Human Needs

Exploration: Then and Now

Essential Questions

How do people adapt to new environments?
How will basic needs be met in new worlds?

Grade Level: 6–8

Connections to Curriculum:

Science and Health

Teacher Preparation Time:

20 Minutes

Lesson Duration:

Five 50-Minute Class Periods

(See Pacing Chart for Options)

National Science Education Standards

Science as Inquiry

Physical Science

Science and Technology

Science in Personal and Social Perspective

National Health Education Standards

Demonstrate the ability to practice health-enhancing behavior and reduce health risks.

Demonstrate the ability to use goal-setting and decisionmaking skills to enhance health.

Lesson Overview

This lesson investigates human needs and how humans adapt to new environments. Students experiment to understand the effects of physical stress on muscles. They also identify food properties that make foods suitable for space flight and travel during colonial times. Using the new food-guide pyramid, students create a food and activity plan for healthy eating and then modify this plan based upon what they learn about past and present exploration.

Background Information

Human beings have certain basic needs. We must have food, water, air, and shelter to survive. If any one of these basic needs is not met, then humans cannot survive.

Before past explorers set off to find new lands and conquer new worlds, they had to make sure that their basic needs were met. Supplies of food and water were brought on the journey or were gathered along the way. Shelter, such as a tent, was either carried or built to protect explorers from the weather or other dangers.

Basic human needs have not changed much since the 17th century. We continue to explore to better understand our own world and to address the modern challenges that face societies in general. Beyond the boundaries of Earth, 21st-century explorers will face a unique set of challenges as they return to the Moon, travel to Mars, and scout the far reaches of the solar system.

Instructional Objectives

Students will:

- explore the effects of physical stress on muscle;
- identify food properties and design tests to select suitable foods for travel during colonial times and space flight;
- create a food and activity plan for healthy eating and modify the plan for 17th-century travel and 21st-century space travel; and
- compare the differences in challenges faced by 17th-century and 21st-century explorers.

Materials

(Students will need journals and class charts in order to organize information throughout this lesson.)

Engage
Per partnership:

- Spring-hinge clothespin
- Stopwatch

Explore
Per group:

- Different food samples. Food samples may include fruits, vegetables, breads, crackers, drinks, meats, or any other readily available food.

Explain
Per student:

- “NASA and Jamestown Human Needs Chart: Food/Water”
- “NASA and Jamestown Human Needs Chart: Health Concerns”

Extend
Per group:

- Internet access

Vocabulary

atrophy: a decrease in size or wasting away of a body part or tissue

bloodletting: a common medical practice of the 17th century consisting of draining blood from a person’s body to cure specific diseases

brackish water: water that is a mixture of freshwater and saltwater

circadian clock: often referred to as circadian rhythm, an internal biological timer with a set number of hours; each individual has their own internal clock that appears to control biological processes, including sleep, hunger, and hormone production

dysentery: an infection of the intestine that causes severe diarrhea

famine: extremely low food supply that leads to starvation

irradiated food: food that has been preserved by exposure to specific heat or light radiation

natural form foods: foods that can be eaten without additional processing

proprioceptors: sensory receptors found chiefly in muscles, tendons, joints, and the inner ear that detect the motion or position of the body or a limb; some proprioceptors are found on the bottom of your feet

rehydratable food: food that has been preserved by removing the water; water is added to the food before it is eaten

resistive exercise: an activity that strengthens bone and muscle by pushing against a force using your own body weight

thermostabilized food: food that has been preserved using heat to destroy harmful bacteria

typhoid fever: an acute infection of the intestines

vestibular system: a bodily system that helps regulate balance and motion and is involved with equilibrium

Suggested Pacing:

	Engage	Explore	Explain	Extend	Evaluate	Total
50-minute class period	**1 class period**	**2 class periods**	**1 class period**	**1 class period**	**Completed throughout the lesson**	**5 class periods**

Instructional Procedure

Teaching Suggestion: *Prior to beginning this lesson, create a chart that will be displayed throughout the lesson to help organize student learning. Ask the students to create similar charts in their journals. The charts may be formatted as follows, but should be large enough to organize information.*

How do people adapt to new environments?
How will basic needs be met in new worlds?

	JAMESTOWN	MOON
FOOD/WATER		
HEALTH CONCERNS		

Engage

Generally, when we think of stress, we think of emotional stress, such as being overworked, mentally tired, or overwhelmed by our daily lives. You would imagine that exploring and settling new worlds would be emotionally stressful for both 17th-century explorers and 21st-century explorers. Too much emotional stress is not good for anyone.

Emotional stress is not the only kind of stress. Our bodies, including our muscles and bones, need some physical stress to be healthy and to grow. Gravity's pull is a force that creates physical stress for everything on Earth. Living and working in a reduced-gravity environment eliminates some physical stress.

Physical stress occurs when bones and muscles work against a force. It occurs when we pick up something heavy, like a large bag of potatoes. Gravity pulls down on the bag and we have to work to overcome that force to lift the bag. The resistance of water when swimming also creates physical stress. Muscles and bones have to work against the water to move the body. Gravity pulls on our bodies and our muscles and bones work to counteract that force and keep us balanced.

Stress from physical activity is necessary for bone growth and maintenance. The body builds bone based on its needs. Muscles also rebuild and grow as a result of physical stress. Stress can lead to change in either muscle strength or muscle stamina (the ability to perform an activity for a long time without becoming tired). High-intensity, short-duration exercises (or stresses), like weight lifting, cause the muscles to increase in strength. Low-intensity, long-duration activities, such as running and swimming, cause muscles to increase in stamina.

Much more is understood about the human body and how it adapts to new environments today than was understood during the 17th century. The Jamestown settlers lived in cramped spaces when they traveled from England. Movement and exercise was limited. Although these cramped quarters compromised the health of the Jamestown settlers, their bodies still benefited from physical stress.

This activity helps your students understand some of the benefits of gravity and physical stress.

1. Discuss the following questions as a class or ask students to write their thoughts in their journals:
   - Imagine that you are an explorer ready to begin a new adventure. What feelings might you have before you begin your exploration?
   - Would you be worried about having enough food, water, and air?
   - Would your feelings be different if you were a 17th-century explorer compared to being a 21st-century explorer?
   - What is stress?
   - Would you feel stress in both situations?
2. Discuss the differences between emotional and physical stress and discuss how/why the body needs physical stresses, such as exercise, to be healthy.
3. Explain to students that they will be exploring the effects of physical stress on the muscles in their hands.
4. The first trial will test each student's initial muscle strength and stamina. Students will work with partners to conduct the activity following these directions:
   - Before each trial, the first person will predict the number of times he or she will be able to click the clothespin in 1 minute.
   - Students will create their own data chart to organize their predictions and observed data.

- One partner will hold a clothespin in his or her nondominant hand between the thumb and index finger.
- The other partner will time 1 minute and count the number of times the first partner is able to click the clothespin.
- The first person running the test will rest for 1 minute and then click the clothespin for another minute. This step will be repeated a total of three times.
- Partners will switch roles.

5. After students have completed all trials, ask the following questions:
   - How do the muscles in your hand feel?
   - How did your hand feel after the first minute? The second minute? The third minute?
   - Why do you think this happened?
6. Every other day for the next two weeks, have students repeat this exercise. This repetition is the conditioning period. The stress induced by the clothespin on the muscles of the hand will cause the muscles to become stronger and increase stamina. Students should predict and report their results each day.
7. Discuss these questions as a class or ask students to write their thoughts in their journals:
   - What is the difference between muscle strength and muscle stamina?
   - How did strength and stamina change in your hand over the conditioning period?
   - Compare your predicted results and actual results. Did your predicted results improve over the course of the experiment?
8. Some current countermeasures for bone and muscle loss during long-duration space flight include nutrition and exercise. Without adequate nutrition, problems can arise for every system in the body. Ensuring that astronauts have the right nutrients in their food is critical for their health before, during, and after flight. At the same time, performing daily exercise also helps astronauts decrease bone and muscle losses. Continue the class discussion by asking these questions:
   - What do astronauts do to counteract bone and muscle deterioration during long-duration space flight?
   - How would a long-duration space flight compare to the trip from England to Jamestown in 1607?
   - What must all explorers do to prepare to live in unfamiliar worlds?

Teaching Suggestion: *You may want to show the 30-minute NASA CONNECT™ video "Good Stress: Building Better Muscles and Bone" to your students, found at* http://connect.larc.nasa.gov/programs/2004-2005/good_stress/index.html*.* *You will find an expanded version of this activity in the NASA CONNECT™ educator guide at this site. This activity originally appeared in <u>From Outer Space to Inner Space/Muscles and Bones: Activities Guide for Teachers</u> created by Baylor College of Medicine for the National Space Biomedical Research Institute under NASA Cooperative Agreement NCC 9-58. This activity is used with permission of Baylor. All rights reserved. A copy of this guide can be downloaded at* http://www.nsbri.org/Education/TG/TG_Muscles.pdf

9. Ask students to add information to the charts they created earlier. Return to the class chart and add information learned during this activity.

Explore

Food is a basic need. Having enough food and meeting nutritional requirements while traveling has always been a problem for explorers.

In 1607, the *Godspeed*, the *Discovery*, and the *Susan Constant* journeyed with 104 settlers for nearly five months on a voyage from England to Virginia. Food and water were carried with the travelers. Limited space and lack of preservation techniques reduced the types of food that could be carried. Early explorers dried and stored food in cool places. They also used sealed containers.

Astronauts must also take their food with them when they travel. Some of the same methods used by early explorers are still being used to store food aboard the Space Shuttle and the International Space Station. Preparation varies with the food type. Some foods can be eaten in their natural form, such as fruit. Other foods require adding water to rehydrate them, such as broccoli in cheese sauce.

With no food refrigerators in space, food must be specially prepared and preserved to avoid spoilage. Settlers in 1607, during the time of Jamestown exploration, faced the same obstacle.

Teaching Suggestion: *Gather a variety of food samples to be tested and identified as suitable or not suitable for space travel. You should have at least two different food samples for each test group. Make sure each group has a different combination of food.*

1. Brainstorm as a class to create a list of foods that students might take with them in a sack lunch on a field trip and discuss reasons for choosing these foods.
2. Review this list to identify foods that astronauts might also take on a trip into space. Discuss some criteria about food suitability for space flight. Some criteria might include:
    - easy to package
    - fits into acceptable size packages for portion control
    - provides proper nutrition
    - acceptable taste and odor
    - travels well and fits into storage compartments
    - does not produce crumbs (crumbly or loose foods can float and contaminate the inside of a spacecraft and become an annoyance or even a hazard to crews and equipment)
    - stores well for long periods of time without spoiling
    - simple to prepare for eating

Teaching Suggestion: *You may want to show the 30-second NASA KSNN™ (Kids Science News Network) video, "Why do astronauts eat tortillas instead of bread?" found at* http://ksnn.larc.nasa.gov/21Century/p2.html. *You will also find an expanded version of this activity and more explanations about food preparation for space travel on this site.*

3. As a class, develop a list of properties that your class will use to determine food suitability for space flight. Use these properties to create a data chart in the journals.

4. Break students into small groups and ask them to develop tests to evaluate food samples for the properties that would make them suitable for space flight. Tests might include:

- handling the food to test for crumbs
- wafting the food to test for desirable smells
- conducting a simulated bite test to produce crumbs
- reviewing the food label to test for proper nutrition and portion size

5. Ask students to describe test procedures in their journals. Give each small group one or two foods to test for space flight suitability.

Teaching Suggestion: *Stress safety issues. Ask students to wear safety glasses and demonstrate rules of the science laboratory regarding smelling (wafting).Tasting is not allowed in the science laboratory. Discuss proper clean-up procedures.*

6. Based upon test results, create a list of foods suitable for space flight.
7. Discuss these questions as a class or ask students to write their thoughts in their journals:

- What qualities make the best foods for space travel?
- Would the same types of foods have been suitable for the Jamestown journey?
- How would you package these foods for a long-duration space flight?
- How would you package these foods for the 1607 Jamestown journey?
- Compare the way the food is packaged in the grocery store to the way it was packaged in 1607?
- How is this different than the packaging used for space flight?

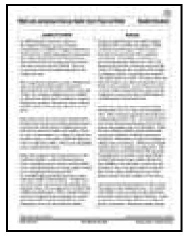
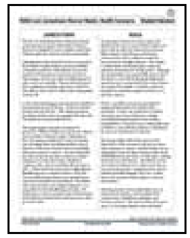
8. Ask students to add any new information to the charts they created earlier. Return to the class chart and add any new information learned during these activities.

Explain

Food and water are essential for human survival. Although the human body usually cannot live more than two weeks without water, the length of time that a person can live without food varies depending on the size of the person. The body will use its fat and stored protein (muscles) to survive.

Maintaining good health requires proper nutrition, exercise, adequate sleep, and proper medical care. To further protect astronauts' health, NASA scientists are studying how space flight and changes in gravity affect the human body. If humans are going to make long-duration space flights, researchers must learn more about bone loss and muscle atrophy and how to reduce the effects of an extended stay in a reduced-gravity environment.

1. Ask students to read the two "NASA and Jamestown Human Needs Charts" to find out more about the importance of food, water, and health concerns for NASA and the early Jamestown settlement.
2. Identify key ideas in the readings.
3. Help students add this information to both the class chart and their own charts.

Food and Water Chart Health Concerns Chart

Extend

Healthy eating is a concern for everyone. A new food-guide pyramid was released by the United States Department of Agriculture (USDA) in 2005 that encourages consumers to make healthier food choices, to be active every day, and to make personal choices that fit their needs.

1. The new food pyramid is not a one-size-fits-all plan. Take your students to the food pyramid Web site, *http://www.mypyramid.gov/*, for a quick estimate of what and how much they need to eat. Posters, interactive computer games, and education resources are also available at this site.

Teaching Suggestion: *An interesting game to introduce the new food pyramid can be found in the NASA SCI Files™ Educator Guide for "The Case of the Physical Fitness Challenge." This game can be found at* http://scifiles.larc.nasa.gov/educators/episodes/2005_2006/fitness/fitness_seg3.pdf*, on page 65.*

2. Give students the following tasks to respond to in their journal:
    - Create a food and activity plan for your own healthy eating.
    - Use the plan for the following explorations:
        - How would this plan change if you were a 1607 Jamestown settler?
        - How would this plan change if you were to travel and live on the Moon?

3. Ask students to develop a multimedia presentation that shows the parallels between past and future exploration. They must focus on the theme of human needs but may include other themes of exploration, such as transportation, settlement, and the hunt for water.
4. Complete other lessons from the "Exploration: Then and Now," NASA and Jamestown Education Module.

Evaluate

Choose one or more of the following activities to assess student understanding.

1. Evaluate the students' charts. Look for an increase in understanding about how people adapt to new environments. How were basic needs met for the Jamestown settlers? How does NASA provide for an astronaut's basic needs?
2. Ask students to apply what they've learned to other environments. How do people adapt to other environments? How are basic needs met in new situations?
3. Assess students' journal responses.

4. Work with students to create a rubric to evaluate the multimedia presentations created to parallel past and future exploration.

Additional NASA Resources

Sections of this lesson were adapted from existing NASA educational products. These additional NASA resources may extend student understanding about ways that human needs are met and how humans adapt to new environments.

Food and Water
Designed for Grades 3–5
The NASA SCI Files™ "The Case of the Great Space Exploration"
Design a nutritionally balanced diet for long-duration space flight.
http://scifiles.larc.nasa.gov/educators/episodes/2004_2005/gs.pdf
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NASA KSNN™
Visit the KSNN™ Web site to watch a 1-minute newsbreak to learn more about how space explorers will provide for the basic needs of food and water. Each newsbreak has accompanying background information, an activity, and additional resources.

"Are there grocery stores in space?"
http://ksnn.larc.nasa.gov/webtext.cfm?unit=food

"Did you know astronauts will recycle water in space?"
http://ksnn.larc.nasa.gov/webtext.cfm?unit=water

Health Concerns
Designed for Grades 3–5
The NASA SCI Files™ "The Case of the Biological Biosphere"
Perform this experiment to simulate an epidemic in your classroom and learn how quickly illness and disease spreads.
http://scifiles.larc.nasa.gov/docs/guides/guide1_03.pdf
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The NASA SCI Files™ "The Case of the Biological Biosphere"
Germs are everywhere. You can't always see them, but they are there. In this activity, you will learn how to prevent the spread of infectious diseases.
http://scifiles.larc.nasa.gov/educators/activities/2002_2003/inclass/stop_germ.html

NASA KSNN™
Visit these Web sites to watch a 1-minute newsbreak to learn more about how space explorers will stay healthy in space. Each newsbreak also has background information, an activity, and additional resources.

"What challenges will we face on a crewed mission to Mars?"
http://ksnn.larc.nasa.gov/webtext.cfm?unit=challenges

"Did you know that astronauts' bodies change in space?"
http://ksnn.larc.nasa.gov/webtext.cfm?unit=body

"What do astronauts do if they get sick in space?"
http://ksnn.larc.nasa.gov/webtext.cfm?unit=astrosick

"Do astronauts need calcium in space?"
http://ksnn.larc.nasa.gov/webtext.cfm?unit=calcium

"How would your body change in space?"
http://ksnn.larc.nasa.gov/21Century/p3.html

JAMESTOWN	NASA
In 1606, King James I granted a charter to the Virginia Company, a group of London entrepreneurs, to establish an English settlement in North America. Before beginning the long journey, the settlers estimated how much food and water they would need for the voyage and for sustenance once they arrived in the New World. John Smith stated, "What could be thought fitting or necessary we had, but what we should find or what we should want or where we should be—we were all ignorant, and supposing to make our passage in two months, with victual to live and the advantage of the spring to work. [But] we were at sea five months, where we both spent our victual and lost the opportunity of time and season to plant, ..." Based upon Smith's words, we can estimate the time he believed they planned for living in the colony before relief arrived from England to be about three to four months. Unfortunately, Captain Christopher Newport left Jamestown for England on June 22, 1607, and did not return until January 2, 1608, over six months later. The voyage lasted nearly five months. With limited space aboard the ships and few methods for preserving food, the selection of food to be stored and carried was restricted. No cooling or refrigeration was available, so all food was salted, dried, or pickled in vinegar to help prevent spoiling. These foods, which could be used for weeks or even months, were often unappetizing. During the voyage, basic daily rations for each traveler included dried hardtack (biscuits that were baked until all moisture was removed); salted, dried, or pickled meats and fish; cheese; oatmeal or barley; and a gallon of beer or wine. Water was stored on the ships, as the colonists	Having adequate, nutritious food and sufficient freshwater while traveling has always been challenge for explorers. Before astronauts travel into space, NASA scientists determine how much food will be needed for each mission. For example, an astronaut on the International Space Station (ISS) uses about 1.83 kilograms (4 pounds) of food per meal each day. About 0.27 kilograms (0.6 pounds) of this weight is packaging material. Longer-duration missions will require much more food. The trip to Mars and back, for instance, may take more than three years. Based on these numbers, a crew of four on a trip to Mars eating only three meals each day would need to carry more than 24,000 kilograms (nearly 53,000 pounds) of food and packaging with them. Food for the early astronauts consisted of freeze-dried powders, bite-size cubes, and semiliquids in tubes. As NASA scientists learned more about the space environment, better ways to prepare and package foods were developed. Today, the types of foods available include rehydratable, thermo-stabilized, irradiated, and natural-form foods. Most foods are ready to eat simply by adding water and/or by heating. All food is precooked and processed so it requires no refrigeration. Food for the ISS is similar to that on the Space Shuttle except that fewer foods require rehydration because of the limited amount of water available on the Station. Astronauts work with nutritionists to select menus that appeal to their individual tastes. Five months before flight, menus are selected and analyzed for nutritional content by food scientists and the nutritional biochemistry team. Meal times and the amount of food consumed by the astronauts are closely monitored in order to ensure proper nutrition.

recorded getting freshwater in the Caribbean; however, it was not a staple of their diet. John Smith once wrote, "…the sack, aqua vitae (alcoholic beverages made from grain or grapes) and other preservatives of our health … were necessary commodities for the welfare of the colonists." In bad weather, no cooking was allowed aboard the ships, so the settlers soaked the biscuits in water to make them edible. Cheese and cold pickled meats completed these meals.

During this time in history, ships crossing the Atlantic Ocean en route to the New World often stopped at the Canary Islands or other Caribbean islands to trade for fresh provisions. Fruits, vegetables, and sea tortoises could be added to the normally bland diet, but fresh supplies needed to be used quickly before they spoiled.

A wonderful sight greeted the Jamestown settlers when they finally reached Virginia. George Percy, one of the settlers, wrote about the beautiful trees and freshwaters. The area appeared to be filled with wildlife and edible plants. When Captain Newport returned to England for fresh supplies, the settlers were instructed to trade for food with the native inhabitants of the area, the Powhatan Indians. Unfortunately, relations with the Virginia Indians were often unpredictable.

Weather conditions and inexperience worked against the settlers, and soon they had little fresh food or water. With the beginning of a drought that lasted for several years, even the Powhatan crops failed, limiting the settlers' chance to trade with the natives for food. The settlers did not know how to hunt and fish the strange species of animals they found in this new environment. Captain Newport's return trip with fresh supplies was delayed by several months. From 1609 to 1610, a period known as the "starving time," the

Food eaten during space flight is much like the foods the astronauts would eat at home. Astronauts in space may choose from foods such as cream of mushroom soup, macaroni and cheese, chicken, beef, ham, scrambled eggs, and cereal.

Foods such as nuts, granola bars, and cookies are classified as natural-form foods. They are ready to eat and are packaged in clear, flexible pouches that are cut open with scissors. Beverages come in powdered form and include coffee, tea, apple cider, orange drink, and lemonade.

On Earth, the average American uses about 132 liters (35 gallons) of water every day. Water is heavy, so attempts are made to minimize the amount of water carried aboard spacecraft. On the Space Shuttle, water is produced as a byproduct from fuel cells. Fuel cells make electricity when hydrogen and oxygen are combined. Water is produced as a byproduct, and this water is then used by the astronauts.

The situation on the ISS is different. Electrical power for the ISS is generated from solar panels rather than from fuel cells and no water is produced. Small amounts of water are recycled aboard the ISS, and each astronaut limits water use to only about 11 liters (3 gallons) per day.

Recycling in space is different from recycling that may take place in your home or school. Astronauts recycle as much of their water as possible, including the moisture they exhale and sweat and the water they use to shower and shave. These wastewaters are purified and then used as drinking water. The ISS uses filtration and temperature sterilization to ensure that the water is safe to drink.

Recycling water will be imperative for

settlers resorted to eating the few horses they had, snakes, rats, mice, and even leather shoes. Some reports tell of settlers trying to survive by rationing barley soaked in water. George Percy stated, “Our food was but a small can of barley sod in water to five men a day; our drink [was] cold water taken out of the river, which was at a flood very salt [y], at a low tide full of slime and filth, which was the destruction of many of our men.” John Smith wrote, “… half a pint of wheat and as much barley this having fried some 26 weeks in the ship’s hold!—contained as many worms as grains … Our drink was water … From May to September [1607] those that escaped lived upon sturgeon and sea crabs; fifty in this time we buried.” No matter who was the source, it is clear that there was very little food that first summer in Jamestown.

Water near the settlement was brackish, containing not only large amounts of salt but also the contagions *Salmonella typhosa* that caused typhoid fever and other diseases. Many historians believe that the lack of freshwater was the leading cause of many of the settlers’ deaths. George Percy wrote, “Our men were destroyed with cruel diseases, as swellings, burning fevers [typhoid fever], and by wars, and some departed suddenly, but for the most part they died of mere famine.”

Eventually, the settlers adapted to this new environment and learned how to find freshwater. By 1610, about half of the meat sources for the settlers came from hunting local wildlife.

The settlers established friendlier relations with the Virginia Indians who shared their knowledge about food, water, and shelter. They taught the settlers to use tuckahoe, an edible plant root, to make bread and prepare a nutritional meal of succotash. Succotash was a mixture of beans, corn,

long-duration missions, such as on the ISS or possible trips to the Moon and Mars. A spacecraft on a lengthy trip to the Moon and Mars would be limited to the amount of water it could carry within its weight restrictions. Additional water would need to be provided through recycling, limiting the use of water, and by developing new ways to create water.

squash, and meat. The settlers also traded coins, beads, and metal products with the Virginia Indians for deer, waterfowl, melons, beans, squash, and berries.	

JAMESTOWN	NASA
The success of the Jamestown settlement seemed promising when Captain Christopher Newport returned to England for more supplies and settlers. Unfortunately, the situation deteriorated quickly. Although the settlers built a fort for protection from hostile Virginia Indians and the possibility of Spanish attack, the walls did little to stop the summer's blistering heat and swarms of insects. The swampy waters near the fort were unfit for drinking and, sadly, the settlers dug no freshwater wells, believing the river water was relatively fresh. The water was fresh when they arrived in the spring but, unfortunately, the settlers did not realize that the river water became saltier during the dry summer months. Less rainfall meant less freshwater in the river. The tidal action of the Atlantic Ocean, which is only 92 kilometers (57 miles) to the east, increased the concentration of salt in the water near Jamestown. The higher salinity levels meant contagions became trapped in the river water near the fort. By summer, the settlers were too weak to dig freshwater wells, forcing them to drink from the river. This led to epidemics of typhoid fever, dysentery, and other ailments such as salt poisoning. A lack of personal hygiene and unsanitary conditions increased the spread of disease. Trash was thrown around and near the fort. The cramped quarters forced the settlers to live near people who were sick. The dead were buried inside the fort. The original group of settlers included two physicians, William Wilkinson and Thomas Wotten, and one barber, Thomas Cooper. Barbers in 1607 would cut hair and shave gentlemen clients, just as they do today.	A carefully constructed and enforced program helps monitor the health of the astronauts. At least one week prior to launch, astronauts move into isolation in a closely controlled living environment that includes bacterial filters. Personal contact with people who are likely to carry infectious disease is minimized for up to six months prior to launch. Concerns about the health of the astronauts increase as they travel farther from Earth and away from medical assistance. NASA is studying how germs and the human body may interact differently in space than on Earth. The human body is affected by space travel. About 40 percent of the astronauts who go into space report symptoms of motion sickness, such as dizziness or nausea. Motion sickness is caused by a variety of factors. The most likely cause in space is sensory conflict among what your eyes are seeing, what the nerve endings in your feet (proprioceptors) record, and what your vestibular system is telling you. Symptoms from motion sickness generally disappear after two or three days, as the astronaut's body adjusts to the new environment. Following Earth's 24-hour light/dark cycle, the human internal clock controls sleep, wakefulness, digestion, and hormonal activity. This clock, known as the circadian clock and often referred to as circadian rhythm, is affected by space travel. As the Space Shuttle orbits Earth, the astronauts on the flight deck are exposed to 45 minutes of light followed by 45 minutes of dark. Excitement, stress, noise, and different environmental light and dark cues may all contribute to changes in the astronaut's circadian rhythm, making it

However, they also had medical training, usually on-the-job from a colleague, that taught them not only how to bloodlet but also how to pull teeth. Physicians of the 17th century completed 14 years of training and schooling before providing medical services; however, they had no knowledge of bacteria, germs, or viruses. No one understood how disease spread, and doctors did not sterilize equipment or wash their hands. Medicines common today, such as penicillin, did not exist in 1607. Plants and herbs were used to fight illnesses. Bloodletting was a common practice of the day. Doctors believed that disease was caused because a person's body held too much blood.

The barber, who may have had some surgical experience, was responsible for the bloodletting procedure. He would open a vein in a person's arm and drain some of the blood out of the body until the person either got well or died.

The Jamestown settlement was nearly lost to illness, disease, and famine. Eventually, the settlers adapted to their new home. The English referred to a "seasoning time" for new settlers. If a new settler lived through two summers in Virginia, they were considered "seasoned" and likely to survive.

Ships traveling from England to Virginia timed their departures so the new settlers would arrive in late winter or early spring. This arrival time gave the new settlers the opportunity to gradually become acclimated to Virginia's climate and allowed time to plant crops to feed the newcomers.

To help stop the spread of disease, the English built a hospital in 1612 to isolate the sick colonists from the other settlers. The hospital, named Mount Malado (or Malady), was built at a location up the James River, completely separate from difficult for them to sleep.

Astronauts face other health challenges while in space. On Earth, the heart distributes blood evenly throughout the body, working against the force of gravity to push fluids to the upper parts of the body. In space, the heart pumps the same way as it does on Earth, but gravity does not pull fluids toward the lower parts of the body. The fluids in the body redistribute in the reduced-gravity environment, causing head congestion; headaches; and puffy, swollen faces. This fluid redistribution takes water from the legs, so the legs become thinner. This condition is known as "puffy face, chicken leg" syndrome. In addition, some lesser-used muscles can lose tone and mass because they no longer have to work against gravity.

During space flight, the force of gravity no longer compresses, or pushes down on, the vertebrae in the spine. As a result, the vertebrae can separate slightly from one another and the spine can lengthen up to 7 centimeters (about 3 inches). The spine returns to normal size when the astronaut returns to Earth, but the change in height plays a critical role in designing flight suits and Extra Vehicular Activity (EVA) suits. When working outside the protective environment of the ISS and Space Shuttle, EVA suits must be flexible enough to accommodate the height change while providing a tight seal to maintain the pressure needed to survive in an environment with little or no atmosphere.

NASA researchers and scientists are working on methods to protect the health of astronauts while they are on long-duration space missions, while working on the Moon or other planets, and when they return to Earth. NASA scientists have studied the effects of exercising in space, and astronauts now train daily on resistive exercise equipment.

Jamestown. As the settlers adapted to their new environment, their health improved. With determination and perseverance, the original settlers left their mark in history, and Jamestown became the first permanent English-speaking settlement in the New World.	