

Chapter One

Intro to Biology

ARE YOU
HUNGRY?

YEAH! I
COULD GO
FOR A **LIGHT**
SNACK.



Day One:

Today, your child should complete their reading and practice problems for the week.

Below are the supplies for this week's lab:

Toothpicks, ~25
~40 gumdrops of four different colors each

Next Generation Science Standards covered this week:

All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins.

(HS-LS3-1)

Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. (HS-LS4-2),(HS-LS4-3)

The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (HS-LS1-5)

Definitions

adaptation	any newfound trait that increases an organism's ability to survive in its environment
adenosine triphosphate (ATP)	an energy-rich molecule found within the cells of all living organisms
anatomy	the study of an organism's physical structure
antigens	proteins found on the surface of viruses and cells that act as "keys" which attach to protein receptor "locks" found on host cells
asexual reproduction	reproduction involving only one parent; offspring from this form of reproduction contains nearly the same genetic information as the parent
atoms	the smallest unit of matter that retains all of the chemical properties of an element
autotrophs	organisms that create their own food from inorganic nutrients
bacteria	single-celled organisms
biodiversity	the diversity or variety of life in the ecosystem
biology	the science of life
biome	a collection of several ecosystems that share a common climate
biosphere	defines all of the possible relationships between living and nonliving matter throughout the planet
cell	the basic structural and functional unit of all organisms
cellular respiration	chemical reactions within cells that produce the energy-rich ATP molecule
chromosomes	a long DNA molecule containing most of an organism's genetic material
climate	long-term pattern of weather
community	all species that reside within a particular geographical area
deoxyribonucleic acid (DNA)	large, double-stranded molecule bound together by a series of specific nitrogenous bases into a double helix structure; provides the genetic material for all life to exist

differentiation	how a cell becomes specialized in order to perform specific functions
ecology	a branch of biology that studies the relationship of organisms with their environment
ecosystem	a collection of all communities of organisms and their environment
element	118 natural or chemically pure substances that have their own unique chemical and physical properties and cannot be broken down into smaller particles by any chemical reaction
evolution	theory utilized in biology to explain how changes within inherited traits are responsible for the increased survivability of a population over the course of many generations
flagella	hair-like extension on several bacterial species which are used for the organism's movement through a fluid
gene	small to large sections of nitrogenous base sequences along the length of DNA which are responsible for the synthesis of individual proteins
gene pool	the genotypes of an entire population
genotype	collection of individualized sequences of nitrogenous bases that is responsible for the synthesis of proteins
glucose	complex molecule produced by photosynthesis and used as a major nutrient by organisms
heterotrophs	organisms that consume autotrophs for nutrients; these organisms cannot produce their own food
homeostasis	the tendency of a cell or organism to maintain its stable internal conditions in response to external pressures
hormones	proteins which act as chemical messengers
inorganic	non-living
latitude	the northern or southern distance from the equator
Linnaean (binomial naming system)	method of naming every organism; contains the individual's genus and species names (e.g. <i>Canis lupus</i>)
macromolecules	very large molecules composed of thousands of atoms bound together

metabolism	biochemical reactions within a cell that are necessary for its survival
molecules	two or more atoms that are bound together
mutations	changes that occur within the sequence of nitrogenous bases along a strand of DNA
natural selection	biological process that drives evolutionary change over time; a "selected" individual gains the ability to survive and (hopefully) pass its traits into future generations within a population
nitrogenous bases	one of four molecules found within the structure of DNA whose sequence determines an organism's genotype
organelles	specialized structures within cells that perform individualized functions
phenotype	the physical structure, development, and behavior of an organism
photosynthesis	the sun's light energy is used to convert water (H_2O) and carbon dioxide gas (CO_2) into more complex molecules to be used as food
physiology	the study of how an organism's structure functions
pili	small extensions found on the surface of unicellular organisms that are used to react to environmental stimuli
population	a group of organisms of the same species that reside in a given area at the same time
sexual reproduction	reproduction requiring two parents who each donate half of the necessary genetic information into their offspring
species	a group of organisms that can reproduce among themselves
stem cells	cells within multicellular organisms that undergo differentiation during the organism's development
taxonomy	universal system used to organize, name, and classify organisms
virus	a small section of genetic material surrounded by a protective layer of protein and sometimes a "bubble" of fat

Sample questions to ask your child after completing the weekly reading.

What is the difference between anatomy and physiology?

Anatomy is the study of the body's physical structures. Physiology is the study of the body's functions.

What molecules do plants need and produce during photosynthesis?

Plants need water (H_2O) and carbon dioxide gas (CO_2) to begin the process of photosynthesis. Glucose ($C_6H_{12}O_6$) is the main product of photosynthesis.

How do autotrophs differ from heterotrophs?

Autotrophs make their own food from inorganic substances while heterotrophs consume autotrophs to acquire the nutrients they need to survive.

What does it mean for an individual to become "selected" in regards to evolution?

An organism that is "selected" has gained an adaptive trait that increases its ability to survive and (hopefully) pass its traits into future generations within a population.

What is the primary function of genes?

The primary function of genes is to make proteins.

Day Two:

Your child should check their work on the practice worksheets today with the answer key on the next page.

In addition, your child should read the lab activity and start collecting all of the necessary materials!

Answer Key for Practice Problems

- | | | |
|-------------------------|----------------------------------|--------------------|
| 1) cellular respiration | 10) flagella | 17) pili |
| 2) atoms | 11) antigens | 18) population |
| 3) glucose | 12) latitude | 19) hormones |
| 4) natural selection | 13) biosphere | 20) cell |
| 5) element | 14) nitrogenous bases | 21) molecules |
| 6) gene pool | 15) organelles | 22) evolution |
| 7) differentiation | 16) adenosine triphosphate (ATP) | 23) climate |
| 8) taxonomy | | 24) macromolecules |
| 9) biome | | |

Multiple choice/Short answer questions:

- 1) d
- 2) c
- 3) b
- 4) d
- 5) a
- 6) a
- 7) Answers may vary, but must include some knowledge of how a cell becomes specialized in order to perform specific functions. For example, the genetic information found within heart cells and skin cells is identical; however, heart cells only use specific genes to create heart tissues whereas skin cells use different genes to perform the functions of our skin. Differentiation occurs throughout development as specific genes are "turned on" and "turned off" depending on the type of tissues that are needed during the organism's growth.
- 8) During photosynthesis, the sun's light energy is used to convert water (H_2O) and carbon dioxide gas (CO_2) into glucose ($C_6H_{12}O_6$) and oxygen gas (O_2).
- 9) Each biome shares the same long-term pattern of weather (climate).

Day Three: Lab Activity

Your child should have already read through this lab and has been reviewing all of this week's vocabulary words.

Collect your supplies for the lab:

Toothpicks, ~25
~40 gumdrops of four different colors each

DNA Modeling and Decoding or...

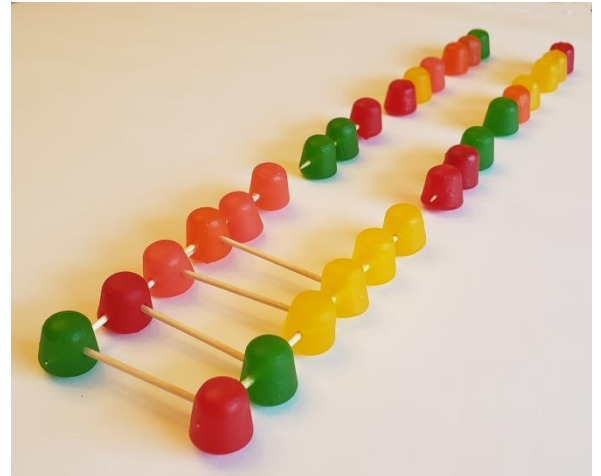
I never knew candy could be so informative!

Students will create a DNA molecule and "decode" it in this activity.

Materials:

Toothpicks, ~25

~40 gumdrops of four different colors each



Procedure:

- Place the correct colored gumdrops on individual toothpicks in the order shown within the tables. If you use different colors as in these tables, make certain to always pair the same two colors together!
- Connect the ends of each toothpick together in Strand One with the toothpick ends. This should make one long strand of gumdrops. Repeat this procedure with Strand Two.
- Place Strand One next to Strand Two so that every red gumdrop is aligned next to a green and every orange gumdrop is next to a yellow.
- Connect these complementary pairs (Red/Green and Orange/Yellow) with toothpicks. The final structure should look like a ladder. Gently twist both ends of this structure and it will look like a double helix.

Strand One	
GREEN	Toothpick #1
ORANGE	
ORANGE	
ORANGE	Toothpick #2
YELLOW	
RED	
RED	Toothpick #3
GREEN	
GREEN	
ORANGE	Toothpick #4
ORANGE	
ORANGE	
ORANGE	Toothpick #5
RED	
GREEN	

Strand Two	
RED	Toothpick #6
YELLOW	
YELLOW	Toothpick #7
YELLOW	
ORANGE	
GREEN	Toothpick #8
GREEN	
RED	
RED	Toothpick #9
YELLOW	
YELLOW	
YELLOW	Toothpick #10
YELLOW	
GREEN	
RED	

- 5) Identify the three nitrogenous base sequences from the colored gumdrops in Strand One. Write these sequences out on the attached worksheet. The first sequence (Green, Orange, Orange = AGG) has been done for you.

Each color of your gumdrops represents a different nitrogenous base:

Green gumdrop = Adenine (A)

Red gumdrop = Thymine (T)

Yellow gumdrop = Cytosine (C)

Orange gumdrop = Guanine (G)

The unique sequence of these bases (genotype) codes for physical characteristics (phenotypes) of an organism.

- 6) Use the color sequence of gumdrops in Strand One to solve the following problem:

The police department needs your help in finding a suspect for a crime. They have acquired DNA samples from the crime scene (Strand One) and need you to identify the phenotypes that are associated with the samples' genotypes and a possible suspect. Use the three nitrogenous base sequences you have identified with the attached Genotype/Phenotype Key and Suspect List to list the phenotypes of the offender.

Explanation:

Only four different nitrogenous bases exist within DNA (adenine, guanine, cytosine, and thymine) and the unique sequence of these bases makes up our genotype. Individualized sequences of nitrogenous bases known as genes are responsible for the synthesis of proteins that are responsible for the growth and development of an organism's phenotype which is the physical structure, development, and behavior of an organism.

FYI - In this simplified model, each of the three nitrogenous bases (gumdrops) represent an individual gene that codes for a specific physical trait such as hair or eye color. In reality, thousands of nitrogenous bases and dozens of different genes may be involved in the development of a single physical trait.

Genotype Sequences of Strand One:

	Green, Orange, Orange	Orange, Yellow, Red	Red, Green, Green	Orange, Orange, Orange	Orange, Red, Green
Genotype	AGG				
Phenotype	Eyes	Hair	Dominant Hand	Height	Nose shape

Genotype/Phenotype Key

Phenotype		Genotype
Eyes	Blue	AGG
	Green	AGC
	Brown	TGG
	Gray	TGC
Hair	Brown	GCC
	Black	GTG
	Blonde	GCT
	Red	GTC
Dominant Hand	Right	TAA
	Left	TTA
Height	Short	GAA
	Medium	GGG
	Tall	GTT
Nose shape	Broad	ATA
	Long	GTA
	Narrow	CAT

What are the physical traits of the suspect, based on the DNA evidence you have studied? Who is the suspect?

Eyes? **Blue**

Hair?

Dominant Hand?

Height?

Nose shape?

Suspect?

Suspect List

Lauren

Eyes: blue
 Hair: red
 Dominant Hand: left
 Height: short
 Nose: broad

Diana

Eyes: green
 Hair: black
 Dominant Hand: left
 Height: short
 Nose: long

Jalen

Eyes: gray
 Hair: black
 Dominant Hand: left
 Height: medium
 Nose: narrow

Shawn

Eyes: green
 Hair: brown
 Dominant Hand: right
 Height: tall
 Nose: broad

Jonathon

Eyes: gray
 Hair: blonde
 Dominant Hand: right
 Height: medium
 Nose: long

Johana

Eyes: brown
 Hair: brown
 Dominant Hand: right
 Height: tall
 Nose: broad

Maria

Eyes: blue
 Hair: brown
 Dominant Hand: right
 Height: medium
 Nose: broad

Jacob

Eyes: blue
 Hair: blonde
 Dominant Hand: right
 Height: medium
 Nose: long

Aaron

Eyes: gray
 Hair: brown
 Dominant Hand: right
 Height: tall
 Nose: long

Answer Key:

	Green, Orange, Orange	Orange, Yellow, Red	Red, Green, Green	Orange, Orange, Orange	Orange, Red, Green
Genotype	AGG	GCT	TAA	GGG	GTA
Phenotype	Eyes	Hair	Dominant Hand	Height	Nose shape

Eyes? **Blue**Hair? **Blonde**Dominant Hand? **Right**Height? **Medium**Nose shape? **Long**Suspect? **Jacob**