NSBRI TAP Classroom Activity

Title: **THE FOOD PYRAMID IN SPACE**

Grade Level: 5-8

Content Area: Science, Health and Technology

National Science Content Standards:
Standard F. Science in Personal and Social Perspectives
- Personal health (Grades 5-8 & 9-12)
- Science and technology in society (Grades 5-8 & 9-12)

Behavioral Objectives:
- The student will use scientific inquiry methods and construct simple charts to organize, examine, and evaluate information during field and laboratory investigations.
- The student will explore ways to enhance and maintain personal health throughout their life span and will apply information from the Food Pyramid to making healthy food choices.
- The student will use a variety of resources, such as the Internet, to acquire information.

Lesson Objective:
- In this lesson, students learn about the Food Pyramid as a structure to use when planning a healthy diet. Students will gain new insight into the importance of nutrition during long duration spaceflight.

Time:
- Five 45 minute class periods; Three 90 minute block period
  *Note: Research will take approximately three 45 minute class periods.

Materials:
1. Space Shuttle Food List found at http://www.space.com/teachspace/module_astronaut_0900/dining_foodlist_0900.html
2. Food Diary Data Sheet (provided with lesson)
3. Computer with Internet access

This lesson was developed by participants and staff of the Teacher Academy Project at Texas A&M University with support from the National Space Biomedical Research Institute through NASA NCC 9-58.

Procedure:

1. Keep a record of your food consumption for a week. Use the food pyramid to analyze your diet. You may also go to the URL: http://www.pueblo.gsa.gov/cic_text/food/food-pyramid/main.htm for additional information on what constitutes a serving along with food examples.

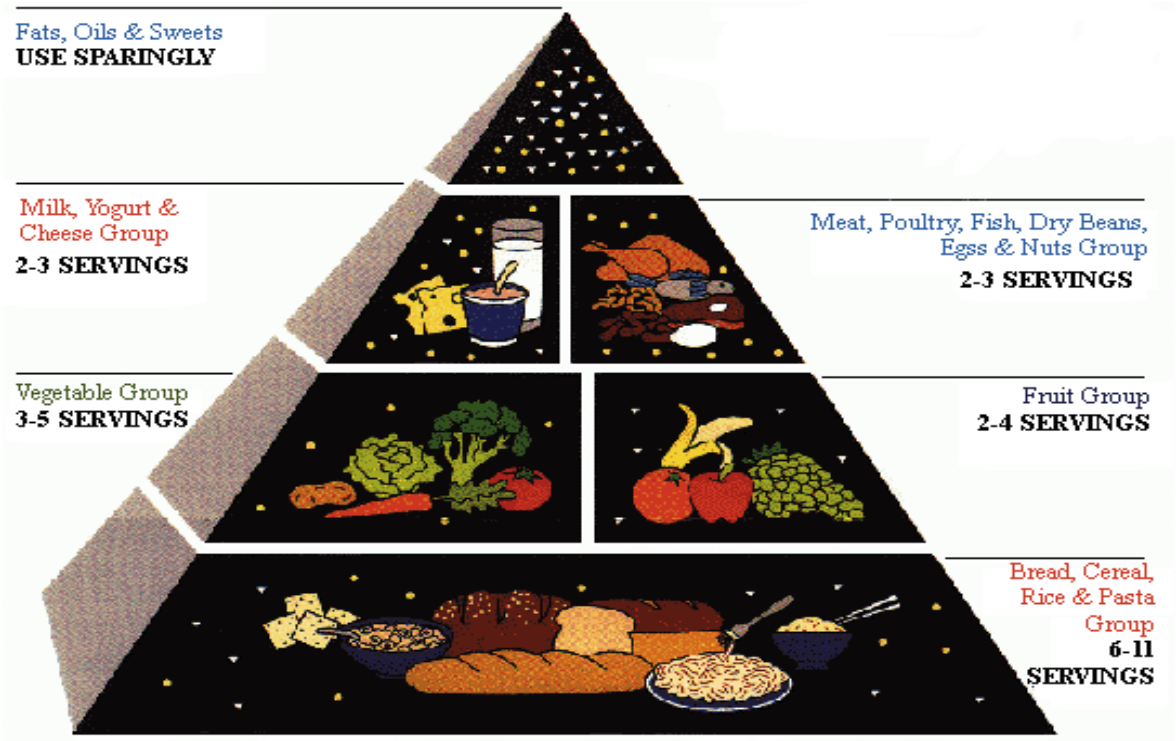
2. You will record your daily food and beverage intake on the data sheet provided. Write down everything you eat and drink. You will use one data sheet per day. Include milk in cereal or cheese or lettuce on a hamburger, or different parts on a pizza.

3. Record the serving size. How much do you put on your plate? This may be estimated.

4. Compare your serving size to the Pyramid serving size. Put the number of servings for each food group you need in the chart

5. Prepare a balanced meal plan for an astronaut (you can find Astronaut Biographies at http://www.jsc.nasa.gov/Bios/) based on what you know about the food pyramid and the Space Shuttle Food List.

USDA Food Pyramid
Daily Consumption



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Food Diary Data Sheet

		Serving Size	Pyramid Serving Size
Date:	Breakfast		
	Lunch		
	Dinner		
	Snack		

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Extension:

- Using the Internet, go to http://www.space.com/teachspace/module_astronaut_0900/m_lesson_index_0900.html and choose Lesson 2 Dining in Space from the top of the page. Print off the entire lesson from the option on the top right hand side of the page. Find out what the astronauts are actually eating from the website
- http://spaceflight.nasa.gov/shuttle/reference/factsheets/food.html Each student chooses a crewmember, makes a log/chart of his /her menu and then evaluates their diet with the food pyramid in mind.
- Assign each student a fictional astronaut/person with different attributes (i.e. allergic to wheat, female, especially likes spicy foods, etc.). Design a day's meal plan for that astronaut.

Resources:
www.space.com/teachspace/ - Lesson 2 Dining in Space from the top of the page

www.spacekids.com/spacenews/menus_000218.html - "What's for Dinner?" - Astronaut's Menus

www.spacekids.com/spacenews/ - Breakfast to Go, link to Food: The Final Frontier and then link to "What's for Dinner?"

http://www.nal.usda.gov:8001/py/pmap.htm - Food Pyramid

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Background Information:

*Note: The background information should be used as introductory material to heighten student awareness to the importance of diet. It can be assigned as additional reading or taught as a separate lesson for younger students.

Imagine you are floating 300 miles above your home, enjoying the view as you squeeze dinner out of a tube. Sound tasty? That was dinner for a Mercury astronaut over 40 years ago. In the days of John Glenn and other Mercury astronauts (circa 1962) had to chew on bite-sized food-cubes covered with gelatin to prevent crumbs. In space, crumbs are dangerous because they don't fall to the floor. They float and can get into and damage equipment. Nowadays they heat their food in ovens before eating their meals with knives and forks, and the food has gotten a LOT better.

The Gemini crews of (1964 – 1966) got a bit of the high life eating shrimp cocktail and butterscotch pudding. Plus, they were the first to be able to choose their own menus. And Apollo crews (1967 – 1972) received even more choices -- they ate hot dogs. Today the astronauts eat food prepared here on Earth. In fact, it's food anyone could buy in grocery stores around the world. On their menu is chicken teriyaki and, since they can't eat bread that has crumbs, their favorite bread is flour tortillas.

Eating well during space flight is a challenge – but it also is for those of us on Earth. Children in the United States do not always eat a balanced a diet. Like many Americans, their daily menus are often too high in fat and carbohydrates. The United States Department of Agriculture (USDA) Food Pyramid was created to raise awareness of the importance of a diet containing a healthy number of servings from each of the five major food groups.

Having healthy food to select from is important for kids and adults on Earth, as well as for astronauts. Contrary to popular belief, astronauts don't eat freeze dried ice cream, chicken in a tube, or other weird space food. Thanks largely to an improvement in packaging technology - allowing food to stay fresh longer and to be eaten before it floats away - space food is very much like that eaten on Earth. Single-serving containers keep foods fresh and make them easy to eat. Several dishes are affixed to a tray that the astronaut attaches to his or her leg. Astronaut silverware is like ours but it can be affixed to the tray with Velcro and includes scissors for opening packages.

Some foods stay fresh in space without additional processing. These "natural form" space foods include nuts, cookies and granola bars. Other foods must be treated to prevent microbes from growing on them. Some foods are dehydrated for astronauts to rehydrate in orbit. These foods include macaroni and cheese, soups and scrambled eggs. Foods such as fruits and tuna are thermostabilized - heat processed to kill harmful microbes - then canned. Sometimes, removing some of the moisture is enough to keep microbes at bay. Peaches, pears, apricots and beef are partially dehydrated and eaten as-is during flight (they're known as "intermediate moisture" food). Beefsteak is the only food that's irradiated for sterilization. Irradiated means the food has been exposed to ionizing radiation. This type of radiation is strong enough to break apart molecules so bacteria won't grow.

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"As we continue lengthy stays aboard the International Space Station (ISS), and plan for missions to Mars begin to unfold, the need for a better understanding of nutritional requirements for astronauts during extended-duration space flight becomes evident. Nutrition is key to maintaining health and physiology on the ground, and it is even more important in flight. The responsibility for overseeing this critical area is that of the scientists in the JSC Nutritional Biochemistry Laboratory, whose charge is to define nutritional requirements for space flight-that is, defining how many calories and other nutrients a crewmember needs in a given day, and how these requirements are altered in flight versus on the ground. Current issues of primary concern to the researchers involve the astronauts' dietary intake, bone loss, and iron absorption in space. "

"A problem that we've seen repeatedly in flight is that the crewmembers do not eat as much as we'd like them to, and that's our first concern," said Dr. Scott M. Smith, lead for the JSC Nutritional Biochemistry Laboratory.

"Crewmembers typically eat a relatively high carbohydrate diet, which is good, and proportions of macronutrients (i.e., protein, carbohydrate, and fat) generally meet standard recommendations. However, total food energy and fluid intakes are lower during space flight, despite the fact that pre-flight and in-flight energy requirements are the same. The balance between energy intake and energy expenditure regulates body weight. Therefore, in space flight where intake is often reduced, and expenditure is unchanged or increased, there is a loss of body mass. This may have significant effects on crew health, and can confound studies of how the body adapts to weightlessness."

"As space flight evolves from short-duration space shuttle missions, to extended habitation aboard the ISS, to exploration missions to the Moon and Mars, NASA will be challenged to provide astronauts with more palatable and more nutritious food. The development of advanced food technologies is essential for successful long-duration missions."

"On ISS, crews keep track of their diets using a computerized questionnaire. This allows us to determine intake of key nutrients during the mission, and to make real-time recommendations of how to improve their diets. The nutrients we measure include water, sodium, potassium, calories, protein, calcium, and iron. Water is extremely important to maintain hydration and is essential to prevent the space flight medical problem of kidney stone formation. Astronauts frequently do not drink enough. They need at least eight cups of fluids from drinks and food. Without adequate calories and protein, the astronauts cannot maintain their muscle strength and actually lose muscle tissue. Obviously this is important for good health and performance during space flight and critical for space walks and returning to Earth."

"Furthermore, calories, protein, and calcium are essential for bone health. Water, sodium and potassium are essential for cardiovascular function. Research with these nutrients has been completed throughout the human space program with experiments on Space Shuttle, Russian space station Mir, and on ISS. Many ground-based simulations of space flight (bed rest for example) are also used to study how the body adapts to "weightlessness." These studies will help us find and test ways to counteract the negative effects of spaceflight – which will be critical for the health of astronauts during flight long-duration missions." Remember – goods nutrition is also important on our long-duration mission – called life!

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Student Assessment (Student Copy)

Title: **THE FOOD PYRAMID IN SPACE**

1. Recall and write down what you have eaten during the last 24 hours. Discuss if your menu is a balanced meal based on the food pyramid. Tell why it is or is not balanced.

2. Draw the food pyramid.

3. In this lesson you learned about different types of space foods and how they are prepared. List and give an example of each type of food.

4. Water is very important for health not only here on earth but also in space. Name one condition that can occur from lack of water.

5. Carbohydrates, proteins, and fats are important for good nutrition. All of these provide calories. If astronauts do not maintain caloric intake during spaceflight, what happens to their strength and stamina?

6. Minerals are important for good health, even though for some, only small amounts are required. Name two body systems that minerals are critical in maintaining. (These two body systems are a major focus in understanding how we will perform during long duration space flight.)

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   Ans.
   - Natural form: nuts, cookies, granola bars
   - Dehydrated: macaroni and cheese, soups, and scrambled eggs
   - Thermostabilized: fruit and tuna
   - Intermediate moisture: apricots, beef, peaches, and pears
   - Irradiation: Beefsteak

4. Water is very important for health not only here on earth but also in space. Name one condition that can occur from lack of water.

   Ans. Dehydration and kidney stones

5. Carbohydrates, proteins, and fats are important for good nutrition. All of these provide calories. If astronauts do not maintain caloric intake during spaceflight, what happens to their strength and stamina?

   Ans. They will lose strength due to the fact they are not ingesting enough calories, which are necessary to maintain healthy muscle. They will lose stamina due to the lack of caloric intake which will deplete muscle energy reserves.

6. Minerals are important for good health, even though for some, only small amounts are required. Name two body systems that minerals are critical in maintaining. (These two body systems are a major focus in understanding how we will perform during long duration space flight.)

   Ans.
   - Skeletal system-Calcium and phosphorus are essential for bone health (calories, protein, vitamin D, and other nutrients are also important, but are not minerals).
   - Cardiovascular system-Sodium and potassium are essential for cardiovascular function, and iron is critical for blood cells. Water is very important for cardiovascular health (but is not a mineral).

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