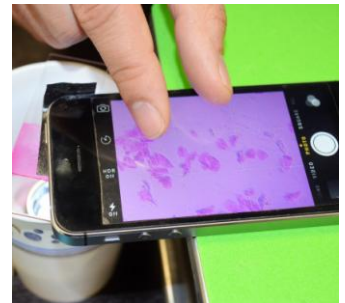


Biotech Skills—Take a “Cellfie”

Be a scientist and learn basic biotechnology skills to get a closer look at what our bodies are made of. You can make a lab anywhere by using a cell phone and some household items.

Try this!

1. Gently scrape the inside lining of your cheek with the flat side of a toothpick to collect cheek cells.
2. Dip the end of the tooth pick into a microcentrifuge tube filled with water. (Shake the tooth pick a little to loosen the cheek cells). Repeat steps 1-2.
3. Use the centrifuge (salad spinner) to spin the tube for 1 minute. When the centrifuge stops, retrieve your tube. What do you notice?
4. Using a pipette, carefully remove the top layer of water and discard. Then, remove the white cloud of cheek cells at the bottom of the tube and transfer to a glass slide.
5. Gently place a small drop of food coloring on top of the sample.
6. Place a thin cover slip on top of your wet sample. Start at an angle and then gently drop the cover slip on the sample.
7. Place the microscope lens onto your cell phone’s camera lens and place on the stage with the camera facing your sample. *Remove phone covers.
8. Focus your cell phone microscope on your cheek cells and take a “cellfie”!



What’s going on?

The white cloud of cheek cells at the bottom of the microcentrifuge tube forms because the spinning action of the centrifuge pulls all the cheek cells down to the bottom of the tube due to centrifugal force. The sediment is called a **pellet** and the liquid above it is called the **supernatant**.

Many samples, particularly cells, can appear transparent, or clear, under a microscope making them difficult to see. Adding color to the cheek cells allow us to see the cells better, this is called **staining**. Food coloring is just one of the ways scientists can stain cells. Adding color to the cheek cells allow us to see the cells better, this is

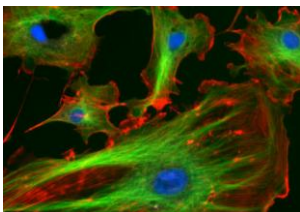
called **staining**. Food coloring is just one way scientists can stain cells. Other examples include iodine, malachite green, and methylene blue.

The microscope lens is made from laser pointer lenses. Lenses magnify images by focusing light emitted from an image into our eyes at a shorter distance, making the image appear larger than it actually is in our brains. Combining two lenses increases the magnification but decreases the distance you need to be from the image to keep it in focus (to keep the image clear). This is called the **working distance** of a microscope.



DIY microscope lens on cell phone camera

How is this biotech?



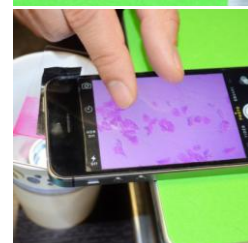
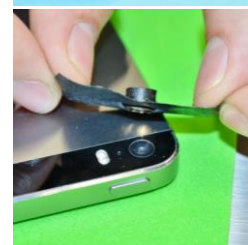
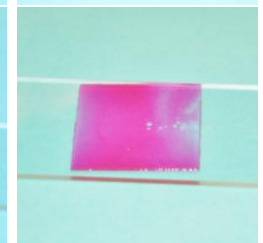
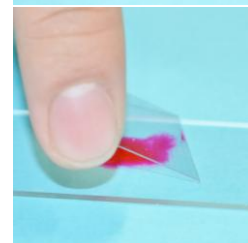
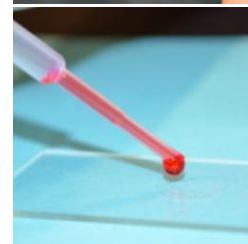
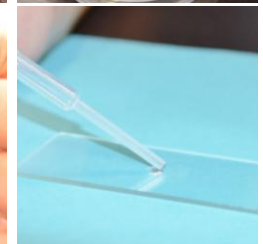
Cells stained with fluorescent dyes

Scientists and engineers use special tools and equipment in biotechnology. Using these tools, scientists can collect and analyze biological samples to help them better understand topics in fields like agriculture, medicine, and alternative energy. Interestingly, certain stains color certain parts of a cell. Scientists choose specific stains and dyes when they want to look at a particular part of a cell.

The DIY cell phone microscope is a simple, low-cost tool for anyone to use to observe small structures. Take a portrait of yourself at the micro level, what we call a “cellfie”!

Visual Step-by-step Procedure

1. Use a toothpick and gently scrape the inside lining of your cheek to collect cheek cells.
2. Transfer the cheek cells to a microcentrifuge tube filled with water. Repeat steps 1-2 two more times.
3. Cap the microcentrifuge tube and insert it into the centrifuge (salad spinner). Make sure to label the tube before spinning.
Spin the centrifuge quickly for 1 minute or until a thick white cloud (pellet) forms at the bottom of the tube.
4. Remove your tube and use a pipette to carefully remove the top layer of liquid. Make sure **not** to disturb the pellet at the bottom of the tube.
Using the pipette, transfer the cheek cells from the bottom of the tube to a glass slide.
5. Add a drop of food coloring on top of the sample (preferably at the edge of the sample so that they mix gently).
6. Place a thin cover slip, on top of your wet sample. Start at an angle and then gently drop the cover slip on the sample. Use the edge of a paper napkin to gently soak up excess liquid from the edge of the cover slip. Place glass slide on top of the cup stand provided.
7. Place the microscope lens onto your cell phone's camera lens and place on the stage with the camera facing your sample. (Remove any phone covers beforehand)
8. Focus your cell phone microscope on your cheek cells by slowly moving the stage up and down, zoom on your phone, and take a **"cellfie"**!
(You can also take video)



Biotech Skills—Take a “Cellfie” Presenter Guide

Learning Objectives

1. Scientists and engineers use special tools and equipment in biotechnology


Materials


- Toothpick
- Cheek cells
- Microcentrifuge tube
- Water (not provided)
- Centrifuge (salad spinner) **Place on separate stand from microscope table to reduce vibrations during imaging.*
- Pipette
- Glass microscope slide
- Cover slip
- Food coloring
- Optional: Ionic solution, 0.9%NaCl (see below for preparation instructions)
- Paper towel (not provided)
- Adjustable stage/stand
- Flashlight
- Cell phone with camera and automatic focus (not provided)
- 2 laser pointer lenses
- Electrical tape
- Trashcan (not provided)
- Container with diameter less than the glass slide
- Gloves (for facilitators)

Activity Diagram



 Set-up
15 minutes

 Program
10-15 minutes

 Clean up
10 minutes

Notes to the Presenter

SAFETY: Cheek cells are biological samples so should be treated as hazardous biological samples. The presenter should always wear gloves and let participants handle their own samples as much as possible. Participants should throw away used toothpicks, microcentrifuge tubes, and pipettes immediately after use. If reusing microscope slides, make sure to store used slides in a sterilizing solution until they can be thoroughly sterilized after the activity. Have all participants wash their hands after the activity and periodically wipe down the activity station, including instruments, with disinfectants.

Before doing this activity: Place the flashlight in the container. This will serve as the slide stand. Turn the flashlight off when not in use to conserve battery life.

Optional: Use isotonic solution, 0.9%NaCl, instead of water to keep the cells from bursting in water: Dissolve 4.5g NaCl in 500mL distilled water.

Tips:

- Be sure to label either the microcentrifuge tubes or the tube rack so participants can identify their samples.

- Let participants quickly spin the centrifuge for approximately 1 min continuously. If you cannot see the pellet at the bottom of the tube, return to the centrifuge and spin for an additional 1 min. Use a separate sturdy table/stand for the centrifuge to limit vibrations on the sample prep and microscope table.
- If you still cannot see a white cloud of cheek cells after centrifugation there may not be enough cheek cells in the tube. Have participants scrape the inside of their cheeks again and add to their sample. It's preferable that participants do not eat immediately before the activity.
- When using the pipette to remove the supernatant, make sure not to disturb the cheek cells at the bottom of the tube. If a participant accidentally mixes the cheek cells back in the liquid they can (1) re-centrifuge, or (2) if most of the supernatant was removed, they can continue to use the concentrated sample. Dispose any liquids in the trash.
- Dilute the concentrated food color before the activity so that one drop of color added to the cheek cell sample will make the sample slightly opaque.
- Too much liquid on the glass slide will make it difficult to view cells through the cell phone microscope. Use a paper towel to wick away excess liquid that overflows around the edges of the cover slip before viewing.
- Not all cell phone cameras are made the same so obtaining a clear picture of cheek cells using the DIY microscope lenses can take some time. Remove any phone covers; covers hinder the microscope lens from being directly up against the cell phone camera which can result in an out of focus images. Move the stage slowly up and down to focus. Use the cell phone's zoom feature to magnify cell image further.
- The DIY microscope lenses also work on tablets, such as iPads, in the same way.

Cleanup: Dispose of the biohazard materials and any glass materials appropriately. If reusing glass slides, wear gloves and safety glasses and place contaminated slides in a large bucket or boiler filled with water, to which 1-2% soft soap or detergent has been added, and boil for 30 minutes. Then rinse the slides again with water until all the detergent or soap is removed. Dry the slides overnight by separating and laying out slides on paper towels or rags. Wipe down the activity cart/table and instruments with a disinfectant.

Related Educational Resources

The World Biotech Tour website (www.worldbiotechtour.org/activities) contains additional resources to introduce visitors to biotechnology and the tools researchers use:

- Hands-on activities: *Biotech Skills – Pipette by Numbers*, *Biotech Skills – Candy Gel Electrophoresis*
- Media include– *Take a Cellfie* How to Video, *Take a Cellfie: Additional Tips* PowerPoint

Credits and Rights

The microscope activity was adapted from: Instructables user Yoshinok. *\$10 Smartphone to digital microscope conversion!* Instructables.com. www.instructables.com/id/10-Smartphone-to-digital-microscope-conversion/

The cheek cell activity was adapted from an activity at the Museum of Science in Boston, MA, USA. *Staining Cells*. legacy.mos.org/sln/sem/staining.html

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Images courtesy of the Association of Science-Technology Centers, Carlin Hsueh. 2015



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