Lesson Plan

EUP ISD Workshop June 27-29, 2011

The Science of Slavery: Real Life Application

Lesson Overview:

The purpose of this lesson is to allow students to analyze the health of slaves based on diet and living conditions by applying their background knowledge of the molecular compounds found in foods and the human body's nutritional requirements.

Objectives:

Students will:

- have an increased understanding of cell functions as they pertain to growth and development in the historical context of the conditions related to slavery.
- be able to analyze diet and consider their effect on the health of slaves.

Science Standards:

Inquiry Process

S.IP.07.11 Generate scientific questions based on observations, investigations, and research.
S.IP.07.12 Design and conduct scientific investigations.
S.IP.07.13 Use tools and equipment (spring scales, stop watches, meter sticks and tapes, models, hand lens, thermometer, models, sieves, microscopes, hot plates, pH meters) appropriate to scientific investigations.
S.IP.07.14 Use metric measurement devices in an investigation.
S.IP.07.15 Construct charts and graphs from data and observations.
S.IP.07.16 Identify patterns in data.

Organization of Living Things

L.OL.07.61L.OL.07.61 Recognize the need for light to provide energy for the production of carbohydrates, proteins and fats.
L.OL.07.62 Explain that carbon dioxide and water are used to produce carbohydrates, proteins, and fats.
L.OL.07.63 Describe evidence that plants make, use and store food.
L.OL.07.32 Examine how through cell division, cells can become specialized for specific functions.

Time Required: 1-2 weeks

Recommended Grade Level(s): 6-12

Topic(s): Science, Health, Nutrition, Social Studies, ELA, Math

Era: 1600's-1800's

Preparation:

Materials:

bread
potatoes
rice
noodles
beans
plantains
test tubes

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Biuret
Sudan III solution
Iodine
Benedict's solution
sweet potatoes

Analyzing Maps Worksheet
Analyzing Photographs and Prints Worksheets

Resources:

Slaves and the Courts, 1740-1860: Persuasive Writing (LOC)
Teacher's Guide: Analyzing Maps (LOC)
Teacher's Guide: Analyzing Photographs and Prints (LOC)
A Slave Ship Speaks: The Wreck of the Henrietta Marie (outside website)

Image	Description	Citation	URL
	Slave-brokers Fitzgerrald and Robertson sold the thirty-one year-old Peter, a former slave of the late Nathen Farris, to Jonathan Forbis of Lincoln County, Kentucky for 115 pounds with a guarantee that both his mind and body were sound.	Digital ID icufaw bmc0187	http://memory.loc.gov/cgi-bin/query/r?ammem/fawbib:@field(DOCID+@lit(bmc0187)
	Describes the age, abilities and condition of each slave for sale.	Advertising Ephemera Collection - Database #A0160 Emergence of Advertising On-Line Project John W. Hartman Center for Sales, Advertising & Marketing History Duke University Rare Book, Manuscript, and Special Collections Library	http://scriptorium.lib.duke.edu/eaa/broadsides/B03/B0317/B0317-72dpi.html
	Map showing the distribution of the slave population of the southern states of the United States. Compiled from the census of 1860 Drawn by E. Hergesheimer. Engr. by Th. Leonhardt.	(Copy 1) g3861e cw0013200 http://hdl.loc.gov/loc.gmd/g3861e.cw0013200	http://memory.loc.gov/cgi-bin/query/r?ammem/gmd:@field(NUMBER+@band(g3861e+cw0013200))

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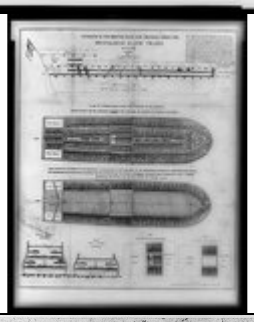
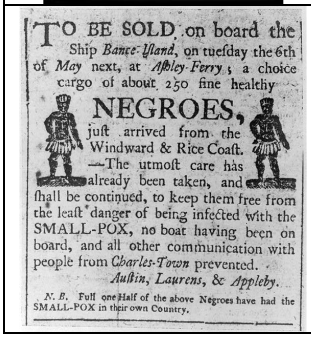
	Reproduction of a broadside from 1860	Prints and Photographs Online Catalog - $100 Reward! Ranaway from [...] Ripley County, Mo., [...] 1860, a Negro Man [...	http://www.loc.gov/pictures/item/98504563/
	Illustration showing deck plans and cross sections of British slave ship Brookes.	Prints and Photographs Online Catalog - Stowage of the British slave ship Brookes under the regulated slave trade act of 1788	http://www.loc.gov/pictures/item/98504459/
	Photograph of newspaper advertisement from the 1780s(?) for the sale of slaves at Ashley Ferry outside of Charleston, South Carolina.	Reproduction number LC-USZ62-10293 DLC (b&w film copy neg.) Digital ID cph 3a52072	http://www.loc.gov/pictures/item/98503865/

Procedure:

Background

Estimates on the total number of Africans who were forced to undergo the Middle Passage generally range from 9 to 15 million. Out of this number, some 3 to 5 million perished before they even reached the Americas. Slaves captured or purchased in the African interior were often held in confinement for months before they finally arrived at the coast. Some of these people had been wounded in battles, and others were exposed to smallpox, yellow fever, and other deadly diseases.

The mortality rate during the Middle Passage was high for slaves and crew alike, averaging between 13 and 33 percent. The likelihood of contagion, however was strongest for the Africans. Common hazards of the voyage, stemmed from no other source than poor diet and close confinement, included scurvy and gangrene. Dehydration, caused by lack of drinking water and high loss of bodily fluids from fevers or dysentery, was a primary killer aboard the slaving vessels.

Symptoms included melancholy and a loss of appetite but were not understood by early ship's physicians, and often went untreated until too late. In addition, contaminated water supplies produced a variety of gastrointestinal disorders which increased fatalities.

Activity 1: What Are Organic Compounds?

Have students observe the 1860 map of Slave Distribution in the Southern United States. Based on prior knowledge, have students brainstorm crops and plants that would most likely grow in the areas specified on the

map. Students should connect their knowledge of biomes, climate, and geography to the vegetation identified with the region on the map.

Almost all of the food we eat comes from plants and animals. Plants and animals contain mainly water and organic compounds, which are molecules made by living organisms such as plants or animals. The table below lists the most common types of organic compounds found in living organisms. For each type of organic compound, give one or two examples and describe one characteristic.

Students will follow the procedures on the *Organic Compounds in Staple Foods Lab* (attached below). Students will test staple foods previously identified from various regions on the transatlantic slave trade route. (Examples: yams, wheat, corn, cassava, potatoes, peanuts, breadfruit, etc.) After completing the lab, have students apply their data and observations of macromolecules and their relationship to various foods to the diet commonly fed slaves on ships.

Activity 2: Graphing Nutrients

Use the nutrient content of foods as found on RDA labels, most often eaten at the time of the Transatlantic Slave Trade to complete the following task.

Students can draw graphs, for example of the amount of energy in kilojoules, protein, carbohydrates, fats and fiber each food has per 100g.

Students will use their graphs to answer the following questions:
- Which food gives the most energy per 100g?
- Which food has the least protein per 100g?
- Which food has the least carbohydrate per 100g?
- Which food has the most fat per 100g?
- For the foods that give most energy, what is the main source of that energy – protein, carbohydrate or fat?

Activity 3: Calculating Malnutrition

Use the RDA tables for calories and seven other main nutrients: protein, carbohydrate, sugars, fat, saturates (saturated fat), fibre and salt, for women, men and children.

1.) If an enslaved African was given approximately 200g of salt fish and 750g of corn a day, how much energy would they get?
2.) What would be missing in their diet?
3.) How much breadfruit would you need to eat to get your RDA of carbohydrates for a day?
4.) How much protein would this give you?

Activity 4: Making Inferences Using Primary Sources

1.) Observe the primary source advertising a reward for a runaway slave. Based on your findings of monetary equivalencies, what can you infer about the health condition of the runaway slave based on the value of the reward?
2.) Read the primary source, "Bill of Sale for Peter". How much was he sold for? What is the present day U.S. dollar equivalency? What can you infer about the health condition of Peter based on the bill of sale?

Extension Activities:

- *Math Connection* – Have students convert pounds to U.S. dollar amounts in determining the value of a slave during the time of slavery compared with today's currency value.

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- *ELA Connection* – Copper Sun (YA novel)
- *Health*- Students can find out the nutritional values of their foods such as burgers or pizzas by looking at the food labels and plot their values. They could also carry out a complete nutritional analysis of a typical meal they eat at home. How does it compare to the range of foods in the diet of an enslaved African?

Evaluation:

Formative Assessment: Making Inferences

"One enslaved African told a free black in Charleston about the food eaten on the slave ship that brought him to America, "We had nothing to eat but yams, which were thrown amongst us at random - and of those we had scarcely enough to support life. More than a third of us died on the passage, and when we arrived at Charleston, I was not able to stand."

Based on this information, infer a diagnosis of the slave's physical condition upon reaching America. Apply your knowledge of organic compounds and the foods in which they are found to the causes of common diseases among slaves. You will need to design an experiment to support your inference/hypothesis.

Organic Compounds in Food Data Table

Food	Carbohydrate Test				Protein Test		Lipid Test
	Test strip color	Glucose present	Iodine test color	Starch present	Biuret test color	Protein present	Lipid present

Lipid Test

1. Obtain five test tubes. Label each one with a different staple food solution.
2. Use a graduated cylinder to transfer 5 mL of distilled water into the test tube labeled "distilled water."
3. Repeat step 2 with each of the food substances. (Each test tube should have only one food item in it.)
4. Add 5 drops of Sudan III stain to each test tube.

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5. *Gently* shake the contents of each test tube. **CAUTION**: Use extreme care when handling Sudan III to avoid staining hands or clothing.
6. Sudan III will dissolve in lipids and stain them red. In the Data Table, write a "+" if lipids are present or a "-" if lipids are not present.
7. Wash the test tubes thoroughly. Move on to Procedure Part II.

Protein Test
1. Obtain five test tubes. Label each one of the following: distilled water, cooking oil, apple juice, gelatin solution, potato solution.
2. Use a graduated cylinder to transfer 5 mL of distilled water into the test tube labeled "distilled water."
3. Repeat step 2 with each of the food substances. (Each test tube should have only one food item in it.)
4. Add 5 drops of Biuret Reagent to each test tube.
5. *Gently* shake the contents of each test tube. **CAUTION:** Biuret Reagent contains a strong base. If you splash any on yourself wash it off immediately with water.
6. Biuret Reagent changes color from blue to violet in the presence of protein. In the Data Table, write a "+" if protein is present or a "-" if protein is not present.
7. Wash the test tubes thoroughly. Move on to Procedure Part II.

Simple Carbohydrate Test
1. Obtain five test tubes. Label each one of the following: distilled water, cooking oil, apple juice, gelatin solution, potato solution.
2. Use a graduated cylinder to transfer 5 mL of distilled water into the test tube labeled "distilled water."
3. Repeat step 2 with each of the food substances. (Each test tube should have only one food item in it.)
4. Add 10 drops of Benedict's Solution to each test tube.
5. *Gently* shake the contents of each test tube.
6. Place the test tubes in the hot water bath for 3-5 minutes. Remove the test tubes using test tube holders.
7. A rusty brown color in response to Benedict's Solution indicates a large amount of simple sugars. An orange color indicates a moderate amount and a green or yellow color indicates a small amount of sugar. A blue color indicates no sugar present. In the Data Table, write a "+" if simple carbohydrates are present or a "-" if simple carbohydrates are not present.
8. Allow the test tubes to cool and then wash them thoroughly. Move on to Procedure Part II.

Complex Carbohydrate Test
1. Obtain five test tubes. Label each one of the following: distilled water, cooking oil, apple juice, gelatin solution, potato solution.
2. Use a graduated cylinder to transfer 5 mL of distilled water into the test tube labeled "distilled water."

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3. Repeat step 2 with each of the food substances. (Each test tube should have only one food item in it.)
4. Add 5 drops of Iodine to each test tube.
5. *Gently* shake the contents of each test tube.
6. Iodine causes complex carbohydrates to turn dark blue or black. Substances without starch are colored brown by the iodine, but do not react with it. In the Data Table, write a "+" if complex carbohydrates are present or a "-" if complex carbohydrates are not present.
7. Wash the test tubes thoroughly. Move on to Procedure Part II.

Procedure Part II
1. Share your results with the team members at your lab table. Your data table should now be complete for a variety of staple foods from around the world.
2. Obtain an unknown substance from your teacher. Your teacher will tell you what the substance is. Using background knowledge, form a hypothesis that will state what macromolecules will be present in your unknown substance. Record your hypothesis on the answer sheet.
3. Perform the test you completed in Procedure Part I with your unknown substance. Use the same procedure, but only use the unknown substance. Record your data in the Data Table.
4. Once all groups at the lab table have completed the tests with the unknown substance, share your data.
5. Choose one member of the lab table to record all of the unknown data on the board. Record the data from the other two unknowns (on the board) in your Data Table.
6. Double check to make sure your station is clean and organized; then answer the analysis questions.

Analyze and Conclude: Answer the following questions using complete sentences. Be thorough in your responses, using lab data when applicable

1. You are preparing both captives and sailors for their journey across the Atlantic. Using your data and your understanding of nutrition, which of the unknown substances would provide the best fuel to endure this long adventure? Explain.
2. Do the sugars in cassava need to be broken down by your digestive system before they can be utilized as an energy source for your body? Explain.
3. Slaves afflicted with Pellagra commonly had diets primarily based on maize (corn). How could your observations in this investigation help you decide if there are any other foods that should be avoided by those suffering from Pellagra?
4. What conclusion could you make if a positive test for any of the macromolecules occurred in the test tube containing only distilled water?
5. A very thin slice is removed from a peanut and treated with Sudan III stain. Then a drop of Biuret Reagent is added to the peanut slice. When you examine the peanut slice under a microscope, patches of red and blue-violet are visible. What conclusions can you draw from your examination?

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