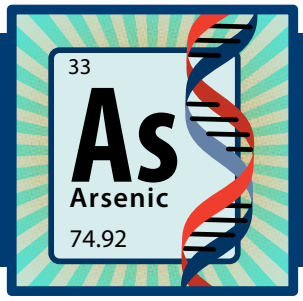
UNIT: DNA
LESSON 1: ARSENIC AND EPIGENETICS: A DNA STORY
ACTIVITY 1A: CONGA LINE



TEXAS BIOMEDICAL RESEARCH INSTITUTE
HEALTH STARTS WITH SCIENCE

Minerals are important elements our bodies need to live. Some of the essential elements our bodies need include:

Mineral/Element (Symbol)	Body Function
Na Sodium	Muscle contraction, nerve transmission
Ca Calcium	Bones, teeth, muscle relaxation
Mg Magnesium	Immune system, protein synthesis
P Phosphorus	Bones, teeth, homeostasis
K Potassium	Muscle contraction, nerve transmission

Mineral/Element (Symbol)	Body Function
Fe Iron	Red blood cells, oxygenation
Zn Zinc	Protein synthesis, immune system health
Cr Chromium	Regulates blood sugar
Cu Copper	Enzyme function, metabolize Fe
I Iodine	Regulates growth and development

These elements occur naturally in the ground. But how do these minerals get into our bodies? Simply put, plants have symbiotic relationships with fungus. The plural for fungus is fungi ***(FUN-guy)***. The fungi attach themselves to the roots of plants. Once attached to the plant root, the fungi obtain sugars and other nutrients from the plant. In return, the fungi break down the soil, extracting vital minerals from the ground which are then absorbed by the roots of plants. Unlike plants that need fungi to obtain minerals, water erodes the ground which releases minerals. These minerals are then carried by the water. When animals, including humans, eat the plants and drink water, these these minerals are absorbed and used by body systems to maintain homeostasis.

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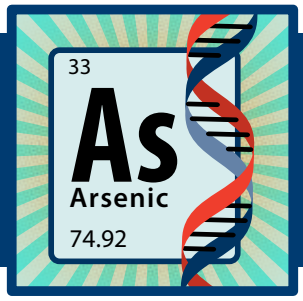

States and Properties of Metals, Nonmetals, and Metalloids

All matter is classified by one of three states, its physical properties and chemical properties. The three states of matter are: solid, liquid, and gas. In a solid, the particles (atoms, ions, or molecules) are tightly packed together and can only "vibrate" in place. In other words, they cannot move apart from one another because they have very low kinetic energy. Unlike solids whose particles are held together, liquids have no defined shape and take the shape of the container, filling from the bottom up (thanks to gravity). Liquids have a higher kinetic energy than solids, meaning the particles are able to move around one another. Matter in the gaseous state have high kinetic energy. The kinetic energy is so high that the particles can spread out and away from one another. Unlike liquids which fill a container from the bottom up, gases will spread out, filling the entire container. If the container does not have a lid, the gas will escape.

There are two properties of matter: physical properties and chemical properties. Physical properties include color, hardness, density, melting and boiling points, and conductivity. Chemical properties include reactivity, flammability, toxicity, and acidity.

Physical Properties of Matter		
Metals	***Nonmetals***	***Metalloids***
Malleable (*hammered into sheets*)	Brittle	Not malleable, not brittle
Ductile (*drawn into a wire*)	Brittle	Not ductile
Shiny, luster	Not shiny, dull	Some are shiny; some are dull
Good conductors of heat	Poor conductors of heat (*good insulators*)	Poor conductor of heat
Good conductors of electricity	Poor conductors of electricity (*good insulators*)	Semi-conductors
Most are magnetic	Not magnetic	Not magnetic
State of Matter – room temperature		
Solid [*except mercury (Hg) which is liquid at room temperature*]	Gas (*oxygen*) Solid (*carbon*) Liquid (*bromine*)	Solid

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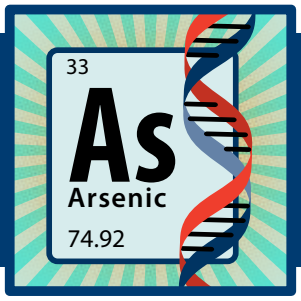

Exposure to low levels of the metalloid ***arsenic (As)*** has been shown to increase the chronic diseases, such as type 2 diabetes (T2D), in American Indian communities. Scientists used data to determine if the rate of type 2 diabetes in American Indian adults could be connected to their mothers' exposure to low to moderate levels of arsenic during pregnancy. Scientists focused on a methyl group structure (CH_3). This "methylation" of DNA found on maternal DNA has been shown to contribute to insulin-resistance in the adult offspring.

Epigenetics (ep-ah-geh-NEH-tics) is the study of how changes in gene expression affects the phenotype which is the physical appearance of an individual, but does not change the DNA sequence. Gene expression refers to when genes are active or not active. Changes to when genes are active or not active can negatively affect the body's metabolism. These changes in gene expression result from interactions between DNA strands. Although the DNA itself is not changed, epigenetic changes in gene expression can be inherited from one generation to the next. Epigenetic changes can also be influenced by environmental factors such as diet, stress, and exposure to toxins, such as arsenic.