

The Human Body: The Marvels of Physics, Chemistry, and Biology Working Together!

The Digestive System

Marjorie Mighells

Diné Institute for Navajo Nation Educators

2019

Author Note: Marjorie Mighells is an English teacher at Valley High School. Correspondence about this curriculum unit can be addressed to Marjorie Mighells, P.O. Box 1713, Sanders, AZ, 86512. Email contact; dineteachersinstitute@nau.edu

Context

Introduction

I am a non-Native American teacher on the Navajo Reservation in Sanders, Arizona. I have a Masters of Education from Arizona State University with an English minor. I have a Bachelor of Arts degree in history with an emphasis on Native American history and culture. I am certified to teach Secondary Education in U.S. History, world history, economics and English. I was born and raised on the Seneca Nation of Indians in upstate New York. I believe that Native Americans have a beautiful culture that should be preserved and not forgotten by reinforcing tribal cultures through the children, especially those on the reservations. Also, Native Americans have a unique set of circumstances in American society which needs to be addressed in an unique way.

Demographics

I teach English at Valley High School, which is now a letter D school under progress monitoring and under supervision of the Dept. of Education because it was once an F school. It has Title 1 status. Only 12% of all students are proficient in ELA, 8% in Math and 9% in Science. The four-year graduation rate is 74%. Students are bused very long distances to school and back every day. The school has 100% free lunch eligibility. One outstanding situation that I observe is that the students all have bags of chips, Doritos, hot Cheetos, candy and cans of sodas stuffed in their backpacks that they eat and share every day with each other. Furthermore, many students do not attend the school breakfast or lunch at Valley High School (VHS) compared to the elementary (SES) and the middle school (SMS). Below is the meal participation for the month of March 2019. The high school students do not go to the cafeteria for a healthy lunch, which is free to all students, as much as the elementary and middle school students do. (See figure 1)

	Breakfast	Lunch
SES	55%	87%
SMS	52%	79%
VHS	33%	59%

Gabe Garner

Procurement • Student Activities • Food Service
Sanders Unified School District No. 18 (Figure 1)

Rationale

Native Americans have the highest rate of diabetes and hypertension than any other ethnic group according to the National Health Statistics Report of March 9, 2010. It is very important that students are educated about how the human body functions in the digestive system, as well as shown what a healthy diet consists of as well as the causes of diabetes and hypertension. Once a student understands what a nutritional, healthy diet consists of and the causes of diabetes, they can take control of their own health, as well as encourage other family members and friends to do so as well. By the end of this unit, they will be able to determine whether they are eating a

healthy diet, to count their calories and determine if they are eating too much to avoid obesity, and to estimate whether they are eating too much salt in their diet, which leads to hypertension. I will teach this unit to a ninth grade class as an end of the year project that combines English, math, science, and Native American history. (See figure 4)

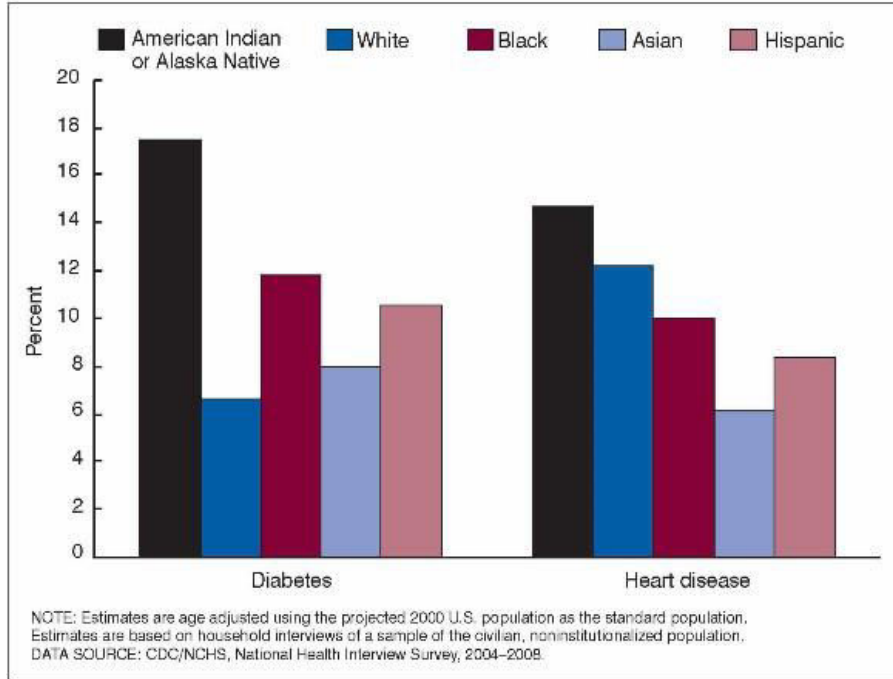
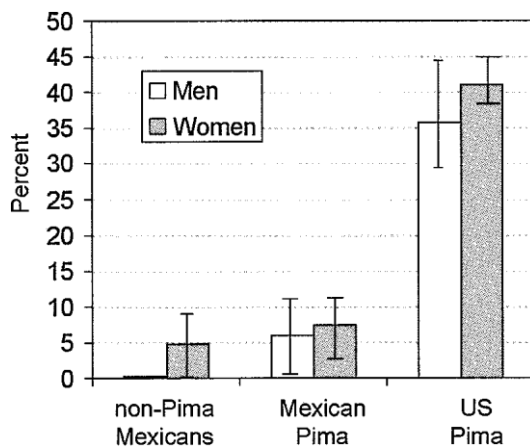


Figure 4. Percentage of adults aged 18 years and over who have ever been diagnosed with diabetes, and percentage of adults aged 18 years and over who have ever been diagnosed with heart disease, by race and ethnicity: United States, 2004-2008

Figure 2—Age-adjusted prevalence (95% CIs) of diabetes in non-Pima Mexicans, Mexican Pima Indians, and U.S. Pima Indians.



CONCLUSIONS — The much lower prevalence of type 2 diabetes and obesity in the Pima Indians in Mexico than in the U.S. indicates that even in populations genetically prone to these conditions, their development is determined mostly by environmental circumstances, thereby suggesting that type 2 diabetes is largely preventable. This study provides compelling evidence that changes in lifestyle associated with Westernization play a major role in the global epidemic of type 2 diabetes.

Diabetes Care 29:1866–1871, 2006

According to "Diabetes in Navajo Youth", a study done by the American Diabetes Association in 2002-2005, diabetes is infrequent among Navajo youth under the age of 10 years old. However, both prevalence and incidence of diabetes are high in older youth. Among adolescents aged 15–19 years, 1 in 359 Navajo youth had diabetes in 2001, and 1 in 2,542 developed diabetes annually. The vast majority of diabetes among Navajo youth with diabetes is type 2, although type 1 diabetes is also present, especially among younger children. Navajo youth with either diabetes type were likely to have poor glycemic control, high prevalence of unhealthy behaviors, and evidence of severely depressed mood. Youth with type 2 diabetes had more metabolic factors associated with obesity and insulin resistance (abdominal fat deposition, dyslipidemia, and higher albumin-to-creatinine ratio) than youth with type 1 diabetes. The study showed that diabetes is an important health problem for Navajo youth. Targeted efforts aimed at primary prevention of diabetes in Navajo youth and efforts to prevent or delay the development of chronic complications among those with diabetes are warranted.

Furthermore, according to the U.S. Food and Drug Administration, the maximum intake of salt should be under 2.3 grams per day. However, most people are consuming twice that much and children as well as adults can be affected by too much salt (WHO, 2016). According to a research report by Appetite in 2013, salt reduction is important for reducing hypertension and the risk of cardiovascular events; nevertheless, salt intakes are above recommendations worldwide. This information shows the importance of teaching Native American children that they are prone to diabetes and hypertension and need education about what a healthy diet consists of, what a healthy amount of daily salt intake is, and how to be proactive in taking control of their own health and diet.

Content Objectives

Pre-Columbian Diet

Traditional Navajo foods are described in *Food Sovereignty the Navajo Way: Cooking with Tall Woman* by Charlotte Frisbie, 2018. The Native Americans were hunters, gatherers, and farmers. The traditional foods are elk, antelope, deer, rabbit, squirrel, bear, bighorn sheep (in the N), turkey (in the SW), and turtle doves for meat. Pinyon and walnuts also provided protein. Vegetables included: corn, squash, beans, wild celery, wild potatoes, carrots, onions, yucca fruit. Berries included sumac, juniper, and wolfberry.

I would like to emphasize the diet Native Americans had for thousands of years before Europeans came to the Americas because as the Navajo medicine man Lorenzo Max stated on June 29, 2019 at a NAU conference that it takes 5,000 years for people to become accustomed to a diet and the traditional foods are what suits the digestive constitution of Navajos best.

After the Spanish conquest of the Aztec Empire in the 16th century, Europeans introduced a number of other foods, the most important of which were meat from domesticated animals (cattle, pig, chicken, goat, and sheep), dairy products (especially cheese and milk), and rice.

The Digestive System

The digestive system organs include: mouth, salivary glands, pharynx, esophagus, stomach, liver, gallbladder, pancreas, large intestine, small intestine, appendix, rectum, anus.

There will be direct instruction taken from "The Structure and function of the Digestive System" (my.clevelandclinic.org/health/articles/7041) on how food is digested down to molecules that can be used by the body through chemical reactions. There are six main functions of the Human Digestive System process: ingestion, motility, secretion, digestion, absorption, excretion. The digestive system is specialized to turn food into the smaller molecules you need to survive and then eliminating the residue for waste disposal. The mouth is where digestion starts with chewing the food into pieces while saliva mixes aiding in the break down. The esophagus then delivers the food after you swallow to the stomach by means of muscular contractions called peristalsis. The stomach holds the food while it is mixed with enzymes that continue the breakdown process. The small intestine receives the contents from the stomach. It is a 22-foot long muscular tube made up of three segments - duodenum, jejunum, and ileum - that break down food using enzymes released by the pancreas. Bile salts from the liver which aid in the digestion of fats. It moves food through by peristalsis while mixing it with digestive secretions from the pancreas and liver. The duodenum breaks down food while the jejunum and ileum start absorbing nutrients into the bloodstream. The leftover-food residue passes from the small intestine to the large intestine, or colon. The colon is a 6-foot long muscular tube connecting the small intestine to the rectum. It is made up of the cecum, where the appendix is attached, the descending left colon, and the sigmoid colon, which connects to the rectum. As stool passes through the colon by means of peristalsis, water is removed and stored in the sigmoid until it empties into the rectum. The rectum is an 8-inch chamber that connects the colon to the anus that holds the stool until the lining of the upper anus detects whether the contents are liquid, gas, or solid. The anus has sphincter muscles that holds the stool until the brain tells it to release.

Chemistry

Nutrients from the food we eat must pass through the walls of the gastrointestinal tract to be absorbed into the bloodstream. The organs that make up the GI tract are collectively known as the digestive system (Wardlaw, 96). The digestive system is composed of 6 separate organs. 1) Mouth: Chew food, release a starch –digesting (amylase) enzyme. 2) Esophagus: moves food to stomach with peristaltic waves. 3) Stomach: protein –digesting (pepsin/protease) enzyme 4) Liver: produces bile acids to aid fat digestion 5) Gallbladder: releases bile into the small intestine 6) Pancreas: secretes sodium bicarbonate and a fat-digesting enzyme (lipase) enzymes 7) small

intestine: digest and absorb most substances using enzymes 8) Large Intestine: absorb and synthesize some vitamins and form feces. 9) Rectum: Hold feces and expel via the anus. (Wardlaw, 97). A series of chemical reactions take place as your body digests food, whether simple or complex, involve changing substances. Enzymes are proteins that act as biological catalysts. Enzymes are large protein molecules with three-dimensional structures. Within each enzyme's structure is a specific area called the *active site*. The properties and shape of the active site are just right to bind the reactant molecule called the substrate. The substrate binds to the active site in a manner of a key fitting into a lock (Tro, 631). The enzyme urease hydrolyzes urea, a constituent of urine, into ammonia and carbon dioxide. The liver contains high levels of the enzyme catalase. Enzymes catalyze most of the chemical changes that occur in the cell. A substrate is a molecule on which the enzyme acts causing the making and breaking of bonds. During digestion, enzymes speed up the breakdown of foods into molecules small enough to be absorbed by cells. Enzymes also make possible the reactions required for cells to extract energy from these nutrients (Glencoe Science, pg. 672). Enzymes in the digestive system break sucrose into glucose and fructose molecules that are small enough to be absorbed and used by cells as nutrients. When you eat a meal, insulin is a hormone released by the pancreas that travels through the blood stream to signal to cells that glucose is available. When excess glucose is produced, the energy that can't be used right away is stored in the liver and muscles as glycogen, a polymer of glucose.(673).

Biology

Biochemists sort macromolecules made up of thousands of smaller molecules into four main groups: carbohydrates, lipids, nucleic acids, and proteins (Mille, Levine, 46). Carbohydrates are made up of carbon, hydrogen, and oxygen atoms usually in a ratio of 1:2:1. A monosaccharide is a single sugar molecule such as glucose and galactose. Sucrose (table sugar) is a disaccharide compound made up of glucose and fructose. Complex Carbohydrates are large macromolecules formed from monosaccharides called polysaccharides. Glycogen is a polysaccharide which is stored until the level of glucose in your blood runs low and then it is broken down into glucose and released into the blood (47). Lipid is another name for fat. Lipids are made up of carbon, oxygen, and hydrogen atoms formed when a glycerol molecule combines to form a compound called a fatty acid (47). Fatty acid chains that have single bonds between all carbon atoms of the main chain are called saturated because the fatty acid contains the maximum possible number of hydrogen atoms. Unsaturated fat (olive oil) have at least one carbon-carbon double bond while polyunsaturated fats (corn oil, sesame oil, canola oil, peanut oil) contain more than one double bond (47). Sources of fat are meats, vegetable oils, vegetable shortenings, egg yolks, and nuts (Weixel,Wempen,340) . Fats can be categorized as saturated or unsaturated, based on the hydrogen atoms bonded to the long chains of carbon atoms that make a fat molecule or fatty acid. Unsaturated fats are healthier for your body than saturated ones because trans fat is a rigid fat that can collect as clumps in your blood stream (Weixel,Wempen,10). Trans refers to the chemical structure of the fatty acid molecule. Artificial hydrogenation of oils can cause the development of trans fats which irritate the circulatory system and create health-risk problems (Weixel,Wempen,341). Nucleic acids are macromolecules of hydrogen, oxygen, nitrogen, carbon, and phosphorus which transmit hereditary information such as RNA and DNA (Miller, Levine,48). Proteins are macromolecules that contain nitrogen, carbon, hydrogen, and oxygen

called amino acids which are linked together with covalent peptide bonds to form a polypeptide (48). Enzymes are proteins that speed up chemical reactions that take place in cells (52). Without the enzyme carbonic anhydrase in the bloodstream to speed up the reaction, carbon dioxide would build up in the body faster than the bloodstream could remove it (52).

Diabetes

There are two types of diabetes: Type 1 and Type 2. Type 1 diabetes occurs when the body cannot produce enough insulin and a daily insulin shot is needed to stabilize the blood sugar (Weixel, Wempton, 122). In Type 2 diabetes the pancreas still produces insulin but the body cells become less responsive to the insulin over time. There is a pre-diabetic phase in which the body develops an insulin insensitivity making the pancreas work harder to produce more insulin and eventually the pancreas may reduce or even stop producing insulin all together. The most significant factor in developing Type 2 diabetes is obesity (123). Type 2 diabetes can be minimized with proper diet and regular exercise. Diabetics are advised to reduce and control the amount of carbohydrates they eat. Studies have found that overweight people are much more likely to develop diabetes; however, if they lose weight in the early stages, they can greatly reduce or eliminate their diabetic symptoms. You can see the Body Mass Index Chart on this website.

https://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmi_tbl.pdf

Hypertension

Hypertension is abnormally high blood pressure. High blood pressure results from too much pressure from the blood running through the veins against the walls of the veins because of restrictions. If untreated, it can cause heart disease and stroke from damage to the heart working overtime to push blood through vessels (Miller, Levine, 959). Vascular diseases like high blood pressure can be controlled by minimizing the consumption of saturated fats, trans fats, the intake of sodium and regular exercise (Weixel, Wempton, 29). According to the U.S. Food and Drug Administration, the recommended amount of salt for children over four to adults is 2,300 mg or 2.3 grams; however, the ideal amount is 1.5g per day (fda.org). The World Health Organization recommends that the maximum intake of salt for adults be adjusted downward for children aged two to 15 years based on their energy requirements relative to those of adults. For instance, children who are in sports, who are outside riding bicycles, or who are in climates of extreme heat may need the maximum of salt per day as adults; however, children who are sedentary should not. Salt in the diet can come from processed foods, either because they are particularly high in salt (such as ready meals, processed meats like bacon, ham and salami, cheese, salty snack foods, and instant noodles, among others) or because they are consumed frequently in large amounts (such as bread and processed cereal products). Salt is also added to food during cooking (bouillon and stock cubes) or at the table (soy sauce, fish sauce and table salt). Consumers should read food labels and choose products low in sodium. Most people consume too much salt—on average 9–12 grams per day, or around twice the recommended maximum level of intake (WHO, 2016). Salt intake of less than 1.5 grams per day for adults helps to reduce blood pressure and risk of cardiovascular disease, stroke and coronary heart attack (FDA). The principal benefit of lowering salt intake is a corresponding reduction in high blood pressure.

Reducing salt intake has been identified as one of the most cost-effective measures countries can take to improve population health outcomes. Eating too much salt can raise blood pressure at any age (WHO, 2016).

A research report by *Appetite* in 2013, found that most people around the world do not know how much salt they are supposed to have every day or how much they are consuming. Eating too much salt can raise blood pressure at any age. 1.5 g of salt (1 teaspoon) will be measured as a visual of how much salt should be consumed in one day according to the U.S. Food and Drug Administration. Reducing salt intake has been identified as one of the most cost-effective measures countries can take to improve population health outcomes according to *Appetite*.

The Healthy Plate

The Department of Agriculture has information on what types of foods are in a healthy diet and how much of each category should be eaten daily in The Healthy Plate chart, as well as how many calories should be eaten a day by age, height, and weight.

Teaching Strategies

Graphic Organizers: Students will fill out a chart on what foods were available to Native Americans before Europeans came to America from a PowerPoint that shows pictures and information about native plants and animals from websites.

Sharing: Students will bring in a traditional Navajo recipe for a class recipe book.

Labeling: Students will have a visual chart of the digestive system to label each organ both in English and Navajo.

Research: Research one of the digestive organs according to the rubric.

Google Slide Presentation: Create a Google slide and present a slideshow to the class on the digestive organ chosen.

Socratic Discussion: after filling out the QFocus Chart on important questions, there will be a class discussion.

Close Reading Strategy: Handouts will be read and highlighted about digestion.

Terms to Define: The definitions of a list of words will be defined.

Group Work: Students will get into groups and write the ingredients of a bag of chips in order to determine if the salt and saturated fat content are high. They will have a chart to fill out with the recommended daily allowance. They will define each ingredient. They will go to a website and answer questions about how salt affects the arteries, heart, brain, and kidneys.

Self Assessment of Eating Habits: Students will go to the Department of Agriculture website of choosemyplate.gov to see what a healthy diet is and how many calories they need according to their height and weight. They will fill out a chart of what they are eating for a week in order to see if they are eating a healthy diet aligned with the Healthy Living Plate, as well as estimate how many calories they are eating a day. This is to help them realize what a healthy diet is, whether or not they are eating healthy, and encourage them to be proactive in future food choices which could prevent health problems in their future.

Poster Creation: Each student will create a poster of their choice of Native American foods, the digestive system, one organ, The Healthy Plate, diabetes, or hypertension to hang out in the hall.

Classroom Activities

Day One: What new food sources did the Spanish bring to the Americas?

After the Spanish conquest of the Aztec Empire in the 16th century, Europeans introduced a number of other foods, the most important of which were meats from domesticated animals (cattle, pig, chicken, goat, and sheep), dairy products (especially cheese and milk), and rice. Around the world, indigenous peoples are returning to traditional foods produced by traditional methods of subsistence. The goal of controlling their own food systems, known as food sovereignty, is to reestablish healthy life ways to combat contemporary diseases such as diabetes and obesity.

<https://www.smithsonianmag.com/arts-culture/going-with-the-grain-161650307/>

<https://www.fs.fed.us/wildflowers/ethnobotany/food/grains.shtml>

<http://www.native-art-in-canada.com/wildrice.html>

<https://newsmaven.io/indiancountrytoday/archive/10-indigenous-foods-thought-to-be-european-uTmaPLGaLUa33WWgvgmSVQ/>

<https://www.fireflyforest.com/flowers/category/edible-plants/>

Fill in a chart of what was available to Native Americans to eat before Europeans came to North America.

Fruits/berries	Grains	Vegetables	Protein	Oil/Fat

Some examples are: yucca fruit, juniper berries, wild celery, wild onions, pinyon nuts, corn, squash, beans, broom snakeweed, cholla, ocotillo, prickly pear, claret cup, black walnuts, pale wolfberry, sumac berry, wax current.

Day Two: Bring in a Recipe. Label the Digestive chart and choose an organ to start researching. Use these websites to research.

Links to the digestive system

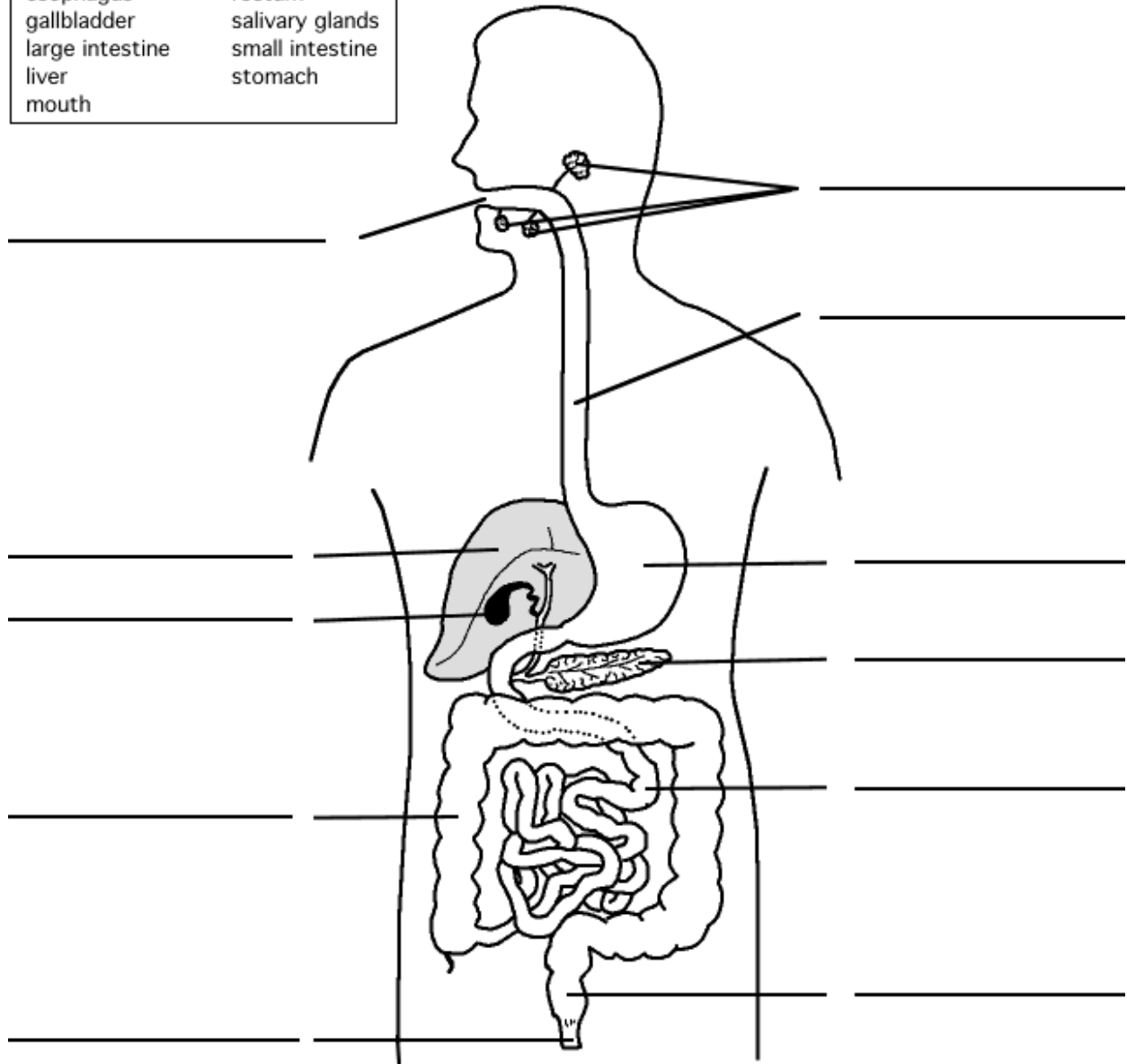
<https://www.niddk.nih.gov/health-information/digestive-diseases/digestive-system-how-it-works>

<https://www.britannica.com/science/human-digestive-system/The-teeth>

<https://my.clevelandclinic.org/health/articles/7041-the-structure-and-function-of-the-digestive-system>

<https://www.merckmanuals.com/home/digestive-disorders/biology-of-the-digestive-system>

anus	pancreas
esophagus	rectum
gallbladder	salivary glands
large intestine	small intestine
liver	stomach
mouth	



Digestive System

Day Three: Continue to bring in recipes for the class recipe book that will be printed for all students who participated. Start creating your Google slide to present to the class.

Day Four: Present your Google Slide to the class.

Day Five: Socratic Discussion

Directions: Create 5 questions from the presentations. Categorize them as open-ended or closed-ended. Open-ended means that the question needs an explanation to answer it. Closed-ended means that it is a yes or no question. Circle the best 3 questions. These are the questions you will present to the class for discussion. After the discussion, write what you learned and how you can use what you learned.

Name _____
 Period _____

QFocus		Categorize: O is open-ended C is closed-ended
1.		
2.		
3.		
4.		
5.		

Circle the 3 best questions

Why did you choose those questions?

Choose one open-ended and make it closed:

Choose one closed-ended and make it open:

What did you learn?

How can you use what you learned?

Day Six: Chemistry lesson

During this lesson, we will read this handout together on how the body changes the food we eat into useable molecules.

Handout

Chemistry

Getting an adequate supply of all nutrients to the body's cells begins with a healthy diet (Wardlaw, 82). Every minute of the day chemical reactions take place- both inside you and around you. Nutrients from the food we eat must pass through the walls of the gastrointestinal tract to be absorbed into the bloodstream. The organs that make up the GI tract are collectively known as the digestive system (Wardlaw, 96). The digestive system is composed of 6 separate organs. 1) Mouth: Chew food, release a starch –digesting (amylase) enzyme. 2) Esophagus: moves food to stomach with peristaltic waves. 3) Stomach: protein –digesting (pepsin/protease) enzyme 4) Liver: produces bile acids to aid fat digestion 5) Gallbladder: releases bile into the small intestine 6) Pancreas: secretes sodium bicarbonate and a fat-digesting enzyme (lipase) enzymes 7) small intestine: digest and absorb most substances using enzymes 8) Large Intestine: absorb and synthesize some vitamins and form feces. 9) Rectum: Hold feces and expel via the anus. (Wardlaw, 97).

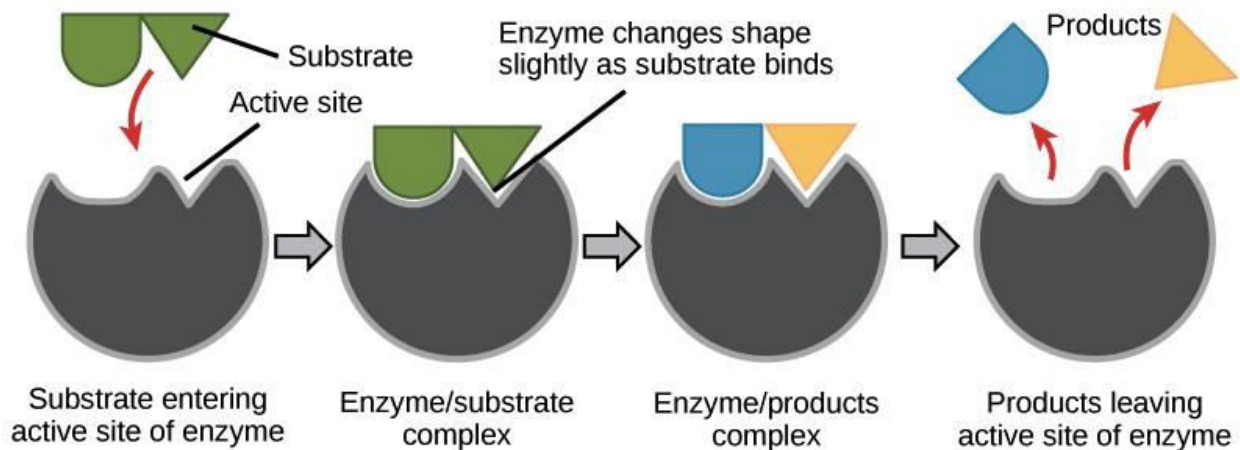
After a meal, a series of chemical reactions take place as your body digests food. All chemical reactions, whether simple or complex, involve changing substances.

Reactants



Products

Enzymes are proteins that act as biological catalysts. The enzyme catalyst speeds up reactions without being changed itself, as well as lowers the activation energy needed for a reaction to occur (Glencoe Science, pg. 672). Enzymes are large protein molecules with three-dimensional structures. Within each enzyme's structure is a specific area called the **active site**. A **molecule** is the smallest unit of most compounds that displays all the properties of that compound. A **substrate** is a molecule on which the enzyme acts causing the making and breaking of bonds. The properties and shape of the active site are just right to bind the reactant molecule, called the substrate. The substrate binds to the active site in a manner of a key fitting into a lock (Tro, 631). Just like a lock and key, only substrates that have a particular shape are allowed to bind to the active site of a particular enzyme-catalyst reaction. The enzyme *urease* hydrolyzes urea, a constituent of urine, into ammonia and carbon dioxide. The liver contains high levels of the enzyme *catalase* which breaks down hydrogen peroxide into oxygen and water. Enzymes catalyze most of the chemical changes that occur in the cell.



khanacademy.org

During digestion, enzymes speed up the breakdown of foods into molecules small enough to be absorbed by cells. Enzymes also make possible the reactions required for cells to extract energy from these nutrients. The enzyme *amylase* that is found in saliva and pancreatic fluid converts glycogen into glucose (Miller, Levine, 876). The enzyme *sucrase* in the small intestine breaks down the substrate sucrose into glucose and fructose molecules so that they are small enough to be absorbed and used by cells as nutrients (878). When you eat a meal, **insulin** is a hormone released by the pancreas that travels through the blood stream to signal to cells that glucose is available (Glencoe Science, pg. 672).

Lipids

Another name for fat is lipid. Sources of fat are meats, vegetable oils, vegetable shortenings, egg yolks, and nuts (Weixel, Wempen, 340). **Lipids** are made up of carbon and hydrogen atoms formed when a glycerol molecule combines to form a compound called a fatty acid (47). Oils and fats in your diet consist of long chain **carboxylic acids** called fatty acids that are bonded to a glycerol molecule (Glencoe, 681). Fats can be categorized as saturated or unsaturated, based on the hydrogen atoms bonded to the long chains of carbon atoms that make a fat molecule or fatty acid. A **fatty acid** is a small unit made of carbon, hydrogen, and oxygen atoms linked together. Fatty acid chains that have a single bond are called **saturated** because the fatty acid contains the maximum possible number of hydrogen atoms. Saturated fatty acids are usually solid at room temperature. Sources of saturated fat are meats, coconut oil, palm oil, and dairy products. **Unsaturated** fatty acids contain one or more carbon-carbon double bonds. Unsaturated fats (olive oil) have at least one carbon-carbon double bond while polyunsaturated fats (corn oil, sesame oil, canola oil, peanut oil) contain more than one double bond (47). Unsaturated fatty acids are liquid at room temperature. However, unsaturated fats that have undergone a process called hydrogenation changes fats from liquid to solids producing trans fats, a potentially harmful type of fat (339). Artificial hydrogenation of oils can cause the development of trans fats which irritate the circulatory system and create health-risk problems (341). The trans fat is the unhealthy fat because the hydrogen on both carbons forming the double bond lie on opposite sides of that bond, rather than on the same side, as in most natural fats. **Trans fat** is a rigid fat that can collect as clumps in your blood stream known as cholesterol. Although a healthy level of

cholesterol is needed for your body to function, a high level can build-up on the walls of the arteries, reducing blood flow to the heart, which causes the blood pressure to go up(10).

Biology

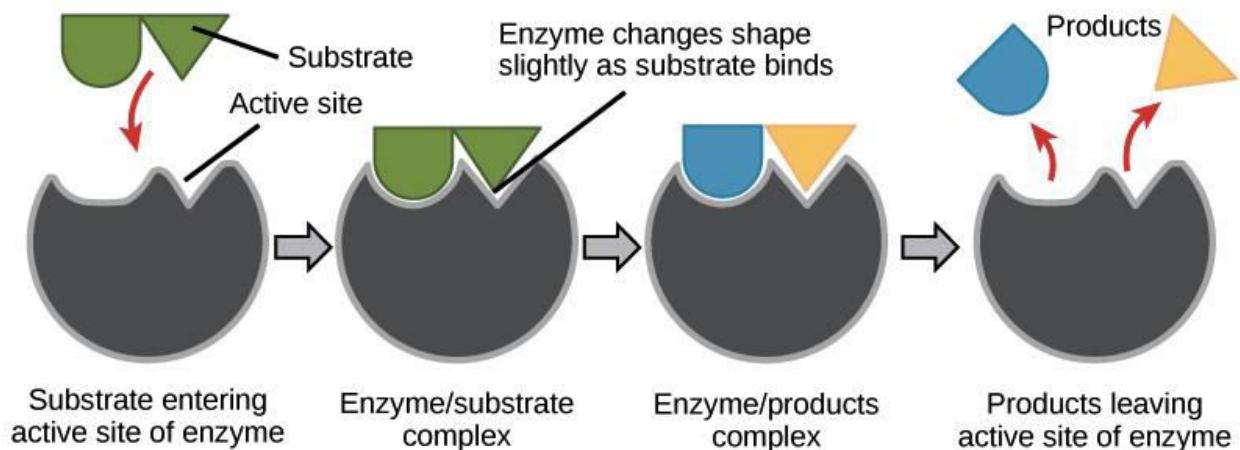
Biochemists sort **macromolecules** made up of thousands of smaller molecules into four main groups: carbohydrates, lipids, nucleic acids, and proteins. **Carbohydrates** are made up of carbon, hydrogen, and oxygen atoms usually in a ratio of 1:2:1. A monosaccharide is a single sugar molecule such as glucose and galactose. Sucrose (table sugar) is a disaccharide compound made up of glucose and fructose. Complex Carbohydrates are large macromolecules formed from monosaccharides called polysaccharides. **Glycogen** is a polysaccharide which is stored until the level of glucose in your blood runs low and then it is broken down into glucose and released into the blood . Nucleic acids are macromolecules of hydrogen, oxygen, nitrogen, carbon, and phosphorus which transmit hereditary information such as RNA and DNA (Miller, Levine,48). **Proteins** are macromolecules that contain nitrogen, carbon, hydrogen, and oxygen called amino acids which are linked together with covalent peptide bonds to form a polypeptide (48). Enzymes are proteins that speed up chemical reactions that take place in cells (52). Without the enzyme *carbonic anhydrase* in the bloodstream to speed up the reaction, carbon dioxide would build up in the body faster than the bloodstream could remove it (52).

Diabetes

The most significant factor in developing Type 2 diabetes is obesity. Type 2 diabetes can be minimized with proper diet and regular exercise. Diabetics are advised to reduce and control the amount of carbohydrates they eat. Studies have found that overweight people are much more likely to develop diabetes; however, if they lose weight in the early stages , they can greatly reduce or eliminate their diabetic symptoms. You can see the Body Mass Index Chart on this website. https://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmi_tbl.pdf

Name _____

Period _____



Terms to Define:

Enzyme

Fatty Acid

Macromolecule

Molecule

Nucleic Acid

Protein

Cholesterol

Saturated Fatty Acid

Unsaturated Fatty Acid

Glycogen

Day Seven:

Teacher Instruction:

How much salt should a person eat in one day?

The U.S. Food and Drug Administration recommends that adults consume less than 2.3 grams of salt per day. For children, The World Health Organization recommends that the recommended maximum intake of salt for adults be adjusted downward for children aged two to 15 years based on their energy requirements relative to those of adults. For instance, children who are in sports, who are outside riding bicycles, or who are in climates of extreme heat may need the 2.3 grams maximum of salt per day as adults; however, children who are sedentary should have 1.5 grams of salt a day.

Most people consume too much salt—on average 9–12 grams per day, or around three times the recommended maximum level of intake.

Salt intake of less than 2.3 grams per day for adults helps to reduce blood pressure and risk of cardiovascular disease, stroke and coronary heart attack. The principal benefit of lowering salt intake is a corresponding reduction in high blood pressure. Reducing salt intake has been identified as one of the most cost-effective measures countries can take to improve population health outcomes. Eating too much salt can raise blood pressure at any age.

Students will be divided into groups and answer this question. What are the ingredients of a bag of chips? I will give each group empty chip bags to log the ingredients and amount of salt and unsaturated fat to determine the contents, define each ingredient, and the sodium and saturated

How much salt a day is a healthy amount?

What are two causes of high blood pressure?

<http://www.bloodpressureuk.org/microsites/salt/Home/Whysaltisbad/Saltseffects#oNu6>

Go to the web site and answer the following questions:

How does salt affect the kidneys?

How does salt affect the arteries?

How does salt affect the heart?

Day Eight: What is on my plate?

Many factors influence your health. Those that are in your control is your own decisions about what you eat. You can control your intake of sugar, fat, and salt in your diet to lower your risk of hypertension and type 2 diabetes, as well as maintain a healthy body weight with exercise.

<https://www.choosemyplate.gov/MyPlatePlan>

Click on the web site above, get your my plate plan by filling out the information, write down the amount of calories you should eat a day, click on the different food groups and see what you should be eating every day.

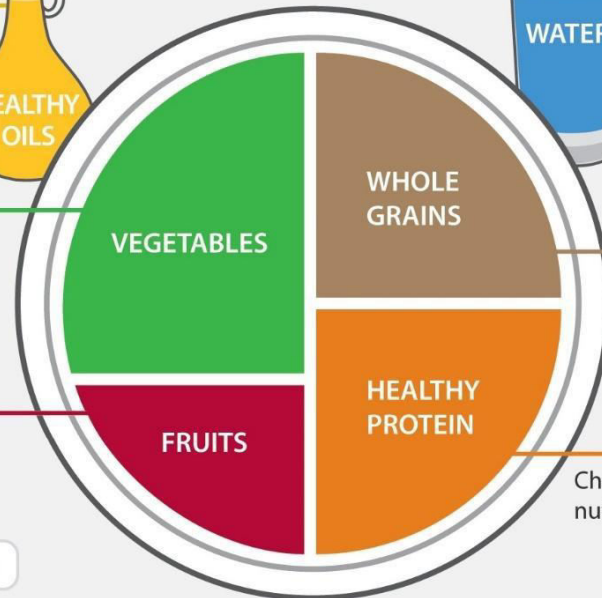
HEALTHY EATING PLATE

Use healthy oils (like olive and canola oil) for cooking, on salad, and at the table. Limit butter. Avoid trans fat.



Drink water, tea, or coffee (with little or no sugar). Limit milk/dairy (1-2 servings/day) and juice (1 small glass/day). Avoid sugary drinks.

The more veggies – and the greater the variety – the better. Potatoes and French fries don't count.



Eat a variety of whole grains (like whole-wheat bread, whole-grain pasta, and brown rice). Limit refined grains (like white rice and white bread).

Eat plenty of fruits of all colors.

Choose fish, poultry, beans, and nuts; limit red meat and cheese; avoid bacon, cold cuts, and other processed meats.



© Harvard University



Harvard T.H. Chan School of Public Health
The Nutrition Source
www.hsph.harvard.edu/nutritionsource

Harvard Medical School
Harvard Health Publications
www.health.harvard.edu



The MyPlate Plans are available below. Use only the plan that is right for you!

Ages 2-3	1,000	1,200	1,400						
Ages 4-8	1,200	1,400	1,600	1,800	2,000				
Ages 9-13	1,600	1,800	2,000	2,200	2,400	2,600	2,800	3,000	3,200
Ages 14+	1,600	1,800	2,000	2,200	2,400	2,600	2,800	3,000	3,200

<file:///E:/MyPlatePlanMenuTemplate.pdf>

Chart to fill out for the week

	Breakfast	Lunch	Dinner	Physical Activity by minutes
Monday				
Tuesday				
Wednesday				
Thursday				
Friday				
Saturday				
Sunday				

https://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmi_tbl.pdf

Are you at a healthy weight? _____

If not, are you underweight or overweight? _____ By how many pounds? _____

Are you getting enough physical activity to be healthy? _____

How many calories should you eat in one day? _____

Student Self-Assessment

These are example questions from the website.

1) What important mineral is found in all foods in the Dairy Group?

- Vitamin C
- Riboflavin
- Calcium
- Fiber



2) Which of these nutrients can you get from eating whole fruit that is not usually found in juice?

- Vitamins
- Minerals
- Fiber
- Sugar



3) Any food made from wheat, rice, oats, cornmeal, barley, or another cereal grain is in the Grains Group.

- True
- False



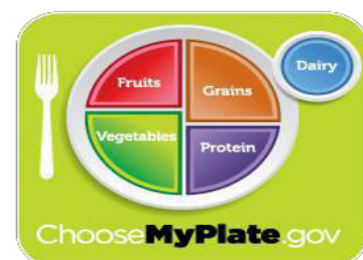
4) Most Americans get enough protein in their diets.

- True
- False



5) About how much of your plate should be fruits and vegetables?

- One quarter
- One half



- Three quarters
- All of it

Day 9 and 10

Create a poster on the topic of your choice. Be as detailed as possible. The poster must have a title, graphics, detailed coverage of the topic, organized layout of design, and correct spelling.

Day 11

There will be one more Socratic Session for closure.

Name _____

Period _____

QFocus		Categorize: O is open-ended C is closed-ended
1.		
2.		
3.		
4.		
5.		

Circle the 3 best questions

Why did you choose those questions?

Choose one open-ended and make it closed:

Choose one closed-ended and make it open:

What did you learn?

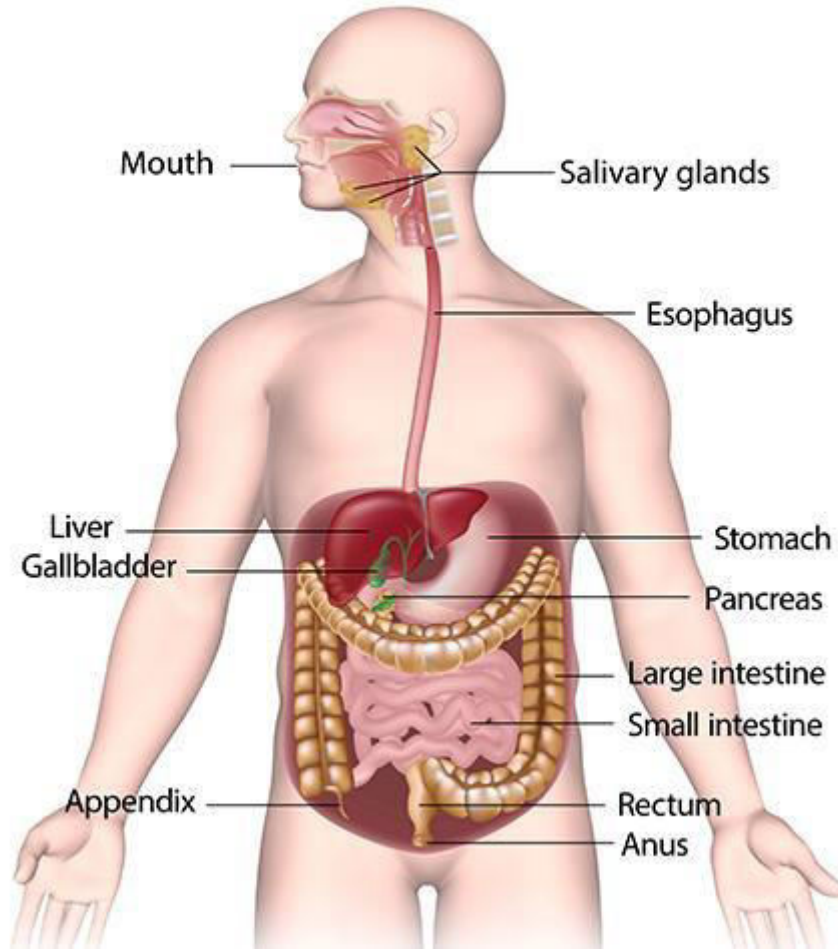
How can you use what you learned?

Rubric for Google Slide Presentation of Organ

Name					Needs Improvement-25-49 Fair-50-74 Good-75-90 Excellent-90-100
Score					
Delivery 8	<ul style="list-style-type: none"> • Holds attention of entire audience with the use of direct eye contact, seldom looking at notes. • Speaks with fluctuation in volume and inflection to maintain audience interest and emphasize key points. 	<ul style="list-style-type: none"> • Consistent use of direct eye contact with audience, but still returns to notes. • Speaks with satisfactory variation of volume and inflection. <p>6</p>	<ul style="list-style-type: none"> • Displays minimal eye contact with audience, while reading mostly from the notes. • Speaks in uneven volume with little or no inflection. <p>4</p>	<ul style="list-style-type: none"> • Holds no eye contact with audience, as entire report is read from notes • Speaks in low volume and/ or monotonous tone, which causes audience to disengage. <p>2</p>	
Content 84	Provides clear function and purpose of subject; pertinent examples, facts, and image.	Has somewhat clear purpose and subject; some examples, facts, and an image that support the subject. 63	Attempts to define purpose and subject; provides weak examples, facts, and image, which do not adequately support the subject. 42	Does not clearly define subject and purpose; provides weak or no image of subject. 21	
Organization 8	Significantly increases audience understanding and knowledge of topic.	Raises audience understanding and awareness of most points.	Raises audience understanding and knowledge of some points.	Fails to increase audience understanding of knowledge of topic. 2	

		6	4		
Points					

The Digestive System



Alignment with Standards

Diné Standard:

9-12 Diné Cultural Standards. I will develop an understanding of the Diné way of life.

Concept 1, PO 1. I will apply and practice what I have learned about self- respect and awareness.

Concept 3, PO 3. I will integrate different uses of plants.

9-12 Diné Character Building Standards. I will develop and apply critical thinking to establish relationships with the environment.

Concept 4, PO 2, I will practice my language and culture by using it to plan and teach others.

Arizona's Science Standard:

L1: Organisms are organized on a cellular basis and have a finite life span. HS.L1U1.22
Construct an explanation for how cellular division is the process by which organisms grow and maintain complex, interconnected systems. In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism.

Arizona's English Language Arts Standards – 9-10th Grade:

9-10.RI.3 Analyze how the author constructs an analysis or series of ideas or events, including the order in which the points are made, how they are introduced and developed, and the connections that are drawn between them.

9-10.RI.4 Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone.

9-10.W.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem: narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

9-10.W.6 Use technology, including the internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

9-10.W.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

- a. Apply grades 9-10 Reading standards to literature.
- b. Apply grades 9-10 Reading standards to informational text and nonfiction.

9-10.SL.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task; use appropriate eye contact, adequate volume, and clear pronunciation.

9-10.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

9-10.RI.10 By the end of the year, proficiently and independently read and comprehend informational texts and nonfiction in a text complexity range determined by qualitative and quantitative measures appropriate to grade 10.

By the end of the year, proficiently and independently read and comprehend informational texts and nonfiction in a text complexity range determined by qualitative and quantitative measures appropriate to grade 10.

I have combined ELA standards with science by using the science as a base for reading, researching, and writing. I have incorporated Diné standards within the unit by focusing on traditional foods and the understanding how they are healthier. The ultimate goal of the lesson is teaching a healthy life style for a proactive better quality of life.

Resources

Teacher Background Reading

References

Bennett, Peter, Esparza, Julian, Kidd, Eric, Kidd, Judith, Schulz, Leslie, Ravussin, Kenneth, Valencia, Mauro (2006). (29:1866–1871). Effects of Traditional and Western Environments on Prevalence of Type 2 Diabetes in Pima Indians in Mexico and the U.S. *Diabetes Care*.

Figure 2

Collene, Angela, Smith, Anne, Gordon, Wardlaw, (2013). *Contemporary Nutrition* (9th edition), New York, NY: McGraw-Hill Companies, Inc.

Healthy dietary guidelines

Dana Dabelea, MD, PHD¹, Joquetta DeGroat², Carmelita Sorrelman, RN, MPH², Martia Glass, MD³, Christopher A. Percy, MD², Charlene Avery, MD⁴, Diana Hu, MD⁵, Ralph B. D'Agostino, Jr., PHD⁶, Jennifer Beyer, MS⁶, Giuseppina Imperatore, MD⁷, Lisa Testaverde, MS¹, Georgeanna Klingensmith, MD⁸,

Richard F. Hamman, MD, DRPH¹ and for the SEARCH for Diabetes in Youth Study Group. (2009). *Diabetes Care* 2009 Mar; 32(Supplement 2): S141-S147. <https://doi.org/10.2337/dc09-S206>

A case study on diabetes in Navajo youth

Devon Mihesuah. (2016). Indigenous Health Initiatives, Frybread, and the Marketing of Nontraditional “Traditional” American Indian Foods. *Native American and Indigenous Studies*, 3(2), 45-69. doi:10.5749/natiindistudj.3.2.0045
www.jstor.org/stable/10.5749/natiindistudj.3.2.0045

Government rations become the nontraditional "traditional" food

Frisbie, Charlotte. (2018). *Food Sovereignty the Navajo Way Cooking with Tall Woman*. Albuquerque: University of New Mexico Press.

Traditional Navajo foods

Keegan, Megan.(1990) *Southwest Indian Cookbook*. 4th Edition, Sante Fe, N.M: Clear Light Publishers.

Recipes from the Navajo, Pueblo, Hopi, and Zuni

Miller, Kenneth., Levine, Joseph. (2010). *Biology*. Chandler, AZ: Pearson Education, Inc.

High School Biology text book

National Center for Health Statistics (U.S.). (2010, March). Division of Health Interview Statistics.

Figure 4

Newson, R.S., Elmadfa, I., Biro, Gy., Cheng, Y., Prakash, V., Rust, P., Barna, M., Lion, R., Meijer, G.W. (2013, December). Barriers for Progress in Salt Reduction in the General Population. An International Study. *Appetite*.(Volume 71, pp. 22-31)

An international study on the barriers of salt reduction

Phillips, John, Strozak, Victor, Wistrom, Cheryl, Zike, Dinah. (2014). *Glencoe Science Chemistry Concepts and Application*. New York, NY: Mc Graw Hill Companies, Inc.

High School Chemistry text book

Ruiz, Atenodoro Jr. MD. (2018). "Overview of the Digestive System"
<https://www.merckmanuals.com/home/digestive-disorders/biology-of-the-digestive-system>

The organs and functions of the digestive system

Tro, Nivaldo.(2014). *Chemistry A Molecular Approach*. (AP* Third Edition). Boston: Pearson Education, Inc.

High School Chemistry text book

Turner, N., & Loewen, D. (1998). The Original "Free Trade": Exchange of Botanical Products and Associated Plant Knowledge in Northwestern North America. *Anthropologica*, 40(1), 49-70. doi:10.2307/25605872

Weixel, Susanne., Wempen, Faith. (2017) *Food and Nutrition for You*. 2nd Edition. Boston: Pearson Education, Inc.

High School Nutrition text book

World Health Organization (2016) Salt Reduction 30 June 2016 Geneva

Article about salt reduction

Student Reading: Chemistry handout

Materials for Classroom Use:

Websites:

<file:///E:/MyPlatePlanMenuTemplate.pdf>

<https://my.clevelandclinic.org/health/articles/7041-the-structure-and-function-of-the-digestive-system>

<http://www.bloodpressureuk.org/microsites/salt/Home/Whysaltisbad/Saltseffects#oNu6>

<https://www.britannica.com/science/human-digestive-system/The-teeth>

<https://www.choosemyplate.gov/MyPlatePlan>

<https://www.fda.gov/food/nutrition-education-resources-materials/use-nutrition-facts-label-reduce-your-intake-sodium-your-diet>

<https://www.fireflyforest.com/flowers/category/edible-plants/>

<https://www.fs.fed.us/wildflowers/ethnobotany/food/grains.shtml>

<https://www.merckmanuals.com/home/digestive-disorders/biology-of-the-digestive-system>

<http://www.native-art-in-canada.com/wildrice.html>

<https://newsmaven.io/indiancountrytoday/archive/10-indigenous-foods-thought-to-be-european-uTmaPLGaLUa33WWgvgmSVQ/>

https://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmi_tbl.pdf

<https://www.niddk.nih.gov/health-information/digestive-diseases/digestive-system-how-it-works>

<https://www.scienceabc.com/innovation/butter-vs-margarine-healthier-choice.html>

<https://www.smithsonianmag.com/arts-culture/going-with-the-grain-161650307/>

<https://www.spanish-food.org/spanish-food-history.html>

Handouts: Can be found in the respective days.