and livestock production," Pringle says. "But productivity -- of both wild and human-dominated landscapes -- may be more intricately tied to the pattern-generating organisms of the larger natural landscape than is commonly understood."

The findings also have important implications for conservation, Palmer says.
"As we think restoring degraded ecosystems, as we think about restoring coral reefs, or restoring plant communities, this over-dispersed pattern is teaching us something," he says. "It's saying we might want to think about doing our coral restoration or plant restoration in a way that takes advantage of this ecosystem productivity enhancing phenomenon."

Pringle and Palmer's co-authors on the *PLoS Biology* paper are Daniel F. Doak of the Mpala Research Centre and the University of Wyoming; Alison K. Brody of the Mpala Research Centre and the University of Vermont; and Rudy Jocqué of the Royal Museum for Central Africa in Tervuren, Belgium. Their work was supported by the Sherwood Family Foundation and the National Science Foundation.

Journal Reference:

1. Pringle RM, Doak DF, Brody AK, Jocqué R, Palmer TM. **Spatial Pattern Enhances Ecosystem Functioning in an African Savanna**. *PLoS Biology*, 2010; 8 (5): e1000377 DOI: 10.1371/journal.pbio.1000377