jump | STEAM AT HOME

DO TRY THESE AT HOME!

MICROSCOPY 102 SKILLS BUILDING

MICROSCOPY 102
BUILDING SKILLS

Overview: Each exercise you do, your skills get better and make you more independent to think critically, make a plan and explore on your own. Already, you've learned to set up the scope, navigate around a slide effectively, create simple slides out of household items, investigated several science areas of microscopy, create your own experiences through experimentation and play. These "INTRODUCTION" experiences should be treated like a RECIPE book that you can go back to anytime you want to use a skill set that you have already learned.

In this section, we are going to hone those microscope skills while you learn some more complex skills like precision viewing specimens, staining specimens, creating a permanent slide and viewing living organisms. We want you to make a lot of mistakes and learn how to correct problems as we encourage your exploration beyond the prescribed experiments. These skills will be important later for better understanding how to explore specific topics, critically thinking about planning to find solutions and how to use some lab reagents and equipment to investigate scientific theories without our detailed guidance.

Each section will have less instruction and more exploration. Here's how:

1. We will introduce a new TOPIC and have you learn or develop a SKILL (maybe both) and give a SCENARIO to investigate.
2. You will refer to your RECIPE book to follow the proper way to set up your slide and carry out the investigation.
3. Then, of course, you will record your notes in your notebook.

UNDERSTANDING OPTICS

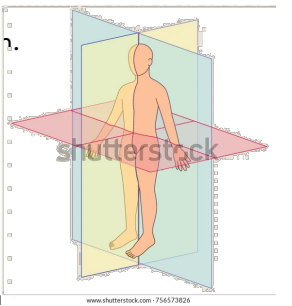
A microscope must accomplish three things: it must **magnify** the object you are trying to view, **resolve** the details of the object, and make these details **contrast** to increase specimen clarity and visibility.

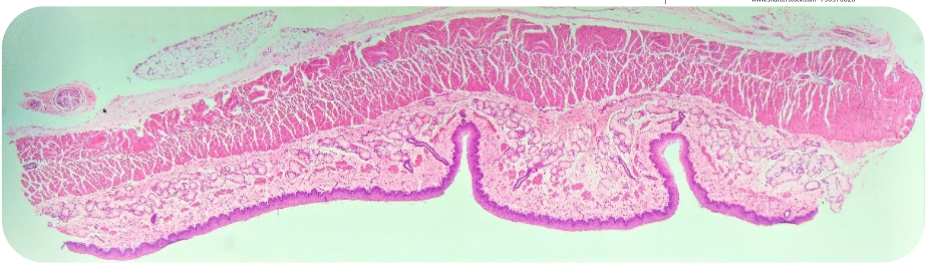
Optics Vocabulary

- **Magnification** – larger image
- **Resolution** – clearer image
- **Numerical Aperture** – light gathering capacity of a lens
- **Working Distance** – the distance from the bottom of an objective to the in-focus area of an object (distance between specimen and lens)

SLIDE TERMINOLOGY AND ABBREVIATIONS

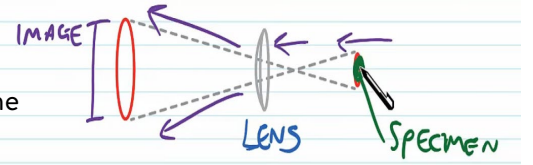
- WM (W.M.) : Whole Mount (Entire Specimen or Organism)
- LS (L.S.) : Longitudinal Section. A section cut lengthwise. Cut parallel to the longitudinal axis.
- CS (C.S.) : Cross-Section. Such as a thin wafer of an Earthworm. Cut perpendicular to the longitudinal axis.
- TS (T.S.) : Transverse. An alternative name for cross-section.
- Sec:Section
- Sm/Smear:Smear
- Sq:Squashed preparation



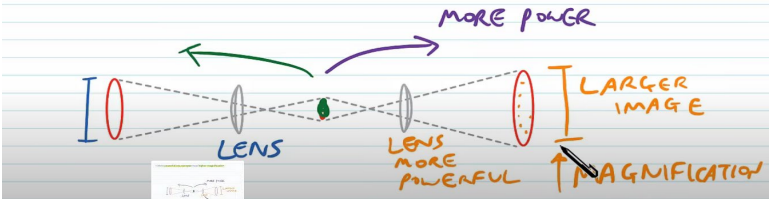


MAGNIFICATION

Microscopes use lenses to ***refract*** light to enlarge the appearance of something.
Magnifying power is how many times bigger an image gets when its under the microscope. If the magnification of a lens is 2X then it roughly doubles the size of the image of the object.



Powerful microscopes use multiple lenses to increase the ***Compound microscopes*** use 2 lens to take the first image and make it even bigger.



We say it increases the magnifying **POWER** or its a more powerful microscope

Increasing the power helps show more details but less of the image in the Field of view (FOV is amount of image we can see)

CALCULATE TOTAL MAGNIFICATION

Total magnification is the *ocular lens* power x the *objective lens* power

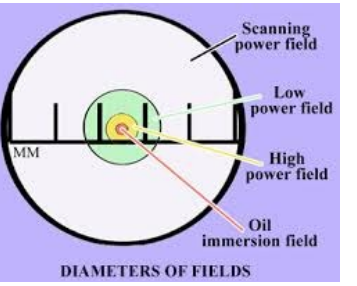
EX. Cornea _____ x Lens _____ = Total Magnification _____

Objective Lens	Magnification	Total Magnification
SCAN		
LOW POWER		
HIGH POWER		

INSECTS DIASCOPIC ILLUMINATION

- It's good to practice examining specimens under both reflected (episcopic) and transmitted (diascopic) illumination, using a variety of light sources and configurations, which are strategically positioned in the appropriate locations can give you a more broad view of specimens and even give you opportunities to see things you cant normally see with under lighting.
- Diascopic illumination (bottom lighting) is commonly used in Entomology (the study of insects) because specimens that are often small and thin, allowing light to pass through.one benefit is that the specimen can be left intact to study the internal organs or one section at a time without being sliced.
- Insects are
    - Animals
    - invertebrates
    - Arthropods
    - Hexapods
- Most insects have five basic physical characteristics:
    - Insects have what we call an exoskeleton or a hard, shell-like covering on the outside of its body.
    - Insects have three main body parts: head, thorax, and abdomen.
    - Insects have a pair of antennae on top of their heads.
    - Insects have three pairs of legs. They use the legs for walking, but sometimes an insect may have a pair of legs that are specially designed for jumping.
    - Insects have two pairs of wings.
- Insects change shape over their lifetime.
- How can an insect be helpful to humans?
- How are insects harmful to people?
- Studying the creature intact tells a lot about it

FIELD OF VIEW



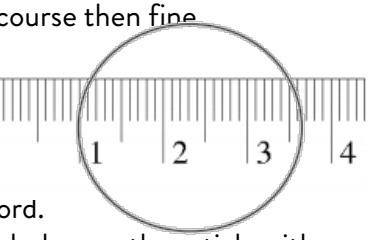
Field of view is the *diameter* of the circle you can see when looking into the microscope lens.

Most microscopes can have slightly different magnifications and in the microscopic world this makes a huge difference especially when increasing magnification. Its important to calibrate to get the best measurement.

Reticle – a grid or line of marks in the eyepiece that overlays your image.

Measuring the field of view

1. Follow the procedure for "setting up your microscope"
2. Place your ruler on the stage and focus using course then fine adjustment.
3. Move your ruler so the first mark is on the far left of the stage
4. Draw what you see clearly. Then measure the ruler in mm on each objective and record.
   **If you have an eyepiece reticle, Line the dashes on the reticle with the first line on the ruler and calculate the distance between reticle lines.
5. Repeat with each magnification.
   The Highest magnification is tough because its usually less than 1mm, so you cant measure directly with the ruler



What is your low power field of view in millimeters (mm).

DETERMINE SPECIMEN SIZE

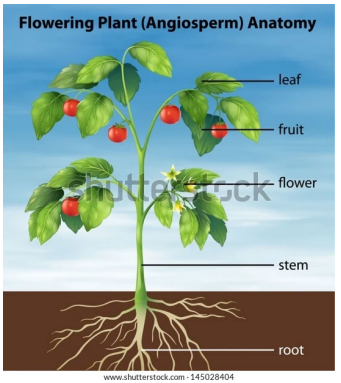
There are 100Micrometeres (um) in 1 mm.
You can switch back and forth using this equation

Field of view in um = field of view in mm x 1000
= x1000
= um
Specimen size = FOV diameter/ ?

The diameter of this field changes as you increase magnification. There is an inverse relationship between magnification and diameter of field. As magnification increases, Field of view decreases, brightness of the field is reduced, working distance decreases, (distance between scope and slide)

PLANTS

Plants are not only beautiful to look at, they are essential for all other life on earth to survive. Even the soil beneath you depends on plants to provide vital nutrients and protection from erosion.



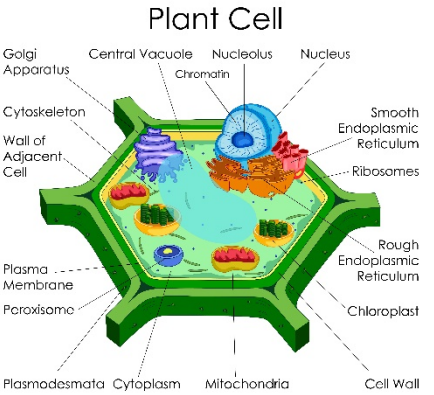
plant organs are groups of tissues that connect millions of specialized cells to carry out special functions, keeping the plant alive.

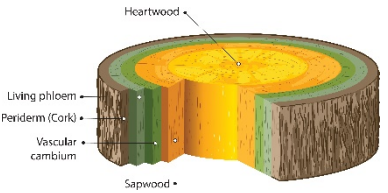
- ✓Roots anchor the plants and absorb water and nutrients
- ✓Stems give structural support and transport nutrients, and water
- ✓Leaves catch sunlight and perform photosynthesis for food
- ✓Flowers, fruits, and seeds are the reproductive parts of plants

Plant tissues are groups of the same type of cell focused on carrying out a specific function

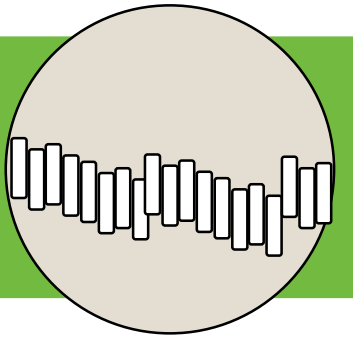
Plant cells are individual, living, units

- organelles carry out specific functions
- Hold 80-90% water in vacuoles
- Cell structure tells you the mechanical properties of the cell





Can you tell the size of your plant cells?
Here is an example:
19 cells are visible and lets assume the FOV is 1000um
Width of cell = 1000um/19 so the cells are approximately 52.6um



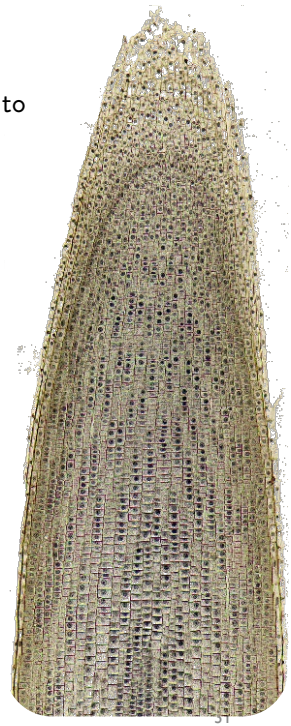
RESOLUTION

Resolution may be more important than magnification in viewing specimens. If the points cannot be clearly focused when they are closer together then the image quality is poor, regardless of the magnification .

Resolution is the ability to differentiate details. Greater resolution gives more fine detail to an image (think high resolution TV) more resolution creates clearer and sharper picture

Resolving power is the ability to distinguish two objects from each other. Light microscopy has limits to both its resolution and its magnification and The resolving power is built into each objective.

Empty magnification occurs when the image continues to be enlarged, but no additional detail is resolved.



Try it!

Use hand and fingers to block light but look through pinhole at object to see clearly. Not magnified, its resolution is better and in focus because pupil changes the amount of light. Try it again by pressing a pinhole into a notecard and look through that hole at an image or print.

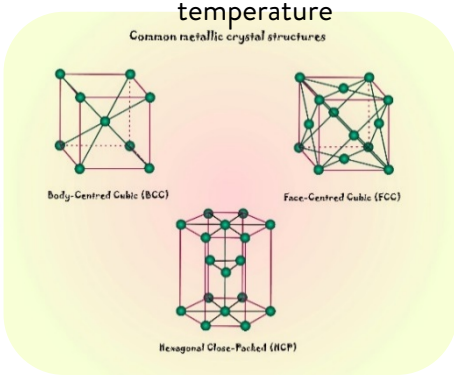
METALS

Practicing EPSCOPIC ILLUMINATION

Episcopic illumination (top lighting) uses reflected light to see superficial characteristics of specimens to thick and dense to project light through. Forming, shaping, grinding metals leaves distinguishable features at the surface that can tell a lot about a metal.

Metallography is the study of the microstructure of all types of metallic alloys or the scientific discipline of observing and determining the chemical, microscopic, and atomic structure and spatial distribution of the grains, constituents, inclusions or phases in metallic alloys it is from the need to understand how microscopic features effect macroscopic function and safety.

All metallic elements (except Cs, Ga, and Hg) are crystalline solids at room temperature



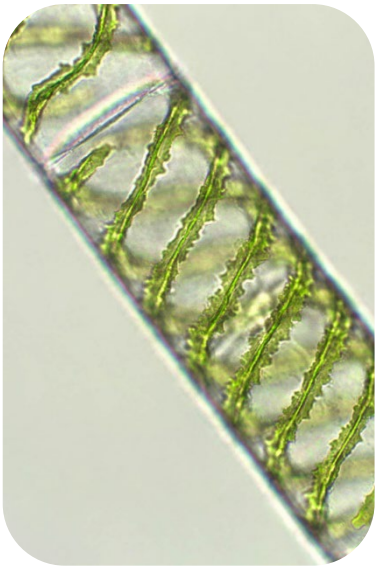
NUMISMATICS (Coin analysis)

How often have you seen a penny? How often have you really looked at it? sometimes we underestimate the power of observation and take everyday objects for granted. Have you ever thought about the process of getting that fine detail onto a metal coin?!?

TIP: Often metal objects will reflect light differently under the microscope depending on the type of light being used adjust different lights to see if you can get the best image. Make note of what works best in your notebook

Follow the link to learn more about metallography and how it needs microscopes.

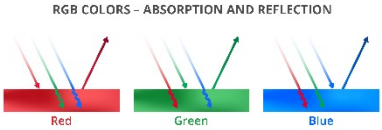
CONTRAST



Contrast is the degree to which an image stands out against the background. Contrast is based on the light absorption of different parts of the specimen. That's where **stains**, **filters, field lighting, and polarization** can make a difference.

High magnification and resolution can't guarantee that you will actually see the specimen. If all of the light passes through a cell no details will be visible. varying light frequencies need to be absorbed to different degrees by different structures in the cell causing each structures to stand out allowing you to see the specimen.

ANALYISING STAINED SPECIMENS



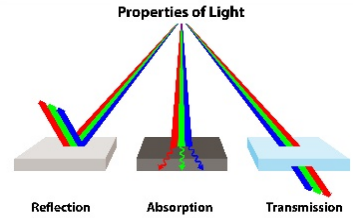
Take out the prepared stained slide and analyze it under the microscope. Can you tell which slides were stained?

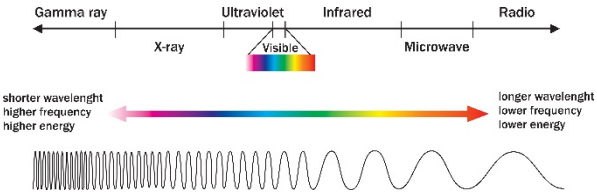
Prepared slides

Biology supply companies will often ***differentially stain*** specimens to view specific parts of a specimen ,like specialized pine root structures. These purchased slides are special which makes them quite valuable and expensive. Look at a prepared root and see if you can tell what parts are artificially stained.

FILTERS

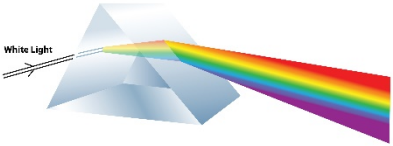
Color filters can block or change light as it passes through the filter to help you increase contrast or to identify structures of a specific stain.





Light moves in waves and each color has its own wavelength

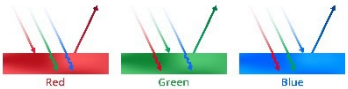
Remember, **white light** has all of the color wavelengths in it. if you pass it through a prism, all the colors separate.



Dispersion

THINK ABOUT THIS...

white light passing through a red filter, isolates the red light to come out the other side. the red filter only allows red light through. The other colors (wavelengths) of the spectrum are **absorbed.**

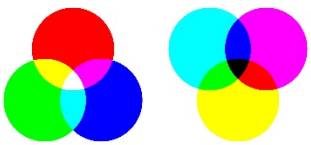


So...if a green filter only allows green light through. And a blue filter only lets blue pass, If a green and a blue filter are placed together, what colors would you expect to be transmitted?

*If you stain a **specimen** with a red **stain**, a green **filter** will darken the red areas, increasing contrast. Or, a green **filter** will lighten any green **stained** area. Color **filters** help **specimen** contrast, especially when taking black and white photomicrographs.*

Most colors of light can be made by mixing red blue and/or green light

Most colors of pigments can be made by mixing magenta cyan and yellow



RGB CMYK

SIMPLE SLIDE MAKING

Most things you look at under the microscope will be too small to hold while you investigate. ***Slides*** are typically thin, flat, rectangular pieces of glass or plastic used as a platform to "fix" or hold a ***specimen*** to.

Temporary mount slides don't have to be glass. If you don't have glass or just need a little help holding something in place while you take a closer look, tape or flat plastic are simple alternatives.

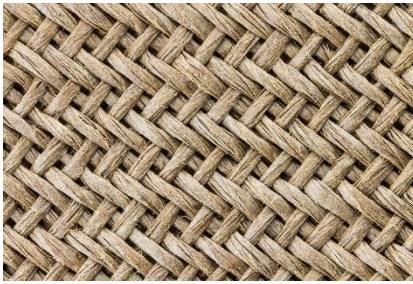
QUICK AND STICKY SLIDES

- Be sure to label each slide you make with an ink pen or permanent marker, so you will know what's on the slides! For a "**sticky**" **slide**, unroll a piece of CLEAR tape the length of the BLUE slide image below and set it sticky side up on the image.
  1. Fold over about 1" of the tape at the red dotted line on each end to make finger holds on each side of the slide.
  2. Place your specimen in the center of the sticky side of the "slide" (circle area on image).
- For a "**quick**" **slide**, cut out a piece of transparency paper to fit the RED dotted rectangle below.
  - Place your specimen in the center circle on the "slide."
- For a "**quick**" **ring slide**, place a ring sticker on the circle of a quick slide. You can even put more than one ring on it.

SIMPLE STICKY SLIDE

TEXTILE ANALYSIS

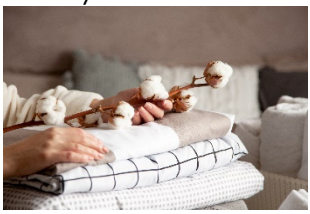
Paper is an example of a textile. Textiles refer to materials made of interlacing fibers by weaving or knitting them like; Baskets, clothes, blankets, paper, and more.



FIBER ANALYSIS

Fibers are made from small pcs of a material twisted or stuc together to form a long strand. Fibers can be made fron **natural** materials like silk, wool, cotton, even metals c **Synthetic** materials like rayon, polyester, and othe chemical fibers. Can you notice some differences betwee natural and synthetic fibers?

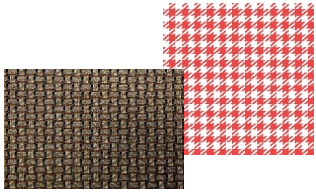
1. Set up a "sticky" slide and place a DIFFERENT fiber on each green line.
2. RECORD which fibers they are and your observations in your notebook!!



FABRIC ANALYSIS

Fibers woven together make fabrics, thread counts and patterns can effect if it is light and airy, waterproof, soft, or even strong enough to stop a bullet.

1. Place a small sample of fabric on the Left and right green lines of your "sticky slide" and fold the tape ends over to secure them.



Follow the link to view the article about smarter textiles in the future of fashion.

Textile engineers have one of the highest median wages of all scientists ($96,810) with potential of over $157,780 partially due to the broadness of the field with creative products like smart fabrics can display the wearer's health status, fabrics in shirts that control digital devices, or antimicrobial fabric that prevents body odor and ecofriendly and sustainable resource fabrics from banana, pineapple leaves, and mushrooms!

KITCHEN CHEMISTRY

The kitchen may be one of the coolest places to take your microscope. A lot of the work that happens in cooking and baking come down to the basic chemical structures, properties, and reactions. Few of things in your kitchen started the way you see them. Think about why we grind plants down into spices and how that may effect flavor.

Experiment in the kitchen to see what happens when things are dried, mixed, cracked or crushed to specific sizes to make them easy to use. The randomness or uniform cuts can tell you a lot about a chemical and so can the way they react with other things.

DISSOLUTION ANALYSIS

Dissolution is dissolving something into a solution. You may notice some things dissolve easily in water (hydrophilic) and others just "hate" water (hydrophobic). Sometimes finely ground powders can be so light that gravity doesn't have much effect in holding them down and wont spread well because of static or other factors. and other times you may have to fight a specimen that is hydrophobic and they just don't get along with water making them hard to isolate in a wet mount.

Experiment: Lets prepare ONE ring slide to hold light powders separately while we test their solubility(ability to dissolve.)

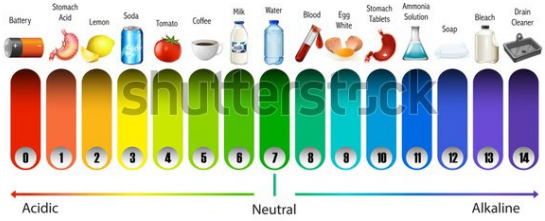
- Tips: make sure your record observations before and after adding water
- when Using the pipette, HOVER and drop one drop of water in the well and observe under the microscope

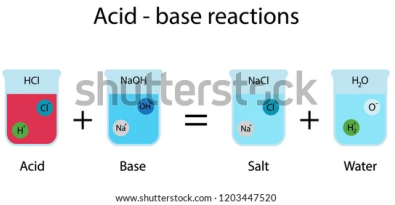
Who has the most delicious job on the planet!

ACID/BASE ANALYSIS

One of the most difficult parts of baking is predicting and measuring the right combination of ingredients, knowing that once you mix and stick it in the oven there's no turning back! Acid/Base reactions are one of the most important reactions in your kitchen. Have you ever looked at what happens on the microscopic level when you put them together?

Experiment: set up a slide to test how acids and bases react with water separately, then together





SIMPLE "WELL" SLIDE

Simple well slides can be made from transparency paper, cardstock or tape by placing a ring on the transparency or tape. Or punching a hole in the cardstock and placing tape o the bottom of the hole

MOSS ANALYSIS

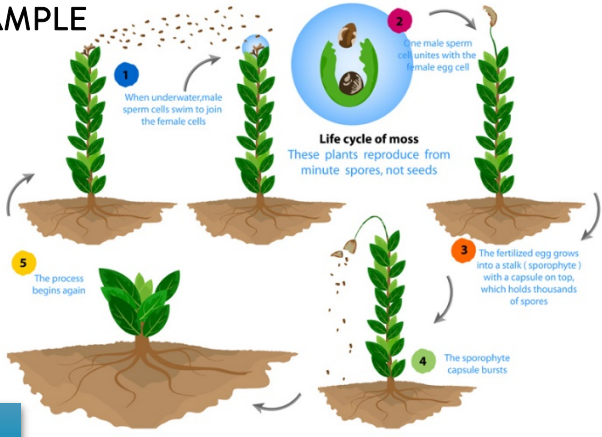
Bryophytes are the oldest plants. They began growing on land before there was even soil. Mosses, liverworts, and hornworts are seedless, flowerless, stemless, plants. They don't have true roots, or stems.

Can you explain Moss characteristics:

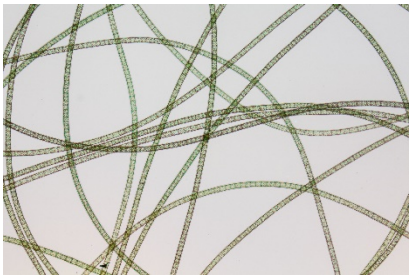
- Mosses are tiny , fuzzy plants.
- Mosses are generally leafy
- Grow in moist shady places; soil tree trunk, tree base, rocks
- Rhizoids anchor them to surfaces
- Don't have cells that move water
- They have no lignified cell walls (like wood) for strength
- Grow where moist
- No seeds, "dusty" spores instead

COMPARE WET TO DRY SAMPLE

Reindeer are one of the few animals that eat moss. It keeps their blood warm



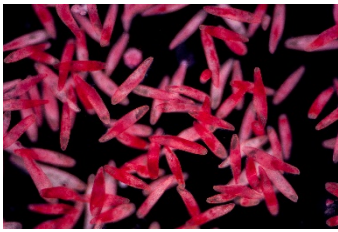
DARK FIELD MICROSCOPY

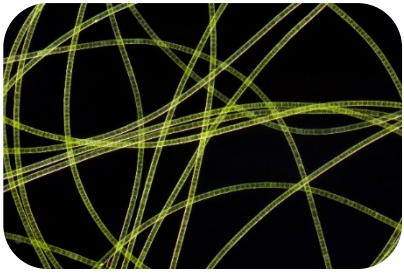


Brightfield Microscopy is a compound microscope's default, Without any special setup. This makes a dark specimen appear on a light background. Manipulating a microscope's condenser or diaphragm, the size and intensity of the light beam can be modified to alter the apparent color or contrast of a specimen

TIPS for Getting better contrast

- Narrow beams provide higher contrast.
- Stain the specimen to get the contrast you need to view specimen details.
- Changing the background of a light specimen to dark or a dark specimen to a light background may help





Dark field microscopy is a popular technique to observe transparent specimens. It's the best microscopy technique for making ***objects appear bright against a dark background*** otherwise if their refractive values are similar to the background they are difficult to see.

DIY

Place something round on the illuminator that blocks most of the light (stickers, coin)
This forces the light to come from the side to increase the contrast.

ANALYSING TRANSPARENT SPECIMENS

Use with:

living aquatic organisms, diatoms, small insects, bone, fibers, hair, unstained bacteria, yeast, cells in tissue culture, and protozoa. Non-biological specimens include mineral and chemical crystals, colloidal particles, dust-count specimens, and thin sections of polymers and ceramics containing small inclusions, porosity differences, or refractive index gradients

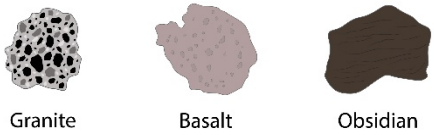
ROCKS AND MINERALS

Geology and Gemology are two professions that study rocks and minerals. Rocks and minerals play an important role in the animal kingdom and the documentation and preservation of historic records of the earth and life on it. Microscopes are a key tool in the discovery of that history.

Rocks are not minerals.

keep in mind that a ***mineral is not a rock, and a rock is not a mineral.*** A rock is a solid piece of the earth containing minerals or other solids. Most rocks consist of several minerals. But Some rocks, such as volcanic glass, contain no minerals. Three classes of rock: **Igneous, Metamorphic,** and **Sedimentary**

Igneous



Granite Basalt Obsidian

Magma is molten rock beneath the surface of the earth. When magma cools and solidifies at or near the surface, it creates igneous rock.

Sedimentary

Conglomerate Mudstone Limestone

As bits of minerals settle into layers over thousands of years, the weight of water and the layers of sediment above press down and cement the minerals into sedimentary rock.

Metamorphic

Gneiss Schist Slate

When sedimentary or igneous rocks are subjected to extreme pressure and heat, their mineral structures transform, resulting in metamorphic rock.

Minerals are natural crystals

Crystals of the same mineral show the same traits, i.e. Quartz, is almost always prismatic with the faces 60° apart. common minerals aid in **bio-mineralization**, the process of how living organisms produce minerals. we'll look at some of these when we discuss living cells and tissues (calcium carbonate, cellulose, chitin, silica, phosphate,

Do you have any of these crystals?

Crystal physical properties

shape, color, luster, cleavage, density, and hardness, polarize light

Crystal basic shapes:

Prismatic- pencil like

Tabular - slab-like

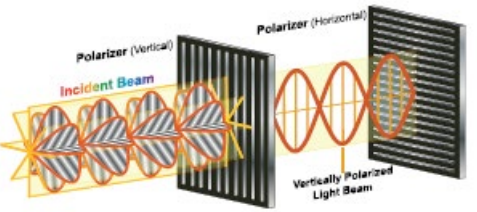
Equant-similar appearance in different directions, e.g. cubes, octahedra, and 'rounded' with similar sized faces

POLARIZING FILTER

Transparent specimens can have **anisotropic** character. This describes the specimens ability to change the direction of light passing through it. **Polarizing filters** allow you see the result of the new direction of the light in ways you normally wouldn't see. This shows us an example of their refractive properties or even their flaws

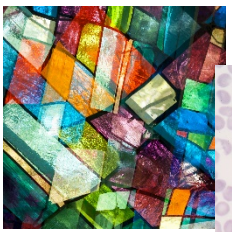
Light moves in waves

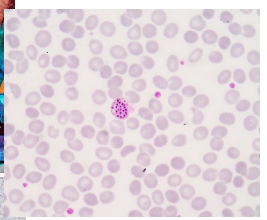
When ordinary light travels, its made up of waves that move in many directions. Some special materials can polarize light, only allowing waves of one certain direction to move through them. If two of these polarizers are turned 90 degrees to the other, called "crossed polarizers," the only light wave passing through the first polarizer will be blocked by the second (the analyzer). rotating the polarizers at different degrees can allow light to be turned on or off.



ANALYSING CLEAR SPECIMENS

Hard plastics, stretchy plastics, cellophane tape, clear glass, clear liquids, biological specimens





DIY

Polarizing microscope

We can place a polarizer below the specimen and the other above the specimen.

Looking through these two polarizers at 90 degrees to each other will block all light wave. BUT, Placing a doubly refracting specimen (a birefringent) between them causes Image contrast as the plane-polarized light interacts with the birefringent producing two individual waves, each polarized in varying perpendicular planes, rescattering the light So, the out of phase light can pass through the second polarizer and then into your eye, showing up as lots of colors.

Hemozoin, a pigment made by malaria parasites inside blood cells are double refractive

FINGERPRINTING

Fingerprints are made of "friction ridges," microscopic lines of raised skin on your fingers to help you grip. The arrangement, shape, size and number of lines in your fingerprints are more unique than your DNA making them one of the most reliable forms of personal identification.

As you grow **in utero** small ridges called **papillae** develop. Papillae form a pattern of ridges and valleys that are unique to you and each of your fingers. The three most common patterns are:

- 65% have **Loops** that begin and end on the same side of the finger.
- 30% have **Whorls** that spiral and don't seem to begin or end on either side.
- 5% have **Arches** that begin on one side and end on the other.
- **Dactyloscopy** is the process of getting and analyzing fingerprints.

Loops

Whorls

Arches

Forensic scientists study biometrics to connect criminals to crime scenes. **Biometrics** are your physical characteristics that can be used to identify you. The minutiae are details you can't see with the naked eye but distinguish you from everyone else on the planet. Fingerprints are cheap, easy to get and never change as you age making them ideal for personal identification.

CREATE A FINGERPRINT CARD

1. Place a 2" piece of tape sticky side up on the table.
2. Use the side of the graphite on your pencil to darken this entire box until it is dark and there is no white visible.
3. Gently slide your index finger over the block you just colored, so that the graphite covers your finger print.
4. Put your finger on the sticky side of a piece of tape.
5. Place the tape on the paper in the box corresponding with the proper finger.
6. Check your prints for patterns.

TRANSFERRING PRINTS FROM A SURFACE: your hands produce oils that cover your skin and stick to smooth surfaces you touch leaving evidence of your presence.

1. Rub a small amount of lotion on your hands.
2. Put your finger on a smooth surface like a counter, plate or a glass slide.
3. Sprinkle a small amount of powder on the surface you touched.
4. Being careful to leave the prints attached, gently brush away excess powder.
5. Place the sticky side of a piece of clear tape on the powder print.
6. Place the tape onto a paper of the contrast color for a background.

Left Thumb	Left Index	Left Middle	Left Ring	Left Pinky
Right Thumb	Right Index	Right Middle	Right Ring	Right Pinky

DEPTH OF FIELD AND FOCAL PLANE

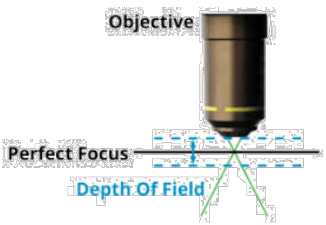
Depth of field Is how much of the specimen is in focus. Eye and the microscope both have limited depth of focus so Only part of the specimen is in focus at one setting. There is a range of the specimen that can be viewed at one time but only one area can be in perfect focus at one time, that is the *focal point*

- When changing the *working distance* with the adjustment knobs, the focal point changes and Only part of the specimen is in focus at one setting
- The depth of field decreases with increasing resolution and increasing magnification so Higher magnification gives a thinner focal plane

Get used to moving the adjustment knobs up and down to get an idea of a 3d image

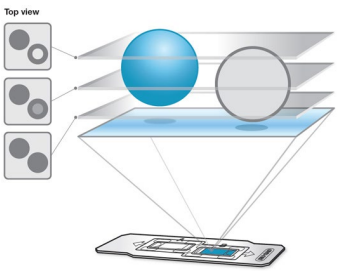
Depth analysis

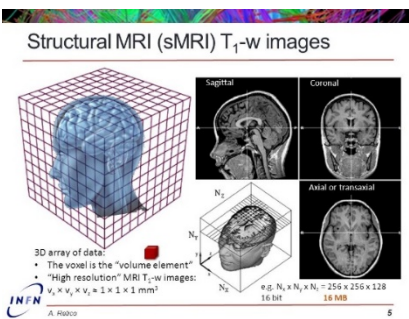
Insects have hairs on their legs
to act as feelers and to dissipate heat.
observe and record what you see
when looking at a prepared slide of an insect leg.



Optical Sectioning

- Sequential focusing at depths shows different structures similar to medical CT or MRI images
- It give the doctor an opportunity to look for abnormal structures like tumors or aneurisms that may be otherwise undetectable.
- A skill doctors develop is identifying something they recognize and mentally following the shape of it through the different slices
- Can you visualize slices in 3d? Click the QR link and slide the blue bar on the bottom to compare the 3D brain with the 2D slices

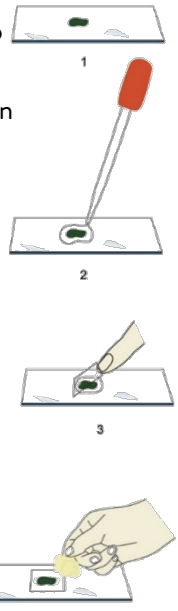




SEMI-PERMANENT SLIDE

Intentionally stacking microscopic items and swapping with friends to challenge them to use their skills help you get practice preparing slides and examining them. Create a permanent mount of three different colored fiber strings by PREPARING A semi-permanent mount slide.

1. Get a clean GLASS slide and coverslip (slide and Coverslip can be made from transparency paper but there is greater risk of bending and breaking the specimen free
2. Place one drop of nail polish on the center of the slide. Don't use too much or the polish, it will run off the edge and make a mess!
3. Center the specimens (3 1 cm segments of different colored fibers) in middle of the polish drop in an overlapping perpendicular fashion.
4. Add one drop of the nail polish to the center of the **cover slip** (this can be transparency paper on glass slide)
5. Place the edge of the cover slip on the slide at 45 degree andgle , NEAR the side of the slides polish drop.
6. Slowly lower the cover slip on top of the slide drop being careful to not trap bubbles.
7. Gently tap the coverslip with pencil eraser if bubbles are visible
8. Blot excess polish with paper towel
9. Place the slide on the stage and view it first with the scanning/low power objective. Once you see the image, you can rotate the nosepiece to view the slide with the different objectives.



Tips:

- Sometimes vegetable oil works better than water if making a wet mount version of this slide
- Sometimes making a "donut" of petroleum jelly works to hold polish or water drops

Take this time to practice! Recognize spatial relationships: move the slide to the left, to the right, toward you and away from you. Note the direction in which the letter strings "appear to move"

- Draw what you see with the naked eye
- Draw what you see at all three objectives
- Which was best for clarity for finding levels of the strings
- What happened to your image as you increased magnifying power?
- Is it always best to use the strongest power objective?

LOOKING FOR MORE JUMP STEAM OPPORTUNITIES FOR HOME?

About Me App

Rube-E App

Go to **jumpsimulation.org/PNC** to learn more about STEAM education and order a copy of the Jump Simulation PNC "About Me" Activity Book and app.

The "About Me" Activity Book and app are interactive tools that give kids the opportunity to learn about the body by coloring 3D models that pop off the page, defend against invading germs in a short video game and watch fun videos! The Rube-E Educational app allows young people to better understand their bodies as they build a 3D Rube Goldberg machine using augmented reality elements.

ABOUT JUMP STEAM

Jump Simulation created its STEAM program to spark the curiosity of our youth in health care careers. Designed to give middle and high school students hands-on opportunities, Jump STEAM offers experiences in everything from learning what it takes to be a doctor to understanding how engineers are working with clinicians to transform health care. Learn more and sign your kids up at **jumpsimulation.org/STEAM**

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