



## Discovery Lab Pre-Visit Activities

### Advanced BioLab

#### Grades 9-12

*Thank you for booking your field trip to the Orlando Science Center! As a means of preparing your students for their Discovery Lab and enhancing their experience, we are providing you with these pre-visit materials to share with your class.*

#### **Discovery Lab Objective:**

Get up close with living things in Biolab to discover chemical change that occur with plants during photosynthesis and cellular respiration using the SPARK Science Learning System and PASCO probeware. Explore the effects of stimulants and depressants on animal cell biology. Observe the similarities and differences of animal and plant cell structure. Discover how traits are passed on from generation to generation.

#### **Next Generation Sunshine State Standards:**

SC.912.L.14.2, SC.912.L.14.3, SC.912.L.16.2

#### **Common Core:**

LACC.910.RST.1.1, LACC.910.RST.1.3, LACC.910.RST.2.5, LACC.910.RST.2.4, LACC.910.RST.3.7, LACC.910.RST.3.9, LACC.910.WHST.1.1, LACC.910.WHST.1.2, LACC.910.WHST.3.7, LACC.910.WHST.3.9, LACC.1112.RST.1.1, LACC.1112.RST.1.3, LACC.1112.RST.2.4, LACC.1112.RST.3.8, LACC.1112.RST.3.9, LACC.1112.WHST.3.9, LACC.1112.WHST.1.2, LACC.1112.WHST.3.7, LACC.1112.WHST.1.1, MACC.912.N-Q.1.1, MACC.912.N-Q.1.2, MACC.912.A-REI.4.10, MACC.912.G-MG.1.1, MACC.912.S-ID.3.7, MACC.912.S-ID.2.6, MACC.912.S-ID.3.9, MACC.912.S-CP.2.9, MACC.912.S-MD.2.7

#### **Key Vocabulary:**

- **Cells:** The basic units of all living matter.
- **Photosynthesis:** The process in which plants convert light energy into chemical energy and store it in the bonds of sugar. Occurring in the chloroplasts in their leaves, plants need light, CO<sub>2</sub>, and water to make sugar and oxygen.
- **Respiration:** The process in which organisms can release the chemical energy stored in sugars which is used to produce ATP (energy that all cells need).
- **Stimulants:** Temporarily increase the physiological activity in the body. Possible side effects include increased heart and respiratory rates and elevated blood pressure. Overdoses can lead to rapid or irregular heart rates, hallucinations, convulsions, and death.
- **Depressants:** Temporarily decrease the rate of physiological activity in the body. Possible side effects include sensory alteration, slurred speech, and impaired judgment. Misuse can lead to respiratory depression, coma, and death.
- **Organelles:** Little organs in the cells (ex. plasma membranes, nucleus, mitochondria, Golgi bodies, endoplasmic reticulum, ribosomes, microtubules and filaments.)
- **Genes:** Discrete units found in the cell nucleus that contain an organism's hereditary information.

- **Alleles:** Alternative forms of a gene; **dominant** – fully expressed, **recessive** – no noticeable effect on the organism's appearance.
- **Homozygous:** A characteristic of an organism that has a pair of identical alleles for a trait.
- **Heterozygous:** A characteristic of an organism that has two different alleles for a trait.
- **Phenotype:** An organism's expressed or physical traits.
- **Genotype:** An organism's genetic makeup.
- **Incomplete dominance:** When a heterozygous trait expresses neither the dominant or recessive phenotype.
- **Diffusion:** Process in which the cell membrane allows water and gases (oxygen and carbon dioxide) to cross in and out of the cell.
- **Passive transport:** The movement of molecules from a high concentration to a low concentration and requires little or no energy of the cell.
- **Active transport:** The movement of molecules from a low concentration to a high concentration and requires energy of the cell.

### **Key Concepts:**

- Photosynthesis is a vital process in which plants convert light energy into chemical energy and store it in the bonds of sugar. Cellular respiration is the process in which all living organisms can release the chemical energy stored in sugars to produce ATP, the energy all cells require to carry out processes for life.
- Drugs are chemicals that change the way a person's body works. Drugs can be classified as stimulants (increase physiological activity) or depressants (decrease physiological activity).
- All organisms are made of one or more cells. Animal and plant cells have some organelles in common. The differences in cell structure affect their function.
- Organisms pass on traits to their offspring. The hereditary information of these traits is found in genes. For each inherited trait, an organism has two genes from each parent with alternative forms called alleles. By composing punnett squares, one can show the possible combinations of alleles that can result in a generation and determine the probability of arriving at these combinations and subsequently having offspring that may carry certain traits.

### Discussion Topics:

- Photosynthesis requires light, carbon dioxide, and water (the reactants) to produce sugars and oxygen (the products). *How does lack of access for plants to any of the reactants affect the amount or quality of the products of this process?*
- Drugs can have beneficial and harmful effects on organisms. Stimulants temporarily increase physiological activity and depressants temporarily decrease physiological activity. *Why can it be detrimental to a person's health to use stimulants and depressants at the same time and in large amounts?*
- Animal cell and plant cells have organelles in common and some that are different. Plant cells are larger than animal cells, surrounded by a thick, rigid cell wall, rectangular in shape and they have chloroplasts which are used in the photosynthesis process to make food. Animal cells don't have a cell wall but have a cell membrane which allows for an easier flow of nutrients and waste in and out of the cell. Unlike plant cells, animal cells are irregular in shape and contain a pair of centrioles near the nucleus which help organize the microtubules (fibrous rods) during cell division. *How does the difference in animal and plant cell structure affect their function?*

### In Class Activity:

- Coin-toss genetics: Obtain two pennies. One penny will represent a pair of genes of one parent. The other penny will represent the same pair of genes of the other parent. The penny's heads side will represent the dominant allele (A) and the tails side will represent the recessive allele (a). The trait for the gene can be whatever your class chooses. For example, the trait could be hair color with the dominant allele (A) being brown and the recessive allele (a) being blue. Have students create a Punnett square of two heterozygous parents (Aa) to determine the expected probability of offspring. Then, have students toss both 'parent' coins together to see that there are only 3 possibilities for outcomes; AA, Aa, aa. Have students toss both coins 50 times and record how many times they arrived at each of the possible outcomes. Have students determine the probability from the coin tosses for each offspring. Compare the coin toss probabilities with the Punnett Square probabilities. How close were both results? What accounts for the differences?
- Demonstrate Osmosis using an egg: Materials needed: 2 raw eggs, measuring tape, vinegar. Have students measure and record the circumference of the widest part of each egg. Weigh both eggs and record it on a datasheet. Have students place each egg in a container with vinegar (make sure the egg is fully covered by vinegar). Label the containers and close them. Students should make hypothesis as to what may happen to the eggs. Have students observe and record any changes (the vinegar will react with the calcium carbonate in the egg shell and form CO<sub>2</sub> bubbles. Leave overnight. The next day, remove the eggs from the containers and gently rinse them with water. Dry each egg and measure and record their new circumference and new weight. Empty the vinegar from one container and replace with water. Put the egg back in the container making sure the water is covering the egg. Remove the vinegar from another container and replace with corn syrup. Return the egg to the container making sure it totally covers the egg. Students should make hypothesis as to what may happen to the eggs. Leave overnight. The next day, remove the eggs from the containers and gently rinse them with water. Dry each egg and measure and record their new circumference and new weight.

### Additional Resources:

[http://www.sciencedaily.com/news/plants\\_animals/biology/](http://www.sciencedaily.com/news/plants_animals/biology/)

<http://education.usgs.gov/>

<http://www.nature.com/>