HOME SCIENCE TOOLS®

COMPLETE INTRODUCTION TO BIOLOGY (GRADES 6TH–8TH)

KT-BIOLINT

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Science Foundations Series

INTRODUCTION

From vast mountain forests to the tiniest cells in a petri dish, the study of biology is wonderful and amazing! This guide and activities will take you on a journey through biology – the study of life – where you'll learn about microorganisms, cells, DNA, genetics, animals, plants, and more.

These activities are designed for scientists ages 11–13. Younger students can enjoy experimenting with parental assistance. Use this kit only under adult supervision, and carefully follow all safety precautions.

Kit Contents

This kit contains the following items:

- Assorted Gummy Bears
- 7 Clear Plastic Cups
- 2 Sheets Drawing Paper
- Isopropyl Alcohol, 30 mL
- Dish Detergent, 10 mL
- 6" Bamboo Skewer
- Test Tube Rack
- 2 Large Test Tubes
- 1 Size 0 Stopper
- 12 White Chenille Stems
- Beads - Red, Blue, Green & Yellow
- 24 Plastic Chips
- Blood Type Testing Kit
- Prepared Nutrient Agar, 125 mL
- Permanent Marker
- 6 Petri Dishes
- 4 Zip Lock Bags
- 1 mL Pipet
- Sheep Heart Dissection Kit
- 8 Sterile Swabs (4 packs of 2)
- Vinyl Apron
- 1 ft Parafilm
- 4 pairs of Nitrile Gloves
- Filter Paper, 10 pack
- Safety Glasses, Adult Size
- Dry Protist Culture
- 12 Microscope Slides
- Yeast Packet
- 5 Medium Balloons
- Funnel
- UV Flashlight
- Plastic Stir Rod
- 10 mL graduated cylinder

ACTIVITY #4 – GENETIC MODEL: SICKLE CELL DISEASE

Sickle cell disease is an inherited (pass down from your parents) genetic disease. In this disease, red blood cells don't form properly and appear elongated in the shape of a sickle (Figure 8). This abnormal structure results in impaired red blood cell function and flow where patients experience chronic **anemia** – thus the name Sickle Cell Anemia.

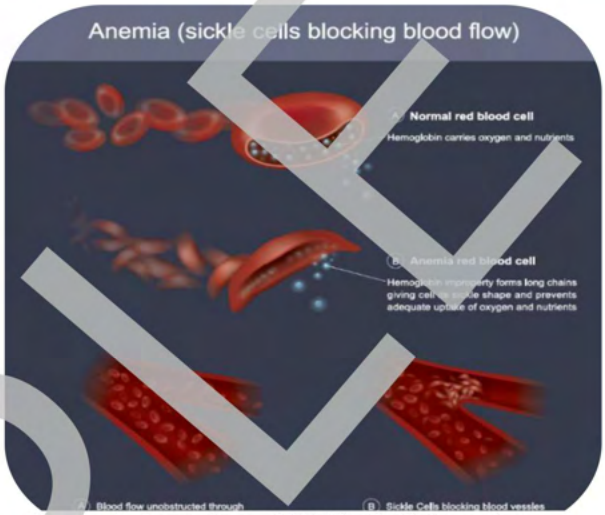
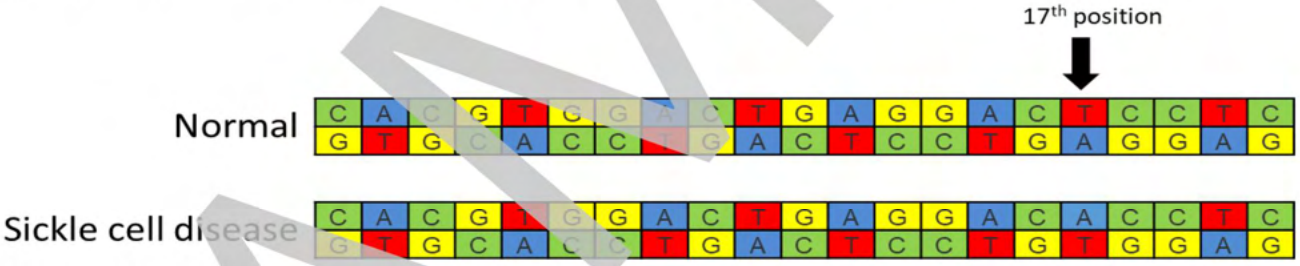


Figure 8. Overview of Sickle Cell Anemia.

The model you created in Activity 2 (sequence shown below as "Normal") shows the first 21 base pairs of the gene responsible for sickle cell disease.

Model the genetic change that causes this disease:

1. Remove the T-A pair at the 17th position on your model.
2. Flip the pair over so that the A takes the original position of the T and vice versa.
3. Reattach the base pairs and tape your model back to the piece of paper.



Believe it or not, that's it!

In a gene that contains over 1600 base pairs (that's 76x longer than your model), this single base pair change is responsible for the life-altering disease. In the US alone, it is estimated that nearly 100,000 people suffer from sickle cell disease. When a child inherits this single base pair mutation (sickle cell trait) from one parent, they will carry that trait but usually won't develop symptoms. When they inherit the trait from both parents, they will develop the disease and require care for life.

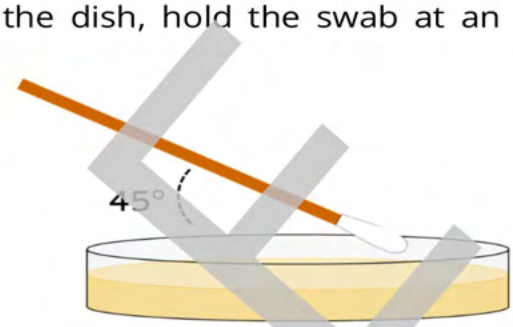
CLASSIFICATION SYSTEMS

Careful observation and organization are crucial to creating a well-informed view of the natural world. In biology, all living things have been organized into a classification system that is often generally referred to as (unsurprisingly) the Classification of Living Things. This field of study is called **Taxonomy**.

Have you ever heard of humans called *Homo sapiens*? That is our classification. We, humans, are referred to in scientific language by our genus (*Homo*) and species (*sapiens*). Why the capitalization and italics? Taxonomy in biology has a set of rules like these to help everyone around the world refer to organisms in the same way. Ever heard of the bacteria *E. coli* – sometimes found in food, causing food poisoning? This organism belongs to the genus *Escherichia* and the species *coli*.

The biological classification system begins by separating all living things into 5 large groups called kingdoms. These kingdoms include: Animalia (Animals), Plantae (Plants), Fungi, Protista (Protists), and Monera (Eubacteria and Archaebacteria).

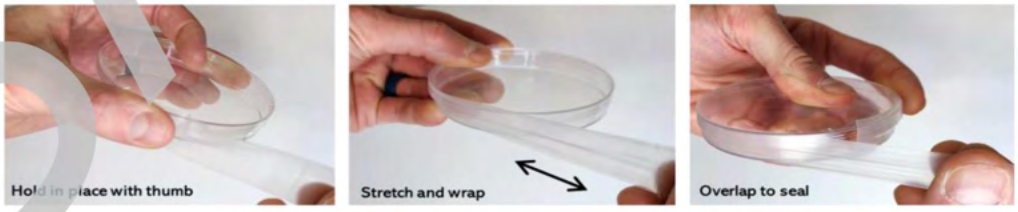
4. With the agar plate face up, remove the cover of the dish, hold the swab at an approximately 45° angle and lightly streak the swab across the surface in a zig-zag pattern. Twist the swab as you do to maximize the transfer of the sample to the plate.



5. Cover the dish immediately.
6. Using new sterile swabs, repeat Steps 1 – 4 to make the following cultures:
    - A **household surface** (table, countertop, cabinet handle, or similar)
    - A **commonly used surface** (cell phone, computer keyboard, a doorknob or similar)
    - A **"gross" surface** (bottom of a shoe, kitchen sink, floor, or similar)
7. With the plate closed, add detail to the label on the bottom of the plates. Indicate the following information:
    - Where you got the sample ("Kitchen Table")
    - The date ("02/02/2020")
    - Your name or initials ("XYZ")

Phase 2: Seal and incubate.

8. Seal the dishes to prevent evaporation using the supplied laboratory film (Parafilm). Use the Parafilm as follows:
    - Cut the parafilm into a ¾" to 1" by 4" strip.
    - Remove the paper backing and discard.
    - Carefully hold the petri dish in one hand, with the lid on.
    - Place the parafilm horizontally against the edge of the dish and hold it in place with your thumb.
    - Carefully pull to stretch the parafilm and wrap it around the dish. Do not pull too hard to avoid breaking the film, but carefully stretch so it becomes "sticky".
    - Continue until the parafilm overlaps itself at least ½".



9. Store the dishes in a warm dark place where they will not be disturbed (e.g., a closet).
10. Check for growth on the surface of the agar every 24 hours for 3-4 days. Once significant growth is observed on the surface, move on to Phase 3. To know when to

5. Every 24 hours, take a sample of the water using a pipet and place 1-2 drops on a microscope slide.
6. Examine the slide with your microscope starting at 40x. Find areas with protist activity by looking for tiny dots moving around on the slide. Once you find an area with protists, increase the magnification to 100x.
7. If no protozoa are visible, try again each following day. Many conditions, such as water hardness, temperature, and water acidity, can affect the growth and development rate of these organisms.
8. Each successive day you will typically find more and different varieties of protists in your culture.
9. Once you've observed a variety of growing protists, identify 3 specific organisms to draw in the spaces provided below.
10. Below each drawing, describe the organism's characteristics including any visible appendages (flagella or cilia), its shape, and its color (clear, green, or other).
11. Note: You will fill in the "Identity" in Activity 11. Leave blank for now.

Protist 1	Protist 2	Protist 3
Appendages:	Appendages:	Appendages:
Shape:	Shape:	Shape:
Color:	Color:	Color:
Identity:	Identity:	Identity:

14. Make observations of the bread every 48 hours until significant mold growth occurs (usually within 5–14 days). Record your observations in the graph below. Add lines connecting data points each day.

Legend
Control
Clean Surface
Dusty Surface
Hand

Mold Growth Scoring System

% of Surface Covered	No observable mold	< 10%	10 – 25%	25 – 50%	50 – 75%	75%+
Score	0	1	2	3	4	5

ACTIVITY #13 – YEAST BALLOONS

FROM THE KIT: Packet of yeast, 10 mL graduated cylinder, 4 balloons, and funnel.
YOU PROVIDE: Sugar, measuring spoons, a ruler, and warm tap water.

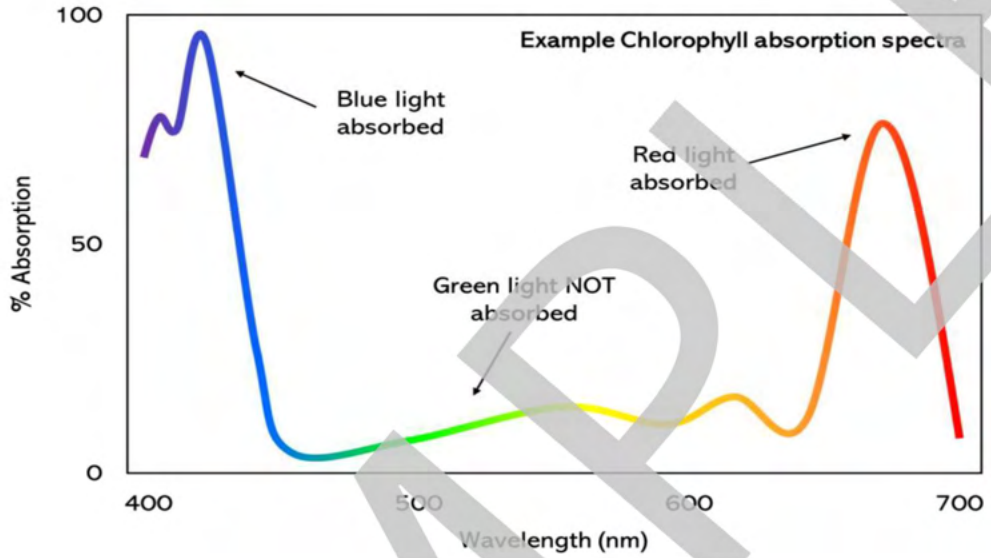
NOTE: In this experiment, you'll be using yeast to blow up balloons. This can get messy, especially if a balloon were to pop. You will also want to conduct this experiment in a warm place (indoors or outside during warmer months). Find a location where you can easily clean up any mess while keeping it warm.

1. With a permanent marker, label balloons as follows:
    - 0 tsp Sugar
    - ¼ tsp Sugar
    - ½ tsp Sugar
    - 1 tsp Sugar
2. Blow up each balloon 2 x (without tying closed) to stretch, and release the air.
3. In each balloon add ½ tsp of yeast granules using the funnel and a measuring spoon.
4. Using the funnel, add sugar to the balloons according to their labels:
    - 0 tsp sugar, ¼ tsp sugar, ½ tsp sugar, 1 tsp sugar
5. To each balloon add 10 mL of warm water.
6. Seal each balloon by tying shut.
7. Predict what will happen to each balloon:

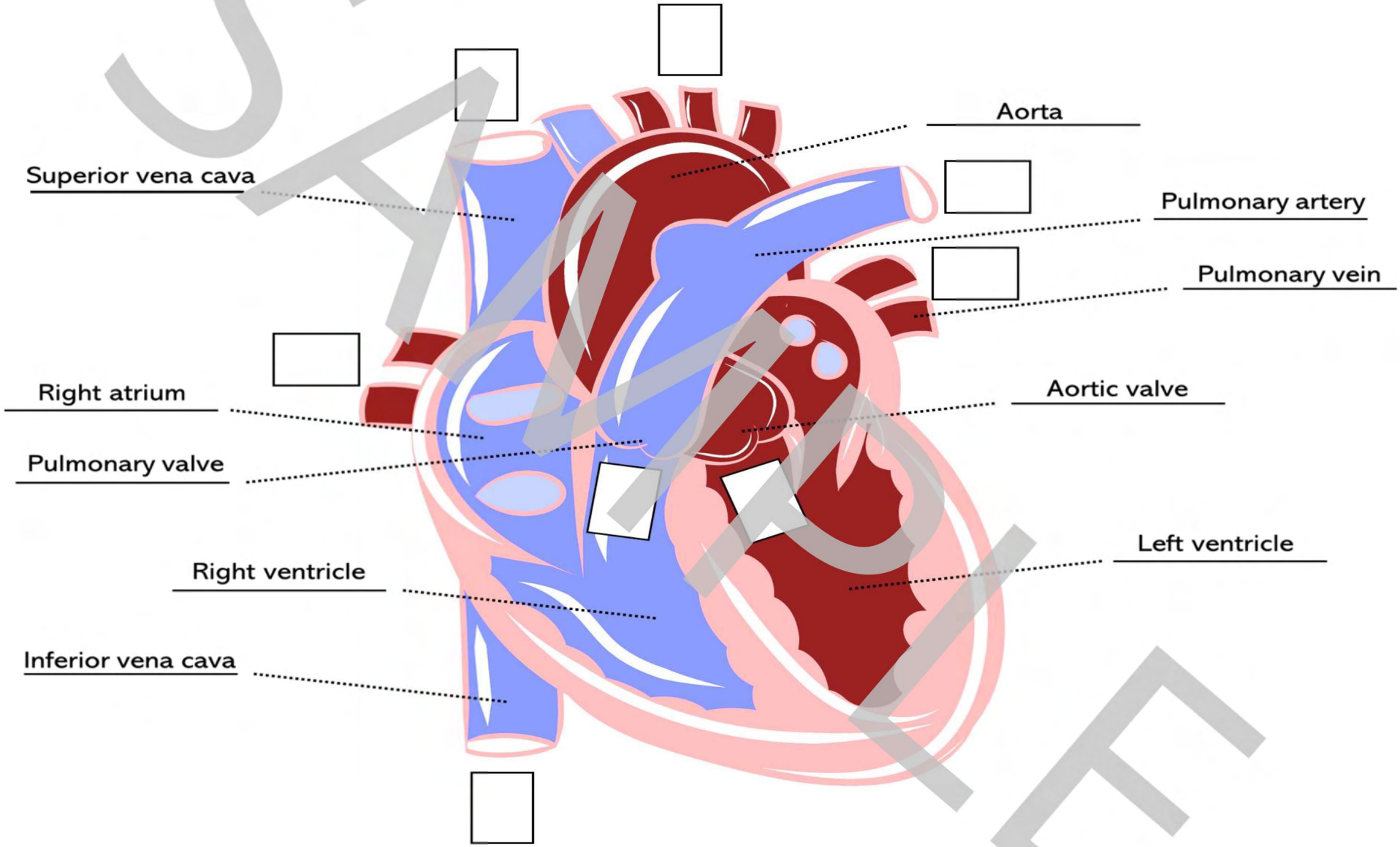
	Prediction
0 tsp	_____
¼ tsp	_____
½ tsp	_____
1 tsp	_____

8. Place balloons on a clean surface.
9. After 30 minutes, check each balloon to see if it has started to inflate.
10. If inflated, mark "yes" in the table below and measure and record the diameter of the balloons (using a ruler)
11. If not inflated, mark "no" and do not measure the balloon diameter.
12. Repeat this measurement and recording every 30 minutes for 2 hours

wavelength of orange/red light). However, at 500 nm (the wavelength of green light) there is almost zero absorption and nearly complete reflection. This reflection means that the green light bounces off the chlorophyll (found in leaves) to your eye, making them look green.



During photosynthesis in a living plant, that absorbed light becomes usable energy within the cell. However, the extracted chlorophyll in the tube cannot "pass" the energy in the same way. The red light that was absorbed is instead emitted in a process called fluorescence. As such, the chlorophyll should appear red (or reddish-purple) under UV light as the energy is released.


Aorta
Superior vena cava
Pulmonary artery
Pulmonary vein
Right atrium
Aortic valve
Pulmonary valve
Left ventricle
Right ventricle
Inferior vena cava