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Human Biology - Digestion and Nutrition

Teacher's Guide

Human Biology Digestion and Nutrition Teacher's Guide

The Program in Human Biology,
Stanford University, (HumBio)

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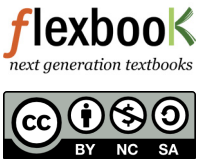

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CHAPTER 1

Introduction to Digestion and Nutrition - Teacher's Guide (Human Biology)

CHAPTER OUTLINE

1.1 Overview

Human Biology: An inquiry-based guide for the middle school student.

Developed by the Program in Human Biology at Stanford University and

EVERYDAY LEARNING®

Contents

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Dedication

The faculty, staff, and teachers of Stanford University's Human Biology Middle Grades Life Science Curriculum Project dedicate the publication of the HumBio Curriculum in memory of our colleagues and friends, Mrs. Donna Harrison and Dr. Mary Budd Rowe. Donna was the lead science teacher at Dozier Middle School, the project test-site school in Newport News, Virginia. She was an outstanding teacher, a community leader, a devoted wife and mother, and a wonderful human being. Her involvement in the HumBio Project enriched the curriculum materials and brought great joy to our lives. Although her life ended suddenly and tragically, the inspiration she gave to all who knew her will live on in what we do to improve the education of children and youth. Mary Budd Rowe was our most distinguished science education colleague and our dear friend. She guided the early organizational stages of the project as a group of university scientists attempted to address issues of middle level science education. Her unbridled enthusiasm for the education of children always reminded us of the important purpose of our work. Mary continued her unwavering support of the HumBio curriculum Until her passing in June of 1996.

1.3 Preface

Stanford University's Middle Grades Life Science Project began in 1986 with the vision of David A. Hamburg, M.D., then President of Carnegie Corporation of New York. A new wave of science education reform was gathering momentum following the release of *A Nation at Risk* by the United States Department of Education and *Educating Americans for the Twenty-First Century* by the National Science Board. Dr. Hamburg brought together the concerns of scientists and science educators over the watered down, vocabulary-laden life science curricula that were typical of middle level science courses at that time with broader public concern over large and increasing numbers of adolescents who engaged in high-risk behaviors leading to school failure, teen pregnancy, and other health problems. Because of his leadership in developing Stanford's undergraduate Program in Human Biology and his interests as a physician and scientist in the major physiological and behavioral transitions in the lives of children, Dr. Hamburg believed that a rigorous middle grades life science curriculum focused on human biology, and where possible on the adolescent, not only would greatly improve the science taught at this level, but through its relevance would capture the interest of this age group.

Initial work on the Human Biology (HumBio) Middle Grades Life Science curriculum brought together faculty, staff, and students from Stanford's Program in Human Biology and its School of Education with local middle and high school teachers. The curriculum development team was enriched in 1991 by twelve interdisciplinary teams of middle level teachers from diverse test site schools across the country. These teams became our most valued collaborators. The teachers attended annual two week summer institutes at Stanford between 1991 and 1994 and used the draft curriculum units in their classes between 1991 and 1995. The teachers and their students provided extensive formative evaluation data on the field-test materials, which has shaped the final student and teacher versions of the units that comprise the HumBio curriculum. Using HumBio units as a starting point, many teams also created their own innovative, interdisciplinary materials, which they taught across the middle level curricula in their schools.

The Project's Advisory Board provided insightful advice on the development of the curriculum from the unique perspectives of the professional associations, the institutions, and the fields its members represented. We are grateful to all of those who served for periods of time during the past seven years. We also would like to express our appreciation to the education consultants from universities, the National Middle School Association, and the California State Department of Education who made presentations and worked with the teacher teams during the summer institutes at Stanford. C. Stuart Brewster served with great distinction as our advisor on publication. We are indebted to him for his keen insights and good advice.

The Project faculty, the staff, and the teachers contributed more to the development of the HumBio Curriculum than anyone could have imagined before this work began. Their expertise, determination, and dedication to improving the education of young adolescents were inspirational. Supporting the curriculum development team and the test-site teachers were wonderful groups of Stanford undergraduates from the Program in Human Biology. They helped to ensure a productive and pleasurable working environment, which was an essential part of the success of the summer institutes.

To be sure, none of this work would have been possible without funding from Carnegie Corporation of New York, the National Science Foundation, and most recently The David and Lucile Packard Foundation. On behalf of the entire Project team we would like to thank these foundations and the program officers who have worked with us over the years for their support. As always, the final content of this Curriculum is the sole responsibility of the Stanford University Middle Grades Life Science Project and does not necessarily reflect the views of Carnegie Corporation of New York, the National Science Foundation, or The David and Lucile Packard Foundation.

H. Craig Heller *Principal Investigator*

Mary L. Kiely *Project Director*

January, 1998

Stanford, California

1.4 Letter to the Teacher

Dear Teacher:

You won't have any trouble getting your students interested in this unit since food is an important part of their lives. Adolescents are particularly fascinated with their changing bodies and that interest can certainly be exploited when studying nutrition and the biology of the digestive system.

The unit begins with a focus on the composition of food and, therefore, on nutrition. From the outset, the students are dealing with relevant topics, such as junk foods, fat, carbo-loading, and calories, that relate directly to their health and their performance. By studying their own diets in terms of composition and calories, they will immediately be applying the science they are learning to their eating habits and the choices they make each day.

A feature of this unit that I particularly like is the imaginary trip through the digestive system. I think this is a creative and memorable way to teach students both anatomy and physiology. If you can augment the images created by doing an actual dissection, students will never forget this unit.

The activities in this unit are particularly rich and they generate many links to other disciplines. For example, the activity that calculates and models the total surface area of the small intestine is a link to mathematics. The activity that measures the composition of foods is a link to chemistry. And, the activity that measures the caloric content of a peanut is a link to physics. One activity that is just plain fun, and students love, is the peristalsis activity.

The connections to health are a really important aspect of this unit. On one hand, we are a nation that runs on fast foods and junk foods, is pathologically overweight, and suffers an incredibly high incidence of eating disorders. On the other hand, health food stores are everywhere, grocery stores commonly carry foods that are "organic," and more of our population exercises regularly and eats healthy diets than ever before. Low fat and low cholesterol are probably the most common words on food labels these days. Thus, young people are receiving conflicting messages about foods and eating habits. They must make choices, and those choices will have long-lasting effects on their health. What they learn in this unit will help them make informed choices and hopefully the right choices more often than not. Also, with the activities in this unit on diet analysis, evaluation of menus, and interpretation of food labels, it is likely that discussions of these activities will extend from the classroom to the home. In one test-site school, the parents became so involved that they made it possible to have ethnic meals for the class, with the recipes fully evaluated for dietary components, of course.

Best wishes and bon appétit!

H. Craig Heller

Chair, Department of Biological Sciences, Stanford University

1.5 Unit Planning

Content Overview

Digestion and Nutrition: What foods do you eat and which ones form a balanced diet? What happens to these foods in your body?

This unit introduces students to the concept of nutrition, including selection of foods in their diet and what constitutes a balanced, healthy diet. Following the exploration of nutrition, students investigate the anatomy and physiology of the human digestive system-its structure and basic components, how it works to provide energy and the building blocks for cell functions, and some of its problems. Students are encouraged to use this knowledge daily to make good personal decisions and wise food choices. They conduct laboratory explorations to learn about nutrients, digestive enzymes, and the relationship between the structure and function of different parts of the digestive system.

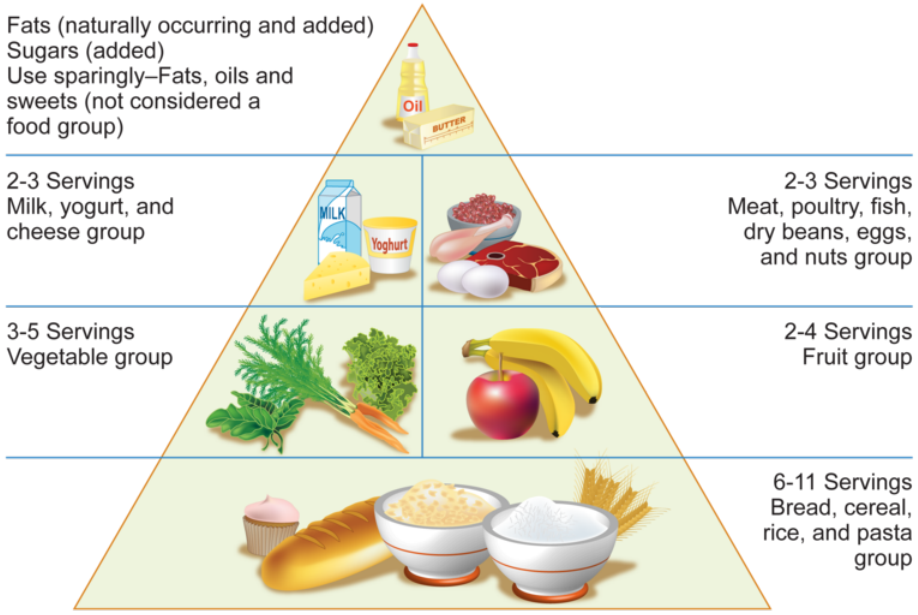
Through exploration students learn that

- Food is important because it provides the energy needed for body functions and the building blocks for body growth and the repair of tissues.
- Each person requires a certain amount energy from food, measured in calories (Cal).
- Digestion of food begins in the mouth where food is chewed and enzymes begin to break down carbohydrates. Digestion continues in the stomach where enzymes begin to break down protein.
- Digestion of foods is completed in the small intestine through the action of enzymes from the pancreas and small intestine. The products of digestion are then absorbed through the intestinal wall.
- Peristalsis, the rhythmic muscular contractions of the digestive tract, are important in helping digest and move food through the digestive tract.
- Food choices are influenced by cultural and social forces and play an important role in maintaining good health.

How is the unit structured?

Section 1: Why Do We Eat?

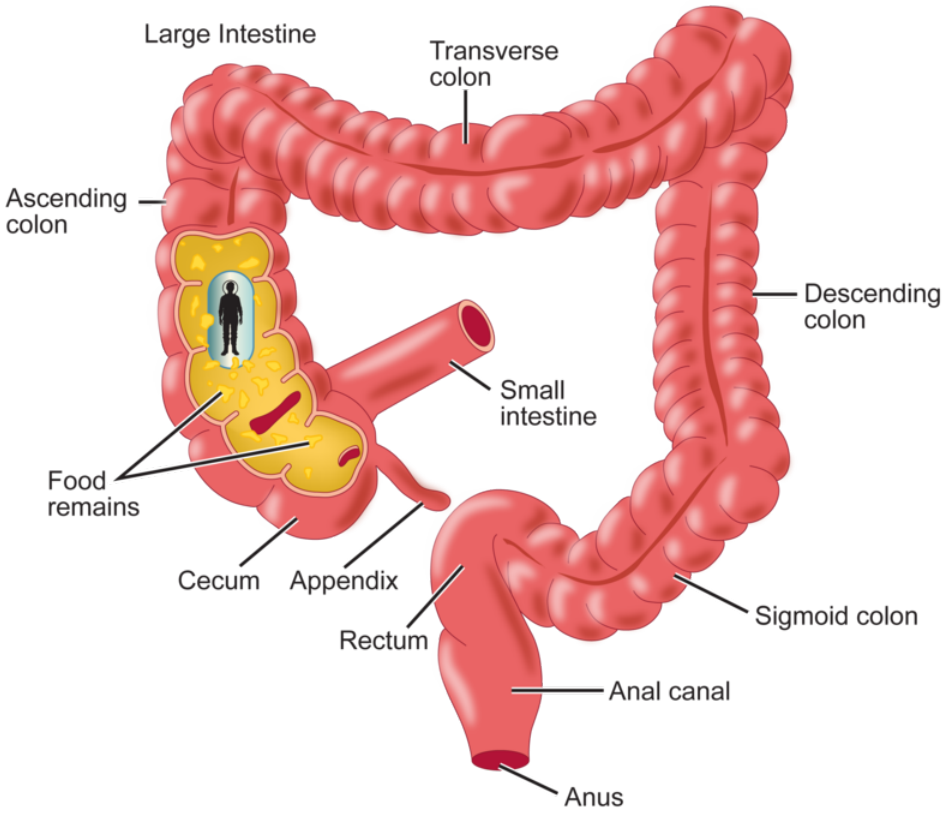
Section 2: Food Is Fuel



PE Figure 2.2 Food pyramid

Section 3: Mouth to Stomach in One Swallow

Section 4: A Journey through the Intestine



PE Figure 4.7 Students' "capsule" surrounded by chyme particles.

How Is the Unit Structured?

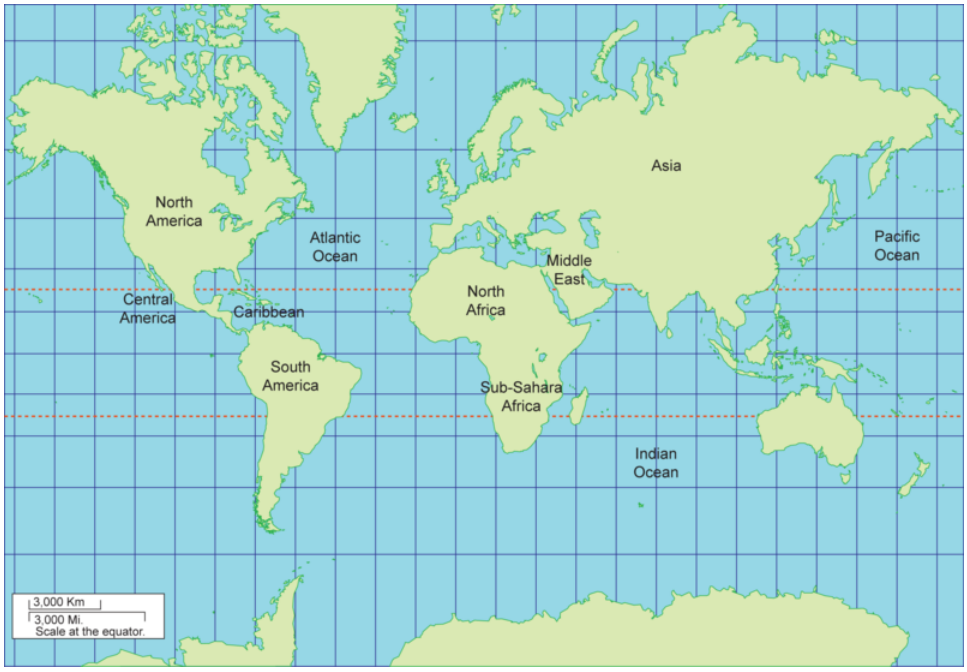
Sections 1 and 2 introduce students to the study of nutrition, the six basic nutrients, and which foods contain each nutrient. Students complete activities to develop the idea of food as energy, measured in calories (Cal), which provides fuel and raw materials for daily activities.

Sections 3 and 4 focus on the processes of digestion. Through lab and text activities, students learn about the structure and function of the digestive tract. They investigate how foods are broken up into smaller particles by chewing and enzyme action. Through a simulation of peristalsis, students discover and experience how materials move through the digestive tract. They continue to explore the structure of the small intestine and calculate how much the villi increase surface area to facilitate absorption of digested foods.

Section 5 extends concepts of nutrition to explore some cultural and social influences and how we choose foods in response to these forces.

Section 6 addresses staying healthy and discusses other factors affecting digestive system function and good health. These factors include exercise, sleep, target heart-rate zone, and sources of stress.

Section 5: Food for life



PE Figure 5.3 Students use this map to discuss foods people grow and eat around the world.

Why Teach this Unit? Connections to the Real World

Adolescents appreciate the opportunity to make their own decisions. In order to make good decisions, they need information. This unit provides students with information about one of the primary body systems-a system that, through their choice of actions, affects their health, how they feel, and how they function daily.

Questions to Consider throughout the Unit

Which foods can you choose to improve your diet?

Why is it important to make careful food choices?

What environmental, social, and cultural factors affect your food choices?

How can you take control of your nutrition and daily activities to help your body function and grow well?

Section 6: Staying Healthy

TABLE 1.1: Unit Activities and Key Ideas

Section	Key Ideas	Activity
1 Why Do We Eat? Does what I eat really matter?	• Nutrition refers to the composition of food and how the various components of food affect the body. • Food is essential to all life, but it is particularly important for children, adolescents, and teens because it provides energy and nutrients needed for growth and healthy development. • Your diet should include a balance of the six essential nutrients-fats, carbohydrates, proteins, vitamins, minerals, and water.	**Mini Activity:** Choices Are Everywhere **Activity 1-1:** Are You What You Eat? **Mini Activity:** Write an Advertisement **Mini Activity:** Word Origin of Carbohydrate **Activity 1-2:** What's in Your Food?

TABLE 1.1: (continued)

Section	Key Ideas	Activity
2 Food Is Fuel How do you measure food energy?	• Food is digested to provide the nutrients needed by the cells in your body. • Cellular respiration is the process in which sugar molecules are chemically broken down to produce energy. • Total energy requirements vary depending on your size, physical activities, and your age. • Eating a balanced diet means choosing foods that provide the recommended amounts of fats, carbohydrates, proteins, vitamins, minerals, and water.	**Activity 2-1:** Calories: In a Nutshell **Activity 2-2:** Calories: How Much Energy Do You Use? **Mini Activity:** Reading Food Labels
3 Mouth to Stomach in One Swallow How does the digestive system break down a bacon, lettuce, and tomato sandwich?	• Digestion involves the physical and chemical breakdown of food into nutrients used by the body. • Physical breakdown of food includes chewing food in the mouth, churning food materials in the stomach, and peristalsis within the stomach and intestines. • Chemical breakdown of food occurs through enzyme action that breaks down large complex food molecules into small simple nutrients that are absorbed primarily in the intestines.	**Mini Activity:** Can You Tell the Types of Teeth? **Activity 3-1:** Digestive Enzyme in Action

TABLE 1.1: (continued)

Section	Key Ideas	Activity
4 A Journey through the Intestine How does your body get the nutrients it needs?	• The pancreas and liver secrete important enzymes and substances necessary for the process of digestion. • The rhythmic contractions of peristalsis mix and move chyme through the intestines. • Nutrient absorption occurs primarily in the small intestine. • Osmosis and diffusion are the processes involved in absorption of digested food molecules (nutrients) from the small intestine into the bloodstream.	**Mini Activity:** Coil a Rope **Mini Activity:** Shake It Up **Activity 4-1:** A Journey through the Intestine (Peristalsis) **Mini Activity:** What Passes Across a Membrane? **Activity 4-2:** A Journey through the Intestine (Villi) **Mini Activity:** Drawing the Actions of the Digestive System **Enrichment 4-1:** Transport of Materials- Exploring Diffusion **Enrichment 4-2:** Chemical Digestion Simulation **Enrichment 4-3:** What Happens to the Digested Nutrients in the Small Intestine?
5 Food for Life What factors affect what I eat?	• Culture and family traditions and availability and cost of food affect what and how we eat. • Malnutrition and obesity are common food problems that can be corrected in many cases. • Anorexia nervosa and bulimia are two eating disorders that can cause severe health problems.	**Mini Activity:** Food Choice **Activity 5-1:** Can You Become Obsessed with Food?
6 Staying Healthy How can I keep my digestive system healthy?	• Diet and nutrition play important roles in maintaining good health. • Staying healthy requires regular exercise and adequate rest.	**Mini Activity:** Your Target Heart-Rate Zone **Mini Activity:** How Much Sleep Do You Need? **Mini Activity:** Sources of Stress **Activity 6-1:** You Are the Food Expert

Teacher's Guide Overview

The *Digestion and Nutrition* unit is built around a variety of student activities. Text material can be used to introduce, reinforce, and extend the concepts developed in the activities. The activities are the foundation of this unit, so the unit's success depends on students' involvement in the activities. Embedded activities are interrelated, since the concepts developed in one may be applied in another.

Section Planning

For each section, you'll find extensive advance planning for the student activities and the section topic. Key ideas, section objectives, background information, suggestions for introducing activities, and the materials needed for each activity are listed on the Section Planning page. Review this information ahead of time to ensure that materials for each activity are available when you need them.

Support for Embedded Activities

Embedded activities are those activities contained or "embedded" in the student edition. Procedures for each embedded activity are contained in the student edition. In the Teacher's Guide, you'll find activity planning information, activity assessment, and student reproducible pages for each embedded activity.

Enrichment Activities

Enrichment activities are activities found in the Teacher's Guide. These activities are designed to extend and enrich students' learning experiences. Complete Enrichment activities, including Teacher Activity Notes and the student procedures and reproducible pages, are located at the end of each appropriate section of the Teacher's Guide.

GroupWork Activities

Learning science is a process that is both individual and social. Students in science classrooms often need to interact with their peers to develop a knowledge of scientific concepts and ideas, just as researchers, engineers, mathematicians, and physicians who are working in teams do to answer questions and to solve problems. The GroupWork activities of the HumBio Curriculum for Middle Grades have been developed to foster a collaborative environment for groups of students. Students plan experiments, collect and review data, ask questions and offer solutions, use data to explain and justify their arguments, discuss ideas and negotiate conflicting interpretations, summarize and present findings, and explore the societal implications of the scientific enterprise. In short, GroupWork activities provide an environment in which students are "doing science" as a team.

For more information, refer to "Using GroupWork Activities" on TE page 98. The specific GroupWork activities for this unit can be found on TE pages 101-136.

Projects

The research and action projects in HumBio are varied and provide students with time to explore a particular topic in depth. With Projects, students have the opportunity to take a position based on knowledge gained through research, debate an issue, and devise a plan of action. In this way, students can apply what they are learning to larger issues in the world around them.

Projects for this unit include

- Research Questions
- A Nutritional Lunch
- A Healthy Food Plan
- Waste in the Fast-Food Industry
- Examining Eating Disorders

Assessment Overview

Within each section of the unit there are suggestions for assessment that can be used individually or in combination to develop a complete assessment package. The list below describes the variety of assessment tools provided.

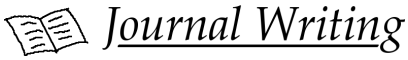
Apply Your Knowledge questions appear throughout each section. They can be used as homework assignments and as ways to initiate a class discussion. These questions are designed to assess

- communication skills
- depth of thought and preparation
- problem-solving skills
- ability to apply concepts to related or big ideas
- how well students relate their new knowledge to different problems

What Do You Think?

These questions appear in each section. They provide students with opportunities to think and write about the concepts they are learning in a larger context. you can use these questions to assess

- writing skills
- problem-solving abilities
- creativity and depth of thought
- the ability to analyze and summarize



Journal writing prompts are suggested throughout the unit. These prompts provide opportunities for students to write critically and creatively about concepts and issues. The writing products can be used to assess

- writing skills
- depth of thought
- and the ability to explain and expand on concepts

Review Questions

Review Questions are located at the end of each section. These questions can be used for written responses or as the basis for class discussion. These questions are designed to assess content knowledge and whether students can explain the concepts explored in the section.

Activity-Based Assessment

Inquiry-based student- centered activities are the foundation of the *Human Biology* program. The unit is rich with relevant and exciting activities that introduce, support, or reinforce concepts students are exploring. within the Teacher's Guide, you'll find extensive teacher information, including assessment strategies, for each type of activity:

- Embedded Activities
- Enrichment Activities
- Mini Activities

- GroupWork
- Projects

You can use students' products to assess their progress. these products include models, simulations, observations and reports of laboratory investigations, role plays, written responses to quetions and written observations, student-designed explorations and procedures, poster presentations and classroom presentations.

PORTFOLIO ASSESSMENT

You may want to have your students develop a portfolio of the unit. A sample assessment portfolio of the unit might contain the following items.

- Written responses to three *What Do You Think?* Questions
- Written responses to one *Apply Your Knowledge* question from each section
- An analysis of their two favorite activities and how those activities helped them learn an important concept
- Reports from three investigations such as

  Activity 1-1: Are You What You Eat? Activity 3-1: Digestive Enzyme in Action Enrichment 4-3: What Happens to the Digested Nutrients in the Small Intestine?

- Two examples of constructing a model from

  Activity 4-2: A Journey through the Intestine (Villi) Enrichment 4-2: Chemical Digestion Simulation

- Calculations from the following:

  Activity 2-1: Calories: In a Nutshell Activity 6-1: You Are the Food Expert

Getting Started

Keep Students Interested. Encourage students to read the text: It is the story line that ties all of the content together. Every effort has been made to make the text interesting to students and appropriate to their reading level. Text material can be used to introduce, reinforce, and extend the concepts addressed within the activities.

The success of the unit depends on the completion of at least the Embedded activities. And keep in mind that some activities are related since the data obtained in one may be used in another.

Plan Ahead. The unit is activity-based, and you can select the activities that will best meet your class' needs. The activities are listed in the Unit Activities chart on pages xiv and xv and in the Activity Index on page 150. Mini Activities are shorter and can be done with minimal teacher input; they are located in the margin of the student edition. The Embedded activities in the student text are investigations that require some planning and setup time; these are the essential activities within the unit. Other investigations called Enrichment activities are located at the end of each section in the Teacher's Guide. Enrichment activities expand student knowledge of the concepts explored in the given section.

A variety of projects were designed to extend the content of the unit. These include ongoing class projects, school projects, and/or community projects. Projects are located at the end of the Teacher's Guide, beginning on page 137.

Customize the Unit. Each section of this unit builds upon knowledge gained in the previous sections. Teaching timelines are provided on TE pages xxii-xxiii. The first timeline on TE page xxii demonstrates how to complete this unit within a three week schedule. The timeline on TE page xxiii demonstrates how to complete this unit within a five-week schedule. Both of these timelines highlight the essential activities. If your class has time to study the unit over a longer period of time, many additional activities are available.

Allow Time for Projects. Consider having students start projects at the beginning of the unit and then prepare those projects for presentation as a culminating event.

Use Current Events. Ask students to bring in newspaper and magazine articles that relate to what they are studying each week. Relating the unit content to current events helps students see that what they are doing in class is, in fact, relevant to their lives outside of school. Students can use current events to make group scrapbooks, bulletin boards, and posters or to develop class presentations.

Make a "question box" available. Have students write down questions they have about what they are investigating and put them in the box. At appropriate times select questions and read them to the class to generate discussion. These questions can also be used to initiate class research projects.

Use a Variety of Resources. We encourage you and your students to use a wide variety of sources for information. The activities provide rich opportunities for students to explore a variety of concepts. The more students incorporate information from resources outside the classroom, the richer their learning experiences will be. Use computer services for gathering student and teacher information, for networking with students in different schools and with community resources, and for contacting experts in the field under study. A list of resources can be found on page 148 of this Teacher's Guide.

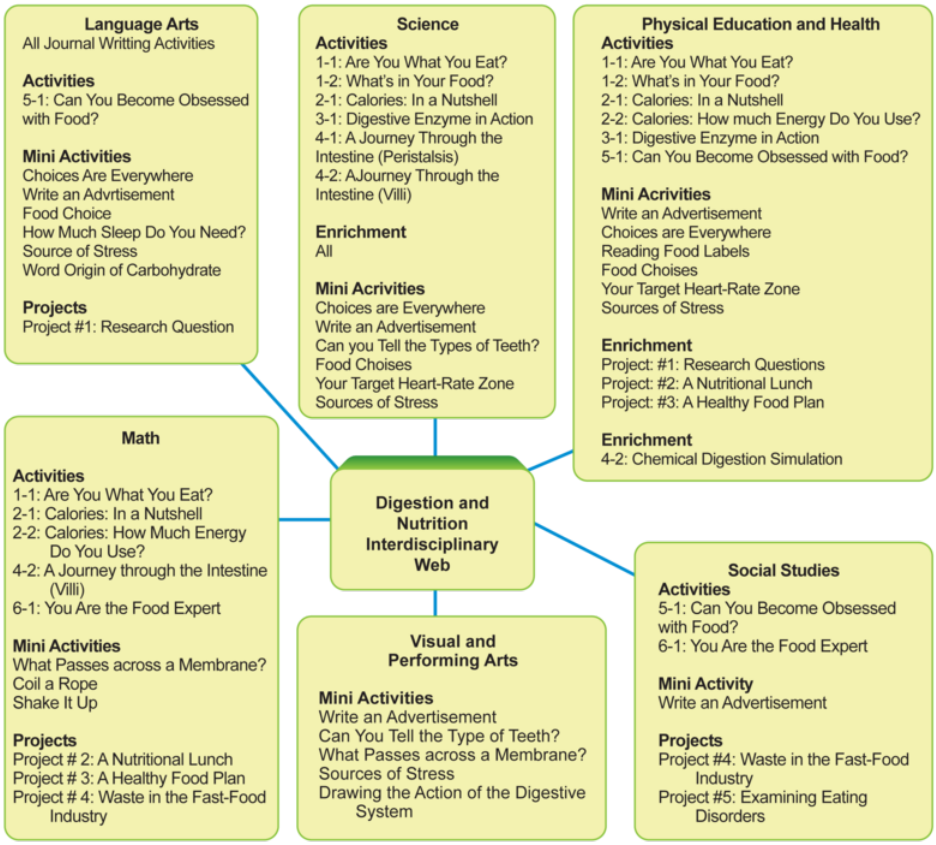
Make Career Connections. Encourage students to investigate careers related to the content of the unit. Invite scientists, physicians, and technologists working in the field to come to your classroom to discuss career opportunities, their research, and specific topics of interest.

Plan for Field Trips. Field trips to local hospitals, industrial sites, or universities need, of course, to be arranged well in advance. Contact the public affairs offices of these institutions for assistance.

Address Health Concerns. Be aware of any special health problems your students may have. Some students may have health conditions that would make it uncomfortable for them to participate in certain activities, such as those that require exercise or that relate directly to their particular health problems. For students unable to participate fully in these activities you may wish to create an alternative assignment or have them use data from another group. If the class is appropriately prepared, the affected students may want to share information about their special circumstances with the class in order to increase empathy and knowledge of all students.

Connect with Other Disciplines. The interdisciplinary web provided is a guide for planning if your school uses an interdisciplinary team approach. The web classifies the unit's activities and projects by related discipline-language arts, math, social studies, physical education and health/nutrition, and visual performing arts, and science. For interdisciplinary planning, schedule meetings with your team early. You are encouraged to tap the talents and interests of your team members as well as of your unique school and community resources in developing other suitable activities for this unit.

Connect with the Home. Give special attention to the unit activities as a means of involving family and community members. Also, encourage your students to take selected Apply Your Knowledge questions and Mini Activities home for further exploration.



Teaching Timelines

You can use these timelines as a place to start in designing your own timelines, or you can use them as they are laid out. If you're planning your own timeline, consider the inclusion of the Embedded activities first. The "Embedded activities" are included in the student edition. The Enrichment activities, GroupWork activities, and Projects can then be included, depending on your time restrictions. The timelines are guides that can vary if some activities are done at home or in other classes in addition to science class.

Given your time constraints, it may not be possible to do all the activities shown on these timelines. If you need to remove activities, be careful not to remove any activities critical to the content of the unit. You may want to divide the activities among interdisciplinary members of your teaching team.

Page references in these charts refer to the student edition, except when Enrichments are suggested. The page references for Enrichments refer to this Teacher's Guide.

TABLE 1.2: Option 1: Three Week Timeline

	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	Introduce Section 1 Begin **Activity 1-1:** Are You What You Eat?	Continue **Activity 1-1:** Are You What You Eat?	Conclude **Activity 1-1:** Are You What You Eat? **Mini Activity:** Write An Advertisement	Summarize and Review Review Section 1 Introduce Section 2 **Activity 2-1:** Calories: In A Nutshell	**Activity 2-2:** Calories: How Much Energy Do You Use? Assign Completion of 48-hour data table for Activity 2-2
Week 2	Complete **Activity 2-2:** Calories: How Much Energy Do You Use?	Explain the Food Pyramid Summarize and Review Section 2 Introduce Section 3 **Activity 3-1:** Digestive Enzyme in Action	Summarize and Review Section 3 Introduce Section 4 **Mini Activity:** Coil a Rope	**Activity 4-1:** A Journey through the Intestine (Peristalsis) Share Ads From **Mini Activity:** Write an Advertisement	**Activity 4-2:** A Journey through the Intestinal (Villi) **Mini Activity:** What Passes Across a Membrane?
Week 3	Summarize and Review Section 4 Introduce Section 5 **Mini Activity:** Drawing the Actions of the Digestive System	**Mini Activity:** Food Choice **Activity 5-1:** Can You Become Obsessed with Food?	Summarize and Review Section 5 Introduce Section 6 **Mini Activity:** Your Target HeartRate Zone **Activity 6-1:** You Are the Food Expert	**Mini Activity:** How Much Sleep Do You Need? **Mini Activity:** Sources of Stress Summarize and Review Section 6	Unit Assessment

TABLE 1.3: Option 2: Five Week Timeline

	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	Introduce Section 1 Journal Writing Prompt: What are your favorite things to eat? **Activity 1-1:** Are You What You Eat? **Mini Activity:** Choices Are Everywhere	Continue **Activity 1-1:** Are You What You Eat? **Activity 1-2:** What's In Your Food?, Part A	Continue **Activity 1-1:** Are You What You Eat? **Activity 1-2:** What's In Your Food?, Part B	Finish and Analyze **Activity 1-1:** Are You What You Eat? Assign Student Activity sheets-charts for **Activity 1-1:** Are You What You Eat? Summarize and Review Section 1	Introduce Section 2 **Activity 2-1:** Calories: In a Nutshell Journal Writing **Activity 2-2:** Calories: How Much Energy Do You Use? Complete the 48-hour data sheet

TABLE 1.3: (continued)

	Monday	Tuesday	Wednesday	Thursday	Friday
Week 2	Complete **Activity 2-2** **Mini Activity:** Reading Food Labels	Explain the Food Pyramid Summarize and Review Section 2	Introduce Section 3 **Activity 3-1:** Digestive Enzyme in Action **Mini Activity:** Can You Tell the Types of Teeth?	Follow the capsule through the system from mouth to stomach Share Ads from **Mini Activity:** Design an Advertisement	Summarize and Review Section 3 Introduce Section 4
Week 3	**Activity 4-1:** Journey through the Intestine (Peristalsis) **Mini Activity:** Coil a Rope	Complete **Activity 4-1** Discuss the journey **Mini Activity:** Shake it Up	**Activity 4-2:** A Journey through the Intestine (Villi) Discuss the journey	**Enrichment Activities 4-1:** Transport of Materials-Exploring Diffusion, **4-2:** Chemical Digestion Simulation, OR **4-3:** What Happens to the Nutrients You Digest Assign **Mini Activity:** What Passes Across a Membrane? (p. 39)	Enrichment Activities Continued
Week 4	**Mini Activity:** Drawing the Actions of the Digestive System Summarize and Review Section 4	Introduce Section 5 **Mini Activity:** Food Choice	Journal Writing Prompt: Eating and the Five Senses **Mini Activity** How Much Sleep Do You Need?	**Activity 5-1:** Can You Become Obsessed with Food?	Summarize and Review Section 5
Week 5	Introduce Section 6 **Mini Activity:** Your Target Heart-Rate Zone **Mini Activity:** Sources of Stress	Work on Projects and/or Presentations	**Activity 6-1:** You Are the Food Expert Review results of **Mini Activity:** How Much Sleep Do You Need?	Summarize and Review Section 6	Unit Assessment

Safety for Teachers

- Always perform an experiment or demonstration on your own before allowing students to perform the activity. Look for possible hazards. Alert students to possible dangers. Safety instructions should be given each time an experiment is begun.
- Wear glasses and not contact lenses. Make sure you and your students wear safety goggles in the lab when performing any experiments.
- Do not tolerate horseplay or practical jokes of any kind.
- Do not allow students to perform any unauthorized experiments.
- Never use mouth suction in filling pipettes with chemical reagents.
- Never "force" glass tubing into rubber stoppers.
- Use equipment that is heat resistant.
- Set good safety examples when conducting demonstrations and experiments.
- Turn off all hot plates and open burners when they are not in use and when leaving the lab.
- When students are working with open flames, remind them to tie back long hair and to be aware of loose clothing in order to avoid contact with flames.
- Make sure you and your students know the location of and how to use fire extinguishers, eyewash fountains, safety showers, fire blankets, and first-aid kits.
- Students and student aides should be fully aware of potential hazards and know how to deal with accidents. Establish and educate students on first-aid procedures.
- Teach students the safety precautions regarding the use of electricity in everyday situations. Make sure students understand that the human body is a conductor of electricity. Never handle electrical equipment with wet hands or when standing in damp areas. Never overload electrical circuits. Use 3-prong service outlets.
- Make sure that electrical equipment is properly grounded. A ground-fault circuit breaker is desirable for all laboratory AC circuits. A master switch to cut off electricity to all stations is desirable for all laboratory AC circuits.
- Make sure you and your students are familiar with how to leave the lab safely in an emergency. Be sure you know a safe exit route in the event of a fire or an explosion.

For Student Safety

Safety in the Classroom

- Wear safety goggles in the lab when performing any experiments. Tie back long hair and tuck in loose clothing while performing experiments, especially when working near or with an open flame.
- Never eat or drink anything while working in the science classroom. Only lab manuals, notebooks, and writing instruments should be in the work area.
- Do not taste any chemicals for any reason, including identification.
- Carefully dispose of waste materials as instructed by your teacher. Wash your hands thoroughly.
- Do not use cracked, chipped, or deeply scratched glassware, and never handle broken glass with your bare hands.
- Lubricate glass tubing and thermometers with water or glycerin before inserting them into a rubber stopper. Do not apply force when inserting or removing a stopper from glassware while using a twisting motion.
- Allow hot glass to cool before touching it. Hot glass shows no visible signs of its temperature and can cause painful burns. Do not allow the open end of a heated test tube to be pointed toward another person.
- Do not use reflected sunlight for illuminating microscopes. Reflected sunlight can damage your eyes.
- Tell your teacher if you have any medical problems that may affect your safety in doing lab work. These problems may include allergies, asthma, sensitivity to certain chemicals, epilepsy, or any heart condition.
- Report all accidents and problems to your teacher immediately.

HANDLING DISSECTING INSTRUMENTS and PRESERVED SPECIMENS

- Preserved specimens showing signs of decay should not be used for lab observation or dissection. Alert your teacher to any problem with the specimen.
- Dissecting instruments, such as scissors and scalpels, are sharp. Use a cutting motion directed away from yourself and your lab partner.
- Be sure the specimen is pinned down firmly in a dissecting tray before starting a dissection.
- In most cases very little force is necessary for making incisions. Excess force can damage delicate, preserved tissues.
- Do not touch your eyes while handling preserved specimens. First wash your hands thoroughly with warm water and soap. Also wash your hands thoroughly with warm water and soap when you are finished with the dissection.

CHAPTER 2 Why Do We Eat? - Teacher's Guide (Human Biology)

CHAPTER OUTLINE

2.1 Planning

Key Ideas

- Nutrition refers to the composition of food and how the various components of food affect the body.
- Food is essential to all life, but it is particularly important for children, adolescents, and teens because it provides energy and nutrients needed for growth and healthy development.
- Your diet should include a balance of the six essential nutrients-fats, carbohydrates, proteins, vitamins, minerals, and water.

Overview

In this introductory section, students learn about the importance of food in providing energy for daily activities, growth, and repair of body tissues. Students monitor their own diets. They learn about the six nutrients, the role of these nutrients in the body, and examples of foods that contain them. Students investigate the composition of different foods by testing some for the presence of carbohydrates, fats, and proteins.

Objectives

Students:

✓ identify the six essential nutrients, give examples, and describe the importance of each nutrient.

✓ determine the average amounts of fats, carbohydrates, and proteins they consume daily and compare with recommended guidelines.

✓ determine the presence of glucose, starch, protein, or fat in foods.

Vocabulary

amino acids, carbohydrate, digestion, fat, minerals, nutrition, protein, vitamin

Student Materials

Activity 1-1: Are You What You Eat?

- Resource 1
- Resource 2

- Diet Data Sheet
- Activity Report
- Measuring cups and spoons; Glasses with 4 ounces and 8 ounces of liquid; Food labels; Fast Food information sheets; Food Models

Activity 1-2: What's in Your Food?

- Resource 1: Part A Data Sheet
- Resource 2: Part B Data Sheet
- Activity Report
- Glucose sugar solution; Egg white, raw; Butter, margarine, or vegetable oil
- Test tubes; Test-tube holder; Water bath; Graduated cylinder; Brown wrapping paper; Plastic knife; Safety goggles; Starch solution; Iodine solution; Biuret solution; Benedict's solution; Medicine droppers (3); Small pieces of various foods (such as orange, apple, carrot, bread, peanut butter or peanuts, grapes, milk, bacon, hard-boiled egg, cheese, potato, banana, pieces of cooked chicken, cookies, doughnuts, butter, oil, or margarine, etc.)

Teacher Materials

Activity 1-1: Are You What You Eat?

- Activity Report Answer Key
- Diet and Calorie charts, Nutrition resource material; Food models; Food pyramid

Activity 1-2: What's in Your Food?

- Activity Report Answer Key
- Small pieces or samples of various types of foods such as orange, apple, carrot, bread, peanut butter or peanuts, grapes, milk, bacon, hard-boiled egg, cheese, potato, banana, pieces of cooked chicken, cookies, doughnuts, butter, oil or margarine, etc.

Advance Preparation

See Activities 1-1 and 1-2 in the Student Edition.

Activity 1-1: Are You What You Eat?

- Ask students to bring in food labels, particularly of favorite foods to help with Resource 1.
- Collect books on nutrition and food calorie lists to use as resources.
- Duplicate class copies of the Food Nutrient Chart on TE pp. 15-17.

Activity 1-2: What's in Your Food?

- Cut up foods to be tested and assemble so students can obtain them easily. Make control solutions: 1. Protein: egg whites beaten, 2. Sugar: 10 *ml* of corn syrup mixed with 90 *ml* of warm water.

Interdisciplinary Connections

Art Make a poster or a collage grouping pictures of the different food types.

Language Arts Write about differences between sugars, starches, fats, and proteins, which foods contain them, and how the body needs them.

Social Studies Study diet and foods from different parts of the world and from different periods in history. Design a "Heart Smart" restaurant as an interdisciplinary project. Include invitations, menus giving nutritional information, meal planning, and food preparation based on a cultural theme.

2.2 Using Why Do We Eat? – Student Edition (Human Biology)

Begin by assigning and then discussing the Journal Writing regarding favorite foods.

Introduce and begin *Activity 1-1: Are You What You Eat?*

Assign *Mini Activity: Choices Are Everywhere* and relate it to the food choices students make each day.

Assign *Mini Activity: Write an Advertisement* in which students design an appealing ad for a fruit or vegetable.

Emphasize the relationship between a food and a food nutrient and the six nutrient groups.

Assign the Journal Writing relating to fats in the diet and the Journal Writing relating to vitamin supplements.

Assign the Journal Writing relating to vitamin deficiencies.

Introduce and complete *Activity 1-2: What's in Your Food?*

Draw students' attention to the key ideas using means such as posters and overhead transparencies.

Select appropriate Projects and Interdisciplinary Connections to complete if time permits.

Use the *Apply Your Knowledge* and *Review Questions* in reviewing the section.

Journal Writing

What are your most favorite things to eat? Write them down. Then write a paragraph or two about whether or not you think your preferred diet is healthy. After you finish this unit, review your list and what you wrote to see if your views have changed.

Mini-Activity

Choices Are Everywhere Students generate a list of choices that they face each day, including food choices, and share them with the class.

2.3 Activities and Answer Keys

Activity 1-1: Are You What You Eat?

PLAN

Summary Students begin their study of nutrition by keeping a food diary for two consecutive days. They determine the calories (Cal) and compare percentages of fats and proteins in their diets with the recommended guidelines.

Objectives

Students:

✓ record food and beverages they consume for two consecutive days.

✓ calculate their individual and the class average percentages of calories (Cal) available from fats and proteins.

Student Materials

- Resource 1: Food Diary (4 copies per student)
- Resource 2: Food Nutrient Chart
- Diet Data Sheet
- Activity Report
- Measuring cups and spoons; Glasses with 4 ounces and 8 ounces of liquid; Food labels; Fast Food information sheets; Food Models

Teacher Materials

- Activity Report Answer Key
- Diet and Calorie charts; Nutrition resource material; Food models; Food pyramid
- Resources 1 and 2

Advance Preparation

Assign students to bring in food labels, particularly of favorite foods, and fast-food restaurant information sheets.

Collect books on nutrition and food calorie lists to use as resources.

Duplicate class copies of the Food Diary Table (Resource 1) and Food Nutrient Chart (Resource 2).

Purchase or make food models. (See Helpful Hints.)

Estimated Time Two to three class periods

Interdisciplinary Connections

Social Studies Study diet and foods from different parts of the world and from different periods in history.

Design a "Heart Smart" restaurant as an interdisciplinary project. Include invitations, menus giving nutritional information, meal planning, and preparation around a cultural theme.

Math Calculate percents of fats, proteins, and carbohydrates present in various diets.

Home Arts Produce an ethnic food fair.

Prerequisites and Background Information

The recommended guideline of under 30% fat includes both saturated and unsaturated fats. For saturated fats the recommended percent is under 10% of the total calories consumed in a day. The recommended amount of protein for growing bodies is 15% of the total calories consumed in a day.

IMPLEMENT

Steps 1-2 Show examples of serving sizes. Use measuring spoons, cups, glasses, and food models.

Emphasize the importance of carefully estimating serving sizes.

Instruct students to begin entering food data in the morning, so that each data page will contain one day's record.

Show students how to use the Food Nutrient Chart to find needed information.

Introduce the idea of the calorie (Cal) as a unit of heat energy provided by food.

Step 2 Fill in a sample Food Diary using the overhead projector with students emphasizing where to record the number of calories and grams of fats, protein, and carbohydrates. Remind students that the recommended daily allowance for calories (Cal) can be found in their text on page 18. A complete Recommended Daily Allowances chart is located on page 96 of this book.

Extend Activity 1-1 by using the Activity Report and Diet Data Sheet for assessment at the end of the unit.

Helpful Hints

- Special emphasis in this activity is on fats and proteins to create an awareness of diets having too much fat and/or too little protein.
- Students keep the food diary for 4 days and choose 2 of the most typical days out of the 4 days.
- The Food Nutrient Chart lists many common foods with the number of calories (Cal), and amounts of protein, carbohydrates, and fat contained per serving. Additional resources can be made available for those foods that are not as commonly found in diets in the United States.
- When analyzing ethnic foods, students may need assistance. They can list the main ingredients and then look for the more common food ingredients that are similar to the foods on their list.
- Display a Food Pyramid for reference.
- Provide some examples of serving sizes. Student totals for calories (Cal) consumed often reflect a much lower daily total from what is actually taken in. The examples can be found in Home Economics catalogues. An alternate way to show serving size is to shape pieces of clay into foods. Particularly helpful are models for 3 ounces of chicken or meat, 1 ounce slice of cheese, and $\frac{1}{2}$ cup servings of pasta, rice, and/or vegetables.
- A helpful resource that lists many foods is *Are You Eating Right?* by Dr. Judi Morrill, San Jose State University, San Jose, CA, 95192-0058.

ASSESS

Use the completed Food Diary, Data Sheet, and written responses on the Activity Report to assess if students can

✓ keep an accurate record of all food and drink for 2 days.

✓ calculate the average percentage of calories available from fats and from proteins in the two-day diet.

✓ compare their diets to the guidelines for healthful limits recommended by the American Heart Association.

✓ identify possible health risks associated with unhealthy diets.

Activity 1-1: Are You What You Eat? – Activity Report Answer Key

- Sample answers to these questions will be provided upon request. **Please send an email to teachers-requests@ck12.org to request sample answers.**

1. Fill in the following chart using your totals from your two-day food diary, Resource 1.
2. How do the percentages of fats and proteins consumed compare to the recommended (a) 30% or less fat and (b) 15% or more from protein? Explain.
3. What changes, if any, could you make so that the percentages of Calories from fat consumed would fall within the recommended range of under 30% of the total Calories consumed?
4. What changes, if any, could you make so that the percentages of Calories from protein consumed would fall within the recommended range of 15% or more of the total Calories consumed?
5. What are two possible consequences for adolescents of diets too high in fat and too low in protein?

What Do You Think?

Why is it that you see lots of ads for fast food and junk food, but very few ads for vegetables and fruits?

Mini-Activity

Write an Advertisement Students create an advertisement for a fruit or vegetable designed to make the fruit or vegetable more appealing.

Mini-Activity

Word Origin of Carbohydrate Students do a library research to find the origin and chemical structure of carbohydrates.

A suggested response will be provided upon request. **Please send an email to teachers-requests@ck12.org.**

Apply Your KNOWLEDGE

Why do coaches tell their athletes to eat a big pasta dinner the night before a competition and simple sugars a few hours before the competition? Why don't the athletes eat pasta right before the competition and a candy bar the night before?

Apply Your KNOWLEDGE

Vegans are people who don't eat any animal products, including meats, eggs, or dairy products. How can these people still get the protein their cells need to grow if each kind of plant they eat doesn't contain complete proteins?

Apply Your KNOWLEDGE

One brand of granola has a label on the container stating, in big letters, "NO TROPICAL OILS." Why do you think this has been pointed out?

Journal Writing

Considering the list of possible ways to reduce fat in your diet, which three things would be the easiest for you to try as part of your own diet? Which three things would be the hardest for you to try? Why? Do you think it is important for you as an adolescent to monitor the fat in your diet? Why or why not?

Journal Writing

Many people take vitamin supplements in the form of pills or vitamin shakes. Now that you know the various vitamins found in foods and what they do for your body functions, what is your personal "philosophy" about getting enough of all the vitamins you need? Do you take large doses of vitamin supplements, moderate amounts, or none at all? Why? How does the information in this section affect your decisions about the vitamins that you consume?

Journal Writing

Make a list of all the things that could go wrong with your body due to vitamin A, B, C, and D deficiencies. Which would be the hardest for you to deal with? Are you willing to eat the foods that contain that vitamin to prevent this problem? Why or why not?

What Do You Think?

Why do you think there are so many advertisements for milk featuring famous athletes and movie stars drinking milk? What audience arc these ads targeting? As a consumer, do you think the ads are effective?

A suggested response will be provided upon request. **Please send an email to teachers-requests@ck12.org.**

Apply Your KNOWLEDGE

What do cooks mean when they say, "A colorful plate is a healthy plate"?

Activity 1-2: What's in Your Food?

PLAN

Summary Students test standard samples of starches, glucose, proteins, and fats to observe and record the chemical reactions. Then they test a variety of food samples to determine the presence, or absence, of carbohydrates, fats, and proteins in each.

Objectives

Students:

✓ perform standard tests to identify carbohydrates, protein, and fat.

✓ determine the presence of glucose, starch, sugar, protein, or fat in a variety of foods.

Student Materials

- Resource 1: Part A Data Sheet
- Resource 2: Part 13 Data Sheet

- Activity Report
- Glucose sugar solution; Egg white, raw; Butter, margarine, or vegetable oil
- Test tubes; Test-tube holder; Water bath; Graduated cylinder; Brown wrapping pa per; Plastic knife; Safety goggles; Starch solution; Iodine solution; Biuret solution; Benedict's solution; Medicine droppers (3); Small pieces of various foods (such as orange, apple, carrot, bread, peanut butter or peanuts, grapes, milk, bacon, hard-boiled egg, cheese, potato, banana, pieces of cooked chicken, cookies, doughnuts, butter, oil, or margarine, etc.)

Teacher Materials

- Activity Report Answer Key
- Small pieces or samples of various types of foods such as orange, apple, carrot, bread, peanut butter or peanuts, grapes, milk, bacon, hard-boiled egg, cheese, potato, banana, pieces of cooked chicken, cookies, doughnuts, butter, oil, or margarine, etc.

Advance Preparation

Cut up foods to be tested and assemble so students can obtain them easily. Make control solutions: 1. Protein: egg whites beaten, 2. Sugar: 10 *ml* of corn syrup mixed with 90 *ml* of warm water.

Estimated Time One and one-half 50-minute periods

Interdisciplinary Connections

Art Make a poster or a collage grouping pictures of the different food types.

Language Arts Write about the differences between sugars, starches, fats, and proteins, which foods contain them, and how they are needed in your body.

Prerequisites and Background Information

SAFETY: Awareness of fire safety, how to use a burner, and how to handle chemical indicators properly is mandatory, Review the safety rules for working in laboratory situations. Wear goggles to model appropriate laboratory safety.

Review with students how to use a graduated cylinder.

Extend Activity 1-2 by having students test plant leaves for glucose and starch after the leaves have been placed in both light and dark environments.

IMPLEMENT

Introduce Activity 1-2 by reviewing what carbohydrates, proteins, and fats are.

- Carbohydrates-sugar and starch-provide energy for your cells. The long chain carbohydrate molecules are broken down into smaller sugar molecules.
- Proteins are digested into building blocks of amino acids. Amino acids are used for building new proteins, which can be used for repairing cells, fighting infections, and other functions including growth.
- Fats are large molecules that store energy and can be digested into building blocks called fatty acids. Fats help you absorb vitamins. They also form part of the cell membrane.

Demonstrate or review the safe procedure for heating liquids in a test tube.

Caution students to use care in handling Biuret and iodine solutions. Provide the Data Sheets for Parts A and B (Resources 1 and 2).

Part A Proceed with Part A as either a student activity or a demonstration to test for starches, sugars, proteins, fats, and oil. Demonstrate the standard tests for carbohydrates, proteins, and fats.

Part B Proceed with Part B as either a student activity or a demonstration to test for nutrients.

Helpful Hints

- Provide a variety of foods for testing.
- Have students compare test results from the foods tested (colors) with the standards.

ASSESS

Use the completion of the experiment and written responses on the Activity Report to assess if students can

✓ demonstrate safe procedures when conducting the experiment.

✓ identify carbohydrates, proteins, and fats using specific standard tests.

✓ determine the presence of glucose, starch, sugar, protein, or fat in given foods.

Activity 1-2: What's in Your Food? – Activity Report Answer Key

- Sample answers to these questions will be provided upon request. **Please send an email to teachers-requests@ck12.org to request sample answers.**

1. Which of the foods you tested contain
   (a) protein?
   (b) carbohydrates: sugars? starches?
   (c) fats?
2. Which, if any, of the foods contained all three nutrients (carbohydrates, proteins, and fats)?
3. Which foods provide quick energy? Why?
4. Which foods promote growth and cell repair? Why?
5. Which foods increase the intake of
   (a) carbohydrates?
   (b) protein?
   (c) fats and oils?
6. What are some ways to limit intake of fats and oils?
7. Two groups testing a cookie for sugar with the Benedict's solution got different results from the same cookie. One group found that the Benedict's solution in the test tube turned green and the other group found that it turned orange. Give a possible reason for the difference observed.

Activity 1-2: What's in Your Food? – Resource 1 Answer Key

Part A Data Sheet Answer Key

Part A: Laboratory Tests for Nutrients

TABLE 2.1:

Nutrient	Description of Test	Results
Carbohydrates (Starch)	Iodine	Iodine changes in color from red to purple-black
Carbohydrates (Sugar)	Benedict's	Benedict's, when heated in the presence of glucose changes in color from blue/green to orange/brown
Protein (Albumin)	Buiret	Buiret, in the presence of protein, changes in color from light blue to pink/violet
Fats and Oils	Brown Bag Paper	Brown bag paper in presence of fat or oil turns clear

Activity 1-2: What's in Your Food? – Resource 2 Answer Key

Part B Data Sheet Answer Key

Part B: Testing Foods for Nutrients

Indicate the results of your tests for nutrients by writing "yes" or "no" in each box.

TABLE 2.2:

Food Tested	Carbohydrate (Starch)	Carbohydrate (Sugar)	Protein	Fats and Oils
1. Milk	No	Yes	Yes	Yes
2. Hamburger	No	No	Yes	Yes
3. Potato	Yes	No	No	No
4. Bread	Yes	Yes	Yes	No
5.				
6.				
7.				
8.				
9.				
10.				

Review Questions/Answers

- Sample answers to these questions will be provided upon request. **Please send an email to teachers-requests@ck12.org to request sample answers.**

1. Why does what you eat matter?
2. Compare a carbohydrate molecule and a glucose molecule.
3. What is meant by the terms *essential amino acids* and *complete* proteins?
4. What is the difference between saturated and unsaturated fats?
5. What are three examples of a vitamin or a mineral deficiency? What disorders can each cause?
6. What are five body functions that need the recommended five 8-oz glasses of water you should drink every day?

Activity 1-1 Resource 1: Are You What You Eat? (Student Reproducible)

TABLE 2.3: Food Diary

Food	Servings	Calories	Protein (g)	Carbohydrates (g)	Fat (g)

Activity 1-1 Resource 2: Are You What You Eat? (Student Reproducible)

TABLE 2.4: Food Nutrient Chart

Fruit Group	Calories	Proteins (g)	Carbohydrates (g)	Fat (g)
Apple, 1 medium	70		18	1
Apple juice, 1 cup	120		30	
Applesauce, 1 cup	110	0	28	0
Apricots, 5 halves (dried, uncooked)	40	0	10	0
Avocado, $\frac{1}{2}$	185	2.5	6	18
Banana, 1 medium	101	1	26	
Cantaloupe, $\frac{1}{4}$ (medium)	30	1	7	
Cherries, 1 cup	105	2	26	
Fruit cocktail, 1 cup (canned)	195	1	50	
Fruit salad, $\frac{1}{2}$ cup	99	2	25	1
Grape juice, frozen (diluted, 1 cup)	135	1	33	
Grapefruit, $\frac{1}{2}$ pink (medium)	45	1	12	
Grapes, $\frac{1}{2}$ cup	48		12	
Honeydew melon, 1 medium wedge	56	1	15	1
Kiwi, 1 medium	46	1	11	
Lemonade, frozen (diluted, 1 cup)	110		28	
Mango, 1 medium	135	1	35	1
Orange, 1 medium	65	1	16	
Orange juice, frozen (diluted, 1 cup)	129	2	31	
Peach, 1 small (uncooked)	35		10	
Peaches, $\frac{1}{2}$ cup (canned)	100	1	26	
Pear, 1 medium	101	1	25	1
Persimmon, 1 medium	118	1	31	
Pineapple, 1 cup (no sugar added)	76	1	19	1

TABLE 2.4: (continued)

Fruit Group	Calories	Proteins (g)	Carbohydrates (g)	Fat (g)
Plum, 1 small (uncooked)	25	7		
Raisins, $4\frac{1}{2}$ TBS	123	1	33	
Raspberries, 1 cup (uncooked)	60	1	14	1
Strawberries, 1 cup (uncooked)	55	1	12	
Tangerine, 1 medium	40		10	
Watermelon, 1 cup diced	49	1	11	

TABLE 2.5:

Milk/Yogurt/Cheese Group	Calories	Proteins (g)	Carbohydrates (g)	Fat (g)
Cheese, American or cheddar, 1 oz	113	7	0	9
Cheese, cottage, 1 cup low fat	162	28	6	2
Cheese, cream, 1 oz	100	2	1	10
Cheese, mozzarella (whole milk), 1 oz	90	6	1	7
Cheese, Parmesan, 1 TBS	25	2	4	2
Cheese, Swiss, 1 oz	105	8	1	8
Ice cream, $\frac{1}{2}$ cup	135	2	16	7
Milk, chocolate (2%), 1 cup	190	8	27	6
Milk (2%), 1 cup	121	8	12	5
Milk (nonfat), 1 cup	85	8	12	0
Milk (whole), 1 cup	150	8	11	8
Milkshake, 11 oz (chocolate)	371	10	66	8
Milkshake, 11 oz (other flavors)	350	12	56	9
Sherbet, 1 cup	270	2	59	4
Whipped cream, 1 cup	154	2	7	13
Yogurt, 8 oz (frozen)	247	9	44	5
Yogurt, fruit, 8 oz	230	10	42	3
Yogurt, vanilla or coffee, 8 oz	200	11	32	4

TABLE 2.6: Food Nutrient Chart

Bread/Cereal/Rice/Pasta Group	Calories	Proteins (g)	Carbohydrates (g)	Fat (g)
Bagel, 1 medium	165	6	28	2
Bran flakes, $\frac{3}{4}$ cup	105	4	28	1
Bread, 1 slice (whole wheat)	60	3	13	1
Bread, 1 slice (enriched, white)	70	2	12	1
Cornbread, $2'' \times 3''$ piece	191	6	30	5
Cornflakes, $\frac{3}{4}$ cup	72	2	16	0
Crackers, 4 graham	108	2	21	2
Crackers, 4 saltines	110	1	8	2
Granola, 1 bar	127	3	19	5
Muffin, 1 blueberry	110	3	17	4
Noodles, egg, (enriched), 1 cup	200	7	37	2
Oatmeal, $\frac{1}{2}$ cup	66	2	12	2
Pancake ($4''$ diameter)	60	2	9	2
Pasta, 1 cup	190	1	39	0
Rice, $\frac{1}{2}$ cup	112	2	25	2
Roll, 1 hard (enriched)	159	5	30	2
Roll (hot dog or hamburger)	119	3	25	2
Sourdough bread, 1 medium slice	73	2	14	1
Tabbouleh, 1 cup	186	3	14	13
Taco shell (fried)	200	3	36	6
Tortilla, corn (enriched, $6''$)	41	1	8	1
Tortilla (whole wheat flour, $8''$)	154	4	28	4

TABLE 2.7:

Meat/Poultry/Dry Beans/Eggs/Nuts Group	Calories	Proteins (g)	Carbohydrates (g)	Fat (g)
Bacon, 3 slices, $\frac{1}{4}$ inch thick	309	24	0	24
Beans, $\frac{1}{2}$ cup (refried)	142	9	26	1
Beef steak, 3 oz (broiled)	260	23	0	15
Beef, 3 oz, regular (ground, cooked)	243	20	0	17

TABLE 2.7: (continued)

Meat/Poultry/Dry Beans/Eggs/Nuts Group	Calories	Proteins (g)	Carbohydrates (g)	Fat (g)
Beef, 3 oz, lean (ground, cooked)	237	22	0	16
Blue fish, 3 oz (baked, butter)	135	22	0	4
Bologna, 1 slice	86	3	0	8
Chicken, 6.2 oz (broiled)	240	52	0	7
Chicken, 6 oz (fried)	402	52	4	18
Egg, 1 large (fried)	83	5	1	6
Egg, 1 large (hard boiled)	79	6	1	6
Egg, 1 large (scrambled)	95	6	1	7
Fish sticks, 1 stick (breaded)	50	5	2	3
Ham, 1 oz	65	5	0	5
Hot dog, 2 oz	172	7	1	15
Hummus, 1 TBS	26	1	3	1
Meat loaf, 3 oz	230	15	13	12
Peanut butter, 2 TBS	190	8	6	16
Peanuts, $\frac{1}{4}$ cup (salt)	211	9	7	18
Pork chop, 3 oz	308	21	0	24
Salmon, 1 oz (poached)	41	7	0	1
Sausage, 2 links	135	5	0	13
Shrimp, 1 cup (boiled)	202	39	2	3
Tuna, 3 oz	168	25	0	7
Turkey, dark (4 medium pieces)	175	26	0	7
Turkey, white (2 medium pieces)	150	28	0	3

TABLE 2.8: Food Nutrient Chart

Vegetable Group	Calories	Proteins (g)	Carbohydrates (g)	Fat (g)
Asparagus, 4 spears	12	1	2	0
Beans, green, 1 cup (cooked)	46	3	11	0
Beans, green, $\frac{1}{2}$ cup (uncooked)	16	1	3	0
Beans, lima, $\frac{1}{2}$ cup	94	7	17	0
Broccoli, $\frac{1}{2}$ cup	20	2	4	0
Carrots, $\frac{1}{2}$ cup	22	1	5	0

TABLE 2.8: (continued)

Vegetable Group	Calories	Proteins (g)	Carbohydrates (g)	Fat (g)
Cauliflower, $\frac{1}{2}$ cup	13	1	3	0
Celery, 8″ stalk	5	0	2	0
Coleslaw, $\frac{1}{2}$ cup	82	1	3	8
Corn, 1 cup	14	4	32	2
Cucumber, 1 small (uncooked)	25	1	6	0
Lettuce, $\frac{1}{2}$ cup	5	1	2	0
Peas, 1 cup (cooked)	70	9	5	2
Potato, 1 large (baked)	132	4	30	0
Potato, 2 small (boiled)	79	2	18	0
Potato, 20 pieces (French fried)	233	4	31	11
Potato, $\frac{1}{2}$ cup (mashed)	63	2	13	1
Potato, sweet	78	1	18	0
Salad, $\frac{1}{4}$ cup (radish, carrot, lettuce, green pepper, tossed)	13	1	3	0
Spinach, 1 cup (cooked, no fat added)	40	6	7	0
Squash, $\frac{1}{2}$ cup (summer)	16	1	3	0
Squash, $\frac{1}{2}$ cup (winter)	56	2	14	0
Sweet red pepper, 1 small	19	1	4	0
Tomato, $\frac{1}{2}$ medium	22	1	5	0
Tomato juice, $\frac{1}{2}$ cup	26	1	5	0

TABLE 2.9:

Other Foods	Calories	Proteins (g)	Carbohydrates (g)	Fat (g)
Rice cake, 1	35	1	7	0
Cheesecake, 1 slice	405	11	37	25
Sorbet	188	1	47	0
Marinara sauce, 1 cup	186	4	26	9
Meat sauce, 1 cup	273	5	40	12
White, milk sauce, 1 cup	393	10	23	30
Hot cocoa with low-fat milk, 1 cup	101	3	22	1

Activity 1-1 Diet Data Sheet: Are You What You Eat? (Student Reproducible)

A nutritionally balanced diet should have the six essential nutrients in appropriate amounts and total calories consumed close in number to the number of calories needed. A standard calorie chart and/or the results of *Activity 2-2: Calories: How Much Energy Do You Use?* will give you an idea of how many Calories are needed per day for someone of your age. A food pyramid will provide information on the kinds of foods that are sources of fats, proteins, and carbohydrates. Figure 1 shows the recommended percentages of carbohydrates, fats, and proteins in your daily diet.

Now complete the two-day diet plan using your Food Diary (Resource 1), Activity 1-1 Report, the food pyramid, and the Food Nutrient Chart (Resource 2). Write a plan that

- fits your daily caloric need
- has no more than 30% of its calories from fats
- has about 15% of its calories from proteins
- includes foods from all 5 food groups

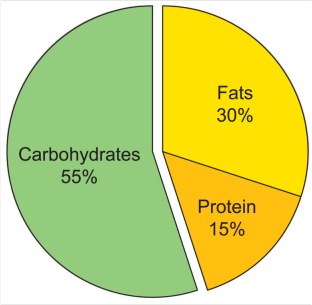


Figure 1

Before filling out the diet plan, find the following values:

1. My calorie use per day is about _____ calories. (Use the chart in the text.)

2. My calories from fats per day should be no more than 30%- _____ calories = calories from fat

3. My total calories from protein per day should be about 15%- _____ calories = calories from protein

4. Can you think of an easy way to calculate how many calories of carbohydrates your diet has?

After filling out your diet plan, answer the following questions:

Day 1 Total grams of fat = _____ calories = _____

Day 2 Total grams of fat = _____ calories = _____

Average number of calories from fat per day = _____

Day 1 Total grams of protein = _____ calories = _____

Day 2 Total grams of protein = _____ calories = _____

Average number of calories from protein per day = _____

How did your recorded diet compare with the nutritionally balanced diet in Figure 1? Explain the references.

Activity 1-1 Report: Are You What You Eat? (Student Reproducible)

1. Fill in the following chart using your totals from your two-day Food Diary (Resource 1).

TABLE 2.10:

Fat	**Protein**
Day 1-Total g of fat _____	Day 1-Total g of protein _____
Day 2-Total g of fat _____	Day 2-Total g of protein _____
Average g of fat/day _____	Average g of protein/day _____
Fats contain 9 calories per gram (9 calories/gram) _____ $g \times 9$ calories/gram = _____ calories	Protein and carbohydrates contain 4 calories per gram (4 calories/gram) _____ $g \times 4$ calories/gram = _____ calories
calories	
Day 1-Total calories _____	
Day 2-Total calories _____	
Average calories/day _____	

Use the following formula to determine the percentage of calories from fat that you eat in a day:

$$\frac{\text{(Total calories of fat in a day)}}{\text{(Total calories in a day)}} \times 100 = \_\_\_\_\_ \% \text{ calories from fat}$$

Use the following formula to determine the percentage of calories from protein that you eat in a day:

$$\frac{\text{(Total calories of protein in a day)}}{\text{(Total calories in a day)}} \times 100 = \_\_\_\_\_ \% \text{ calories from protein}$$

TABLE 2.11:

Fat	**Protein (Needed for Growth)**
Recommended intake: 30% or less of average daily calorie total	Recommended intake: 15% or average daily calorie total

2. How do the percentages of fats and proteins consumed compare to the recommended (a) 30% or less from fat and (b) 15% or more from protein? Explain.

3. What changes, if any, could you make so that the percentages of calories from fat consumed would fall within the recommended range of under 30% of the total calories consumed?

4. What changes, if any, could you make so that the percentages of calories from protein consumed would fall within the recommended range of 15% or more of the total calories consumed?

5. What are two possible consequences for adolescents of diets too high in fat and too low in protein?

Activity 1-2 Resource 1: What's in Your Food? (Student Reproducible)

Part A Data Sheet

Part A: Laboratory Tests for Nutrients

TABLE 2.12:

Nutrient	Description of Test	Results
Carbohydrates (Starch)		
Carbohydrates (Sugar)		
Protein (Albumin)		
Fats and Oils		

Activity 1-2 Resource 2: What's in Your Food? (Student Reproducible)

Part B Data Sheet

Part B: Testing Foods for Nutrients

Indicate the results of your tests for nutrients by writing "yes" or "no" in each box.

TABLE 2.13:

Food Tested	Carbohydrate (Starch)	Carbohydrate (Sugar)	Protein	Fats and Oils
1. Milk				
2. Hamburger				
3. Potato				
4. Bread				
5.				
6.				
7.				
8.				
9.				
10.				

Activity 1-2 Report: What's in Your Food? (Student Reproducible)

1. Which of the foods you tested contain

a. protein?

b. carbohydrates:

sugars?

starches?

c. fats?

2. Which, if any, of the foods contained all three nutrients (carbohydrates, proteins, and fats)?

3. Which foods provide quick energy? Why?

4. Which foods promote growth and cell repair? Why?

5. Which foods increase the intake of

a. carbohydrates?

b. protein?

c. fats and oils?

6. What are some ways to limit intake of fats and oils?

7. Two groups testing a cookie for sugar with the Benedict's solution got different results from the same cookie. One group found that the Benedict's solution in the test tube turned green and the other group found that it turned orange. Give a possible reason for the difference observed.

CHAPTER 3 Food Is Fuel - Teacher's Guide (Human Biology)

CHAPTER OUTLINE

3.1 Planning

Key Ideas

- Food is digested to provide the nutrients needed by the cells in your body.
- Cellular respiration is the process in which sugar molecules are chemically broken down to produce energy.
- Total energy requirements vary depending on your size, physical activities, and age.
- Eating a balanced diet means choosing foods that provide the recommended amounts of fats, carbohydrates, proteins, vitamins, minerals, and water.

Overview

Students expand their knowledge of food nutrients by examining how they are converted into energy within cells through the process of cellular respiration. They use a calorimeter to measure the heat energy released from a peanut. Students learn the average daily energy requirements for their age and chart their energy needs based on selected daily activities. Students study the food pyramid and identify examples and recommended daily amounts of each of the five food groups. Students revisit their food diaries from Section 1 to compare energy taken in with energy needed.

Objectives

Students:

✓ describe how the energy stored in food molecules is released through the process of cellular respiration.

✓ learn how to measure food energy stored in a peanut.

✓ identify the five different food groups and the major nutrients in each food group.

✓ estimate individual energy needs over a 24-hour period.

✓ demonstrate how to use the food pyramid as a guide for healthy eating.

Vocabulary

calorie, cellular respiration, combustion

Student Materials

Activity 2-1: Calories: In a Nutshell

- Data Sheet
- Resource
- Activity Report
- Goggles; Test tube; Test-tube holder; Calorimeter (a can adapted for this purpose); Thermometer; Graduated cylinder; Cork; Needle; Matches; Peanuts

Activity 2-2: Calories: How Much Energy Do You Use?

- Data Sheet
- Activity Report

Teacher Materials

Activity 2-1: Calories: In a Nutshell

- Activity Report Answer Key
- Resources on heat energy, nutrition

Activity 2-2: Calories: How Much Energy Do You Use?

- Activity Report Answer Key
- Calorie expenditure charts and resources

Advance Preparation

See Activities 2-1 and 2-2 in the Student Edition

Activity 2 -1: Calories: In a Nutshell

- Collect 8-ounce cans.
- Make calorimeters as described in the Activity in the Teacher's Edition on TE p. 26.

Activity 2 -2: Calories: How Much Energy Do You Use?

- Gather charts and resources that list various activities and their calorie expenditures per unit time.

Interdisciplinary Connections

Math Students calculate averages and percents and practice making data tables and charts. Perhaps the computational part of the activity can be done in math class.

Physical Education Relate the calories in food to the fuel needed for a young person's daily activities. Compare energy requirements for various sports and physical activities.

Social Studies Discuss how different cultures regard physical activity and exercise. Compare calorie requirements for different types of jobs, for instance, between a computer programmer and a construction worker.

Background Information

It should be noted that physiologists are abandoning the calorie as an energy unit and switching to the System of International units used by most European countries. The replacement for the calorie in the System of International units is the joule; one calorie (Cal) is equal to 4.184 joules.

3.2 Using Food Is Fuel – Student Edition (Human Biology)

Emphasize the importance of calories (Cal or kilocalories) in measuring energy available in food.

Introduce or review the process of cellular respiration.

Introduce and complete *Activity 2 -1: Calories: In a Nutshell.*

Assign the Journal Writing on exercise.

Relate energy and calories to students' activities as an introduction to *Activity 2-2: Calories: How Much Energy Do You Use?*

Discuss the 5 food groups and the food pyramid.

Draw students' attention to the key ideas using means such as posters and overhead transparencies.

Select appropriate Projects and Interdisciplinary Connections, if time permits.

Use the *Apply Your Knowledge* and *Review Questions* in reviewing the section.

3.3 Activities and Answer Keys

Activity 2-1: Calories: In a Nutshell

PLAN

Summary Students investigate the relationship between food and heat energy. They measure heat energy (in units called calories or "Cal") released by food (a burning peanut) using a calorimeter.

Objectives

Students:

✓ define *heat energy* and *calorie.*

✓ determine the relationship between food and calories.

Student Materials

- Goggles; Test tube; Test-tube holder; Calorimeter (a can adapted for this purpose); Thermometer; Graduated cylinder; Cork; Needle; Matches; Peanuts
- Data Sheet
- Resource
- Activity Report

Teacher Materials

- Activity Report Answer Key
- Resources on heat energy, nutrition

Advance Preparation

Collect 8- and 16-ounce cans. Make calorimeters by first removing the top of an aluminum can. The n punch a one-half inch hole in the center of the bottom of the can. Cut 2 notches along the other end of the can for air circulation. (See the Resource.)

Gather and organize student materials listed.

Estimated Time One 50-minute class period

Interdisciplinary Connections

Math Students calculate averages and percents and practice making and using data tables.

Physical Education Relate the calories in food to fuel needed for a young person's (ages 11-15) daily activities. Compare the energy required for different sports and physical activities.

Prerequisites and Background Information

The amount of heat energy released by food is expressed in units called calories. One calorie (cal) is the amount of heat needed to raise the temperature of 1 gram (milliliter) of water by one degree Celsius. The number of calories is found by multiplying the mass of water in grams by the change in temperature in degrees Celsius. The equation is

$$\text{CALORIES} = \text{WATER (grams)} \times \text{CHANGE IN TEMPERATURE (DEGREE CELSIUS)}$$

We are more familiar with food calories, abbreviated with a capital C (Cal or kilocalories). The food calorie is a bigger unit of measurement than the calorie abbreviated with the small c. One calorie (Cal) is equal to one thousand calories (Cal). In equation form, if we burn a peanut and it heats 50 grams of water from 20 degrees Celsius to 50 degrees Celsius, then we are measuring 1,500 calories or 1.5 Calories (Cal).

A calorimeter is often used to determine the number of calories (Cal), or the energy in a given food item. It measures the amount of heat energy released when a food item is burned. When using a calorimeter, a person measures the temperature of water in the calorimeter before and after burning a food item. Heat energy released during this burning is absorbed by the calorimeter's water. The change in water temperature is then used to calculate the amount of heat energy released by the food.

Extend Activity 2-1 by having students conduct this activity using potato chips, both regular and reduced calorie chips. Students can design this investigation.

IMPLEMENT

Introduce Activity 2-1 by reviewing the safety rules for lab experiments. CAUTION students to wear goggles in all experimental laboratory situations. Make sure you are wearing goggles when working with fire as a model for students. Also, caution students to be very careful with the matches and the flame in this activity.

Steps 1-7 Set up the calorimeter. Then demonstrate how to carefully place the peanut on the needle. Review how to read a thermometer.

Steps 8-9 Ask students why it is important to get 3 peanuts similar in size. Allow time at the end of the period to assist with calculations and discuss the lab results.

Helpful Hints

- It is possible to do this experiment without a calorimeter. If no calorimeter is used, some heat will be lost into the air, and the temperature difference observed will not be as great as it would be if a calorimeter is used.
- Weigh the peanuts to ensure that the three being used are similar in size.
- The average peanut half has approximately 1-3 calories.
- Provide cool, unheated, and clean test tubes for each peanut test to keep the starting temperature the same.

ASSESS

Use the completion of the experiment and written responses on the Activity Report to assess if students can

✓ relate the terms *heat energy* and *calorie* to each other.

✓ explain the importance of food in providing our bodies with energy.

✓ explain the function of calorimeters.

✓ explain the importance of conducting a number of trials to collect the most accurate data.

Activity 2-1 Calories: In a Nutshell – Activity Report Answer Key

- Sample answers to these questions will be provided upon request. **Please send an email to teachers-requests@ck12.org to request sample answers.**

1. Using the data collected, calculate the average number of calories (Cal) in a peanut half.
2. What function does the calorimeter serve?
3. What reason could there be for a difference in the numbers of calories (Cal) in the 3 peanut halves?
4. There are dry roasted peanuts on the market that are advertised to be lower in calories (Cal) than other peanuts. How could you test this advertising claim?
5. If a peanut half and a sugar cube weighed the same, which do you think would provide more energy when burned? Explain.
6. Approximately how many whole peanuts would you have to eat to provide your body with 1,800 calories (Cal)?

Journal Writing

You are the advertising director for a campaign to encourage teens to exercise. What specific aspects of the lifestyles of different teenagers would you target in your campaign? What are some slogans that you would use in your advertisements? Why do you think they would be effective?

Activity 2-2: Calories: How Much Energy Do You Use?

PLAN

Summary Students estimate the number of calories (Cal) the body needs for a typical day. Using the Food Diary from *Activity 1-1: Are You What You Eat?* students compare the number of calories consumed with the calories they actually need based on age and weight.

Objectives

Students:

✓ determine the average number of calories (Cal) they need in a 24-hour period.

✓ compare the number of calories they eat with the number of calories they need.

Student Materials

- Data Sheet
- Activity Report

Teacher Materials

- Activity Report Answer Key
- Calorie expenditure charts and resources

Advance Preparation

Gather charts and resources that list various activities and their calorie (Cal) expenditures per unit time and RDA Chart. (See Resource, Activity 6-1.)

Estimated Time 20 minutes on the first day and 20 minutes after students collect their data

Interdisciplinary Connections

Physical Education Compare energy requirements for different sports or physical activities such as walking and running.

Math Calculate averages. Make and use data charts and tables.

Social Studies Discuss how different cultures regard physical activity. Students can compare calorie (Cal) requirements for different types of occupations.

Prerequisites and Background Information

Completion of *Activity 1-1: Are You What You Eat?* and *Activity 2-1 : Calories: In a Nutshell.*

IMPLEMENT

Introduce Activity 2-2 by reviewing the calorie (Cal) expenditures for different physical activities.

Steps 1-2 Select a day for students to begin their 48-hour activity record. Use a chart on a transparency to fill in sample data from a student volunteer. In this way students see an example of how to estimate calories expended per hour. An alternative would be to use hypothetical data reflecting a typical pattern of activities for a middle school student. Suggest that students record activities for one weekday and one weekend day.

Step 3 There may not be 10 males and 10 females in class. However, make sure students record an equal number of males and females. For example, if there are only 8 males in the class, have students record the data for 8 males and 8 females during a 24-hour period.

Helpful Hints

- Provide lists or examples of calorie expenditures for different physical activities.
- Have students bring their Activity 1-1 Report. If not available, have them use the Resource (RDA Chart) from Activity 6-1 to determine the allowances for their gender/age.
- Assist students in estimating the calorie expenditures per hour if they have engaged in more than one type of activity.

ASSESS

Use the completion of the Activity Data Sheet and written responses on the Activity Report to assess if students can

✓ identify the average number of calories (Cal) needed in a 24-hour period.

✓ compare the number of calories (Cal) they consumed with the number of calories (Cal) they need in a typical day.

✓ calculate the average calorie (Cal) expenditure per day for students in the classroom.

✓ compare average calorie (Cal) expenditures per day for girls with those for boys.

Activity 2-2 Calories: How Much Energy Do You Use? – Activity Report Answer Key

- Sample answers to these questions will be provided upon request. **Please send an email to teachers-requests@ck12.org to request sample answers.**

1. Calculate the average number of calories you expend in one day. Calories expended per day _____

2. Are the days during which you recorded your energy use typical days for you? Are you usually more or less active?
3. Can you think of a way to obtain results that show a more accurate picture of how much energy you typically use?
4. What was your average daily calorie intake, that is, the number of calories you usually consume, as determined in the Food Diary from *Activity 1-1: Are You What You Eat?* _____ = average number of calories (Cal) consumed per day
5. How does your average number of calories (Cal) consumed (#4) compare with the average number of calories you used (#1)? Explain. Calories Consumed = _____ Calories Expended = _____
6. What is the average calorie (Cal) expenditure per day for 10 females in your class? Calories per day =
7. What is the average calorie (Cal) expenditure per day for 10 males in your class? Calories per day =
8. Compare the average daily energy use in calories (Cal) for males with the average daily energy use for females. What factors determine energy or calories (Cal) needed per day?

Mini-Activity

Reading Food Labels Students analyze a variety of food labels. It is important that they, as consumers, know what they are buying. Federal laws require that certain information be provided. Some manufacturers print additional information on their labels.

What Do You Think?
Why do you think it is recommended that you take the skin off chicken before you eat it?

What Do You Think?
Why do you think fruit yogurt has more calories (Cal) than plain yogurt?

A suggested response will be provided upon request. **Please send an email to teachers-requests@ck12.org.**

Apply Your KNOWLEDGE

A healthy amount of fat for 11-14-year-olds to consume ranges from 65 to 85 grams per day. Suppose that in one day you eat 2 chocolate chip cookies, 4 servings of potato chips, an ice cream cone, and 2 tablespoons of mayonnaise on your sandwich. How many grams of fat have you consumed?

What Do You Think?
Considering the list of nutritional guides shown here, which do you think would be the easiest for you to follow and why? Which would be the hardest for you to follow and why?

Review Questions/Answers

- Sample answers to these questions will be provided upon request. **Please send an email to teachers-requests@ck12.org to request sample answers.**

1. What is the relationship between a calorie (Cal), a piece of bread, and the term *energy?*
2. Explain why the 5 food groups are displayed in the shape of a pyramid instead of a square.
3. Design and complete a table that includes the food groups, major nutrients in each group, and examples of food in each group.

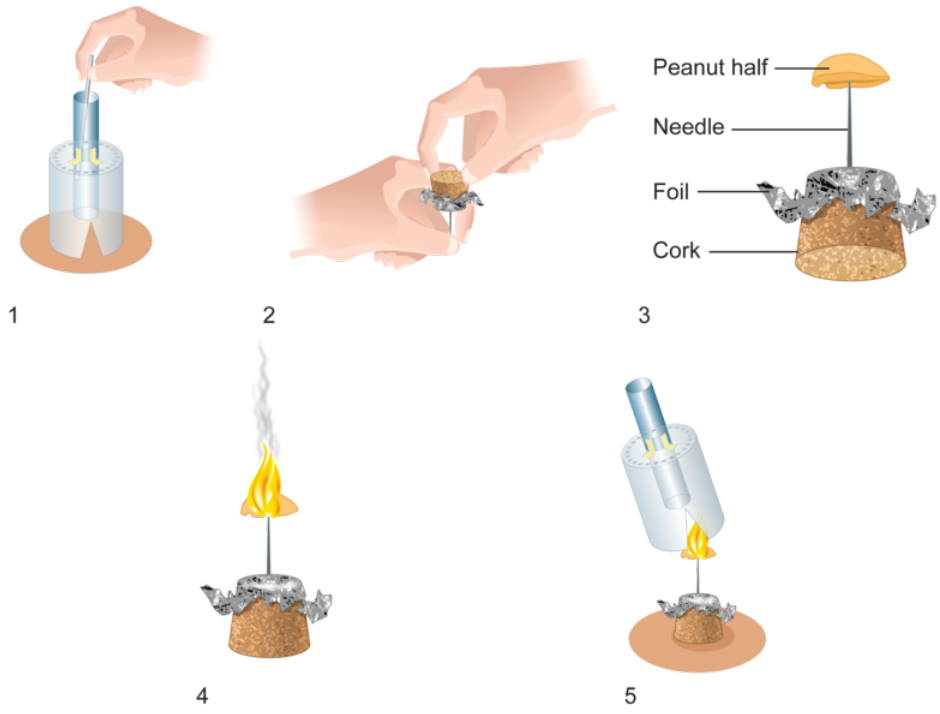
Activity 2-1 Data Sheet: Calories: In a Nutshell (Student Reproducible)

A calorie (Cal) is the amount of heat needed to raise the temperature of 1 liter of water $1°C$.

TABLE 3.1:

	Trial 1	Trial 2	Trial 3
A. water volume (ml)			
B. water temp. $(°C)$: ***before*** heating with burning peanut half			
C. water temp. $(°C)$: ***after*** heating with burning peanut half			
D. temp. increase			
E. small calories (Cal) in peanut half volume of water (ml) $\times$ temp. increase			
F. big calories (Cal or kilocalories) in peanut half (small calories/1,000)			

Activity 2-1 Resource: Calories: In a Nutshell (Student Reproducible)



Activity 2-1 Report: Calories: In a Nutshell (Student Reproducible)

1. Using the data collected, calculate the average number of calories (Cal) in a peanut half.

2. What function does the calorimeter serve?

3. What reason could there be for a difference in the numbers of calories (Cal) in the 3 peanut halves?

4. There are dry roasted peanuts on the market that are advertised to be lower in calories (Cal) than other peanuts. How could you test this advertising claim?

5. If a peanut half and a sugar cube weighed the same, which do you think would provide more energy when burned? Explain.

6. Approximately how many whole peanuts would you have to eat to provide your body with 1,800 calories (Cal)?

Activity 2-2 Data Sheet: Calories: How Much Energy Do You Use? (Student Reproducible)

Fill in the chart over 2 clays. One day should be a weekend day if possible.

TABLE 3.2:

Time	**Day 1** Activities	Calories Burned	**Day 2** Activities	Calories Burned
Noon-1 PM				
1 PM-2 PM				
2 PM-3 PM				
3 PM-4 PM				
4 PM-5 PM				
5 PM-6 PM				
6 PM-7 PM				
7 PM-8 PM				
8 PM-9 PM				
9 PM-10 PM				
10 PM-11 PM				
11 PM-Midnight				
Midnight-1 AM				
1 AM-2 AM				
2 AM-3 AM				
3 AM-4 AM				
4 AM-5 AM				
5 AM-6 AM				
6 AM-7 AM				
7 AM-8 AM				
8 AM-9 AM				
9 AM-10 AM				
10 AM-11 AM				
11 AM-Noon				

Activity 2-2 Report: Calories: How Much Energy Do You Use? (Student Reproducible)

1. Calculate the average number of calories you expend in one day.

Calories used per day _____

2. Are the days during which you recorded your energy use typical days for you? Are you usually more or less active?

3. Can you think of a way to obtain results that show a more accurate picture of how much energy you typically use?

4. What was your average daily calorie intake, that is, the number of calories you usually consume, as determined in the Food Diary from *Activity 1-1: Are You What You Eat?*

_____ = average number of calories (Cal) consumed per day

5. How does your average number of calories (Cal) consumed (#4) compare with the average number of calories you used (#1)? Explain.

Calories Consumed =_____ Calories Expended =_____

6. What is the average calorie (Cal) expenditure per day for 10 females in your class?

Calories per day = _____

7. What is the average calorie (Cal) expenditure per day for 10 males in your class?

Calories per day = _____

8. Compare the average daily energy use in calories (Cal) for males with the average daily energy use for females. What factors determine energy or calories (Cal) needed per day?

CHAPTER 4 Mouth to Stomach in One Swallow - Teacher's Guide (Human Biology)

CHAPTER OUTLINE

4.1 Planning

Key Ideas

- Digestion involves the physical and chemical breakdown of food into nutrients used by the body.
- Physical breakdown of food includes chewing food in the mouth, churning food materials in the stomach, and peristalsis within the stomach and intestines.
- Chemical breakdown of food occurs through enzyme action that breaks down large complex food molecules into small simple nutrients that are absorbed primarily in the intestines.

Overview

Students take an imaginary voyage through the digestive system to experience the anatomy and physiology of digestion. They begin their journey in the mouth. Students learn about the digestive action of the enzyme salivary amylase on carbohydrates. They continue their journey from the mouth down the esophagus, entering the stomach. Students learn how proteins are first digested in the stomach, through the action of stomach acid and enzymes, to form chyme.

Objectives

Students:

✓ identify the major regions of the digestive system.

✓ describe the digestive action of enzymes in the mouth and stomach.

✓ demonstrate and explain the role enzymes play in the digestive process.

✓ identify where each enzyme is produced and describe its function.

✓ explain how food moves along the food tube.

Vocabulary

amylase, chyme, enzyme, esophagus, gastrointestinal tract, glucose, mucus, peristalsis, saliva

Student Materials

Activity 3-1: Digestive Enzyme in Action

- Activity Report
- Milk, regular and lactose-free; Glucose test strips (4); Lactase tablets (2); Two small beakers; Masking tape

Teacher Materials

Activity 3-1: Digestive Enzyme in Action

- Activity Report Answer Key
- Model or chart of the digestive system; Glucose solution; Extra student supplies

Advance Preparation

See Activity 3-1 in the Student Edition.

Activity 3-1: Digestive Enzyme in Action

- Purchase glucose test strips and lactase enzyme tablets (Lactaid) from drugstore.
- Purchase milk and lactose-free milk from the grocery store.

Interdisciplinary Connections

Health Discuss what constitutes good dental health.

4.2 Using Mouth to Stomach in One Swallow – Student Edition (Human Biology)

Introduce the section by using the metaphor of the conveyor belt in reverse as the digestive system breaks down a bacon, lettuce, and tomato sandwich.

Before students begin the journey through the gastrointestinal tract in the inner space capsule, direct them to the illustration (Figure 3.5).

Assign *Mini Activity: Can You Tell the Types of Teeth?*

Introduce and assign *Activity 3 -1: Digestive Enzyme in Action.*

Continue to follow the journey of the inner space capsule until it leaves the stomach and enters the small intestine. Point out that in the next section students will investigate peristalsis.

Assign and discuss the *Journal Writing* relating to stress.

Draw students' attention to the key ideas using means such as posters and overhead transparencies.

Select appropriate Projects to complete if time permits.

You may want to do *Enrichment 4-1: Transport of Materials-Exploring Diffusion* as a demonstration when beginning the section. Students can do this activity again themselves at the end of Section 4.

Use the *Apply Your Knowledge* and *Review Questions* in reviewing the section.

What Do You Think?

Why do you think some birds need to swallow stones to help them digest their food? Describe how you think their digestive systems work, considering the kinds of food they eat.

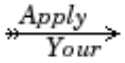
What Do You Think?

Have you ever watched a TV commercial for a hot, steaming pizza that made you hungry even though you weren't hungry a moment before? A Russian scientist named Dr. Pavlov did an experiment on salivation. Dr. Pavlov rang a bell whenever a dog was fed. The dog salivated because it smelled and tasted the food. After many feedings, the dog would begin salivating when the bell rang, even if there wasn't any food. What do you think this shows about how the brain connects to our digestive systems? Why do we sometimes convince ourselves we are hungry when our bodies don't agree, or that we aren't hungry when we really are? Is this healthy behavior? Why or why not?

Mini-Activity

Can You Tell the Types of Teeth? Students look at their teeth in a mirror and identify the incisors, canines, bicuspids, and molars.

A suggested response will be provided upon request. **Please send an email to teachers-requests@ck12.org.**



Can you tell what kinds of foods different animals eat by looking at their teeth? Describe some differences between animal teeth and how they match the diets of those animals.

Apply Your KNOWLEDGE

The sight or smell of good food can make you salivate. Another condition that causes you to salivate is nausea, for example, when you get seasick. What role do you think saliva can play when you are nauseated?

4.3 Activities and Answer Keys

Activity 3-1: Digestive Enzyme in Action

PLAN

Summary Students test milk for the presence of glucose both before and after the enzyme lactase has been added. They lest regular milk and lactose-free milk.

Objectives

Students:

✓ define the term *enzyme*.

✓ demonstrate a test for the presence of the glucose using lactase with regular and lactose-free milk samples.

✓ explain the action of the digestive enzyme lactase on milk.

Student Materials

Per team

- Activity Report
- Milk, regular and lactose-free; Glucose test strips (4); Lactase tablets (2); Two small beakers; Masking tape

Teacher Materials

- Activity Report Answer Key
- Model or chart of the digestive system; Glucose solution; Extra student supplies

Advance Preparation

Purchase glucose test strips and lactase enzyme tablets (Lactaid) from drugstore. Cut test strips into two strips lengthwise so each student team will receive four slender strips. Purchase milk and lactose-free milk from the grocery store. Prepare glucose solution by adding a small amount of glucose (dextrose) to approximately 100 *ml* of water.

Estimated Time $\frac{1}{2}$ class period

Interdisciplinary Connections

Social Studies Conduct research to find out which ethnic groups have a prevalence of lactose intolerance. Is there an advantage to this intolerance?

Home Arts Survey grocery stores to see what other lactose-free products are available.

Prerequisites and Background Information

Students need to know the function of enzymes as catalysts for chemical reactions. Enzymes play an integral role in the digestive process. It would be helpful for students to know that lactose is a complex sugar that breaks down into two monosaccaride molecules, glucose and galactose.

Chapter 5, "Cultural Mediation: The Evolution of Adult Lactose Absorption" in the book *CoEvolution* by William Durham (Stanford University Press, 1991) is an excellent resource for background information on lactose intolerance.

IMPLEMENT

You can do this activity as a demonstration or have students conduct the activity in lab teams.

Introduce Activity 3-1 by reviewing the role of enzymes in reactions. Share with students that the enzyme lactase is produced in the small intestine. Lactase breaks down lactose in the small intestine.

Steps 1-3 Demonstrate the positive test for glucose using a glucose solution and a glucose strip. If students are conducting this activity in teams, you might want to introduce a control. Discuss the use of controls in experiments. Then have students use water as a control in this procedure.

> **Helpful Hints**
> Lactase is also available in liquid form.

Steps 1-5 Review the importance of maintaining clean test equipment. If the beakers have residue from the other milk being tested, the test results may be contaminated.

Conclude Activity 3-1 by discussing the effect the enzyme lactase had on lactose.

ASSESS

Use the completion of the experiment and written responses on the Activity Report to assess if students can

✓ explain the function of enzymes in digestion.

✓ interpret the results of the glucose test on regular and lactose-free milk.

✓ explain the action of the digestive enzyme lactase on milk.

Activity 3-1: Digestive Enzyme in Action – Activity Report Answer Key

- Sample answers to these questions will be provided upon request. **Please send an email to teachers-requests@ck12.org to request sample answers.**

1. What happens to the glucose test strip in the presence of glucose?
2. Describe the results of the glucose strip test with
   (a) regular milk.
   (b) lactose-free milk.
3. Describe the results of the glucose test with the regular milk after the lactase tablet has been added. Explain.
4. Describe the digestive action of lactase.
5. Why do some individuals substitute lactose-free milk for regular milk in their diets?

Journal Writing

Think about how you feel when you are under stress. How does your stomach feel? Explain how you think an ulcer can be caused by a person being under a lot of stress. Describe several ways you could deal with the stress in your life to leave you feeling calm instead of upset.

Review Questions/Answers

- Sample answers to these questions will be provided upon request. **Please send an email to teachers-requests@ck12.org to request sample answers.**

1. The three major components in food that require digestion are carbohydrates, fats, and proteins. How is digestion of these three components similar and/or different, until the time they reach the pylorus?
2. Why is it important to chew food thoroughly?
3. What role do enzymes play in digestion? Include two examples of enzymes. Explain where each enzyme is produced, where each does its work, and what it does.
4. What moves food along the food tube? Explain what keeps food moving in the right direction.

Activity 3-1 Report: Digestive Enzyme in Action (Student Reproducible)

1. What happens to the glucose test strip in the presence of glucose?

2. Describe the results of the glucose strip test with

a. regular milk.

b. lactose-free milk.

3. Describe the results of the glucose test with the regular milk after the lactase tablet has been added. Explain.

4. Describe the digestive action of lactase.

5. Why do some individuals substitute lactose-free milk for regular milk in their diets?

CHAPTER 5 A Journey through the Intestine - Teacher's Guide (Human Biology)

CHAPTER OUTLINE

5.1 Planning

Key Ideas

- The pancreas and liver secrete important enzymes and substances necessary for the process of digestion.
- The rhythmic contractions of peristalsis mix and move chyme through the intestines.
- Nutrient absorption occurs primarily in the small intestine.
- Osmosis and diffusion are the processes involved in absorption of digested food molecules (nutrients) from the small intestine into the bloodstream.

Overview

Students complete their imaginary voyage through the intestines. They observe the emulsifying action of bile produced by the liver on fats. Students explore the role of the pancreatic enzymes on food in the small intestine. They simulate peristalsis and observe how food in the form of chyme moves through the intestines. They investigate the structure and vast surface area of the intestines. Students learn about osmosis and absorption. They complete the voyage through the digestive tract by learning what happens in the colon or large intestine.

Objectives

Students:

✓ identify the major regions of the digestive tract.

✓ describe the digestive action in the intestines.

✓ explain the roles of the pancreas and liver in the digestive process.

✓ describe the structure and function of the small intestine.

✓ demonstrate and explain peristalsis in the small intestine.

✓ describe the structure and function of the villi in the small intestine.

✓ explain the role of the colon in the digestive process.

Vocabulary

cirrhosis, diffusion, emulsifies, feces, liver

Student Materials

Activity 4-1: A Journey through the Intestine (Peristalsis)

- Activity Report
- Tubing (2-inch diameter); Simulated chyme (cooked oatmeal/rice); Coloring material; Selected food items (grapes/lettuce); Bucket of water and paper towels; Water bottle; Spoons; Gloves; Funnel with large opening

Activity 4-2: A Journey through the Intestine (Villi)

- Activity Report
- Slides of intestine showing villi, and epithelial cells. (Electron micrographs of microvilli from textbooks); Microscope; Model or diagram of human digestive tract; Corrugated box cardboard; Sheep, pig, or cattle intestine; Butcher paper and/or adding machine paper; Scissors, markers, tape, ruler; Calculator; Scalpel or razor blade; Gloves (latex or plastic)

Teacher Materials

Activity 4-1: A Journey through the Intestine (Peristalsis)

- Materials for simulated chyme-Rice mixture: 2 cups water, 1 cup rice, 3 teaspoons salt; Oatmeal mixture: 6 cups water, 2.5 cups oatmeal, 5 teaspoons salt
- Diagram or model of the digestive system
- Activity Report Answer Key

Activity 4-2: A Journey through the Intestine (Villi)

- Diagram or model of the digestive system
- Activity Report Answer Key

Advance Preparation

See Activities 4-1 and 4-2 in the Student Edition

Activity 4-1: A Journey through the Intestine (Peristalsis)

- Prepare the simulated chyme and store in refrigerator for at least 2 days.
- Order tubing.

Activity 4-2: A Journey through the Intestine (Villi)

- Order the intestines (sheep, pig, cattle) from a packinghouse or a local grocery store or butcher.
- Order the microscope slides of the intestine.

- Buy adding machine paper or cut strips of butcher paper.
- Collect corrugated cardboard and string.

Interdisciplinary Connections

Language Arts Students use creative writing to describe the digestive process.

Physical Education Create a dance simulating the digestion process.

Enrichment Activities

Enrichment 4-1: Transport of Materials-Exploring Diffusion

Order or borrow potassium permanganate, large graduated cylinders and glass tubing from the science department of your local high school.

Enrichment 4-2: Chemical Digestion Simulation

Enrichment 4-3: What Happens to the Digested Nutrients in the Small Intestine?

Order iodine, Benedict's solution, and soluble starch.

Obtain dialysis tubing (from local medical supply store, science supply, or hospital).

5.2 Using A Journey through the Intestine – Student Edition (Human Biology)

Discuss the role of models in science. Continue the capsule journey as it travels through the intestine to find out how the body gets the nutrients it needs.

Complete *Mini Activity: Coil a Rope* as a model of the size of the small intestine.

Complete *Mini Activity: Shake It Up* as part of the discussion of emulsification.

Continue the discussion of digestive juices including the names, location, and actions.

Use the completion of *Activity 4-1: A Journey through the Intestine (Peristalsis)* to model and describe the movements of the small intestine.

Complete *Mini Activity: What Passes across a Membrane?*

Discuss the importance of a vast surface area of the small intestine for absorption as an introduction to *Activity 4-2: A Journey through the Intestine (Villi).*

Discuss diffusion and osmosis as they relate to digestion. Use *Enrichment 4-1: Transport of Materials-Exploring Diffusion* if time permits.

Continue the capsule journey through the digestive system observing the colon, the appendix, and the liver.

Complete *Mini Activity: Drawing the Actions of the Digestive System.*

Draw students' attention to the key ideas using means such as posters and overhead transparencies.

Select appropriate Enrichment Activities and Projects to complete if time permits.

Use the *Apply Your Knowledge* and *Review Questions* in reviewing the section.

Mini-Activity

Coil a Rope Students coil a 1″ inch, 25-foot rope into the smallest space possible. They compare this coiling to the coiling of the intestines. They explain what features of the rope would enable them to fit it in a smaller space (i.e., flexibility-to produce the coils and folds).

Mini-Activity

Shake It Up Students put some oil and water in a jar with a tight-fitting lid and shake it. They watch the oil and water separate and then compare this action with what happens when they add some liquid soap (clear works best) to the jar and shake. The soap enables the water and oil to mix. Students then relate this mixing to the digestion of fat in the body.

A suggested response will be provided upon request. **Please send an email to teachers-requests@ck12.org.**

Apply Your KNOWLEDGE

What are gallstones?

What Do You Think?

Now that you know how different kinds of foods are digested, think about what kinds of foods you digest first and what kinds you digest last. Why do you think you are not supposed to eat fatty foods before you exercise?

5.3 Activities and Answer Keys

Activity 4-1: A Journey through the Intestine (Peristalsis)

PLAN

Summary Students make a model of an intestine out of polyethylene tubing. They simulate peristalsis by filling the tube with an oatmeal mixture representing chyme. Using their hands to simulate muscles moving the chyme through the tube, they demonstrate the most efficient method that moves food and wastes through the intestine.

Objectives

Students:

✓ define the term *peristalsis.*

✓ explain the importance of peristalsis.

✓ demonstrate the muscle movements necessary to move food mixtures (chyme) through the digestive tract.

✓ describe the physical structure of the intestine and how it promotes absorption of nutrients.

Student Materials

- Activity Report
- Tubing (2-inch diameter); Simulated chyme (cooked oatmeal/rice); Coloring material; Selected food items (grapes/lettuce); Bucket of water and paper towels; Water bottle; Spoons; Gloves; Funnel with large opening

Teacher Materials

- Activity Report Answer Key
- Materials for simulated chyme-Rice mixture: 2 cups water, 1 cup rice, 3 teaspoons salt; Oatmeal mixture: 6 cups water, 2.5 cups oatmeal, 5 teaspoons salt
- Diagram or model of the digestive system

Advance Preparation

Prepare the simulated chyme. This can be stored in the refrigerator for a few days. Apportion chyme in plastic zip-lock bags, one for each student lab group. Order tubing. Cut one piece of tubing for each lab team. Purchase any additional "roughage" food items, such as grapes or lettuce.

Estimated Time One 45-50-minute class period

Interdisciplinary Connections

Health Discuss the effects of alcohol, drugs, and coffee on the small intestine.

Arts Make a cloth or wooden model of the digestive tract, possibly showing the inside of the intestine with its muscular layers and villi that help absorption.

Prerequisites and Background Information

No special knowledge is required, though familiarity with the parts of the digestive tract would be helpful. Peristalsis is wavelike muscular contractions of the digestive tube propelling chyme through to the colon. Circular and

longitudinal smooth muscles control the diameter and the length of segments of the intestines. Peristalsis moves chyme along the intestines and rubs it against the wall so digested molecules can be absorbed. A large surface for absorption ensures adequate nutrition. Patients with shortened intestines (e.g., resulting from surgery) can become malnourished because of inadequate absorption. Acetyl-choline stimulates peristalsis and, in excess, can cause diarrhea. Norepinephrine slows peristalsis. Paregoric, an opiate, paralyzes peristalsis. In contrast to the migrating rings of peristalsis in the intestine, colonic movements are to and fro. Colonic movements occur more frequently in the ascending than in the transverse colon and facilitate the absorption of water. An increased number of squeezes at one end moves chyme along the colon. Students can mimic these movements (called haustral shuttling or mass movements) at the aboral (anal) end of their long tube model.

Chyme can be whitish yellow at the start and then turns stool color later, after the duodenum, because bile enters. Black stools come from stomach bleeding because hemoglobin acted on by stomach acid turns black.

IMPLEMENT

This activity works well when each lab group has a set of materials at the lab station. However, if time is limited, this activity is also a good demonstration. You might have several students do the demonstration under your guidance.

Introduce Activity 4-1 by demonstrating it.

Steps 1-6 Students can use their peristalsis models to simulate the actions of certain drugs, such as acetylcholine (to speed up peristalsis), norepinephrine (to slow peristalsis), or paregoric (an opiate that paralyzes peristalsis).

Extend Activity 4-1 by encouraging students to perform research about disorders of the intestine and the effects of drugs.

Helpful Hints

You may want to demonstrate how to fill and squeeze materials through the tube before students begin working with their own lab groups.

- To save time, you can fill up the tubes for students ahead of time.
- Chyme can be simulated with oatmeal or rice.
- Use one quart of chyme material for each 3-foot length of tubing.
- The following combination of rice and oatmeal makes about 9 cups of chyme (4-5 demos). Each team of two will need approximately 2 cups or about 420g, e.g., 9 cups chyme = enough for 4-5 teams of 2 students.

Rice :	8×2 cups $H_2O = 16$ cups H_2O
	8×1 cup rice $= 8$ cups rice
	8×3 teaspoons salt $= 24$ teaspoons salt
	makes 24 cups cooked rice
Oatmeal :	8×6 cups $H_2O = 48$ cups H_2O
	8×2.5 cups oatmeal $= 20$ cups oatmeal
	$8 \times 5\ t$ salt $= 40\ t$ salt

- Roll of polyethylene tubing may be purchased from

Gillis #38; Lane, Inc. (packaging co.)

830 2nd Ave.

Redwood City, CA

(650) 367-9900

Fax #: (650) 367-7580

(8-12, 1-5: M-F)

Flat Tubing part # RTN MIL 02

12″ diameter rolls: 2″ , as folded and collapsed

2″ mill 2,150 linear feet/roll

Need 2-3 days notice plus time for mailing

ASSESS

Use the completion of the simulation and written responses on the Activity Report to assess if students can

✓ explain the process and importance of peristalsis.

✓ demonstrate how food moves through the intestine.

✓ describe the composition of chyme.

✓ explain how nutrients are absorbed by the small intestine.

✓ explain how certain drugs can affect the digestive tract.

Activity 4-1: A Journey through the Intestine (Peristalsis) – Activity Report Answer Key

- Sample answers to these questions will be provided upon request. **Please send an email to teachers-requests@ck12.org to request sample answers.**

1. Which type of hand movements were most effective in mixing and moving the chyme along the tube?
2. Describe what happened when you added the coloring agent and the food item.
3. Design a follow-up activity to extend your knowledge of peristalsis. (Use the back of this sheet if necessary).

Mini-Activity

What Passes across a Membrane? Students determine the sizes of four molecules-water, glucose, an amino acid, and starch-based on their ability to pass through different membranes with different-sized pores. They answer a series of questions to help them reach and justify their conclusions.

Activity 4-2: A Journey through the Intestine (Villi)

PLAN

Summary Students investigate the structural and functional characteristics of the small intestine through observations of an animal's small intestine. They explore how to increase surface area, make a model of the human intestine, look

at slides of cross sections of intestines, and measure a rectangular area representative of the surface area of the small intestine.

Objectives

Students:

✓ describe the function and structure of the small intestine.

✓ explain the function and structure of the villi of the small intestine.

✓ observe the intestinal structures of different animals.

✓ calculate the surface area of the small intestine.

✓ explain the relationship between surface area and the efficient absorption of nutrients.

Student Materials

- Activity Report
- Slides of intestine showing villi, and epithelial cells. (Electron micro-graphs of microvilli from textbooks); Microscope; Model or diagram of human digestive tract; Corrugated box cardboard; Sheep, pig, or cattle intestine; Butcher paper and/or adding machine paper; Scissors, markers, tape, ruler; Calculator; Scalpel or razor blade; Gloves (latex or plastic)

Teacher Materials

- Model or diagram of human digestive tract
- Activity Report Answer Key

Advance Preparation

Order the intestines (pig, sheep, or cattle) from a packinghouse or a local grocery store or butcher. Order the microscope slides of the intestine. Buy adding machine paper or cut strips of butcher paper. Collect corrugated cardboard and string.

Estimated Time Two 50-minute periods

Prerequisites and Background Information

It is helpful if students know how to calculate the circumference of a circle although it is possible to learn about the concept of surface area of the intestines without having this skill.

A videotape titled *Design for Living* emphasizes the efficiency of the human body. One particular sequence shows the villi and how their structure provides a large surface area for efficient absorption of nutrients. Films for the Humanities and Sciences, Inc., Box 2053, Princeton, NJ 08543

IMPLEMENT

Introduce Activity 4-2 by reviewing safety rules for working with dissection specimens. Wear gloves as you set up the necessary equipment.

Day 1

Steps 1-2 Cut sections of the intestine just before passing them out to students for dissection. The yellowish fluid, the chyme, oozes out of the ends and starts to dry up. Set up all the necessary equipment for the dissection of the intestine.

Rinse and pat dry the intestine. Then cut it into pieces of desired lengths.

Step 3 Set up microscopes for viewing slides of the cross sections of the intestinal tissue.

Day 2

Steps 4-6 Make available the materials for the intestinal model. Cut squares of corrugated cardboard of approximately 7 $cm \times 7$ cm .

Helpful Hints
This activity goes hand in hand with *Activity 4-1: A Journey through the Intestine (Peristalsis).*

ASSESS

Use the completion of the activity and written responses on the Activity Report to assess if students can

✓ describe the structure and function of the small intestine, including the villi.

✓ relate the total surface area of the intestine to the total number of villi present.

✓ explain how the folded structure of the villi increases the surface area available for food absorption.

✓ explain the relationship between surface area and the efficient absorption of nutrients.

✓ build a model and calculate the surface area of the small intestine.

Activity 4-2: A Journey through the Intestine (Villi) – Activity Report Answer Key

- Sample answers to these questions will be provided upon request. **Please send an email to teachers-requests@ck12.org to request sample answers.**

1. How does the inside surface of the intestine feel? Why?
2. Describe and sketch the corrugated cardboard square both before and after it has been flattened.
3. How is your intestinal lining like the cardboard? Why is this important?
4. What do you think would happen if part of the approximately 5-meter-long small intestine were removed?
5. Draw 3 or 4 of the villi that you see under the microscope. How are they designed for efficient nutrient absorption?
6. It has been said that the small intestine is an engineering masterpiece. Explain.
7. Many animals, like wolves, have a keen sense of smell. They have many more sense receptors than dogs, yet their noses are similar in size. How can all those receptors fit into a limited space?

A suggested response will be provided upon request. **Please send an email to teachers-requests@ck12.org.**

Apply Your KNOWLEDGE

Why do health workers not just run water into your blood through the IV?

Mini-Activity

Drawing the Actions of the Digestive System Students create three drawings of the actions of the digestive system that are analogous to the steps involved in recycling old cars.

Review Questions/Answers

- Sample answers to these questions will be provided upon request. **Please send an email to teachers-requests@ck12.org to request sample answers.**

1. What is peristalsis and how does it help you process food in the small intestine?
2. What is the role of the small intestine in digestion?
3. When a person has had his or her gall bladder removed, which digestive process will be affected? How will that process be affected?
4. What is bile? What role does it play in digestion?
5. Why don't the digestive enzymes of the pancreas digest the pancreas?
6. What is osmosis?
7. Why is the liver important? Explain five important functions of your liver.

Activity 4-1 Report: A Journey through the Intestine (Peristalsis) (Student Reproducible)

1. Which type of hand movements were most effective in mixing and moving the chyme along the tube?

2. Describe what happened when you added the coloring agent and the food item.

3. Design a follow-up activity to extend your knowledge of peristalsis. (Use the back of this sheet if necessary.)

Activity 4-2 Report: A Journey through the Intestine (Villi) (Student Reproducible)

1. How does the inside surface of the intestine feel? Why?

2. Describe and sketch the corrugated cardboard square both before and after it has been flattened.

3. How is your intestinal lining like the cardboard? Why is this important?

4. What do you think would happen if part of the approximately 5-meter-long small intestine were removed?

5. Draw 3 or 4 of the villi that you see under the microscope. How are they designed for efficient nutrient absorption?

6. It has been said that the small intestine is an engineering masterpiece. Explain.

7. Many animals, like wolves, have a keen sense of smell. They have many more sense receptors than dogs, yet their noses are similar in size. How can all those receptors fit into a limited space?

5.4 Enrichment

Enrichment 4-1: Teacher Activity Notes

Transport of Materials-Exploring Diffusion

PLAN

Summary

Students observe the diffusion of potassium permanganate $(KMnO_4)$ crystals and water in a graduated cylinder.

Objectives

Students:

✓ describe what happens when several crystals of potassium permanganate are placed at the bottom of a column of water in a graduated cylinder.

✓ explain the effect of stirring on the rate of diffusion.

✓ explain the effect of heating or cooling on the rate of diffusion.

Student Materials

- Activity Guide
- Activity Report

Teacher Materials

- Activity Guide
- Activity Report Answer Key
- Two $50 - 1,000$ *ml* (milliliter) graduated cylinders
- One 2-foot-long piece of clean, ***dry*** glass tubing with an internal diameter of about 3 *mm*
- 1 container of potassium permanganate $(KMnO_4)$ crystals
- Water

Advance Preparation

Obtain the $KMnO_4$, graduated cylinders, and glass tubing. If you don't have these available, they can be borrowed from the science department of your local high school. Or they can be ordered from a scientific supply house.

Carolina Biological Supply Company, 2700 York Rd., Burlington, NC 27215. Call 1-800-334-5551.

Estimated Time

20 minutes to set up the demonstration. Setup can be done before class. 5-10 minutes each period over several days. Allow enough time for students to observe the diffusion.

Interdisciplinary Connection

Math Tables and rate determination of diffusion could be completed in math class.

Prerequisites and Background Information

SAFETY CAUTION: Potassium permanganate is poisonous. Be sure that students do not come in contact with it at any time.

Diffusion can be defined as the movement of materials from a region of greater concentration to a region of lesser concentration due to random motion. The energy required for this movement comes from molecular motion of the materials involved. This energy is available to move materials in systems above $-273^{\circ}C$. Diffusion will continue as long as there is a difference in concentration ***and*** molecular motion within the system. Diffusion will stop when equilibrium is reached. Once equilibrium is reached, although diffusion stops, molecular motion continues.

Temperature is a net measurement of the molecular motion of the substances in a given system. For example, in an ice cube, water molecules are vibrating as they would in any solid. In liquid water, molecules are moving slowly and randomly. In water vapor, a gas, water molecules are moving rapidly.

Altering the rate of molecular motion can change the rate of diffusion. Molecular motion can be increased by adding more energy to the system in the form of heat energy (raising the temperature) or mechanical energy (stirring). Removing heat from the system (cooling) can slow the rate of diffusion.

Also, the nature of the substance determines its rate of diffusion. For example, perfume diffuses more rapidly than motor oil.

IMPLEMENT

Steps 1-4 If you set this demonstration up in advance, you may want to encourage students to try to explain how you put the potassium permanganate at the bottom of the cylinder. Take a second cylinder, fill it with water, and drop some crystals into the water. These crystals will dissolve and diffuse on the way down to the bottom.

The rate of diffusion also can be influenced by concentration. For example, you can change the rate by increasing or decreasing the substance added or by increasing or decreasing the amount of liquid in the system.

You may wish to do the demonstration at different temperatures, with varying concentrations or amounts of mechanical energy (stirring). Encourage students to record the time required for diffusion under different conditions and to make a drawing, table, or graph of the results.

Helpful Hints

- It is important that the glass tubing is dry.
- It is best to select two or three medium-size crystals of potassium permanganate.

Step 5 You and your students should see a clearly distinct band of the purple dye at the bottom of the cylinder. Over a period of several days, have students observe the process of diffusion. Have them record their observations each day. The size and number of crystals will influence the time necessary for diffusion to reach equilibrium.

ASSESS

Use the observations of the diffusion of potassium permanganate $(KMnO_4)$ crystals and water in a graduated cylinder and the written responses on the Activity Report to assess if students can:

✓ describe what happens when potassium permanganate crystals are placed at the bottom of a column of water in a graduated cylinder.

✓ explain the effect of stirring on the rate of diffusion.

✓ explain the effect of heating or cooling on the rate of diffusion.

✓ explain the effect of concentration on the rate of diffusion.

Enrichment Activity 4-1: Transport of Materials-Exploring Diffusion – Activity Report Answer Key

- Sample answers to these questions will be provided upon request. **Please send an email to teachers-requests@ck12.org to request sample answers.**

1. Explain the process of diffusion.
2. Draw the apparatus.
3. Describe the water in the apparatus.

Day 1 Day 2 Day 3 Day 4

4. How long did the diffusion process take to reach equilibrium?

Enrichment 4-1 Activity Guide: Transport of Materials-Exploring Diffusion (Student Reproducible)

Introduction

SAFETY CAUTION: Potassium permanganate is poisonous. Be sure that you do not come in contact with it at any time. Because of the poisonous nature of potassium permanganate, it is recommended that this Enrichment be done as a whole-class demonstration.

The diffusion of potassium permanganate $(KMnO_4)$ crystals in water can be used as a colorful (purple) and simple demonstration.

In this demonstration, your teacher places a few crystals of $KMnO_4$ at the bottom of a column of pure water in a graduated cylinder. The diffusion of the $KMnO_4$ is easily observed as it diffuses throughout the column of water.

Predict what will happen to the crystals when placed at the bottom of the cylinder of water and how long it will take for equilibrium to be reached.

Describe why and how the process of diffusion occurs.

Procedure

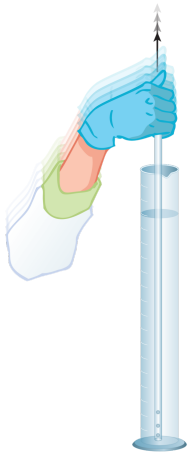
Step 1 Fill two graduated cylinders $(50 - 1,000\ ml)$ with water. One cylinder will serve as a control. The potassium permanganate $(KMnO_4)$ will be placed at the bottom of the other. Discuss the role of controls in good experimental design.

Step 2 Select a 2-foot-long piece of clean, dry glass tubing with an internal diameter of about 3 mm . The teacher places a thumb over one end of the tube and puts several crystals of $KMnO_4$ into the other end of the tube. The teacher inverts the tube allowing the crystals to fall down to the other end of the glass tube where the teacher's thumb is positioned.

Step 3 The teacher's thumb is tight against one end of the tube while it is placed into the graduated cylinder. It is important that the cylinder is tipped slightly without spilling the water as the tube is placed carefully into the cylinder. The end of the tube comes into contact with the bottom of the cylinder.

Step 4 Once the tube is placed on the bottom of the cylinder, the cylinder is returned to an upright position to allow the crystals to fall to the bottom of the tube. The teacher quickly removes the tube from the cylinder without removing his/her thumb from the end of the tube.

5.4. ENRICHMENT



Step 5 Within a minute, you should see a clearly distinct band of the purple dye at the bottom of the cylinder. Over a period of several days, the class can observe the process of diffusion. The size and number of crystals will influence the time necessary for diffusion to reach equilibrium.

Enrichment 4-1 Activity Report: Transport of Materials-Exploring Diffusion (Student Reproducible)

1. Explain the process of diffusion.

2. Draw the apparatus.

3. Describe the water in the apparatus.

Day 1

Day 2

Day 3

Day 4

4. How long did the diffusion process take to reach equilibrium?

Enrichment 4-2: Teacher Activity Notes

Chemical Digestion Simulation

PLAN

Summary

In this activity students simulate the chemical digestion of food in the mouth, stomach, and small intestine by moving models of nutrients through the digestive tract while simulating the action of digestive enzymes on them.

Objectives

Students:

✓ simulate the action of the digestive enzymes on carbohydrates, fats, and proteins in the mouth, stomach, and small intestine.

✓ identify the end products of the chemical digestion of carbohydrates, fats, and proteins and where they are absorbed.

✓ describe what happens to vitamins, minerals, and water in the digestive tract.

Student Materials

- Activity Guide
- Activity Report
- Butcher paper
- Marking pens
- Food nutrient cards (6)

  Carbohydrate, Fat, Protein, Vitamin, Mineral, Water

- Scissors labeled Carbohydrases
- Scissors labeled Proteases
- Scissors labeled Lipases

Teacher Materials

- Torso model or chart of the digestive system
- Samples/charts representing the six food nutrients
- Activity Report Answer Key

Advance Preparation

Prepare a set of nutrient cards per group or colored 3×5 cards or construction paper. 3 pair labeled scissors per team.

Estimated Time

$1\ \frac{1}{2}$ to 2 class periods

Interdisciplinary Connections

Music/Band Make musical sounds of digestion.

Language Arts Students can write about the digestive process in a paragraph, poem, or song.

Physical Education Create a dance or a physical game simulating digestion.

Prerequisites and Background

Knowledge of the nutrients that require digestion and the location and action of the digestive enzymes is helpful.

IMPLEMENT

Introduce Enrichment 4-2 by reviewing with students the composition and end products of carbohydrates, fats, and proteins, as well as digestive enzymes and the locations where they work in the digestive tract.

Steps 1-2 Because of space, you may need to have students complete Step 1 at different times depending on how many groups there are. Monitor student progress at the completion of Step 2.

Steps 3-4 Monitor student progress at the completion of Step 4.

Steps 5-6 Monitor student progress at the completion of Step 6.

Steps 7-11 Monitor student progress at the completion of Step 11.

ASSESS

Use the completion of the activity and the written responses on the Activity Report to assess if students can

✓ demonstrate the action of the digestive enzymes carbohydrases, lipases, and proteases on the appropriate nutrients.

✓ identify the end products of the chemical digestion of carbohydrates, fats, and proteins and where they are absorbed.

✓ describe what happens to vitamins, minerals, and water in the digestive tract.

Enrichment Activity 4-2: Chemical Digestion Simulation – Activity Report Answer Key

- Sample answers to these questions will be provided upon request. **Please send an email to teachers-requests@ck12.org to request sample answers.**

1. (a) What is the only food nutrient chemically digested in the mouth?
   (b) Where are the enzymes produced that partially digest this food nutrient in the mouth?
   (c) What is the general name for these enzymes?

   (a) What food nutrient is chemically digested initially in the stomach?
   (b) Where are the enzymes produced that partially digest this food nutrient in the stomach?
   (c) What is the general name for these enzymes?

   (a) What food nutrient is chemically digested initially in the small intestine?
   (b) Where are the enzymes produced that digest this food nutrient in the small intestine?
   (c) What is the general name for these enzymes?

   (a) What other food nutrients are chemically digested in the small intestine?
   (b) Where are the enzymes produced that partially digest these food nutrients in the small intestine?
2. What are the names of the nutrients or molecules that are ready to be absorbed into the wall of the small intestine?
3. What are the two main characteristics of food nutrients in their final form that allows them to be absorbed into the small intestine?
4. What other nutrients are not chemically digested in your digestive tract but are absorbed? Explain.

Enrichment Activity Guide: Chemical Digestion Simulation (Student Reproducible)

Introduction

What is the purpose of chemical digestion? Where does it take place in your digestive tract? In this activity you simulate the process of chemical digestion of food by enzymes that takes place in your mouth, stomach, and small intestine.

Materials

- Butcher paper
- Marking pens

- Food nutrient cards (6)

  Carbohydrate, Fat, Protein Vitamin, Mineral, Water

- Scissors labeled Carbohydrases
- Scissors labeled Proteases
- Scissors labeled Lipases
- Activity Report

Procedure

Step 1 Have a group member lie down on a large sheet of butcher paper, and have another group member trace his/her body outline with a pencil.

Step 2 Using the map of your digestive tract on page 26, draw the digestive tract to scale within the body outline. Label the mouth, stomach, and small intestine on the digestive tract drawing. Draw and label the salivary glands and pancreas.

Digestion in the mouth

Step 3 Place the cards that represent the six nutrients in the mouth region of the digestive tract drawing.

Step 4 Using a pair of scissors to represent the carbohydrase enzymes from the salivary glands, cut the carbohydrate card (starch) into double units. These double unit pieces represent double sugars.

Digestion in the stomach

Step 5 Move all the nutrient cards and pieces into the stomach region of the digestive tract.

Step 6 Using a pair of scissors to represent the protease enzymes from the stomach, cut the protein card into short pieces of 2-4 units each. These pieces represent short amino acid chains.

Digestion in the small intestine

Step 7 Move all the nutrient cards and pieces into the small intestine region of the digestive tract.

Step 8 Using a pair of scissors to represent the lipase enzymes from the pancreas and small intestine, cut the fat card into individual pieces that represent fatty acids (3) and glycerol. These fatty acids and the glycerol molecule are small and soluble. They can be absorbed into the small intestine (villi) and bloodstream.

Step 9 Using a pair of scissors to represent the carbohydrase enzymes from the pancreas and small intestine, cut the carbohydrate pieces consisting of double units into single units. These single units are glucose molecules that are small and soluble. They can be absorbed into the small intestine (villi) and bloodstream.

Step 10 Using a pair of scissors to represent the protease enzymes from the pancreas and small intestine, cut the protein pieces into smaller pieces that represent individual amino acids. These amino acid molecules are small and soluble and therefore can be absorbed into the small intestine (villi) and bloodstream.

Step 11 You should notice that the nutrients water, vitamins, and minerals are not digested because they are small and soluble and ready for absorption in the small intestine. A lot of the water passes into the colon or large intestine and is absorbed there.

Step 12 Check with your teacher as to cleanup procedures.

Step 13 Discuss with the members of your group the questions on the Activity Report and then record your answers.

Enrichment 4-2 Activity Report: Chemical Digestion Simulation (Student Reproducible)

1. a. What is the only food nutrient chemically digested in the mouth?

b. Where are the enzymes produced that partially digest this food nutrient in the mouth?

c. What is the general name for these enzymes?

2. a. What food nutrient is chemically digested initially in the stomach?

b. Where are the enzymes produced that partially digest this food nutrient in the stomach?

c. What is the general name for these enzymes?

3. a. What food nutrient is chemically digested initially in the small intestine?

b. Where are the enzymes produced that partially digest this food nutrient in the small intestine?

c. What is the general name for these enzymes?

4. a. What other food nutrients are chemically digested in the small intestine?

b. Where are the enzymes produced that partially digest these food nutrients in the small intestine?

5. What are the names of the nutrients or molecules that are ready to be absorbed into the wall of the small intestine?

6. What are the two main characteristics of food nutrients in their final form that allows them to be absorbed into the small intestine?

7. What nutrients are not chemically digested in your digestive tract but are absorbed? Explain.

Enrichment 4-3: Teacher Activity Notes

What Happens to the Digested Nutrients in the Small Intestine?

PLAN

Summary

Students explore the process of absorption and the characteristics of a selectively permeable membrane. They use dialysis tubing as a model of the selectively permeable membrane of the small intestine and investigate which substances pass through it into the bloodstream.

Objectives

Students:

✓ describe how a selectively permeable membrane works and compare it to cell membranes of the intestine.

✓ explain why glucose, but not starch or fiber, passed through the dialysis tubing.

Student Materials

- Activity Guide
- Activity Report
- 2 test tubes in rack; Benedict's solution; Stirring rod; Iodine solution; Hot plate; String (2 $15-cm$ pieces); Safety goggles; Dialysis tubing $(20\ cm)$; Paper towels; Water; Jar or $500-ml$ (milliliter) beaker; Eye dropper;

Starch solution; Glucose solution; 250 *ml* (milliliter) beaker; Cereal such as shredded wheat

Teacher Materials

- Extra student supplies including test tubes
- Activity Report Answer Key

Advance Preparation

Order iodine, Benedict's solution, and soluble starch. Obtain dialysis tubing (from local medical supply store, science supply, or hospital). Prepare (or order) the glucose and starch solutions. The glucose solution can be prepared by adding 25 *ml* of corn syrup to 1,000 *ml* of water. The starch solution can be prepared by adding 15 grams of cornstarch to 1,000 *ml* of water.

Estimated Time

One 45-50-minute class period

Prerequisites and Background Information

Knowledge of digestion in the small intestine, the basic principles of diffusion, and the characteristics of a selectively permeable membrane is helpful.

IMPLEMENT

Introduce Enrichment 4-3 by discussing what a selectively permeable membrane is and how it works.

Steps 1-4 It may be helpful to make controls to review the positive tests for starch and glucose using iodine and Benedict's solution. Demonstrate a positive test for the presence of glucose and starch.

Steps 5-7 Caution students to be very careful using hot plates. Remind them of the importance of wearing safety glasses during lab activities. Remind students to tie back long hair and roll up loose sleeves. Wear goggles as you demonstrate how to heat the Benedict's solution.

Helpful Hints

Point out to students that the cereal represents fiber that the body cannot digest because of the lack of the appropriate enzymes.

ASSESS

Use the completion of the experiment and the written responses on the Activity Report to assess if students can

✓ describe and confirm a positive test for glucose and starch.

✓ explain why some substances moved across the selective membrane and others did not.

Enrichment Activity 4-3: What Happens to the Digested Nutrients in the Small Intestine? – Activity Report Answer Key

- Sample answers to these questions will be provided upon request. **Please send an email to teachers-requests@ck12.org to request sample answers.**

1. Predict if glucose, starch, or fiber will pass through the membrane of the dialysis tubing. How will you know which ones passed through?

2. Did starch pass through the dialysis tubing? Explain.
3. Did glucose (sugar) pass through the dialysis tubing? Explain.
4. Did fiber, represented by the shredded wheat, pass through the dialysis tubing? Explain.
5. What do the results of this activity tell you about the dialysis tubing membrane? How is the dialysis tubing membrane similar to an intestinal cell membrane (small intestine)?

Enrichment 4-3 Activity Guide: What Happens to the Digested Nutrients in the Small Intestine? (Student Reproducible)

Introduction

During digestion, food nutrients are converted to a small, soluble molecular form that can pass into the cells of your small intestine and bloodstream. In this activity you investigate a model of a cell membrane and observe the selective process of the absorption of nutrients.

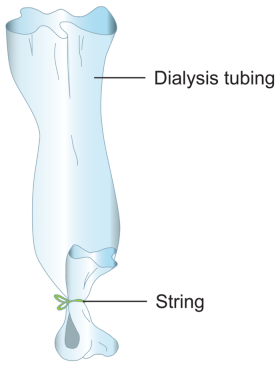
Materials

- 2 test tubes in rack
- Benedict's solution
- Stirring rod
- Hot plate
- Iodine solution
- String (2, 15 *cm* pieces)
- Safety goggles
- Dialysis tubing (20 *cm*)
- Paper towels
- Water
- Beakers/jars
- Eye dropper
- Starch solution
- Glucose solution
- 250 *ml* beaker
- Cereal such as shredded wheat

Procedure

Step 1 Soak a 20 – *cm* piece of dialysis tubing in water for a few minutes. Gently rub the ends between your thumb and forefinger until the ends separate.

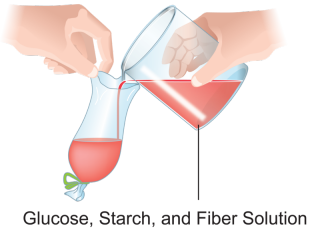
Step 2 Fold one end of the tubing and then tie it **tightly** with a piece of string, so it will not leak.



Step 3 Fill a beaker or jar $\frac{1}{3}$ full of a solution of glucose. Add an equal amount of starch solution. Add the contents of 1 or 2 pieces of fiber (shredded wheat) to the solution. Carefully stir to mix the solutions together.

Step 4 Fill the dialysis tubing $\frac{3}{4}$ full of the starch/sugar solution plus fiber. Tie the dialysis tubing **tightly** with a piece of string. Place the dialysis tubing in the beaker containing water.

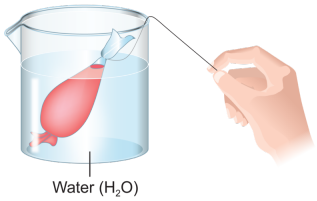
Wait 15 minutes.



Discuss with your partner/group Question 1 on the Activity Report, then record your response.

Your teacher will demonstrate a positive test for the presence of glucose and starch.

After 15 Minutes



Step 5 Transfer four eyedroppers full of the contents of the beaker into a test tube labeled #1. Put a similar amount into a second test tube labeled #2.

Step 6 Add several drops of iodine into test tube #1. If starch is present, the iodine will change in color from red to purple. Discuss with your partner/group Question 2 on the Activity Report, then record your response.

Step 7 Add 2 droppers full of Benedict's solution into test tube #2. Wearing goggles, gently heat test tube #2 in the water bath. If glucose is present, the Benedict's will change in color from blue to orange/brown. Discuss with your partner/group Questions 3 and 4 on the Activity Report, then record your responses.

Step 8 Ask your teacher for cleanup instructions.

Step 9 Complete the Activity Report.

Enrichment 4-3 Activity Report: What Happens to the Digested Nutrients in the Small Intestine? (Student Reproducible)

1. Predict if glucose, starch, or fiber will pass through the membrane of the dialysis tubing. How will you know which ones pass through?

2. Did starch pass through the dialysis tubing? Explain.

3. Did glucose (sugar) pass through the dialysis tubing? Explain.

4. Did fiber, represented by the shredded wheat, pass through the dialysis tubing? Explain.

5. What do the results of this activity tell you about the dialysis tubing membrane? How is the dialysis tubing membrane similar to an intestinal cell membrane (small intestine)?

CHAPTER 6 Food for life - Teacher's Guide (Human Biology)

CHAPTER OUTLINE

6.1 Planning

Key Ideas

- Culture and family traditions and availability and cost of food affect what and how we eat.
- Malnutrition and obesity are common food problems that can be corrected in many cases.
- Anorexia nervosa and bulimia are two eating disorders that can cause severe health problems.

Overview

Students apply their knowledge from previous section to identify habits and factors that affect dietary choices. They learn about hunger, appetite, and food preferences. Students investigate how certain factors affect dieting and eating disorders.

Objectives

Students:

✓ compare present-day choices of food gathering, diet, preparation, and preservation with choices available hundreds of thousands of years ago.

✓ identify factors affecting diet.

✓ describe malnutrition, obesity, anorexia nervosa, and bulimia.

Vocabulary

anorexia nervosa, bulimia

Student Materials

Activity 5-1: Can You Become Obsessed with Food?

- Activity Report
- Video clip or video film titled ***Fear of Fat*** (or information on anorexia nervosa and bulimia)
- Assorted magazines

Teacher Materials

Activity 5-1: Can You Become Obsessed with Food?

A large variety of magazines, especially fashion magazines, and lists of popular movie titles and television shows

Advance Preparation

See Activity 5-1 in the Student Edition

Activity 5-1: Can You Become Obsessed with Food?

- Collect magazines.
- Obtain and preview video ***Fear of Fat***. (If unavailable, collect articles or other reliable media about bulimia and anorexia nervosa.)

Interdisciplinary Connections

Social Studies Examine the important cultural and social roles of food in different countries.

Health Design an ad campaign to communicate the importance of eating a balanced diet to stay healthy.

Background Information

The following are some warning signs of bulimia:

People who appear to eat large amounts of food do not gain weight. They discuss ways to eat a lot of food without weight gain. They may buy or carry laxatives. There is evidence of throwing up after meals. For example, catching the person in the act, residue or smells in the bathroom, leaving the table to go to the bathroom right after eating, buying or carrying drugs that cause vomiting, and swollen glands under the jaws. Large dentist bills may also be evidence of repeatedly throwing up. The acid in the stomach contents ruins tooth enamel. In addition, physical problems such as paleness, dizziness, muscle cramps, and heart or kidney problems may indicate bulimic behavior. People with bulimia need help from a trained health professional.

6.2 Using Food for Life – Student Edition (Human Biology)

Begin this section by assigning and then discussing *Mini Activity: Food Choice* and the *Journal Writing* that deals with eating as a sensory experience.

Discuss the factors affecting what people eat, such as culture and family, availability of foods, and cost.

Assign the *Journal Writing* dealing with malnutrition and discuss.

Assign the *Journal Writing* on promoting healthy eating and display student work.

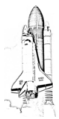
Discuss anorexia nervosa and bulimia as an introduction to *Activity 5-1: Can You Become Obsessed with Food?*

Draw students' attention to the key ideas using means such as posters and overhead transparencies.

Select appropriate Projects and Interdisciplinary Connections to complete if time permits.

Use the *Apply Your Knowledge* and *Review Questions* in reviewing the section.

What Do You Think?
Why did our ancestors begin cooking foods?



Mini-Activity

Food Choice Students make a list of the foods they have eaten in the last 24 hours and note why they have selected those foods. They can share this information with the class.

A suggested response will be provided upon request. **Please send an email to teachers-requests@ck12.org.**

Apply Your KNOWLEDGE

Many things can affect your appetite. How many can you think of? What situations make you hungry? What situations make you lose your appetite? Which of these things do you have control over?

Journal Writing

The next time you are waiting for and then eating a meal, think about the role your five senses play in the experience. Write a poem, song, or story about eating as a sensory experience. Can you make someone salivate just listening to your poem, song, or story?

What Do You Think?
Do you enjoy going to a friend's house for dinner? Why or why not? What are some of the factors that make it both enjoyable and sometimes a little stressful?

What Do You Think?
Explain why some people have temporary digestive upsets when they move from one region of the United States to another or from one country to another.

Journal Writing

If there is so much food in the world, why are some people malnourished? You have been appointed by the president to a commission on hunger. The commission's task is to come up with solutions to this country's hunger problems. After reading hundreds of reports and studies, your commission has gleaned the following facts.

- Millions of people in the United States are malnourished.
- The United States is one of the wealthiest countries in the world.
- Farmers are paid by the government to NOT produce some foods because we have so much in storage (for example, wheat).
- The people most affected by malnutrition are pregnant women and children.
- The problem doesn't seem to be food availability. The real problem seems to be cost, distribution, and education.

Write your four best suggestions for feeding people in this country who are malnourished. Make sure you explain how your solutions address the facts about the causes of malnutrition, cost and distribution of food, and education for healthy diets. Discuss your suggestions in class. Are there some ideas that have occurred to many students? Which ones would be easiest to implement?

Journal Writing

Design an advertising campaign promoting healthy eating. Your campaign might include songs, posters, flyers, newsletters, commercials during lunch breaks, and more. Be creative!

A suggested response will be provided upon request. **Please send an email to teachers-requests@ck12.org.**

Apply Your KNOWLEDGE

What are some things that happen to your body if you don't eat for several days? For several weeks?

6.3 Activities and Answer Keys

Activity 5-1: Can You Become Obsessed with Food?

PLAN

Summary Students watch a clip of a videotape entitled *Fear of Fat* and review magazine ads for food and body images.

Objectives

Students:

✓ identify how society, the media, and fashion influence ideas of how the body should look to be attractive.

✓ explain how compulsive overeating, anorexia nervosa, and bulimia affect the body.

✓ recognize some of the danger signs of an eating disorder.

Student Materials

- Activity Report
- Video clip or video film titled *Fear of Fat* (or information on anorexia nervosa and bulimia)
- Assorted magazines

Teacher Materials

- Activity Report Answer Key
- A large variety of magazines, especially fashion magazines, and lists of popular movie titles and television shows

Advance Preparation

Collect magazines. Obtain and preview video *Fear of Fat*. (If unavailable, collect articles or other reliable media about bulimia and anorexia nervosa.)

Estimated Time One to two 50-minute class periods

Interdisciplinary Connections

Social Studies Examine the ideal body images in different countries.

Health Design an ad campaign to communicate a positive body image.

Prerequisites and Background Information No special knowledge is required.

Fear of Fat video content: The mainstream media in our society have encouraged obsessive eating behaviors, particularly in young women. The film contrasts today's preoccupation with thinness with fashions of other periods. It goes on to look critically at how food has become a preoccupation, whether a person is dieting or gaining weight, and how this preoccupation can lead to an eating disorder when coupled with other psychological problems, often stemming from family relationships. The focus is on five young women, all in stages of recovery from eating disorders.

IMPLEMENT

Introduce Activity 5-1 by encouraging students to think of and write down questions that occur to them as they watch the video *Fear of Fat.*

If you cannot obtain a copy of the film, use magazine articles, newspaper articles, and/or television programs that address eating disorders and some of the causes of eating disorders.

Step 1 Discuss with students some signs that indicate eating disorders.

Emphasize the role of the media in presenting body images considered to be attractive, which are impossible for most girls and women to achieve. Discuss each of the three disorders, anorexia, bulimia, and compulsive overeating, and how they affect the body.

Steps 2-3 Discuss the magazines, television ads and shows, and other direct and indirect causes of eating disorders. Discuss play the advertisements students create.

Helpful Hints

Use a food pyramid to discuss and review healthy eating habits.

Conclude Activity 5-1 by discussing how the ads students created are different from the magazine ads and how the new ads emphasize healthy attitudes about body image.

ASSESS

Use the completion of the written responses on the Activity Report to assess if students can

✓ identify how society, the media, and fashion influence ideas of how the body should look to be attractive.

✓ explain how compulsive overeating, anorexia nervosa, and bulimia affect the body.

✓ recognize some of the danger signs indicating that someone they know might have an eating disorder.

Activity 5-1: Can You Become Obsessed with Food? – Activity Report Answer Key

- Sample answers to these questions will be provided upon request. **Please send an email to teachers-requests@ck12.org to request sample answers.**

1. What issues does the video say are responsible for eating disorders and a preoccupation with weight and dieting? Do you agree that these issues are widespread?
2. What personal/psychological conditions may lead to eating disorders?
3. Although males are not as often afflicted with eating disorders, female friends, girlfriends, and sisters may be. What could you do if you suspected someone you love or care for has an eating disorder?
4. How did your magazine ad differ from the original one in the magazine?
5. Is it realistic for a person who does not have a slender body type to keep trying to achieve it? What are some of the sacrifices and burdens? Is it worth it?

Review Questions/Answers

- Sample answers to these questions will be provided upon request. **Please send an email to teachers-requests@ck12.org to request sample answers.**

1. Why do people eat?
2. What are some ways to control your appetite?
3. Diets are different in different cultures. What are some of the reasons people choose different foods?
4. Why are fad diets so dangerous to your health?

Activity 5-1 Report: Can You Become Obsessed with Food? (Student Reproducible)

1. What issues does the video say are responsible for eating disorders and a preoccupation with weight and dieting? Do you agree that these issues are widespread?

2. What personal/psychological conditions may lead to eating disorders?

3. Although males are not as often afflicted with eating disorders, female friends, girlfriends, and sisters may be. What could you do if you suspected someone you love or care for has an eating disorder?

4. How did your magazine ad differ from the original one in the magazine?

5. Is it realistic for a person who does not have a slender body type to keep trying to achieve it? What are some of the sacrifices and burdens? Is it worth it?

CHAPTER 7

Staying Healthy - Teacher's Guide (Human Biology)

CHAPTER OUTLINE

7.1 Planning

Key Ideas

- Diet and nutrition play important roles in maintaining good health.
- Staying healthy requires regular exercise and adequate rest.

Overview

The focus of this last section is staying healthy. In addition to good nutrition and a balanced diet, students learn that staying healthy requires regular exercise and adequate rest.

Objective

Students:

✓ identify lifestyle factors that influence good health.

Vocabulary

stress

Student Materials

Activity 6-1: You Are the Food Expert

- Activity Report
- Food Nutrient Chart, p. 60 of the Student Edition (Or use Resource 2: Food Nutrient Chart in *Activity 1-1: Are You What You Eat?)*
- Resource: Recommended Dietary Allowances (RDA)
- Fast food nutrition information
- Fast food menus

Teacher Materials

Activity 6-1: You Are the Food Expert

- Activity Report Answer Key
- Food Nutrient Chart, p. 60 of the Student Edition (Or use Resource 2: Food Nutrient Chart in *Activity 1-1 : Are You What You Eat?)*
- Fast food nutrition information
- Fast food menus

Advance Preparation

See Activity 6-1 in the Student Edition

Activity 6-1: You Are the Food Expert

- Collect fast food menus and nutritional information from various fast food restaurants.

Interdisciplinary Connections

Math Review computational skills needed in this section.

7.2 Using Staying Healthy – Student Edition (Human Biology)

Assign *Mini Activity: Your Target Heart-Rate Zone.*

Discuss results of *Mini Activity: How Much Sleep Do You Need?*

Assign *Mini Activity: Sources of Stress.*

Assign *Activity 6-1: You Are the Food Expert.*

Draw students' attention to the key ideas using means such as posters and overhead transparencies.

Select appropriate Projects to complete if time permits.

Use the *Apply Your Knowledge* and *Review Questions* in reviewing the section.

What Do You Think?

Is a taste for particular foods something you are born with or something you acquire from your family and culture?

Your Target Heart-Rate Zone Students calculate their target heart-rate zone.

How Much Sleep Do You Need? For two weeks students keep track of how much sleep they get and note their physical and energy levels for each day. They then check to see if there is a correlation between amount of sleep and energy level.

Sources of Stress Students make a list of things that cause them stress and how they handle stress. They analyze their lists to suggest ways to reduce their stress.

Using your knowledge of the digestive system, think of a slogan that promotes keeping your digestive system healthy.

7.3 Activities and Answer Keys

Activity 6-1: You Are the Food Expert

PLAN

Summary Students examine the nutrients in fast food and create a healthy meal.

Objectives

Students:

✓ determine the nutrient levels of fast foods.

✓ determine whether fast foods meet the RDA guidelines.

Student Materials

- Activity Report
- Food Nutrient Chart, p. 60 of the Student Edition (Or use Resource 2: Food Nutrient Chart in *Activity 1-1: Are You What You Eat?)*
- Resource: Recommended Dietary Allowances (RDA)
- Fast food nutrition information
- Fast food menus

Teacher Materials

- Activity Report Answer Key
- Food Nutrient Chart, p. 60 of the Student Edition (Or use Resource 2: Food Nutrient Chart in *Activity 1-1: Are You What You Eat?)*
- Resource: Recommended Dietary Allowances (RDA)
- Fast food nutrition information
- Fast food menus

Advance Preparation

Collect fast food menus and nutritional information from various fast food restaurants.

Estimated Time One 45- 50 minute class period

Interdisciplinary Connections

Health This activity could be done in health education.

Math Review computational skills needed in this activity.

Prerequisites and Background Information

No special knowledge is required.

IMPLEMENT

Introduce Activity 6-1 by discussing the Resource.

Steps 1-2 After students have filled out Tables A and B, ask the question "Why does Table B reflect healthier choices than Table A?"

Give Table A to a group to fill in using a particular fast food chain's information with instructions to choose the worst combinations of food. Then trade Activity Reports with another group along with the fast food information and the challenge to make the choices the healthiest possible.

Helpful Hints

- This activity works best when students are able to choose from various fast food chain menus.
- Encourage students to choose the "worst" food combinations for Table A.

ASSESS

Use the completion of the chart and written responses on the Activity Report to assess if students can

✓ determine the percentages of calories (Cal) from carbohydrates, proteins, and fats in fast foods.

✓ determine whether fast foods meet the RDA guidelines.

Activity 6-1: You Are the Food Expert – Table A Answer Key

Student Food Table A: Favorite Food

Fast Food Restaurant

TABLE 7.1:

Nutrients			**Protein**			**Carbohydrates**			**Fat**	
Food	Total Calories	grams	Calories $(g \times 4)$	Percent $\left(\frac{C}{TC} \times 100\right)$	grams	Calories $(g \times 4)$	Percent $\left(\frac{C}{TC} \times 100\right)$	grams	Calories $(g \times 9)$	Percent $\left(\frac{C}{TC} \times 100\right)$
1. Double Deluxe Burger w/Cheese	941	47	188	19.98	33	132	14.03	69	621	65.99
2. Jumbo Fries	395	5	20	5.06	51	204	51.65	19	171	43.29
3. Milk Shake	327	11	44	13.46	55	220	67.28	7	63	19.27
4. Answers will										
5. Answers will vary.										

TABLE 7.1: (continued)

Nutrients	Protein	Carbohydrates	Fat
Totals			
Answers will vary.			

Key

C = Calories

TC = Total Calories

For RDA Guidelines Information:

Table A:

Answers will vary, but these foods probably will not be within RDA Guidelines.

Table B:

Answers will vary, but these foods probably will be within RDA Guidelines.

Activity 6-1 Report: You Are the Food Expert – Table B Answer Key

Student Food Table B: Food Modified

Fast Food Restaurant

TABLE 7.2:

Nutrients			Protein			Carbohydrates			Fat	
Food	Total Calories	grams	Calories $(g \times 4)$	Percent $\left(\frac{C}{TC} \times 100\right)$	grams	Calories $(g \times 4)$	Percent $\left(\frac{C}{TC} \times 100\right)$	grams	Calories $(g \times 9)$	Percent $\left(\frac{C}{TC} \times 100\right)$
1. Cheeseburger	326	15	60	18.40	35	140	42.94	14	126	38.65
2. Regular Fries	263	11	44	16.73	30	120	45.63	11	99	37.64
3. Soft Drink	200	0	0	0	50	200	100.00	0	0	0
4. Side Salad	39	3	12	30.77	0	0	0	3	27	69.23
5. Low-Cal Dressing	34	2	8	23.53	2	8	23.53	2	18	52.94
Totals	862	31	124	14.39	117	468	54.29	30	270	31.32

Key

C = Calories

TC = Total Calories

Review Questions/Answers

- Sample answers to these questions will be provided upon request. **Please send an email to teachers-requests@ck12.org to request sample answers.**

1. What factors can you control that will help you stay healthy?
2. What are some of the benefits of regular exercise? Why is exercise important?
3. In what way does vigorous exercise shortly after eating affect digestion?
4. Describe some ways in which the body responds to stress. In what ways does stress affect digestion?

Activity 6-1 Resource: You Are the Food Expert (Student Reproducible)

TABLE 7.3:

Recommended Dietary Allowances		
	Boys 11-14	**Girls 11-14**
Energy	2,500 Calories	2,200 Calories
Carbohydrate	134 *g*	138 *g*
Protein	45 *g*	46 *g*
Fat	84 *g*	75 *g*
Vitamin A	1,000 *mcg*	800 *mcg*
Vitamin C (ascorbic acid)	50 *mg*	50 *mg*
Vitamin D	10 *mcg*	10 *mcg*
Vitamin E	10 *mg*	8 *mg*
Niacin	17 *mg*	15 *mg*
Riboflavin	1.5 *mg*	1.3 *mg*
Thiamin	1.3 *mg*	1.1 *mg*
Vitamin B-6	1.7 *mg*	1.4 *mg*
Vitamin B-12	2 *mcg*	2 *mcg*
Vitamin K	45 *mcg*	45 *mcg*
Calcium	1,200 *mg*	1,200 *mg*
Phosphorus	1,200 *mg*	1,200 *mg*
Iodine	150 *mcg*	150 *mcg*
Iron	12 *mg*	15 *mg*
Magnesium	270 *mg*	280 *mg*
Selenium	40 *mcg*	45 *mcg*
Zinc	15 *mg*	12 *mg*
Folate	150 *mcg*	150 *mcg*

$$g = gram$$
$$1\ g = 1,000\ mg = 1,000,000\ mcg$$
$$mg = \text{milligram}, \frac{1}{1,000} \text{ of a gram}$$
$$mcg = \text{microgram}, \frac{1}{1,000,000} \text{ of a gram}$$

Activity 6-1 Report: You Are the Food Expert (Student Reproducible)

Student Food Table A: Favorite Food

Fast Food Restaurant

TABLE 7.4:

Nutrients			**Protein**		**Carbohydrates**		**Fat**	
Food	Total Calories	grams	Calories $(g \times 4)$	Percent grams $\left(\frac{C}{TC} \times 100\right)$	Calories $(g \times 4)$	Percent grams $\left(\frac{C}{TC} \times 100\right)$	Calories $(g \times 9)$	Percent $\left(\frac{C}{TC} \times 100\right)$
1.								
2.								
3.								
4.								
5.								
Totals								

Key

C = calories

TC = Total calories

TABLE 7.5:

	Protein	**Carbohydrates**	**Fat**
RDA Guidelines Are the nutrients in this meal within recommended RDA Guidelines?	(Yes/No)	(Yes/No)	(Yes/No)

Student Food Table B: Favorite Food Modified

Fast Food Restaurant

TABLE 7.6:

Nutrients			**Protein**		**Carbohydrates**		**Fat**	
Food	Total Calories	grams	Calories $(g \times 4)$	Percent grams $\left(\frac{C}{TC} \times 100\right)$	Calories $(g \times 4)$	Percent grams $\left(\frac{C}{TC} \times 100\right)$	Calories $(g \times 9)$	Percent $\left(\frac{C}{TC} \times 100\right)$
1.								
2.								
3.								

TABLE 7.6: (continued)

Nutrients	Protein	Carbohydrates	Fat
4.			
5.			
Totals			

Key

C = calories

TC = Total calories

TABLE 7.7:

	Protein	Carbohydrates	Fat
RDA Guidelines Are the nutrients in this meal within recommended RDA Guidelines?	(Yes/No)	(Yes/No)	(Yes/No)

CHAPTER 8 Additional Resources Digestion and Nutrition - Teacher's Guide (Human Biology)

CHAPTER OUTLINE

8.1 Using GroupWork Activities

Learning science is a process that is both individual and social. Like researchers, engineers, mathematicians or physicians who work in teams to answer questions and to solve problems, students in science classrooms often need to interact with their peers to develop deeper knowledge of scientific concepts and ideas. The GroupWork activities were developed to foster an environment in which groups of students work cooperatively to:

- plan experiments,
- collect and review data,
- ask questions and offer solutions,
- use data to explain and justify their arguments,
- discuss ideas and negotiate conflicting interpretations,
- summarize and present findings,
- and explore the societal implications of the scientific enterprise.

The GroupWork environment is one in which students are "doing science" as a team. Suggestions about when to introduce these group activities are included in the Teacher Activity Notes.

Format and Organization of GroupWork Activities

Each GroupWork activity includes teacher activity notes, an activity guide, an individual report, resource materials, and at times, data sheets. The activity guide contains instructions for the group's task and questions to be discussed as students plan for and work on a group product. Resource materials are varied. They might include textual information, visual resources such as photos, drawings, graphs or diagrams, video, or audiotapes. Individual reports by students are an integral pan of each activity to be completed in class or as pan of a homework assignment. Planning information for the teacher is found on the Teacher Activity Notes page.

Sets of GroupWork activities are organized around a central concept or a basic scientific question-a "big idea." Ideally, as students rotate to complete these activities, they encounter this central idea, question, or concept in different scientific contexts or in different social settings. These rotations provide students with multiple opportunities to grapple with the material, explore related questions and dilemmas, look at different representations, and think of different applications. Figure 1 shows how students rotate from activity to activity around the "big idea."

The GroupWork activities were designed to be open-ended to foster the development of higher-order thinking skills. Such open-endedness allows students to decide as a group how to go about completing the task, as well as what the final group product might be. Open-ended group activities increase the need for interaction as students serve as resources for one another, draw upon each other's expertise and knowledge, and take advantage of their different problem-solving strategies. When groups are heterogeneous and include students with many different intellectual abilities, the repertoire of strategies and previous experiences is rich and diverse. As students interact with their peers, they learn how to communicate effectively, justify their arguments when challenged, and examine scientific problems from different perspectives. Such interaction scaffolds students' knowledge of scientific concepts and principles.

These GroupWork activities then are quite different from traditional lab activities that include more step-by-step procedures and are crowded with details. In addition to reading, writing, and computing (the traditional academic abilities), students use many different intellectual abilities to complete their task. They make observations, pose questions, plan investigations; they use and create visual models, access and interpret scientific information from different sources and from different media, and convey scientific findings in diagrams, graphs, charts, or tables. The use of a wide array of resource materials provides students with additional ways to access and use information, as well as with additional opportunities to demonstrate their intellectual competence and be recognized for their

contributions. We have included in the Teacher Activity Notes a partial list of some of the multiple abilities students might be observed using in these group activities.

When group activities are open-ended, rich, and intellectually demanding, a single student will not be able to complete the task in a timely fashion by himself or herself. Making students responsible as a group to interpret a challenging task and to design a common product or group presentation increases group interdependence. Teachers know, however, that it is also important to hold each student personally accountable for contributing to the group's success and for mastering the concepts or the big idea of the activity. To do so, students are required to complete individual written reports in which they respond in their own words to key discussion questions and summarize what they have learned in the group activity. These written responses can be useful for teachers in gauging and monitoring student knowledge and progress.

Role of the Teacher Planning ahead and organizing the classroom for GroupWork is important for the successful implementation of group activities. We suggest that you refer to Elizabeth Cohen's book, *Designing GroupWork: Strategies for Heterogeneous Classrooms,* published by Teachers College Press in 1994. (See also Lotan, RA., J.A. Bianchini, and N. C. Holthuis (1996). "Complex Instruction in the Science Classroom: The Human Biology Curriculum in Action," in R.J. Stahl, (Ed.) *Cooperative Learning in Science. A Handbook for Teachers,* Addison-Wesley Publishing Company)

Many teachers have realized that when students work in groups, direct instruction is no longer practical. The teacher can't be everywhere at once, telling students exactly what to do and how to do it. Thus, teachers delegate authority to students and students take responsibility for their own behavior and their own learning. Rather than constantly turning to the teacher for help, students talk with each other to find out what they should be doing and to solve the challenging problems assigned to them. Teaching students to work collaboratively and to be responsible to one another as a group is an important prerequisite for successful GroupWork. Students also support the smooth operation of groups when they have learned to play different roles in their groups effectively. For example, the facilitator sees to it that everyone in the group knows what has to be done and gets help when necessary. The recorder keeps notes of the group's discussions and checks to see if individual reports have been completed. The materials manager sees to it that the group has all the equipment necessary and that the tables are cleared at the end of the lesson. The reporter presents the findings of the group during wrap-up time. When the activity involves hazardous materials, a safety officer might be needed. Every student must have a role to play, and roles rotate so students learn how to perform each role competently.

Delegating authority doesn't mean that the teacher withdraws from the class or completely stays out of the action. Instead of being the focal point of the classroom, the teacher carefully observes the students as they work in the groups, stimulates and extends their thinking, and provides specific feedback.

Equalizing Participation among Members of the Group Making sure that all members of the group have access to the materials and that one group member doesn't take over or dominate the group while another withdraws are among the principal challenges of GroupWork. Teachers can increase participation of students by explaining how the different intellectual abilities are relevant to the successful completion of the task. The teacher states that while no one group member has all the abilities, everyone in the group has some of the intellectual abilities necessary to complete the task successfully. Furthermore, after careful observation of the students' work in groups, the teacher can publicly acknowledge those students who have made relevant contributions and explain specifically how these contributions made the group move forward and become more successful. It is important that the teacher be able to notice the intellectual contributions of students who have low academic or peer status, and who are frequently left out of group interactions. These strategies are particularly relevant in untracked classrooms, where students have a wide range of previous academic achievement (mainly in reading) or where significant proportions of students are English-language learners. Teachers, class mates, and the low-status students themselves need to understand that when many different intellectual abilities are necessary to complete a task successfully, everybody's contribution becomes critical to the success of the group. As more previously low-achieving students feel and are expected to be competent, their participation in the group increases, and subsequently their learning achievements increase as well.

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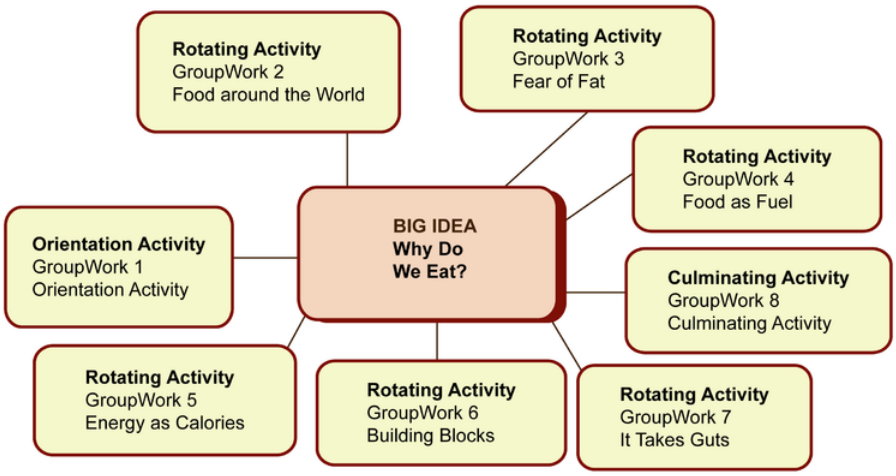


Figure 1: Activity Rotation in GroupWork

GroupWork Contents

TABLE 8.1:

Activity	Duration	Materials	Activity Summary
1. Orientation Activity	20-30 minutes	None	Students discuss possible answers to the question, "Why do we eat?"
2. Food around the World	50 minutes	Dietary table, multinational/ethnic cookbooks, an encyclopedia, and geography or world history books	Students research why people in a particular country eat the kinds of food that they do. Students are asked to explore a wide range of possible influences: environmental, religious, political, economic, and cultural.
3. Fear of Fat	50 minutes	Videotape (edited) of *Fear of Fat,* ads and/or articles taken from assorted magazines, paper and colored pencils, crayons, or pens	Students examine the flip side of the "why do we eat" question by exploring why some people *don't* eat. Students use the information about eating disorders and self-image provided on the resource sheet and video to analyze, and subsequently redesign, a magazine ad.

TABLE 8.1: (continued)

Activity	Duration	Materials	Activity Summary
4. Food as Fuel	40-45 minutes	Use student materials from page 000.	Students explore the concept of food as energy. They use a calorimeter to determine the energy content of two food items.
5. Energy as Calories	35-40 minutes	Packaged foods, audiotapes, and tape recorder	Students explore the concept of food as energy. They determine the number of calories in different kinds of foods and discuss how the human body uses food for energy.
6. Building Blocks	50 minutes	Butcher paper and colored candies, paper, or blocks	Students create a model depicting segments of two proteins found in food. They then show how the protein is broken down into amino acids and reconfigured to create protein for cell membranes.
7. It Takes Guts	50 minutes	Butcher paper, balloons, and assorted art supplies including pens, paint, and construction paper	Students explore the physiological mechanism that controls appetite: the stomach. Students create a model showing the changes in the nervous system signals sent when the stomach is empty and when it is full.
8. Culminating Activity	40 minutes	Food labels	Students synthesize the information from the previous group activities in order to analyze food labels and provide reasons why an individual mayor may not eat a particular food.

GroupWork 1: Teacher Activity Notes - Orientation Activity

Big Idea: Why Do We Eat?

PLAN

Summary Students discuss possible answers to the question, "Why do we eat?"

Group Size 4 to 5 students

Objectives

Students:

- identify reasons why humans eat.

Multiple Abilities

- Making connections between ideas/concepts, logically analyzing the problem, applying previous knowledge (reasoning ability)
- Explaining clearly and fully, using words precisely (communication skills)

Estimated Time 20-30 minutes (10 minutes in groups and 15-20 minutes for reports and discussion)

Suggested Use

- This set of activities works well near the end of the unit.

Student Materials

None required

IMPLEMENT

1. There is neither a student Activity Guide nor an Individual Report for this activity. Have students write their responses on a group data sheet.
2. Ask each group to brainstorm answers to the question, "Why do we eat?" Although the question seems simple, it has many answers: psychological, physiological, anatomical, cultural, and sociological. For example, physiologically we eat to get energy, building blocks (amino acids), vitamins, and minerals. Each group should write its ideas on a data sheet. Each group should also be prepared to support its answers with reasons and examples.
3. Ask each group to share its answers to this question with the rest of the class. Write each group's responses on the board, organizing its ideas around the above broad categories.
4. After completion of this activity, introduce students to the big idea of this unit as well as to the group activities. Make connections among students' responses, the big idea, and the activities' purpose.

Extension Questions

- A closely related question to "***Why*** do we eat?" is "***What*** do we eat?" What factors determine what a person eats? (Examples range from soil/climate of land to customs to advertisements to personal preferences to nutritional requirements.)
- What do you hope to learn about the topics of digestion and nutrition as a result of completing these group activities?
- What are some reasons people don't eat?

ASSESS

Use the group data sheet and discussion to assess if students can:

- list the psychological, physiological, anatomical, cultural, and sociological reasons why humans eat.

GroupWork 2: Teacher Activity Notes - Food around the World

Big Idea: Why Do We Eat?

PLAN

Summary Students research why people in a particular country eat the kinds of food that they do. Students are asked to explore a wide range of possible influences: environmental, religious, political, economic, and cultural.

Group Size 4 to 5 students

Objectives

Students:

- identify the different kinds of food eaten by people around the world.
- describe the factors that influence what people eat.
- explain a sociocultural answer to the question, "Why do we eat?"

Multiple Abilities

- Making connections between ideas/concepts, logically analyzing the problem, applying previous knowledge (reasoning ability)
- Reading comprehension (conventional academic ability)
- Imagining an experience you have never experienced (creativity)

Estimated Time 50 minutes

Suggested Use

- This set of activities works well near the end of the unit.

Student Materials

Dietary table, multinational/ethnic cookbooks, an encyclopedia, geography or world history books

IMPLEMENT

1. Provide a dietary table listing the caloric and nutritional values of foods as well as additional resource materials about the countries described on the Resources. You may need to explain to your students how to use the dietary table as well as how to skim the resource materials for relevant information. Students should consult this dietary table to help determine the nutritional value of the meal.
2. If your class is ethnically diverse, you might ask students to create their own resources with menus for meals commonly eaten in their culture or country of origin.

Extension Questions

- How similar to or different from the food you eat is the food eaten in the country you selected to research?
- Why is it often difficult to explain, in general terms, what people in a particular country eat?
- Why is it that people around the world can eat different kinds of foods and yet receive adequate vitamins, minerals, and calories?

ASSESS

The group discussion, presentation, and Individual Reports can be used to assess if students can:

- identify the different kinds of food eaten by people around the world.
- describe the wide range of social, cultural, geographic, and economic factors that influence what people eat.
- explain a sociocultural answer to the question, "Why do we eat?"

Background Information

- Each menu on the Resources was suggested by a person who had lived in that particular town or city. The rest of the information was compiled from nutrition textbooks and cookbooks.
- Factors that influence the kinds of food eaten include the following: practicality (cost and availability), culture, religion, climate, location (central, inland, etc.), and environment. In our description of each country, we have attempted to include a brief description of one or more of these factors.

Extend the Activity by asking each student to bring in a dish frequently eaten in another country or culture for his or her group and/or the class to sample.

GroupWork 2 Activity Guide: Food around the World (Student Reproducible)

Big Idea: Why Do We Eat?

Introduction

What's for dinner? What we eat for dinner is not simply a matter of personal choice. Our family, culture, country, and environment also influence what we eat. In this activity, you will study the kinds of food eaten in another country. You will explore how and why a meal in that country differs from meals in the United States.

Materials

- Dietary table, multinational/ethnic cookbooks, an encyclopedia, geography or world history books

Procedure

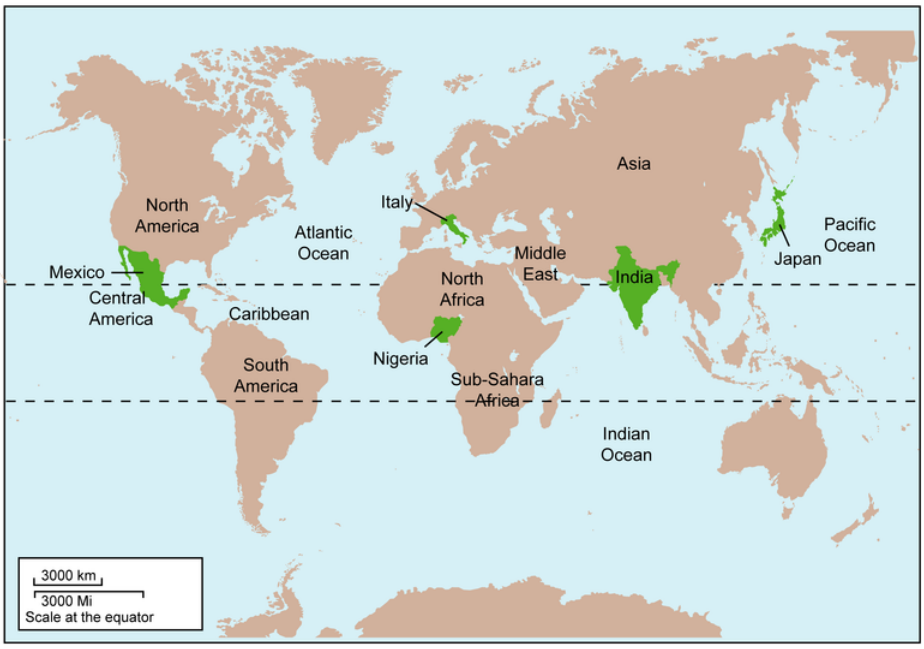
1. In your group, describe a typical meal eaten in your community. The meal can be lunch or dinner, whichever is considered more important. Include beverages and dessert if appropriate. Also, discuss the following question: What factors influence the kinds of food you eat?

2. Examine the Resources. Each Resource describes a meal eaten in another part of the world. Select one of these countries for further investigation.

3. For the country selected, use the Resource and additional resource materials to answer the following questions:

- Is the meal described on the Resource nutritious? How do you know?
- What other kinds of food are commonly eaten in this country?
- What factors influence what food is eaten? (Examples of factors include climate, soil, location, religion, and history.) How do you know?
- Do you think everyone in this country eats the meal described on the Resource? Explain.
- What does examination of this menu tell you about eating habits around the world? About your own eating habits?

4. Prepare to share your research on this country with the class. In your presentation, include your answers to the above questions.



GroupWork 2 Resource 1: Food around the World (Student Reproducible)

Big Idea: Why Do We Eat?

Eating in Japan

Sachi lives in Kyoto, Japan. For dinner, Sachi might eat the following:

All of the above dishes would be served together perhaps the rice last. For the Japanese, rice is essential to every meal. In fact, it is said that if the rice is ruined, the entire meal is ruined.

As you can see from the menu, a Japanese meal includes several different dishes. Each dish comes on a separate plate. Separate plates are a tradition in Japan. People don't like the tastes of different foods to run together; they like

the tastes to be pure and separate.

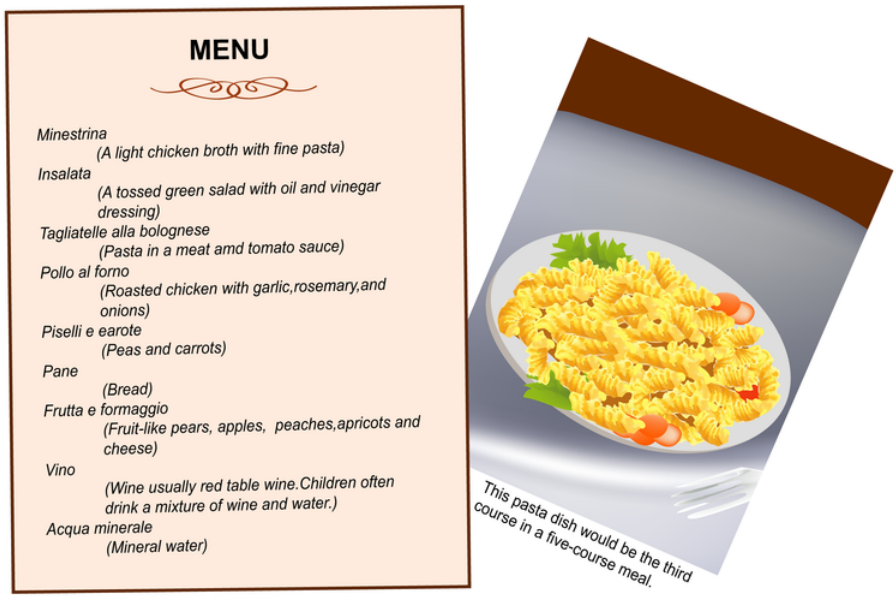
Some Japanese dishes are regional. They depend on the area's location and weather. Kyoto, for example, is part of the Kansai region on the big island of Japan. Because it is located inland, people in Kyoto eat less fish and more vegetables and tofu than people living on the coast.

GroupWork 2 Resource 2: Food around the World (Student Reproducible)

Big Idea: Why Do We Eat?

Eating in Italy

Giorgio lives in a small town called Cascine di Buti in the Toscana region of Italy.



The food on this menu is eaten in courses. Giorgio would eat the soup first, then the salad, the pasta, the chicken, and finally the fruit and cheese.

As in much of Europe, lunch in Italy is the most important meal of the day. In fact, at 12:30 P.M., streets fall silent as people stop their work, schooling, or traveling to have the midday meal. Although this tradition is no longer common in the big cities, it is still found in the smaller towns.

For Italians, there is no such thing as one definitive Italian food. Foods are quite traditional and regional. A cookbook in Italy may be divided into 21 chapters for the 21 regions of Italy. Cooking in the central region of Tuscany combines the flavors of northern and southern Italy. It uses both olive oil and butter and features pasta as well as gnocchi (potato dumplings).

GroupWork 2 Resource 3: Food around the World (Student Reproducible)

Big Idea: Why Do We Eat?

Eating in Mexico

José lives in San Juan de Los Lagos, a town in the state of Jalisco in Mexico. The following is a meal José might eat for lunch with his family:

For lunch, José would get a large plate with a little of all the foods described above on it and plenty of corn tortillas. Mexican meals are rarely broken into courses.

In Mexico, lunch is called "la comida." It is the most important meal of the day-both socially and in terms of the amount and quality of food. Traditionally, la comida comes before the siesta. However, the siesta is becoming a thing of the past because of Mexico's exploding economy.

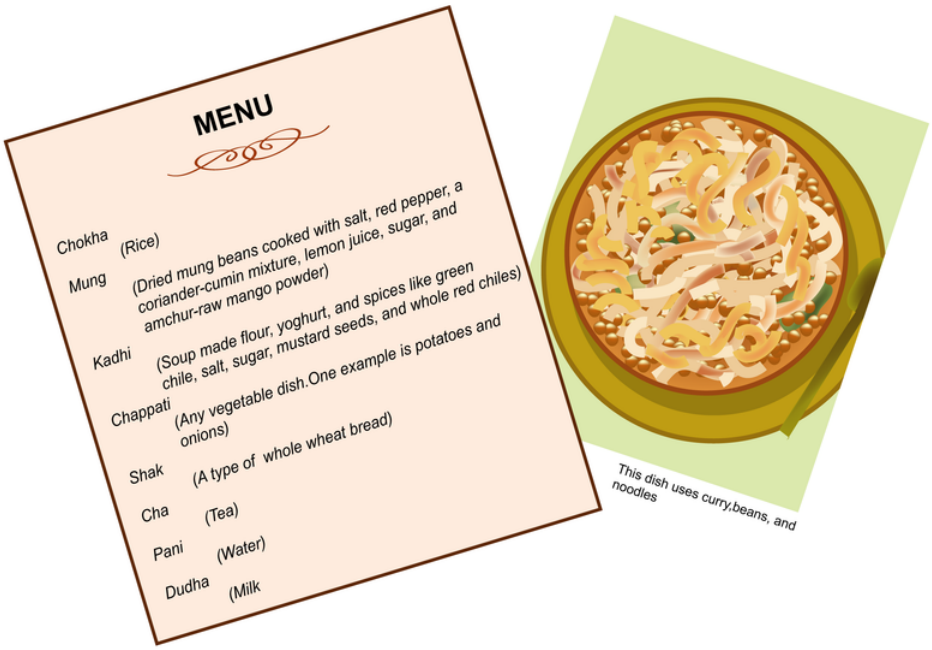
Mexican cuisine draws from both the ancient Aztec and Spanish cultures. Spanish conquistadors landed in Mexico and conquered the Aztecs in 1519. The Aztecs had a highly developed agriculture. They grew maize (corn), tomatoes, beans, and cocoa, as well as vanilla, chiles, avocados, squash, pineapple, and papaya. The Spanish, on the other hand, introduced sugar cane, daily products, citrus fruits, and pork to Mexico. The exchange of various foods and ways of cooking gave rise to a new cuisine. For example, the Aztecs had a specialty drink of chocolate and chiles. The Spanish sweetened it with sugar, added cinnamon, and left out the chiles. The result was Mexican hot chocolate, which is still popular today.

GroupWork 2 Resource 4: Food around the World (Student Reproducible)

Big Idea: Why Do We Eat?

Eating in India

Smita lives in Surat, a town in the state of Gujarat in India. For lunch, Smita might eat the following meal with her family:



Smita would eat all these dishes at once-perhaps with the rice last. She would also eat an assortment of relishes, chutneys, and Indian spicy pickles with her meal.

As early as 2000 B.C., India was home to a flourishing population. Since then, wave after wave of different people have come to India to conquer or to make their homes, resulting in an incredible diversity of cultures, languages, and food.

The wide range of climates in India accounts, in part, for the variety of Indian cuisine. Rice grows well in the wet areas of southern and eastern India, where a meal without rice is very rare. Bread is the staple in the dry north where wheat and barley grow. In coastal areas, fish and seafood are popular and tropical fruits are abundant. In the inland mountains, fruits such as apples, apricots, peaches, and strawberries are grown.

Today, the majority of people in India are vegetarians. Most of them do not eat meat for religious reasons. Vegetarianism is central to Hinduism, Buddhism, and Jainism-religions that believe in nonviolence toward all living creatures.

GroupWork 2 Resource 5: Food around the World (Student Reproducible)

Big Idea: Why Do We Eat?

Eating in Nigeria

Nnamdi lives in the rural lands surrounding Enugu, a large city in Nigeria. For a typical dinner on Sunday, Nnamdi might eat the following meal:

Nnamdi eats two meals a day-one at noon and one in the evening. These two meals are basically the same. They are usually made up of a soup or stew served with some sort of starch, such as fufu. In the cities, more and more people are eating three meals a day as is done in the West. Desserts are also more common in the city than they are in rural villages.

In a typical meal, the main dish is placed on individual plates and the starch is served on a communal plate. The diners break off a piece of bread or scoop up a small amount of fufu in their fingers and use it to scoop up some of the food on their plate. The starch cools the heat of the main dish, which can be quite spicy.

People in Nigeria snack all day long. A snack might be a piece of bread, roasted or fried plantains (a type of fruit), or meat on a stick. It is unusual to eat something sweet for a snack.

Nigeria is located along the coast of the South Atlantic Ocean. The land is low and flat. It is hot throughout the year but has both a wet and dry season. The variety of fruits and vegetables found in Nigeria is staggering. Most were brought to Nigeria from Europe or the Middle East. Meat, fish, and poultry are less abundant and therefore more expensive. One reason that soups and stews are such staples is that they make a little meat stretch to feed many people.

GroupWork 2 Individual Report: Food around the World (Student Reproducible)

Big Idea: Why Do We Eat?

1. For the country you selected, was the meal described on the Resource nutritious? Explain.
2. In the country you selected, what factors influence what food is eaten? How do you know?
3. Do you think everyone in this country eats the meal described on the Resource? Explain.
4. How does this activity help answer the question, "Why do we eat?"

GroupWork 3: Teacher Activity Notes - Fear of Fat

Big Idea: Why Do We Eat?

PLAN

Summary Students examine the flip side of the "why do we eat" question by exploring why some people *don't* eat. Students use the information about eating disorders and self-image provided on the Resource and video to analyze, and subsequently redesign, a magazine ad. You will need to locate the video.

Group Size 4 to 5 students

Objectives

Students:

- identify how society, the media, and fashion influence ideas of body image.
- identify the causes and effects of eating disorders.
- explain how compulsive overeating, anorexia nervosa, and bulimia affect the body.

Multiple Abilities

- Conceiving of an idea for an illustration, generating alternatives (artistic/creative ability)
- Analyzing an issue, making connections between ideas and concepts (reasoning ability)
- Understanding information provided verbally

Estimated Time 50 minutes

Suggested Use

- This set of activities works well near the end of the unit.

Student Materials

Videotape (edited) of *Fear of Fat*, ads and/or articles taken from assorted magazines, paper and colored pencils, crayons or pens

IMPLEMENT

1. You might want to introduce this activity by showing students pictures of the "ideal" man or woman in the 16th or 17th century (or even periods during the 20th century) when larger men and women were seen as more attractive. Thinness was a sign of poverty and thus was not considered attractive. This introduces students to the idea that there is no one, true "ideal" body-culture, society, and the media all influence what people think is attractive.
2. We suggest you tear out ads and/or articles from particular magazines (e.g., *Teen, Glamour, Seventeen*, or *GQ*). Place them in a folder labeled with the name of the magazine.
3. Although the video focuses on dieting, direct students' attention to weight and body image in general. Students who are very thin due to rapid growth during adolescence can feel as self-conscious and unattractive as those who feel they are too fat.
4. Remind students that some boys experience eating disorders as well. They feel pressure to be big, tall, and muscular in order to fit society's ideal image.
5. Make sure students redesign an ad rather than simply making an ad against eating disorders. In addition, students should use the data and information given in the video and resource card to make informed changes to the ad.

Extension Questions

- What messages does your school send to you about eating, being thin, and dieting? How does it send these messages?

- What makes a person more or less susceptible to believing the messages he or she gets from the surrounding environment such as magazines, media, and fashion? Explain your reasoning.
- How is being healthy different from being thin?

ASSESS

Use the group product, Individual Report, and group discussion to assess if students can:

- identify how society, the media, and fashion influence ideas of body image.
- identify the causes and effects of eating disorders.
- explain how compulsive overeating, anorexia nervosa, and bulimi a affect the body.

GroupWork 3 Activity Guide: Fear of Fat (Student Reproducible)

Big Idea: Why Do We Eat?

Introduction

You only have to turn on the TV or open a magazine to see the ads and articles that cater to people trying to lose weight or "look their best." Eating well and staying fit is important, but how much is too much? Why do some people become obsessed with their weight and body? Why do they think they're so fat that they must starve themselves? Why do others worry about being too thin?

Materials

- Videotape (edited) of *Fear of Fat*, ads and/or articles taken from assorted magazines, paper and colored pencils, crayons, or pens

Procedure

1. Watch the videotape provided and examine the Resource. Then discuss the following questions with your group:

- What societal and personal factors are responsible for eating disorders and a preoccupation with weight and weight loss?
- At what point would you start to worry that a friend had crossed the line from dieting to an eating disorder? What would you do?
- Are boys and girls equally at risk of developing an eating disorder?
- How do boys and girls compare with respect to how they feel about their bodies? Explain.

2. Analyze magazine ads and/ or articles to see if you find evidence of the societal pressures mentioned in the film.

- Looking at the ads and articles, what do you think the magazine says to people about the ideal body, weight, and eating?
- Does the magazine send different messages to women than it does to men?
- What effect might constant exposure to these magazines and similar media (television, billboards) have on people?

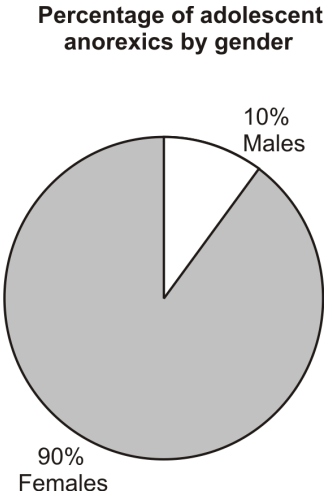
3. As a group, **redesign** one of the ads in the magazine so that it provides healthy messages to women and men about their bodies. Consider answers to the following questions before beginning:

- What images will you change?
- What content will you change?
- What message do you want to send to your audience?
- How can you use the information on the Resource and in the video to make informed changes to the ad?

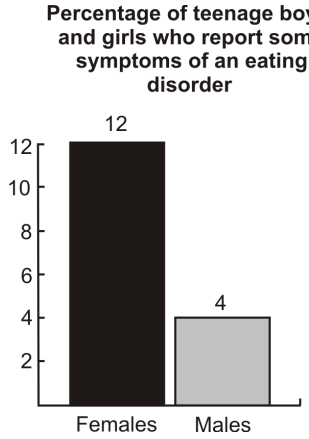
GroupWork 3 Resource: Fear of Fat (Student Reproducible)

Big Idea: Why Do We Eat?

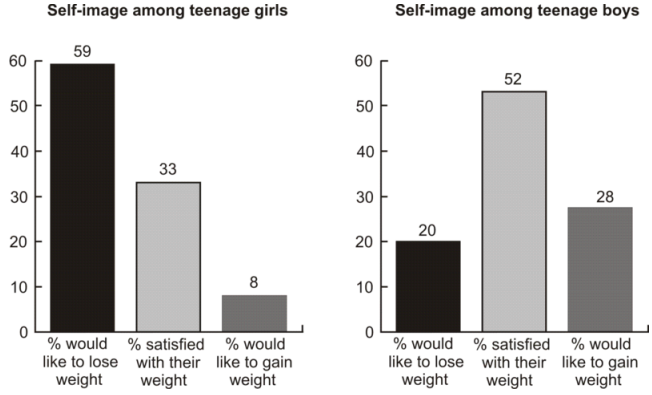
Research Findings: Eating Disorders and Self-Image amongst Adolescents in the United States



(Source: National Institute of Mental Health, 1987)



(Source: Gallup, November, 1985)



(Source: Gallup, November, 1985)

GroupWork 3 Individual Report: Fear of Fat (Student Reproducible)

Big Idea: Why Do We Eat?

1. What societal pressures does the video say are responsible for eating disorders and a preoccupation with weight and dieting? Do you agree that these societal pressures are common and strong?

2. What personal/psychological factors may lead to eating disorders?

3. Why are males not as often afflicted with eating disorders as females?

4. What would you do if you thought someone you cared for had an eating disorder?

5. How did your magazine ad differ from the original in the magazine?

GroupWork 4: Teacher Activity Notes - Food as Fuel

Big Idea: Why Do We Eat?

PLAN

Summary Students explore the concept of food as energy. They use a calorimeter to determine the energy content of two food items.

Group Size 4 to 5 students

Objectives

Students:

- define *heat energy* and *calorie* (Cal).
- describe the relationship between energy and calories.
- explain the importance of food for providing our bodies with energy.
- identify that different kinds of food contain different amounts of energy.

Multiple Abilities

- Making connections between ideas/concepts, logically analyzing the problem, solving a problem experimentally, making a hypothesis (reasoning ability)
- Recording data correctly and clearly, measuring accurately, explaining clearly and fully, observing carefully and accurately (ability to be precise)

Estimated Time 40 minutes

Suggested Use

- This set of activities works well near the end of the unit.

Student Materials

Ring stand, ring clamp, empty soda can, large paper clips, cork stopper, fireproof pad or aluminum foil, metric ruler, beaker of water, small cup of water, 200 – *ml* graduated cylinder, matches, thermometer, safety goggles and gloves, a can of shell-less peanuts, a bag of miniature marshmallows

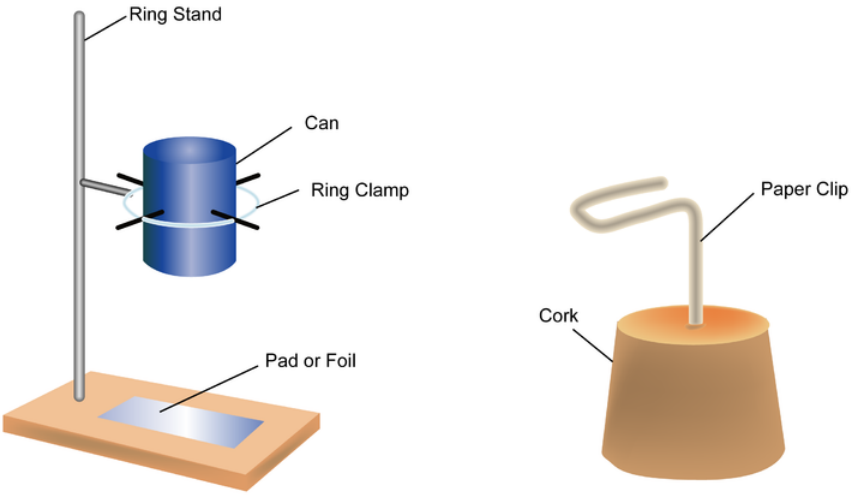
IMPLEMENT

If you already have calorimeters, use them. Otherwise, use the information below to build your own.

How to Make a Calorimeter

1. Use a nail to make four small holes spaced evenly apart in the sides of the can near the top. Straighten two paper clips and insert them through the opposing holes. Wrap a rubber band around the ends of the paper clips to hold them in place. The can is now ready to be suspended from a ring clamp. (Note: An aluminum can has been reported to produce better results than similar experiments using glassware.)

2. Set up the calorimeter-ring stand, ring clamp, aluminum can, and fireproof pad or piece of aluminum foil.



3. To make a food platform, bend the outer end of a paper clip straight down so it is at a right angle to the rest of the clip. Insert this end into the cork stopper. Refer to the diagram on the previous page.

4. Place the food platform on the fireproof pad or piece of foil. Adjust the height of the can so that it is close to the platform.

Helpful Hints

- You may wish to include a whole-class lecture at the beginning of this unit to explain to students what a calorimeter is, how it works, and what it is used for. In this activity, students do not use the calorimeter to calculate the number of calories (Cal) in a given food item; they simply measure the change in water temperature. The curriculum developers felt students would lose the big idea-food is energy-if they conducted the calculations necessary to determine the number of calories.
- Make sure students burn the peanut or marshmallow completely. They may have to relight the food item one or more times.
- Give students the can of peanuts and bag of marshmallows so that they can read and discuss the nutritional information on the back. If the labels provide nutritional information only by weight and not by number of peanuts or marshmallows, provide students with a scale to determine number of items per unit of weight.
- Given the simple nature of this calorimeter with all its possibilities for heat loss, students should still be able to measure about 80% of the energy contained in the peanut or marshmallow. They should also be made aware of the limitations of their experimental setup.

Extension Questions

- Do you think a piece of chocolate would provide more or less energy than a peanut? A marshmallow? How could you find out? How would you explain differences in energy content among these three food items?
- Can humans get energy from other sources beside s food? Explain.
- Why is it unhealthy to eat too few or too many calories?

ASSESS

The group Data Sheet, presentation, Individual Report, and group discussion can be used to assess if students can

- define *heat energy* and *calorie* (Cal).
- describe the relationship between energy and calories.
- explain the importance of food for providing our bodies with energy.
- identify that different kinds of food contain different amounts of energy.

Background Information

- In foods, energy is stored in the chemical bonds of the food molecules. When those bonds are broken, either through burning or through digestion, energy is released.
- One calorie (cal) is the amount of heat needed to raise the temperature of one gram of water by one degree Celsius. One calorie (Cal, often used to describe the amount of energy in food) equals 1,000 calories. Food calories (Cal) are also known as kilocalories.
- One way to determine the energy value of a food item is to burn it and measure the amount of heat energy produced. To determine the number of calories in a food item, the mass of the water (in grams) is multiplied by the change in water temperature (in degrees Celsius). Food calories are then determined by dividing the number of calories by 1,000. The burning of food, however, is rarely done outside of school labs. There are two reasons: (1) not all of the energy released in burning is available to one's body since some of the ingested food is not absorbed, and (2) many foods are difficult, if not impossible, to burn.
- A second and much more common way of determining the energy value of a food item is to calculate the number of grams of fat, protein, and carbohydrates in it and then to multiply each by its physiologic energy value (the energy available to the human body). The physiologic energy value for a gram of fat is 9.0 calories; for a gram of protein, 4.0 calories; and for a gram of carbohydrates, 4.0 calories.
- Burning a marshmallow or peanut is very similar to what happens in our own bodies. We simply "burn" the food much, much more slowly so that the energy released can be used by our bodies.

Extend the activity by having students

- use the following equation to determine the number of calories in a food item they have burned: Number of calories = mass of water (g) change in water temperature $(^{\circ}C)$. Calories $(Cal) = \frac{calories}{1{,}000}$.
- burn other food items to compare the amount of energy they release.

GroupWork 4 Activity Guide: Food as Fuel (Student Reproducible)

Big Idea: Why Do We Eat?

Introduction

Food is fuel for organisms. Much of the food we eat is broken down by our cells for energy-energy that is then used for growth and repair. In this activity, you will see for yourselves that food contains energy and that different foods contain different amounts.

Materials

- Ring stand, ring clamp, empty soda can, large paper clips, cork stopper, fireproof pad or aluminum foil, metric ruler, beaker of water, small cup of water, 200 *ml* graduated cylinder, matches, thermometer, safety goggles and gloves, a can of shell-less peanuts, a bag of miniature marshmallows

Procedure

1. What is a calorimeter? Read the Resource to find out.

2. You are now ready to determine the amount of energy present in different kinds of food. Place a peanut on the food platform and set it on fire. Measure the change in temperature of the water in the soda can. Record your data on the Data Sheet.

3. Repeat the test using a fresh peanut and fresh water.

4. Does a marshmallow store more or less energy than a peanut? Repeat steps 2 and 3 to find out.

5. Now, as a team, discuss the following questions:

- Why burn food in a calorimeter?
- For a given food item, how is a change in water temperature related to its energy content? According to your experiment, which has more energy: a peanut or a marshmallow?
- Were your peanuts and marshmallows approximately the same size and mass? How might such differences affect your results?
- Examine the labels on the peanut and marshmallow packages. Calories are a common way of indicating how much energy a given food product provides. Calculate the number of calories in 1 peanut and 1 marshmallow. Which has more calories? How closely do these findings match your experimental results?

6. Prepare to present and explain your findings to the rest of the class.

GroupWork 4 Resource: Food as Fuel (Student Reproducible)

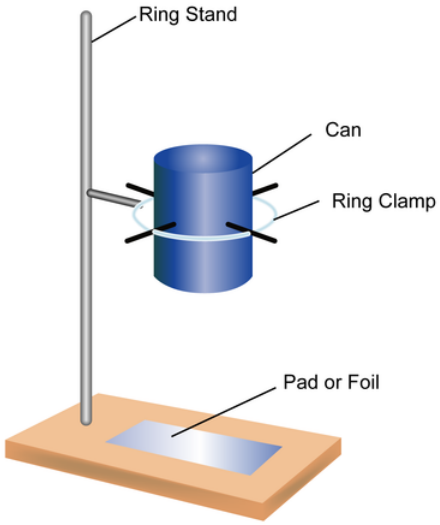
Big Idea: Why Do We Eat?

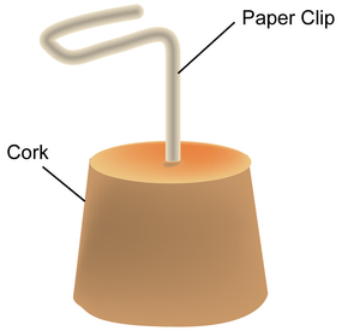
What Is a Calorimeter?

A calorimeter is often used to determine the amount of energy in a given food item. It measures the amount of heat energy released when a food item is burned. Heat energy released during burning is absorbed by the calorimeter's water. Foods high in calories, like potato chips, release a lot of energy in the form of a large and/or long-lasting flame. They make the water hot. Foods low in calories (Cal), like rice cakes, release much less energy. When lit, they have small and/or short-lived flames. They cause only a small change in water temperature.

How Do You Use a Calorimeter?

1. Put on safety goggles and gloves.
2. Pour a measured amount of water $(200\ ml)$ into the soda can.
3. Measure the temperature of the water and record it on the data sheet. Take the thermometer out of the can.
4. Place the food item on the paper clip on the food platform.
5. Light the food item and place the platform under the soda can. Place the used match in a cup of water.
6. After the food item is completely burned, remeasure the temperature of the water. Record it on the data sheet.





What Safety Tips Must You Follow?

- Wear your safety goggles and gloves at all times.
- Handle the matches with care.
- Do not touch the can immediately after burning. It may be hot.

GroupWork 4 Individual Report: Food as Fuel (Student Reproducible)

Big Idea: Why Do We Eat?

1. Why burn food in a calorimeter?

2. For a peanut or a marshmallow, how is the change in water temperature related to its energy content?

3. According to the food labels, about how many calories (Cal) are in one peanut? One marshmallow? Why is it important to know the number of calories in a particular food item?

4. How does this activity help answer the big idea of the unit, "Why do we eat?"

GroupWork 4 Data Sheet: Food as Fuel (Student Reproducible)

Big Idea: Why Do We Eat?

TABLE OF PEANUT TRIALS

TABLE 8.2:

	Peanut Trial #1	Peanut Trial #2
Grams of Water		
Starting Temperature		
Finishing Temperature		

Average Change in Water Temperature : _____

TABLE OF MARSHMALLOW TRIALS

TABLE 8.3:

	Marshmallow Trial #1	Marshmallow Trial #2
Grams of Water		
Starting Temperature		
Finishing Temperature		

Average Change in Water Temperature: _____

GroupWork 5: Teacher Activity Notes - Energy as Calories

Big Idea: Why Do We Eat?

PLAN

Summary Students explore the concept of food as energy. They determine the number of calories in different kinds of foods and discuss how the human body uses food for energy.

Group Size 4 to 5 students

Objectives

Students:

- identify the amounts of proteins, fats, and carbohydrates and the number of calories in a given amount of food.
- describe the relationship among food, calories, and energy.
- explain how and why the human body uses food for energy.

Multiple Abilities

- Conceiving of an idea for a song (creative ability)
- Making connections between ideas/concepts, considering as many solutions as possible (reasoning ability)
- Explaining clearly and fully, using words precisely (communication skills)

Estimated Time 40 minutes

Suggested Use

- This set of activities works well near the end of the unit.

Student Materials

Packaged foods, audiotapes, and tape recorder

IMPLEMENT

- Before beginning this activity, encourage students to bring in tapes and/ or lyrics by popular artists. Students may want to listen to these tapes to help them write and/or present their song.
- Provide students with a wide variety of packaged foods with clearly marked food labels. If you wish to include unprocessed foods (apples, lettuce, whole beans, etc.) in the food collection, include a dietary table as well.

- Make sure students connect the composition of a given food (amounts of protein, fats, and carbohydrates) to its number of calories and to the amount of energy it provides.

Extension Questions

- Why does a gram of fat have more calories than a gram of protein or carbohydrate?
- What are empty calories? (Alcohol, for example, has empty calories.)
- If a bag of potato chips has the same number of calories as two apples, why eat the apples instead of the chips?
- Why is it helpful and important to read food labels?
- Do nonfat foods have calories? Explain.

ASSESS

Use the group discussion, presentation, and Individual Reports to assess if students can

- identify the amounts of proteins, fats, and carbohydrates and the number of calories in a given amount of food.
- describe the relationship among food, calories, and energy.
- explain how and why the human body uses food for energy.

Background Information

- Kilocalories are sometimes referred to as calories (abbreviated with a capital C). There are 1,000 calorie s in one kilocalorie or Cal. Food is measured in calories (Cal).
- Protein s and carbohydrates contain approximately 4 calories per gram, while fats contain approximately 9 calories per gram. Alcohol, on average, yields about 7 calories per gram.

Extend the activity by asking students to research the recommended caloric intake for people of their size, age, and sex. Why are these recommendations given? Have the recommendations changed over time (from the 1950s to the present)? Why or why not?

GroupWork 5 Activity Guide: Energy as Calories (Student Reproducible)

Big Idea: Why Do We Eat?

Introduction

Food is fuel for our bodies. The amount of fuel, or energy, found in food is measured in calories (Cal). Different kinds of food provide our bodies with different amounts of energy. Our bodies use the energy to make new molecules, in other words, to maintain our bodies and to allow us to grow.

Materials

- Packaged foods, audiotapes, and tape recorder

Procedure

1. The movie producer, Spark Dee, has asked your team to write the lyrics to the theme song for his upcoming film *Fuel*. The film examines the subject of nutrition and targets adolescents. Before writing this song, research the relationship among food, calories, and energy. To do so, examine the nutrition labels of the foods provided and your student text. Discuss the following questions:

- Which foods are high in calories? Low in calories?

- How is the number of calories in a given food related to the amounts of protein, fat, and carbohydrates found in it?
- How are calories related to energy?
- What do our cells do with the calories we eat? How do you know?
- What happens if one's diet contains too few calories? Too many calories?

2. Write the lyrics to Spark Dee's theme song. Dee asks that you include answers to the following questions in your lyrics:

- How is food energy?
- Why do our bodies need energy?
- How do our bodies use energy?

3. Prepare to present your song to the rest of the class. If you wish, you may set your lyrics to the melody of a popular song or create a melody of your own.

GroupWork 5 Individual Report: Energy as Calories (Student Reproducible)

Big Idea: Why Do We Eat?

1. Why do different kinds of food contain different numbers of calories (Cal)?

2. How are calories related to energy?

3. What do our cells do with the calories we eat? How do you know?

4. What are the main points of your team's song? Why did you decide to include each point?

GroupWork 6: Teacher Activity Notes - Building Blocks

Big Idea: Why Do We Eat?

PLAN

Summary Students create a model depicting segments of two proteins found in food. They then show how the protein is broken down into amino acids and reconfigured to create protein for cell membranes.

Group Size 4 to 5 students

Objectives

Students:

- identify the structure and function of protein.
- explain why protein is a necessary component of a person's diet.
- explain how the protein we eat is used to build the structures of our body.

Multiple Abilities

- Creating a model (spatial/visual ability)
- Making connections

Estimated Time 50 minutes

Suggested Use

- This set of activities works well near the end of the unit.

Student Materials

Butcher paper and colored candies, paper, or blocks. (There are 15 different amino acids found in the proteins that students will be constructing. Thus, whatever objects are used, there will need to be at least 15 different colors or shapes. Jelly beans or multicolored paper cut into different shapes will work well.)

IMPLEMENT

Emphasize to students that protein is a unique nutrient. Unlike the other dietary nutrients(fats, carbohydrates, vitamins, and minerals), protein provides the raw materials (amino acids) for new growth and maintenance. Protein can be a source of energy as well. However, our bodies won't use protein for energy unless there are no fats or carbohydrates available.

Extension Questions

- Why are vegetarians at greater risk of protein deficiency?
- Why is protein an important nutrient for pregnant women? For infants and adolescents?

ASSESS

The group Data Sheet, presentation, Individual Report, and group discussion can be used to assess if students can

- identify the structure and function of protein.
- explain why protein is a necessary component of a person's diet.
- explain how the protein we eat is used to build the structures of our body.

Background Information

- There are 22 (when you count cystine and ornithine) amino acids, 8 to 9 of which are considered essential (histidine is essential for infants, not for adults). The human body cannot manufacture essential amino acids-they must be ingested.
- Unlike fat, our bodies are unable to store protein. If one's diet lacks the necessary protein, the body will begin to break down vital tissues, such as muscle, to get the necessary amino acids.

Extend the activity by

- providing students with a dietary table listing the caloric and nutritional values of foods. Have students create a high-protein meal that would be both nutritional and tasty.
- having students investigate "Protein Powders", which are popular with bodybuilders and some athletes. Based on what they know about protein, protein synthesis, storage, and catabolism, should protein powder really help build muscle? Why or why not? Under what conditions?

GroupWork 6 Activity Guide: Building Blocks (Student Reproducible)

Big Idea: Why Do We Eat?

Introduction

You probably know by now that you need to eat food with protein. But why? What's so special about protein? In this activity, you will create a model showing how the protein you eat is necessary for building some of the structures of your body such as cell membranes, hair, and bones.

Materials

- Butcher paper and colored candies, paper, or blocks

Procedure

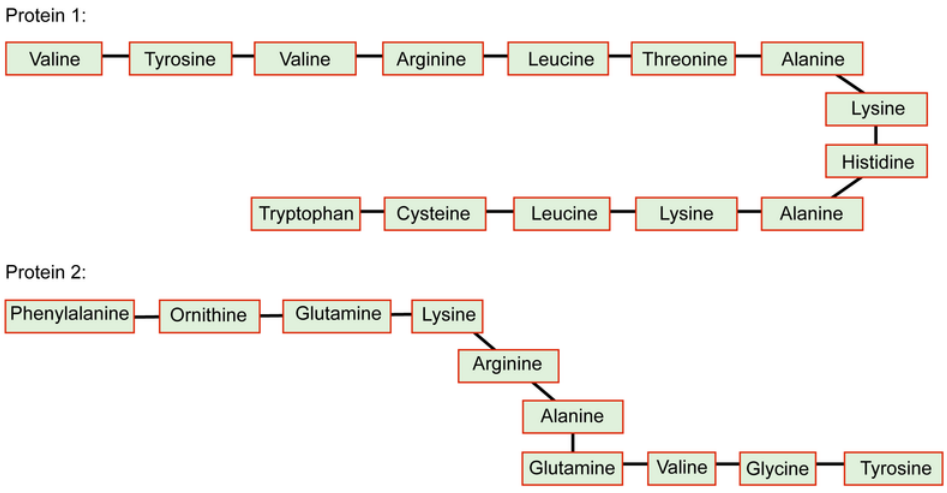
1. Picture this: you're sitting down to eat dinner. You bite into a hamburger. Then you take a big gulp of milk. You may not know it, but there are vital proteins in the food you're eating. The structures of two segments of these proteins-both from milk are shown on the Resource. Using colored objects, create a model of the protein segments. Each amino acid should be represented by a different color.
2. Using your model, show how these protein molecules are broken down into the amino acids when the food is digested. Then create the new protein that becomes part of a cell membrane.
3. Present your model to the class. The model should show (1) the structures of two parts of protein found in food, (2) what the protein molecules look like after they are broken down into separate amino acids, and (3) the new protein molecule that has become part of a cell membrane.

GroupWork 6 Resource: Building Blocks (Student Reproducible)

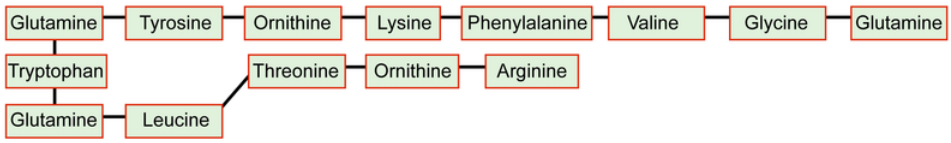
Big Idea: Why Do We Eat?

Protein provides your body with building blocks for growth and maintenance. The protein you get from food is made up of molecules called amino acids. The amino acids are connected together in long chains to make proteins, just as letters are put together in a row to make words. These chains fold and tangle so that they look more like crazy jungle gyms than straight chains.

After you eat food with protein in it, the protein molecules are broken down into their separate amino acids. These amino acids are then put back together again in a different order and combined with others to make the protein molecules your body needs. Below are parts of two proteins found in food.



After eating these proteins, your body breaks them down into their separate amino acids. These amino acids are then recombined to make the following protein found in cell membranes:



GroupWork 6 Individual Report: Building Blocks (Student Reproducible)

Big Idea: Why Do We Eat?

1. Phenylalanine is an amino acid that we can't make ourselves. The only way we can get it is by eating food that contains phenylalanine. What would happen if a person didn't eat any food containing phenylalanine? Be specific.

2. What might happen to you if you didn't eat enough protein?

3. Explain this statement: "Protein provides your body with building blocks for your body's growth and maintenance."

GroupWork 7: Teacher Activity Notes - It Takes Guts

Big Idea: Why Do We Eat?

PLAN

Summary Students explore the physiological mechanism controlling one's appetite. After studying the neural connections between the stomach and brain, students create a model showing what happens when one's stomach is empty and when it is full.

Group Size 4 to 5 students

Objectives

Students:

- identify the signals the stomach sends to the hypothalamus when it is empty and full.
- describe the biological/anatomical reasons one eats or doesn't eat.
- explain how the digestive and nervous systems interact to control one's desire to eat.

Multiple Abilities

- Drawing an idea, creating a model (spatial/visual ability and creative/artistic ability)
- Analyzing an issue, making connections between ideas and concepts (reasoning ability)

Estimated Time 50 minutes

Suggested Use

- This set of activities works well near the end of the unit.

Student Materials

Butcher paper, balloons, and assorted art supplies including pens, paint, and construction paper

IMPLEMENT

1. As is pointed out on the Resource, it's important to note that the hypothalamus does not send two *different* messages ("I'm hungry, let's eat" and "I'm full, don't eat") to the rest of the brain. Rather, the hypothalamus can send only a "let's eat" message to the rest of the brain or no message at all. If students have difficulty understanding this concept, you may wish to compare this feedback system with a telephone. When someone calls you, the phone rings. When no one is trying to call you, it doesn't ring. There is not some other signal that the phone gives telling you no one is trying to call you; there is simply no message at all.
2. The feedback system between the stomach and hypothalamus is slightly different. Two messages are sent to the hypothalamus: one excitatory message, when the stomach is empty, and one inhibitory message, when it's full. This is more analogous to a traffic light. You get a green light when you are allowed to go and a different light-a red one-when you are not allowed to go.
3. The balloons can be used to represent a full and an empty stomach.

Extension Questions

- What limitations does your diagram have as far as representing the control mechanism? What strengths does your diagram have?
- What would happen if damage occurred to the hypothalamus such that it could no longer respond to the excitatory messages from the stomach? to the inhibitory messages from the stomach?
- Why do you sometimes eat when you are not hungry, i.e., when your stomach is full?

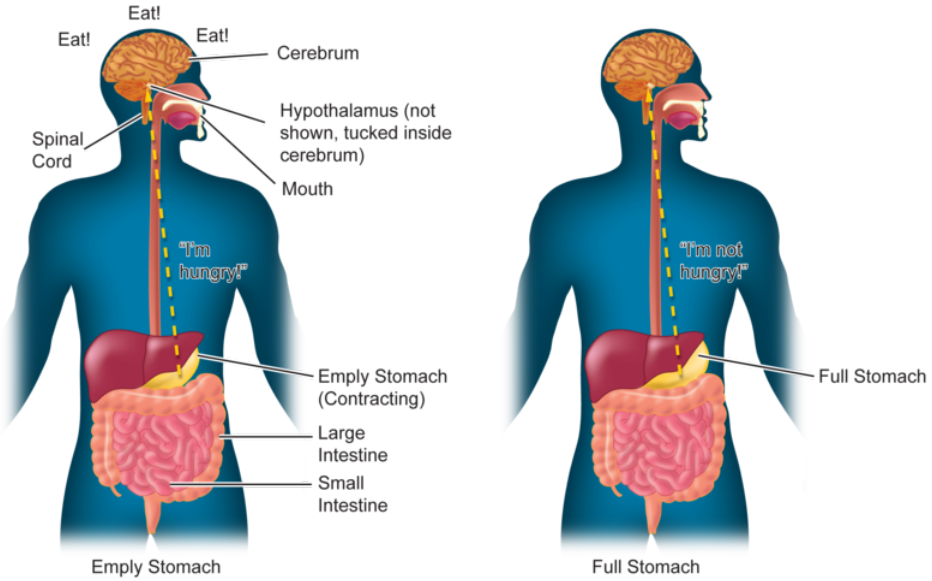
ASSESS

Use the group Data Sheet, presentation, Individual Report, and group discussion to assess if students can

- identify the signals the stomach sends to the hypothalamus when it is empty and full.
- describe the biological/anatomical reasons one eats or doesn't eat.
- explain how the digestive and nervous systems interact to control one's desire to eat.

Background Information

The following diagrams depict the inhibitory and excitatory messages sent under hungry and satiated conditions.



GroupWork 7 Activity Guide: It Takes Guts (Student Reproducible)

Big Idea: Why Do We Eat?

Introduction

You're sitting in social studies when your stomach starts to growl. "Man, am I hungry! I wonder what they're serving in the cafeteria." You glance at the clock. "Uhgg, how much longer till lunch?!" When the bell finally rings, you head for the cafeteria for one very obvious reason: your stomach is telling you that your body needs food.

Materials

- Butcher paper, balloons, and assorted art supplies

Procedure

1. The stomach plays an important part in telling you when you're hungry or full. Read the Resource that explains how the stomach tells your brain when it needs or does not need food. Then discuss the following questions:

- What signals does the stomach send when it is full? What is the result?
- What signals does the stomach send when it is empty? What is the result?
- Does the information you read agree with what it feels like for you when you are hungry? Full? Explain.

2. Create two life-size displays of what you have learned about the link between your brain and stomach when you are hungry or when you are full. Use the butcher paper to trace two outlines of a body. Then use any art supplies to represent the important organs of the ***digestive system*** and ***nervous system*** and ***what they do under each of the following situations:***

- When your stomach is **full.**
- When your stomach is **empty.**

3. Check your text and other resources to find out what other signals tell your body it's time to eat.

4. In your presentation to the class, use your displays to teach your classmates how and why they feel hungry or full.

GroupWork 7 Resource: It Takes Guts (Student Reproducible)

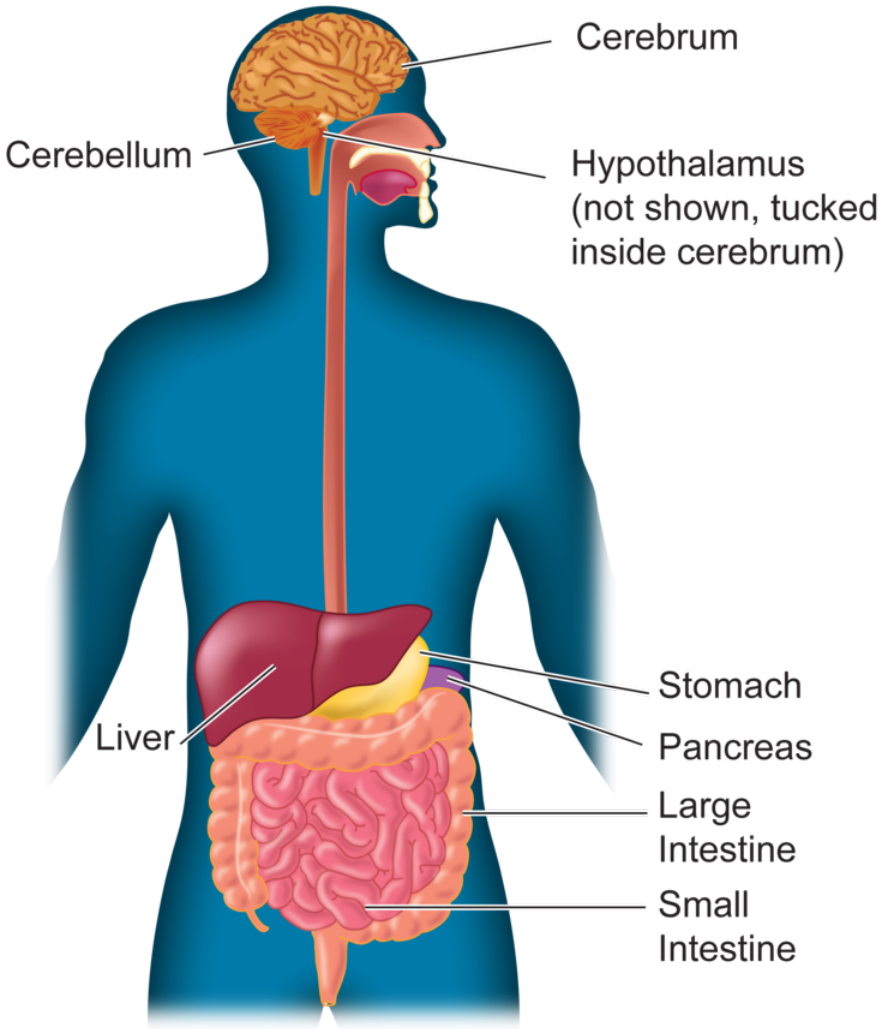
Big Idea: Why Do We Eat?

The stomach sends signals to the hypothalamus (a part of the brain) telling the brain whether the stomach is full or empty. In response, the hypothalamus either sends a message to the rest of the brain telling you to eat or doesn't send any message at all.

For example, if the stomach is empty, it will start to contract (sometimes you can hear the contractions when your stomach growls). The contractions stimulate nerves, which send "Hey-the stomach is empty" messages to the hypothalamus. As a result, the hypothalamus sends "let's eat" messages to the part of your brain that controls behavior.

If the stomach is full, it sends messages to the hypothalamus telling it so. In response, the "let's eat" signal being sent to the rest of the brain is turned off: no message at all is sent from the hypothalamus to the rest of the brain. As a result, you stop feeling hungry.

It's important to note that when your stomach is full, your brain does not get a "don't eat" message from the hypothalamus. It simply stops getting a "let's eat" message.



GroupWork 7 Individual Report: It Takes Guts (Student Reproducible)

Big Idea: Why Do We Eat?

1. Explain what signals the stomach sends to the hypothalamus when it is empty and full. How does the hypothalamus respond?

2. What other signals tell your body it's time to eat? Explain.

3. Scientists call nerve messages that turn something off, inhibitory signals and messages that turn something on, excitatory signals. Given this, what would you call messages sent by the stomach when it is empty? What about messages sent when the stomach is full? Explain.

GroupWork 8: Teacher Activity Notes - Culminating Activity

Big Idea: Why Do We Eat?

PLAN

Summary Students synthesize the information from the previous group activities in order to analyze food labels and provide reasons why an individual may or may not eat a particular food.

Group Size 4 to 5 students

Objectives

Students:

- identify the nutritional benefits of certain foods.
- describe the physiological, psychological, sociological, and cultural reasons why people eat (or don't eat).
- explain that the nutritional value of a food depends not only on the food but on who eats it.

Multiple Abilities

- Integrating and applying information from various parts of the unit (reasoning ability)

Estimated Time 40 minutes

Suggested Use

- This set of activities works well near the end of the unit.

Student Materials

Each group will need a food label.

IMPLEMENT

1. Gather these eight different foods, each with a food label :

can of soup	cookies
rice cakes	frozen dinner
burrito	cottage cheese
frozen spinach	package of rice

2. Students should consider the following when evaluating the reasons why someone may or may not eat a particular food: physiological reasons (a person needs the fat, protein, carbohydrates, vitamins, and/or minerals found in the food), physical reasons (a person's stomach is growling), psychological reasons (a person is depressed, stressed, or anorexic), sociological reasons (thinner or fatter than the ideal body depicted in society), cultural (it goes against a person's religion, he or she is a vegetarian), or geographical reasons (it's not commonly found in the region, can't be grown in the climate, or is not imported into the area).

3. You may need to provide a dietary table listing the caloric and nutritional values of foods. You will also need to explain to your students how to use this table as well as how to calculate the nutritional values of foods.

4. Emphasize to students that deciding whether a food is healthy or unhealthy depends on a lot of different things: how much of it one eats, how active one is, and what other foods one eats. For example, a food that may be good for a weight lifter about to enter a bodybuilding contest might be quite unhealthy for someone who has a very sedentary job or does little physical exercise. Similarly, a food that is important to the health of a pregnant woman could be unhealthy for an infant or elderly person.

Extension Questions

- Food labels are required to list the percentages of the RDA (recommended daily allowance) that the food provides. How much of the RDA does this food product provide with respect to protein? fat? carbohydrates? vitamins?
- What requirements does your body have that this food does not provide (e.g., oxygen, nitrogen, friends)? How are those requirements filled?

ASSESS

Use the group Data Sheet, presentation, Individual Report, and group discussion to assess if students can

- identify the nutritional benefits of certain foods.
- describe the physiological, psychological, sociological, and cultural reasons why people eat (or don't eat).
- explain that the nutritional value of a food depends not only on the food but on who eats it.

GroupWork 8 Activity Guide: Culminating Activity (Student Reproducible)

Big Idea: Why Do We Eat?

Introduction

Food is essential to our bodies and minds. It can fulfill a tremendous number of physiological, and even psychological, requirements. In this activity, you will analyze one food item or product and consider the reasons why someone may or may not eat it.

Procedure

1. As a group, study the food label you've been given.

- What nutrients does this food provide a person who eats it?

- What nutrients does it not provide?
- What would be the benefits of eating this food? What would it allow you to do?
- What would be the costs or negative effects of eating this food?

2. Based on your analysis of the food:

- Which of the people described below would be likely to eat this type of food? (Choose as many as are appropriate.) Explain.

a. A teenager who's been trying to diet by ea ting only fruit and drinking diet soda.

b. A vegetarian runner who is going to compete in a 10-mile run in a few hours.

c. A toddler whose diet lacks protein.

d. A teenage girl in India who is training for the Olympics in swimming.

e. A pregnant, 35-year-old doctor living in a coastal town in China.

f. A factory worker in Italy who doesn't get much exercise.

g. A young boy in Kansas whose stomach is growling.

h. A woman in California who just ate a steak for dinner.

i. You.

- What foods (if any) should be added to make a well-balanced, nutritional meal? Explain.

3. As a group, create a description of a person who **would *or* should** eat this type of food. Include information about his or her culture, religion, location, occupation, age, gender, and physical activity, and any other information that pertains to the person's nutritional needs. Also suggest other foods that might be eaten with the type of food to make a well-balanced, nutritional meal.

GroupWork 8 Individual Report: Culminating Activity (Student Reproducible)

Big Idea: Why Do We Eat?

1. What nutrients does this food product provide? What nutrients are missing?

2. Who would or should eat this type of food?

3. Who probably wouldn't eat this type of food? Why?

4. What would happen to a person's body if this were the only food he or she ate?

8.2 Projects

The following Projects are an assortment of long-term activities that can be completed ind individually, in groups or as a class. We have provided starting points for research and development; you and the students can work together to create a more detailed plan of action. Consider the following two recommendations. First, because of the amount of work involved in a Project, students should choose one of great interest to them. Second, to encourage excellence and promote student-student learning, students should present their finished projects to the rest of the class, to the school and to the community, if appropriate.

Project 1: Research Questions and Action Projects

Project 1 differs from the others: it is a list of possible research topics organized according to some key ideas and addressed to students.

In assigning a Research Question or Action Project, we ask that you allow students to choose their topic either one provided or one of their own. You might also:

1. Specify length of piece.
2. Make clear the purpose and the audience.
3. Suggest sources and ideas for information.
4. Provide in-class time for compiling information and writing.
5. Require students to exchange papers and provide written feedback.
6. Provide a breakdown of due-dates for the following stages: choice of topic, outline, rough draft and final draft.
7. Permit students to supplement a written report with a skit, a piece of artwork, a piece of music, a dance, a video, or a multimedia presentation.

ASSESS

Provide the students with evaluation criteria that include:

- accuracy of the content based on guiding questions.
- clarity of writing.
- effective organization of main ideas.
- use of detailed examples or citing evidence to support their conclusions.

Projects 1: Research Questions

You Are What You Eat

1. What are the basic food groups? Use textbooks and research articles to answer the following questions: When were the basic food groups introduced? For what purpose? How have they changed over time? Why? What can food groups tell you about what and how much to eat?

2. Are you learning the same nutritional information as your parents? Your grandparents? Examine life science textbooks from the last several decades. Answer the following: How has nutritional information changed over time?

Why? How do these changes affect your life? How do these changes reflect larger changes in American society? What do these changes say about the scientific process?

3. What is a healthy diet? Use the latest information on health and nutrition to do the following: recommend when, what, and how much a teenager like yourself should eat; create a short menu of healthy meals and snacks; and provide evidence to support your choices.

4. What are vitamins? Choose two vitamins described in your text. Research the following: what they are, in what foods they are found, what they do in your body, what happens if you get too much or too little of them, and if your diet provides you with an adequate supply.

5. Why is too much fat unhealthy? Describe the following: what fat is, what the purpose of fat is in the body, what foods are high in fat, why too much fat is unhealthy, and how you can avoid too much fat in your own diet.

Your Food and Your Life

6. How has the human diet changed over time? Research the major changes in the human diet, the events that caused those changes, and the benefits or drawbacks of those changes. For example, people began eating frozen foods about 50 years ago-after we learned how to freeze food. Your text can help get you started.

7. Do all humans eat the same kinds of food? Research people's diet in one culture or country. Describe what they eat and why. The "why" can include available resources, traditions, and religious reasons. Compare this culture's diet with your own.

8. Is it easy to be a vegetarian in the United States? Describe what it means to be a vegetarian. Explain the costs and benefits of eating a vegetarian diet. For example, one cost is difficulty in maintaining a balanced diet with all essential amino acids and one benefit is lower food bills. Are you or would you like to become a vegetarian? Explain your answer.

9. What is a fad diet? Research a current fad diet. Describe what the diet is, how it claims to work, and any evidence of its effectiveness. Then discuss why the fad diet should not be tried-how the diet can cause more harm than good.

10. Why is the United States often considered the land of the obese? Research obesity in American society. How is obesity defined? How many Americans are considered obese? What are the causes of obesity? Why is being obese unhealthy? What can you do to avoid or overcome obesity?

11. Why are some people anorexic or bulimic? Research one or both of these eating disorders. Describe what it is, who it affects, what causes it, how it is treated, and how it can be prevented. Discuss societal pressures that may contribute to these eating disorders.

12. Why does malnutrition remain a global problem? Choose a country, like the United States, Ethiopia, or Mexico, in which some people continue to go hungry. Research the following: Who goes hungry? Why? What can that country's government do to help its people? What can other nations do? What can you do?

Our Bodies Need Building Blocks

13. Your text tells you: Plants and animals are linked together and need each other to live. What does this sentence mean? Research and describe several connections between plants and animals. Explain what these connections mean to you.

14. Your text compares your digestive system to a disassembly line. Create your own analogy to describe how the digestive system works. Compare your analogy with that in the text. What are the strengths and weaknesses of both? Why do scientists often use analogies to describe how something works? Are analogies generally helpful or confusing?

A Journey through the Digestive System

15. Do you have strong, healthy teeth? In recent decades, people have learned how to take better care of their teeth. What are some recent advances in dental care? How did these advances come about? How do they affect you and your teeth?

16. Who are Dr. Beaumont and Alexis St. Martin? Many textbooks give a brief description of how Dr. Beaumont and Alexis St. Martin performed experiments to learn how the stomach works. Conduct your own research on the story. Do textbooks provide an accurate description of what happened? What immediate effects did Dr. Beaumont's discoveries have on people's knowledge of the digestive system? What effect do they have today?

17. What do you do when someone is choking? Research the causes and prevalence of choking. How can choking be prevented? How could you help a choking victim?

18. How do antacid tablets neutralize stomach acid? When should people take them? Research antacid tab lets: how they work, when they should be used, and when they are no longer enough. Include other ways to treat an upset stomach. Explain why having an upset stomach on a regular basis is a bad sign. What will you do next time your stomach is upset?

19. How does fiber help the large intestine do its job? Answer the following questions about fiber: What is fiber? What are good sources of fiber? How does fiber affect the large intestine? What can happen if people don't eat enough fiber? How can you include more fiber in your own diet?

Staying Healthy

20. Are food additives necessary? Can they harm your health? Research a food additive such as MSG. Describe what it is, why it is used, in what foods it is found, who sets standards for use, and its health benefits or risks. Find out what might happen to you if you eat a lot of this additive. Decide if you want to continue to do so.

21. Are fast foods really bad foods? Choose one fast food restaurant in your community. Research the types of food it serves, the foods' nutritional and caloric content, and how such food is prepared and cooked. Attempt to create a "healthy" meal from its menu. Make sure to support your opinions with evidence.

22. Is losing weight easy? Conduct research to determine when a person should lose weight, which weight-loss diets are best, and what happens once a person stops dieting. If you have ever been on a weight-loss diet, include your own experiences and insights.

23. Is gaining weight easy? Conduct research to determine when a person should gain weight and what foods he or she should eat. If you have ever been on a diet to gain weight, include your own experiences and insights.

24. Why is exercise often linked to good nutrition? Describe several connections between eating right and exercising regularly. Also include a self-examination: What are your eating and exercise habits? How can they be imp roved?

25. What is cholesterol? Why is some cholesterol good and some bad? Examine the latest research on cholesterol: what it is, what it does, in what foods it is found, why certain kinds of cholesterol are considered bad and good, and what you can do to keep your cholesterol level low.

Projects 2: Teacher Activity Notes - A Nutritional Lunch

PLAN

Summary Students use their knowledge of the body's energy and nutrient needs to assess the nutritional value of their lunches. They consider whether lunches served by the school cafeteria (if one exists at their school) or lunches brought from home conform to guidelines for a healthy diet.

Interdisciplinary Health/Nutrition

Estimated Time Some class time each day to record and analyze the makeup of their lunches. Several class periods for students to prepare and present their projects.

Student Materials

A nutritional chart or software that analyzes the diet and a food pyramid

Teacher Materials

None required

Advance Preparation

None required

Product

Oral and written reports of group findings Nutritionally sound menu

IMPLEMENT

1. Before initiating this project, discuss it with the head of the cafeteria in order to ensure cooperation on his or her part as well as respect and consideration on the part of the class.

2. Divide students into groups to conduct a study of the nutritional value of one real-life lunch. If the school has a cafeteria, have each team analyze a different lunch-some from the cafeteria and some from home. If there is no cafeteria in the school, then students in a team can exchange lunch diaries and analyze each other's lunches. Each team should study the following: the kinds and amounts of food in the lunch and estimates of the amounts of fat, protein, carbohydrates, and vitamins and of the numbers of calories present in the food served. An alternative to this analysis can be for students to use a food pyramid to tally up food choices for each of the food groups, looking for a balance and for a number of servings tally to represent about one-third of the recommended servings per day.

3. Each team should present its findings orally and in writing to the rest of the class.

4. The class should come up with an ideal lunch plan for a week. The plan should include the following:

- Lunch menus for 5 days. Explain why you chose the foods in your menus (i.e., why they are considered nutritional).
- A complete analysis of the protein, fat, carbohydrate, calorie, and vitamin content of your weeklong plan
- An estimate of the cost of each lunch
- Packaging that reflects a consideration of the environment

Note: It may be helpful to provide a table for students to list the foods on their menus and assign each food to a food group and nutrient category. See page 142.

Remind students that lunch items should be broken down into their parts and each part should be listed separately (e.g., a turkey sandwich is comprised of bread, turkey, lettuce).

5. Finally, have a class lunch, picnic style, using your menus. To do this, you may choose to have students bring in the lunches they prepared according to the menus. Or, as a team or a class, you may choose to pick one day's menu and have each student bring in part of it (enough for a few people). Ask the cafeteria to serve the lunch. Menus can be displayed for all to see.

Extensions

- A few months later, ask students to repeat their analysis of the lunches from home or at the cafeteria. How does it compare with their initial analysis? Is their analysis faulty in some way? Has the cafeteria's menu improved from a nutritional point of view? If not, why not? Does the cafeteria lack the funds to provide healthier food? Are there federal or state laws controlling the cafeteria's choices? Have students' concerns or recommendations fallen on deaf ears?

TABLE 8.4:

Lunch Item	Food Group	Nutrient

- Ask students to assess what they learned and/or did in this project. Have them write about these experiences in a reflective paper.
- Ask students to synthesize in an article all that the groups have learned and done. Submit this article to the school and/or local newspaper for publication.
- Have a professional nutritionist visit the class and discuss his or her job as it relates to promoting healthy eating.

ASSESS

Use the research results and presentations to assess if students can

- identify the amounts of fat, protein, carbohydrates, and vitamins and the numbers of calories in the foods from lunch.
- design an ideal lunch plan for five days.
- analyze their ideal lunch plan according to food group and nutrient category.

Projects 3: Teacher Activity Notes - A Healthy Food Plan

PLAN

Summary What is a healthy two-day food plan for students? In this project students design a healthy food plan based on what they have learned about healthy eating.

Interdisciplinary Math, Home Arts

Estimated Time A day to create the food plan and a lunch period for sharing the food

Student Materials

Activity Guide

Food nutrient chart

Food pyramid

Food diaries from *Activity 1-1: Are You What You Eat?*

Results from *Activity 2-2: Calories: How Much Energy Do You Use?*

Teacher Materials

None required

Advance Preparation None required

Product

A healthy food plan covering a time period of two days, a healthy lunch menu, and a meal to be presented at the Class Picnic

IMPLEMENT

1. Have students design a healthy, two-day food plan for themselves or for a friend. They should include the names of the food, the amounts eaten, the calories per serving, and the amounts of protein, carbohydrates, and fats available in grams.

The food plan should

- fit their daily calorie requirements. (Refer students to *Activity 2-2: Calories: How Much Energy Do You Use?)*
- be heart smart; contain less than 30% fat calories. (Refer students to *Activity 1-1 : Are You What You Eat?)*
- contain 15% or more of protein calories. (Refer students to *Activity 1-1: Are You What You Eat?)*
- include food from all five food groups as they appear in the food pyramid.
- include all six nutrients.

2. In their teams, students can share ideas for menus based on their healthy food plans. Then they can decide on a menu that includes a variety of easy-to-make, tasty, and nutritious foods. Plan to share the lunch at a school picnic or as part of a science activity in science class. Have students make sure that their lunches

- follow the healthy food guide lines described above.
- use packaging materials that respect the environment.
- include a written menu to display while "picnicking" with their group.

Assess

Use the healthy food plan and the meal presented to assess if students can:

- design a food plan for two days that includes the names of the foods, the amounts eaten, the calories per serving, and the amounts of protein, carbohydrates, and fats in grams.
- demonstrate how their food plan fits the criteria outlined in the project.
- calculate their daily calorie (Cal) intake of fat, protein, and carbohydrates.

Project 3 Activity Guide: A Healthy Food Plan (Student Reproducible)

Helpful Information to Consider before Planning the Meal

Before filling out the diet plan, find the following values:

1. My calorie use per day is about _____ calories. (Use the chart in the text or the results from *Activity 2-2: Calories: How Much Energy Do You Use?*)

2. My total fat intake per day should be no more than

30% × _____ calories needed per day = _____ calories from fat.

3. My total protein intake per day should be about

15% × _____ calories needed per day = _____ calories or more from protein.

4. Can you think of an easy way to calculate how many calories of carbohydrates your diet has?

After filling out your 2-day diet plan, answer the following questions:

Day 1: Total grams of fat = _____ calories = _____

Day 2: Total grams of fat = _____ calories = _____

Average number of fat calories per day = _____ (a)

Day 1: Total grams of protein = _____ calories = _____

Day 2: Total grams of protein = _____ calories = _____

Average number of protein calories per day = _____ (b)

* One gram of fat has 9 calories. One gram of protein and one gram of carbohydrates each has 4 calories.

How do (a) and (b) above compare?

Projects 4: Teacher Activity Notes - Waste in the Fast-Food Industry

PLAN

Summary Students study the effects of waste products from fast food restaurants on the environment.

Interdisciplinary Social Studies, Math

Estimated Time Approximately $1 - 1\frac{1}{2}$ weeks

Student Materials

None required

Teacher Materials

None required

Advance Preparation

None required

Product

Class presentations of results and written proposals to reduce restaurant waste

IMPLEMENT

1. Divide students into groups and have them pick a fast food restaurant in your town. If possible, each group should pick a different restaurant. Have students determine how much waste (by weight) a typical meal (e.g., a large hamburger, fries, and soft drink) produces each *year*. To do so, they will need a plan. For example, they will need to visit the fast food restaurant, collect the paper and Styrofoam garbage left from a typical meal, and find out how many such meals are typically sold each day (they may wish to interview the manager or owner of the restaurant to determine the *approximate* sales figures per day).

2. In researching how these various waste products are handled, the groups should consider the following:

- Where does each type of waste go and what happens to it? (Is it burned, processed, or dumped?)
- Could it be recycled? Reused?
- What impact on the environment does it have?
- Could it be replaced with something else or eliminated completely?

Give groups time to discuss the following questions:

- Do you think the restaurant should attempt to reduce the amount of garbage it produces? If so, what can it do and how? Is it feasible? Economical?
- What action(s) could customers or the community take?

3. Have groups design reports that *present their results* and *provide a proposal* to help their restaurant reduce its waste. Each group must present its report to the class using visuals, audiotapes, videos, and any other creative means to relay the information.

4. Finally, ask students to compare their results to those of groups investigating other fast food chains. Have them consider these questions:

- How do the results compare?
- What fast food chain produces the least garbage?
- How does each try to minimize its waste?

Helpful Hints

- Depending on the math skills of the students in the class, they may need some assistance. You may wish to collaborate with the math teacher at your school in order to make the computational part of this project a math assignment.
- Students could also determine the volume of trash produced by using a large container of water and measuring the amount of water displaced by the garbage. Thus, the concept of mass versus volume could be explored.

Extensions

- Have students send their report to an executive from the fast food company they analyzed. Send a letter with their report explaining their findings and requesting a response. When/if the companies respond, you can revisit the issue.
- Students might also get other students in the school or community involved in order for everyone to be aware of and take responsibility for the waste produced by the fast food industry.
- Ask students to synthesize in an article all that the groups have learned and done. Submit this article to the school and/or local newspaper for publication.

ASSESS

Use the research findings on fast-food restaurant waste disposal and the recommendations presented to assess if students can

- determine how much waste a typical fast-food restaurant produces daily.
- devise a plan to reduce waste that is economically feasible.

Projects 5: Teacher Activity Notes - Examining Eating Disorders

PLAN

Summary Students examine the issue of eating disorders. They consider the effects of the medial advertising and fashion industries on young people, especially girls. Students evaluate the opinions of medical and psychology experts who say that popular media and the fashion industry send signals that say you must be a certain shape and size to be happy, to be loved, or to be beautiful. Students formulate a plan of action to resist these strong messages sent to the public.

Interdisciplinary Social Studies and Health

Estimated Time Will vary but a minimum of two weeks, with about 3 days of in-class time

Student Materials

Will vary, but should include a variety of magazines and advertisements

Product

- A presentation of research on the effects of eating disorders and related social and public policy issues
- A written action plan for a healthy body image campaign

IMPLEMENT

1. Facilitate a class discussion focusing on why young people are so concerned with the shape and size of their bodies. Do students agree with the experts that we are constantly getting messages to be a certain shape and size from the society around us? If so, what makes people more or less susceptible to believing these messages?

2. Next, discuss what the class as a whole knows about eating disorders. Discuss the medical problems associated with eating disorders as well as the psychological problems. Ask students to conduct additional research if necessary.

3. Finally, ask students what they could do in another class, the school, or a nearby school to make a difference by helping lower the incidence of eating disorders among adolescents. They may first want to consider studying the situation to get an accurate picture of the problem. For example, ask them to observe carefully the environment of the school to see what messages are being sent to students about their bodies. They might look at the magazines in the library, posters on the wall, or textbooks and/or listen to how boys and girls talk and/or how teachers talk.

4. Either in groups or as a class, brainstorm several methods that could be useful for convincing others to have a healthy image of their body and avoid eating disorders. Choose one method to use to target your school, community, or state. Have students develop a detailed plan of action to carry out their campaign:

What are they going to do?

Who is going to do what and when?

Who do they need to contact for help, supplies, information, or permission to post posters or use space?

5. Have students implement their plan, if possible. They could write to local or state health officials or politicians. The letters should summarize student research, plan of action, and results as well as encourage politicians to enact the plan on a larger scale.

Helpful Hints

- Although the topic of this activity is eating disorders, focus students' attention on the greater issue of general body image. Students worried about being too thin or too fat or not having big enough muscles should realize the importance of accepting everyone's body including their own.

- Activity 5-1 explores the topic of eating disorders. It provides some information and a chance to identify "be thin" messages in magazines.

Extensions

- Ask students to assess what they learned and/or did in this project. Have them write about these experiences in a reflective paper.
- Have a guest speaker come in to talk to the class. Some communities have groups composed of people recovering from eating disorders who visit schools and organizations to speak about eating disorders and their experiences. In addition, some psychiatrists, psychologists, doctors, and nutritionists specialize in eating disorders and might be willing to speak to the class.

ASSESS

Use the research results and written action plan to assess if students can:

- identify the medical effects of eating disorders.
- explain why people continue to develop eating disorders even when they know the negative health effects.
- evaluate the impact of advertisements that, in effect, promote eating disorders.
- present an organized action plan for developing a healthy body image and avoiding eating disorders.
- make a convincing presentation using factual information.

8.3 Additional Resources

Book

Morrill, Judy. *Science, Physiology, and Nutrition: A Primer/or the Non-scientist.* San Jose, Calif. San Jose University.

CD ROM

Mindscape. 1995. "How Your Body Works" AW Publishing Group.

Publications

American Cancer Society Pamphlet, with student activities "Mother Was Right." California Division West Bay Region.

American Heart Association. Middle School Pamphlets: "Heart Decisions" (Module III), "Food, Fun, and Fitness" (Teachers Guide); and various pamphlets on nutrition. 1 Almadin Blvd, San Jose, Calif. 95113; Phone: 1-800-242-8721; web address: http://www.americanheart.org

Center for Science in the Public Interest. "Nutrition Action Newsletter." 1875 Connecticut Ave, NW, Suite 300, Washington D.C. 20009; web site: http://www.csc1.csc1net.org

USDA Food and Nutrition Information Center. Various publications. USDA National Agricultural Library, 10301 Baltimore Blvd., Room #304, Beltsville, Maryland 20705-2351; web site: a.gov/fnic http://www.na1.usd a.gov/fnic

Videocassettes

Disney. 1992. "Bill Nye the Science Guyon . . . Digestion; . . . the Human Body."

"Magic School Bus For Lunch." 1995. 30 minutes. Can be ordered through Teacher's Video Company. PO Box CSF-4455, Scottsdale, Arizona, 85261.

National Geographic Society. 1988. "Digestion" (Grades 7-12). 17 min.

_____ 1985. "Nutrition, Eating Well" (Grades 4-9). 25 min.

Nova. 1995. "Universe Within." 60 minutes.

Videodisc

National Geographic Society. 1992. "STY Human Body: Level III" (Grades 5- 12) "Respiration," "Circulation," and "Digestive Systems."

8.4 Digestion and Nutrition Glossary

amino acids the building blocks of proteins.

amylase an enzyme that digests starch.

anorexia nervosa an eating disorder that causes malnutrition, loss of body fluid, and vitamin and mineral deficiencies.

bulimia an eating disorder in which the person overeats or "binges" and then uses laxatives or forces vomiting to prevent the absorption of food in the intestines.

calorie (cal) the amount of heat needed to raise the temperature of 1 milliliter (1 cc) of water 1 degree Celsius $(1°C)$.

calorie (Cal) the amount of heat needed to raise the temperature of 1 liter (1,000 cc) of water 1 degree Celsius $(1°C)$. The energy in food is usually measured in Calories.

carbohydrates food nutrients that provide energy and building blocks. Examples include sugars and starches.

cellular respiration a process in cells in which oxygen is combined with fuel molecules to release the stored energy in the fuel.

cirrhosis a condition in the liver in which the cells die, causing the liver to harden.

combustion a rapid chemical reaction that combines molecules of oxygen with molecules of fuel resulting in the release of energy (light and heat).

chyme the semifluid mixture of digestive juices and partially digested food in the stomach.

diffusion the movement of molecules from an area of high concentration to an area of low concentration.

emulsify breaking up fat into tiny droplets or particles.

enzyme a protein in cells that affects the rate of chemical reactions.

esophagus a hollow, muscular tube connecting the pharynx to the stomach.

fats a food nutrient also known as lipids.

feces or stool the final waste product of digestion.

gastrointestinal tract the digestive tube that begins with the mouth and includes the throat, esophagus, stomach, and intestines.

glucose a simple sugar.

liver an organ that is a storehouse, a chemical manufacturing plant, and a sewage treatment station.

minerals an essential nutrient for good health. Minerals are simple chemical elements such as iron that come from the earth.

mucus a slippery substance secreted by cells for protection.

peristalsis the process that moves food through the gastrointestinal tract.

protein a food nutrient composed of amino acids that regulates body functions, builds muscles and bones, makes muscles contract, helps fight illness, transports substances in the blood, and transmits information between cells, as well as other functions.

saliva a secretion in the mouth that contains an enzyme that breaks down starch into sugar.

stress a response to your surroundings. The body can show stress in many ways.

vitamin a chemical the body cannot make for itself but needs in small amounts to help enzymes do their jobs in cells.