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Curriculum Units by Fellows of the National Initiative
2011 Volume VII: Organs and Artificial Organs

A Recipe for Success: The Semi-sweet Pancreas

Curriculum Unit 11.07.02, published September 2011
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Overview

The human body is a fascinating entity comprised of many different organ systems that work together to allow us to function and do everyday tasks. For example, we do not have to put forth a conscious effort to make sure that we breathe or that our heart is pumping enough blood. Our bodies take care of these processes almost automatically. Collectively, as a group of people, we have learned how organs work and what causes organs to stop working in the case of illness or disease. Mankind has also discovered ways in which to create some artificial organs to replace those that have been damaged by disease or trauma.

This curriculum unit will focus on the pancreas, diabetes, and the effect of diabetes on female student self-esteem. The unit will assist me in teaching my students about the pancreas in a manner in which they can apply the knowledge to their personal lives. The unit starts with a description of the pancreas and its normal role within the body. The next section describes the differences in a diabetic pancreas as compared with a normal pancreas. The various types of diabetes are presented with a focus on Type I diabetes. The unit also addresses ways to encourage my students to prevent diabetes. Since I teach only female students, I plan to incorporate information concerning eating disorders and self-esteem conflicts in females as they relate to diabetes. Finally, the unit describes artificial pancreases that have been created. The learning experience that students will gain from this unit will enable students to live healthier lives.

Rationale

I feel that it is important for my students to learn about the pancreas and diabetes because diabetes is a rampant disease that has inflicted some of my students and their family members. Approximately 98% of my students are African American females and studies show that diabetes is a severe problem among African American women [1] . Additionally, according to the American Diabetes Association [2] some groups of individuals have a higher risk for developing Type II diabetes than others such as African Americans, Latinos, Native Americans and Asian Americans, Native Hawaiians and other Pacific Islanders.

Since diabetes decreases the life span of individuals and compromises the quality of life that individuals are able to live [3] , I feel that it is imperative that the students see the importance of their pancreas to their health and learn the function of this organ. Diabetes mellitus affects multiple organs including the pancreas [4] . Its wide-spread affects on multiple organs also contributes to the number of individuals who suffer complications and even death after developing this disease [5] . Some of the organs affected by diabetes include kidneys, limbs, eyes, and the heart [6] . Since diabetes is the seventh leading cause of death in the United States [7] , I am looking for ways to influence my students and their families to do all that they can to prevent diabetes. Planning nutritious meals and exercising regularly may be a way that my students and their family members can prevent the spread of this disease.

Students who are dealing with this disease in their personal lives may experience some conflicts of emotion that may result in low self-esteem. Studies have shown that girls with diabetes sometimes struggle with their view of themselves as a "normal" girl. This unit will provide an opportunity for students to express themselves and see that they are not alone in facing this disease or its side effects.

Ronald E. McNair Middle School

I teach in an urban middle school located east of Atlanta, Georgia. The school has little diversity based on the student population. Approximately 98% of the student body is African-American. Based on the socio-economic status of my students and their families and the number of students receiving free or reduced meal plans, McNair Middle is classified as a Title I school.

The school is divided into three separate academies based on physical hallway location and student gender. The boy's academy is located on A hall, the co-ed academy on B hall, and the girl's academy on E hall. Both male and female educators teach in each of the academies. I teach only female students in the girl's academy.

I am responsible for teaching four seventh grade classes of Life Science based on a block schedule. The science classes are arranged so that I teach two classes of science a day for 110 minutes, but I only see my students every other day. Based on this schedule, this unit will be taught at the end of the first nine weeks, during weeks eight and nine of the Cells and Body Systems domain. This time frame will give the students a total of five days to work on this unit.

Unit Course Objectives

Students in the seventh grade taking classes in Georgia's public school system must keep records of any scientific observations that they make. They use their observations to analyze any data that they collect. The students also use the observations that they have made to make models that represent systems such as cells, tissues, organs, and organ systems. The Life Science course in seventh grade is meant to provide students with a foundation upon which they can build in their high school biology classes. The purpose of the class is to

provide students with a snapshot of all of the major domains in life science such as the diversity of living organisms and the structure and function of cells and body systems.

Background Information

Pancreas

The pancreas is an important part of the human body. Some individuals refer to the pancreas as an organ, but according to Kapit, Macey, and Meisami [8] the pancreas is actually a large gland that has both an exocrine and an endocrine function. Whether you consider the pancreas to be an organ or a gland, the importance of its functions in the human body is clear.

The structure of the pancreas, its anatomy and the arrangement of the gland within the human body, is strongly correlated to the pancreas' efficient and reliable function. This gland or organ is located in the abdominal cavity directly beneath the stomach [9] . In fact, the pancreas is located deep in the abdomen – sort of hidden behind the liver.

The pancreas plays an important role in digestion, through its exocrine function. The construction of the portion of the pancreas responsible for digestion consists of several pancreatic ducts. The pancreatic duct then empties into the duodenum. As a part of the exocrine function of the pancreas, the duct cells secrete an alkaline solution, rich in sodium bicarbonate, to neutralize stomach acid. The pancreas also secretes enzymes that break down protein in food, digest carbohydrates, and digest triglycerides into fatty acids.

While the pancreas has two major functions, this unit will focus on the pancreas' endocrine function. Within the pancreas are located the islets of Langerhans. According to Corry and Shapiro [10] , the overall volume of the pancreas includes one to two per cent islets of Langerhans with all of the islets of Langerhans working together as one endocrine organ. These islets are cellular aggregates that contain the endocrine cells of the pancreas [11] , which produce three types of hormones: insulin, glucagon, and somatostatin. Four types of cells are located within islets, each secretes predominantly a specific hormone. Alpha (A) cells secrete the hormone glucagon, whereas the Beta (B) cells secrete insulin. Additionally, Delta (D) cells secrete somatostatin and the F cells (also now called the PP cells) secrete a polypeptide called the pancreatic polypeptide, which appears to function as an aid for regulation of the secretion of the other pancreatic hormones [12] .

The table below summarizes the four types of cells found in the endocrine portion of the pancreas and their predominant hormone product:

(image 11.07.012.01 is availabler in print form)

Insulin Cycle

The pancreas is necessary in the human body to maintain normal blood glucose levels [13] . One method that it uses to maintain normal blood glucose levels is to produce a protein hormone called insulin, and actively release insulin into the blood [14] . Since cells within the pancreas secrete insulin [15] they need help to move the insulin from the pancreas to other parts of the body. To aid in the distribution of insulin throughout the body, a

rich blood supply surrounds the endocrine portion of the pancreas. In a normal pancreas, the pancreas senses large and small changes in glucose levels and responds to changes in glucose level by production of specific hormones [16] such as insulin. Insulin was discovered in 1922 [17] , and in the years since scientists have determined many important functions of insulin in the human body.

Glucose presence in the blood is the major physiological stimulator for insulin production and secretion by beta cells [18] . In fact, glucose is the most important regulator of insulin gene expression in beta cells. Glucose affects gene transcription, mRNA translation, and secretion [19] . Beta cells comprise about fifty to seventy per cent of the endocrine cells in the pancreas [20] because insulin secretion is a major function of the organ [21] . The specialized beta cell is the only cell that can sense changes in blood glucose levels and respond by adjusting the insulin secretion rates [22] . Islet cells are able to produce insulin and become activated when there is glucose in the blood and deactivated when there is less glucose in the blood. The amount of insulin secreted is dependent on the glucose concentration in the body [23] .

One of the major functions of insulin is to stimulate storage of glucose in various human body cells [24] . Glucose is a small molecule that is water soluble and therefore needs special passageways to cross the lipid-rich cell membranes. These passageways are called channels or glucose transporters. Channels are similar to pores except that they are only open for specific molecules and are sometimes gated. Glucose crosses the cell membrane using facilitated transport carriers. Facilitated transport channels have two gates, one on either side of the cell membrane. In facilitated transport, both channel gates are never open at the same time, instead each gate opens only when concentrations of glucose need to reach equilibrium. During the first stage of facilitated transport the carrier is open to the cell exterior. In the second step, glucose enters from the outside and binds to the channel binding site. Next, with glucose bound to the channel, the outer gate closes and the other side of the channel opens. If the concentration of glucose is lower on the other side of the gate, then glucose leaves the channel and enters the cell and the channel closes. The glucose molecule can also move from inside the cell to outside of the cell using the same mechanism. Once inside the cell, glucose is available for use or storage. In liver and muscle cells, glucose is stored by conversion to a different molecular form, called glycogen.

The Table below, adapted from Mark Saltzman [25] , shows how insulin and glucose levels look inside of a human body that has received nutrients and a human body that has not received nutrients:

(image 11.07.012.02 is availabler in print form)

Types of Diabetes

Diabetes is a common disease among adolescents and adults in the United States. In fact, there are about 25.8 million people in the world affected with this disease [26] . In the United States, 8.3% of the population is inflicted with diabetes, this includes 215,000 people younger than 20 years old [27] . In the field of science this disease is referred to as diabetes mellitus [28] . Diabetes mellitus presents itself in two different ways – as Type I and Type II diabetes.

Although Type I diabetes presents itself most of the time in adolescents, it does not only affect young individuals. Type I diabetes mellitus accounts for five to ten per cent of all diagnosed cases of diabetes [29] . Type I diabetes patients develop this disease after they have experienced an autoimmune destruction of their insulin cells [30] . More specifically, the insulin-producing beta cells have been destroyed; therefore, the body

loses its ability to sense glucose and produce insulin in response [31] . Some individuals believe that there is a biochemical mechanism that is responsible for the onset of diabetic acidosis – the release of free fatty acids in the blood [32] . Individuals with Type I diabetes often experience excess water in urine (osmotic dieresis), excess urine production (polyuria), excessive thirst (polydipsia), muscle wasting, muscle weakness, weight loss, production of keto acids in the liver, and sugar in urine (glycosuria) [33] .

Individuals with Type II diabetes experience a lack of insulin responsiveness and/or their bodies do not produce enough insulin [34] . This type of diabetes is seen more commonly in patients over the age of forty because of the disease's association with increased body fat and obesity [35] . Insulin resistance seems to increase with an increase in patient age and weight [36] . Weight gain and the aging process are part of the reason insulin fails to be secreted, thus leading to diabetes. As patients get older, their glucose tolerance and insulin secretion declines, while insulin resistance increases [37] . Ninety percent of individuals diagnosed with Type II diabetes develop this disease due to a lifestyle disorder [38] .

Avoidance of Disease

Although the side effects of diabetes are long term [39] , the disease can be treated. Treatment for Type I diabetes patients includes a regular injection of insulin before eating, eating balanced meals, and exercise [40] . Treatment for Type II diabetes patients is similar, but the treatment plan also includes reducing body fat and the possible use of oral hypoglycemic medications [41] . Since a reduction in body fat often reduces a patient's dependence on diabetic medication, it is thought that a reduction in body fat may also prevent or put off the development of the disease [42] . If necessary, Type II diabetes patients can inject insulin into their bodies to help maintain their blood glucose levels [43] .

According to a publication written by the National Institutes of Health and the Centers for Disease Control and Prevention, both Type I and Type II patients can utilize specific meal plans to manage their diabetes. The food pyramid for a diabetic would include six or more serving of grains, beans, and starchy vegetables per day. Diabetics should also have three to five servings of vegetables and two to four servings of fruit each day. Milk, meat, and other protein sources should comprise about two to three servings per day. Food items that fall into the fat, sweets, or alcoholic categories should be avoided or consumed only on rare occasions.

Many individuals are interested in determining if they can prevent the spread of diabetes by examining different factors. The use of genetic markers has been thought to predict if an individual would develop diabetes. According to Kennedy, Idris, and Gazis [44] , genetic markers are not able to predict if an individual will or will not be susceptible to diabetes. Another factor in determining the spread of diabetes concerns breast-feeding infants. Infants who are breast-fed may be less susceptible to developing diabetes due to increased tolerance of insulin and decreased risk of excessive weight gain [45] .

Diabetes and Self-Esteem

For many young females, their image is important to the way they interact with their peers and in society. For some girls, diabetes is treated as a convention through which girls lose weight or control their current weight. In this manner, individuals can control their weight and have control over how they look or appear to others. If a girl's self-esteem is low and she is concerned about her weight, she may allow herself to lose weight drastically or misuse insulin to control or increase weight loss. According to Watkins [46] eating disorders are very common in young girls with diabetes. Girls with diabetes are tempted by their ability to lose weight while

eating freely due to the production and administration of too little insulin [47] . This temptation is especially hard to resist for girls who may be overweight.

Artificial Pancreas and Tissue Engineering

Artificial or synthetic organs are often used to replace human organs that have stopped working or been destroyed due to a disease. Cell and tissue cultures are important in the effort because they can provide for the synthesis of molecules such as insulin that are produced by beta cells. In the case of diabetes, the pancreas is not functioning properly and needs to be replaced or supplemented with cells that work. Tissue engineering provides the opportunity for the growth of a pancreas. Martin Press [48] explored the reasons surrounding the need for pancreatic transplantation. Diabetes has a high impact on communities and society; therefore, there is a lot of interest in exploring new treatment options [49] .

One of the first ways invented to artificially control insulin secretion was with the use of insulin pump therapy. The pump consists of a soluble form of insulin in a syringe that is attached to the individual's body – usually in the abdominal area [5^0] . A piece of tape usually keeps the pump in place, while the small pump is attached to a belt on the waist or a shoulder strap. Individuals who use an insulin pump are usually able to maintain an unaffected lifestyle – with the exception of extremely rigorous activities. However, patients using an insulin pump are still insulin dependent.

Pancreatic transplantation can also be used as a way to decrease the number of individuals suffering with diabetes. The first pancreas transplantation in a human was performed by Drs William D. Kelly and Richard C. Lillilei in 1966 at the University of Minnesota [51] . In fact, the pancreas became the fourth kind of organ to be successfully transplanted [52] . Whole organ transplant has been successful in some cases; however, cellular transplantation is also an option and an area of interest for scientists and medical professionals [53] . Cellular transplantation has also been shown to work with islet cells: in this case, normal pancreatic cells are infused into the body so that they can sense changes in glucose levels and produce insulin [54] .

To create a successful transplantation process for patients with diabetes, it is necessary to determine a viable way to transplant islet cells [55] . Islet cells were first discovered in the 1860s by a medical student named Paul Langerhans [56] . Currently there are about seventeen countries participating in human islet trials, nineteen of the centers conducting these trials are located in the United States [57] . Pancreatic transplantation has evolved over a period of decades. In the late 1960s to the early 1970s it was common for the whole pancreas to be transplanted, whereas, in the late 1970s to early 1980s the pancreas was transplanted mostly in segments [58] . The trend has now moved back to whole organ transplantation. Future research will focus on overcoming the current obstacles experienced in using an artificial pancreas in a human body [59] .

Unit Implementation Strategies

The delivery of the lesson plans and activities mentioned in the section below will include a variety of instructional strategies to provide learning that meets the individual needs of students. On day one of instruction I will address auditory learners by giving a lecture on the pancreas, while at the same time addressing kinesthetic learners with note taking and coloring exercises. The students will engage in a note

taking strategy that will require them to write down main details and summarize information. Both visual and kinesthetic learners will be engaged on day two of the lesson implementation with a role play activity incorporating the functions of the pancreas. Students will also be able to use the creative side of their brain to create a story in the life of a glucose molecule. On day three the students will observe a demonstration and then apply the knowledge to create their own experiment to demonstrate facilitated diffusion. Students will be conducting an experiment and writing a lab report that incorporates many of the characteristics of science such as measurement, communicating scientific information, and using models to represent real life occurrences. On days four and five the students will take the information that they have learned in the classroom and apply it to real life situations. In the culminating activity the students will be able to display all of their work from the two weeks in an effort to bring awareness to others about diabetes and raise money for continued research that will bring about a cure for diabetes.

Lesson Plans and Activities

Day One Activities

On day one of this unit students will review the standard and element that applies to this unit. Students will also review and discuss the essential question in relationship to their prior knowledge. Then students will be introduced to the pancreas as an organ in the human body that is essential to insulin and glucose regulation. The students will take notes on the structure and two functions of the pancreas – endocrine and exocrine. While the students are taking notes, we will discuss the associated vocabulary for the unit with which the students are unfamiliar (i.e. endocrine, exocrine, insulin, pancreas, glucose, etc.). The students will take notes using the following format: student name, date, and class period in the top right hand corner; the title of the lesson (i.e. Pancreas) at the top of the page in the center; notes on the left side of the page; questions on the right side of the page; and a three sentence summary of the notes at the bottom of the page. See the example below.

(image 11.07.012.03 is availabler in print form)

After the students finish taking notes, I will use the plates from the *Physiology Coloring Book* to show the students the location of the pancreas. The students will read the associated text for the coloring page and then follow the directions to color their own pancreas coloring sheet.

Day Two Activities

On day two students will be introduced to diabetes. The students will learn about the two types of diabetes (i.e. Type I and Type II). I will introduce the lesson by asking the students if they have heard of diabetes. Then, I will ask the students if they know what causes a person to develop diabetes. I will then explain the insulin cycle and show the students how insulin is produced and travels throughout the human body. I will use the plates from the *Physiology Coloring Book* to show the students the insulin cycle. The students will read the associated text for the coloring pages and then follow the direction to color in their own insulin cycle coloring sheet. To ensure that the students have a clear understanding of the function of the pancreas and the organ's relationship to diabetes the students will engage in a role play activity that is similar to charades. The students will act out the following scenes from the pancreas: destroying beta cell; a functioning and non-functioning pancreas; and the endocrine and exocrine functions of the pancreas. The students who will

represent the pancreas will wear yellow, students representing the beta cells will wear white, and the students representing glucose will wear purple. To close the lesson on day two, the students will write a short story that depicts them as a glucose molecule and tracks their journey through the human body. The students will choose to be a glucose molecule in either a person with Type I diabetes, a person with Type II diabetes, or a person without diabetes.

Day Three Activity

My students will observe a demonstration to show how glucose is able to diffuse across a cell membrane. First I will pour about 100 ml of oil into a beaker and then I will pour in 2 g of sugar into the same beaker. I will let this mixture sit for approximately five minutes. The students will be able to observe that the sugar (i.e. glucose) is not able to dissolve into the oil. This will simulate that glucose is not able to diffuse across the cell membrane because it cannot dissolve within the oily portion of the cell membrane.

The students will then design an experiment to show how glucose moves across the cell membrane through facilitated transport across a gated channel in the cell membrane. The students will use the same materials used in the demonstration with the addition of a straw. The expected procedure and outcome of the experiment is as follows: pour 200 ml of oil into a beaker, then place a straw with a sealed end in the oil and pour 2 g of sugar into the straw. This will demonstrate that glucose can move across the cell membrane with some help – facilitated diffusion. The students will conclude the experiment by documenting there results with photos and a written conclusion.

Day Four Activity

On days three and four students will develop brochures or multimedia presentations with information concerning the pancreas and diabetes prevention. The class will be divided into teams of two assigned to one of the following areas of expertise: food and nutrition or exercise and staying physically fit. The students will create a brochure about the pancreas – its location in the body, how it works, and how to keep it healthy. The brochures will also contain a picture of the pancreas – either hand drawn or from the computer. The students will include in their pamphlet healthy foods and exercise routines that will help an individual with diabetes stay as healthy as possible. Teams will be provided with books, internet access, research materials, colored paper, and other needed materials to complete the assignment. See appendix two for a rubric.

Day Five Activities

On day five students will design a menu and create a recipe that will feature ingredients that are suitable for individuals with diabetes to eat. The menu will include a beverage, appetizer, entrée, and dessert. One of the menu items will feature the recipe that the students have created. The menus and recipe products created by the students will be typed and include pictures and step by step instructions for creating the various parts of the menu. After all of the menus and recipes have been created I will bind them into a recipe book that will be used during a parent's night event. It is my hope that the students will be able to sell the books at the parent's night event with all proceeds benefiting the American Diabetes Association. If possible, this event will be held in conjunction with a Parent Teacher Student Association meeting where community members are invited to participate.

Culminating Project and Presentation

The students will culminate the *Semi-sweet Pancreas* project by getting copies of their brochures and recipe

books made and displayed in the parent center at our school. Selected students will be selected to present their multimedia presentation at a parent's night event. The parent's night event will also feature a panel of students who will discuss diabetes and the prevention of the disease. After the event parents will be invited to partake in some of the dishes represented in the students' recipe books. Parents and family members will be able to take home a copy of their chosen brochure for future reference.

Bibliography/References

American Diabetes Association (2009). Leading the fight to stop diabetes. https://donations.diabetes.org/site/Donation2?df_id=9640&9640.donation=landing&s_src=adcenterbrandkeywords&cr=helpcontinuethe&utm_source=adcenter&utm_medium=cpc&utm_term=american%20diabetes%20association&utm_content=searchforacure&utm_campaign=9640combo6americandiabetesassociation

This site provides current statistics concerning the number of people suffering with diabetes and some steps to preventing the spread of this disease.

Baum, J.D., and Kinmonth, A. L. (1985). Care of a child with diabetes.

This book discusses insulin pump therapy, the developments leading up to insulin therapy, and how the therapy affects the lives of individuals with diabetes.

Blitterswijk, C. V. *Tissue Engineering.* Boston: Academic Press, 2008.

This book describes the tissue engineering of several organs, including the pancreas.

Centers for Disease Control and Prevention. National diabetes fact sheet: national estimates and general information on diabetes and prediabetes in the United States, 2011. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2011.

This site provides current statistics concerning the number of people suffering with diabetes and some steps to preventing the spread of this disease.

Cheta, D. (2002). New insights into experimental diabetes. Editura Academiei Romane: Bucharest, Romania.

This book contains information concerning insulin therapy and its effects on patients with diabetes.

Collins, C. (2006). African American women's health and social issues. Praiger: Westport, Connecticut.

This book references the statistics surrounding the number of African-Americans, women in particular, who suffer from diabetes. The author explains some of the reasons why African-American women do not want to seek medical help when they feel symptomatic.

Corry, R., Shapiro, R. (2007). Pancreatic transplantation. Informa Healthcare: New York, New York.

In this book the authors describe the biology and physiology of islet cells.

Hakim, N., Stratta, R., Gray, D. (2002). Pancreas and islet transplantation. University Press: Oxford, United Kingdom.

The authors of this book discuss ways in which pancreas and islet transplantation may be advantageous for patients with diabetes.

Hakim, N., Stratta, R., Gray, D., Friend, P. and Colman, A. (2010). Pancreas, islet, and stem cell transplantation for diabetes. Oxford University Press 2010.

This book is provides information concerning the pancreas, islet cells, and stem cell transplantation as they relate to diabetes.

Kapit, W., Macey, R. I., & Meisami, E. *The Physiology Coloring Book.* California: Addison Wesley Longman, 2000.

This physiology coloring book allows individuals to be hands-on in their discovery of how the human body works with coloring activities and written explanations.

Kennedy, L., Idris, I., Gazis, A. (2006). Problem solving in diabetes. Clinical Publishing: Oxford, United Kingdom.

This book gave insight into the prevention of Type I and Type II diabetes in patients of all ages.

National Institutes of Health and Centers for Disease Control and Prevention (2004). Recipe and meal planner guide.

This book provided information concerning the number of servings from the food pyramid that diabetic individuals should have daily.

Saltzman, W. M. *Tissue Engineering: Principles for the Design of Replacement Organs and Tissues.* New York: Oxford University Press, 2004.

The author explains the way in which tissue engineering works in the pancreas. The author also describes how artificial islet cells can be manufactured.

Santin, M. *Strategies in Regenerative Medicine: Integrating Biology with Materials Design.* New York: Springer.

This book describes the biology and pathology of the pancreas. Additionally, the book describes tissue engineering in relationship to the pancreas.

U.S. Department of Health, Education, and Welfare (1977). Psychosomatic diabetic children and their families. Dhew publication.

This pamphlet explained some of the psychological difficulties that individual, especially young people, go through when dealing with diabetes.

Watkins, P., Amiel, S., Howell, S., Turner, and E. (2003). Diabetes and its management. Blackwell Publishing.

This book describes the social problems that children may encounter when dealing with diabetes. Information concerning girls and their self-esteem as it relates to diabetes is also discussed.

Teacher Reading List

Centers for Disease Control and Prevention. National diabetes fact sheet: national estimates and general information on diabetes and prediabetes in the United States, 2011. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2011.

Kapit, W., Macey, R. I., & Meisami, E. *The Physiology Coloring Book.* California: Addison Wesley Longman, 2000.

Student Reading and Resource List

American Dietetic Association. www.eatright.org

American Association of Diabetes Educators. www.diabeteseducator.org

American Diabetes Association www.diabetes.org/wizdom

CDC's Nutrition and Physical Activity website for healthy eating tips and

the Kids Walk to School Program www.cdc.gov/nccdphp/dnpa/publicat.htm

Free recipes for diabetics

http://freerecipes.diabeticconnect.com/?vendor_hash=74920f99a9f91c47120399aef5427c224c3ca3c312393&provider_code=cirrusNMS&affiliate_id=american%20diabetes%20association

The Dietary Guidelines for Americans http://www.health.gov/dietaryguidelines/

dga2005/document/

My Pyramid Plan http://www.mypyramid.gov/

Appendix 1

Georgia Characteristics of Science Standards *S7CS9.*

Students will investigate the features of the process of scientific inquiry. Students will apply the following to inquiry learning practices:

a. Investigations are conducted for different reasons, which include exploring new phenomena, confirming previous results, testing how well a theory predicts, and comparing competing theories.

b. Scientific investigations usually involve collecting evidence, reasoning, devising hypotheses, and formulating explanations to make sense of collected evidence.

c. Scientific experiments investigate the effect of one variable on another. All other variables are kept constant.

d. Scientists often collaborate to design research. To prevent this bias, scientists conduct independent studies of the same questions.

e. Accurate record keeping, data sharing, and replication of results are essential for maintaining an investigator's credibility with other scientists and society.

f. Scientists use technology and mathematics to enhance the process of scientific inquiry.

g. The ethics of science require that special care must be taken and used for human subjects and animals in scientific research. Scientists must adhere to the appropriate rules and guidelines when conducting research.

S7CS10.

Students will enhance reading in all curriculum areas by:

a. Reading in All Curriculum Areas

• Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas

• Read both informational and fictional texts in a variety of genres and modes of discourse

• Read technical texts related to various subject areas

b. Discussing books

• Discuss messages and themes from books in all subject areas.

• Respond to a variety of texts in multiple modes of discourse.

• Relate messages and themes from one subject area to messages and themes in another area.

• Evaluate the merit of texts in every subject discipline.

• Examine author's purpose in writing.

• Recognize the features of disciplinary texts.

c. Building vocabulary knowledge

• Demonstrate an understanding of contextual vocabulary in various subjects.

• Use content vocabulary in writing and speaking.

• Explore understanding of new words found in subject area texts.

d. Establishing context

• Explore life experiences related to subject area content.

• Discuss in both writing and speaking how certain words are subject area related.

• Determine strategies for finding content and contextual meaning for unknown words.

Georgia Life Science Standards

S7L2.

Students will describe the structure and function of cells, tissues, organs, and organ systems.

a. Explain that cells take in nutrients in order to grow and divide and to make needed materials.

b. Relate cell structures (cell membrane, nucleus, cytoplasm, chloroplasts, mitochondria) to basic cell functions.

c. Explain that cells are organized into tissues, tissues into organs, organs into systems, and systems into organisms.

d. Explain that tissues, organs, and organ systems serve the needs cells have for oxygen, food, and waste removal.

e. Explain the purpose of the major organ systems in the human body (i.e., digestion, respiration, reproduction, circulation, excretion, movement, control, and coordination, and for protection from disease).

Appendix 2

Rubric for Brochure or Multimedia Presentation

Exceeding the Requirement for the Task	Meeting the Requirement for the Task	Approaching the Requirement for the Task
The student clearly explained the purpose of a major organ in the human body by creating a brochure with all of the following components: a title; the organ's location in the body; how the organ works; and how to keep the organ healthy.	The student explained the purpose of a major organ in the human body by creating a brochure with some of the following components: a title; the organ's location in the body; how the organ works; and how to keep the organ healthy.	The student attempted to explain the purpose of a major organ in the human body by creating a brochure with one or two of the following components: a title; the organ's location in the body; how the organ works; and how to keep the organ healthy.

Endnotes

1. 1 Collins, C. (2006). African American women's health and social issues.
2. 2 American Diabetes Association (2009). Leading the fight to stop diabetes.
3. 3 Hakim, N., Stratta, R., Gray, D. (2002). Pancreas and islet transplantation.
4. 4 Corry, R., Shapiro, R. (2007). Pancreatic transplantation.
5. 5 Ibid
6. 6 Centers for Disease Control and Prevention (2011). National diabetes fact sheet: national estimates and general information on diabetes and prediabetes in the United States.
7. 7 Ibid
8. 8 Kapit, W., Macey, R. I., & Meisami, E. (2000). The Physiology Coloring Book.
9. 9 Ibid
10. 10 Corry, R., Shapiro, R. (2007). Pancreatic transplantation.
11. 11 Kapit, W., Macey, R. I., & Meisami, E. (2000). The Physiology Coloring Book.
12. 12 Ibid
13. 13 Saltzman, W. M. (2004). Tissue Engineering: Principles for the Design of Replacement Organs and Tissues.

14. 14 Ibid
15. 15 Ibid
16. 16 Ibid
17. 17 Corry, R., Shapiro, R. (2007). Pancreatic transplantation.
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