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We Are What We Eat! The Importance of Nutritional Facts Labels and Balanced Diet in Making Healthy Food Choices

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Introduction and Rationale

I teach 10th-grade Biology at an inner-city comprehensive high school. The school is considered a neighborhood high school as it draws students not only from the surrounding neighborhoods but also from surrounding towns. We have a revolving door policy, serve a transient student population, and take in students throughout the year. This makes teaching especially challenging as students that move into the neighborhood from across the country as well as across the world are mixed with other students. The student population is culturally diverse and is at different levels of the learning process.

My high school utilizes a block schedule wherein students attend four sessions per day, each running for about 90 minutes. Students have eight classes total and any given class meets either 2 or 3 times per week. This presents challenges for teachers concerning homework and turn-around time for feedback because of long gaps between class meetings. What the block schedule does offer is a longer class period wherein lab experiments could be carried out with ease. The biology classes are predominantly designed for 10th graders. Biology is a mandatory class for all students and is a graduation requirement. This unit is designed with the 9-12th grade students in mind. This unit could be applied to students who are enrolled in Biology, Human Physiology, Public Health, and Science and Research classes.

The target audiences for this unit are the biology students. The unit was designed with the Next Generation Science Standards (NGSS) in mind[1] . The State of Connecticut adopted the NGSS in November 2015. The main objectives of these standards are to engage learners in meaningful and exciting science learning. This approach teaches K-12th -grade students to learn science in their way while collaborating with others. Some of the major features of the NGSS are incorporated in this unit. These main features include the three-dimensional learning that encompasses the science and engineering practices, using science to explain the real-world phenomenon, and lastly the engineering design. The school district recently adopted the NGSS and is currently in the process of aligning the K-12 science curricula with these standards. The absence of this information in the current curriculum is one of the main inspirations behind the development of this unit.

According to the Next Generation Science Standards (NGSS), the High School, Life Science curriculum consists of five topics: 1) Structure and Function, 2) Inheritance and Variation of Traits, 3) Matter and Energy in

Organisms and Ecosystems, 4) Interdependent Relationships in Ecosystems, and 5) Natural Selection and Evolution. This unit covers a part of the first topic, Structure, and Function. “How do the structures of organisms enable life’s functions?” This topic has tremendous potential to introduce problem-solving skills, the NGSS Science and Engineering Practices, challenge students to attain basic knowledge, and apply it to the real world. This unit will also incorporate the NGSS practices of Asking Questions and Designing Solutions, Analyzing and Interpreting Data, Obtaining Evaluating, and Communicating Information[2] . Science and Engineering Practices covered by this unit include NGSS-HS-ETS1-2: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Purpose and Motivation Behind the Study

The current 10th -grade curriculum is partially aligned with the NGSS. For example, during the first marking period, the biology curriculum expects that the students will be able to understand the basics of biochemistry, macromolecules, and their structure and function. However, the curriculum fails to expose the students to the importance of reading Nutritional Facts Labels, portion sizes, and the importance of a balanced diet. Hence this unit will provide 7-12th grade teachers opportunities to introduce the importance of these two topics as a real-life example while discussing the basics of biochemistry. This information is particularly important for the inner-city student population that the author serves. These two topics can be emphasized as the motivating factors behind the unit.

This unit has the potential to fill the gaps in the current curriculum such that students will gain solid background knowledge about biomolecules, reading Nutritional Facts labels, calculating portion sizes, and learning about the importance of a balanced diet and its role in combating illnesses such as obesity and even Type-2 Diabetes. The students in the author's 10th -grade biology class are an inspiration behind this unit. Every day students have opportunities to purchase snacks and beverages from the school store as well as from staff members who raise funds for after school programs. The snacks are normally catered to young adults' needs and often contain an array of healthy goods such as fruits and water as well as unhealthy foods such as soda and candy. The author observes that the students who are enrolled in sports at school purchased water, orange juice, and fruits whereas students who are not enrolled in sports at school purchased potato chips, beverages such as soda, and candy. The author takes this opportunity to introduce the Nutritional Facts Labels to the students. Through this process, students will understand that a 12-ounce can of Coca Cola contains 39 grams of total carbohydrates and 39 grams of added sugar. They will be able to convert the grams into teaspoons and conclude that 39 grams of sugar is equal to 7.8 teaspoons. Another truth that will be revealed during this process is that the added sugar is in the form of high fructose corn syrup which is sourced by Genetically Modified Crops (GMO).

During this unit, students can also have a conversation around the idea of, which is healthier drinking orange juice or soda and why, whether you are better off eating frosted flakes or corn flakes and why, and lastly eating nutritional snacks or junk food. The ultimate goal is for the students to design a balanced diet for themselves and understand the rationale behind it. For example, if the student is an athlete or exercises regularly, they might need more calories because they have more opportunities to burn those calories. Whereas, those students who do not participate in after school activities or do not exercise regularly, might

not have the opportunity to burn the calories that they consume. As high school could be considered as formative years in an individual's life, this unit aims to help students make good dietary choices that will positively affect their lives in adulthood. Another hope is that students might pass the knowledge that they obtained during this unit to their friends and family members and hence the potential to improve public health.

This two-week unit (5 blocks of 90-minute long periods) is designed for the students to understand the importance of Nutrition Facts Labels and how to read them. Next, the focus shifts to a balanced diet, how to achieve it, and the role it plays in maintaining good health. The unit is designed with the 10th - grade, inner-city high school students in mind. First, the students will be provided with the basic biochemistry background about the structure and function of the biological molecules: carbohydrates, proteins, lipids, and nucleic acids. Next, they will bring a Nutritional Facts Label from one of the cereals they have for breakfast, learn to read food labels and understand portion sizes. After that, they will learn how to calculate the calories and the amount of work they need to do to burn the calories they consume. The students will be recommended to download "My Fitness Pal App" on their smartphones where they can keep track of all of the foods they eat during a day as well as the types of activities they perform. This will give them ideas about how many calories they need to consume to keep up with the activities throughout the day. Lastly, they will create a model revolving around the "My Plate" concept with the main idea around the number of calories they should consume to perform activities effectively during a school day. For example, a student who plays sports after school or walks a dog, babysits, or helps around the house might need to consume enough calories to be able to perform these activities effectively.

This unit attempts to answer the following questions:

1. What are the structure and functions of biological molecules?
2. What is the importance of a Nutrition Facts Label?
3. How could students utilize the "My Plate" concept in making healthy food choices?

Content Objectives

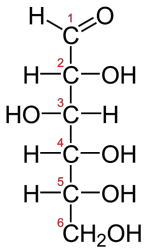
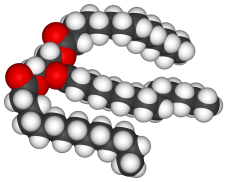
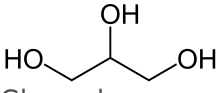
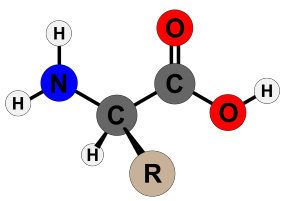
Structure and Function of Biological Molecules

The main content covered in this unit includes the Structure and Function of the biological molecules, the energy flow and the nutrients, Nutritional Facts Labels, and the My Plate concept. Proteins, nucleic acids, polysaccharides in carbohydrates are considered macromolecules, and the lipid molecules are considered as biomolecules. For clarity purposes, proteins, nucleic acids, carbohydrates, and fats will be referred to as "biological molecules" throughout the unit. The history of studying these biological molecules dates back to the early 19th century. British physician-chemist, William Prout (1785-1850) was the first to classify "foodstuffs or ingredients of life into saccharinous (carbohydrates), oleaginous (fats), and albuminous (proteins)" and urged that "a satisfactory diet should include carbohydrates, fats, protein, and water"[3] . Carl Schmidt coined the term "carbohydrates" in 1844.

Biological molecules are organic molecules that are present in living cells. They can be small or large molecules. Whereas, biomacromolecules are large molecules with a molecular weight of over a few thousand

grams per mole. Biomacromolecules are often biopolymers that are made up of hundreds and thousands of smaller molecules called monomers[4] . The word monomer comes from the Greek word *monas* meaning single and *meros* meaning part. Polymerization is a process through which monomers are joined to form polymers. This process is often a dehydration (removal of a molecule of water) process in the formation of a biopolymer such as protein. On the other hand, the process of breaking down biopolymers into monomers is often hydrolysis (breaking down), e.g. digestion of protein. The four major groups of biological molecules that are found in living organisms are carbohydrates, proteins, fats, and nucleic acids. All living beings need these molecules to survive.

Carbohydrates are compounds that are made up of elements of carbon, hydrogen, and oxygen[5] . There are different types of carbohydrates, such as monosaccharide, disaccharide, and polysaccharides were mono- di- and poly- refer to one, two, and many, respectively. Some examples of monosaccharides are glucose and fructose. A combination of two monosaccharides results in disaccharides, e.g., sucrose and maltose. Polysaccharides are chains of thousands of monosaccharides. Some examples include cellulose that is present in the grass and starch that is present in bread products and rice. Carbohydrates not only are excellent sources of energy but also function as energy storage. Plants undergo the process of photosynthesis, where they intake carbon dioxide from the air, water from the ground, convert the light energy from the Sun into chemical energy (glucose), and release oxygen into the atmosphere. Animals store energy for short-term usage in the form of glycogen, another type of polysaccharides.

Biological Molecules	Functions	Food Examples
Carbohydrates **Monomers:** Monosaccharides/Simple Sugars  Glucose	Sources of energy for cell activities, building structures. Cellulose constructing cell wall in plants.	Pasta, bread, fruits, and vegetables Simple sugars: table sugar, components of milk and fruits Complex carbohydrates: Glycogen (or animal starch) and starch and cellulose in plants
Lipids Made up of Glycerol (backbone) and Fatty Acids  Fatty acids  Glycerol	Long-term storage of energy, important parts of biological membranes and waterproof coverings	Unsaturated fats such as olive oil and corn oil, and saturated fats such as butter and lard
Proteins **Monomers:** Amino Acids 	Enzymes controlling rates of reactions and regulating cell processes, muscle development, transport substances in and out of the cells or helping to fight diseases	Beans, meats, fish, cheese, eggs, and dairy products

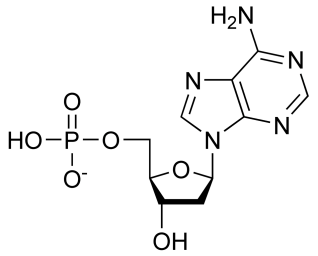
Nucleic Acids **Monomers:** Nucleotides (made up of sugar, phosphate, and a nitrogenous Base) Monomers of DNA and RNA are different  Deoxyadenosine monophosphate (dAMP)	Dictate the amino acid sequence of proteins, store and transmit hereditary or genetic information for traits	All plant and animal products

Figure 1: Biological Molecules. Downloaded from Wikipedia, Public Domain https://en.wikipedia.org

Lipids or triglycerides are biological molecules. They are hydrophobic and thus not miscible with water. They contain abundant non-polar chemical bonds and are mostly made up of elements of carbon, hydrogen, and oxygen atoms[6] . They are made up of glycerol backbone and fatty acids. The functions of lipids include long-term storage of energy. There are several types of triglyceride molecules: saturated fats, unsaturated fats, trans fats, and omega-3 fats. Saturated fats are triglycerides made of fatty acids that contain C-C single bonds. They are solids at room temperature, examples include butter and lard. Unsaturated fats are triglycerides containing fatty acids with C=C double bonds. These double bonds give a few kinks in fatty acid chains, making unsaturated fats as liquids at room temperature. Examples include vegetable oils, such as corn oil. Trans fats are harmful to health while omega-3 fats are essential to heart health. Both can be obtained in food. Phospholipids are formed when one of the fatty acids in a triglyceride fat molecule is swapped with a phosphate group. Phospholipids make up the cell membranes in living organisms. They are unique due to the hydrophilic (water-loving) heads and hydrophobic (water-fearing) tails. Thus, they are amphipathic.

Proteins are mainly made up mostly of elements of carbon, hydrogen, oxygen, and nitrogen but also contain sulfur. Some of their functions include controlling the rates of reactions, regulating cell processes, forming important cellular structures, transporting substances in or out of the cells, helping to fight diseases, forming protein hormones, etc. The monomers of proteins are called amino acids which contain an amino group on one end and a carboxylic group on the other end of the carbon atom which is bonded to a hydrogen atom and an R group. There are 20 types of natural amino acids and they differ in the R group as side chains. Hence, the side chains distinguish the characteristics of the amino acids. Some side chains make the amino acids acidic and others basic. Some side chains are polar yet others are nonpolar. Out of the 20 amino acids, human beings cannot make 9 of them and hence have to obtain them through food. The amino acids are bonded together by peptide bonds to make proteins. Proteins are complex and fold into well-defined 3-dimensional structures according to the protein sequence. Protein structures can be described at different levels: primary, secondary, tertiary, and quaternary structures.

Lastly, the nucleic acids are made up of elements of carbon, hydrogen, oxygen, nitrogen, and phosphorus. They include deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). The monomers of the nucleic acids are nucleotides, which are made up of sugar (deoxyribose in DNA and ribose in RNA), phosphate, and nitrogenous bases. The nitrogenous bases in DNA include adenine, thymine, cytosine, and guanine, and the nitrogenous bases in RNA include adenine, uracil, cytosine, and guanine. The major functions of the nucleic acids are to carry genetic information and pass it from generation to generation (from parents to offsprings). The DNA

sequence dictates the amino acid sequence of proteins. Thus, DNA stores and transmits hereditary or genetic information for traits and contains information that is important for the structure and function of the organism.

In conclusion, biological molecules include carbohydrates, lipids, proteins, and nucleic acids. These molecules have different structures and functions. They make up the food that we ingest daily. The knowledge of the elements that these molecules are composed of, examples of foods that contain these molecules, and the process through which these molecules are built and broken down, and how they contribute to the metabolism of foods and the survival of living organisms is valuable for students.

Energy and Nutrients

Allliving organisms need energy to survive. Living organisms convert chemical energy obtained from the biological molecules that they produce or consume into energy[7] . All living cells need a constant source of energy to perform work and other bodily functions, such as growth, repair, building muscles, transporting chemicals, and so forth. Different living organisms obtain this energy in different ways. Organisms, such as trees and blue-green algae that produce their food through the process of photosynthesis are called autotrophs (*auto* in Greek means self). Autotrophs or producers capture energy from the sun and absorb inorganic materials and other chemicals from the surroundings to produce organic compounds. On the other hand, heterotrophs (*hetero* in Greek means other and *troph* means feeding) are organisms that obtain energy by eating other organisms either living or dead. Heterotrophs or consumers are organisms that obtain their energy from producers or other organisms that eat producers, for example, humans that consume plants, fruits, and meat. Lastly, decomposers are organisms, such as fungi and certain bacteria, which obtain their energy from breaking down dead materials from plants and animals.

Both heterotrophs and autotrophs undergo cellular respiration, a set of chemical reactions where the organic or biological molecules that they consume are broken down to release chemical energy. As we know, the food that we consume consists of biological molecules, such as carbohydrates, proteins, lipids, and nucleic acids. During the process of digestion, the food is further broken down into simple organic compounds, for example, glucose, amino acids, fatty acids, nucleotides such that they could be absorbed. These organic compounds are then transported by the blood to every cell in the body.

The cellular respiration is a set of chemical reactions where these organic compounds are broken down in the presence (aerobic respiration) or absence (anaerobic respiration) of oxygen, resulting in the release of energy in the form of adenosine triphosphate (ATP) and waste products, such as carbon dioxide and water vapor. ATP is the energy currency for all living beings. This energy is then used for cellular work such as muscle contraction, growth, movement, etc. One needs to keep in mind that not all energy derived from food is used in its entirety. For example, one Oreo cookie contains 55 calories. When we eat an Oreo cookie, some of the energy is spent on chewing the cookie and digesting. In the end, our body might obtain fewer calories than intended. Some of the energy is lost or released to the surrounding environment as heat energy. It is helpful to note this information to understand the energy obtained from the food we consume.

In conclusion, energy flow highlights information about how different organisms obtain their energy. Producers convert light energy from the sun to chemical energy. Consumers obtain energy from producers or other consumers. Decomposers obtain energy from dead producers or consumers. The process of cellular respiration involves a set of chemical reactions where the biological molecules are converted into energy either in the presence or absence of oxygen.

The Nutrition Facts Label

The Food and Drug Administration (FDA) is a U.S. government agency that is responsible for developing policies and regulations with regards to nutrition labeling and food standards[8] . The FDA created the Nutrition Fact Labels (food labels) to educate and enlighten the consumer about the important information about the food products that they consume. According to the FDA, the main idea of introducing the Nutrition Fact Label to students is to set the stage for good nutrition and better health.

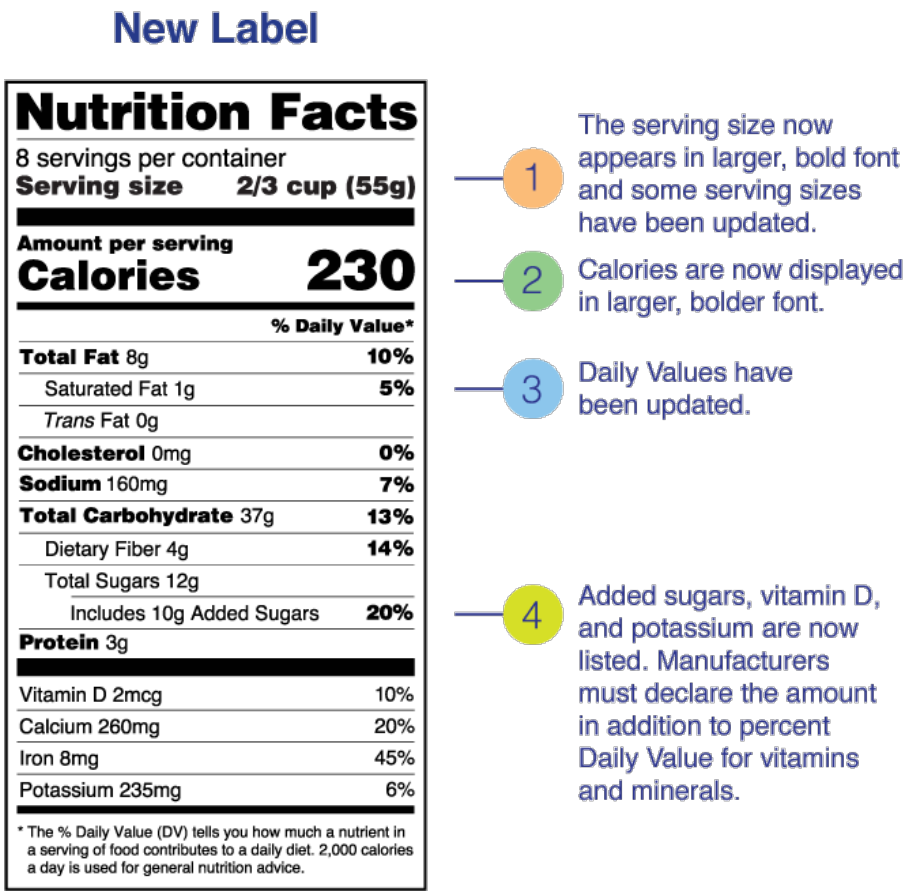


Figure-2: Highlights of the new changes made to the Nutrition Facts Labels (created by the Food and Drug Administration, Public Domain)

The New Nutrition Facts label highlights the following:

1. Serving Sizes appear in a large bolder font so that the consumers know exactly how many servings are included in the packet
2. Calories are now displayed in larger bolder fonts and ensure that the calorie needs of individuals vary according to age, sex, height, and levels of physical activity “2,000 calories a day is used as a guide for general nutrition advice”. A calorie is traditionally the unit of measure for energy. It is the amount of energy required to raise the temperature of one gram of water by one degree Celsius. The unit of measurement of food energy in kilocalories (kcal or Cal), which is equal to 1000 calories.
3. Daily values have been updated. The Percent Daily Value (%DV) shows how much a nutrient in a serving of food contributes to a total daily diet.
4. The amounts of added sugars (consuming too much-added sugars can make it hard to meet nutrient needs while staying within calorie limits), and vitamin D and potassium, which can reduce the risk of

osteoporosis and high blood pressure, respectively are included.

5. Lastly, the FDA, suggests the consumers to use the new labels to support their personal dietary needs, e.g. choosing healthier options of food, such as higher dietary fiber and lower in saturated fats that help reduce the possibility of developing certain health conditions such as high blood pressure, cardiovascular disease, osteoporosis, and anemia.

In conclusion, according to the Food and Drug Administration (FDA), The Nutrition Facts Label is an accessible tool with nutrient information to help make healthy food choices. Consumers can refer to the labels to make healthy decisions, understand the importance of good nutrition, maintain healthy lives, and avoid diseases. One of the goals of this unit is to teach students how to apply information from the food labels and make healthy food choices.

The My Plate Concept

The United States Department of Agriculture (USDA) first created a guide to food groups in 1918 [9] . We are all aware of the food guide pyramids in the early 1990s. The My Plate concept was created in 2011 with the main idea to grab consumers' attention with a new visual cue and added the word "My" to create a personalized feeling. This concept portrays a visual guide of what kinds of foods fall under different categories, such as fruits, vegetables, grains, dairy, and proteins. This concept ensures that we are consuming a balanced diet that will provide our bodies with the energy to perform work and live healthily. The My Plate concept website is interactive and caters to the needs of children, teens, young adults, college students, families, adults, and professionals. One can also have a variety of selections from the food groups (classification of food, daily amounts to be consumed, as well as the portion sizes), physical activity, meal planning, budget, shopping, recipes, and food safety. The information is also available in Spanish. My Plate concept encourages consumers to find a healthy eating style and build upon it throughout their lifetime.

By using this concept, teachers will be able to break down the menu according to several categories such as fruits, vegetables, grains, protein foods, and dairy. The students will have a visual representation of the portion sizes and amounts of each of the above-mentioned categories they are required to consume based on their age, height, weight, and activity levels. They will then have a clear idea about what they could eat for breakfast, lunch, and dinner. Once this is established, the plate could be personalized based on dietary needs, religious and cultural beliefs, and health-related issues, such as lactose-intolerant, vegan, kosher, and other meal categories. This would help K-12th grade students to understand what exactly they are required to eat and how much. The students then will have several opportunities to share this information with their friends as well as family members.

Figure 3: The My Plate Concept, created by the U.S. Department of Agriculture (USDA), Public Domain.

In conclusion, the My Plate Concept will provide the readers a visual description of the amount as well as the types of foods such as fruits, vegetables, grains, protein foods, and dairy that one needs to consume daily. This information could be further researched in the United States Department of Agriculture (USDA) website.

This website is interactive and will allow students as well as teachers to determine their My Plate meal plan. For example, a 14-year female student weighed 110 pounds at a height of 5 feet 5 inches, who performs moderate activities for 30 to 60 minutes per day, needs to consume around 2000 calories per day. Students could also obtain recipes and design their breakfast, lunch, and dinner menus for not only themselves but also their friends, family, and community. This knowledge has the potential to impact lifelong decisions concerning eating style. It is therefore pertinent to instill this knowledge to young adults.

Conclusion

The unit has the potential to teach high school students the structure and function as well as the importance of biological molecules. This unit will also emphasize the importance of reading Nutritional Facts Labels, which help students understand what exactly they are consuming. Thus, they will learn the importance of a balanced diet. Armed with the knowledge in these areas, they are encouraged to incorporate an exercise regimen that will help them make good food choices and lead a healthy lifestyle. After all, we are what we eat. This unit could be modified for middle school and elementary level students and their teachers could show the Nutritional Fact Label. The teachers can then explain what the food the students consume and what the food is made up of. Teaching students the knowledge of reading the food labels and understanding portion sizes, calories consumed, and a balanced diet are particularly important for the inner-city student population. This is the main motivation behind the development of this unit. The author would like to ensure that her students can relate to the content of this unit such that they can apply it to their daily lives and share the knowledge with their friends, and family members.

This unit was originally inspired by an observation made by the author. The author observed that several of her students were consuming too many products rich in sugar content. These students did not possess the knowledge of calorie count and did not understand the Nutritional Facts Labels. Thus, they were not aware of the concept of a balanced diet. This observation echoes with the evidence from the latest research that the epidemic of obesity is negatively affecting young adults in the U.S. and the cases of type-2 diabetes are on the rise, especially amongst the inner-city young adults. Some of these debilitating diseases can be easily preventable through a balanced diet and exercise [10] . The tough task is to educate young adults and drive home the idea of good nutrition. For example, the COVID-19 pandemic that is currently devastating the world population has forced nations across the world to go into lockdown and decreased opportunities for physical activities. Under these circumstances, knowing how to read the Nutritional Facts Labels and understanding the important role of a balanced diet could be crucial to one's health. Hence, through education, teachers will be able to empower their students to take charge of their diet as well as their health.

Teaching Strategies and Lesson Plan Structure

This unit will be taught over 2 weeks, a maximum of 5 blocks (90 minutes long periods). The unit will go hand in hand with the biochemistry unit that the 10th graders are required to learn in September, during the first marking period. This unit could be useful for teachers who teach 10th graders. It could be modified for middle

school and elementary level students. Moreover, this unit could also be used for an enrichment project for the students at any level. However, there are a couple of challenges that the 10th -grade teachers might come across during the first marking period: a) students might not be ready for to conduct individual research and complete projects and b) students are still learning the rules and routines that are common at the beginning of the school year. The author recommends the teachers to introduce this unit as an enrichment activity. They can pilot it with one class where they can make adjustments as needed and then introduce it to the other classes during the fourth marking period when the students are introduced to the human organ system.

Classroom Activities: (Five 90-minute class periods in total will be used to teach this unit)

Day 1: Identify the structure and function of the biological molecules (carbohydrates, proteins, lipids, and nucleic acids) (1 block/ 90-minute class period)

During the first 10 minutes of every class, the students will answer the "do now or warm-up" question. Students will first answer this question in their journal, then they will turn to talk to the person sitting next to them and share their answers. This activity will promote student discourse in the class.

- "Do now" question: Students will be asked to name the 4 biological molecules.

Learning Objectives: Biological molecule poster presentation (70 minutes)

By the end of the class, the students will be able to understand the structure and function of the biological molecules, take notes, work in cooperative groups, conduct internet research, create a poster, and present it to class. The teacher will be rotating through the class, ensuring the students are working on their research while clarifying misconceptions, and providing guidance.

Learning Activities (70 minutes):

By the end of the class the students will be able to accomplish the following:

- Review the biological molecule PowerPoint presentation (created by the teacher) and take notes.
- Work in cooperative groups of 4 and research the biological molecule assigned to them by the teacher.
- Gather information from the PowerPoint presentation, textbook, internet and understand the structures, functions, and examples of food that contain these molecules
- Create a poster about the biological molecule assigned to them.
- Present their posters to the class and have an opportunity to clear misunderstandings and misconceptions.
- Have an opportunity to ask questions

The last 10 minutes of every class students will fill out an exit slip. On this exit slip, they will list 3 things that they learned, 2 things that they found interesting, and 1 question they still have about the content that they learned during the class.

Materials and Teacher-developed resources needed:

Paper; color pencils, textbook, Chrome books/cell phones, internet access

Homework:

Students will download the Fitness Pal App on their phones and start keeping track of what they have been eating and drinking as well as the activities they have been performing throughout the day. They will jot this information down in their Food/Activity Journal and bring it to class.

Day 2: What's in a Nutrition Fact Label? (1 block/ 90-minute class period)

Students will answer the following "do now" question in their journals, then they will turn to talk to the person sitting next to them and share their answers.

- The "do now" question: Students will observe the Nutritional Facts Labels (Diet and Regular soda) projected on the board and guess which one was from a diet beverage and which one is a regular beverage and explain why.

Learning Objectives: The Nutrition Facts Label

By the end of the class, the students will be able to understand the importance of the Nutritional Facts Labels. They will work in cooperative groups and pay special attention to the serving size, the total amount of calories per serving, daily values of total fat, cholesterol, sodium, total carbohydrates, proteins, and added sugars, vitamin D, and potassium. They will determine which foods are healthy and which are not, and provide explanations.

Learning Activities (70 minutes):

By the end of the class the students will be able to accomplish the following:

- Review the Nutrition Facts Labels from different foods, such as cereals, canned goods, potato chips, candy, soda, fruit juice, and other items that will be placed at 6 different stations.
- Work in groups of 4
- Visit all of the stations and review the Nutritional Facts Labels
- Write down the most important information regarding the serving size, the total amount of calories per serving, daily values of total fat, cholesterol, sodium, total carbohydrates, proteins, and added sugars, vitamin D and potassium on the worksheet provided followed by a class discussion (see below for details).
- Have an open discussion during the last 30 minutes of the class about the information they collected, the position sizes, calories per serving, and other important information that they gather from their observations.
- Hypothesize which foods are healthy, which are not healthy, and why.

The last 10 minutes at the end of every class students will fill out an exit slip. On this exit slip, they will list 3 things that they learned, 2 things that they found interesting, and 1 question they still have about the content that they learned during the class.

Materials and Teacher-developed resources needed:

Computer, LCD projector, paper, and colored pencils.

Homework:

Students will continue keeping track of what they have been eating and drinking as well as the activities they have been performing throughout the day. They will jot this information down in their Food/Activity Journal and bring it to class.

Day 3: Data Analysis and Interpretation: Food/Activity Journal (1 block or a 90-minute class period)

Students will answer the following "do now" question in their journals, then they will turn to talk to the person sitting next to them and share their answers.

- The "do now" question: Students will log into the My Plate app on the United States Department of Agriculture (USDA) website, input their personal information about their age, sex, weight, height, and physical activity and calculate the number of calories that they are suggested to consume. They will jot this information down in their food/activity journal.

Learning Objectives: Data Analysis and Interpretation of the Food/Activity Journal entries:

By the end of the class, the students will be able to understand the number of calories that they are suggested to consume, work individually or in cooperative groups according to activity levels, and compare the data that they have been collecting in their food/activity journals, and analyze and interpret the data. Next, they will reflect on their findings and collect information about the types of foods that they may consume to obtain the suggested number of calories. **During this activity the teacher needs to be sensitive to their students' personal information. The teacher may need to ensure confidentiality, respecting the students' ideas about their image and diet. Hence, the students should be allowed to keep their activity/food journal entries private.

Learning Activities (70 minutes)

By the end of the class the students will be able to accomplish the following:

- Individually summarize their daily intake of calories and the number of calories spent in the past 3 days.
- Analyze and interpret the data collected in their journals either individually or in 3 activity-level groups (less than 30 minutes per day, 30-60 minutes per day, and more than 60 minutes of moderate activity levels)
- Reflect on their findings
- Utilize the USDA website and collect information about the types of foods that one need to consume to obtain the suggested amount of calories
- Create a breakfast menu for their activity levels and share their findings with the other activity-level groups.

The last 10 minutes at the end of every class students will fill out an exit slip. On this exit slip, they will list 3 things that they learned, 2 things that they found interesting, and 1 question they still have about the content that they learned during the class.

Materials and teacher-developed resources needed:

Computer, LCD projector, paper, and colored pencils, student food/activity journals.

Homework:

Students will continue keeping track of what they have been eating and drinking as well as the activities they have been performing throughout the day. They will jot this information down in their journals and bring it to class. They will utilize the new information that they obtained from the USDA site during the class activities.

Day 4: My Plate Concept /Balanced Diet (1 block or a 90-minute class period)

Students will answer the following "do now" question in their journals, then they will turn to talk to the person sitting next to them and share their answers.

- The "do now" question: Students will explain the term balanced diet.

Learning Objectives: The My Plate Concept

By the end of the class the students will be able to understand the importance of the My Plate Concept, work in 3 activity-level groups (less than 30 minutes, 30-60 minutes, and more than 60 minutes of moderate activity per day) or individually, and create a breakfast, lunch, and dinner menu for their group. The students are required to work in a cooperative group and in the process need to pay special attention to the diets of each group member.

Learning Activities (70 minutes)

By the end of the class the students will be able to accomplish the following:

- Understand the importance of the My Plate Concept
- Apply the concept and conduct individual research on the USDA website
- Work in 3 activity-level groups (less than 30 minutes, 30-60 minutes, and more than 60 minutes of moderate activity per day) or individually
- Pay special attention to the dietary requirements of their group members
- Ensure that their menus align with the meal choices, health, and personal needs of each group member, e.g., vegan, vegetarian, lactose intolerant, eats on kosher meals.
- Choose how to create their menus, either on paper or a computer

The last 10 minutes at the end of every class students will fill out an exit slip. On this exit slip, they will list 3 things that they learned, 2 things that they found interesting, and 1 question they still have about the content that they learned during the class.

Materials and Teacher-developed resources needed:

Computer, LCD projector, paper, and colored pencils.

Homework:

Students will put finishing touches to their My Plate activity.

Day 5 Culminating Activity: The Invention Convention Expo (1 block or 90-minute class period)

During the first 10 minutes of every class, the students will answer the “do now or warm-up” question. Students will first answer this question in their journal, and then they will turn to talk to the person sitting next to them and share their answers. This activity will promote student discourse in the class.

- The “do now” question: Students will write down what they had for breakfast, lunch, and supper and categorize the foods into the following groups: fruits, vegetables, grains, protein foods, and dairy.

Learning Objectives: The Invention Convention Expo

By the end of the class, the students will be able to understand the diets/menus of different student groups. These groups are based on the 3 different activity-level groups (less than 30 minutes, 30-60 minutes, and more than 60 minutes of moderate activity per day) as well as the dietary needs of the group members. Some students worked on their menus individually. The student group will display their breakfast, lunch, and dinner menus and also explain the number of calories in these menus along with the activity levels.

Learning Activities (70 minutes)

By the end of the class the students will be able to accomplish the following:

- Participate in a jigsaw (visit every station)
- Understand the similarities and differences between the diets/menus for the 3 different activity-level groups.
- Pay attention to the dietary needs of their team members
- Display their breakfast, lunch, and dinner menus
- Explain the number of calories these menus are designed to provide
- Visit all of the other stations
- Ask probing questions
- Leave positive feedback (1 thing they liked about the project and 1 way the project could be improved)

The My Plate concept projects/menus will be displayed in the classroom.

The last 10 minutes at the end of every class students will fill out an exit slip. On this exit slip, they will list 3 things that they learned, 2 things that they found interesting, and 1 question they still have about the content that they learned during the class.

Materials and teacher-developed resources needed:

Completed My Plate concept projects, post-it notes, writing utensils

Homework:

Students will reflect on the unit, write down what they learn during the unit, how they plan to apply the knowledge and skillsets that they learned to their lives.

Appendix on Implementing District Standards

Connecticut Next Generation Science Standards (NGSS-CT): A Toolkit for Local

School Boards". 2020. Portal.Ct.Gov. https://portal.ct.gov/-/media/SDE/Science/NGSS_Boards.pdf?la=en.

"HS-LS1 From Molecules To Organisms: Structures And Processes | Next Generation

Science Standards". 2020. Nextgenscience.Org. https://www.nextgenscience.org/dci-arrangement/hs-ls1-molecules-organisms-structures-and-processes

NHPS Mastery Scoring Criteria:

http://newhavenscience.org/NGSSCurriculum/NHPSScienceMasteryScoringCriteria.pdf

NSTA. “Science and Engineering Practices.” NGSS@NSTA.

https://ngss.nsta.org/PracticesFull.aspx.

Resources for students

Storyboards: https://www.storyboardthat.com/

Crash Course Biology: Carbon, so simple: https://youtu.be/QnQe0xW_JY4

Crash Course Biology: Biological Molecules: https://youtu.be/H8WJ2KENlK0

Bozeman Biology: Biological Molecules: https://youtu.be/PYH63o10iTE

Amoeba Sisters: Biomolecules: https://youtu.be/YO244P1e9QM

United States Department of Agriculture (USDA): Get Your My Plate Plan:

https://www.choosemyplate.gov/resources/MyPlatePlan

Resources for teachers

Diabetes Overview.” Diabetes Overview - Symptoms, Causes, Treatment. https://www.diabetes.org/diabetes.

“Education Series Choose MyPlate. https://choosemyplate-prod.azureedge.net/sites/default/files/tentips/DGTipsheet1ChooseMyPlate.pdf.

MyPlate Partner Title Become a MyPlate Partner!” MyPlate. https://www.choosemyplate.gov/.

NHPS Mastery Scoring
Criteria: http://newhavenscience.org/NGSSCurriculum/NHPSScienceMasteryScoringCriteria.pdf

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“Chapter 1: The Chemistry of Life” Greenberg, Jon. 2001. BSCS Biology. 8th

ed. New York: Glencoe/McGraw-Hill.

This textbook chapter has been consulted for the basic structures and functions of the biological molecules and information about the energy and nutrients.

“Chapter 2: Energy, Life, and The Biosphere” Greenberg, Jon. 2001. BSCS Biology. 8th

ed. New York: Glencoe/McGraw-Hill.

This textbook chapter has been consulted for energy and nutrients information.

“Chapter 2: Carbon Compounds” Miller, Kenneth R, and Joseph S Levine. 2010.

Biology. Boston, Massachusetts: Pearson

The biology textbook has been used to collect information about Biochemistry, biological molecules, cellular respiration, Reading the food labels, and calculating calories per serving.

“Chapter 11: Nutrition.” Fahlman, Bradley D, Kathleen Purvis-Roberts, John S Kirk,

Resa M Kelly, and Patrick L Daubenmire. 2018. Chemistry In Context: Applying Chemistry to Society. 9th ed. New York, NY: McGraw-Hill Education, 2018

This chapter was consulted for the basics of Food Labels, Structure and Function of Biological Molecules especially Carbohydrates, Proteins, and Fats

Connecticut Next Generation Science Standards (NGSS-CT): A Toolkit For Local

School Boards". 2020. Portal.Ct.Gov. https://portal.ct.gov/-/media/SDE/Science/NGSS_Boards.pdf?la=en.

This document is created as a toolkit for local school boards. It highlights the Connecticut Next Generation Science Standards (NGSS-CT)

"Diabetes Overview - Symptoms, Causes, Treatment". 2020. American Diabetes

Association. https://www.diabetes.org/diabetes.

The American Diabetes Association provides an overview of Diabetes, types of diabetes, risk, the importance

of fitness, research, and resources that help individuals.

"Education Series Choose Myplate". 2020. Choosemyplate-Prod.Azureedge.Net.

https://choosemyplateprod.azureedge.net/sites/default/files/tentips/DGTipsheet1ChooseMyPlate.pdf.

The United States Department of Agriculture website has been used to introduce My Plate concept to students, to create different recipes, and learn important information about a balanced diet at the same time.

"HS-LS1 From Molecules To Organisms: Structures And Processes | Next Generation

Science Standards". 2020. Nextgenscience.Org.
https://www.nextgenscience.org/dci-arrangement/hs-ls1-molecules-organisms-structures-and-processes

The Next GenerationScience Standards (NGSS) provide the national standards for one of the five topics that make up the Life Science Curriculum.

"Myplate | Choosemyplate". 2020. Choosemyplate.Gov. Accessed June 28.

https://www.choosemyplate.gov/.

The USDA created my plate to give a visual presentation of different types of foods that fall under different food groups, such as fruits, vegetables, grains, dairy, and proteins.

Rosenfeld, Louis. 2003. William Prout: Early 19th Century Physician-Chemist. Ebook.

49th ed. Oxford University Press (OUP) C. https://doi.org/10.1373/49.4.699.

This article highlights the life and work of the 19th-century Physician-Chemist, William Prout. William Prout was the first scientist who identified the biological molecules, carbohydrates, lipids, and proteins and their importance in our diet.

"Science and Engineering Practices". 2020. National Science Teachers Association.

https://ngss.nsta.org/PracticesFull.aspx.

This document highlights the 8 NGSS practices; Asking Questions and Defining Problems, Developing and Using Models, Planning and Carrying out Investigations, Analyzing and Investigation Data, Using Mathematical and Computational Thinking, Constructing Explanations and Designing Solutions, Engaging in Argument from Evidence, and Obtaining, Evaluating and Communicating Information.

The U.S. Food and Drug Administration (FDA). 2020. The New Nutrition Facts Label,

What's In It For You? Image.
https://www.fda.gov/food/nutrition-education-resources-materials/new-nutrition-facts-label.

The United States Food and Drug Administration (FDA) is an official website of the United States government. FDA regulates foods, drugs, biologics, medical devices, electronic products that give off radiation, cosmetics, and more. Their job is to keep the citizens informed about the above-mentioned topics.

U.S. Department of Agriculture, Center of Policy and Promotion. 2020. What's My Plate

All About? Image. Accessed June 26. https://choosemyplate-prod.azureedge.net/sites/default/files/tentips/2013-WhatsMyPlateAllAboutInfographic.pdf.

The United States Department of Agriculture provides leadership on food, agriculture, natural resources, rural development, nutrition, and related issues based on public policy, the best available science, and effective management.

Wikimedia Commons. 2005. Chemical Structure of a Nucleotide (Deoxyadenosine

Monophosphate). Image. https://commons.wikimedia.org/wiki/File:DAMP_chemical_structure.png.

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Wikimedia Commons. 2006. D-Glucose In The En: Fischer Projection. Image.

https://commons.wikimedia.org/wiki/File:D-glucose-chain-2D-Fischer.png.

This is an image of the D-glucose

Wikimedia Commons. 2006. Trimyristin-3D-View. Image.

https://commons.wikimedia.org/w/index.php?curid=1019610.

This is an image of a 3D view of Trimyistin

Wikimedia Commons. 2007. Structure of Glycerol, Skeletal Formula. Image.

https://commons.wikimedia.org/w/index.php?curid=2008348.

This is an image of a skeletal formula of the Structure of Glycerol.

Wikimedia Commons. 2020. The Structure of an Un-Ionized Amino Acid. The Group

At the Position, R Can Vary. Image. https://commons.wikimedia.org/w/index.php?curid=89198282.

This is an image of an un-ionized Amino Acid

Notes

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[1] "Connecticut Next Generation Science Standards (NGSS-CT) — A Toolkit for Local School Boards." CONNECTICUT NEXT GENERATION SCIENCE STANDARDS (NGSS-CT). Accessed June 15, 2019. https://portal.ct.gov/-/media/SDE/Science/NGSS_Boards.pdf?la=en.

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[3] Rosenfeld, Louis. 2003. William Prout: Early 19Th Century Physician-Chemist. Ebook. 49th ed. Oxford University Press (OUP) C. https://doi.org/10.1373/49.4.699.

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[6] “Chapter 1: The Chemistry of Life” Greenburg, Jon. *BSCS Biology A Molecular Approach*. 8th ed. New York, NY: Glencoe McGraw-Hill, 2001

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