SEE WHAT LIFE SCIENCE IS ALL ABOUT

K-3

CELLS / GENETICS:

The microprojector and its operation

* **Operation of the microprojector:** (Ken-A-Vision Model X-1000 with mechanical stage) [teacher information]

light source
2 auxiliary lenses plus polarizing filter
3 objective lenses
mirror

Objective lenses: the lower the number, the greater the magnification.

Auxiliary lens positions:

"C" - Clear, no auxiliary lens.
"A" - 5X magnification, wide-field lens.
"E" - 10X magnification, auxiliary lens.
"P" - Polarizer (to be used in conjunction with top polarizing filter which rotates).

Mechanical stage: allows you to adjust the location of specimens on the slide.
Note: Make your room as dark as possible when using the microprojector.

Plant and animal cells

* **Plant cells:** [observational activity]

onion skin
cover slip
slide
microprojector

1. Peel off a thin piece of onion membrane, lay it on the slide.
2. Add 1 drop of iodine.
3. Cover with a cover slip (drop one end of cover slip first to spread liquid out evenly).
4. Notice the hard cell wall. Also look for nucleus (red dot) in each cell.

* **Animal cells:** [observational activity]

cheek cells (epithelial cells)
slide
tincture of iodine
flat toothpick
cover slip
microprojector

1. Scrape inside of cheek lightly with toothpick, smear cells on slide.
2. Add 1 drop of iodine and cover slip.
3. Notice that these cells don't have any particular shape as there is no hard outer cell wall like plant cells have.

Cell model

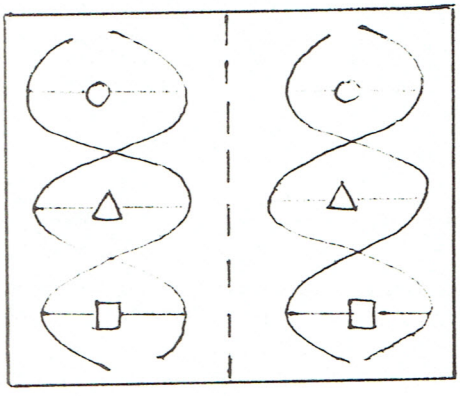
* **Model #1:** [observational activity]

plastic bag with water and small water balloon inside to represent the nucleus.

Cell division

* **Model #2 - How cells divide:** [observational activity]

Large bag with a smaller bag inside. In the smaller bag is a "secret message" (piece of paper folded in half - see drawing), plus another large and small plastic bag.



1. The code makes a copy of itself then splits (tear paper in half). Each new code now becomes part of a nucleus (put in separate small plastic bags).
2. Each nucleus becomes part of a new cell - this is called "mitosis" (put small bag [nucleus] in large plastic bag).

Ask students what they think happens next. Help them realize that this process repeats itself and, since each cell makes two more, we will now have four. Be sure to emphasize that this is just a model of a cell. Our cells are not made out of plastic bags and paper but mostly water and chemicals made by our body from the food we eat.

Advanced concept: Built within the code of each cell is a means by which new, different cells can be made. As an organism grows this process enables different types of cells to exist and replicate (nerve, blood, muscle, skin cells, etc.).

Observing an egg

Egg yolks are the largest cells (the ostrich egg being the largest).

* **How a chicken makes an egg:** [observational activity]

olive jar with the yolk of a chicken egg inside

Two main parts:

1. Yellow yolk: nutrient for the developing embryo.
2. Tiny white spot the size of a pin head. This is what the embryo develops from if the egg is fertilized (called the "germ").

It takes nine days to make a yolk. The yolk travels down a tube (oviduct). Different glands along the way add albumin to protect the yolk, wrap it up and hold it in the center of the shell. Another gland secretes the shell. The shell material is soft at first and hardens later. It takes approximately 24-25 hours from when the yolk is made until the egg is laid.

Unfertilized egg: only has one-half the code (half of the "secret message" shown earlier) and cannot grow into a chicken.

Fertilized egg: sperm cells from rooster reach the egg in upper part of the oviduct and supply the missing half of the code. The embryo can now develop (mitosis can take place).

Note: Only sex cells (special cells) have half the code. All other cells have a complete code. This can help to explain why children look like both their parents or seeds from the same plant look alike.

* **Observing the egg:** [observational activity]

eggs
magnifiers
string or sizing squares
baby food jar and larger jar

Record observations:
1. Physical appearance: "flat" on one end, "pointed" on the other.
2. Weigh the eggs, compare weights.
3. Measure the circumference using string or sizing squares.
4. Use magnifiers to look closely at a shell looking for imperfections.
5. Float an egg in a jar of fresh water (older eggs float better).

Guide students to the conclusion that an (immovable) air pocket must exist inside the egg. Use a baby food jar with an air bubble inside as a model.
Experiment with the egg to determine that the air bubble doesn't move inside the egg like it does in the jar.
Have the students hypothesize which end of the egg has the air pocket. Have them make a drawing to show how big they think the air pocket is (this goes well with sink and float activities).

* **Egg candling:** [observational activity]

  paper towel tube, tape flashlight
  egg

  Darken room. Hold egg to end of tube, look for repaired fractures, etc.
  Students can make drawings of what they see.

* **Identifying the five main parts of an egg:** [lesson]

  1. Yolk.
  2. Germ (tiny white spot).
  3. Chalaza (thread-like albumin from the ends of the yolk that hold it in place).
  4. Thick albumin (near yolk). Fresher eggs have more thick albumin.
  5. Thin albumin (further out).

* **Inside the shell:** [observational activity]

  Students can look for the air sac.

  Note: Inside the shell are two very thin membranes (skins) that lie very close to each other except at the air sac where they split apart.

  Information: The shell itself is made of a chemical compound called calcium carbonate.

* **Identifying old eggs:** [observational experiment]

  Can be done in classroom or as at-home assignment.

  Remove one egg from refrigerator each week for three weeks. Mark date on eggs with crayon.

  After third week, hypothesize: a.) Which will float the best?
  b.) Which egg will have the most thick albumin?

  Float each egg, record observations.
  Crack each egg open, observe albumin and record observations.

  Note: If done as at-home assignment, have everyone open their eggs the same evening and report back observations on the next day.

* **Genetics puzzle cards:** [observational activity]

  Note: samples are on next page.

  (It would obviously be more challenging if the pieces were all the same color!)

Living vs. non-living

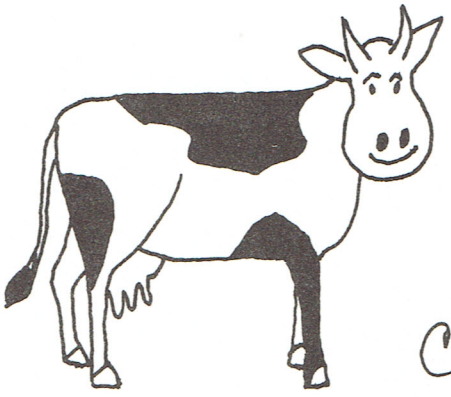
* **Identifying simple objects:** [observational activity]

  Set up ten stations with objects at each. Student groups of 2-3 students each identify objects as "living" or "non-living." Samples may include:

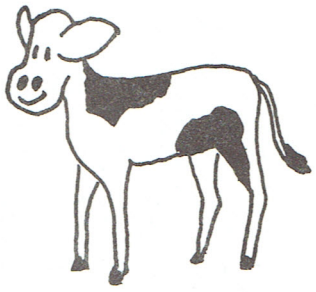
  1. potting soil with pencil/golf ball
  2. battery
  3. dead insect
  4. lima beans
  5. vials with live bugs inside
  6. cocoon

* **Characteristics of living things:** [lesson]

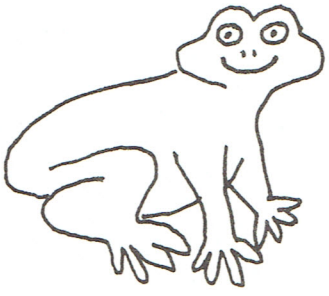
  1. Need food.
  2. Move.
  3. Grow.
  4. Reproduce.
  5. Are made of cells.



cow



calf



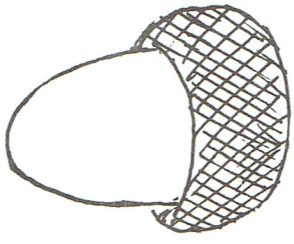
frog

tadpole

man

boy

tree



acorn

Classifying plants and animals

* **Classifying plants and animals:** [lesson]

Consider only one characteristic at a time:
Animals: 1. What they eat (plants/animals)
2. Type of body covering.
3. How many appendages.
4. Where they live.

Plants: 1. Bark or no bark.
2. Type of roots.
3. Flowers, berries or nuts.

There are three broad categories (kingdoms): plants, animals, protists.

Protists are living things that are neither plants nor animals. Many are single celled and some have characteristics of both plants and animals.

MICRO LIFE / FOSSILS

Microscopic life / preparing slides

* **Single cell standard specimens:** [teacher information]

The following are fairly large and good samples for microprojectors:

amoeba
paramecium
volvox
stentor
spirostomum
vorticella

Use standard slides and 18 X 18 mm (#1) cover slips (omit cover slip for larger specimens). You may also try using a "well" slide which has an indentation.

For fast-moving specimens like paramecium, add a few strands of cotton before adding the cover slip. This makes "corrals" that trap the specimens.
Some chemicals, like methyl cellulose, are available to slow down fast-moving specimens (usually one drop is added to the specimen drop).

Note: Because of the intense light used in the microprojector, you may notice that some of the protists burst after a few minutes under the light from too much heat. The light is pinpointed at the slide and, like a magnifying glass, will also produce heat. This effect can be reduced by using the top polarizing filter when not directly observing the specimen or using a well slide with 3-4 drops of sample (more water reduces the heating effect).

Amoebas (no cover slip): Live on bottom or sides of container (look like tiny white specks). Use a dropper and, after partially filling it, release single drops until you see an amoeba. Place that drop onto the slide. You may notice a water bubble inside the amoeba. The nucleus is very small and difficult to see.

Stentor (no cover slip): Has hairs (cilia) on wide end to gather food and move around. May anchor itself with tapered end. Students can file by the screen for a better view.

Paramecium (cover slip and "corral" with cotton): Smaller than other specimens, moves quite rapidly.

Volvox (no cover slip): Found near the surface, spherical in shape. Colony of many single-celled organisms connected together by fibers. Each cell has two tiny whips (flagella) which beat in unison and allow the whole colony to move. Moves like an animal but has chlorophyll to make food from light like plants.

Microscopic animals (multicelular)

Use prepared slides or refer to 4-6 Life Science, part 1, "Cells" to make your own. Basic biology slide sets are available from science supply companies.

Daphnia (no cover slip): Are also called "water fleas." They are transparent and interesting to watch. Once you get a sample (in a drop of water) on your slide, they may be wildly spinning or moving about. To stop them, carefully soak up some of the water on the slide with a twisted piece of paper towel (they will "run aground" on the slide).

Fossils

By studying fossils, scientists have discovered that the first life forms were single-celled plants and animals. More complex life evolved from these forms. Some of the tougher, more adaptable species have lived a long time (i.e., cockroach — 350 million years).

* **Who was there?:** [observational activity]

  bird nest
  pine needles
  chicken egg
  tie and newspaper

  Students make as many inferences as possible about what type of animal or plant might have left the evidence.

* **Fossils:** [lesson]

  A fossil is the record or evidence of a plant or animal that lived in the past. Scientists determine the age of the fossil by measuring the amounts of certain chemicals found in the fossil or in the rock surrounding the fossil.

  How fossils form:

  1. Animal preserved in ice or tar.
  2. Mineralized bone.
  3. Insect imbedded in amber (tree sap).
  4. Print (mold or cast).

Model of a fossil

clay
plaster of Paris
paper collar
seashell, walnut, bone, etc.

Press object into clay, remove. Place collar around it. Mix plaster (2 parts plaster to 1 part water) to the consistency of pancake batter. Pour plaster into collar to make a cast.

NOTE: A five pound bag of plaster makes 50-60 casts.

You can make a mold by using a paper cup and floating the object in the plaster. Use petroleum jelly on the object to keep the plaster from sticking.

PLANTS

Useful and harmful plants

Underlying goal: Develop a respect and appreciation for all living things - including plants.

* **How plants help us:** [observational activity]

  Students make a bulletin board of products that come from plants:

  1. Food
  2. Food for animals
  3. Bark (cork, cinnamon, medicines)
  4. Wood (lumber, paper)
  5. Sap (rubber, syrup, gum)
  6. Seeds (cotton)
  7. Stems (linen)
  8. Leaves (rope, sisal)

  Some plants are harmful:

  dieffenbachia
  poison ivy
  oleander
  poison oak

Observations and activities with seeds

* **Classify and order seeds:** [observational activity]

  Classify and order by size, color or shape.
  Good samples are lima, kidney, pinto, garbanzo, black and green beans, squash, black-eyed peas, corn, green peas and soybeans.
  Use magnifiers to look for the oval mark.
  Look for the tiny hole where seeds get air when germinating.

* **Dissecting a lima bean seed:** [observational activity]

  Students learn the parts of a seed:

  1. Seed coat.
  2. Embryo (which has roots, stem and tiny leaves).
  3. Cotyledons (large food pieces for the young plant to use before it uses sun energy).

* **Observing the breathing hole in a seed:** [observational activity]

  Choose lima bean seeds with complete seed coats (no cracks). Drop seeds into very hot water, watch air escape from the tiny breathing hole (micropyle).

* **Importance of micropyle:** [observational experiment]

  Seal the tiny hole on four lima bean seeds with fingernail polish. Germinate these with four control (unpainted) seeds. Students make a guess about what they think will happen.

* **Plant genetics:** [lesson]

  Reinforce the idea that each seed has its own complete "code" which decides what type of plant it will be. Note: The code becomes complete when the two sex cells unite in the flower to produce the seed.
  Compare a tiny watermelon seed to a large lima been seed. Students should be aware that the size of the seed is not a factor in the size of the plant or the fruit it produces.

* **Germination sequence:** [observational experiment]

  Germinate batches of seeds (i.e. radish seeds) daily for one week.
  Give each group a plant from each batch and have them sequence the plants from oldest to youngest.
  Try different seeds and compare germination rates.
  Out of ten seeds, do all seeds germinate? Try it. You may introduce the idea of percentages. If students now took a second sample of ten seeds, how many do they think would germinate. Remind them to look at previous data before making a guess.

* **Ways to germinate seeds:** [observational activity]

1. Plastic plate with seeds sandwiched in between moist paper towel.
2. Jar with seeds glued onto blotter paper. Pour a small amount of water into bottom of jar. Carefully roll up blotter paper (seeds facing outward) and place inside jar. Use small amount of gravel, if necessary, to hold blotter paper in place.
3. Paper cup filled with seeds planted in vermiculite and small amount of water. Good for root-observation activities.
4. Paper towel folded flat inside plastic sandwich bag with a row of staples approximately 1" from bottom of bag. Students can easily measure plant height and observe roots with this technique.
5. Demonstration:

   Two pieces of pane glass (edges taped) 1 piece of blotter paper
   1 seed 2 rubber bands

   With blotter paper sandwiched between glass panes, place one edge in a pan of water. As roots grow toward the water, turn the glass 90°. After a few days, roots will once again bend toward the water. Note: Gravity is also a factor in this experiment.

Investigating plant growth

* **What are the best conditions for growing plants?** [observational experiment]

16 oz. clear plastic cups (punch holes in bottom using hot nail and pliers)
potting soil (make sure all samples have the same type of soil)
kidney bean seeds

Each student gets two kidney beans and a cup with soil.
Students plant the beans just under the surface. If both sprout, remove one so that there is only one plant per cup.
Divide class into six groups with approximately five samples per group.

Introduce the idea of keeping everything the same except the one thing you are testing and explain that a control is an unaffected sample used for comparison.

Group #1: **control** - sunlight, 50 ml water on Monday and Friday.
Group #2: **low water** - sunlight, 50 ml water on Monday or every other Monday.
Group #3: **extra water** - sunlight, water every day or keep each cup in a dish of water.
Group #4: **salt water** - sunlight, 50 ml of salt water solution (20 grams salt per 4 liters water or 1 heaping tablespoon salt per gallon water) on Monday and Friday.
Group #5: **plant food** - sunlight, 50 ml fertilized water (try Schultz-Instant) on Monday and Friday.
Group #6: **low light** - place in dark area, 50 ml water on Monday and Friday (like control).

Ask students which one thing is different in each group compared to the control. Each student records plant height (in centimeters) every Monday, Wednesday and Friday.

Every Friday, set up six stations - one for each group of plants. Allow students to observe and compare the effects of each variable.
At the end of four weeks have a class discussion about the conclusions from this experiment (i.e. what are the best conditions for growing plants).

Propose a new problem: How would different soil affect the growth of plants? See if your students can offer an experimental set-up (give each plant the same amount of sunlight, water, etc., and only change the type of soil).

Ask your students if they think a different type of plant (like radishes) would react like the kidney beans did. In this experiment, we only tested kidney beans. Therefore, we can only show evidence about kidney beans. We can hypothesize (or guess) about radishes from our results, but we would ultimately have to test them to be sure!

* **Adopt a tree:** [observational activity]

  Students find a friendly tree near their home and visit it regularly. They observe and record information about it throughout the school year.

* **Identifying produce:** [observational activity]

  Bring in several different types of fruits and vegetables.
  Students identify them as "roots," "stems," "leaves," "flowers" or "seeds".
  Students can also taste samples and record flavors.

* **Observing plants and seeds from your neighborhood:** [observational activity]

  Explain that flowers make seeds: pollen from the male part reaches the egg in the center of the flower, fertilizes it and gives the seed a complete "code" so it can grow into a plant and have flowers of its own.

* **How seeds travel:** [observational activity]

  Discuss ways in which seeds travel (wind, water, animals). Look at some seeds with the microprojector.

* **Invent a seed:** [observational activity]

  Students draw pictures of their "seed" and explain to the class how it would travel.

* **Oranges:** [observational activity]

  Observe the outside first. Which end is the stem end? Which is the flower end? How big is it (circumference, weight)?
  Hypothesize: 1.) How many orange sections are there?
  2.) How many seeds are inside?
  Students can try to peel the skin in one piece. Compare the thickness of skin on different oranges. California oranges have thicker skins to keep moisture inside due to the dry climate.
  Measure the thickness of the skin with a stack of pieces of paper. "This orange skin is 22 sheets thick."

The parts of a plant and their functions

* **Observing flowers:** [lesson]

  Sepals: The green leaves surrounding petals. Support and protect the flower.
  Petals: Attract insects and birds, protect the interior of the flower. Have students count and record the number of petals on different flowers.
  Stamens: The male part of the plant which produces pollen.
  Pistil: A long tube (sometimes sticky on the end). Pollen travels down the inside of the pistil and fertilizes the eggs in the center of the flower to make seeds.

* **Stem activities:** [observational activities]

  1. Grow stems (potatoes, pothos).
  2. Place celery or white carnations in water with food color. Use a control (clear water) for comparison. Do as a demonstration - encourage students to try at home.

     Students can look at a thin slice of celery with magnifiers. They will see tiny tubes used to carry water and food throughout the plant.

3. Tree rings / bark:
   The heartwood in the center is dead, the sapwood further out is alive.
   Determine the age of trees by counting rings. Light bands are produced in spring (active growth). Dark bands (smaller cells with thicker walls) are made in late summer and fall.
   Note: You can photocopy your tree cross-sections and hand out the copies instead of real samples.
4. Bark rubbings (compare rubbings from different trees):
   Tape paper on the side of a tree. Rub the flat side of a crayon along the paper.

* **Activities with roots:** [observational activities]

1. Plant seeds along the edge of a clear plastic cup with holes in bottom. Cover the cup with foil and observe roots after 1-2 weeks.
2. Root comparisons:
   a.) Bring in plants from neighborhood.
   b.) Grow different plants in vermiculite which can be eaily removed to observe roots.
   c.) Explain (with a sample) what "root bound" means.
   d.) Grow plants from roots:
   sweet potatoes - use toothpicks and a jar of water.
   carrot - slice top end about 1" (2½ cm), plant in vermiculite, keep damp.
3. Investigate vegetative reproduction (growing plants from other plant parts). Try spider plants, pothos, potatoes or African violets.
4. Observe root hairs of young radish plants with the microprojector.

* **Activities with leaves:** [observational activities]

1. Observe different types.
2. Classify leaves according to different characteristics:
   a.) Shape
   b.) Smooth or serated outer edge
   c.) Branched or parallel (straight line) veins
   d.) Do they alternate on the stem or grow from the same location?
3. Observe succulents or desert plants with waxy leaves. Demonstrate with sponges and waxed paper the reason for the waxy surface.
4. Preserve plants by sandwiching leaves between newspaper under a heavy book. Change newspaper after one day.
5. Leaf printing:
   a.) Flat crayon method.
   b.) Splatter prints (spray paint or watercolors and toothbrush - messy!)
   c.) Sunprint paper.
   d.) Carbon paper and rolling pin method: put leaf on top of carbon paper and white sheet under it.

<u>Simple plants: ferns and mosses</u>

* **Ferns and mosses:** [lesson]

  Ferns and mosses are flowerless, simple green plants that have spores instead of seeds. Mosses don't have tubes in their stems (like celery) and, therefore, don't grow very large. Ferns usually have their roots and stems underground. Fern leaves are called "fronds."

* **Keep a Boston fern in your classroom:** [observational activity]

* **Make a moss garden:** [observational activity]

  Use a large jar lying on its side. Add soil, a few rocks, a little water and some moss. Keep in a shady spot.

ANIMALS

* **Major topics to cover:** [teacher information/lesson]

1. Diversity of animals
2. Respect and appreciation for animals
3. Needs of animals
4. Characteristics of animals:
   a.) Size (big or small)
   b.) Outer covering
   c.) How they move.
   d.) Where they live.
   e.) What they eat.

Characteristics of vertebrates

* **Five major groups of vertebrates (animals with backbone):** [lesson]

1. Mammals (hair or fur, lungs, warm-blooded)
2. Birds (feathers, wings, beaks, lungs, warm-blooded)
3. Fish (scales, fins, tails, gills, cold-blooded)
4. Reptiles (horny scales, lungs, cold-blooded)
   Body types:
   a.) Crocodile or lizard
   b.) Snake
   c.) Turtle
5. Amphibians (live on land and in water, soft moist skin or dry skin, breathe through skin or with lungs, cold-blooded).

Mammals are born alive, the other four (mostly) are hatched from eggs.

Classifying animals

* **Classify animals pictures:** [observational activity]

Students classify pictures by one of the characteristics above (i.e. big or small). With experience students may be able to identify what major group a strange animal belongs to by its characteristics.

Investigating the earthworm

* **Investigating the harmless and quite friendly earthworm:** [observational activity]

earthworm
magnifier
plate
water

Student groups (2-4 students) get one worm:
1. Look for head end (nearest the smooth "segment")
2. Look for vein along top of body with magnifier.
3. Notice how worm moves (stretches and fattens it body).
4. Compare top and bottom (color).

Information:
1. Worms have both male and female sex organs and cross-fertilize each other.
2. The smooth segment is called the "clitellum" and is part of the reproductive system.
3. Students should not allow their worm to dry out or submerge it in water. Lay it on a wet paper towel occasionally.
4. Keep worms in refrigerator when not being used (they won't eat much).
5. When finished with this activity, liberate worms in loose soil. Cover with board or newspaper.

* **How earthworms react to light:** [observational activity]

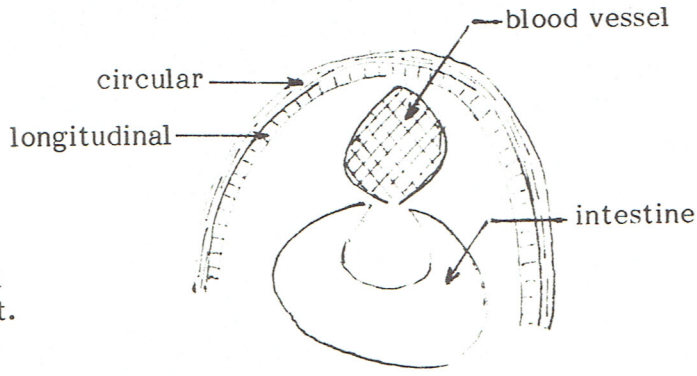
25 mm X 200 mm test tube
worm
aluminum foil
flashlight

Wrap bottom half of test tube with foil. Place worm inside (head first). The worm should move toward the dark end.
Try putting the worm in tail first. It may take longer as light sensors are near the head end.

* **Investigating the inside of a worm:** [observational activity]

hot dog
microprojector
prepared slide of earthworm X.S. (or C.S.)

1. Slice a thin wafer of hot dog to explain what students will be looking at.
2. Place prepared slide on microprojector.



Muscles can only contract and relax. When circular muscles contract (get shorter) the worm gets skinny and long. When longitudinal muscles contract the worm gets short and fat. It moves by stretching its body out, grabbing onto an object then bringing the back part of its body forward (by shortening the longitudinal muscles).

Mealworms, snails, sow bugs and crickets

* **Other investigations with invertebrates:** [observational activities]

1. Meal worms (from a bait store).
2. Snails (from a yard). Mark shells with paint.
3. Sow bugs (from a yard).
4. Crickets (from a pet store). Place crickets in plastic bags (blow up and seal). Pass them around for observation. Use magnifiers for close viewing. The female has a long egg-laying tube (ovipositor) near tail.

Experimenting with brine shrimp

* **Brine shrimp:** [observational experiment]

brine shrimp eggs
distilled water
Q-tips
balance
magnifiers
non-iodized salt
10 oz. clear plastic cups

Groups set up 10 different concentrations of salt water:

1. 100 ml of water in each cup (1/3 full).
2. Weigh and add salt. Technique: first weigh paper, then add salt weight to paper weight. Add salt until balance is achieved. If you only have one balance, assist one representative from each group with weighing. This is good for logic development. Discuss what you are doing each time with the class.

   Group #1 - no salt (control)
   Group #2 - 1 gram salt (note: 1 gram salt is about 1/8 teaspoon; 2 grams = 1/4 t., etc.)
   Group #3 - 2 grams salt, etc., to group with 10 grams salt.

3. Add brine shrimp eggs (all you can hold on a Q-tip).
4. Eggs should hatch in 48 hours if kept at room temperature.

Question: "Which concentration of salt water is best for hatching brine shrimp eggs?" Have students make a guess - educated or not. Note: Seawater is close to the 3 gram solution.

4. Observe each sample with magnifiers (try using a flashlight in a darkened room). Record results.
   Students draw a picture of what they think the brine shrimp look like. Later, look at sample with microprojector (no cover slip).
   Ask students to explain how they move (flap arms, push, paddle, etc.).

* **Vinegar eels:** [observational activity]

Can be found in unpasteurized vinegar or purchased from a science supply company.
A good topic for discussion on health and safety.

* **Prepared slides:** [observational activity]

There are many great things to look at (i.e. mosquito head, housefly leg, bee stinger).

Classroom pets

* **Classroom pets:** [teacher information]

Typical examples:

finches	garter snakes	fish
anoles	guinea pigs	turtles
rabbits	hamsters	mice
hermit crabs		

Check with your pet shop before making a commitment (don't forget about vacations). Make a deal with the pet shop, if necessary, to return the pet in June. Many will loan animals for awhile or, perhaps, visit the school to display different animals.

HUMANS

Health and safety

* **Health and safety information:** [teacher information/lesson]

1. Integrate health and safety throughout all pertinent science lessons. Examples: dangers of household electricity (and safeguards), dangerous tools, germs in a drop of water, use of safety equipment (masks, goggles, etc.).
2. Needs of a healthy body: fresh air, water, good food, rest and exercise.
3. Discuss causes of sickness, how immunizations protect us. Also discuss different types of injuries (cuts, bruises, broken bones, colds, etc.) and the roles of doctors and nurses.

* **Analogy between human and car:** [lesson]

A car uses fuel and air (we use food and air).
A car has paint to protect its body (we have skin).
Unlike a car, if something breaks in our bodies we may not be able to fix it. On the other hand, our bodies are capable of healing minor injuries when a car can't.

* **Investigating our five senses:** [refer to K-3 Physical Science, part 1, "Matter"]

We place the use of the five senses on the physical science tape because a major goal in chemistry is to identify an unknown by observing its characteristics. This section in physical science is very comprehensive.

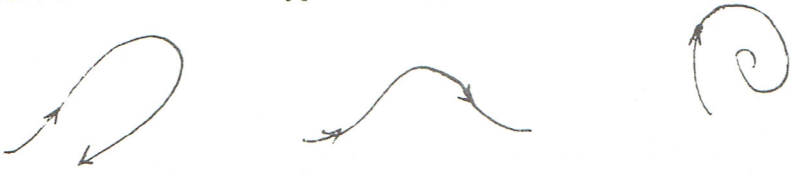
Fingerprints

* **Recognize diversity in the human race:** [observational activities]

1. Classify people according to their characteristics (hair, eyes, skin color, sex, age, height, weight, etc.).
2. Fingerprints:

pencil	paper
old 35 mm slide holders	magnifiers
cellophane tape	soft pencil

a.) Rub finger in pencil graphite, press tape onto finger. Remove tape and place on fingerprint data sheet.
b.) There are three main types:



Loop Arch Whorl

c.) Value of ridges on our fingers - relate to the soles of tennis shoes.
d.) Look for ridges on the bottom of feet.

The skin, pores and glands

* **Our skin:** [observational activities]

1. Look at knuckles with magnifiers. Notice wrinkled skin. Close hand into fist, look again (try to pinch skin when hand is open vs. closed).
   Extra skin is there so we can close our hand (relate to a pair of tight pants and someone trying to bend over!).

2. Rub burnt cork on finger, remove most with dry cloth. Look at finger with magnifier. Notice hundreds of tiny pin holes between ridges of fingerprint.
   These are pores from which we perspire. We perspire mainly to keep our bodies cool. When water evaporates into the air it takes heat from the body with it and cools down the body. Alcohol evaporates more readily than water. That's why it feels cold when it's on our finger (evaporating).

   Our bodies also secrete oil (from glands) to keep skin from cracking and peeling.

* **Demonstrate how soap cuts grease:** [observational activity]

2 test tubes	water
cooking oil	soap

1. Fill each test tube 1/4 full of water, 1/4 full of oil. Add soap to one.
2. Shake both. Wait two minutes. Notice how soap helps water to mix with oil.

* **Importance of skin:** [observational activity]

2 apples or 2 potatoes

Peel one, don't peel the other. Leave uncovered for one day. Notice how the skin helps protect the apple or potato.

Reaction timer

* **Reaction time:** [observational experiment]

12 squares numbered 1 to 12 clock
reaction time charts

1. Pick numbers from a hat one at a time (good lesson in probability. Guess which number will be picked next).
2. Record each number on the chart in the order it was picked.
3. Students work in groups of two. The timer says, "Go." The other student uses only the left hand and touches each number in order (1 to 12). When finished, student says "Stop," and timer records the time.
4. Groups do five trials with the left hand, then five with the right hand. Students switch positions and repeat.
5. Topics to discuss:
   a.) Do scores improve with the number of trials?
   b.) Is there a learning cross-over from left to right hand (with experience)?
   c.) Are left-handed people better? are right-handed better?
6. Try it again (re-draw numbers). This time students start with the right hand first. Discuss the results. Does the second hand tested always do better? Why? Encourage students to think on this one!

Lung capacity

* **Lung capacity:** [observational experiment]

fish tank or large bowl 1 gal. container
long tube (hardware store) alcohol

1. Holding container with open end down, mark the side in 10 equal increments.
2. Fill container with water from fish tank. Place container into fish tank upside down. Insert tube.
3. Have each student take a deep breath and blow air through tube into the container until their lungs feel empty. The air will push the water out, measuring the lung capacity.
4. Record student scores in chart form on the blackboard. Sterilize tube with alcohol, rinse with water.
5. Do boys or girls have greater lung capacity?
6. Graph results with a histogram (number of students on vertical axis, score on horizontal axis). Note diversity among classmates.
7. Bring volunteers from upper grades in to record their results. Teachers should be able to score a "10".

Muscles and joints

* **Open and close hand for one minute:** [observational experiment]

1. Muscles tire quickly. Using hand contractions, relate to the heart muscle contracting 60 times per minute (average) for every minute we're alive.
2. Ask students how many times their heart muscle has contracted since they were born. Demonstrate why learning math is important to solve this problem:

$$\frac{60 \text{ beats}}{\text{min.}} \times \frac{60 \text{ min.}}{1 \text{ hr.}} \times \frac{24 \text{ hrs.}}{1 \text{ day}} \times \frac{365 \text{ days}}{1 \text{ year}} \times 8 \text{ years} = 252{,}288{,}000 \text{ beats/8 years}$$

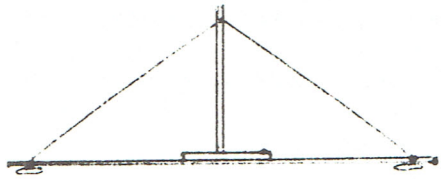
2. Use a bicycle pump as analogy for the heart.

* **Three types of muscles:** [lesson]

1. Hand type.
2. Heart (designed not to tire like the hand does).
3. Stomach (grinds food).

* **Muscle model:** [observational activity]

cardboard
rubber bands
paper clips
tape



* **Investigating bone connections:** [observational activity]

door hinge
broom stick
tennis ball
larger rubber ball

Demonstrate the hinge joint (knee, elbow) and the ball and socket joint (hip, shoulder).

Adaptations

* **Importance of the shoulder joint, thumbs, etc:** [observational activity]

cellophane tape
glass of water
wrapped candies
rope
soda straw
misc. objects

1. Pick a student "volunteer." Tie rope from one biceps to the other and from each wrist to the belt.
2. Challenge the student to do things (i.e. throw a ball, comb hair).
3. Tape thumbs to index finger. See if they can write their name, use scissors, open wrapped candy.
4. Without using their lips, have them try to drink water using a straw.
5. Students can use their tongues to feel the different types of teeth in their mouths. Discuss the value of front teeth for biting and back teeth for grinding.

ECOSYSTEMS

Definition: The interaction of life with the physical environment.

Needs of living things

* **What animals need to survive:** [lesson/observational activity]

Food Shelter
Water Space
Air

1. Develop these concepts with bulletin boards, pictures and activities.
2. Investigate what animals eat. Begin to develop the idea of a food chain.
   a.) Have students list what they ate for breakfast or lunch or discuss the items on a lunchroom plate. Which items are from plants? Which are from animals?
3. Investigate animal homes (good bulletin board).

Resources in our community

* **What is a community?** [lesson]

1. Discuss where our water, food, electricity and gasoline comes from. Too often we take these for granted as unlimited resources.
2. Discuss the concept of the community in which we live that supports our lives.

Animal communities

* **Animals have communities:** [lesson]

1. Introduce the idea that animals also live in communities.
2. Many of the same types of animals live together (herds, flocks, schools, etc.) and usually live with other animals in their special community.
   Example: A desert community might have insects, lizards, snakes, owls, mice, rabbits, coyotes, armadillos, etc.

* **Which animal doesn't belong?** [observational activity]

Students identify the "misplaced" animal in a group (i.e. polar bear, alligator, parrot).

Food chains

* **Predator–prey relationship:** [observational activity]

food chain boards
pencils
yarn
templates

1. Make one food chain board using 8–9 finishing nails. Partially pound in nails in a random manner so that animal or plant pictures can be drawn next to each nail.
2. Use the first board to make a paper template. Use the template to make other boards.
3. Make handouts with animal and plant pictures for the students (don't forget to start the chain with the sun). Punch holes in the paper with pencil tip.
4. Students connect yard from one food source to the next (i.e. sun -> plant -> insect -> bird -> cat).
5. A less active method is to omit the boards and have students draw lines with arrows from one source to the next.

Miscellaneous activities

* **Space (carrying capacity):** [observational activity]

1. Have students stand very close together for one minute (or sit very close together in the classroom).
2. Discuss how being crowded together makes them feel. Relate their feelings to the plight of wild animals being crowded by human development.
3. Ask students how close they could get to particular animals (i.e. birds, fish, lions, snakes) before that animal would react. Would it become agressive or would it turn and flee?
   Caution students about approaching any animal (even a dog or a parrot could bite).

* **Ethical questions:** [lesson]

1. What can we see that helps the environment?
2. What do we notice that may harm the environment?
3. People are part of the community and part of the ecosystem. People should respect other life found living in their community.