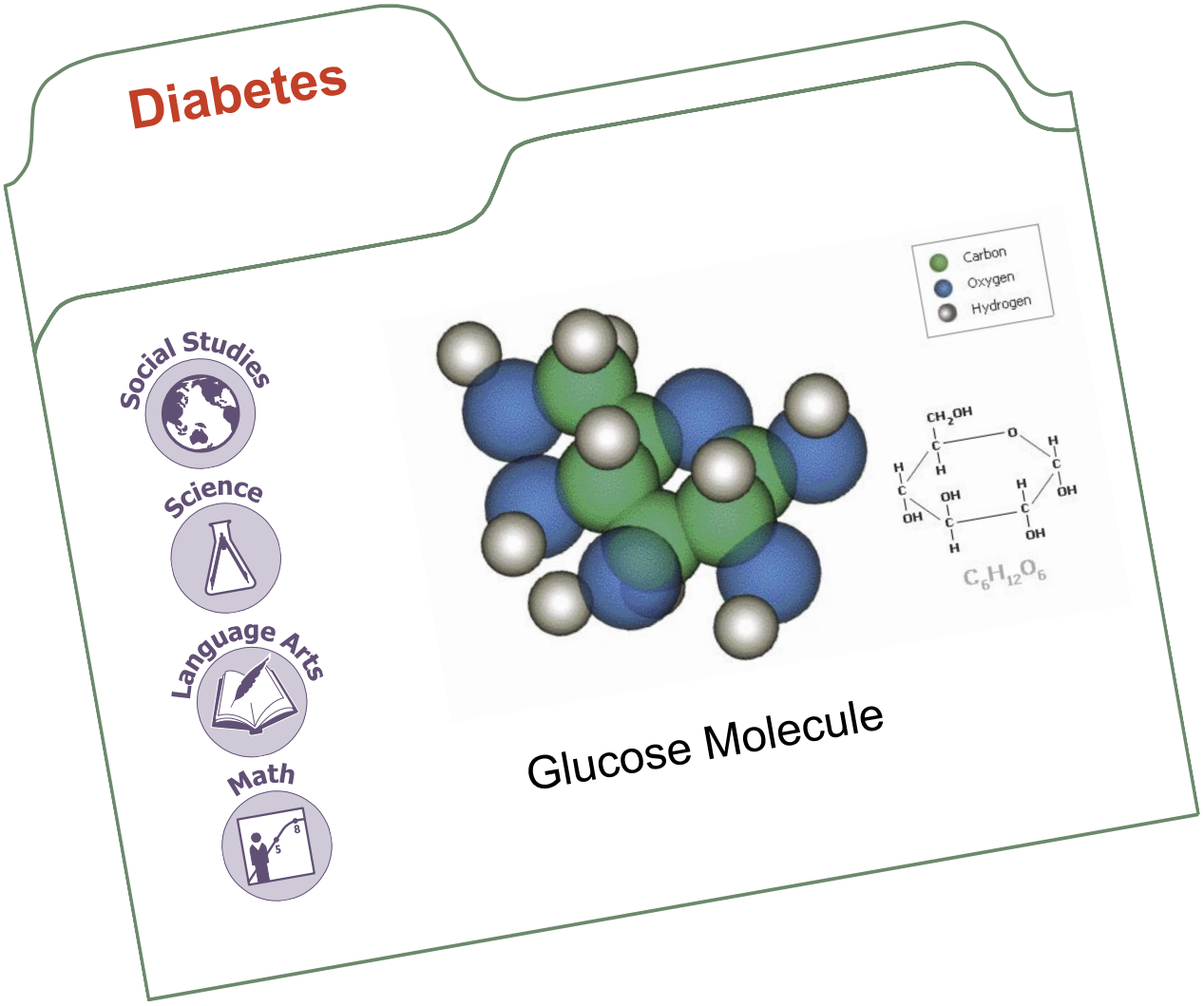
Environmental Health

Fact File

New Mexico



Diabetes

Interdisciplinary Environmental Health Curriculum for Middle School Students

IEHMSP
INTEGRATED ENVIRONMENTAL HEALTH MIDDLE SCHOOL PROJECT

IEHMSP

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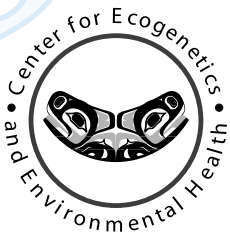

These materials are produced by the NIEHS New Mexico Center for Environmental Health Sciences, Albuquerque, NM and the NIEHS Center for Ecogenetics & Environmental Health at the University of Washington, Seattle.

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La Tierra Sagrada Society

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Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the view of the funding agency.

Table of Contents

Introduction to the Environmental Health Fact Files

How to Use the Fact Files

This FACT FILE was created for use by teachers participating in the Integrated Environmental Health Middle School Project (IEHMSP). The IEHMSP is funded by the National Institute of Environmental Health Sciences (NIEHS). This Fact File: Diabetes was funded by the University of New Mexico, School of Medicine La Tierra Sagrada Society. The IEHMS Project introduces middle school teachers and students in Washington State and New Mexico to the field of environmental health and facilitates the teaching of environmental health topics across the middle school (grades 6-8) curriculum.

Every FACT FILE produced for the project is designed to make it easy for teachers to team teach a specific environmental health-related topic. Teachers who are interested in teaching an environmental health topic across the curriculum can use these lesson plans and resources to help them integrate environmental health themes into their individual subject areas. By integrating these topics across subject areas, teaching teams demonstrate to students the interdisciplinary nature of the field of environmental health and help break down artificial barriers between subjects.

Each FACT FILE provides subject-specific lesson plans to teachers of social studies, science, language arts, and math. Additional resource materials are also included to help school librarians who are facilitating student research projects and to help school staff better support students with diabetes. A companion web page is available with annotated links to related web sites (see “Resources for the Librarian” section for the website address).

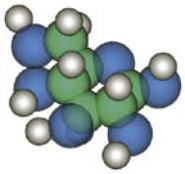
In order to provide students with a foundation of knowledge about the topic, every FACT FILE includes a **Student Introduction** section that introduces the basics of environmental health and shows how the specific topic relates to the field. This page should be given to students before they embark on any of the subject specific lesson plans. It can be used across disciplines and should be distributed by the first teacher in the team to introduce the topic.

Teachers wishing to learn more background information about the topic should use the “Resources for the Librarian” section and the associated web pages.

The lesson plans included in the FACT FILES are designed to be stand alone units – the only assumption is that the students will have been introduced to the information contained in the **Student Introduction** section. This allows teaching teams to mix and match lessons and present them in any order that is convenient to their particular situation and constraints.

We hope you find these lesson plans useful and that the experience of using environmental health as an integrating context for teaching is a rewarding one. Please feel free to contact us with your questions, comments, and suggestions. Contact information can be found on page 16.

Lessons at a Glance



Student Introduction 1: ENVIRONMENTAL HEALTH AND DIABETES

The **Student Introduction 1** provides students with the background knowledge they need about environmental health and diabetes before proceeding with any of the discipline-specific lessons in this curriculum. The **Student Introduction 1** should be presented by the first teacher in the team to introduce the topic. The reading is divided into sections that are accompanied by **Check Your Understanding** questions that can be used to assess student understanding of the material. Enrichment activities are provided for a more in-depth investigation of environmental health and diabetes.

Suggested Grade Levels: 6–9
Curriculum Connections: Environmental health and diabetes

Student Introduction 2: YEAST AND HOUSEHOLD SUBSTANCES: A TOXICOLOGY EXPERIMENT

This experiment is an excellent hands-on lesson to accompany the **Student Introduction 1**. The **Student Introduction 2** gives students an opportunity to see and experience the concepts introduced in the **Student Introduction 1**, such as exposure, dose, and response. In this lesson students expose yeast to different household substances and determine if there are any toxic effects on the yeast by measuring the volume of carbon dioxide gas (CO2) released by the yeast. This lesson fits best in a Science class.

Suggested Grade Levels: 6–9
Curriculum Connections: Environmental health, data collection and analysis, observation, biological requirements for living
NM Education Standards: Number & Operations, Algebra, Data Analysis & Probability, Scientific Thinking & Practice, Life Science: Process of living things and their environments

Health: DIABETES AND NUTRITION

Lesson Overview: Students read about how diabetes relates to nutrition and exercise. They learn about basic nutrition information including carbohydrates, protein, fat and calories then answer questions to heck their understanding. Extension activities are also included for additional ways to explore the topic.

Suggested Grade Levels: Grades 5-8
Curriculum Connections:
NM Education Standards Grades 5-8: Health Education, Standard 1 - A, C, E, F, G, H; Standard 3 - D; Standard 7 – A, C, D, E

Social Studies:
FOOD IN NEW MEXICO HISTORY

Lesson Overview: Students learn about the role of food in various New Mexico cultures from Pre-Colombian times to the present and how changes in diet and lifestyle relate to the prevalence of obesity and diabetes in New Mexico today. Students answer questions to check their understanding.

Suggested Grade Levels: Grades 6-9
Curriculum Connections: New Mexico history from 11,000 B.C. to present, general U.S. history
NM Education Standards Grades 5-8: Social Studies - History: I-A, I-B, I-D; Geography: II-B, II-E; Economics: IV-A, IV-C. Language Arts – I-A, I-B, I-C, I-D, II-B, II-C, III-A,

Science:
PROTEIN PUZZLE

Lesson Overview: Students learn about the primary, secondary, and tertiary structures of protein and construct a 3-D model of an insulin protein (the protein that carries sugar from the blood into cells). Students then investigate how protein structure relates to insulin resistance.

Suggested Grade Levels: Grades 6-9
Curriculum Connections: Amino acids, cells, protein, insulin, diabetes
NM Education Standards Grades 5-8: Science Strand II, Benchmark III

Language Arts:
FOOD, CULTURE AND DIABETES: A PERSONAL REFLECTION

Lesson Overview: Students write a personal and historic essay about the relationship between their own culture and foods, their personal relationship with food, and their experience or opinions about diabetes with respect to food and their family. Students conduct research as needed and consider how they can still honor their heritage while eating healthy.

Suggested Grade Levels: Grades 6-9
Curriculum Connections: essay writing, research, history, cultural heritage, diabetes
NM Education Standards Grades 5-8:

Math:
ENERGY BALANCE

Lesson Overview: Students read background information on nutrition, label reading, and energy balance (energy input versus output). Students find the fat, carbohydrate, protein, and caloric value for two lunch examples and the caloric value for two full-day menus. Students then determine whether their previous day's activities would have burned off the calories from the different full day meals. A homework assignment is included to give students an opportunity to look more closely at their personal eating and activity behaviors.

Suggested Grade Levels: Grades 6-9
Curriculum Connections: Arithmetic operations in using contextual situations, percent
NM Education Standards Grades 5-8: Number & Operations I

IEHMSP Student Learning Outcomes

1. **Students will understand the relationship between human health and the environment.**

   - Students will understand that the amount of a substance that gains entry into the body (dose) is a critical factor in determining whether the substance has an effect (positive or negative) on health.

   - Students will be able to describe the three ways in which a chemical can enter the human body: by inhalation (breathing), ingestion (swallowing), and dermal absorption (contact with skin). Students will also be able to identify which body systems (respiratory, nervous system, etc.) are impacted.

   - Students will understand how individual factors (for example genetics, age, gender, and body size) can affect the overall impact of environmental exposures on health.

   New Mexico Education Standards
   Science: Strand II. Standard II. Benchmark I
   Health: Standard 1, Standard 3

2. **Students will investigate the roles that individuals, communities and governments play in decisions that can affect human health.**

   - Students will understand that we make decisions by weighing the risks and the benefits of a particular action. A student's ability to critically ask the right questions (such as 'what is the route of exposure?', 'what is the dose?' and 'are there specific individual susceptibilities to consider?') and assess these factors is fundamental.

   - Students will acquire the skills to reduce their environmental health risks at home, school, work, and in the community.

   - Students will recognize that some groups of people are exposed to more environmental pollution than others are, and may suffer higher rates of health problems. These groups often have less economic and political impact on the development of public policy and decision-making.

   - Students will understand that it is important to consider ethical, legal and social implications of environmental health research and community health issues.

   - Students will recognize that different groups of people have different beliefs and opinions about environmental health issues depending upon their interests (economic, cultural, spiritual, etc.).

   - Students will be able to effectively research an environmental health issue by gathering information and data from government agencies, community

groups, businesses, scientists and scientific articles, and individual citizens with relevant knowledge.

- Students will be able to describe the information or data that already exists about an issue and identify what data or information still needs to be collected in order to address the problem.

- Students will identify appropriate local civic forums (community council, newspapers, etc.) that they may approach to address issues, present findings and seek change.

- Students will understand that problem solving and decision-making occurs at the personal, local, state, national and international level.

- Students will be able to clearly and effectively communicate their findings to their peers and other audiences (teachers, parents, community members, etc.).

New Mexico Education Standards

Science: Strand II. Standard II. Benchmark I
Health: Standard 1, Standard 2, Standard 3, Standard 4, Standard 5, Standard 7
Language Arts: 5-8 Benchmark I-A, I-B, I-C, I-D, II-A, II-B, II-C, III-A
Social Studies: 5-8 Benchmark II-A, II-B, II-C, II-E, II-F, ,III-A, III-D, IV-A

Connecting to the New Mexico State Education Standards (NMSESs)

Environmental Health Fact File: Diabetes	**Introduction 1:** Environmental Health and Diabetes	**Introduction 2:** Yeast and Household Substances: A Toxicology Experiment	**Health:** Diabetes and Nutrition	**Social Studies:** Food in New Mexico History	**Science:** Protein Puzzle	**Language Arts:** Food, Culture and Diabetes: A Personal Reflection	**Math:** Energy Balance
Language Arts, 5-8							
I-A: listen to, read, react to, and interpret information	X	X	X	X	X	X	X
I-B: Gather and use information for research and other purposes		X	X	X		X	
I-C: Apply critical thinking skills to analyze information	X	X	X	X	X	X	

I-D: Demonstrate competence in the skills and strategies of the reading process	X	X	X	X	X	X	X
II-A: Use speaking as an interpersonal communication tool		X	X				
II-B: Apply grammatical and language conventions to communicate		X	X		X	X	
II-C: Demonstrate competence in the skills and strategies of the writing process		X	X	X		X	
III-A: Use language, literature, and media to understand various social and cultural perspectives			X			X	
III-B: Identify ideas and make connections among literary works.							
Math, 5-8							
Number & Operations 1: understand numbers, ways of representing numbers, relationships among numbers, and number systems		X					X
2: Understand the meaning of operations and how they relate to one another		X					X
3: Compute fluently and make reasonable estimates		X					X
Algebra 1: Understand patterns, relations, and functions		X					X
2: Represent and analyze mathematical situations and structures using algebraic symbols		X					X
3: Use mathematical models to represent and understand quantitative relationships		X					X
4: Analyze changes in various contexts		X					X
Geometry 1: Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematics arguments about geometric relationships							
2: Specify locations and describe spatial relationships using coordinate geometry and other representational systems							

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3: Apply transformations and use symmetry to analyze mathematical situations							
4: Use visualization, spatial reasoning, and geometric modeling to solve problems							
Measurement 1: Understand measurable attributes of objects and the units, systems, and processes of measurement		X					X
2: Apply appropriate techniques, tools, and formulas to determine measurements		X					X
Data Analysis & Probability 1: Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them		X			X		
2: Select and use appropriate statistical methods to analyze data		X					
3: Develop and evaluate inferences and predictions that are based on data		X					
4: Understand and apply basic concepts of probability							
Science, 5-8							
I. Scientific Thinking & Practice I.I.I.: Use scientific methods to develop questions, design and conduct experiments using appropriate technologies, analyze and evaluate results, make predictions, and communicate findings.		X			X		
I.I.II: Understand the processes of scientific investigation and how scientific inquiry results in scientific knowledge		X			X		
I.I.III: Use mathematical ideas, tools, and techniques to understand scientific knowledge.		X					
II. Content of Science: **I. Physical Science** I. Know the forms and properties of matter and how matter interacts.							

II.I.II. Explain the physical processes involved in the transfer, change, and conservation of energy.							
II.I.III: Describe and explain forces that produce motion in objects.							
II. Life Science II.II.I. Explain the diverse structures and functions of living things and the complex relationships between living things and their environments.	X	X			X		
II.II.II. Understand how traits are passed from one generation to the next and how species evolve.	X				X		
II.II.III. Understand the structure of organisms and the function of cells in living systems.	X	X			X		
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III. Earth & Space Science II.III.I. Describe how the concepts of energy, matter, and force can be used to explain the observed behavior of the solar system, the universe, and their structures.							
II.III.II. Describe the structure of Earth and its atmosphere and explain how energy, matter, and forces shape Earth's systems.							
III. Science & Society III.I.I. Explain how scientific discoveries and inventions have changed individuals and societies.	X				X	Possible	
Social Studies, 5-8							
History I.I-A: New Mexico: Explore and explain how people and events have influenced the development of New Mexico up to the present day.				X		X	
I.B: United States: Analyze and interpret major eras, events, and individuals from the periods of exploration and colonization through the Civil War and Reconstruction in United States history.				X		Possible	

I-C.: World: Compare and contrast major historical eras, events, and figures from ancient civilizations to the Age of Exploration.				X			
I-D.: Skills: Research historical events and people from a variety of perspectives.						X	
Geography: II-A: Analyze and evaluate the characteristics and purposes of geographic tools, knowledge, skills and perspectives and apply them to explain the past, present, and future in terms of patterns, events, and issues.						X	
II.B.: Explain the physical and human characteristics of places and use this knowledge to define regions, their relationships with other regions, and their patterns of change.				X		Possible	
II.C.: Understand how human behavior impacts man-made and natural environments, recognizes past and present results, and predicts potential changes.	X	X		X		X	
II.D.: Explain how physical processes shape the Earth's surface patterns and biosystems.							
II-E: Understand how economic, political, cultural, and social processes interact to shape patterns of human populations, and their interdependence, cooperation, and conflict.				X		X	
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II-F: Understand the effects of interactions between human and natural systems in terms of changes in meaning, use, distribution, and relative importance of resources.	X			X		Possible	
Civics & Government III-A: Understand the structure, functions, and powers of government (local, state, tribal and national).							

III-B: Explain the significance of symbols, icons, songs, traditions, and leaders of New Mexico and the United States that exemplify ideals and provide continuity and a sense of unity.							
III-C: Compare political philosophies and concepts of government that became the foundation for the American Revolution and the United States government.							
III-D: Explain how individuals have rights and responsibilities as members of social groups, families, schools, communities, states, tribes, and countries.	X						
Economics: IV-A: Explain and describe how individuals, households, businesses, governments, and societies make decisions, are influenced by incentives (economic as well as intrinsic) and the availability and use of scarce resources, and that their choices involve costs and varying ways of allocating.				X			
IV-B: Explain how economic systems impact the way individuals, households, businesses, governments and societies make decisions about resources and the production and distribution of goods and services.				X		Possible	
IV-C: Describe the patterns of trade and exchange in early societies and civilizations and explore the extent of their continuation in today's world.				X			

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Health, 5-8							
Standard 1: Students will comprehend concepts related to health promotion and disease prevention.							
A. Explain the relationship between positive health behaviors and the prevention of injury, illness, disease, and premature death;	X	X	X	X		X	X
B. Describe the interrelationship of mental, emotional, social, and physical health during adolescence;						X	X
C. Explain how health is influenced by the interaction of body systems;	X	X	X		X	X	X
D. Describe how family and peers influence the health of adolescents;				X		X	X
E. Analyze how environments and personal health are interrelated;	X	X	X	X	X	X	X
F. Describe ways to reduce risks related to adolescent health issues;	X	X	X			X	X
G. Explain how health care can prevent premature death and disability; and	X	X	X	X		X	X
H. Describe how lifestyle, pathogens, family history, and other risk factors are related to the prevention or cause of disease and other health problems.	X	X	X	X	X	X	X
Standard 2: Students will demonstrate the ability to access valid health information and health-promoting products and services.							
A. Analyze the availability and validity of health information, products, and services;							
B. Demonstrate the ability to utilize resources from home, school, and community that provide valid health information;						X	X
C. Analyze how the media influences the selection of health and information and products;						Possible	
D. Demonstrate the ability to locate health products and services;							
E. Compare the costs and validity of health products; and							
F. Describe situations requiring professional health services.							

Standard 3: Students will demonstrate the ability to practice health-enhancing behaviors and reduce health risks.							
A. Explain the importance of assuming responsibility for personal health behaviors;		X				X	X
B. Analyze a personal health assessment to determine health strengths and risks;						X	X
C. Distinguish between safe and risky or harmful behavior in relationships;						Possible	
D. Demonstrate strategies to improve of maintain personal and family health;		X	X			X	X
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E. Develop injury prevention and management strategies for personal and family health;		X					
F. Demonstrate ways to avoid and reduce threatening situations;		X					
G. Demonstrate strategies to manage stress.							
Standard 4: Students will analyze the influence of culture, media, technology, and other factors on health.							
A. Describe the influence of cultural beliefs on health behaviors and the use of health services;				X		X	
B. Analyze how messages from media and other sources influence health behaviors;						X	
C. Analyze the influence of technology on personal and family health;							
D. Analyze how information from peers influence health.							

Standard 5: Students will demonstrate the ability to use interpersonal communication skills to enhance health.							
A. Demonstrate effective verbal and nonverbal communication skills to maintain health-enhancing relationships;							
B. Describe how the behavior of family and peers affects interpersonal communication;							
C. Demonstrate positive ways to express needs, wants, and feelings;							
D. Demonstrate ways to communicate care, consideration, and respect of self and others;							
E. Demonstrate communication skills to build and maintain relationships;							
F. Demonstrate refusal and negotiation skills to enhance health;							
G. Analyze the possible causes of conflict among youth in schools and communities;							
H. Demonstrate strategies to manage conflict in positive ways.							
Standard 6: Students will demonstrate the ability to use goal-setting and decision-making skills to enhance health.							
A. Demonstrate the ability to apply decision-making process to health issues and problems individually and collaboratively;							
B. Analyze how health-related decisions are influenced by individuals, family, peers, and community values;						X	
C. Predict how decisions regarding health behaviors have consequence for self and others;							
D. Apply strategies and skills needed to attain personal health goals;							
E. Describe how personal health goals are influenced by changing information, abilities, priorities, and responsibilities;							

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F. Develop a plan that addresses personal strengths, needs, and health risks.							X
Standard 7: Students will demonstrate the ability to advocate for personal, family, peer, and community health.							
A. Analyze various communication methods to accurately express health information and ideas;			X				
B. Express information and opinions about health issues;						X	
C. Identify barriers to effective communication of information, ideas, feelings, and opinions about health issues;			X				
D. Demonstrate the ability to influence and support others in making health-enhancing choices;			X				
E. Demonstrate the ability to work cooperatively when advocating for healthy individuals, families, and schools.			X				

Key to Symbols

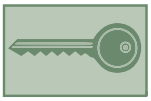
Each FACT FILE contains five sections. Icons clearly indicate the SUBJECT AREA for which the lesson plan was created.

This icon indicates points in the lesson plan that provide good **Opportunities for Student Assessment.**

This icon indicates a handout that should be **Copied and Distributed to Students**.

Student Handout

This icon indicates a **Teacher's Answer Key for a Student Handout**.



Teacher Key

This icon indicates content that relates to the core environmental health concept of **Routes of Exposure.**

This icon indicates content that relates to the core environmental health concept of **Dose**.

This icon indicates content that relates to the core environmental health concept of **Individual Susceptibility**.

This icon indicates content that relates to the core environmental health concept of **Risk**.

This icon indicates content that relates to **Environmental Justice**.

This icon indicates content that relates to **Community Resources and Action.**

About the IEHMSP

The Integrated Environmental Health Middle School Project (IEHMSP) is a partnership between the Center for Ecogenetics and Environmental Health at the University of Washington and the New Mexico Center for Environmental Health Sciences at the University of New Mexico. IEHMSP trains middle school teachers in environmental health, giving them expertise to help students identify and research environmental health in their communities. The IEHMSP involves teachers from a variety of subjects, as well as school librarians and technology coordinators. Participants complete a training workshop and are given a set of detailed materials and resources to help them integrate environmental health topics into their teaching. A web-based teaching module, called The Quicksilver Question, has been developed to help teachers introduce environmental health to their students. All materials are being developed with regional and cultural diversity in mind.

The IEHMSP is part of a national Environmental Health Sciences as an Integrating Context (EHSIC) program funded by the National Institute of Environmental Health Sciences (NIEHS). The Diabetes module was funded by the University of New Mexico School of Medicine's La Tierra Sagrada Society and NIEHS.

About the Sponsoring Centers

The New Mexico Center for Environmental Health Sciences is an NIEHS funded center at the University of New Mexico (UNM) Health Sciences Center and Lovelace Respiratory Research Institute. The Center addresses the needs and concerns of Southwestern communities relating to environmental health issues and conducts basic and transnational research on regionally-relevant environmental public health issues. Many New Mexico and Tribal communities in the Southwest have historically borne a disproportionate share of exposure to a wide variety of environmental toxicants in the air, water and soil, and recent evidence raises concerns that members of many communities are suffering adverse health effects from environmental exposures. The theme of this NIEHS Center is "Environmental Disease and Health Promotion in Susceptible Southwestern Populations."

For more information, go to: http://hsc.unm.edu/envirohealth/

The University of Washington (UW) **NIEHS Center for Ecogenetics and Environmental Health** strives to understand and communicate how genetic factors influence human susceptibility to environmental health risks. Center researchers study the biochemical and molecular mechanisms underlying human variability in response to environmental exposures. The Center's more than 50 core investigators hold appointments in 15 departments within the UW Schools of Medicine, Public Health and Community Medicine, Law, and Pharmacy as well as the Fred Hutchinson Cancer Research Center. The Center's organizational structure encourages collaboration among these distinguished scientists.

For more information, go to: http://depts.washington.edu/ceeh/

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We are here to serve as resources for students and teachers involved in the project. Please feel free to contact us with any questions, concerns or comments you have about this Fact File.

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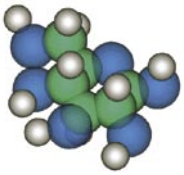


Student Introduction: ENVIRONMENTAL HEALTH AND DIABETES

Introduction Overview

The **Student Introduction** provides students with the background knowledge they need about environmental health and diabetes before proceeding with any of the discipline-specific lessons in this curriculum. The **Student Introduction** should be presented by the first teacher in the team to introduce the topic. The reading is divided into sections that are accompanied by **Check Your Understanding** questions that can be used to assess student understanding of the material. Extension activities are also provided for a more in-depth investigation of environmental health & diabetes.

Suggested Grade Levels: 6-9
Topics: Environmental health, diabetes and human biology.

Procedure

The **Student Introduction** is divided into sections along with **Check Your Understanding** questions. You can assign the entire reading and the questions, or assign one section at a time. The questions will help guide the students' reading and will help you evaluate student understanding of the materials. The Teacher Key provides sample answers to all of the questions.

You may want to assign the **Student Introduction** as homework or as an in-class reading. Additionally, students can work in small groups to read aloud and discuss the questions. Alternatively, you may ask for student volunteers to each read aloud a short section of the reading to the entire class. You may want to approach the **Check Your Understanding** questions as a written assignment or a class discussion. Students may be able to check their own work after the class discusses the answers.

It is recommended that the students also do the science experiment **Yeast and Household Substances: A Toxicology Experiment** to help them experience and better understand the environmental health concepts presented in this introduction. Additional activities are described in the next section **Extension Activities.**

Student Assessment:
Student work can be assessed in the following ways:

Did the students complete the reading?

Did the students correctly answer the "Check Your Understanding" questions?

Did students demonstrate their understanding of environmental health and asthma through one of the extension activities?

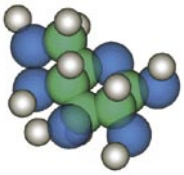
Extension Activities

Environmental Health Collage: Using images from magazines, students create a collage of environmental health hazards, prevention, and environmental health-related careers. Students write a one-page description of their collage.

Classroom Speaker: Invite an environmental health professional from your community to visit your class to talk about diabetes or his or her job.

Hazards in Your Community: Make a list of possible environmental health hazards in your community. Discuss what students can do to protect themselves from the hazards. Explore how they might be able to reduce or eliminate the hazards.

Diabetes Prevention Poster: Create a poster that provides tips on how to protect youth from diabetes.



Student Introduction: ENVIRONMENTAL HEALTH AND DIABETES

What is Environmental Health?

Your health depends on the environment around you. **Environmental health** is the study of how the environment affects human health. It differs from the study of how humans affect the environment, because it focuses on people's health. An environmental scientist might study how water pollution is hurting fish. An environmental health scientist would study what happens to the health of people when they catch and eat those fish. Environmental health is not just about the health of the environment – it always comes back to you and whether the environment you are part of is helping you stay healthy, or making you sick.

Environmental Health: How the environment affects human health.

Hazard: Something that can harm the health of humans or the environment.

Chemical: Any substance that is made from elements combined into molecules.

Every day, you come in contact with things in your environment that can help you or hurt you. Some of these things are important for keeping you healthy, such as oxygen or medicines. However, some of these things may be harmful to your health, such as tobacco smoke or snake venom. Things in the environment that are harmful are called **hazards** and include things like **chemicals**, disease-causing bacteria, loud noises and even stress. Hazards can be natural or human-made.

People working in the fields of environmental health do many different jobs. They work to identify environmental hazards, and prevent people from being harmed by them. Some are scientists working in laboratories. Some work for the government writing regulations and studying pollution. Some work for corporations to help make sure that workplaces are safe and that the environment is kept as clean as possible. Most of these jobs require a solid understanding of science and math, knowledge about history and the law, and good communication skills.

To understand the field of environmental health, you need to understand seven core concepts: **Toxicity, Exposure, Dose/Response, Individual Susceptibility, Risks, Benefits,** Environmental Justice, and **Community Resources and Action**.

Toxicity:
A measure of how dangerous a chemical is.

Toxicology:
The study of the harmful effects of chemicals on living things.

Source of Exposure:
A hazard's point of origin, such as cars, industry, or a volcanic eruption.

1. TOXICITY

Most people working in environmental health-related jobs have taken classes in the science of **toxicology**. Toxicology is the study of how environmental hazards, such as natural and human-made chemicals, can enter our bodies and make us sick.

When scientists study different chemicals in the environment to see if they might be dangerous to humans, they are trying to understand the toxicity of those chemicals. Toxicity is a measure of how dangerous a chemical is. The greater a chemical's toxicity, the less it takes to make a person sick or even kill them. The Environmental Protection Agency, for example, uses the following scale to rate the toxicity of products commonly used in the home.

Toxicity Rating	**Word and symbols that appear on product's label**	**Approximate amount needed to kill an average size adult**
1 – Highly Toxic	DANGER or POISON 	A few drops to one teaspoon
2 – Moderately Toxic	WARNING 	One teaspoon to one ounce
3 – Slightly Toxic	CAUTION	More than one ounce
4 – Not Toxic	none	

A bottle of bleach, for example, will have the word DANGER on the label, because it is highly toxic if ingested (toxicity rating = 1). Borax powdered cleaner, however, is rated as slightly toxic (toxicity rating = 3) and will have the word CAUTION on the label. This is just one example of a system used to measure the toxicity of hazards.

Exposure:
The total amount of chemical that comes into direct contact with the body.

2. EXPOSURE

We all know what it means to be "exposed" to something like a cold or a flu. Everyday our bodies are exposed to all sorts of environmental hazards, such as bacteria, viruses, and the sun's ultra-violet (UV) rays. Some of these hazards exist naturally and some of them are the result of human activities. There are many possible **sources** of exposure to hazards, such as cars, industry, even volcanic eruptions. In order for us to be exposed, however, the hazard has to get from the source to us. To do this, it travels along an **environmental pathway**. Pathways include the

air we breathe, the water we drink, the food we eat, and even the soil we work in, play in, and use to grow much of our food.

Environmental health scientists use the term exposure to describe the total amount of a hazard that comes in direct contact with your body. Once you have come into contact with a hazard, it can get into your body through different routes. You can breathe it in (**inhalation**). You can eat or drink it (**ingestion**). You can get it directly on your skin or in your eyes (**dermal absorption**). You can also get it directly into your body through an injection. Inhalation, ingestion, and dermal absorption are the three main routes of exposure. Things that help us stay healthy, like vitamins, nutrients, and medicines, enter the body through these **routes of exposure**, but hazards can use these same routes to enter the body and make us sick.

3. DOSE/RESPONSE

Imagine that someone has been exposed to a hazardous chemical through one of the three possible routes of exposure. They have now received a **dose** of that chemical. Dose is the amount of the hazard that actually enters your body. The amount someone gets into their body (their dose) depends on many factors, including how long you are exposed, how often you are exposed, and how big or small you are. For instance, if someone is exposed over a long period of time to a hazard, their dose will be larger. For example, 4 hours spent under the bright summer sun would give you a much larger dose of UV rays than 30 minutes spent under the sun. This is called the **duration of exposure**. The **frequency of exposure** can also influence the dose. If someone works in a factory and is exposed to a chemical every day at work, their dose might be larger than someone who is only exposed once.

Dose can also depend on how big or small you are. When a doctor prescribes a medicine for you, he or she calculates the amount of the medicine you should have based on your body size. The doctor can then give you the correct dose of the medicine for your body weight. While a teaspoon of medicine might be right for an adult, it may be far too large of a dose for an infant.

The dose you receive can influence how your body responds to a hazard. For most hazards, the larger the dose, the more extreme the **response** will be. The smaller the dose, the more mild the response will be. Drinking one can of a caffeinated soda might be fine. Drinking three cans in a row may make you jittery. Drinking five cans of soda might make you feel light-headed and sick.

4. INDIVIDUAL SUSCEPTIBILITY

Some people are more likely than others to get sick when they are exposed to environmental hazards. This might be because of their **genetics**, body size, age, gender or general health. This is called their **individual susceptibility**.

Environmental Pathways: How a hazard travels from its source to humans. These include air, water, food, and soil.

Inhalation: Breathing. When chemicals enter the body through this route of exposure, they can get stuck in the lungs and/or be taken up into the bloodstream.

Ingestion: Swallowing (usually by eating or drinking). When chemicals enter the body through this route of exposure, they can easily be taken up into the bloodstream.

Dermal Absorption: Absorbing a chemical through any part of the skin, including the eyes. When chemicals come in contact with the skin, they can sometimes enter the bloodstream through this route of exposure. However, for many chemicals the skin provides good protection of your body.

Routes of Exposure: The ways in which a chemical can enter the human body. The three main routes of exposure are inhalation, ingestion, and dermal absorption.

Dose: The total amount of a chemical that gets into a human or other living thing, relative to the individual's body weight.

Duration of Exposure: The length of time you are in direct contact with a hazard.

Frequency of Exposure: How often you are in direct contact with a hazard.

Response: The reaction to an exposure or dose of a hazard. A response can be anywhere from mild (e.g. headaches, a rash) to severe (e.g. brain damage, cancer).

Genetics: Information that is contained in the genes (DNA) of a person's cells. Genetic information is passed down from parents to their children.

Individual Susceptibility:
Differences in the ways that individuals react after exposure to the same amount of a hazardous chemical. Differences in susceptibility can be caused by differences in body size, age, genetics, gender and general health.

Benefit:
Something that results in increased well-being or good health.

Risk:
The possibility of being hurt or killed.

For example, some people are more likely than others to get sick when they are exposed to certain kinds of pesticides, just because of their genes. We all know that genes help determine things like hair color and eye color, but they also lead to some important (and invisible) differences in the way bodies work. It turns out that some people have a more extreme response to certain pesticides because of their genes. These people are said to be more "individually susceptible" to pesticide poisoning. Someone who lives or works on a farm where pesticides are sprayed might want to know how susceptible he or she In order to avoid exposure and stay healthy.

5. RISKS & BENEFITS

We live in an industrial society that depends on the use of both natural and human-made chemicals to function. The use of these chemicals results in **benefits** to society as well as **risks**. Pesticides, for example, make it easier to grow fruit. Unfortunately, in some cases, pesticides can make people sick. Most of us have heard that we can reduce the risk of getting sick without giving up the health benefits that fruit offers by washing or peeling the fruit before we eat it.

Scientific researchers and government officials measure the risks and benefits that we face when we manufacture or use certain products. They work to explain what they have learned to the public and create safety standards that help people protect themselves from unnecessary risk. Their goal is simple – to help us enjoy the greatest benefits from the products that we manufacture, while exposing ourselves to the least possible risk. By understanding the risks and benefits that we face each day, we can make decisions that reduce our risk and keep us as safe and healthy as possible.

Environmental Justice:
The fair treatment of people regarding the development of environmental laws, regulations and policies.

6. ENVIRONMENTAL JUSTICE

Everyone has the right to live in an environment that doesn't make them sick, regardless of their race, culture, or income. This is called **environmental justice** (EJ).

Unfortunately, some neighborhoods or communities are exposed to more environmental hazards than others, and may suffer higher rates of health problems. These communities often have less economic or political power in society when decisions are made. For example, toxic waste dumps, polluting factories, and busy highways are often built in lower-income neighborhoods or communities of color. Communities recognize this as an environmental health issue and work to seek environmental justice.

7. COMMUNITY RESOURCES & ACTION

Where can you go in your own community to collect information about an environmental health issue? You can learn more about specific issues, understand environmental laws or seek environmental justice by using community resources. Community resources include places like the library and city hall. You could search the Internet for local, state, or federal agencies that can give you

information about your issue. You can also talk to environmental health scientists at local universities or health departments, and ask your teachers and family members what they know about the issue.

Community Resources and Action:
An individual's ability to access resources and act on new information in order to created positive change in their own community.

Once you have gathered your resources and studied the issue carefully, it's time to take action! First, ask yourself what you as an individual can do to help solve the problem. If you are concerned about air pollution, for example, you might decide to walk to school instead of getting a ride in a car. Next, ask yourself how you can share what you have learned with others so that they can help too. Maybe you could write a letter to the editor of your local newspaper or speak to your community council or school board. Maybe you could create a flyer to hand out in your neighborhood. There are many great ways to get the word out and make positive changes in the world – use your imagination and be creative!

Check Your Understanding

1. Name one product that can be found in your home that might be considered to be highly or moderately toxic. ***Answers will vary, but may include bleach, ammonia, furniture polish, nail polish remover, weed killer, rat poison, motor oil, antifreeze, etc.***

2. List the three routes of exposure. For each one, give an example of an environmental hazard to which you could be exposed through that route. ***Inhalation (e.g. tobacco smoke), ingestion (e.g. drug overdose), dermal absorption (e.g. acid)***.

3. Explain how the concept of "exposure" is different from the concept of "dose." ***Exposure is a measurement of how much of a hazard your body comes in contact with, while dose is a measurement of how much of the hazard actually enters your body.***

4. Pick four vocabulary words from the margin on the previous pages and use each one in a complete sentence. ***Answers will vary.***

Diabetes mellitus
A disease where body cells do not properly remove or uptake blood glucose resulting in high glucose levels in the blood and urine

Glucose:
The sugar that is released into the bloodstream during the digestion process of the foods we eat. Our bodies use the sugar for energy.

Insulin:
A protein-based hormone that helps move sugar from the blood into cells.

Type 1 diabetes:
The type of diabetes where the body does not make enough insulin to control the blood sugar. This is also called insulin dependent diabetes.

Type 2 diabetes:
The type of diabetes where the body makes enough insulin but the cells ignore the insulin leaving the sugar in the blood. This is often called adult onset diabetes, but it is being seen more frequently in children.

Fasting Plasma Glucose Test:
A blood test used to help diagnose diabetes.

What is Diabetes?

Diabetes is a disease where there is too much sugar or **glucose** in the blood. When this happens the sugar can damage different parts of the body including the eyes, kidneys, nervous system and circulatory system. Normally our bodies can “handle” the sugar with the help of a special protein-based hormone called **insulin**. Insulin helps sugar go into cells, such as our muscle cells. Once the sugar is where it needs to be, it is used for energy within the cell.

There are two types of diabetes, **type I** and **type II**. The difference between the two types relates to how the diabetes occurs. With type I diabetes the body does not produce enough insulin to handle the sugar. With type II diabetes enough insulin is usually produced, but the body’s cells ignore the insulin leaving the sugar in the blood instead of taking it into the cell where it can be used.

Pre-diabetes

Pre-diabetes is when glucose in the blood is high but not high enough to diagnose as diabetes. The elevated blood glucose levels still cause damage to the eyes and other body systems. Very few people know they have pre-diabetes or that they are at risk for diabetes.

Diagnosing Diabetes

Diagnosing diabetes requires testing the sugar level in the blood. One common blood test is a **fasting plasma glucose** test. To take a fasting plasma glucose test, blood is drawn from a person who has not had anything to eat in the morning. The blood is then tested for increased amounts of glucose. A normal range of blood sugar or glucose is 80-100 mg/dl (that is milligrams of glucose per deciliter of blood). A range of 100-125 is called pre-diabetes, and greater than 126 diagnoses diabetes.

Blood Glucose Level (mg/dl)	What This Glucose Level May Mean
Below 100	Normal
100-125	Pre-diabetes
Over 126	Diabetes

Health Impacts of Diabetes

The health impacts of diabetes are many. Because blood travels throughout the body, the sugar that is left in the blood has a chance to damage many places including the kidneys, eyes, circulatory system, and nervous system. This is why it is very important to prevent diabetes, and if diagnosed with it, to manage the diabetes correctly.

Some examples of the health impacts of diabetes are in the bulleted list below.

- Heart disease and stroke are 2-4 times more likely in people with diabetes.
- Diabetes can lead to blindness.
- New Mexicans who have diabetes are 3 times more likely than those who do not have diabetes to be told they have high blood pressure.
- In 2000, there were 18, 435 diabetes-related hospitalizations in NM
- Diabetes is the leading cause of non-traumatic lower-limb amputations.
- In 2000, 307 New Mexicans lost one or more limbs or part of a limb to diabetes.
- Native American were 3.5 times more likely to have an amputation than Caucasions.
- Diabetes was the 6th leading cause of death in New Mexico in 2001.
- Diabetes affects more than 18 million people in the United States which is 6.3 % of the population
- Of those diagnosed, 5-10% have type 1 and 90-95% have type 2 diabetes.

Obesity:
The state of being overweight from too much body fat.

In New Mexico there are approximately 120,555 people with diabetes. Of those, only 83,982 know they actually have diabetes. New Mexico has a number of high-risk populations for diabetes. African Americans, Hispanic, and Native American have much higher rates of diabetes compared to Anglos. In fact, Hispanics and African Americans are twice as likely to be diagnosed with diabetes compared to Caucasians. Native Americans are three times more likely to be diagnosed than Caucasians. **Obesity,** genetic family history, diet, exercise, and certain environmental exposures are very important risk factors for diabetes. Genetic family history means that if a relative has diabetes or if someone is overweight, the risk of getting diabetes is higher.

Check Your Understanding

1. Your grandfather was just diagnosed with diabetes. What body systems and organs may be affected? ***Answers may include: eyes, circulatory system (heart, blood pressure), kidneys, limbs (hands, feet), and nerves.***

2. What is insulin and what role does it play in diabetes? ***Answers may include: Insulin is a protein-based hormone that helps regulate sugar in the blood stream by stimulating cells to absorb the sugar. The role insulin plays in diabetes is either there is not enough produced by the body (type 1) or the body's cells ignore the insulin (type II).***

3. What percentage of New Mexicans who have diabetes do NOT know they have diabetes? (HINT: The numbers given in the reading are for how many New Mexicans know they have diabetes. You first need to find the difference, then find the percentage.) ***Answer: If 120,555 New Mexicans have diabetes and 83,982 know that they have diabetes, then 36,573 New Mexicans do not know that they have diabetes. 36,573 ÷ 120,555 = 0.3 X 100 = 30%.***

How Does Diabetes Relate to Environmental Health?

Environmental health is the effect of the environment on a person's health. In the case of diabetes, it is believed that a person's genetic make-up, combined with personal choices and environmental exposure, trigger the disease.

Built Environment:
The part of the environment built by humans.

There are many aspects of one's environment that can impact diabetes. For example, the **built environment**, which includes the buildings, streets, sidewalks, parks, and food venues in and around neighborhoods, can affect how much people walk, exercise, or what they eat. Busy streets and no sidewalks keep people from walking to nearby places. Local parks encourage walking and playing. Grocery stores, farmers markets, or fruit and vegetable stands support and encourage access to fresh foods. If fast food restaurants and convenience stores are the only nearby food sources, then access to healthy food may be limited. The environment, combined with personal choices within that environment, can impact diabetes.

Autoimmune disease:
When a person's immune system, including white blood cells or anti-bodies, attack the bodies' own tissues or extra-cellular proteins.

Immune response:
The body's defense mechanism against foreign invaders like toxic chemicals, allergens, viruses, or harmful bacteria.

The environment may also trigger type 1 diabetes (when the body stops producing insulin) by exposure to a toxic chemical, drug, bacteria or virus. Type 1 diabetes is considered to be an **autoimmune disease**, where a person's **immune response** (or protective responses) get out of control and the body begins attacking itself. In the case of type 1 diabetes, the immune system

attacks the **pancreas** where insulin is produced. There are many chemicals that are known to cause autoimmune disease responses, such as mercury or poly vinyl chloride (the material in PVC pipes), but scientists do not yet know what specific environmental agent causes type 1 diabetes.

Pancreas:
A gland located behind the stomach that secretes insulin and other important chemicals into the bloodstream.

Chronic exposure:
When the body comes into contact with small amounts of a chemical over long periods of time.

What does DOSE have to do with diabetes?

There are three ways dose relates to diabetes. The first relates to the dose of the original chemical exposure that triggers the diabetes in the first place. It is suspected that this dose is from **chronic exposure**, which occurs in small amounts over long periods of time. In the case of type 1 diabetes that may be the dose of the chemical or biological agent that a person is exposed to over time. In type II diabetes it may be the dose of certain fats, sugars, and high glycemic foods (combined with a lack of exercise) over time that trigger the disease.

The second way dose relates to diabetes is the dose of sugar a person receives with each meal. This is very important once someone already has the disease. The higher the dose of sugar the more insulin a person needs to handle that sugar. If the dose of sugar is continuously high and there is either not enough insulin or the cells are ignoring the insulin then the body's response to the sugar increases (dose-response). The body's response to diabetes includes blindness, kidney failure, poor circulation, and heart disease.

The third way dose relates to diabetes is either too low a dose of sugar or too high a dose of insulin (especially for people who have to give themselves shots of insulin). In this case there is not enough sugar to feed the cells and a person may become nervous, shaky, confused, sweaty, pale, weak, lose consciousness, have seizures, or, in extreme cases, die.

What is the main ROUTE OF EXPOSURE for most cases of diabetes?

The route of exposure varies depending on the agent. In the case of sugar, the route of exposure is ingestion (oral exposure). For example we drink sodas and eat candy bars, which get digested and deliver the sugar to our blood. In insulin dependant diabetes, type 1, a person may have to give themselves insulin shots. The route of exposure for insulin is injection directly into the blood stream. Lastly the route of exposure to the environmental agents that may trigger type 1 diabetes is unknown, since the exact environmental agent is unknown. Exposure could be from any or all of the following sources - ingestion through contaminated food and water, inhalation of contaminated air, or absorption from the chemical on clothing or in water.

What does INDIVIDUAL SUSCEPTIBILITY have to do with diabetes?

Individual susceptibility with respect to diabetes relates to their individual genetics and environmental conditions. People who have genetically-related family members with diabetes are at higher risk of getting diabetes, and each person's individual exposure to environmental agents can trigger diabetes. Those environmental agents may be chemicals, drugs, or biological pathogens

(bacteria or viruses) that begin the autoimmune response in type 1 diabetes, or the eating and exercise lifestyle that a child is exposed to or a person has chosen.

Usually multiple factors need to be in place for diabetes to occur. For example, a person may be genetically susceptible to diabetes, but their food choices and exercise habits keep the diabetes from happening. Each person's individual circumstances are different, and the combination of the different factors that can trigger diabetes will vary from person to person.

Calorie:
A unit used to describe the energy producing potential of food. Specifically it is the amount of energy needed to raise 1 gram of water by 1°C from a standard initial temperature while at 1 atmosphere of pressure.

Fat:
A soft, solid, or semisolid compound found in plants and animals. Fat is made up of glycerol and fatty acids.

Check Your Understanding

1. List two ways the environment relates to diabetes.
Answers may include: The built environment can encourage or prevent access to health food and exercise; Type 1 diabetes may be triggered by a chemical, bacteria, or virus in the environment.

2. Provide two examples of how dose relates to diabetes.
Answers may include: The amount of chemical, bacteria or virus that a person is exposed to in order to trigger type 1 diabetes; The amount of sugar a person is exposed to; the amount of insulin a person has.

DIABETES AND NUTRITION

Lesson Overview

Students read about how diabetes relates to nutrition and exercise. They learn about basic nutrition information including carbohydrates, protein, fat and calories then answer questions to heck their understanding. Extension activities are also included for additional ways to explore the topic.

New Mexico State Education Standards

New Mexico State Education Standards: This lesson addresses the following New Mexico State education Standards for grades 5-8.

Health Education, Standard 1 - A, C, E, F, G, H
Health Education, Standard 3 - D
Health Education, Standard 7 – A, C, D, E

Teacher Background

The student materials provide sufficient background information for this activity. For additional information on diabetes, nutrition, and exercise consult the following resources:

Websites here

Teacher Preparation

- Make enough copies of the **Student Handouts** for each student to have a set.
- If you are the first teacher in your team to use this FACT FILE, make copies of the student handout titled **Student Introduction: Environmental Health and Diabetes**. Ensure that students have read the handout and mastered the vocabulary.

Procedure

- Distribute the **Diabetes and Nutrition Student Handout #1**. Have the students read the material and discuss as needed to reinforce reading and advance understanding.
- Inform the students that will create a fun and unique message for healthy eating for a target audience. As a class, generate a list of potential audiences, such as children ages 5-8, female adolescents, family members, adult males, etc. Then generate a list of possible approaches for messages, such as a TV commercial, radio announcement, cartoon, restaurant menu, song, etc. Assign students to group or individual work

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #R25-ES10738-01, NIEHS #P30 ES012072, and a University of New Mexico College of Medicine La Tierra Sagrada Society Grant).

as appropriate.

- Distribute the **Diabetes and Nutrition Student Handout #2: Message Ideas**. Have the students fill out their target audience and message ideas on the handout. Inform the students that you need to review and sign **Handout #2** before they begin working on their project.
- Distribute the **Diabetes and Nutrition Student Handout #3: Grading Rubric** to every student. Review the peer-grading rubric so students understand the expectations of the assignment. Let students know when the assignment is due and how much class time they will have to work on it.
- On the day of presentations, distribute blank copies of the **Diabetes and Nutrition Student Handout #3: Grading Rubric**. Each student will need as many copies as there are presentations.

Extension Activities

Calorimetry Lab – Student burn a nut, marshmallow, and beef jerky underneath water and measure the temperature change of the water to determine the calories of each food. For a full version of the lesson go to the website *.

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Lesson One: DIABETES AND NUTRITION

Teacher Key

How Does Diabetes Relate to Nutrition and Exercise?

Nutrition is the science of foods and their components (nutrients and other substances), including nutrition's relationship to health and disease. **Energy balance** is the balance in our body between amounts of energy consumed and expended.

Energy Balance

Energy In → Energy Out

When a person eats food high in sugar, the blood glucose level rises in the blood stream. The rise in blood glucose triggers the body to release insulin. In diabetes, glucose stays in the blood stream because A) our body does not make insulin or B) our body's cells ignore insulin.

Exercise influences the energy balance between cells' nutritional intake and how much nutrients they use up during exercise. When you exercise your body is using glucose stores. If diabetics do not eat a small snack before exercising, they could possibly become **hypoglycemic**. However, if diabetics eat too much they could become **hyperglycemic**. Normally these dangerous levels of blood glucose do not occur in a healthy person. When people do not eat healthy by balancing good nutrients, like complex carbohydrates and protein, with sugar intake, they can develop hypo/hyperglycemia which may lead to pre-diabetes or diabetes. Exercise also helps keep blood glucose levels at a normal range by decreasing insulin resistance and increasing glucose uptake into the cells. Refined sugars like that found in candy and cookies are unhealthy in excess amounts. Even though fruit has sugar, it also has fiber and healthy chemicals like vitamins and minerals.

Nutrition: The science of foods and their components (like vitamins, minerals, fats, etc.)

Energy balance: The balance in the body between amounts of energy consumed and expended.

Hyperglycemia: Abnormally high concentration of glucose in the blood. Symptoms are: increased thirst, nausea, vomiting, fatigue, weakness

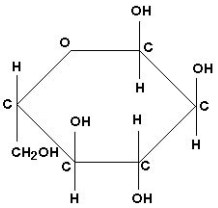
Hypoglycemia: Abnormally low blood glucose level. Symptoms are: cold sweats, clammy skin, dizziness, headache

Carbohydrates: A group of chemicals made by plants that provide a major energy source for animals and include sugars, starches, cellulose, and gums.

What are Carbohydrates?

There are two types of carbohydrates: simple and complex. Simple carbohydrates are made up of 3 or less units of sugar linked together in single molecule that have a very sweet taste. Examples of simple carbs are table sugar, corn syrup and the sugar in fruit. Refined sugars, like that found in candy and cookies are unhealthy in excess amounts. Even though fruit has sugar, it also has fiber and healthy chemicals like vitamins and minerals.

Complex carbohydrates are made up of more than 3 units of sugar linked together. There can be hundreds of thousands of sugar units in a single molecule. They are pleasant to the taste buds, but are not sweet. Complex carbohydrates are the healthiest choice for nutrition, because of the many vitamins, minerals, and enzymes they have. Complex carbohydrates can actually prevent many heart diseases.



α-D-GLUCOSE

$C_6H_{12}O_6$

simple sugar molecule

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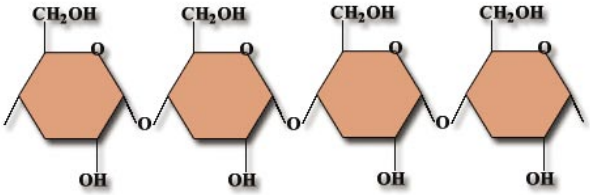

Complex Carbohydrate Molecule

So how many carbohydrates should you eat?

- About 2 cups of fruits and 2 ½ cups of vegetables every day.
- Four servings of pasta and grain foods every day (half should come from whole grains like whole wheat bread, brown rice, and whole wheat pasta).
- Very few sugary drinks and sweets.

What happens if you eat too many simple carbohydrates?

Eating too many simple carbohydrates can result in weight gain, which is an outcome you can see. Some other outcomes that you cannot see, are diseases of the blood vessels and immune system effects, which can lead to more infections.

What are Proteins?

Proteins are very large molecules made of a combination of twenty amino acids. They make up and help build our muscles and come from both animal and plant sources. Some sources of protein are better than others.

- Both animals and plants provide an abundance of the essential amino acids to make protein.
- Plant sources, such as soy, don't have the heavy fat load seen in animal sources such as meat, milk, and eggs. Soy can prevent cancer if eaten regularly.
- Protein that contains fat should come from polyunsaturated and monounsaturated fatty acid sources, such as fish, nuts, and vegetable oils.

Protein:
A group of chemicals made up of amino acids that are required in the diet of animals for tissue growth and repair. Proteins compose cells, enzymes, antibodies, and hormones, including insulin.

How much protein should you eat?

2-3 servings a day, where a serving is about the size of your palm.

What happens if you eat too much protein?

Normally, the liver breaks excess protein down into urea. Urea is a byproduct of protein metabolism which causes water loss as it is filtered out of the blood in the kidneys. If you eat too much protein, too much urea passes through the kidneys, causing too much water to be lost. This leads to dehydration, and

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can also cause your body to lose important minerals such as calcium.

What are the chances that you are eating too much protein?

Chances are good! Most Americans eat too much meat. Try eating a balance of complex carbohydrates and plant-based protein like soy or quinoa.

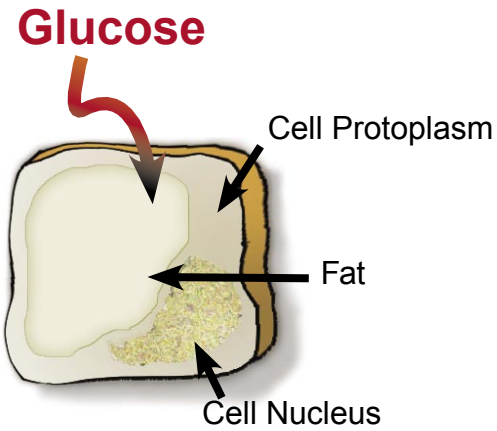
What are Calories and Fat?

Calories are units of measurement that tell us how much energy is in the food we eat. We need energy from food for our body to function. You may have heard that calories are bad for us. The truth is that calories provide us with the energy we need to do our activities throughout the day. Think about how your body would feel if it took in no calories in one day. You would feel tired and low on energy.

Calories: A term used to describe the amount of energy contained in food. One calorie is the amount of heat needed to raise 1 gram of water by 1 degree celcius (oC)

Fat: An organic chemical (carbon-based) that is made up of fatty acids and esters of glycerol. Fat can be found in both animals and plants and store more energy, or calories, than carbohydrates or proteins.

Fats are one type of nutrient found in food. You may also hear them called lipids. There are good fats like fish oils, nuts, and vegetable oils, and unhealthy fats like trans-fats and saturated fats in meat, butter and shortening.



Fat Cell

Our body keeps a certain amount of fat and uses it in two main ways: as building blocks and as fuel. Fat is used as building blocks by building hormones and nerve tissue. It provides our bodies with a way to regulate heat, and it cushions our bones and internal organs. Our body also uses fat as fuel by breaking it down into smaller parts to burn as energy. If we eat more fats than what our body uses for fuel, it is stored in our body in fat cells. Think of these fat cells as a storage unit for energy. By storing fat for future use, your body plans ahead for those times when food might be scarce.

So, why have we heard so much talk about, “counting calories” and, “don’t eat that because it’s loaded with fat?” This is because many of us eat far more fat and calories than our bodies need. If we are very active, we need more fat and calories. If we are less active, we need less fat and calories. Eating more calories and fat than what our daily activities require leads to more fat being stored in our fat cells. Over time, if we don’t burn off this stored fat, this leads to being overweight. Controlling our weight by eating healthy and exercising is the key for preventing diabetes.

How many calories do we need?

Each person’s body burns calories at different rates, so it is hard to determine just one number that we all need each day. That is why there is a recommended range. School age kids require 1600-2500 calories. Young adolescents need

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anywhere from 2500-3000 because of body changes due to puberty. Adults normally need around 1500-2000. If you are more active, you will need to be at the higher caloric end for your age range. If you are less active, you will need to be at the lower caloric end for your age range.

It is a great idea to be active at least 1 hour, and up to several hours, a day. Playing sports, riding your bike, running outside, climbing stairs, and even making your bed are all activities that burn calories and keep your body functioning properly. It is no surprise that playing video games and watching television don't burn many calories. That is why we should limit these activities. In fact, you burn more calories sleeping than you do watching TV!

Adding it All Up

Calories from the foods we eat come from proteins, carbohydrates, and fat. One gram of protein contains 4 calories. One gram of carbohydrates also contains 4 calories. One gram of fat contains 9 calories. This is the reason why foods with the same serving size may differ in calories. High fat foods have more calories than foods that are lower in fat. High fat foods also tend to have high amounts of protein and carbohydrates, making it easy to quickly accumulate, or add up, the number of calories eaten.

For example, one serving of ice cream (1/2 cup ~ 1 small scoop) contains:
2 grams of protein (2 grams x 4 calories= 8 calories)
15 grams of carbohydrates (15 grams x 4 calories= 60 calories)
12 grams of fat. (12 grams x 9 calories=108 calories)

This calculates to 178 total calories. Sixty-one percent (61%) of these calories come from fat (108 fat calories divided by 178 total calories). This is not to say that you should not eat ice cream, but it gives you an example of how fast calories can add up. Think how many calories you would consume if you "super-sized" your portion to 2 or 3 large scoops of ice cream! That could easily reach over 500 calories, which is over 20% of an average daily caloric allowance for adolescents.

So what? Young adolescents need the fuel from calories to grow and mature into adults. Exercising and getting the proper nutrients without the extra fat are simple steps to a healthy lifestyle and will help you feel good now and for years to come, and will help prevent diabetes.

Having diabetes not only can produce long term health effects like eye and kidney damage, but it also requires self-monitoring blood glucose levels (pricking your finger every day) and a very strict diet. Sometimes it even requires giving yourself insulin shots. It is easier to prevent diabetes through your actions today then to manage it for the rest of your life. The actions required to prevent diabetes will also help you feel and look good now!

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Check Your Understanding

1. Give an example of a healthy fat, healthy protein, and healthy carbohydrate. ***Answers may include: healthy fats – fish oil, nuts, unsaturated oils, vegetable oils; healthy protein – fish, vegetable protein like soy, egg white. Chicken or turkey with skin removed are also acceptable protein sources. Healthy carbohydrates – fruit, vegetables, beans, whole grains, whole wheat bread.***

2. Give an example of an unhealthy fat, unhealthy protein source, and an unhealthy carbohydrate. ***Answers may include: unhealthy fats – saturated fats like those found in meat and butter, shortening, trans-fats like those found in french fries and many baked goods; unhealthy protein sources – meats that are high in fats especially ground beef, sausage, bacon; unhealthy carbohydrate – simple carbohydrates, sugar, anything with refined flour like white bread, cookies, saltine crackers, etc.***

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Diabetes and Nutrition Student Handout #2: Message Ideas

Working either individually or in a group, you are going to have a chance to be creative and have some fun creating a message about healthy foods and eating. Include the information from the Diabetes and Nutrition reading in your message. You will also be grading your peers using the grading rubric on page *. Use this rubric to help you get an excellent grade by meeting all of the assignment requirements!

NAME: _____

NAME: _____

NAME: _____

NAME: _____

Who is your target audience? _____

What is your creative idea to reach this target audience? _____
_____
_____

List the steps and materials you will need implement your idea. Assign specific team members to complete each step.

Step	Materials Needed	Who is Responsible?
1.		
2.		
3.		
4.		

Take this completed form to your teacher and get an approval signature: ___
_____

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Diabetes and Nutrition Student Handout #3: Grading Rubric

Teacher Key

You are going to have the opportunity help grade the work of other students in your class. Use this grading rubric to help you. Score your peers based on the quality of their work and how well they meet the requirement listed below. Ask questions to get the information you need to fairly grade on each requirement. Do not be influenced by whether or not you personally like group members!

Score using a scale of 0-3 where:
0 = did not meet the requirement
1 = met some aspects of the requirement
2 = met the requirement
3 = met the requirement in an above average fashion
4 = did an excellent, stellar job with the requirement

Requirement	Score
Message contained accurate information about a healthy diet including good carbohydrates, fat, and protein sources.	
Message contained accurate information about energy balance.	
Message was effective for the target audience.	
Message was creative and interesting.	
Information was presented in a well-organized manner.	
It was clear that all group members contributed fairly to the assignment.	
Total Points:	

Share any comments you may have for the group:

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NEW MEXICO HISTORY AND FOOD

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Lesson One: NEW MEXICO HISTORY AND FOOD

Teacher Key

Today life in New Mexico is very different than it was 10,000 years ago, 1000 years ago or even just 100 years ago. Historically there were no video games or computers, large-scale manufacturing and transportation systems did not exist, physical activity for "life maintenance" (like processing and obtaining food) was much higher, and the types of food eaten were quite different.

New Mexico's culturally rich history is one worth exploring. We will explore this history through foods of the period from the Paleo-Indians approximately 11,000 years ago, to the Spanish Inquisition beginning in the 1600's, to the Anglo settlements in the 1800's, to our modern society. As you read this history, it should become clearer how lifestyle, environment and food influence health and culture in New Mexican communities.

The Pre-Columbian Period in New Mexico – at least 11,000 Years Ago to 1492 A.D.

The Archeological and Oral Records

In New Mexico the Pre-Columbian period was a time spanning at least 11,000 years before Europeans, like Christopher Columbus, came to the Americas by crossing the Atlantic Ocean in 1492 **A.D.** This period had many **eras**, or spans of time marked by specific events or changes in human cultures.

Archeology, as well as oral stories passed down through the generations, are important tools to help piece together history. Archeology is based upon the **preserved** physical evidence left by humans over time. The oldest accepted record of widespread human presence in North America was found near Portales, New Mexico. This is a famous archeological site called "Blackwater Draw." Although no human bones have been found at this site, many layers of beautifully sculpted stone spearheads have been found associated with or "inside" **extinct** animals. Since the bones of these animals are about 11,000 years old, it is generally accepted by **archaeologists** that humans were definitely in North America (and New Mexico) at least 11,000 years ago.

[IMAGE]
Courtesy of the University of Pennsylvania Museum. http://www.metmuseum.org/toah/hd/blac/hd_blac.htm

Native American communities often tell stories of their own origins and say they have been on this North American land since "time immemorial." Some stories tell of crossing ice, indicating a possible human presence in North America as

A.D.(Anno Domini): The current calendar system indicating the years after Christ was born.

Eras: Periods of time marked by characteristic or identifiable events.

Archeology: The systematic study of human culture by the recovery and examination of human-made objects like buildings, pottery, tools, and graves.

Preserved: To remain unchanged or unaltered, or prevent from decaying or spoiling.

Extinct: No longer living.

Archeologists: Scientists who study human culture by examining physical and preserved remnants of that culture.

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Ice age:
Cold periods in earth's history where ice and glaciers covered large portions of the earth.

Inhabited:
To live or reside in.

Stratigraphic:
layers of rock or earth showing progressions in time, with the oldest layers often below more recent layers.

cremated:
The practice of burning the body after death.

Nomadic:
Moving from place to place.

Subsistence:
Activities that maintain life.

Hunting and gathering:
A way of living that hunts animals and collects local plants to eat.

long as 20,000 to 30,000 years ago, which was the peak of the last **ice age**. There may be some archeological evidence supporting these stories. Humans may have **inhabited** New Mexico as long as 25,000 years ago. Again no human bones have been unearthed, but stone tools were found in the caves of the Sandia Mountains near Albuquerque, NM amongst extinct animals of the Ice Age, like saber-tooth tigers. The Sandia archeological site is not as well accepted as "Blackwater Draw" because the evidence there is limited and it does not have as many clear **stratigraphic** layers showing "layers" of time. When looking at archeological or historical layers in the soil, usually the oldest layers are deeper - much like when new wallpaper is placed over any previous layers.

Finding human bones would be the best, most accurate way to date the presence of humans in North America. No one knows for sure why no bones older than * years old have been found, but, based on historic Native American traditions and the mobile nature of the groups, it is thought that the dead were probably burned, or **cremated**, instead of buried.

Food of the Paleo-Indians (Desert Culture) (11,000 – 6,500 Years Ago)

The earliest group of people in New Mexico and North America are called the Paleo-Indians. It is best to think of these people as the "original" Native Americans, as they are not related to the Indians of India. The Desert Culture Native Americans were **nomadic**, or moving from place to place, without the luxury of horses, mules, or camels to carry supplies. They walked the desert lands of what is known today as Mexico, New Mexico and the Southwestern United States searching for food and hunting for meat. This type of **subsistence** is called **"hunting and gathering".**

Stone was a primary material for tools and weapons, such as spear points, knives, and scrapers for skinning animal hides. Animal bones and wood were also important resources, since metal was unknown to this group.

The presence of stone projectiles with animal bones tells something about what the Paleo-Indians ate and how they obtained their food. When times were plentiful, they found large game such as mammoths, mastodons, and now extinct forms of sloth, bison, antelope, camel, and horse. Plant seeds and parts have also been found associated with remnants of human-made objects like pottery or baskets. The Paleo-Indians mainly harvested wild berries, grass seeds, mesquite beans, pinon nuts, and yucca fruit when the large game migrated.

The traditional diet of this time was naturally low in fat, high in fiber and rich in important vitamins and minerals. Processed and simple sugars, like those

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found in today's candy bars and sodas, were essentially absent. Honey, a simple sugar, was an occasional treat to peoples of this period. Although honey contains simple sugars, which the human body needs in **moderate** amounts, it also contains vitamins and other healthy chemicals, like **antioxidants**.

Moderate:
Of average quality, not extreme.

Antioxidents:
Chemicals that help eliminate damaging free-radicals or oxidation in the body.

In the Pre-Columbian period, or even just prior to the modern era beginning in the 1800's, foods were not available prepackaged from grocery stores or grown in mass amounts with the use of pesticides. People spent their time and energy finding, hunting, growing, gathering, harvesting, and processing food. They balanced their energy input, or calories, from the food they ate with energy output from the physical activity required to obtain it.

Cultivation of Corn – (6,500 years ago)

6,500 years ago an important food event occurred. Native peoples of Tehuacan, Mexico discovered how to **cultivate** corn. Native Americans often gathered chili, squash, beans, and corn, but they never previously cultivated it. The discovery of farming played an important role in the development and progression of the Native American cultural history of the Southwest. The people now had a choice, they could either hunt or gather food or they could stay in one place and grow their own food.

cultivate:
To improve or prepare land to grow crops.

Through cultivation, corn became the queen of crops in the Southwest as Native Indians appreciated its value. Native Americans learned how to **crossbreed** the plant to make blue corn, red corn, white corn and yellow corn. In plentiful years, Indian farmers could produce a large enough corn crop to feed more than one family. Corn could be harvested in abundance, preserved by drying and then stored for a long time. Corn was a dependable source of food for the people even when there were scarce amounts of water and wild plants.

crossbreed:
To make a different variety of plant or animal by mating individuals of different breeds or types. For example "muts" are considered crossbreeds of different types of dogs, such mating between a pit bull and a poodle.

Through careful planning and timing of crops Native Americans survived drought and seasons of poor weather. There were less incidents of starvation and populations increased and flourished. Farming is what led to the great Native American cultures of the Southwest: the Cochise, Mogollon, Anasazi, and Hohokam.

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Use of Corn in Native American Cultures Today

Corn remains a staple food in most Native American cultures. Many Native Americans and Northwest Mexicans eat and drink corn in several ways. It is made into tortillas, which are eaten directly or folded into tacos, enchiladas, or tostadas. **Masa** (a dough made of corn meal) filled with chili and meat, and then steamed in corn husks became known as tamales.

Blue corn has a sacred significance in Native Indian cultures in the United States. Using blue corn flour that is mixed into boiling water to make a semi-thick drink, similar to Cream of Wheat, makes **Atole**. **Piki bread** is a paper thin bread cooked on stone griddles that are passed down for generations.

Dried corn could be made into **hominy**. To make hominy, the dried corn was soaked in a mixture of water and ashed for two days. When the kernels had puffed up and split open, they were drained and rinsed in cold water. Hominy is used to make many stews in Native Indian cultures such as red chile pasole.

Corn is not only a food crop, it is given a special place in Native Indian traditions. For the Pueblo Indians corn is a symbol of human life and the relationship to nature. Corn is still used in ceremonies as a way of prayer and giving thanks to mother Earth. Corn is ground into corn meal and is used daily in many Native Indian cultures as a form of prayer. Corn is also used during traditional corn dances in New Mexico and Arizona pueblo cultures. When children are born in traditional Pueblo communities, they are presented to the sun with two perfect ears of corn, called their corn mothers, which are kept until they are buried.

Masa:
A dough made of corn meal.

Atole:
A drink made of water and blue corn flour.

Piki bread:
A very thin bread made by some Native American cultures.

Hominy:
Dried corn soaked in water and used in stews.

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The Cochise Culture – (9,000 to 2,000 years ago)

Because of the success in farming, the Native Americans living in southern Arizona and New Mexico were living very differently from their ancestors, the Paleo-Indians or Desert Culture.

The Cochise Culture was one of the first to abandon the nomadic way of life to settle down. The Cochise Indians built homes, a very new accomplishment of their time. The homes they built were round and partially underground. They were also farmers, planting beans, squash, and corn. They used **manos** and **metates**, which were rocks used to grind corn. Since they continued to use spears, they most likely combined agriculture with hunting game. It was agriculture, however, that enabled the Cochise culture to prosper and survive until about 2,000 years ago.

Manos:
Smaller rocks used to grind corn against the larger metates.

Metates:
Large rock base used to grind corn.

[Map of region]

The Mogollon Culture – (2,000 to 600 years ago)

Overtime, other agricultural societies emerged from the Cochise Culture. By about 2,000 years ago the Mogollon people had developed. The Mogollon inhabited the southwestern portion of New Mexico and as far north as the Four Corners area. Their culture spanned 1400 years, which was shorter than that of the Cochise Culture which spanned of 7000 years. By 900 A.D. the Mogollon population was dramatically reduced. Scientist believe that they were influenced by the developing Anasazi culture and gradually blended into the Anasazi way of life. Because of this **acculturation** (the modification of the culture as a result of contact with a different culture), the Mogollon lost their old identity.

Acculturation:
Changes in one culture due to the introduction to or interaction with another coulture.

[Pit house photo]

The Mogollon were separate from the Cochise even though they lived in same area. The Mogollon way of life is considered more advanced than the Cochise. The Mogollon farmed mesa tops in addition to streambeds. They lived in pit-houses built above ground and arranged them in semicircles or three-sided squares to create the first villages. Village building was a new initiative that demonstrated one way for a group of people to live willingly together. About 2,300 years ago the Mogollon were the very first to make and use pottery. The pottery was undecorated at first, but during later stages of their culture, their pottery had geometric, animal, and human designs.

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The Anasazi Culture
(2,000 – 500 years ago, 1 AD – 1500 AD)

Corn planting and farming also influenced the Anasazi, but they developed additional skills. The Anasazi were the "Basketmakers." They crafted baskets from fibers of plants, which later became trademarks much admired by neighboring groups like the Mogollon and Cochise. The baskets were used to carry water without leaking. They were also used for cooking and to carry plants and fruit. In addition to farming, the Anasazi gathered pinon nuts, yucca fruit, berries, and other wild plants. The Anasazi men hunted deer, elk, antelope, and bighorn sheep. They **domesticated** turkeys and primarily raised them for their feathers to weave into blankets.

domesticated:
To train or adapt a plant or animal to live with or be of use to humans.

The Anasazi were skilled builders. They assembled cliff dwellings that were large and built into canyon walls or under rock overhangs. The rock, multistory buildings are a contrast to the ground-level pit-houses of the Mogollon. The Anasazi way of life as cliff dwellers lasted about 300 years (1000 A.D. to 1300 A.D.). By the mid-1300's, they had abandoned their cliff dwellings to live in multilevel homes later to be called Pueblos. It is suspected that they left the cliff dwelling because of other hostile Native American invaders, climate changes, loss of food supply, or severe dryness.

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Check Your Understanding

Fill in the table below

	Paleo-Indians (Desert Culture)	Cochise Culture	Mogollon Culture	Anasazi Culture
Period of existence	~ 11,000 –6,500 years ago	9,000– 2000 years ago	2000 – 600 years ago	2000 – 500 years ago (1 – 1500 AD)
Primary type of living (hunter & gatherer or farmers)	Hunter and gatherer, later learned farming	Hunter and gatherer then moved into farming	Farming	Farming
What made this culture unique?	Earliest group of people in the Americas; made stone projectiles; first to cultivate corn	Built homes that were round and partially underground	Farmed mesa tops; created first villages; lived in above-ground pit houses; first to make & use pottery	Basket makers; built cliff dwellings
What kind of foods did they eat?	Extinct forms of mammoth, mastadons, sloth, bison, antelope, camel, horse, wild berries, grass seeds, mesquite beans, pinon nuts, yucca fruit, corn	Corn, beans, pinon nuts, yucca fruit, berries, other wild plants, squash, amaranth, cactus, mesquite beans, deer, elk, antelope, big horn sheep,		

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Modern Native American Communities

The Hohokam and Tohono O'odham Culture

The Hohokam culture overlapped the time of the Anasazi (1 A.D. to 1500 A.D.) but they lived farther south in the deserts of Arizona, Southwestern New Mexico, and Northern Mexico. This group of Indians grew out of the Cochise culture, beginning their development around the start of the Christian era in Europe and the Middle East (1 A.D.). The word Hohokam means "those who have gone before." The decendants of the Hohokam call themselves the Tohono O'odham, the desert people or the Akimel O'odham, the river people. Today the desert people are the O'odham and have previously been called the Papago. The river people or the Akimel O'odham are also known as the Pima Indians. Often the names tribes call themselves are different from those given by **anthropologists**.

Anthropologists:
People who study human cultures, often by interviewing or observing the culture directly.

The Hohokam are remembered best for two original accomplishments, an inventive technique for pottery making and a complex system for irrigation. With the use of their complex irrigation system the Hohokam were able to cultivate crops such as corn, beans, squash, tobacco, cotton, and amaranth. Not only did they farm, they also gathered crops such as saguaro cactus fruit, prickly pear pads, cholla, cactus buds, plantain, mesquite beans, and agave from the wild desert. Agave is a wild desert plant that was used to provide food, fiber, and building materials for the Hohokam people. Cotton was processed by hand and made into yarn for clothing and blankets. Mesquite beans were collected from trees that grew along rivers and were later stored in baskets and jars or mashed into flour. The flour would then be used to make broths, stews, and breads.

The Pueblos

After 1500 A.D. the Native Americans who began farming learned much from their ancestors, the Anasazi and the Mogollon. Pueblo groups chose to build their unique "pueblo style" villages near or along streams and riverbanks like the Rio Grande, the Gila River, the Jemez River, the Pecos River, the San Juan River, and the Canadian River, so that agriculture could be possible.

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The Pueblo groups used the irrigation system their ancestors invented to carry water to their crops. Every member of the family helped farm crops; it was a community project. Both men and women dug and cleaned the irrigation ditches. The men tilled the soil and planted the crops. The women joined the men in harvesting crops. Some Pueblo communities built their villages where no water sources were readily available and practiced a type of farming called **dry farming**. Dry farming involved planting crops near dry washes or arroyos, which then carried rainwater and the runoff from melted snow atop mountains to the fields. To overcome the lack of water, the farmers had to till deep into the ground so that the soil retained enough moisture. The Pueblo Indians also practiced a technique called **crop rotation** that involved changing the crops they grew in certain locations. By rotating their crops, they were less likely to wear out the soil.

dry farming:
A type of farming that does not artificially bring water to the fields. It generally depends on the natural rainfall, uses plants that require little water, and uses special techniques, such as mulching, to try to keep existing water in the soil and not evaporate.

crop rotation:
The farming practice of rotating or changing crops to keep the soil healthy and help control insects and plant diseases.

The main crop of the Pueblo Indians was and still is corn. Beans and squash were also grown in the fields. The pueblo women ground the corn and did the cooking. They also gathered wild plums, berries, acorns, pinon nuts, and walnuts. The Pueblo Indians found ways to use cactus, yucca, sunflowers, mustard plants, and cattails. In all, Pueblo Indians used more than 70 plants for food, medicine, and dyes. Today there are nineteen pueblo communities in New Mexico, including Acoma, Jemez, Santa Clara, Cochiti, and Pojoaque.

The Athabascans (The Apaches & Diné)

The Athabascans migrated from Asia to the Southwest about 1300 A.D. (700 years ago). These were the most recent Native American groups to arrive in the Southwestern U.S. The Athabascans that moved into New Mexico are known as the Apache and Diné (also called the Navajo). The main difference between the two groups is that the Diné had agricultural interests and the Apache preferred to be hunters and gatherers. When the Diné reached the southwest, they met the Pueblo Indian farmers who taught them to plant corn, beans, squash, and melons. The Diné primarily lived (and some still live) in homes called hogans made from wooden poles, tree bark, and mud. The door to the hogan always faced the east so that when the sun rose they were able to welcome the sun. Although the Diné farmed and lived in hogans, they would spend at least part of the year moving around.

The Diné and Apaches were the largest groups of non-pueblo Indians to come

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into the southwest. Some archaeologists suggest that the Diné and Apaches were partly responsible for the Anasazi's departure from the cliff dwellings. Others believe that the Diné and Apaches did not reach the Southwest until the 1500's arriving only a short time before the Spaniards.

The Diné are currently the largest North American Indian population with over 140,000 people on 16 million acres of land covering most of Arizona and part of New Mexico.

The Spanish Inquisition
The Spaniards Arrive (1540-1841)

In 1492 the King and Queen of Spain funded the exploratory travels of the Italian sailor Christopher Columbus. The goal of Columbus' travel was to find wealth and a quicker route to India, home of many wonderful foods and exotic spices. Instead of finding India, Columbus ran into the Canary Islands of the Caribbean. When they encountered the native peoples living on the islands, Columbus mistakenly called them "Indians" thinking he landed in India. Even though he eventually discovered that he encountered uncharted lands, later called the "New World," the name of "Indians" for the native peoples of the Americas remained.

Colonize:
to form or establish a new town or location to live.

Columbus made four voyages from Spain to the New World. He primarily explored the Caribbean areas of the Bahamas, Jamaica, Cuba, and Puerto Rico. Spain sent more explorers and leaders to **colonize**, or claim as their own, the lands of the Caribbean, South America, and Mexico. The Spanish encountered the Aztec, Mayan, and Incan Native American cultures when they explored South and Central America and Mexico. In 1540 Francisco Vasquez de Coronado was sent on a mission from Mexico City, Mexico to conquer the lands to the north. Originally, he was in search of the Seven Cities of Cibola, which was a rumor of cities made entirely of gold. The cities of gold did not exist, but Coronado encountered "new" Native American groups like the Zuni, Pueblos, Athabascans, and Tohono O'odham.

In the 17th Century (1600s), Spain began its active colonization of the Southwest, including New Mexico. Priests accompanied Spanish soldiers and politicians, like Don Juan de Onate, to forcefully convert the Native Americans to Christianity and follow Spain's rule. Spain's, and especially Onate's, cruelty was what led the Pueblo Indians and Athabascans to fight back in the Pueblo Revolt of 1680. The Pueblo Revolt was led by Popé, a member of the Toas Pueblo. The Pueblos banded together to successfully drive the Spaniards out of New Mexico for twelve years, then in 1692 the Spanish returned under the leadership of Diego de Vargas.

The arrival of the Spanish to the Americas was devastating to Native Americans, many died from disease, torture, and fighting. However, the cultural identity and languages of many of the Pueblos and other Southwestern tribes remained mostly in tact despite Spain's attempt to colonize and acculturate. The Spanish did introduced new tools, metal, plants, animals and building techniques, which significantly shaped some of the local cultures. For example, the Diné learned

to raise sheep brought by the Spanish and became experts at using wool to weave clothes, rugs, and blankets. The Diné also used sheep for food, with mutton stew as a favorite recipe. Horses brought by the Spanish transformed the nomadic Native American tribes, like the Apache, Comanche, and other Plains Indian tribes. These groups became expert horsemen, hunters, and warriors using the horse as a tool of the trade. The Spanish/Europeans also introduced grapes, wine, sugarcane, rice, bananas, olives, and the grains wheat and barley.

Even though the Spanish brought many new foods to the Americas, the Americas offered cocoa, potatoes, tomatoes, avocado, chile pepper, peanuts, pineapple, corn, beans, and squash. These new foods made their way around the world and transformed European cuisine, especially Italian and Irish, as well as, the cuisine of India and the Orient. The great sharing of foods around the world was called the **Columbian Exchange**.

Columbian Exchange: A world-wide exchange of goods and foods that occurred after Columbus discovered the Americas.

European Expansion

While the Spanish were colonizing the southwestern U.S., Central and South America, the Caribbean, and Mexico, the Pilgrims, a religious group from England, set sail for the "New World" in 1620 for the purpose of religious freedom. They landed on the northeastern coast of the U.S. and named the region "New England." Many different Christian-based religious groups (such as Protestant, Episcopalian, Catholic) and nationalities from other countries in Europe, such as the Dutch, German, and French, sailed across the Atlantic Ocean to make a home in the "New World." They also brought servants and slaves from other countries, especially Africa.

Just as there was an exchange of foods, technology and culture between the Spanish and the Native Americans of Central and South America, Mexico, and the Southwest U.S., the Europeans that arrived on the east coast had similar exchanges with Native Americans of that region. In fact, it was Native Americans who saved the lives of many of the earliest European settlers by sharing their foods and means of survival in that climate.

Over time the Native Americans of the East Coast and other parts of North America would face **decimation** from disease and war brought by the Europeans. In many places Native Americans were forced to convert to Christianity, however, many Native American groups fought to maintain their identity, continued to practice their own religion and their cultures and languages have **persisted** to this day.

Decimation: To destroy or kill a large part of.

Persist: To continue or maintain.

As the Europeans became more established in the "New World" they built cities, then grew, imported, and ate the foods to which they were accustomed in England. This formed the basis of today's American diet. This historic American diet focused on animal meat as the main entrée, especially salted and preserved

animal meats like ham, with a small side of grains or vegetables, accompanied by an alcoholic beverage, followed by a highly sugared dessert. Europeans drank alcohol instead of water because much of the water in Europe and other countries they previously explored was contaminated with disease.

The upper class ate **refined** flour, like that in "white" bread. The American diet was low in fresh fruits and vegetables and high in fat, salt, and sugar. It lacked important key nutrients like vitamins A, D, C, riboflavin (a B vitamin) and the mineral calcium. The lack of nutrients decreased **life expectancy** and increased infant **mortality**. Because people in early America performed much physical labor to survive, they tended to balance energy output with food intake, so obesity did not appear to be a problem.

U.S. Expansion

The thirteen New England colonies were originally ruled by England, but on July 4, 1776 the colonists declared independence and formed a new country, the United States (U.S.). The thirteen original states were Massachusetts, Rhode Island, Connecticut, New Hampshire, New York, Delaware, New Jersey, Pennsylvania, Virginia, Maryland, North Carolina, South Carolina, and Georgia. New states were added as the U.S. expanded west and south.

A major step towards expansion westward began in 1803 when American president Thomas Jefferson negotiated the **Louisiana Purchase** with the French. The Louisiana Purchase added over 500 million acres up the center of the U.S. President Jefferson then sent the explorers Meriwether Lewis and William Clark (Lewis and Clark) to find a water route to the Pacific Ocean and to explore and map the lands to the west of the original United States.

Once the lands were "claimed" by the U.S. and mapped, Americans began **migrating** westward in the 1820s and 1830s. The **Santa Fe Trail** was established in 1821 as a commercial route from the state of Missouri to Santa Fe, New Mexico. New Mexico was still part of Mexico at that time, not a state. The Oregon Trail was another major westward route established in the 1830s.

When people traveled they brought **preserved** foods, similar to the foods they were eating in the colonies. Meats were dried and salted, grains were dried and ground into flour or boiled whole. Very few fresh fruits and vegetables were eaten, and milk products were limited. The discovery of **pasteurization** and canning in 1809 allowed some **perishable** products to be stored and transported. However, carrying heavy containers was difficult in a wagon. Although natural ice, removed from places like glaciers and frozen lakes, was occasionally used, refrigeration as we know it had not yet been invented.

New Mexico's progression to statehood began with the Mexican-American War in 1846. In 1848, the **Treaty of Guadalupe Hidalgo** gave up a large portion of the Southwestern land to the US. Five years later, the **Gadsden Purchase** added the remaining portions of what is today known as Arizona and New Mexico. By 1853, Mexico had **relinquished** the territories that would

Refined:
To remove parts or layers of a plant or seed until only a small portion is used.

Life expectancy:
The average length of a lifetime, usually for a particular group.

Mortality:
Death rate.

Louisiana Purchase:
The purchase of the Louisiana territory from the French in 1803 by U.S. President Thomas Jefferson. The purchase consisted of 600 million acres between the Mississippi River and the Rock Mountains and makes up 13 states
.

Migrating:
moving.

Santa Fe Trail:
A commercial, dirt "highway" used in the 1800s to connect Missouri and Santa Fe, New Mexico.
preserved:

Oregon Trail:
A dirt trail from Missouri to Oregon used by "Pioneers" to settle the western U.S.

Pasteurization:
Heating food and drink (like milk) to kill microorganisms to prevent illness and food rot.

Perishable:
Subject to decay or spoilage.

Treaty of Guadalupe Hidalgo:
Treaty that ended the Mexican-American war in 1848 and the U.S. received Texas, New Mexico, and part of California.

Gadsden Purchase:
A negotiation between Mexico and the U.S. (after the Treaty of Guadalupe Hidalgo) to resolve a boundary dispute along the U.S.-Mexico border from El Paso to the western edge of Arizona.

Relinquished:
To give up.

eventually make up southwestern Texas, Arizona, New Mexico, Utah, Nevada, and California. Arizona and New Mexico were territories until 1912 when they entered statehood.

The westward expansion of the U.S. continued to stress the Native American tribes who had been on that land for thousands of years. In the 1830s President Andrew Jackson forcefully removed Native American tribes such as the Cherokee and Choctaw from east of the Mississippi to the state of Oklahoma. In the 1851 the U.S. government built Fort Defiance on Diné (Navajo) land in Arizona. This forced the Diné to negotiate for their own land and water. The anger that developed from this led to the Navajo-Apache wars that would last for the next 20 years between the tribes in Arizona and New Mexico and the Federal Government.

In the 1850s through the 1930s the U.S. entered into treaties with the various Native American tribes and established **reservations**, or allotments of land, for those tribes to live on and, eventually, govern as their own. Most Native Americans endured extreme hardships before and after formal assignment of and to reservations. In most cases, the land given to the Native Americans was of poor quality and difficult to farm or gather from. Thus, the U.S. forcefully took away the tribes' means of growing or obtaining their traditional foods as a way to control them. Unfortunately the U.S. government did not stop there, they helped abolish the American buffalo, or bison, to deny Native Americans another major food source. As a result of this food warfare, Native Americans were forced to accept sub-standard rations of food including flour, oil, and alcohol. This history of oppression through food, as well as voluntary cultural exchange shaped the diet of today's Native American communities, and plays a very important role in the increased rate of diabetes in those communities.

Reservations:
A plot of land set aside for Native Americans.

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Check Your Understanding

Fill in the table below

	Hohokam/ Tohono O'odham	Pueblo	Navajo	Apache
Period of existence	1 AD to present	1500 AD to present	1300 AD to present	1300 AD to present
Primary type of living (hunter & gatherer or farmer)	Farming	Farming	Farming and hunter & gatherer	Hunter & gatherer
What makes them unique?	New technique for pottery; built complex irrigation systems	Pueblo housing style; built villages along streams; dry farming	Migrated from Asia, among most recent Native American groups to arrive in the Southwest U.S.; lived in hogans;	Migrated from Asia, among most recent Native American groups to arrive in the Southwest U.S.; remained hunter & gatherers
Of what does their traditional diet consist?	Corn, beans, squash, amaranth, cactus fruits, plantain, mesquite beans,	Corn, beans, squash, wild plums, berries, acorns, pinon nuts, sunflowers. Mustard plants, cattails	Corn, beans, squash, melons,	Local plants and animals
List 3 things that changed after Spanish exploration.	Sheep and horses were introduced; plants like grapes (wine), sugarcane, rice, bananas, olives, wheat and barley were introduced; new tools were introduced; Christianity was introduced; Many Native Americans died from disease and fighting with the Spanish			
List 3 things that changed after the "Americans" moved in.	Additional new diseases and fighting; new Christian religions; reservations; decimation of traditional foods; introduction and wide-spread (and forced) use of refined sugar, flour, and oils, and alcohol.			

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Industrial Revolution

While the U.S. was expanding into "Indian Territory" in the 1850s, the **Industrial Revolution** was beginning. The Industrial Revolution transformed the way food was produced, transported, and consumed in the U.S. In the early 1800s about 95% of the population lived on small farms, but by the 1900s the Industrial Revolution brought people into cities and only 65% worked on or with farms. This number would continue to decrease over time. As of 2005, less than 10% of people in the U.S. live or work on farms.

Industrial Revolution: A period of time beginning in the 1850s when machinery, factories, and large-scale industrial practices shaped the economy and lifestyle of the United States and other parts of the world.

With the industrial revolution came other major changes in food production and eating. **Mechanization** played a role in the large-scale industry of food. Farming machinery allowed a farmer to harvest 135 acres in the same time it previously took to harvest 7.5 acres. People stopped producing food for their own consumption and instead purchased processed or prepared foods. Farms and railroads expanded west and a refrigerated railroad car (using ice) was invented in 1867, which allowed fresh foods like eggs, meat, milk, and produce to be shipped to city residents.

Mechanization: The use of machines to perform jobs or assist with tasks.

Changes in lifestyle and technology began to move quickly and resembles what we know today. In 1850 people began condensing and preserving milk for distribution. In 1859 Mason jars were invented. In the 1870s Kellogg's Corn Flakes and Post Grape Nuts were created. Tin cans were invented in 1880.

By the early 1900s twenty percent of the U.S. manufacturing was food processing. Hamburgers, ice cream cones and peanut butter were introduced at the 1904 World's fair in St. Loius, Missouri. In 1905 America's first Pizzaria opened in New York City. Oreo cookies were created 1912. 1915 brought Kraft processed cheese, and in 1916 the first modern grocery store, called Piggly Wiggly, was open in Memphis Tennessee. Piggly Wiggly sold only prepackaged and individually priced items, much like the convenience stores of today. The 1920s brought Kool-Aid, popsicles, and Campbell's condensed soups. The 1930s people could purchase Toll House cookies, Wonder Bread, Twinkies, Spam, Ritz crackers, Lay's Potato Chips Velveeta, Milky Way, Mounds Bar, and Reese's Peanut Butter Cups.

The next major invention that shaped the access of food in the U.S. was the refrigerator. In 1931, the compressed gas refrigerator using "Freon" was invented in the General Motors Frigidaire division. "Freon", a chlorinated fluorocarbon compound (CFC), later found to deplete the earth's protective ozone layer, was less toxic and non-explosive compared to other compressed gases, like ammonia. The Freon allowed the refrigerators to be small, significantly increasing its potential uses. By the 1950s most homes had refrigerators allowing frozen food, fresh fruits and dairy to be part of the ordinary American diet. In general, refrigeration improved nutrition in the U.S.

Industrialization and refrigeration made food less expensive and more plentiful. For the first time people ate more than was necessary and medical records of obesity and digestive problems increased. A quote from a medical doctor in a 1924 industry trade journal summarizes diets and activities of the day and

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medical effects they were seeing.

> "The good old fashioned American meal…is being rapidly supplemented by sugary concoctions…This indiscreet eating, with almost a total lack of exercise, now features the life of the average businessman, Up at 8 in the morning, a hasty breakfast, ride downtown in an automobile; a ten –minute lunch of miscellaneous sugary drinks in the quick lunch or drug store, back to the office, home in an automobile – they call that a day…The consequences are indigestion, bad nerves, decaying teeth, restless nights, and cutting down on the span of life." [1]

Consumption:
To use.

Rationed:
A fixed portion.

The American diet of high sugar, fat, and salt with relatively low nutritional value was established in the early colonial era, enhanced by industrialization, and continues to this day. There have been a few periods of increased **consumption** of fresh fruits and vegetables, like during World Wars I and II, when meat, butter, sugar, and flour were **rationed**. However, for the most part, Americans were used to the convenience and taste of prepared and packaged goods. Once these processed foods were readily available, Americans chose them over fresh fruits, vegetables, and whole grains.

Epidemic:
Wide spread, often associated with disease.

As a result of the processed foods diet, today the U.S. is facing a health **epidemic** for obesity and diabetes. A major part of the problem is sugar is added to most processed foods including salad dressings, bread, and crackers, in addition to the obviously sugared colas, cookies, and candies. Americans are eating about 142 pounds of sugar per person each year. Compare that to the average consumption of broccoli at 8 pounds per person per year.

Communicable:
Can be easily transmitted, often refers to diseases.

Science is showing us the effects of the American diet and lifestyle on health. The U.S. has advanced quite far in reducing the number of deaths from **communicable** diseases via vaccines and treatments, but today one of the most important things we can do for our health is eat whole grain breads and cereals, five fruits and vegetables per day, and healthy fats and proteins from sources like fish and nuts.

Interestingly, the traditional diet of the Native Americans in this region were very healthy. Although many Native American communities view Indian fry bread as traditional, it is not. Fry bread came out of the era when the Native Americans were forced onto reservations and given flour and oil as food rations. As a means of survival, Native Americans made and ate fry bread. Fry bread contains many of the unhealthy aspects of modern diets, highly refined flours, lard or saturated fats, and often topped with sugar.

The traditional Native American diets included the corn, beans, squash, nuts, cactus fruits, amaranth, and mesquite beans. Current scientific research shows that many of the fruits, vegetables, and plants Native Americans, and even the

[1] Quoted from the book *Food, Society, and Environment* by Charles L. Harper and Bryan F Le Beau, 2003, page 87.

Spanish, used contain healthy chemicals like anti-oxidants, which can help prevent diseases like cancer. There are also some foods, like mesquite flour and prickly pear fruit, which may help control blood sugar, important for control of prevention of diabetes.

Native American communities are starting look back at their traditional diets and find ways to **incorporate** those foods into their current lifestyles. This task has proven challenging for them, just like for many Hispanic and Anglo peoples in the U.S. and here in New Mexico. Salt, sugar, and refined foods taste good to us and the pre-packaged convenience is nice and easy. But this addiction to salt, sugar, and "easy" are coming at a high price - our good health. With care, persistence, and focus all cultures of New Mexico and the U.S. can change the way we eat and bring personal health and prosperity to our state and this nation.

Incorporate:
To unite with something already in existence.

Check Your Understanding

1. Describe how the historic Anglo European diet and the Industrial Revolution shaped our diet today. ***From the time of the earliest Anglo European American settlements on the East coast meals have been dominated by salted or preserved animal meats, with a side of grains and maybe a small side of vegetables. Refined sugar and flour were symbols of the upper class and soon became wide-spread and the preferred food taste during the Industrial Revolution. During the Industrial Revolution people stopped farming and processing their own foods and began buying highly processed, refined packaged foods, much like our diet of today.***

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Science Lesson: Protein Puzzle

Lesson Overview

Students learn about the insulin protein and its primary, secondary, and tertiary structures by constructing a 3-D model of the insulin protein. They learn how structure and shape relates to insulin's ability to do its job moving sugar from blood into cells.

Suggested Grade Levels: 6-9
Curriculum Connections: Protein, amino acids, cell function, modeling, diabetes

New Mexico State Education Standards

New Mexico State Education Standards: This lesson meets the following New Mexico State Education Standards for grades 5-8.

Strand I (Scientific Thinking and Practice), Standard I, Benchmarks I, II
Strand II (Content of Science), Standard II (Life Science), Benchmarks I, III
Strand III (Science and Society), Standard I, Benchmark I

Teacher Background

The **Student Handout #1** provides very basic background information on protein structure and how it relates to insulin's function. For more detailed information please refer to the web resources listed below. Additional web resources are found for this lesson under the section "Resources for the Libraran."

- Principles of Protein Structure, http://www.cryst.bbk.ac.uk/PPS2/top.html
- Proteins - Introduction, Virtual Chembook, http://www.elmhurst.edu/~chm/vchembook/565proteins.html
- Proteins, Indiana State University, http://web.indstate.edu/thcme/mwking/protein-structure.html
- Protein Structure and Function, http://medweb.bham.ac.uk/bmedsci/bms2/chime/structure/structure.html

Teacher Preparation

MATERIALS:

- Copies of the **Student Handout**
- 1 set of coloring markers per group.
- Scissors, per student or group as available
- Clear tape, per group

- Make copies of the **Student Handout** including the page titled "The Insulin Protein Puzzle." Master copies of the handouts are at the back of

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this book.

- If you are the first teacher in your team to use this FACT FILE, make copies of the student handout entitled, **Student Introduction: Environmental Health and Diabetes**. Ensure that students have read the handout and mastered the vocabulary.
- Assemble the materials.

Procedure

- Review amino acids, proteins, and protein structure as needed.
- Distribute the **Student Handout**, including the page titled "The Insulin Protein Puzzle."
- Review the instructions on constructing a model of the insulin protein under Step 1.
- Students will build their insulin protein individually but will share scissors, tape, and markers as needed. Some tips to help the students build their model are: a) Cut the strip in rows since they are already sequentially numbered. b) Point out that there will be two separate strips labeled "a" and "b". c) When the students make their spiral (secondary structure) they can wrap the strip around their finger loosely and then tape.
- Before students do Step 2, you may want to review an example of an experimental design of an experiment you did in class. Identify the question the experiment was trying to answer, review the steps and how those steps help answer the question, and review the control for the experiment and why you need a control. You could use the **Student Introduction 2 - Yeast and Household Substances: A Toxicology Experiment for this purpose**. You may also need to take time with students to help them shape a research question. One approach is that the class generates a research question about insulin resistance and then students, either individually or as a group, come up with the experiment design.
- See the **Teacher Key of the Student Handout** for correct answers.

Extension Activities

- You may consider having the students investigate the types of bonds in the primary, secondary, and tertiary protein structures. Students could even draw the chemical structure on each amino acid and properly align the areas of the amino acid that bond in each structural level.

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PROTEIN PUZZLE
Student Handout #1

Teacher Key

Introduction

In this lesson you will learn about the insulin protein and how its shape helps it do the job of moving sugar from the blood into other cells. You will also build a three-dimensional (3-D) model of insulin.

STEP 1: Read the information below and then follow the instructions to build an insulin protein model.

You probably already know that **atoms**, the smallest representative sample of an element, bond together to form **molecules**. Different atoms of **elements** (like carbon, oxygen, and nitrogen) bond together in different amounts and different ways to form the billions of chemicals that make up everything in our universe. Living things tend to create complex molecules in order to do specific jobs to maintain life.

Some of the complex molecules that help life function are carbohydrates, fats, **steroids**, and proteins. Some of these molecules are used in cell structure, others are "active" compounds that move or change chemicals. Proteins are a class of chemicals that participate in every function of the living cell, including structural support for the cell, muscle movement, breaking down chemicals (these proteins are called **enzymes**), turning genes off or on, or **cell signaling**.

Proteins play a very important role in biology and biochemistry. You can differentiate proteins from other chemicals in a living thing because proteins are made up of **amino acids**. Proteins also often have complex three-dimensional structures. There are twenty-two amino acids, such as cysteine, lysine, alanine, phenylalanine, serine, and aspartic acid. The human body uses twenty of these amino acids and can make ten of them on its own. The other ten we have to get through eating.

When amino acids bond together they are called **peptides**. Polypeptides are simply another name for a protein, where many amino acids are joined together (poly = many). There are proteins that are very short, such as the artificial sweetener aspartame which is a dipeptide (two amino acids bonded). And, there are proteins that contain several thousand amino acids.

When many amino acids bond together, the molecules can get quite large compared to the rest of its microscopic, cellular surroundings. Imagine trying to stretch out a 50' (foot) rope in a 10' x 10' room. You would not be able to fully extend the rope into a straight position, you would need to bend or curve the rope, or pile it upon itself. Large proteins face a similar challenge, so they fold in upon themselves to generate a three-dimensional (3-D) structure.

Atom:
The smallest unit of an element.

Molecule:
The smallest part of a substance that retains the characteristic of that substance. It can be made up of a single element or multiple elements. For example, one molecule of carbon would be a carbon atom, one molecule of the oxygen we breathe would be two oxygen atoms (O2), and one molecule of water would be two hydrogen atoms and one oxygen atom (H2O).

Element:
A substance composed of specific atoms that cannot be broken down into simpler substances by normal chemical means.

Enzymes:
Specialized proteins that help biochemical process, such as, digesting food.

Cell Signal:
The use of chemicals by cells to communicate. Some examples of cell signaling include sending messages to open or close "gates" in the cells so that certain chemicals can enter or leave or sending messages to release antibodies when an unwanted invader, like a virus, is in the body.

Amino acids:
An organic, or carbon-containing, compound that make up proteins. There are 22 amino acids which all contain an amino group (NH2), a carboxylic acid group (COOH), and a side group.

Peptide:
Two or more amino acids attached together. Protein can be a dipeptide with two peptides or a polypeptide with many peptides.

Genes:
A hereditary unit made up of DNA.

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Primary structure:
When the body makes proteins the first step is to attach amino acids together in a line in a very specific sequence.

There are three parts to this 3-D structure. The **primary structure** is the amino acid "chain" bonded together, much like the "straight" rope in our analogy. The order and type of amino acids in this primary structure are what define a specific protein. The amino acid type, order and number are different for the hemoglobin protein (which carries oxygen in the blood) compared to the insulin protein (which manages sugar in the blood).

Secondary structure:
Once the primary structure of proteins is complete, the protein folds in on itself and bonds with the amino acids in the primary structure in a very specific way, either as an alpha-helix (spiral), a beta-sheet (like pleats or zig-zags), or a random coil.

Alpha (α) –helix:
a spiral shape.

The **secondary structure** of a protein is the first step of a protein "folding in" on itself. The secondary structure folding is in a regular, repetitive pattern like an **alpha (α)-helix** (or spiral), a **beta (β)-sheet**, or a random coil. For an α-helix structure, imagine taking your rope and swirling it into a circular pile. Then imagine where each part of the rope touches the rope above and below they stick together or bond. For a β-sheet you would fold the rope so there are many parallel strands, like making compressed S's or zig-zags. The pieces of rope (or protein) that are parallel or next to each other would bond. The bonds are what stabilize the secondary structure.

[Image of helix and beta sheet]

Tertiary structure:
The third stage of proteins folding in on themselves. Amino acids bond again which holds the 3-dimensional protein structure and gives the protein its specific "key-like" shape.

The third part of the protein structure is called the **tertiary structure**. This is additional bending and kinking of the secondary structure to compress the protein even more.

Imagine taking your coiled rope and folding it again. Like the primary and secondary structures, the tertiary structure is formed and held by bonds. The really interesting feature of the protein's tertiary structure is it's function beyond saving space. The hills and valleys of the outside of the protein act like a key that fits to a specific lock or a puzzle piece. When the key or puzzle piece fits with its intended counter part, the protein is doing its job – like carrying oxygen, stimulating the release of hormones, or fighting off infection.

[image of insulin]

Now you are going to build a model of a protein called insulin. Insulin helps regulate the amount of sugar in our blood. People who either do not release enough insulin or their insulin becomes less effective get a disease called diabetes. If diabetes is left untreated, the excess sugar in the body can cause blindness, kidney damage, artery damage, or death. Diabetes can be prevented or managed through a healthy diet of fruit, vegetables, "good" fats (like the fat in nuts, olives, and fish), plenty of water and exercise. Extreme cases of diabetes requires that a person inject insulin into their bodies near meal time.

Follow the steps to build a model of the protein insulin and answer the questions.

1. Refer to the handout titled "The Insulin Protein Puzzle." Color each amino acid rectangle in Table 2 with the assigned color found in the parenthesis

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next to the amino acid name and abbreviation in Table 1.

Students color, cut out, and assemble the insulin model. Make sure the amino acids are colored and are in the proper primary sequence (following the sequential numbering for each a and b strand). Check that the proper sections of the protein are spiraled in an alpha-helix (amino acids are labeled with H). Check that the tertiary structure is properly "bonded" (S1, S2, and S3 labels are matched).

1.a. Which two amino acids occur the most in insulin? Using Table 1 on the "Insulin Protein Puzzle" handout, spell out the full amino acid name instead of the abbreviation.

Cystine (there are 6) and Leucine (there are 6)

1.b. Which two amino acids occur only once in insulin? Spell out the full amino acid name instead of the abbreviation.

Lysine and Proline

2. Cut out the colored amino acid rectangles. You will save time and effort if you cut in rows (rather than cutting out individual squares) keeping the sequential numbering.

3. Tape the amino acids in the numbered sequence for each strand (a and b). You will end up with two straight strands (1a-21a and 1b-30b).

3.a. Which protein structural level does taping the amino acids together in a linear fashion represent? ***Primary***

4. Spiral the paper sections that are labeled with sequential H's (e.g. 1a-8a). Tape the helix so that it is stable. You may find it helpful to loosely wrap the paper around your finger then tape the paper.

4.a. Which protein structural level does spiraling represent? ***Secondary***

4.b. Look at the insulin image on page *, does insulin have an alpha-helix, beta-sheet structure, or both? ***Both***

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5. Next, tape together the corresponding "disulfide bonds" labeled with S in the upper right-hand corner of some of the amino acids rectangles (pair S1 with S1, S2 with S2, etc.).

   5.a. Which protein structural level does taping the S's (sulfide bonds) together represent? ***Tertiary***

Step 2: Proteins work like a puzzle or "lock and key." This is why the shape is very specific to each type of protein and is very important. Insulin works like a key by fitting into a special insulin receptor, or the lock, on the outside of a cell. When insulin does not fit in the receptor, diabetes can result because insulin cannot properly perform the job of moving sugar into the cell. When insulin stops working this is called insulin resistance and is the cause of type 2 diabetes.

Insulin resistance can be caused by genetics, obesity, or a combination of the two. A mutation in the insulin receptor gene can cause the insulin receptor on the outside of the cell to slightly change its shape. Scientists hypothesize that obesity may work in a similar way, by changing the shape of the insulin receptor so the "lock and key" no longer fit. One research study showed that fat cells produce a hormone called "resistin" which seems to inhibit insulin's ability to work.

Science is a process where questions are constantly being asked and multiple hypothesis are tested until those hypothesis are eliminated or supported through data from experiments. In the case of diabetes, there are many hypotheses about how obesity, diet, and physical exercise relate to insulin resistance.

A. If you were a scientist doing research on insulin resistance, what one question would you want answered and how would you design an experiment to answer that question? Be sure to identify only ONE question and provide enough details in your experimental design to demonstrate that you could answer that question. You can assume that the technology exists to do your experiment, but you need to describe what that technology would be that would help you (e.g. a machine to identify a molecule). Your experiment can look at the micoscopic or molecular level (like genetics or insulin receptors on cells) or it can look at the population level (such as research that studies groups of people with or without diabetes.)

Be sure to include the following in your experiment design:

Question to answer: ***The question needs to be specific and testable. You may need to help students refine their question before they start designing the experiment or study.***

How you will do the experiment step by step (First, Second, etc. or 1, 2, 3…):

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Look for logical steps that answer the question they are asking. If the experiment would not answer their question, have the students try to identify the question it would attempt to answer. This is an excellent critical thinking skill! If the experimental design is good, but does not answer their original question, the student could just change their question.

Your control (i.e. what you compare to or your "normal" reference): ***Make sure the student has clearly and accurately identified a control.***

General assessment should include checking for grammar and clear, logical writing. Students should be encouraged to revise multiple times before receiving their actual grade. Multiple revisions will produce the most improvement in writing, self-evaluation, and critical thinking, which will ultimately help their overall academics.

The Insulin Protein Puzzle

TABLE 1: The Amino Acids and their Abbreviations

Essential Amino Acids (those the human body cannot generate on its own)	Non-Essential Amino Acids (those the human body can generate on its own)
Tryptophan – Trp Lysine – Lys – (blue stripes) Methionine - Met Phenylalanine – Phe – (orange dots) Threonine – Thr – (black dots)) Valine – Val – (orange) Leucine – Leu – (green dots) Isoleucine – Ile – (yellow) Histidine – His – (brown dots) (essential in children) Arginine – Arg – (orange stripes) (essential in children)	Tyrosine – Tyr – (red dots) Glycine – Gly – (red) Serine – Ser – (green dots) Glutamic acid – Glu – (blue) Aspartic acid - Asp Cystine – Cys – (purple) Proline – Pro – (purple stripes) Alanine – Ala – (green stripes) Aspargine – Asn – (purple dots) Glutamine – Gln – (green)

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1a H Gly	2a H Ile	3a H Val	4a H S1 Glu	5a H Gln
6a H Cys	7a H S2 Cys	8a H Thr	9a Ser	10a Ile
11a S1 Cys	12a Ser	13a Leu	14a Tyr	15a H Gln
16a H Leu	17a H Glu	18a H Asn	19a H Tyr	20a S3 Cys
21a Asn		1b Phe	2b Val	3b Asn
4b Gln	5b His	6b Leu	7b S2 Cys	8b Gly
9b H Ser	10b H His	11b H Leu	12b H Val	13b H Glu
14b H Ala	15b H Leu	16b H Tyr	17b H Leu	18b H Val
19b H S3 Cys	20b Gly	21b Glu	22b Arg	23b Gly
24b Phe	25b Phe	26b Tyr	27b Thr	28b Pro
29b Lys	30b Ala			

FOOD, CULTURE AND DIABETES: A PERSONAL REFLECTION

Lesson Overview

Students write a personal and historic essay about the relationship between their own culture and foods, their personal relationship with food, and their experience or opinions about diabetes with respect to food and their family. Students conduct research as needed and consider how they can still honor their heritage while eating healthy.

Suggested Grade Levels: 6-9

Curriculum Connections: essay writing, research, history, cultural heritage, diabetes

New Mexico State Education Standards

This lesson meets the following New Mexico State Education Standards for grades 5-8. Language Arts – IA, IB, IC, ID, IIB, IIC, IIIA

Teacher Background

It would be best if this lesson were implemented following the social studies lesson "New Mexico History and Food," however it is not absolutely necessary. The social studies lesson will provide a unique perspective and historic overview about the relationship between food, culture, and our nation's history. Whether or not students do the social studies lesson, they may want to do research on their own cultural heritage using the Internet, the library, or by interviewing family members.

The ultimate goal of this essay is person reflection. However, it is a useful skill for students to know how to intertwine factual and historic information into a reflective writing. Doing so lends additional strength, depth, and substance to the piece.

Below are some writing prompts you may want to use to help the students.

- With what cultural heritage do you identify yourself?
- Are there traditional foods that go with that heritage?
- What are your favorite foods? Why are those your favorite foods?
- Is there a certain meal that makes you feel good? Safe? Cared for?
- What is it about that meal that makes you feel that way?
- What is the history of the foods associated with your heritage? From where did that food originally come? Was it native to the lands of your "people" or was it introduced by another culture?

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- How much of your and your family's diet reflects your traditional heritage?
- Is your diet healthy?
- Do you have any family members with diabetes? Or do you have diabetes? How does that make you feel?
- What ideas do you have to honor your health, food, and culture?
- How do you think honoring your health, food, and culture will make you feel?

Students should be given the opportunity to edit their work multiple times. Repeated editing will produce strong writers and generate a work of which a student can be proud. You may even consider not accepting a piece until it is at least a 70% or C level. Students may complain at first, but with consistency over the course of a school year their attitude changes for the better and so does their writing.

Teacher Preparation

MATERIALS:

- Copies of the **Student Handout**
- If students are doing research, Internet access and/or books on food, culture, and U.S. history (refer to the Librarian Resource Section for Internet websites and book references.)

- Make copies of the **Student Handout.**
- If you are the first teacher in your team to use this FACT FILE, make copies of the student handout entitled, **Student Introduction: Environmental Health and Diabetes**. Ensure that students have read the handout and mastered the vocabulary.
- This lesson would be best if implemented following the social studies lesson "New Mexico History and Food," but it is not required. The social studies lesson will provide students with a more thorough, historical concept about the relationship between food, culture and history and how that shaped where we are today in terms of our dietary habits and subsequent health effects.

Procedure

- Give students the **Student Handout** and review the instructions.
- Provide guidance on essay writing and your expectations for the product (review the Assessment Guidelines as needed).
- Initiate a dialogue with the students about food, culture and diabetes. Use the writing prompts included in the Background section to help the process.
- Inform the students that they will be writing multiple drafts. Explain that like everything writing takes practice and even the most practiced writers re-write and refine their work many, many times.

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Extension Activities

- Students can write an editorial or position paper on whether or not schools should ban soda machines and change their food offerings in the cafeteria, or even whether the state of New Mexico should require such a change by law (which there have been attempts to do).
- Students can write an editorial or position paper on whether or not the state of New Mexico should require physical education in all schools, or just elementary and/or middle schools.

Student Assessment

Did students create a thoughtful essay that shares their cultural food history and personal relationship to food?

Did students correctly cite references (if applicable)?

Did students use correct grammar, logic, and good sequential flow in their writing?

Did the student provide rich, descriptive details in their essay?

Did the student edit their work enough times to generate an essay worthy of at least a grade of 70%?

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FOOD, CULTURE AND DIABETES: A PERSONAL REFLECTION

Teacher Key

Essay

Write a two-page essay about your own cultural history with respect to food and your personal relationship with food. Be sure to incorporate or consider diabetes in your essay and how you may be able to honor your cultural food heritage while eating healthy. You may want to discuss if you have any family members with diabetes, whether you have diabetes, or how you feel about diabetes. Be sure to use good grammar, have a clear thesis, and statements with sufficient description and/or evidence to back your position. Be descriptive and expressive about your thoughts, feelings, and experiences. Conduct research as needed to learn about your cultural food history and properly cite resources. Follow your teacher's instructions with respect to citing references, drafts, edits, and re-writes (writing, editing and refining multiple drafts makes you a good writer!)

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Math Lesson: BALANCING ACT

Lesson Overview

Students read background information on diabetes, nutrition, label reading, and energy balance (energy intake versus output). Students then find the fat, carbohydrate, protein, and caloric value for two lunch examples and determine whether their previous day's activity would have burned off the calories from either of the lunches. A homework assignment is included to give students an opportunity to look more closely at their eating and activity behaviors.

New Mexico State Education Standards

This lesson addresses the following New Mexico State Education Standards in Science for grades 5-8.

- (To be added)

Teacher Background

The student materials provide sufficient background information for this activity. For additional information on diabetes, nutrition, and exercise consult the following resources:

Websites here

Teacher Preparation

Copies of Balancing Act Student Handouts #1 and #2. If students are assigned the homework, copy handouts #3 and #4.

- Make enough copies of the **Student Handouts** for each student to have a set.
- If you are the first teacher in your team to use this FACT FILE, make copies of the student handout entitled **Student Introduction: Environmental Health and Diabetes**. Ensure that students have read the handout and mastered the content and vocabulary.

Procedure

- Distribute the **Balancing Act Student Handout #1: Food Labels**. Have the students read the material and discuss as needed to reinforce reading and advance understanding.
- Distribute the **Balancing Act Student Handout #2: Energy Balance**. Inform the students that are going to calculate the calories for two different lunches. This would be the "calories eaten" in our energy balance model. Next they will estimate the number of calories they burned based on

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yesterday's activities. This is the "calories used" in our energy balance model.

- After the students have completed their work, review Section 1 and Section 2 of the **Balancing Act Student Handout #2**.
- Assign homework as desired and distribute **Balancing Act Student Handout #3** and **#4**. In this assignment students keep track of their personal food intake and activities for one day. Then they write a self-reflection paragraph summarizing what they learned about their eating and activity behaviors and how that may impact their personal general health, well-being, risk of diabetes, and self-esteem.

Extension Activities

Websites

1. http://www.diabetes.org/home.jsp click on Take the Diabetes Risk Test. Answer quiz questions to estimate if student is at risk for diabetes. For most accurate results the quiz should be done after Section 2 is completed, so student has some idea of activity level.
2. http://www.caloriecontrol.org/exercalc.html has a more extensive activity checklist, to enhance Section 2.

Additional Lunch Models

1. Students bring to class a contribution for a potluck picnic. The class then reads and answers Section 1 questions using the food labels they brought in to class. This version gives the students a good picture of the type of food choices they make daily.
2. Students could evaluate the food eaten in their cafeteria.

Different Activity Calculator

1. Use pedometers to calculate average steps and energy expenditure used from students' own activities.

Student Assessment

- Did students participate in the lesson: completing in class questions, homework, and self-evaluation summary?
- Did self-evaluation summary demonstrate an understanding of caloric intake and expenditure, and the impact this process has on diabetes?

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BALANCING ACT: Food Labels
Student Handout #1

Teacher Key

A Look at Food Labels

"You are what you eat." There may be some truth to that old saying. Through extensive research, scientists have learned that what we eat influences our health. A balanced diet and exercise supports good health. On the other hand, a diet high in fat combined with an inactive lifestyle increases our risk for not only diabetes, but also cancer, stroke, and heart disease. The U.S. Department of Agriculture (USDA) is a government agency that establishes guidelines in order to aid us in making healthier food choices.

*Don't get stuck on certain foods, but, rather, eat a wide variety.
*Keep simple sugars and refined flour (like candy, cookies, and white bread) and sodium to a minimum.
*Choose foods low in saturated fats and cholesterol (e.g. minimize things like hamburgers and fried chicken, eat food like olives and nuts).
*Include plenty of whole-grain products for fiber (like whole wheat bread).
*Make a "rainbow" out of your plate with vegetables and fruits to ensure you are consuming wide variety of nutrients.
*Grab most often for the foods that do not have a label (i.e. fresh fruits and vegetables)

So, what does that label on the side of food packages mean? The food label tells us information about the food inside the package. The USDA created this nutritional tool to aid us in following their guidelines. In order to make healthy food choices, it is important to learn how to read the different parts of a food label.

Macaroni & Cheese

Nutrition Facts
Serving Size 2.5 oz (70g/about ½ cup macaroni and 2 tablespoons dry cheese mix)
Makes about 1 cup prepared
Servings Per Container about 3

Amount Per Serving	As Packaged	Prepared
Calories	260	400
Calories from Fat	15	150
		% Daily Value**
Total Fat 2g*	3%	27%
Saturated Fat 1g	4%	17%
Cholesterol less than 5mg	1%	2%
Sodium 720mg	30%	37%
Total Carbohydrate 50g	17%	17%
Dietary Fiber 2g	7%	7%
Sugars 5g		
Protein 9g		
Vitamin A	0%	15%
Vitamin C	0%	0%
Calcium	8%	10%
Iron	10%	10%

* Amount in unprepared product
** Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories	2,000	2,500
Total Fat	Less than	65g	80g
Saturated Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Serving Size
This is the first nutritional fact listed on the label. It is the total amount of food a person would need to eat to get the amount of listed nutrients. For example, the serving size for macaroni and cheese is 1 cup after it is cooked. So, by eating 1 cup you would consume all the nutrients listed on the label. Next, look at how many servings there are per container. This package says there are 3 servings. This would mean if you ate the whole package, you would be consuming three times the calories and nutrients listed on the label.

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Calories

A calorie is a unit of measurement that measures how much energy food provides for our bodies. The amount of calories required for individuals differs according to age, weight, gender, and activity level. Most school age children require 1600-2500 calories per day, but young adolescents entering puberty require 2500-3000 calories per day. Food labels are based on a 2,000-calorie per day diet.

Calories from Fat

This number, which is right by the total calories, tells us how many calories are coming from fat in one serving. It is a helpful number for people who are carefully monitoring their fat intake. It is recommended that no more than 30% of total calories come from fat. If you consumed 2500 calories over the course of a day, only 750 of those calories should come from fat (750 calories divided by 2500 total calories multiplied by 100). Let's look at how many calories from fat are in one prepared serving of macaroni and cheese (prepared means milk and butter were added as instructed). This label says that 150 calories from the total 400 calories come fat. If we calculate the percentage (150/400 x 100), 37.5% of the calories in one serving come from fat.

Percent % Daily Values

These are the percentages listed in the right hand column of the label. These percentages tell us how much of our daily value of certain nutrients we are getting if we eat one serving of that food. One serving of prepared macaroni and cheese provides 15% of the **Recommended Daily Allowance** (RDA) of Vitamin A. Our daily goal is to consume 100% of each of the nutrients listed. Therefore, this one serving is providing us with 15% of our daily goal.

Recommended Daily Allowance (RDA): The amount of a nutrients per day people need to stay healthy. The RDA was developed by the National Academy of Sciences/National Research Council and are updated based on research.

The percent daily values give us a general guideline for figuring out if a food is high or low in nutrients. Foods low in nutrients have daily values that are less than 5%. Values that are 10-19% are a good source of nutrients. Over 20% value is a food that is a high source of nutrients.

% Nutrients	Value of Nutrient Source
5%	Low
10-19%	Moderate
More than 20%	High

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Total Fat

This number tells us how much fat is included in one serving and is measured in grams (g). All fat is not bad for us. We do need some fat in our diets because it is an important source of energy. Fat also provides our bodies with insulation and cushioning for our skin, bones, and our body's organs. Fat even helps carry some nutrients throughout our body and helps store these vitamins (A,D, E, and K) in our body's tissues. Some types of fats are better than others, for example fats found in fish, nuts and olive oil are healthier than fats from beef or pork. We do need healthy fats as part of our daily diet, however, eating too much fat leads to obesity and other health problems. Fat should be limited to 30% of the total day's calories (for a 2000 calorie/day diet that is 600 calories from fat).

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Saturated Fat and Trans Fat

This number tells us how much of the total fat is made up of saturated and/or trans fats. Saturated fat comes from animal products. Butter, ice cream, cheese, whole milk, and meats are examples of saturated fats. Trans fats are also found in these foods, but trans fats are also vegetable oils that are specially treated or hydrogenated. If trans fat is not listed on the label, look for words like hydrogenated or shortening. These give us a clue if the food we are eating has trans fat. So why should we look for the amount of saturated and trans fat? Because these are unhealthy fats which raise cholesterol and can increase our risk for developing diabetes and heart disease. Think about a stick of butter. It can be melted, but it is normally solid at room temperature. Now imagine how this can clog our arteries!

Unsaturated Fat

These are sometimes referred to as the "good" fats. We can distinguish these from the "bad" fats, because these are liquid at room temperature. Vegetable oil, nuts, and fish are sources of unsaturated fat. These fats do not raise our cholesterol levels.

Cholesterol

Some cholesterol is important in our diet for some of our hormones and for producing Vitamin D. However, our liver produces most of the cholesterol that we need, so we don't need to eat much of it. Cholesterol can become a big problem if we eat too many of the foods that contain large amounts of cholesterol. Meat, as well as many fast foods and fried foods contain cholesterol. High levels of cholesterol in our bodies contribute to diabetes.

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Dietary Fiber		25g	30g

Total Carbohydrate

This is a total of the dietary fibers, sugars, and other carbohydrates (or carbs) that make up one serving. Carbs can either be simple or complex. Simple carbs are called sugars, and complex carbs are called starches. The best sources of carbohydrates are whole-grain cereals, rice, whole-grain breads, pastas, potatoes, vegetables, and fruits. Carbohydrates are a good source of calories that provide us with abundant energy. It is recommended that at least 50% of our total daily calories come from carbohydrates.

Sugars

Sugars can be found in either starches or simple sugar carbohydrates. Pasta is a starch that is high in complex carbohydrates so it is a healthy food choice. Chips, candy, and soda are examples of simple sugars and should be limited in our diet. The calories found in simple sugars are often called “empty calories” because they provide no nutrients for us--just calories! These sugars also raise blood glucose levels very rapidly. You know that mid-afternoon feeling of wanting to take a nap? Well that is often a sign that we are eating too much simple sugars and have rapid rises and falls of blood sugar levels.

Dietary Fiber

Dietary fiber has no calories, but we need fiber in our diet to help reduce cholesterol and promote bowel regularity. Fiber also helps us feel full and is good if we want to reduce calories but not be hungry.

Protein

Our body’s muscles, skin, and immune system are made of proteins, so we need to eat them to stay strong and healthy. We should consume anywhere from 10-20% protein in our daily diet. Young adolescents really need to eat protein because protein helps us to grow. If our bodies do not get enough energy from carbohydrates and fat, it uses protein for energy. Low-fat milk, egg whites, soybeans, meat, fish, poultry, cheese, yogurt, and nuts are excellent sources of protein.

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The Footnote at the Bottom of the Food Label

There is a final chart at the bottom of most food labels. This chart lists the daily-recommended dietary intake for all Americans based on either a 2000 or 2500 calorie diet. Notice how the fat and carbohydrate information changed based on the different intake of calories. What remained the same for both diets? Yes, cholesterol and sodium intake should always remain the same.

Calories per Gram

These numbers are usually in the chart near the bottom of the food label. They remind us how many calories are in one gram of fat (90 calories), protein (4 calories), and carbohydrates (4 calories).

Macaroni & Cheese

Nutrition Facts

Serving Size 2.5 oz (70g/about ½ cup macaroni and 2 tablespoons dry cheese mix)
Makes about 1 cup prepared
Servings Per Container about 3

Amount Per Serving	As Packaged	Prepared
Calories	260	400
Calories from Fat	15	150
		% Daily Value**
Total Fat 2g*	3%	27%
Saturated Fat 1g	4%	17%
Cholesterol less than 5mg	1%	2%
Sodium 720mg	30%	37%
Total Carbohydrate 50g	17%	17%
Dietary Fiber 2g	7%	7%
Sugars 5g		
Protein 9g		
Vitamin A	0%	15%
Vitamin C	0%	0%
Calcium	8%	10%
Iron	10%	10%

* Amount in unprepared product
** Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories	2,000	2,500
Total Fat	Less than	65g	80g
Saturated Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Nutrients to Note

Vitamin A
The food label usually lists important nutrients as a part of the percent (%) daily value of one serving. Vitamin A is a common nutrient listed. It is important for good eyesight and healthy skin.

Vitamin C
Vitamin C is necessary for healing wounds and fighting colds and infections. The best sources are citrus fruits.

Iron
Our bodies need iron for making new, healthy red blood cells every 3 months. It is important to get lots of iron in our diet, because our red blood cells carry the oxygen that we need throughout our bodies. Iron-fortified cereals, raisins, and dark green, leafy vegetables are good sources of iron.

Sodium
Sodium refers to the amount of salt in the serving. The USDA recommends that sodium intake is limited to 2,400 milligrams (mg) per day. Sodium helps the body maintain its balance of water and acids, but too much sodium can cause high blood pressure. The average American diet consumes too much sodium, typically between 4000-5000 mg per day.

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BALANCING ACT
Student Handout #2

Teacher Key

Section 1, Energy In:

- Use the lunch examples below to answer the following questions.

Lunch 1
Pizza
Candy bar
Soda

Lunch 2
PBJ on whole wheat
Apple
Water

Bread

Nutrition Facts
Serving Size 1 Slice (26g)
Servings Per Container 26
Calories 70
Calories from Fat 10

Amount/serving	%Daily Value*	Amount/serving	%Daily Value*
Total Fat 1g	2%	**Sodium** 140mg	6%
Saturated Fat 0g	0%	**Total Carbohydrate** 12g	4%
Polyunsaturated Fat 0g		Dietary Fiber 1g	4%
Monounsaturated Fat 0g		Sugars 1g	
Cholesterol 0mg	0%	**Protein** 2g	

Vitamin A 0% • Vitamin C 0% • Calcium 2% • Iron 4%
Thiamine 8% • Riboflavin 0% • Niacin 4% • Folate 4%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

F2612426
INGREDIENTS: ENRICHED WHEAT FLOUR [FLOUR, BARLEY MALT, FERROUS SULFATE (IRON), "B" VITAMINS (NIACIN, THIAMINE MONONITRATE (B1), RIBOFLAVIN (B2), FOLIC ACID)], WATER, MOLASSES, YEAST, WHEAT BRAN, WHOLE WHEAT FLOUR, WHEAT GLUTEN, HIGH FRUCTOSE CORN SYRUP, CONTAINS 2% OR LESS OF: SOYBEAN OIL, BUTTER, HONEY, SALT, DOUGH CONDITIONERS (SODIUM STEAROYL LACTYLATE, CALCIUM DIOXIDE, CALCIUM IODATE, ALPHA AMYLASE), DATEM, DICALCIUM PHOSPHATE, DIAMMONIUM PHOSPHATE, ENZYMES, CALCIUM SULFATE, VINEGAR, MONOGLYCERIDES, SOY FLOUR, CALCIUM CARBONATE. 120186

CONCORD
Grape Jelly

Nutrition Facts
Serving Size: 1 tbsp (20g)
Servings Per Container: 31
Amount Per Serving
Calories 50

	% Daily Value*
Total Fat 0g	0%
Sodium 15mg	1%
Total Carb. 13g	4%
Sugars 13g	
Protein 0g	

*Percent Daily Values are based on a 2,000 calorie diet.

Soda Pop

Nutrition Facts
Serving Size: 1 Can
Servings Per Container: 12
Amount Per Serving
Calories 150

	% Daily Value*
Total Fat 0g	0%
Sodium 55mg	2%
Total Carb. 40g	13%
Sugars 40g	
Protein 0g	

*Percent Daily Values are based on a 2,000 calorie diet.

CARBONATED WATER, HIGH FRUCTOSE CORN SYRUP AND/OR SUGAR, CARAMEL COLOR, PHOSPHORIC ACID, ARTIFICIAL AND NATURAL FLAVORS, SODIUM BENZOATE (PRESERVATIVE), CAFFEINE.

Pizza

Nutrition Facts
Serving Size ½ Pizza (155g)
Servings Per Container 2
Amount Per Serving
Calories 380 Calories from Fat 190

	% Daily Value*
Total Fat 21g	33%
Saturated Fat 5g	26%
Cholesterol 15mg	6%
Sodium 840mg	35%
Total Carbohydrate 35g	12%
Dietary Fiber 2g	7%
Sugars 3g	
Protein 13g	

Calcium 15% • Iron 10%
Not a significant source of vitamin A and vitamin C.
*Percent Daily Values are based on a 2,000 calorie diet.

Nutrition Facts
Serving Size 1/3 bar (35g)
Servings Per Container 72
Amount Per Serving
Calories 170 Calories from Fat 70

	% Daily Value**
Total Fat 8g	12%
Saturated Fat 3g	15%
Trans Fat 0g	
Cholesterol 5mg	2%
Sodium 85mg	4%
Total Carbohydrate 21g	7%
Dietary Fiber 1g	4%
Sugars 18g	
Protein 3g	

Vitamin A * • Vitamin C *
Calcium 2% • Iron *
Thiamine 2% • Riboflavin 2%
Niacin 4%

*Contains less than 2% of the Daily Value of these nutrients.
**Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat. Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

MILK CHOCOLATE (SUGAR, COCOA BUTTER, CHOCOLATE, LACTOSE, SKIM MILK, MILKFAT, SOY LECITHIN, ARTIFICIAL FLAVOR), PEANUTS, CORN SYRUP, SUGAR, SKIM MILK, BUTTER, MILKFAT, PARTIALLY HYDROGENATED SOYBEAN OIL, LACTOSE, SALT, EGG WHITES, ARTIFICIAL FLAVOR.
Allergy Information: May contain almonds.

Candy Bar

Apple
0 grams of fat,
30 g of carbohydrates,
0 g of protein,
Calories 120

Peanut Butter

Nutrition Facts
Serving Size 2 Tbsp (32 g)
Servings Per Container 16
Calories 200
Fat Cal. 140
*Percent Daily Values (DV) are based on a 2,000 calorie diet.

Amount/serving	%DV*	Amount/serving	%DV*
Total Fat 16g	25%	**Total Carb.** 7g	2%
Sat. Fat 3g	15%	Fiber 2g	8%
Cholest. 0mg	0%	Sugars 3g	
Sodium 160mg	7%	**Protein** 8g	

Vitamin A 0% • Vitamin C 0% • Calcium 0% • Iron 2%

INGREDIENTS: PEANUTS, DEXTROSE, HYDROGENATED VEGETABLE OIL (RAPESEED, COTTONSEED, SOYBEAN), SALT.

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1. Refer to the food labels on page 73. What are the fat, carbohydrate, protein, and calorie values for lunch 1 and 2? Fill in the table below.

Lunch			Total Fat (grams)	Total Carbohydrate (grams)	Protein (grams)	Calories
Lunch 1	Pizza (x 2)		42	70	26	760
	Candy Bar (x 3)		24	63	9	510
	Soda (1 can)		0	40	0	150
	TOTAL LUNCH 1		66	173	35	1420
Lunch 2	PBJ on whole wheat	Peanut Butter (2 tbsp)	16	7	8	200
		Jelly (1 tbsp)	0	13	0	50
		2 slices of whole wheat bread	2	24	4	146
	Apple		0	30	0	120
	Water		0	0	0	0
	TOTAL LUNCH 2		18	74	12	516

2. What is the difference in caloric values between the 2 lunches?

1420 - 516 = 904 calories

3. Based on a 2000-calorie diet, what percentage of the daily caloric allowance is from lunch 1 and lunch 2? (calories from lunch/2000 calories x 100)

1420/2000 X 100 = 71%

516/2000 X 100 = 25.8%

4. Add your lunch calorie totals to the following two scenarios to get a total caloric intake for a day.

	Breakfast	Lunch	Dinner	Snacks	Total Calories
Whole Day Calories Example 1	Hot cakes, syrup, butter, sausage, and orange juice	Lunch 1:	Large cheeseburger, French fries, and soda	Tortilla chips, chocolate chip cookies, soda	
Calories	517	1420	1120	696	**3753**
Whole Day Calories Example 2	Raisin bran, 1% low-fat milk, low-fat ham steak	Lunch 2:	Grilled chicken breast, broccoli, brown rice, water	Yogurt (fat-free, fruit), dry-roasted almonds, carrots, 3 stalks celery, water	
Calories	514	516	325	325	**1680**

Section 2, Energy Out:

- Put a check next to the activities you participated in yesterday, then calculate the total calories you used or expended. The listed number of calories burned is for approximately 30 minutes of activity. If you did an activity for an hour, then multiply the number of calories by 2. If you did the activity for 15 minutes, then multiply the number of calories by 0.5.
- The resting metabolic rate is the base number of calories burned for your body to function. For example, energy is used to keep your body temperature ay 98.6° F, it's used for your heart to beat, for your cellular processes, and even thinking. The resting metabolic rate varies from person to person, but for this example we will assume everyone has a resting metabolic rate of 1100 calories.

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Activity	Length of Time You Did the Activity (in hours)	Calories Used in 1 Hour(multiply by the length of time in hours)	Total Calories Used
☐ Aerobics		270	
☐ Baseball		234	
☐ Basketball		270	
☐ Bicycling		294	
☐ Dancing		128	
☐ Housecleaning		262	
☐ Football		366	
☐ Jogging		450	
☐ Soccer		312	
☐ Sweeping		112	
☐ Swimming		402	
☐ Walking – briskly		264	
☐ Walking – Normal		130	
☐ Watching TV		48	
☐ Weight lifting		312	
☐ Yoga		240	
Resting metabolic rate			1100
		TOTAL CALORIES USED	

- Answer the following questions:

1. Did your activities from yesterday burn off calories from the Whole Day Calories Example 1 or Whole Day Calories Example 2? Show your calculation and explain.

Answers will vary

2. What kind of activity and for how long is needed to burn off calories from the whole day's caloric intake? Show your calculations.

Check correct calculations

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BALANCING ACT: Homework
Student Handout #3

Teacher Key

1. Use the table below to keep track of the following information for 1 day. When possible, look at the food labels to get the total calories for each food you eat. Be sure to pay attention to the serving size! The serving size for cookies may be 2 cookies, but if you eat 4 cookies you have to multiply the number of calories listed on the package by 2.

   Refer to the Student Handout #5: Calories of Common Foods for calorie values.

Time of Day	Food Eaten	Calories Eaten	Activity	Calories Used	Food and/or Activity Alternatives
Morning Wake-up-11 a.m.					
Mid-Day 11 a.m.-2 p.m.					
Evening 5 p.m.-bedtime					
	TOTAL CALORIES EATEN		TOTAL CALORIES USED		

2. Write a self-reflection summary of what you learned about your own eating and activity level. Discuss the impact your behaviors may have on your general health, overall well-being, risk of diabetes, and self-esteem.

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BALANCING ACT: Calories of Common Fast Foods
Student Handout #4

Teacher Key

Reference: http://www.annecollins.com/calories/calories-fast-food.htm
This website has calories for many other foods as well.
Index of Nutrition and Calories in Food: http://www.calorie-counter.net/nutrition-calories-in-food.htm
Calorie-count.com: http://www.calorie-count.com/calories/item/8013.html

Food	Calories
Beans – refried (3.5 oz)	94
Beans – Red Kidney (3.5 oz, canned)	85
Beans – Garbanzo (4 oz)	75
Breakfast - Cheerios	111
Breakfast - Pop Tarts	369
Breakfast - Nutrigrain cereal bar	140
Breakfast – pancakes w/ butter and syrup	
Breakfast - Raisin Bran	188
Breakfast – 1 Krispy Kreme Glazed	220
Condiments - Ranch Dressing (1 pkg)	230
Condiments – Catsup (3.5 oz)	95
Dairy - Cottage cheese (low fat, 3.5 oz)	87.5
Dairy - Nacho cheese (3.5 oz)	356

Food	Calories
Meat - Chicken Nuggets (No Sauce)	300
Meat - Hot Dog (with Chili meat & bun)	325
Meat - Chicken breast, oven roasted	180
Meat - Burrito, beef	238
Meat - Beef, Sirloin	154
Meat - Bologna	313
Meat - Turkey, lunch meat	126
Meat - Salmon steak (6 oz)	250
Meat - Canned Tuna (3.5 oz)	128
Meat - Fish sticks	290
Meat - Cheeseburger (Large)	610
Meat - Hamburger (Large)	520
Meat - Fried Chicken	450

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Food	Calories
Dairy - Eggs (1 large)	75
Dessert - Hot Fudge Sundae	290
Dessert – Brownie (3.5 oz)	405
Dessert – Chocolate Chip Cookie (3.5 oz)	481
Fruit – apple (1 medium)	85
Fruit – Banana (1 medium0	90
Fruit - Orange	70
Grain - Rice	114
Grain- Noodles (1 cup)	340
Juice – Orange (3.5 oz)	45
Juice – Apple (3.5 oz)	47

Food	Calories
Other - Pizza – (Pepperoni, one 14” slice)	220
Other – Cheese Enchilada (3.5 oz.)	196
Other – Nachos w/ cheese	65
Vegetables - French Fries (Large)	500
Vegetable - Baked potato (w/ skin)	198
Vegetable - Asparagus (3.5 oz)	20
Vegetable - Broccoli (3.5 oz)	34
Vegetable - Carrots (3.5 oz)	35
Vegetable - Celery (1 stalk)	5
Vegetable - Corn-on-the-cob (with butter)	106
Vegetable - Green Salad (no dressing)	30

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DIABETES Resources for the Librarian

General Background Resources on Diabetes

The following resources are intended to provide additional information and in-depth research opportunities for teachers and students studying environmental health and asthma. Visit the IEHMSP website for more teacher and student resources at: http://depts.washington.edu/iehms

Internet Resources

New Mexico-specific Resources for Training & Support

New Mexico Department of Health, Diabetes Prevention Program
www.diabetesnm.org

New Mexico Health Care Takes on Diabetes
www.nmtod.com

Healthier Schools of New Mexico
www.healthierschools.org

General Resources

Diabetes at School: What school Personnel Need to Know, American Diabetes Association, http://www.diabetes.org/advocacy-and-legalresources/discrimination/school/schooltraining.jsp

Diabetes in Children and Adolescents Fact Sheet, National Diabetes Education Program, http://www.ndep.nih.gov/diabetes/youth/youth_FS.htm

Prevalence of Diabetes, U.S. Center for Disease Control http://www.cdc.gov/diabetes/statistics/prev/national/figpersons.htm

Resources on Children and Adolescents, National Diabetes Education Program, http://www.ndep.nih.gov/diabetes/youth/youth.htm

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School Personnel: Diabetes Support

Introduction

The incidence of diabetes is on the rise nationally and within New Mexico. According to the CDC the number of Americans with diabetes increased from 5.8 million to 13.8 million people between 1980 through 2003. Although people older than 65 constitute almost 40% of the people with diabetes, diabetes is increasing across all age groups. 151,000 children have (1 in 400)

Diabetes disproportionately affects African American, Hispanic, and Native American populations compared to Anglos. Obese children in these populations have an increased risk for diabetes and the risk is even greater if a child's relative has the disease. Because of the overall increase of diabetes in youth and the high-risk populations present in New Mexico, school personnel need to be familiar with diabetes, its treatment, and prevention.

There are many levels school personnel can provide positive support for the treatment and prevention of diabetes. For example, modifying the food selections at the school and offering guided physical activity (beyond recess) for 30 - 60 minutes a day would make a significant positive impact on the disease. This is because children spend a large fraction of their day at school and many students depend almost solely on the food provided at schools.

Diabetes is a disease that requires ongoing management. Thus, school personnel are often put into a position of providing some level of support for a child with diabetes. The type and extent of support depends on a number of factors including the student's age, the severity of the diabetes, parent/caregiver involvement, the ability of the student to self-manage, and the presence of trained health-care professionals in the school or community.

The Diabetes Support section of this curriculum is intended to provide some resources and guidelines for school personnel in diabetes prevention, as well as, helping students manage the disease. Although this document was developed in conjunction with physicians and school nurses and is based on established materials used by the National Diabetes Education Program, local New Mexico School Districts, and the New Mexico Public Education Department School and Family Support Bureau, this document does not replace or substitute for physician care or student-specific treatment plans. The goal of this Diabetes Support section is to provide a starting point for school personnel to understand some of the major prevention and control issues for diabetes so that the best care is being provided to students at all schools.

The primary aspect to remember is that managing diabetes occurs 24 hours

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a day, 7 days a week. There needs to be a balance of healthy food and exercise, and, if needed, insulin and medication. The following section provides additional information on counseling support, diabetes symptoms, personal diabetes plans, and school personnel turnover and personnel support.

Counseling Support

- Watch for depression and eating disorders in students.
- Provide support to help students avoid tobacco (exacerbated cardiovascular, circulatory problems) , alcohol (blood sugar), and drugs.
- Help students manage scheduling issues and pressures.

Diabetes Symptoms

- Symptoms do not always occur when a student has diabetes. Below is a list of common symptoms to watch for in both diagnosed and undiagnosed students.
- Increased thirst, hunger, urination, blurred vision, feeling tired a lot, weight loss, high blood pressure.
- Skin around the next and armpits appears dark, thick, and velvety.
- Hypoglycemia (blood sugar is too low) – this presents the greatest immediate health danger for people with diabetes. Student may appear nervous, shaky, confused, have a sudden change in behavior, sweaty, pale, headache, weak, blurry vision, loss of consciousness, and seizures.
- Hyperglycemia – student may experience increased thirst, frequent urination, fatigue, blurry vision, diabetic ketoacidosis, fruity breath odor, nausea, vomiting, stomach pain, deep breathing, increasing sleepiness.

Personal Diabetes Plan – Students should have individual plans that include:

- Meal plans with portion sizes, times to eat, specific carbohydrates (complex, low glycemic).
- An exercise plan which includes when to exercise and for how long, and instructions that students do not exercise if blood glucose levels are below a specific level.
- A monitoring plan with specific times to use a blood glucose meter to track blood glucose levels (before eating, exercise, or if there are symptoms of hyper or hypo-glycemia), urine ketone testing, and when and where monitoring will occur. It is recommended that students be allowed to self-monitor anywhere at any time needed. Students will need a disposal container of heavy-duty plastic or metal with tight lid. Student and support staff need to be trained on local waste disposal laws for biohazards.
- A medication plan that includes the student's insulin type (rapid acting, intermediate or long), dosage and delivery system (syringe, pen, pump), and glucagons administration, when and where given and by who, hyperglycemia extra water, supplemental insulin, medication storage (30 days at room temp or 3 months if refrigerated, store unopened vials in refrigerator separate labeled box or medication-only refrigerator). When school nurse is not available to administer insulin it is recommended that two trained personnel verify the medication dose prior to administration.

- A school plan. Parents or guardians need to be present when making the plan and notified if changed, identify school staff responsible for implementing the plan, identifying medical emergencies, and who to contact.
- An emergency plan. The student should never be left alone or sent somewhere when experiencing symptoms of hypoglycemia. To immediately treat hypoglycemia administer 3-4 glucose tablets, 3/4 tube (3 tsp) glucose gel, 4 ounces juice, or half a can of non-diet soda, then recheck glucose level 10-15 minutes later. Repeat glucose treatment if the student is still below the target range. If a student becomes unconscious, turn him/her on the side, contact school nurse or trained personnel, and administer glucagons if such instructions are in the student's plan. If student is exhibiting symptoms of hyperglycemia, vomiting or there are ketones in the urine that will not go away when given additional water and/or insulin call parents and contacts according to the plan. Notify 911 and parents as needed, if there are no glucagons then call 911 immediately.
- Consider these plans in conjunction with any Section 504 Plans or IEPs a student may have, such as free access to restroom and water fountain, allowance of food and drink in class, alternative times for exams if student is experiencing hypo or hyperglycemia, permission for absences for diabetes-related illness and appointments, maintaining student's privacy and confidentiality.

School Personnel Turnover and Personnel Support

School personnel turnover is problematic in New Mexico schools and can result in dangerous gaps in care for students with diabetes. Some ways that schools can maintain support for diabetic students even with new staff are:

- Have the principal or assistant principal generate a three-ring binder that contains checklists for any new personnel. The check list may need to be specific to the position, such as, one for teachers, administrators, nurses, etc. The check-list should refer the personnel specific resources within the school and "what to do if" scenarios.
- One resource that should be available to all teachers in a single, central location are quick-reference binders relating to important issues. Do not have one huge binder with all of the school's information and plans together. Separate handbook sections into individual binders that are clearly labeled, e.g. emergency plan, student health care instructions, IEPs, personal plans for students with diabetes, etc.
- A student's personal diabetes plans and/or IEPS can be sorted by grade and alphabetically. Summaries should be on the front of those plans so the person reviewing the information does not have to "dig" to find information they need to know. If IEPs and diabetes plans (or other healthcare plans) are in separate binders, then cross reference so the teacher knows to look for more information elsewhere. Files that contain sensitive student information need to be locked.
- Teachers may have their own copies of some of these materials, however, they are often misplaced, not updated, and, in the rush of getting a new person "up to speed," not always given to new personnel. By having the check list a simple sheet of paper is given to the teacher and everyone knows

where to go for the most up-to-date versions of information and materials.

- When key personnel who may have specific information about a students (such as updated health information in a file somewhere) leave school employment, have that person update the central binder as a requirement of their departure.
- Provide professional development. Professional development is one method where all school personnel can be trained to better support the needs of students, including dealing with specific health needs like diabetes. With respect to students with diabetes, the NCLB instructs that teachers must provide effective instruction methods for teaching children with special needs. Health and science teachers can enhance that students specific understanding of the disease through their classroom and personal learning. In general, teachers need to be prepared to accommodate the learning of diabetic students in circumstances where they must leave class to administer medication or when they are absent to their illness.

Supporting school personnel is important in keeping them employed at your school. It is best to have people with clear, specific roles and not ask too much of any one person, especially teachers. In many schools teachers have been asked to take on more and more administrative responsibilities. Managing and teaching multiple subjects and large classes is enough of a challenge for teachers, and it becomes that much more complex (and potentially overwhelming) when teachers have to remember and meet the variety of student's needs. Try to make the teacher's job of supporting diabetic students as simple as possible, by using the quick-reference check lists and binders and having counselors and health-care support work closely with teachers. Some of the general methods for retaining teachers also apply to helping teachers support students with special needs. For example The National Commission on Teaching and America's Future (NTAF www.nctaf.org) have several useful strategies that could apply to better supporting special-needs students, including.

- Creating strong learning communities in schools to break down the barriers that isolate teachers. Restructure small learning communities to allow teachers to have the necessary time, flexibility, and resources needed to meet the various needs of the students.
- States, school systems, unions, and school boards need to provide superior staff who can act as mentors for new staff and teachers, support new teachers, promote professional development, and recognize and reward accomplished teachers.

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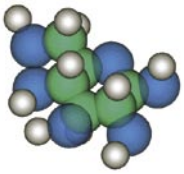
Master Copies of Student Handouts



Student Introduction: ENVIRONMENTAL HEALTH AND DIABETES

Student Handout

Name _____

Date _____

What is Environmental Health?

Your health depends on the environment around you. **Environmental health** is the study of how the environment affects human health. It differs from the study of how humans affect the environment, because it focuses on people's health. An environmental scientist might study how water pollution is hurting fish. An environmental health scientist would study what happens to the health of people when they catch and eat those fish. Environmental health is not just about the health of the environment – it always comes back to you and whether the environment you are part of is helping you stay healthy, or making you sick.

Environmental Health: How the environment affects human health.

Hazard: Something that can harm the health of humans or the environment.

Chemical: Any substance that is made from elements combined into molecules.

Every day, you come in contact with things in your environment that can help you or hurt you. Some of these things are important for keeping you healthy, such as oxygen or medicines. However, some of these things may be harmful to your health, such as tobacco smoke or snake venom. Things in the environment that are harmful are called **hazards** and include things like **chemicals**, disease-causing bacteria, loud noises and even stress. Hazards can be natural or human-made.

People working in the fields of environmental health do many different jobs. They work to identify environmental hazards, and prevent people from being harmed by them. Some are scientists working in laboratories. Some work for the government writing regulations and studying pollution. Some work for corporations to help make sure that workplaces are safe and that the environment is kept as clean as possible. Most of these jobs require a solid understanding of science and math, knowledge about history and the law, and good communication skills.

To understand the field of environmental health, you need to understand seven core concepts: **Toxicity, Exposure, Dose, Response, Individual Susceptibility, Risks, Benefits,** Environmental Justice, and **Community Resources and Action**.

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1. TOXICITY

Toxicity:
A measure of how dangerous a chemical is.

Toxicology:
The study of the harmful effects of chemicals on living things.

Source of Exposure:
A hazard's point of origin, such as cars, industry, or a volcanic eruption.

Most people working in environmental health-related jobs have taken classes in the science of **toxicology**. Toxicology is the study of how environmental hazards, such as natural and human-made chemicals, can enter our bodies and make us sick.

When scientists study different chemicals in the environment to see if they might be dangerous to humans, they are trying to understand the toxicity of those chemicals. Toxicity is a measure of how dangerous a chemical is. The greater a chemical's toxicity, the less it takes to make a person sick or even kill them. The Environmental Protection Agency, for example, uses the following scale to rate the toxicity of products commonly used in the home.

Toxicity Rating	Word and symbols that appear on product's label	Approximate amount needed to kill an average size adult
1 – Highly Toxic	DANGER or POISON 	A few drops to one teaspoon
2 – Moderately Toxic	WARNING 	One teaspoon to one ounce
3 – Slightly Toxic	CAUTION	More than one ounce
4 – Not Toxic	none	

A bottle of bleach, for example, will have the word DANGER on the label, because it is highly toxic if ingested (toxicity rating = 1). Borax powdered cleaner, however, is rated as slightly toxic (toxicity rating = 3) and will have the word CAUTION on the label. This is just one example of a system used to measure the toxicity of hazards.

Exposure:
The total amount of chemical that comes into direct contact with the body.

2. EXPOSURE

We all know what it means to be "exposed" to something like a cold or a flu. Everyday our bodies are exposed to all sorts of environmental hazards, such as bacteria, viruses, and the sun's ultra-violet (UV) rays. Some of these hazards exist naturally and some of them are the result of human activities. There are many possible **sources** of exposure to hazards, such as cars, industry, even volcanic eruptions. In order for us to be exposed, however, the hazard has to get from the source to us. To do this, it travels along an **environmental pathway**. Pathways include the

air we breathe, the water we drink, the food we eat, and even the soil we work in, play in, and use to grow much of our food.

Environmental health scientists use the term exposure to describe the total amount of a hazard that comes in direct contact with your body. Once you have come into contact with a hazard, it can get into your body through different routes. You can breathe it in (**inhalation**). You can eat or drink it (**ingestion**). You can get it directly on your skin or in your eyes (**dermal absorption**). You can also get it directly into your body through an injection. Inhalation, ingestion, and dermal absorption are the three main routes of exposure. Things that help us stay healthy, like vitamins, nutrients, and medicines, enter the body through these **routes of exposure**, but hazards can use these same routes to enter the body and make us sick.

3. DOSE/RESPONSE

Imagine that someone has been exposed to a hazardous chemical through one of the three possible routes of exposure. They have now received a **dose** of that chemical. Dose is the amount of the hazard that actually enters your body. The amount someone gets into their body (their dose) depends on many factors, including how long you are exposed, how often you are exposed, and how big or small you are. For instance, if someone is exposed over a long period of time to a hazard, their dose will be larger. For example, 4 hours spent under the bright summer sun would give you a much larger dose of UV rays than 30 minutes spent under the sun. This is called the **duration of exposure**. The **frequency of exposure** can also influence the dose. If someone works in a factory and is exposed to a chemical every day at work, their dose might be larger than someone who is only exposed once.

Dose can also depend on how big or small you are. When a doctor prescribes a medicine for you, he or she calculates the amount of the medicine you should have based on your body size. The doctor can then give you the correct dose of the medicine for your body weight. While a teaspoon of medicine might be right for an adult, it may be far too large of a dose for an infant.

The dose you receive can influence how your body responds to a hazard. For most hazards, the larger the dose, the more extreme the **response** will be. The smaller the dose, the more mild the response will be. Drinking one can of a caffeinated soda might be fine. Drinking three cans in a row may make you jittery. Drinking five cans of soda might make you feel light-headed and sick.

4. INDIVIDUAL SUSCEPTIBILITY

Some people are more likely than others to get sick when they are exposed to environmental hazards. This might be because of their **genetics**, body size, age, gender or general health. This is called their **individual susceptibility**.

Environmental Pathways: How a hazard travels from its source to humans. These include air, water, food, and soil.

Inhalation: Breathing. When chemicals enter the body through this route of exposure, they can get stuck in the lungs and/or be taken up into the bloodstream.

Ingestion: Swallowing (usually by eating or drinking). When chemicals enter the body through this route of exposure, they can easily be taken up into the bloodstream.

Dermal Absorption: Absorbing a chemical through any part of the skin, including the eyes. When chemicals come in contact with the skin, they can sometimes enter the bloodstream through this route of exposure. However, for many chemicals the skin provides good protection of your body.

Routes of Exposure: The ways in which a chemical can enter the human body. The three main routes of exposure are inhalation, ingestion, and dermal absorption.

Dose: The total amount of a chemical that gets into a human or other living thing, relative to the individual's body weight.

Duration of Exposure: The length of time you are in direct contact with a hazard.

Frequency of Exposure: How often you are in direct contact with a hazard.

Response: The reaction to an exposure or dose of a hazard. A response can be anywhere from mild (e.g. headaches, a rash) to severe (e.g. brain damage, cancer).

Genetics: Information that is contained in the genes (DNA) of a person's cells. Genetic information is passed down from parents to their children.

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Individual Susceptibility:
Differences in the ways that individuals react after exposure to the same amount of a hazardous chemical. Differences in susceptibility can be caused by differences in body size, age, genetics, gender and general health.

Benefit:
Something that results in increased well-being or good health.

Risk:
The possibility of being hurt or killed.

For example, some people are more likely than others to get sick when they are exposed to certain kinds of pesticides, just because of their genes. We all know that genes help determine things like hair color and eye color, but they also lead to some important (and invisible) differences in the way bodies work. It turns out that some people have a more extreme response to certain pesticides because of their genes. These people are said to be more "individually susceptible" to pesticide poisoning. Someone who lives or works on a farm where pesticides are sprayed might want to know how susceptible he or she In order to avoid exposure and stay healthy.

5. RISKS & BENEFITS

We live in an industrial society that depends on the use of both natural and human-made chemicals to function. The use of these chemicals results in **benefits** to society as well as **risks**. Pesticides, for example, make it easier to grow fruit. Unfortunately, in some cases, pesticides can make people sick. Most of us have heard that we can reduce the risk of getting sick without giving up the health benefits that fruit offers by washing or peeling the fruit before we eat it.

Scientific researchers and government officials measure the risks and benefits that we face when we manufacture or use certain products. They work to explain what they have learned to the public and create safety standards that help people protect themselves from unnecessary risk. Their goal is simple – to help us enjoy the greatest benefits from the products that we manufacture, while exposing ourselves to the least possible risk. By understanding the risks and benefits that we face each day, we can make decisions that reduce our risk and keep us as safe and healthy as possible.

Environmental Justice:
The fair treatment of people regarding the development of environmental laws, regulations and policies.

6. ENVIRONMENTAL JUSTICE

Everyone has the right to live in an environment that doesn't make them sick, regardless of their race, culture, or income. This is called **environmental justice** (EJ).

Unfortunately, some neighborhoods or communities are exposed to more environmental hazards than others, and may suffer higher rates of health problems. These communities often have less economic or political power in society when decisions are made. For example, toxic waste dumps, polluting factories, and busy highways are often built in lower-income neighborhoods or communities of color. Communities recognize this as an environmental health issue and work to seek environmental justice.

7. COMMUNITY RESOURCES & ACTION

Where can you go in your own community to collect information about an environmental health issue? You can learn more about specific issues, understand environmental laws or seek environmental justice by using community resources. Community resources include places like the library and city hall. You could search the Internet for local, state, or federal agencies that can give you

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information about your issue. You can also talk to environmental health scientists at local universities or health departments, and ask your teachers and family members what they know about the issue.

Community Resources and Action:
An individual's ability to access resources and act on new information in order to created positive change in their own community.

Once you have gathered your resources and studied the issue carefully, it's time to take action! First, ask yourself what you as an individual can do to help solve the problem. If you are concerned about air pollution, for example, you might decide to walk to school instead of getting a ride in a car. Next, ask yourself how you can share what you have learned with others so that they can help too. Maybe you could write a letter to the editor of your local newspaper or speak to your community council or school board. Maybe you could create a flyer to hand out in your neighborhood. There are many great ways to get the word out and make positive changes in the world – use your imagination and be creative!

Check Your Understanding

1. Name one product that can be found in your home that might be considered to be highly or moderately toxic.

2. List the three routes of exposure. For each one, give an example of an environmental hazard to which you could be exposed through that route.

3. Explain how the concept of "exposure" is different from the concept of "dose."

4. Pick four vocabulary words from the margin on the previous pages and use each one in a complete sentence.

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Diabetes mellitus
A disease where body cells do not properly remove or uptake blood glucose resulting in high glucose levels in the blood and urine

Glucose:
The sugar that is released into the bloodstream during the digestion process of the foods we eat. Our bodies use the sugar for energy.

Insulin:
A protein-based hormone that helps move sugar from the blood into cells.

Type 1 diabetes:
The type of diabetes where the body does not make enough insulin to control the blood sugar. This is also called insulin dependent diabetes.

Type 2 diabetes:
The type of diabetes where the body makes enough insulin but the cells ignore the insulin leaving the sugar in the blood. This is often called adult onset diabetes, but it is being seen more frequently in children.

Fasting Plasma Glucose Test:
A blood test used to help diagnose diabetes.

What is Diabetes?

Diabetes is a disease where there is too much sugar or **glucose** in the blood. When this happens the sugar can damage different parts of the body including the eyes, kidneys, nervous system and circulatory system. Normally our bodies can "handle" the sugar with the help of a special protein-based hormone called **insulin**. Insulin helps sugar go into cells, such as our muscle cells. Once the sugar is where it needs to be, it is used for energy within the cell.

There are two types of diabetes, **type I** and **type II**. The difference between the two types relates to how the diabetes occurs. With type I diabetes the body does not produce enough insulin to handle the sugar. With type II diabetes enough insulin is usually produced, but the body's cells ignore the insulin leaving the sugar in the blood instead of taking it into the cell where it can be used.

Pre-diabetes

Pre-diabetes is when glucose in the blood is high but not high enough to diagnose as diabetes. The elevated blood glucose levels still cause damage to the eyes and other body systems. Very few people know they have pre-diabetes or that they are at risk for diabetes.

Diagnosing Diabetes

Diagnosing diabetes requires testing the sugar level in the blood. One common blood test is a **fasting plasma glucose** test. To take a fasting plasma glucose test, blood is drawn from a person who has not had anything to eat in the morning. The blood is then tested for increased amounts of glucose. A normal range of blood sugar or glucose is 80-100 mg/dl (that is milligrams of glucose per deciliter of blood). A range of 100-125 is called pre-diabetes, and greater than 126 diagnoses diabetes.

Blood Glucose Level (mg/dl)	What This Glucose Level May Mean
Below 100	
100-125	
Over 126	

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Health Impacts of Diabetes

The health impacts of diabetes are many. Because blood travels throughout the body, the sugar that is left in the blood has a chance to damage many places including the kidneys, eyes, circulatory system, and nervous system. This is why it is very important to prevent diabetes, and if diagnosed with it, to manage the diabetes correctly.

Some examples of the health impacts of diabetes are in the bulleted list below.

- Heart disease and stroke are 2-4 times more likely in people with diabetes.
- Diabetes can lead to blindness.
- New Mexicans who have diabetes are 3 times more likely than those who do not have diabetes to be told they have high blood pressure.
- In 2000, there were 18, 435 diabetes-related hospitalizations in NM
- Diabetes is the leading cause of non-traumatic lower-limb amputations.
- In 2000, 307 New Mexicans lost one or more limbs or part of a limb to diabetes.
- Native American were 3.5 times more likely to have an amputation than Caucasions.
- Diabetes was the 6th leading cause of death in New Mexico in 2001.
- Diabetes affects more than 18 million people in the United States which is 6.3 % of the population
- Of those diagnosed, 5-10% have type 1 and 90-95% have type 2 diabetes.

Obesity:
The state of being overweight from too much body fat.

In New Mexico there are approximately 120,555 people with diabetes. Of those, only 83,982 know they actually have diabetes. New Mexico has a number of high-risk populations for diabetes. African Americans, Hispanic, and Native American have much higher rates of diabetes compared to Anglos. In fact, Hispanics and African Americans are twice as likely to be diagnosed with diabetes compared to Caucasians. Native Americans are three times more likely to be diagnosed than Caucasians. **Obesity,** genetic family history, diet, exercise, and certain environmental exposures are very important risk factors for diabetes. Genetic family history means that if a relative has diabetes or if someone is overweight, the risk of getting diabetes is higher.

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Check Your Understanding

1. Your grandfather was just diagnosed with diabetes. What body systems and organs may be affected?

2. What is insulin and what role does it play in diabetes?

3. What percentage of New Mexicans who have diabetes do NOT know they have diabetes? (HINT: The numbers given in the reading are for how many New Mexicans know they have diabetes. You first need to find the difference, then find the percentage.)

How Does Diabetes Relate to Environmental Health?

Environmental health is the effect of the environment on a person's health. In the case of diabetes, it is believed that a person's genetic make-up, combined with personal choices and environmental exposure, trigger the disease.

Built Environment:
The part of the environment built by humans.

There are many aspects of one's environment that can impact diabetes. For example, the **built environment**, which includes the buildings, streets, sidewalks, parks, and food venues in and around neighborhoods, can affect how much people walk, exercise, or what they eat. Busy streets and no sidewalks keep people from walking to nearby places. Local parks encourage walking and playing. Grocery stores, farmers markets, or fruit and vegetable stands support and encourage access to fresh foods. If fast food restaurants and convenience stores are the only nearby food sources, then access to healthy food may be limited. The environment, combined with personal choices within that environment, can impact diabetes.

Autoimmune disease:
When a person's immune system, including white blood cells or anti-bodies, attack the bodies' own tissues or extra-cellular proteins.

Immune response:
The body's defense mechanism against foreign invaders like toxic chemicals, allergens, viruses, or harmful bacteria.

The environment may also trigger type 1 diabetes (when the body stops producing insulin) by exposure to a toxic chemical, drug, bacteria or virus. Type 1 diabetes is considered to be an **autoimmune disease**, where a person's **immune response** (or protective responses) get out of control and the body begins attacking itself. In the case of type 1 diabetes, the immune system

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attacks the **pancreas** where insulin is produced. There are many chemicals that are known to cause autoimmune disease responses, such as mercury or poly vinyl chloride (the material in PVC pipes), but scientists do not yet know what specific environmental agent causes type 1 diabetes.

Pancreas:
A gland located behind the stomach that secretes insulin and other important chemicals into the bloodstream.

Chronic exposure:
When the body comes into contact with small amounts of a chemical over long periods of time.

What does DOSE have to do with diabetes?

There are three ways dose relates to diabetes. The first relates to the dose of the original chemical exposure that triggers the diabetes in the first place. It is suspected that this dose is from **chronic exposure**, which occurs in small amounts over long periods of time. In the case of type 1 diabetes that may be the dose of the chemical or biological agent that a person is exposed to over time. In type II diabetes it may be the dose of certain fats, sugars, and high glycemic foods (combined with a lack of exercise) over time that trigger the disease.

The second way dose relates to diabetes is the dose of sugar a person receives with each meal. This is very important once someone already has the disease. The higher the dose of sugar the more insulin a person needs to handle that sugar. If the dose of sugar is continuously high and there is either not enough insulin or the cells are ignoring the insulin then the body's response to the sugar increases (dose-response). The body's response to diabetes includes blindness, kidney failure, poor circulation, and heart disease.

The third way dose relates to diabetes is either too low a dose of sugar or too high a dose of insulin (especially for people who have to give themselves shots of insulin). In this case there is not enough sugar to feed the cells and a person may become nervous, shaky, confused, sweaty, pale, weak, lose consciousness, have seizures, or, in extreme cases, die.

What is the main ROUTE OF EXPOSURE for most cases of diabetes?

The route of exposure varies depending on the agent. In the case of sugar, the route of exposure is ingestion (oral exposure). For example we drink sodas and eat candy bars, which get digested and deliver the sugar to our blood. In insulin dependant diabetes, type 1, a person may have to give themselves insulin shots. The route of exposure for insulin is injection directly into the blood stream. Lastly the route of exposure to the environmental agents that may trigger type 1 diabetes is unknown, since the exact environmental agent is unknown. Exposure could be from any or all of the following sources - ingestion through contaminated food and water, inhalation of contaminated air, or absorption from the chemical on clothing or in water.

What does INDIVIDUAL SUSCEPTIBILITY have to do with diabetes?

Individual susceptibility with respect to diabetes relates to their individual genetics and environmental conditions. People who have genetically-related family members with diabetes are at higher risk of getting diabetes, and each person's individual exposure to environmental agents can trigger diabetes.

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Calorie:
A unit used to describe the energy producing potential of food. Specifically it is the amount of energy needed to raise 1 gram of water by 1°C from a standard initial temperature while at 1 atmosphere of pressure.

Fat:
A soft, solid, or semisolid compound found in plants and animals. Fat is made up of glycerol and fatty acids.

Those environmental agents may be chemicals, drugs, or biological pathogens (bacteria or viruses) that begin the autoimmune response in type 1 diabetes, or the eating and exercise lifestyle that a child is exposed to or a person has chosen.

Usually multiple factors need to be in place for diabetes to occur. For example, a person may be genetically susceptible to diabetes, but their food choices and exercise habits keep the diabetes from happening. Each person's individual circumstances are different, and the combination of the different factors that can trigger diabetes will vary from person to person.

Check Your Understanding

1. List two ways the environment relates to diabetes.

2. Provide two examples of how dose relates to diabetes.

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Lesson One: DIABETES AND NUTRITION

Student Handout

Name _____

Date _____

How Does Diabetes Relate to Nutrition and Exercise?

Nutrition is the science of foods and their components (nutrients and other substances), including nutrition's relationship to health and disease. **Energy balance** is the balance in our body between amounts of energy consumed and expended.

Energy Balance

Energy In → Energy Out

When a person eats food high in sugar, the blood glucose level rises in the blood stream. The rise in blood glucose triggers the body to release insulin. In diabetes, glucose stays in the blood stream because A) our body does not make insulin or B) our body's cells ignore insulin.

Exercise influences the energy balance between cells' nutritional intake and how much nutrients they use up during exercise. When you exercise your body is using glucose stores. If diabetics do not eat a small snack before exercising, they could possibly become **hypoglycemic**. However, if diabetics eat too much they could become **hyperglycemic**. Normally these dangerous levels of blood glucose do not occur in a healthy person. When people do not eat healthy by balancing good nutrients, like complex carbohydrates and protein, with sugar intake, they can develop hypo/hyperglycemia which may lead to pre-diabetes or diabetes. Exercise also helps keep blood glucose levels at a normal range by decreasing insulin resistance and increasing glucose uptake into the cells. Refined sugars like that found in candy and cookies are unhealthy in excess amounts. Even though fruit has sugar, it also has fiber and healthy chemicals like vitamins and minerals.

Nutrition: The science of foods and their components (like vitamins, minerals, fats, etc.)

Energy balance: The balance in the body between amounts of energy consumed and expended.

Hyperglycemia: Abnormally high concentration of glucose in the blood. Symptoms are: increased thirst, nausea, vomiting, fatigue, weakness

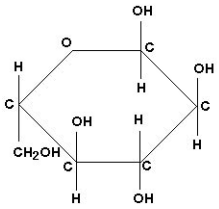
Hypoglycemia: Abnormally low blood glucose level. Symptoms are: cold sweats, clammy skin, dizziness, headache

Carbohydrates: A group of chemicals made by plants that provide a major energy source for animals and include sugars, starches, cellulose, and gums.

What are Carbohydrates?

There are two types of carbohydrates: simple and complex. Simple carbohydrates are made up of 3 or less units of sugar linked together in single molecule that have a very sweet taste. Examples of simple carbs are table sugar, corn syrup and the sugar in fruit. Refined sugars, like that found in candy and cookies are unhealthy in excess amounts. Even though fruit has sugar, it also has fiber and healthy chemicals like vitamins and minerals.

Complex carbohydrates are made up of more than 3 units of sugar linked together. There can be hundreds of thousands of sugar units in a single molecule. They are pleasant to the taste buds, but are not sweet. Complex carbohydrates are the healthiest choice for nutrition, because of the many vitamins, minerals, and enzymes they have. Complex carbohydrates can actually prevent many heart diseases.



α-D-GLUCOSE

$C_6H_{12}O_6$

simple sugar molecule

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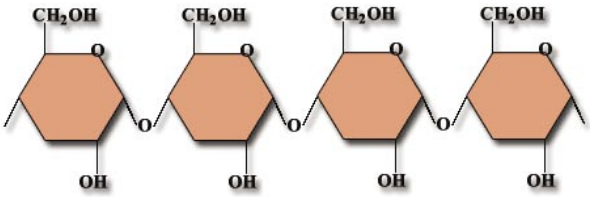

Complex Carbohydrate Molecule

So how many carbohydrates should you eat?

- About 2 cups of fruits and 2 ½ cups of vegetables every day.
- Four servings of pasta and grain foods every day (half should come from whole grains like whole wheat bread, brown rice, and whole wheat pasta).
- Very few sugary drinks and sweets.

What happens if you eat too many simple carbohydrates?

Eating too many simple carbohydrates can result in weight gain, which is an outcome you can see. Some other outcomes that you cannot see, are diseases of the blood vessels and immune system effects, which can lead to more infections.

What are Proteins?

Proteins are very large molecules made of a combination of twenty amino acids. They make up and help build our muscles and come from both animal and plant sources. Some sources of protein are better than others.

Protein:
A group of chemicals made up of amino acids that are required in the diet of animals for tissue growth and repair. Proteins compose cells, enzymes, antibodies, and hormones, including insulin.

- Both animals and plants provide an abundance of the essential amino acids to make protein.
- Plant sources, such as soy, don't have the heavy fat load seen in animal sources such as meat, milk, and eggs. Soy can prevent cancer if eaten regularly.
- Protein that contains fat should come from polyunsaturated and monounsaturated fatty acid sources, such as fish, nuts, and vegetable oils.

How much protein should you eat?

2-3 servings a day, where a serving is about the size of your palm.

What happens if you eat too much protein?

Normally, the liver breaks excess protein down into urea. Urea is a byproduct of protein metabolism which causes water loss as it is filtered out of the blood in the kidneys. If you eat too much protein, too much urea passes through the kidneys, causing too much water to be lost. This leads to dehydration, and

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can also cause your body to lose important minerals such as calcium.

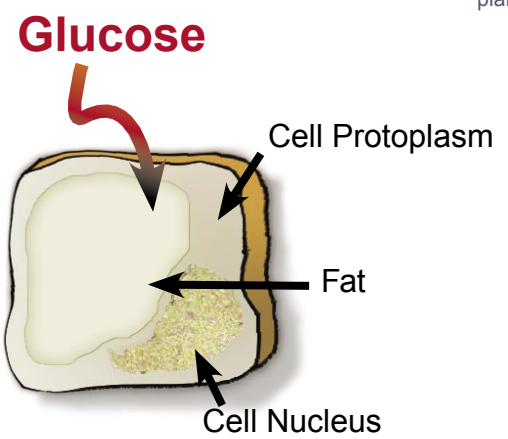
What are the chances that you are eating too much protein?
Chances are good! Most Americans eat too much meat. Try eating a balance of complex carbohydrates and plant-based protein like soy or quinoa.

What are Calories and Fat?
Calories are units of measurement that tell us how much energy is in the food we eat. We need energy from food for our body to function. You may have heard that calories are bad for us. The truth is that calories provide us with the energy we need to do our activities throughout the day. Think about how your body would feel if it took in no calories in one day. You would feel tired and low on energy.

Calories:
A term used to describe the amount of energy contained in food. One calorie is the amount of heat needed to raise 1 gram of water by 1 degree celcius (oC)

Fat:
An organic chemical (carbon-based) that is made up of fatty acids and esters of glycerol. Fat can be found in both animals and plants and store more energy, or calories, than carbohydrates or proteins.

Fats are one type of nutrient found in food. You may also hear them called lipids. There are good fats like fish oils, nuts, and vegetable oils, and unhealthy fats like trans-fats and saturated fats in meat, butter and shortening.



Fat Cell

Our body keeps a certain amount of fat and uses it in two main ways: as building blocks and as fuel. Fat is used as building blocks by building hormones and nerve tissue. It provides our bodies with a way to regulate heat, and it cushions our bones and internal organs. Our body also uses fat as fuel by breaking it down into smaller parts to burn as energy. If we eat more fats than what our body uses for fuel, it is stored in our body in fat cells. Think of these fat cells as a storage unit for energy. By storing fat for future use, your body plans ahead for those times when food might be scarce.

So, why have we heard so much talk about, “counting calories” and, “don’t eat that because it’s loaded with fat?” This is because many of us eat far more fat and calories than our bodies need. If we are very active, we need more fat and calories. If we are less active, we need less fat and calories. Eating more calories and fat than what our daily activities require leads to more fat being stored in our fat cells. Over time, if we don’t burn off this stored fat, this leads to being overweight. Controlling our weight by eating healthy and exercising is the key for preventing diabetes.

How many calories do we need?
Each person’s body burns calories at different rates, so it is hard to determine just one number that we all need each day. That is why there is a recommended range. School age kids require 1600-2500 calories. Young adolescents need

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anywhere from 2500-3000 because of body changes due to puberty. Adults normally need around 1500-2000. If you are more active, you will need to be at the higher caloric end for your age range. If you are less active, you will need to be at the lower caloric end for your age range.

It is a great idea to be active at least 1 hour, and up to several hours, a day. Playing sports, riding your bike, running outside, climbing stairs, and even making your bed are all activities that burn calories and keep your body functioning properly. It is no surprise that playing video games and watching television don't burn many calories. That is why we should limit these activities. In fact, you burn more calories sleeping than you do watching TV!

Adding it All Up

Calories from the foods we eat come from proteins, carbohydrates, and fat. One gram of protein contains 4 calories. One gram of carbohydrates also contains 4 calories. One gram of fat contains 9 calories. This is the reason why foods with the same serving size may differ in calories. High fat foods have more calories than foods that are lower in fat. High fat foods also tend to have high amounts of protein and carbohydrates, making it easy to quickly accumulate, or add up, the number of calories eaten.

For example, one serving of ice cream (1/2 cup ~ 1 small scoop) contains:
2 grams of protein (2 grams x 4 calories= 8 calories)
15 grams of carbohydrates (15 grams x 4 calories= 60 calories)
12 grams of fat. (12 grams x 9 calories=108 calories)

This calculates to 178 total calories. Sixty-one percent (61%) of these calories come from fat (108 fat calories divided by 178 total calories). This is not to say that you should not eat ice cream, but it gives you an example of how fast calories can add up. Think how many calories you would consume if you "super-sized" your portion to 2 or 3 large scoops of ice cream! That could easily reach over 500 calories, which is over 20% of an average daily caloric allowance for adolescents.

So what? Young adolescents need the fuel from calories to grow and mature into adults. Exercising and getting the proper nutrients without the extra fat are simple steps to a healthy lifestyle and will help you feel good now and for years to come, and will help prevent diabetes.

Having diabetes not only can produce long term health effects like eye and kidney damage, but it also requires self-monitoring blood glucose levels (pricking your finger every day) and a very strict diet. Sometimes it even requires giving yourself insulin shots. It is easier to prevent diabetes through your actions today then to manage it for the rest of your life. The actions required to prevent diabetes will also help you feel and look good now!

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Check Your Understanding

1. Give an example of a healthy fat, healthy protein, and healthy carbohydrate.

2. Give an example of an unhealthy fat, unhealthy protein source, and an unhealthy carbohydrate.

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Diabetes and Nutrition Student Handout #2: Message Ideas

Student Handout

Name _____

Date _____

Working either individually or in a group, you are going to have a chance to be creative and have some fun creating a message about healthy foods and eating. Include the information from the Diabetes and Nutrition reading in your message. You will also be grading your peers using the grading rubric on page *. Use this rubric to help you get an excellent grade by meeting all of the assignment requirements!

NAME: _____

NAME: _____

NAME: _____

NAME: _____

Who is your target audience? _____

What is your creative idea to reach this target audience? _____
_____
_____

List the steps and materials you will need implement your idea. Assign specific team members to complete each step.

Step	Materials Needed	Who is Responsible?
1.		
2.		
3.		
4.		

Take this completed form to your teacher and get an approval signature: ___
_____

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Diabetes and Nutrition Student Handout #3: Grading Rubric

Student Handout

Name _____

Date _____

You are going to have the opportunity help grade the work of other students in your class. Use this grading rubric to help you. Score your peers based on the quality of their work and how well they meet the requirement listed below. Ask questions to get the information you need to fairly grade on each requirement. Do not be influenced by whether or not you personally like group members!

Score using a scale of 0-3 where:
0 = did not meet the requirement
1 = met some aspects of the requirement
2 = met the requirement
3 = met the requirement in an above average fashion
4 = did an excellent, stellar job with the requirement

Requirement	Score
Message contained accurate information about a healthy diet including good carbohydrates, fat, and protein sources.	
Message contained accurate information about energy balance.	
Message was effective for the target audience.	
Message was creative and interesting.	
Information was presented in a well-organized manner.	
It was clear that all group members contributed fairly to the assignment.	
Total Points:	

Share any comments you may have for the group:

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Social Studies

Lesson One: NEW MEXICO HISTORY AND FOOD

Student Handout

Name _____

Date _____

Today life in New Mexico is very different than it was 10,000 years ago, 1000 years ago or even just 100 years ago. Historically there were no video games or computers, large-scale manufacturing and transportation systems did not exist, physical activity for "life maintenance" (like processing and obtaining food) was much higher, and the types of food eaten were quite different.

New Mexico's culturally rich history is one worth exploring. We will explore this history through foods of the period from the Paleo-Indians approximately 11,000 years ago, to the Spanish Inquisition beginning in the 1600's, to the Anglo settlements in the 1800's, to our modern society. As you read this history, it should become clearer how lifestyle, environment and food influence health and culture in New Mexican communities.

The Pre-Columbian Period in New Mexico – at least 11,000 Years Ago to 1492 A.D.

The Archeological and Oral Records

In New Mexico the Pre-Columbian period was a time spanning at least 11,000 years before Europeans, like Christopher Columbus, came to the Americas by crossing the Atlantic Ocean in 1492 **A.D.** This period had many **eras**, or spans of time marked by specific events or changes in human cultures.

Archeology, as well as oral stories passed down through the generations, are important tools to help piece together history. Archeology is based upon the **preserved** physical evidence left by humans over time. The oldest accepted record of widespread human presence in North America was found near Portales, New Mexico. This is a famous archeological site called "Blackwater Draw." Although no human bones have been found at this site, many layers of beautifully sculpted stone spearheads have been found associated with or "inside" **extinct** animals. Since the bones of these animals are about 11,000 years old, it is generally accepted by **archaeologists** that humans were definitely in North America (and New Mexico) at least 11,000 years ago.

[IMAGE]
Courtesy of the University of Pennsylvania Museum. http://www.metmuseum.org/toah/hd/blac/hd_blac.htm

Native American communities often tell stories of their own origins and say they have been on this North American land since "time immemorial." Some stories

A.D.(Anno Domini): The current calendar system indicating the years after Christ was born.

Eras: Periods of time marked by characteristic or identifiable events.

Archeology: The systematic study of human culture by the recovery and examination of human-made objects like buildings, pottery, tools, and graves.

Preserved: To remain unchanged or unaltered, or prevent from decaying or spoiling.

Extinct: No longer living.

Archeologists: Scientists who study human culture by examining physical and preserved remnants of that culture.

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Ice age:
Cold periods in earth's history where ice and glaciers covered large portions of the earth.

Inhabited:
To live or reside in.

Stratigraphic:
layers of rock or earth showing progressions in time, with the oldest layers often below more recent layers.

cremated:
The practice of burning the body after death.

Nomadic:
Moving from place to place.

Subsistence:
Activities that maintain life.

Hunting and gathering:
A way of living that hunts animals and collects local plants to eat.

tell of crossing ice, indicating a possible human presence in North America as long as 20,000 to 30,000 years ago, which was the peak of the last **ice age**. There may be some archeological evidence supporting these stories. Humans may have **inhabited** New Mexico as long as 25,000 years ago. Again no human bones have been unearthed, but stone tools were found in the caves of the Sandia Mountains near Albuquerque, NM amongst extinct animals of the Ice Age, like saber-tooth tigers. The Sandia archeological site is not as well accepted as "Blackwater Draw" because the evidence there is limited and it does not have as many clear **stratigraphic** layers showing "layers" of time. When looking at archeological or historical layers in the soil, usually the oldest layers are deeper - much like when new wallpaper is placed over any previous layers.

Finding human bones would be the best, most accurate way to date the presence of humans in North America. No one knows for sure why no bones older than * years old have been found, but, based on historic Native American traditions and the mobile nature of the groups, it is thought that the dead were probably burned, or **cremated**, instead of buried.

Food of the Paleo-Indians (Desert Culture) (11,000 – 6,500 Years Ago)

The earliest group of people in New Mexico and North America are called the Paleo-Indians. It is best to think of these people as the "original" Native Americans, as they are not related to the Indians of India. The Desert Culture Native Americans were **nomadic**, or moving from place to place, without the luxury of horses, mules, or camels to carry supplies. They walked the desert lands of what is known today as Mexico, New Mexico and the Southwestern United States searching for food and hunting for meat. This type of **subsistence** is called **"hunting and gathering".**

Stone was a primary material for tools and weapons, such as spear points, knives, and scrapers for skinning animal hides. Animal bones and wood were also important resources, since metal was unknown to this group.

The presence of stone projectiles with animal bones tells something about what the Paleo-Indians ate and how they obtained their food. When times were plentiful, they found large game such as mammoths, mastodons, and now extinct forms of sloth, bison, antelope, camel, and horse. Plant seeds and parts have also been found associated with remnants of human-made objects like pottery or baskets. The Paleo-Indians mainly harvested wild berries, grass seeds, mesquite beans, pinon nuts, and yucca fruit when the large game migrated.

The traditional diet of this time was naturally low in fat, high in fiber and rich in important vitamins and

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minerals. Processed and simple sugars, like those found in today's candy bars and sodas, were essentially absent. Honey, a simple sugar, was an occasional treat to peoples of this period. Although honey contains simple sugars, which the human body needs in **moderate** amounts, it also contains vitamins and other healthy chemicals, like **antioxidants**.

Moderate: Of average quality, not extreme.

Antioxidents: Chemicals that help eliminate damaging free-radicals or oxidation in the body.

In the Pre-Columbian period, or even just prior to the modern era beginning in the 1800's, foods were not available prepackaged from grocery stores or grown in mass amounts with the use of pesticides. People spent their time and energy finding, hunting, growing, gathering, harvesting, and processing food. They balanced their energy input, or calories, from the food they ate with energy output from the physical activity required to obtain it.

Cultivation of Corn – (6,500 years ago)

6,500 years ago an important food event occurred. Native peoples of Tehuacan, Mexico discovered how to **cultivate** corn. Native Americans often gathered chili, squash, beans, and corn, but they never previously cultivated it. The discovery of farming played an important role in the development and progression of the Native American cultural history of the Southwest. The people now had a choice, they could either hunt or gather food or they could stay in one place and grow their own food.

cultivate: To improve or prepare land to grow crops.

Through cultivation, corn became the queen of crops in the Southwest as Native Indians appreciated its value. Native Americans learned how to **crossbreed** the plant to make blue corn, red corn, white corn and yellow corn. In plentiful years, Indian farmers could produce a large enough corn crop to feed more than one family. Corn could be harvested in abundance, preserved by drying and then stored for a long time. Corn was a dependable source of food for the people even when there were scarce amounts of water and wild plants.

crossbreed: To make a different variety of plant or animal by mating individuals of different breeds or types. For example "muts" are considered crossbreeds of different types of dogs, such mating between a pit bull and a poodle.

Through careful planning and timing of crops Native Americans survived drought and seasons of poor weather. There were less incidents of starvation and populations increased and flourished. Farming is what led to the great Native American cultures of the Southwest: the Cochise, Mogollon, Anasazi, and Hohokam.

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Use of Corn in Native American Cultures Today

Corn remains a staple food in most Native American cultures. Many Native Americans and Northwest Mexicans eat and drink corn in several ways. It is made into tortillas, which are eaten directly or folded into tacos, enchiladas, or tostadas. **Masa** (a dough made of corn meal) filled with chili and meat, and then steamed in corn husks became known as tamales.

Blue corn has a sacred significance in Native Indian cultures in the United States. Using blue corn flour that is mixed into boiling water to make a semi-thick drink, similar to Cream of Wheat, makes **Atole**. **Piki bread** is a paper thin bread cooked on stone griddles that are passed down for generations.

Dried corn could be made into **hominy**. To make hominy, the dried corn was soaked in a mixture of water and ashed for two days. When the kernels had puffed up and split open, they were drained and rinsed in cold water. Hominy is used to make many stews in Native Indian cultures such as red chile pasole.

Corn is not only a food crop, it is given a special place in Native Indian traditions. For the Pueblo Indians corn is a symbol of human life and the relationship to nature. Corn is still used in ceremonies as a way of prayer and giving thanks to mother Earth. Corn is ground into corn meal and is used daily in many Native Indian cultures as a form of prayer. Corn is also used during traditional corn dances in New Mexico and Arizona pueblo cultures. When children are born in traditional Pueblo communities, they are presented to the sun with two perfect ears of corn, called their corn mothers, which are kept until they are buried.

Masa:
A dough made of corn meal.

Atole:
A drink made of water and blue corn flour.

Piki bread:
A very thin bread made by some Native American cultures.

Hominy:
Dried corn soaked in water and used in stews.

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The Cochise Culture – (9,000 to 2,000 years ago)

Because of the success in farming, the Native Americans living in southern Arizona and New Mexico were living very differently from their ancestors, the Paleo-Indians or Desert Culture.

The Cochise Culture was one of the first to abandon the nomadic way of life to settle down. The Cochise Indians built homes, a very new accomplishment of their time. The homes they built were round and partially underground. They were also farmers, planting beans, squash, and corn. They used **manos** and **metates**, which were rocks used to grind corn. Since they continued to use spears, they most likely combined agriculture with hunting game. It was agriculture, however, that enabled the Cochise culture to prosper and survive until about 2,000 years ago.

Manos:
Smaller rocks used to grind corn against the larger metates.

Metates:
Large rock base used to grind corn.

[Map of region]

The Mogollon Culture – (2,000 to 600 years ago)

Overtime, other agricultural societies emerged from the Cochise Culture. By about 2,000 years ago the Mogollon people had developed. The Mogollon inhabited the southwestern portion of New Mexico and as far north as the Four Corners area. Their culture spanned 1400 years, which was shorter than that of the Cochise Culture which spanned of 7000 years. By 900 A.D. the Mogollon population was dramatically reduced. Scientist believe that they were influenced by the developing Anasazi culture and gradually blended into the Anasazi way of life. Because of this **acculturation** (the modification of the culture as a result of contact with a different culture), the Mogollon lost their old identity.

Acculturation:
Changes in one culture due to the introduction to or interaction with another coulture.

[Pit house photo]

The Mogollon were separate from the Cochise even though they lived in same area. The Mogollon way of life is considered more advanced than the Cochise. The Mogollon farmed mesa tops in addition to streambeds. They lived in pit-houses built above ground and arranged them in semicircles or three-sided squares to create the first villages. Village building was a new initiative that demonstrated one way for a group of people to live willingly together. About 2,300 years ago the Mogollon were the very first to make and use pottery. The pottery was undecorated at first, but during later stages of their culture, their pottery had geometric, animal, and human designs.

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The Anasazi Culture
(2,000 – 500 years ago, 1 AD – 1500 AD)

Corn planting and farming also influenced the Anasazi, but they developed additional skills. The Anasazi were the "Basketmakers." They crafted baskets from fibers of plants, which later became trademarks much admired by neighboring groups like the Mogollon and Cochise. The baskets were used to carry water without leaking. They were also used for cooking and to carry plants and fruit. In addition to farming, the Anasazi gathered pinon nuts, yucca fruit, berries, and other wild plants. The Anasazi men hunted deer, elk, antelope, and bighorn sheep. They **domesticated** turkeys and primarily raised them for their feathers to weave into blankets.

domesticated:

The Anasazi were skilled builders. They assembled cliff dwellings that were large and built into canyon walls or under rock overhangs. The rock, multistory buildings are a contrast to the ground-level pit-houses of the Mogollon. The Anasazi way of life as cliff dwellers lasted about 300 years (1000 A.D. to 1300 A.D.). By the mid-1300's, they had abandoned their cliff dwellings to live in multilevel homes later to be called Pueblos. It is suspected that they left the cliff dwelling because of other hostile Native American invaders, climate changes, loss of food supply, or severe dryness.

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Check Your Understanding

Fill in the table below

	Paleo-Indians (Desert Culture)	Cochise Culture	Mogollon Culture	Anasazi Culture
Period of existence				
Primary type of living (hunter & gatherer or farmers)				
What made this culture unique?				
What kind of foods did they eat?				

Modern Native American Communities

The Hohokam and Tohono O'odham Culture

The Hohokam culture overlapped the time of the Anasazi (1 A.D. to 1500 A.D.) but they lived farther south in the deserts of Arizona, Southwestern New Mexico, and Northern Mexico. This group of Indians grew out of the Cochise culture, beginning their development around the start of the Christian era in Europe and the Middle East (1 A.D.). The word Hohokam means "those who have gone before." The decendants of the Hohokam call themselves the Tohono O'odham, the desert people or the Akimel O'odham, the river people. Today the desert people are the O'odham and have previously been called the Papago. The river people or the Akimel O'odham are also known as the Pima Indians. Often the names tribes call themselves are different from those given by **anthropologists**.

Anthropologists:
People who study human cultures, often by interviewing or observing the culture directly.

The Hohokam are remembered best for two original accomplishments, an inventive technique for pottery making and a complex system for irrigation. With the use of their complex irrigation system the Hohokam were able to cultivate crops such as corn, beans, squash, tobacco, cotton, and amaranth. Not only did they farm, they also gathered crops such as saguaro cactus fruit, prickly pear pads, cholla, cactus buds, plantain, mesquite beans, and agave from the wild desert. Agave is a wild desert plant that was used to provide food, fiber, and building materials for the Hohokam people. Cotton was processed by hand and made into yarn for clothing and blankets. Mesquite beans were collected from trees that grew along rivers and were later stored in baskets and jars or mashed into flour. The flour would then be used to make broths, stews, and breads.

The Pueblos

After 1500 A.D. the Native Americans who began farming learned much from their ancestors, the Anasazi and the Mogollon. Pueblo groups chose to build their unique "pueblo style" villages near or along streams and riverbanks like the Rio Grande, the Gila River, the Jemez River, the Pecos River, the San Juan River, and the Canadian River, so that agriculture could be possible.

The Pueblo groups used the irrigation system their ancestors invented to

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carry water to their crops. Every member of the family helped farm crops; it was a community project. Both men and women dug and cleaned the irrigation ditches. The men tilled the soil and planted the crops. The women joined the men in harvesting crops. Some Pueblo communities built their villages where no water sources were readily available and practiced a type of farming called **dry farming**. Dry farming involved planting crops near dry washes or arroyos, which then carried rainwater and the runoff from melted snow atop mountains to the fields. To overcome the lack of water, the farmers had to till deep into the ground so that the soil retained enough moisture. The Pueblo Indians also practiced a technique called **crop rotation** that involved changing the crops they grew in certain locations. By rotating their crops, they were less likely to wear out the soil.

dry farming:
A type of farming that does not artificially bring water to the fields. It generally depends on the natural rainfall, uses plants that require little water, and uses special techniques, such as mulching, to try to keep existing water in the soil and not evaporate.

crop rotation:
The farming practice of rotating or changing crops to keep the soil healthy and help control insects and plant diseases.

The main crop of the Pueblo Indians was and still is corn. Beans and squash were also grown in the fields. The pueblo women ground the corn and did the cooking. They also gathered wild plums, berries, acorns, pinon nuts, and walnuts. The Pueblo Indians found ways to use cactus, yucca, sunflowers, mustard plants, and cattails. In all, Pueblo Indians used more than 70 plants for food, medicine, and dyes. Today there are nineteen pueblo communities in New Mexico, including Acoma, Jemez, Santa Clara, Cochiti, and Pojoaque.

The Athabascans (The Apaches & Diné)

The Athabascans migrated from Asia to the Southwest about 1300 A.D. (700 years ago). These were the most recent Native American groups to arrive in the Southwestern U.S. The Athabascans that moved into New Mexico are known as the Apache and Diné (also called the Navajo). The main difference between the two groups is that the Diné had agricultural interests and the Apache preferred to be hunters and gatherers. When the Diné reached the southwest, they met the Pueblo Indian farmers who taught them to plant corn, beans, squash, and melons. The Diné primarily lived (and some still live) in homes called hogans made from wooden poles, tree bark, and mud. The door to the hogan always faced the east so that when the sun rose they were able to welcome the sun. Although the Diné farmed and lived in hogans, they would spend at least part of the year moving around.

The Diné and Apaches were the largest groups of non-pueblo Indians to come

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into the southwest. Some archaeologists suggest that the Diné and Apaches were partly responsible for the Anasazi's departure from the cliff dwellings. Others believe that the Diné and Apaches did not reach the Southwest until the 1500's arriving only a short time before the Spaniards.

The Diné are currently the largest North American Indian population with over 140,000 people on 16 million acres of land covering most of Arizona and part of New Mexico.

The Spanish Inquisition
The Spaniards Arrive (1540-1841)

In 1492 the King and Queen of Spain funded the exploratory travels of the Italian sailor Christopher Columbus. The goal of Columbus' travel was to find wealth and a quicker route to India, home of many wonderful foods and exotic spices. Instead of finding India, Columbus ran into the Canary Islands of the Caribbean. When they encountered the native peoples living on the islands, Columbus mistakenly called them "Indians" thinking he landed in India. Even though he eventually discovered that he encountered uncharted lands, later called the "New World," the name of "Indians" for the native peoples of the Americas remained.

Colonize:
to form or establish a new town or location to live.

Columbus made four voyages from Spain to the New World. He primarily explored the Caribbean areas of the Bahamas, Jamaica, Cuba, and Puerto Rico. Spain sent more explorers and leaders to **colonize**, or claim as their own, the lands of the Caribbean, South America, and Mexico. The Spanish encountered the Aztec, Mayan, and Incan Native American cultures when they explored South and Central America and Mexico. In 1540 Francisco Vasquez de Coronado was sent on a mission from Mexico City, Mexico to conquer the lands to the north. Originally, he was in search of the Seven Cities of Cibola, which was a rumor of cities made entirely of gold. The cities of gold did not exist, but Coronado encountered "new" Native American groups like the Zuni, Pueblos, Athabascans, and Tohono O'odham.

In the 17th Century (1600s), Spain began its active colonization of the Southwest, including New Mexico. Priests accompanied Spanish soldiers and politicians, like Don Juan de Onate, to forcefully convert the Native Americans to Christianity and follow Spain's rule. Spain's, and especially Onate's, cruelty was what led the Pueblo Indians and Athabascans to fight back in the Pueblo Revolt of 1680. The Pueblo Revolt was led by Popé, a member of the Toas Pueblo. The Pueblos banded together to successfully drive the Spaniards out of New Mexico for twelve years, then in 1692 the Spanish returned under the leadership of Diego de Vargas.

The arrival of the Spanish to the Americas was devastating to Native Americans, many died from disease, torture, and fighting. However, the cultural identity and languages of many of the Pueblos and other Southwestern tribes remained mostly in tact despite Spain's attempt to colonize and acculturate. The Spanish did introduced new tools, metal, plants, animals and building techniques, which significantly shaped some of the local cultures. For example, the Diné learned

to raise sheep brought by the Spanish and became experts at using wool to weave clothes, rugs, and blankets. The Diné also used sheep for food, with mutton stew as a favorite recipe. Horses brought by the Spanish transformed the nomadic Native American tribes, like the Apache, Comanche, and other Plains Indian tribes. These groups became expert horsemen, hunters, and warriors using the horse as a tool of the trade. The Spanish/Europeans also introduced grapes, wine, sugarcane, rice, bananas, olives, and the grains wheat and barley.

Even though the Spanish brought many new foods to the Americas, the Americas offered cocoa, potatoes, tomatoes, avocado, chile pepper, peanuts, pineapple, corn, beans, and squash. These new foods made their way around the world and transformed European cuisine, especially Italian and Irish, as well as, the cuisine of India and the Orient. The great sharing of foods around the world was called the **Columbian Exchange**.

Columbian Exchange: A world-wide exchange of goods and foods that occurred after Columbus discovered the Americas.

European Expansion

While the Spanish were colonizing the southwestern U.S., Central and South America, the Caribbean, and Mexico, the Pilgrims, a religious group from England, set sail for the "New World" in 1620 for the purpose of religious freedom. They landed on the northeastern coast of the U.S. and named the region "New England." Many different Christian-based religious groups (such as Protestant, Episcopalian, Catholic) and nationalities from other countries in Europe, such as the Dutch, German, and French, sailed across the Atlantic Ocean to make a home in the "New World." They also brought servants and slaves from other countries, especially Africa.

Just as there was an exchange of foods, technology and culture between the Spanish and the Native Americans of Central and South America, Mexico, and the Southwest U.S., the Europeans that arrived on the east coast had similar exchanges with Native Americans of that region. In fact, it was Native Americans who saved the lives of many of the earliest European settlers by sharing their foods and means of survival in that climate.

Over time the Native Americans of the East Coast and other parts of North America would face **decimation** from disease and war brought by the Europeans. In many places Native Americans were forced to convert to Christianity, however, many Native American groups fought to maintain their identity, continued to practice their own religion and their cultures and languages have **persisted** to this day.

Decimation: To destroy or kill a large part of.

Persist: To continue or maintain.

As the Europeans became more established in the "New World" they built cities, then grew, imported, and ate the foods to which they were accustomed in England. This formed the basis of today's American diet. This historic American diet focused on animal meat as the main entrée, especially salted and preserved

animal meats like ham, with a small side of grains or vegetables, accompanied by an alcoholic beverage, followed by a highly sugared dessert. Europeans drank alcohol instead of water because much of the water in Europe and other countries they previously explored was contaminated with disease.

The upper class ate **refined** flour, like that in "white" bread. The American diet was low in fresh fruits and vegetables and high in fat, salt, and sugar. It lacked important key nutrients like vitamins A, D, C, riboflavin (a B vitamin) and the mineral calcium. The lack of nutrients decreased **life expectancy** and increased infant **mortality**. Because people in early America performed much physical labor to survive, they tended to balance energy output with food intake, so obesity did not appear to be a problem.

U.S. Expansion

The thirteen New England colonies were originally ruled by England, but on July 4, 1776 the colonists declared independence and formed a new country, the United States (U.S.). The thirteen original states were Massachusetts, Rhode Island, Connecticut, New Hampshire, New York, Delaware, New Jersey, Pennsylvania, Virginia, Maryland, North Carolina, South Carolina, and Georgia. New states were added as the U.S. expanded west and south.

A major step towards expansion westward began in 1803 when American president Thomas Jefferson negotiated the **Louisiana Purchase** with the French. The Louisiana Purchase added over 500 million acres up the center of the U.S. President Jefferson then sent the explorers Meriwether Lewis and William Clark (Lewis and Clark) to find a water route to the Pacific Ocean and to explore and map the lands to the west of the original United States.

Once the lands were "claimed" by the U.S. and mapped, Americans began **migrating** westward in the 1820s and 1830s. The **Santa Fe Trail** was established in 1821 as a commercial route from the state of Missouri to Santa Fe, New Mexico. New Mexico was still part of Mexico at that time, not a state. The Oregon Trail was another major westward route established in the 1830s.

When people traveled they brought **preserved** foods, similar to the foods they were eating in the colonies. Meats were dried and salted, grains were dried and ground into flour or boiled whole. Very few fresh fruits and vegetables were eaten, and milk products were limited. The discovery of **pasteurization** and canning in 1809 allowed some **perishable** products to be stored and transported. However, carrying heavy containers was difficult in a wagon. Although natural ice, removed from places like glaciers and frozen lakes, was occasionally used, refrigeration as we know it had not yet been invented.

New Mexico's progression to statehood began with the Mexican-American War in 1846. In 1848, the **Treaty of Guadalupe Hidalgo** gave up a large portion of the Southwestern land to the US. Five years later, the **Gadsden Purchase** added the remaining portions of what is today known as Arizona and New Mexico. By 1853, Mexico had **relinquished** the territories that would

Refined:
To remove parts or layers of a plant or seed until only a small portion is used.

Life expectancy:
The average length of a lifetime, usually for a particular group.

Mortality:
Death rate.

Louisiana Purchase:
The purchase of the Louisiana territory from the French in 1803 by U.S. President Thomas Jefferson. The purchase consisted of 600 million acres between the Mississippi River and the Rock Mountains and makes up 13 states .

Migrating:
moving.

Santa Fe Trail:
A commercial, dirt "highway" used in the 1800s to connect Missouri and Santa Fe, New Mexico.
preserved:

Oregon Trail:
A dirt trail from Missouri to Oregon used by "Pioneers" to settle the western U.S.

Pasteurization:
Heating food and drink (like milk) to kill microorganisms to prevent illness and food rot.

Perishable:
Subject to decay or spoilage.

Treaty of Guadalupe Hidalgo:
Treaty that ended the Mexican-American war in 1848 and the U.S. received Texas, New Mexico, and part of California.

Gadsden Purchase:
A negotiation between Mexico and the U.S. (after the Treaty of Guadalupe Hidalgo) to resolve a boundary dispute along the U.S.-Mexico border from El Paso to the western edge of Arizona.

Relinquished:
To give up.

eventually make up southwestern Texas, Arizona, New Mexico, Utah, Nevada, and California. Arizona and New Mexico were territories until 1912 when they entered statehood.

The westward expansion of the U.S. continued to stress the Native American tribes who had been on that land for thousands of years. In the 1830s President Andrew Jackson forcefully removed Native American tribes such as the Cherokee and Choctaw from east of the Mississippi to the state of Oklahoma. In the 1851 the U.S. government built Fort Defiance on Diné (Navajo) land in Arizona. This forced the Diné to negotiate for their own land and water. The anger that developed from this led to the Navajo-Apache wars that would last for the next 20 years between the tribes in Arizona and New Mexico and the Federal Government.

In the 1850s through the 1930s the U.S. entered into treaties with the various Native American tribes and established **reservations**, or allotments of land, for those tribes to live on and, eventually, govern as their own. Most Native Americans endured extreme hardships before and after formal assignment of and to reservations. In most cases, the land given to the Native Americans was of poor quality and difficult to farm or gather from. Thus, the U.S. forcefully took away the tribes' means of growing or obtaining their traditional foods as a way to control them. Unfortunately the U.S. government did not stop there, they helped abolish the American buffalo, or bison, to deny Native Americans another major food source. As a result of this food warfare, Native Americans were forced to accept sub-standard rations of food including flour, oil, and alcohol. This history of oppression through food, as well as voluntary cultural exchange shaped the diet of today's Native American communities, and plays a very important role in the increased rate of diabetes in those communities.

Reservations:
A plot of land set aside for Native Americans.

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Check Your Understanding

Fill in the table below

	Hohokam/ Tohono O'odham	Pueblo	Navajo	Apache
Period of existence				
Primary type of living (hunter & gatherer or farmer)				
What makes them unique?				
Of what does their traditional diet consist?				
List 3 things that changed after Spanish exploration.				
List 3 things that changed after the "Americans" moved in.				

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Industrial Revolution

While the U.S. was expanding into "Indian Territory" in the 1850s, the **Industrial Revolution** was beginning. The Industrial Revolution transformed the way food was produced, transported, and consumed in the U.S. In the early 1800s about 95% of the population lived on small farms, but by the 1900s the Industrial Revolution brought people into cities and only 65% worked on or with farms. This number would continue to decrease over time. As of 2005, less than 10% of people in the U.S. live or work on farms.

Industrial Revolution: A period of time beginning in the 1850s when machinery, factories, and large-scale industrial practices shaped the economy and lifestyle of the United States and other parts of the world.

With the industrial revolution came other major changes in food production and eating. **Mechanization** played a role in the large-scale industry of food. Farming machinery allowed a farmer to harvest 135 acres in the same time it previously took to harvest 7.5 acres. People stopped producing food for their own consumption and instead purchased processed or prepared foods. Farms and railroads expanded west and a refrigerated railroad car (using ice) was invented in 1867, which allowed fresh foods like eggs, meat, milk, and produce to be shipped to city residents.

Mechanization: The use of machines to perform jobs or assist with tasks.

Changes in lifestyle and technology began to move quickly and resembles what we know today. In 1850 people began condensing and preserving milk for distribution. In 1859 Mason jars were invented. In the 1870s Kellogg's Corn Flakes and Post Grape Nuts were created. Tin cans were invented in 1880.

By the early 1900s twenty percent of the U.S. manufacturing was food processing. Hamburgers, ice cream cones and peanut butter were introduced at the 1904 World's fair in St. Loius, Missouri. In 1905 America's first Pizzaria opened in New York City. Oreo cookies were created 1912. 1915 brought Kraft processed cheese, and in 1916 the first modern grocery store, called Piggly Wiggly, was open in Memphis Tennessee. Piggly Wiggly sold only prepackaged and individually priced items, much like the convenience stores of today. The 1920s brought Kool-Aid, popsicles, and Campbell's condensed soups. The 1930s people could purchase Toll House cookies, Wonder Bread, Twinkies, Spam, Ritz crackers, Lay's Potato Chips Velveeta, Milky Way, Mounds Bar, and Reese's Peanut Butter Cups.

The next major invention that shaped the access of food in the U.S. was the refrigerator. In 1931, the compressed gas refrigerator using "Freon" was invented in the General Motors Frigidaire division. "Freon", a chlorinated fluorocarbon compound (CFC), later found to deplete the earth's protective ozone layer, was less toxic and non-explosive compared to other compressed gases, like ammonia. The Freon allowed the refrigerators to be small, significantly increasing its potential uses. By the 1950s most homes had refrigerators allowing frozen food, fresh fruits and dairy to be part of the ordinary American diet. In general, refrigeration improved nutrition in the U.S.

Industrialization and refrigeration made food less expensive and more plentiful. For the first time people ate more than was necessary and medical records of obesity and digestive problems increased. A quote from a medical doctor in a 1924 industry trade journal summarizes diets and activities of the day and

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medical effects they were seeing.

> "The good old fashioned American meal…is being rapidly supplemented by sugary concoctions…This indiscreet eating, with almost a total lack of exercise, now features the life of the average businessman, Up at 8 in the morning, a hasty breakfast, ride downtown in an automobile; a ten –minute lunch of miscellaneous sugary drinks in the quick lunch or drug store, back to the office, home in an automobile – they call that a day…The consequences are indigestion, bad nerves, decaying teeth, restless nights, and cutting down on the span of life." [1]

Consumption:
To use.

Rationed:
A fixed portion.

The American diet of high sugar, fat, and salt with relatively low nutritional value was established in the early colonial era, enhanced by industrialization, and continues to this day. There have been a few periods of increased **consumption** of fresh fruits and vegetables, like during World Wars I and II, when meat, butter, sugar, and flour were **rationed**. However, for the most part, Americans were used to the convenience and taste of prepared and packaged goods. Once these processed foods were readily available, Americans chose them over fresh fruits, vegetables, and whole grains.

Epidemic:
Wide spread, often associated with disease.

As a result of the processed foods diet, today the U.S. is facing a health **epidemic** for obesity and diabetes. A major part of the problem is sugar is added to most processed foods including salad dressings, bread, and crackers, in addition to the obviously sugared colas, cookies, and candies. Americans are eating about 142 pounds of sugar per person each year. Compare that to the average consumption of broccoli at 8 pounds per person per year.

Communicable:
Can be easily transmitted, often refers to diseases.

Science is showing us the effects of the American diet and lifestyle on health. The U.S. has advanced quite far in reducing the number of deaths from **communicable** diseases via vaccines and treatments, but today one of the most important things we can do for our health is eat whole grain breads and cereals, five fruits and vegetables per day, and healthy fats and proteins from sources like fish and nuts.

Interestingly, the traditional diet of the Native Americans in this region were very healthy. Although many Native American communities view Indian fry bread as traditional, it is not. Fry bread came out of the era when the Native Americans were forced onto reservations and given flour and oil as food rations. As a means of survival, Native Americans made and ate fry bread. Fry bread contains many of the unhealthy aspects of modern diet, highly refined flours, lard or saturated fats, and often topped with sugar.

The traditional Native American diets included the corn, beans, squash, nuts, cactus fruits, amaranth, and mesquite beans. Current scientific research shows that many of the fruits, vegetables, and plants Native Americans, and even the

[1] Quoted from the book *Food, Society, and Environment* by Charles L. Harper and Bryan F Le Beau, 2003, page 87.

Spanish, used contain healthy chemicals like anti-oxidants, which can help prevent diseases like cancer. There are also some foods, like mesquite flour and prickly pear fruit, which may help control blood sugar, important for control of prevention of diabetes.

Native American communities are starting look back at their traditional diets and find ways to **incorporate** those foods into their current lifestyles. This task has proven challenging for them, just like for many Hispanic and Anglo peoples in the U.S. and here in New Mexico. Salt, sugar, and refined foods taste good to us and the pre-packaged convenience is nice and easy. But this addiction to salt, sugar, and "easy" are coming at a high price - our good health. With care, persistence, and focus all cultures of New Mexico and the U.S. can change the way we eat and bring personal health and prosperity to our state and this nation.

Incorporate:
To unite with something already in existence.

Check Your Understanding

1. Describe how the historic Anglo European diet and the Industrial Revolution shaped our diet today.

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PROTEIN PUZZLE
Student Handout #1

Name _____

Date _____

Student Handout

In this lesson you will learn about the insulin protein and how its shape helps it do the job of moving sugar from the blood into other cells. You will also build a three-dimensional (3-D) model of insulin.

STEP 1: Read the information below and then follow the instructions to build an insulin protein model.

You probably already know that **atoms**, the smallest representative sample of an element, bond together to form **molecules**. Different atoms of **elements** (like carbon, oxygen, and nitrogen) bond together in different amounts and different ways to form the billions of chemicals that make up everything in our universe. Living things tend to create complex molecules in order to do specific jobs to maintain life.

Some of the complex molecules that help life function are carbohydrates, fats, **steroids**, and proteins. Some of these molecules are used in cell structure, others are "active" compounds that move or change chemicals. Proteins are a class of chemicals that participate in every function of the living cell, including structural support for the cell, muscle movement, breaking down chemicals (these proteins are called **enzymes**), turning genes off or on, or **cell signaling**.

Proteins play a very important role in biology and biochemistry. You can differentiate proteins from other chemicals in a living thing because proteins are made up of **amino acids**. Proteins also often have complex three-dimensional structures. There are twenty-two amino acids, such as cysteine, lysine, alanine, phenylalanine, serine, and aspartic acid. The human body uses twenty of these amino acids and can make ten of them on its own. The other ten we have to get through eating.

When amino acids bond together they are called **peptides**. Polypeptides are simply another name for a protein, where many amino acids are joined together (poly = many). There are proteins that are very short, such as the artificial sweetener aspartame which is a dipeptide (two amino acids bonded). And, there are proteins that contain several thousand amino acids.

When many amino acids bond together, the molecules can get quite large compared to the rest of its microscopic, cellular surroundings. Imagine trying to stretch out a 50' (foot) rope in a 10' x 10' room. You would not be able to fully extend the rope into a straight position, you would need to bend or curve the rope, or pile it upon itself. Large proteins face a similar challenge, so they fold in upon themselves to generate a three-dimensional (3-D) structure.

Introduction

Atom:
The smallest unit of an element.

Molecule:
The smallest part of a substance that retains the characteristic of that substance. It can be made up of a single element or multiple elements. For example, one molecule of carbon would be a carbon atom, one molecule of the oxygen we breathe would be two oxygen atoms (O2), and one molecule of water would be two hydrogen atoms and one oxygen atom (H2O).

Element:
A substance composed of specific atoms that cannot be broken down into simpler substances by normal chemical means.

Enzymes:
Specialized proteins that help biochemical process, such as, digesting food.

Cell Signal:
The use of chemicals by cells to communicate. Some examples of cell signaling include sending messages to open or close "gates" in the cells so that certain chemicals can enter or leave or sending messages to release antibodies when an unwanted invader, like a virus, is in the body.

Amino acids:
An organic, or carbon-containing, compound that make up proteins. There are 22 amino acids which all contain an amino group (NH2), a carboxylic acid group (COOH), and a side group.

Peptide:
Two or more amino acids attached together. Protein can be a dipeptide with two peptides or a polypeptide with many peptides.

Genes:
A hereditary unit made up of DNA.

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Primary structure:
When the body makes proteins the first step is to attach amino acids together in a line in a very specific sequence.

There are three parts to this 3-D structure. The **primary structure** is the amino acid "chain" bonded together, much like the "straight" rope in our analogy. The order and type of amino acids in this primary structure are what define a specific protein. The amino acid type, order and number are different for the hemoglobin protein (which carries oxygen in the blood) compared to the insulin protein (which manages sugar in the blood).

Secondary structure:
Once the primary structure of proteins is complete, the protein folds in on itself and bonds with the amino acids in the primary structure in a very specific way, either as an alpha-helix (spiral), a beta-sheet (like pleats or zig-zags), or a random coil.

Alpha (α) –helix:
a spiral shape.

The **secondary structure** of a protein is the first step of a protein "folding in" on itself. The secondary structure folding is in a regular, repetitive pattern like an **alpha (α)-helix** (or spiral), a **beta (β)-sheet**, or a random coil. For an α-helix structure, imagine taking your rope and swirling it into a circular pile. Then imagine where each part of the rope touches the rope above and below they stick together or bond. For a β-sheet you would fold the rope so there are many parallel strands, like making compressed S's or zig-zags. The pieces of rope (or protein) that are parallel or next to each other would bond. The bonds are what stabilize the secondary structure.

[Image of helix and beta sheet]

Tertiary structure:
The third stage of proteins folding in on themselves. Amino acids bond again which holds the 3-dimensional protein structure and gives the protein its specific "key-like" shape.

The third part of the protein structure is called the **tertiary structure**. This is additional bending and kinking of the secondary structure to compress the protein even more.

Imagine taking your coiled rope and folding it again. Like the primary and secondary structures, the tertiary structure is formed and held by bonds. The really interesting feature of the protein's tertiary structure is it's function beyond saving space. The hills and valleys of the outside of the protein act like a key that fits to a specific lock or a puzzle piece. When the key or puzzle piece fits with its intended counter part, the protein is doing its job – like carrying oxygen, stimulating the release of hormones, or fighting off infection.

[image of insulin]

Now you are going to build a model of a protein called insulin. Insulin helps regulate the amount of sugar in our blood. People who either do not release enough insulin or their insulin becomes less effective get a disease called diabetes. If diabetes is left untreated, the excess sugar in the body can cause blindness, kidney damage, artery damage, or death. Diabetes can be prevented or managed through a healthy diet of fruit, vegetables, "good" fats (like the fat in nuts, olives, and fish), plenty of water and exercise. Extreme cases of diabetes requires that a person inject insulin into their bodies near meal time.

Follow the steps to build a model of the protein insulin and answer the questions.

1. Refer to the handout titled "The Insulin Protein Puzzle." Color each amino acid rectangle in Table 2 with the assigned color found in the parenthesis next to the amino acid name and abbreviation in Table 1.

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Students color, cut out, and assemble the insulin model. Make sure the amino acids are colored and are in the proper primary sequence (following the sequential numbering for each a and b strand). Check that the proper sections of the protein are spiraled in an alpha-helix (amino acids are labeled with H). Check that the tertiary structure is properly "bonded" (S1, S2, and S3 labels are matched).

1.a. Which two amino acids occur the most in insulin? Using Table 1 on the "Insulin Protein Puzzle" handout, spell out the full amino acid name instead of the abbreviation.

1.b. Which two amino acids occur only once in insulin? Spell out the full amino acid name instead of the abbreviation.

2. Cut out the colored amino acid rectangles. You will save time and effort if you cut in rows (rather than cutting out individual squares) keeping the sequential numbering.

3. Tape the amino acids in the numbered sequence for each strand (a and b). You will end up with two straight strands (1a-21a and 1b-30b).

3.a. Which protein structural level does taping the amino acids together in a linear fashion represent?

4. Spiral the paper sections that are labeled with sequential H's (e.g. 1a-8a). Tape the helix so that it is stable. You may find it helpful to loosely wrap the paper around your finger then tape the paper.

4.a. Which protein structural level does spiraling represent?

4.b. Look at the insulin image on page *, does insulin have an alpha-helix, beta-sheet structure, or both?

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5. Next, tape together the corresponding "disulfide bonds" labeled with S in the upper right-hand corner of some of the amino acids rectangles (pair S1 with S1, S2 with S2, etc.).

    5.a. Which protein structural level does taping the S's (sulfide bonds) together represent?

Step 2: Proteins work like a puzzle or "lock and key." This is why the shape is very specific to each type of protein and is very important. Insulin works like a key by fitting into a special insulin receptor, or the lock, on the outside of a cell. When insulin does not fit in the receptor, diabetes can result because insulin cannot properly perform the job of moving sugar into the cell. When insulin stops working this is called insulin resistance and is the cause of type 2 diabetes.

Insulin resistance can be caused by genetics, obesity, or a combination of the two. A mutation in the insulin receptor gene can cause the insulin receptor on the outside of the cell to slightly change its shape. Scientists hypothesize that obesity may work in a similar way, by changing the shape of the insulin receptor so the "lock and key" no longer fit. One research study showed that fat cells produce a hormone called "resistin" which seems to inhibit insulin's ability to work.

Science is a process where questions are constantly being asked and multiple hypothesis are tested until those hypothesis are eliminated or supported through data from experiments. In the case of diabetes, there are many hypotheses about how obesity, diet, and physical exercise relate to insulin resistance.

A. If you were a scientist doing research on insulin resistance, what one question would you want answered and how would you design an experiment to answer that question? Be sure to identify only ONE question and provide enough details in your experimental design to demonstrate that you could answer that question. You can assume that the technology exists to do your experiment, but you need to describe what that technology would be that would help you (e.g. a machine to identify a molecule). Your experiment can look at the micoscopic or molecular level (like genetics or insulin receptors on cells) or it can look at the population level (such as research that studies groups of people with or without diabetes.)

Be sure to include the following in your experiment design:

How you will do the experiment step by step (First, Second, etc. or 1, 2, 3…):

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The Insulin Protein Puzzle

TABLE 1: The Amino Acids and their Abbreviations

Essential Amino Acids (those the human body cannot generate on its own)	Non-Essential Amino Acids (those the human body can generate on its own)
Tryptophan – Trp Lysine – Lys – (blue stripes) Methionine - Met Phenylalanine – Phe – (orange dots) Threonine – Thr – (black dots)) Valine – Val – (orange) Leucine – Leu – (green dots) Isoleucine – Ile – (yellow) Histidine – His – (brown dots) (essential in children) Arginine – Arg – (orange stripes) (essential in children)	Tyrosine – Tyr – (red dots) Glycine – Gly – (red) Serine – Ser – (green dots) Glutamic acid – Glu – (blue) Aspartic acid - Asp Cystine – Cys – (purple) Proline – Pro – (purple stripes) Alanine – Ala – (green stripes) Aspargine – Asn – (purple dots) Glutamine – Gln – (green)

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1a H Gly	2a H Ile	3a H Val	4a H S1 Glu	5a H Gln
6a H Cys	7a H S2 Cys	8a H Thr	9a Ser	10a Ile
11a S1 Cys	12a Ser	13a Leu	14a Tyr	15a H Gln
16a H Leu	17a H Glu	18a H Asn	19a H Tyr	20a S3 Cys
21a Asn		1b Phe	2b Val	3b Asn
4b Gln	5b His	6b Leu	7b S2 Cys	8b Gly
9b H Ser	10b H His	11b H Leu	12b H Val	13b H Glu
14b H Ala	15b H Leu	16b H Tyr	17b H Leu	18b H Val
19b H S3 Cys	20b Gly	21b Glu	22b Arg	23b Gly
24b Phe	25b Phe	26b Tyr	27b Thr	28b Pro
29b Lys	30b Ala			

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FOOD, CULTURE AND DIABETES: A PERSONAL REFLECTION
Student Handout

Student Handout

Name _____

Date _____

Essay

Write a two-page essay about your own cultural history with respect to food and your personal relationship with food. Be sure to incorporate or consider diabetes in your essay and how you may be able to honor your cultural food heritage while eating healthy. You may want to discuss if you have any family members with diabetes, whether you have diabetes, or how you feel about diabetes. Be sure to use good grammar, have a clear thesis, and statements with sufficient description and/or evidence to back your position. Be descriptive and expressive about your thoughts, feelings, and experiences. Conduct research as needed to learn about your cultural food history and properly cite resources. Follow your teacher's instructions with respect to citing references, drafts, edits, and re-writes (writing, editing and refining multiple drafts makes you a good writer!)

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Math

BALANCING ACT: Food Labels

Student Handout #1

Student Handout

Name _____

Date _____

A Look at Food Labels

"You are what you eat." There may be some truth to that old saying. Through extensive research, scientists have learned that what we eat influences our health. A balanced diet and exercise supports good health. On the other hand, a diet high in fat combined with an inactive lifestyle increases our risk for not only diabetes, but also cancer, stroke, and heart disease. The U.S. Department of Agriculture (USDA) is a government agency that establishes guidelines in order to aid us in making healthier food choices.

*Don't get stuck on certain foods, but, rather, eat a wide variety.
*Keep simple sugars and refined flour (like candy, cookies, and white bread) and sodium to a minimum.
*Choose foods low in saturated fats and cholesterol (e.g. minimize things like hamburgers and fried chicken, eat food like olives and nuts).
*Include plenty of whole-grain products for fiber (like whole wheat bread).
*Make a "rainbow" out of your plate with vegetables and fruits to ensure you are consuming wide variety of nutrients.
*Grab most often for the foods that do not have a label (i.e. fresh fruits and vegetables)

So, what does that label on the side of food packages mean? The food label tells us information about the food inside the package. The USDA created this nutritional tool to aid us in following their guidelines. In order to make healthy food choices, it is important to learn how to read the different parts of a food label.

Serving Size

This is the first nutritional fact listed on the label. It is the total amount of food a person would need to eat to get the amount of listed nutrients. For example, the serving size for macaroni and cheese is 1 cup after it is cooked. So, by eating 1 cup you would consume all the nutrients listed on the label. Next, look at how many servings there are per container. This package says there are 3 servings. This would mean if you ate the whole package, you would be consuming three times the calories and nutrients listed on the label.

Macaroni & Cheese

Nutrition Facts

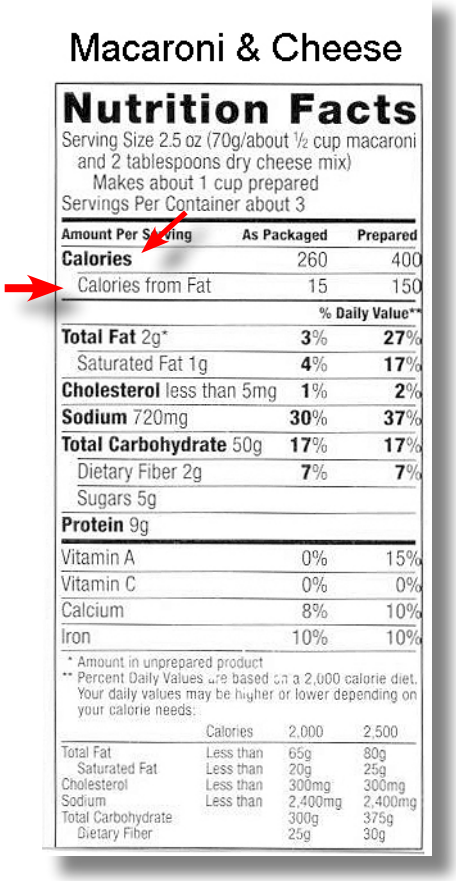
Serving Size 2.5 oz (70g/about ½ cup macaroni and 2 tablespoons dry cheese mix)
Makes about 1 cup prepared
Servings Per Container about 3

Amount Per Serving	As Packaged	Prepared
Calories	260	400
Calories from Fat	15	150
		% Daily Value**
Total Fat 2g*	3%	27%
Saturated Fat 1g	4%	17%
Cholesterol less than 5mg	1%	2%
Sodium 720mg	30%	37%
Total Carbohydrate 50g	17%	17%
Dietary Fiber 2g	7%	7%
Sugars 5g		
Protein 9g		
Vitamin A	0%	15%
Vitamin C	0%	0%
Calcium	8%	10%
Iron	10%	10%

* Amount in unprepared product
** Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories	2,000	2,500
Total Fat	Less than	65g	80g
Saturated Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #R25-ES10738-01, NIEHS #P30 ES012072, and a University of New Mexico College of Medicine La Tierra Sagrada Society Grant).



Macaroni & Cheese

Nutrition Facts

Serving Size 2.5 oz (70g/about ½ cup macaroni and 2 tablespoons dry cheese mix)
Makes about 1 cup prepared
Servings Per Container about 3

Amount Per Serving	As Packaged	Prepared
Calories	260	400
Calories from Fat	15	150
		% Daily Value**
Total Fat 2g*	3%	27%
Saturated Fat 1g	4%	17%
Cholesterol less than 5mg	1%	2%
Sodium 720mg	30%	37%
Total Carbohydrate 50g	17%	17%
Dietary Fiber 2g	7%	7%
Sugars 5g		
Protein 9g		
Vitamin A	0%	15%
Vitamin C	0%	0%
Calcium	8%	10%
Iron	10%	10%

* Amount in unprepared product
** Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories	2,000	2,500
Total Fat	Less than	65g	80g
Saturated Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Calories

A calorie is a unit of measurement that measures how much energy food provides for our bodies. The amount of calories required for individuals differs according to age, weight, gender, and activity level. Most school age children require 1600-2500 calories per day, but young adolescents entering puberty require 2500-3000 calories per day. Food labels are based on a 2,000-calorie per day diet.

Calories from Fat

This number, which is right by the total calories, tells us how many calories are coming from fat in one serving. It is a helpful number for people who are carefully monitoring their fat intake. It is recommended that no more than 30% of total calories come from fat. If you consumed 2500 calories over the course of a day, only 750 of those calories should come from fat (750 calories divided by 2500 total calories multiplied by 100). Let's look at how many calories from fat are in one prepared serving of macaroni and cheese (prepared means milk and butter were added as instructed). This label says that 150 calories from the total 400 calories come fat. If we calculate the percentage (150/400 x 100), 37.5% of the calories in one serving come from fat.

Percent % Daily Values

These are the percentages listed in the right hand column of the label. These percentages tell us how much of our daily value of certain nutrients we are getting if we eat one serving of that food. One serving of prepared macaroni and cheese provides 15% of the **Recommended Daily Allowance** (RDA) of Vitamin A. Our daily goal is to consume 100% of each of the nutrients listed. Therefore, this one serving is providing us with 15% of our daily goal.

Recommended Daily Allowance (RDA): The amount of a nutrients per day people need to stay healthy. The RDA was developed by the National Academy of Sciences/National Research Council and are updated based on research.

The percent daily values give us a general guideline for figuring out if a food is high or low in nutrients. Foods low in nutrients have daily values that are less than 5%. Values that are 10-19% are a good source of nutrients. Over 20% value is a food that is a high source of nutrients.

% Nutrients	Value of Nutrient Source
5%	Low
10-19%	Moderate
More than 20%	High

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Total Fat

This number tells us how much fat is included in one serving and is measured in grams (g). All fat is not bad for us. We do need some fat in our diets because it is an important source of energy. Fat also provides our bodies with insulation and cushioning for our skin, bones, and our body's organs. Fat even helps carry some nutrients throughout our body and helps store these vitamins (A,D, E, and K) in our body's tissues. Some types of fats are better than others, for example fats found in fish, nuts and olive oil are healthier than fats from beef or pork. We do need healthy fats as part of our daily diet, however, eating too much fat leads to obesity and other health problems. Fat should be limited to 30% of the total day's calories (for a 2000 calorie/day diet that is 600 calories from fat).

Macaroni & Cheese

Nutrition Facts

Serving Size 2.5 oz (70g/about ½ cup macaroni and 2 tablespoons dry cheese mix)
Makes about 1 cup prepared
Servings Per Container about 3

Amount Per Serving	As Packaged	Prepared
Calories	260	400
Calories from Fat	15	150
		% Daily Value**
Total Fat 2g*	3%	27%
Saturated Fat 1g	4%	17%
Cholesterol less than 5mg	1%	2%
Sodium 720mg	30%	37%
Total Carbohydrate 50g	17%	17%
Dietary Fiber 2g	7%	7%
Sugars 5g		
Protein 9g		
Vitamin A	0%	15%
Vitamin C	0%	0%
Calcium	8%	10%
Iron	10%	10%

* Amount in unprepared product
** Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories	2,000	2,500
Total Fat	Less than	65g	80g
Saturated Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Saturated Fat and Trans Fat

This number tells us how much of the total fat is made up of saturated and/or trans fats. Saturated fat comes from animal products. Butter, ice cream, cheese, whole milk, and meats are examples of saturated fats. Trans fats are also found in these foods, but trans fats are also vegetable oils that are specially treated or hydrogenated. If trans fat is not listed on the label, look for words like hydrogenated or shortening. These give us a clue if the food we are eating has trans fat. So why should we look for the amount of saturated and trans fat? Because these are unhealthy fats which raise cholesterol and can increase our risk for developing diabetes and heart disease. Think about a stick of butter. It can be melted, but it is normally solid at room temperature. Now imagine how this can clog our arteries!

Unsaturated Fat

These are sometimes referred to as the "good" fats. We can distinguish these from the "bad" fats, because these are liquid at room temperature. Vegetable oil, nuts, and fish are sources of unsaturated fat. These fats do not raise our cholesterol levels.

Cholesterol

Some cholesterol is important in our diet for some of our hormones and for producing Vitamin D. However, our liver produces most of the cholesterol that we need, so we don't need to eat much of it. Cholesterol can become a big problem if we eat too many of the foods that contain large amounts of cholesterol. Meat, as well as many fast foods and fried foods contain cholesterol. High levels of cholesterol in our bodies contribute to diabetes.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #R25-ES10738-01, NIEHS #P30 ES012072, and a University of New Mexico College of Medicine La Tierra Sagrada Society Grant).

Macaroni & Cheese

Nutrition Facts

Serving Size 2.5 oz (70g/about ½ cup macaroni and 2 tablespoons dry cheese mix)
Makes about 1 cup prepared
Servings Per Container about 3

Amount Per Serving	As Packaged	Prepared
Calories	260	400
Calories from Fat	15	150
		% Daily Value**
Total Fat 2g*	3%	27%
Saturated Fat 1g	4%	17%
Cholesterol less than 5mg	1%	2%
Sodium 720mg	30%	37%
Total Carbohydrate 50g	17%	17%
Dietary Fiber 2g	7%	7%
Sugars 5g		
Protein 9g		
Vitamin A	0%	15%
Vitamin C	0%	0%
Calcium	8%	10%
Iron	10%	10%

* Amount in unprepared product
** Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories	2,000	2,500
Total Fat	Less than	65g	80g
Saturated Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Total Carbohydrate

This is a total of the dietary fibers, sugars, and other carbohydrates (or carbs) that make up one serving. Carbs can either be simple or complex. Simple carbs are called sugars, and complex carbs are called starches. The best sources of carbohydrates are whole-grain cereals, rice, whole-grain breads, pastas, potatoes, vegetables, and fruits. Carbohydrates are a good source of calories that provide us with abundant energy. It is recommended that at least 50% of our total daily calories come from carbohydrates.

Sugars

Sugars can be found in either starches or simple sugar carbohydrates. Pasta is a starch that is high in complex carbohydrates so it is a healthy food choice. Chips, candy, and soda are examples of simple sugars and should be limited in our diet. The calories found in simple sugars are often called “empty calories” because they provide no nutrients for us--just calories! These sugars also raise blood glucose levels very rapidly. You know that mid-afternoon feeling of wanting to take a nap? Well that is often a sign that we are eating too much simple sugars and have rapid rises and falls of blood sugar levels.

Dietary Fiber

Dietary fiber has no calories, but we need fiber in our diet to help reduce cholesterol and promote bowel regularity. Fiber also helps us feel full and is good if we want to reduce calories but not be hungry.

Protein

Our body’s muscles, skin, and immune system are made of proteins, so we need to eat them to stay strong and healthy. We should consume anywhere from 10-20% protein in our daily diet. Young adolescents really need to eat protein because protein helps us to grow. If our bodies do not get enough energy from carbohydrates and fat, it uses protein for energy. Low-fat milk, egg whites, soybeans, meat, fish, poultry, cheese, yogurt, and nuts are excellent sources of protein.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #R25-ES10738-01, NIEHS #P30 ES012072, and a University of New Mexico College of Medicine La Tierra Sagrada Society Grant).

The Footnote at the Bottom of the Food Label

There is a final chart at the bottom of most food labels. This chart lists the daily-recommended dietary intake for all Americans based on either a 2000 or 2500 calorie diet. Notice how the fat and carbohydrate information changed based on the different intake of calories. What remained the same for both diets? Yes, cholesterol and sodium intake should always remain the same.

Calories per Gram

These numbers are usually in the chart near the bottom of the food label. They remind us how many calories are in one gram of fat (90 calories), protein (4 calories), and carbohydrates (4 calories).

Macaroni & Cheese

Nutrition Facts

Serving Size 2.5 oz (70g/about ½ cup macaroni and 2 tablespoons dry cheese mix)
Makes about 1 cup prepared
Servings Per Container about 3

Amount Per Serving	As Packaged	Prepared
Calories	260	400
Calories from Fat	15	150
		% Daily Value**
Total Fat 2g*	3%	27%
Saturated Fat 1g	4%	17%
Cholesterol less than 5mg	1%	2%
Sodium 720mg	30%	37%
Total Carbohydrate 50g	17%	17%
Dietary Fiber 2g	7%	7%
Sugars 5g		
Protein 9g		
Vitamin A	0%	15%
Vitamin C	0%	0%
Calcium	8%	10%
Iron	10%	10%

* Amount in unprepared product
** Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories	2,000	2,500
Total Fat	Less than	65g	80g
Saturated Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Nutrients to Note

Vitamin A
The food label usually lists important nutrients as a part of the percent (%) daily value of one serving. Vitamin A is a common nutrient listed. It is important for good eyesight and healthy skin.

Vitamin C
Vitamin C is necessary for healing wounds and fighting colds and infections. The best sources are citrus fruits.

Iron
Our bodies need iron for making new, healthy red blood cells every 3 months. It is important to get lots of iron in our diet, because our red blood cells carry the oxygen that we need throughout our bodies. Iron-fortified cereals, raisins, and dark green, leafy vegetables are good sources of iron.

Sodium
Sodium refers to the amount of salt in the serving. The USDA recommends that sodium intake is limited to 2,400 milligrams (mg) per day. Sodium helps the body maintain its balance of water and acids, but too much sodium can cause high blood pressure. The average American diet consumes too much sodium, typically between 4000-5000 mg per day.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #R25-ES10738-01, NIEHS #P30 ES012072, and a University of New Mexico College of Medicine La Tierra Sagrada Society Grant).

Math

BALANCING ACT

Student Handout #2

Name _____

Date _____

Student Handout

Section 1, Energy In:

- Use the lunch examples below to answer the following questions.

Lunch 1
Pizza
Candy bar
Soda

Lunch 2
PBJ on whole wheat
Apple
Water

Bread

Nutrition Facts
Serving Size 1 Slice (26g)
Servings Per Container 26

Calories 70
Calories from Fat 10

Amount/serving	%Daily Value*	Amount/serving	%Daily Value*
Total Fat 1g	2%	**Sodium** 140mg	6%
Saturated Fat 0g	0%	**Total Carbohydrate** 12g	4%
Polyunsaturated Fat 0g		Dietary Fiber 1g	4%
Monounsaturated Fat 0g		Sugars 1g	
Cholesterol 0mg	0%	**Protein** 2g	

Vitamin A 0% • Vitamin C 0% • Calcium 2% • Iron 4%
Thiamine 8% • Riboflavin 0% • Niacin 4% • Folate 4%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

F2612426
INGREDIENTS: ENRICHED WHEAT FLOUR [FLOUR, BARLEY MALT, FERROUS SULFATE (IRON), "B" VITAMINS (NIACIN, THIAMINE MONONITRATE (B1), RIBOFLAVIN (B2), FOLIC ACID)], WATER, MOLASSES, YEAST, WHEAT BRAN, WHOLE WHEAT FLOUR, WHEAT GLUTEN, HIGH FRUCTOSE CORN SYRUP. CONTAINS 2% OR LESS OF SOYBEAN OIL, BUTTER, HONEY, SALT, DOUGH CONDITIONERS (SODIUM STEAROYL LACTYLATE, CALCIUM DIOXIDE, CALCIUM IODATE, ALPHA AMYLASE), DATEM, DICALCIUM PHOSPHATE, DIAMMONIUM PHOSPHATE, ENZYMES, CALCIUM SULFATE, VINEGAR, MONOGLYCERIDES, SOY FLOUR, CALCIUM CARBONATE. 120186

CONCORD
Grape Jelly

Nutrition Facts
Serving Size: 1 tbsp (20g)
Servings Per Container: 31

Amount Per Serving
Calories 50

	% Daily Value*
Total Fat 0g	0%
Sodium 15mg	1%
Total Carb. 13g	4%
Sugars 13g	
Protein 0g	

*Percent Daily Values are based on a 2,000 calorie diet.

Soda Pop

Nutrition Facts
Serving Size: 1 Can
Servings Per Container: 12

Amount Per Serving
Calories 150

	% Daily Value*
Total Fat 0g	0%
Sodium 55mg	2%
Total Carb. 40g	13%
Sugars 40g	
Protein 0g	

*Percent Daily Values are based on a 2,000 calorie diet.

CARBONATED WATER, HIGH FRUCTOSE CORN SYRUP AND/OR SUGAR, CARAMEL COLOR, PHOSPHORIC ACID, ARTIFICIAL AND NATURAL FLAVORS, SODIUM BENZOATE (PRESERVATIVE), CAFFEINE.

Pizza

Nutrition Facts
Serving Size ½ Pizza (155g)
Servings Per Container 2

Amount Per Serving
Calories 380 Calories from Fat 190

	% Daily Value*
Total Fat 21g	33%
Saturated Fat 5g	26%
Cholesterol 15mg	6%
Sodium 840mg	35%
Total Carbohydrate 35g	12%
Dietary Fiber 2g	7%
Sugars 3g	
Protein 13g	

Calcium 15% • Iron 10%

Not a significant source of vitamin A and vitamin C.

*Percent Daily Values are based on a 2,000 calorie diet.

Candy Bar

Nutrition Facts
Serving Size 1/3 bar (35g)
Servings Per Container 72

Amount Per Serving
Calories 170 Calories from Fat 70

	% Daily Value**
Total Fat 8g	12%
Saturated Fat 3g	15%
Trans Fat 0g	
Cholesterol 5mg	2%
Sodium 85mg	4%
Total Carbohydrate 21g	7%
Dietary Fiber 1g	4%
Sugars 18g	
Protein 3g	

Vitamin A * • Vitamin C *
Calcium 2% • Iron *
Thiamine 2% • Riboflavin 2%
Niacin 4%

*Contains less than 2% of the Daily Value of these nutrients.
**Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat. Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

MILK CHOCOLATE (SUGAR, COCOA BUTTER, CHOCOLATE, LACTOSE, SKIM MILK, MILKFAT, SOY LECITHIN, ARTIFICIAL FLAVOR), PEANUTS, CORN SYRUP, SUGAR, SKIM MILK, BUTTER, MILKFAT, PARTIALLY HYDROGENATED SOYBEAN OIL, LACTOSE, SALT, EGG WHITES, ARTIFICIAL FLAVOR.
Allergy Information: May contain almonds.

Apple

0 grams of fat,
30 g of carbohydrates,
0 g of protein,
Calories 120

Peanut Butter

Nutrition Facts
Serving Size 2 Tbsp (32 g)
Servings Per Container 16
Calories 200
Fat Cal. 140
*Percent Daily Values (DV) are based on a 2,000 calorie diet.

Amount/serving	%DV*	Amount/serving	%DV*
Total Fat 16g	25%	**Total Carb.** 7g	2%
Sat. Fat 3g	15%	Fiber 2g	8%
Cholest. 0mg	0%	Sugars 3g	
Sodium 160mg	7%	**Protein** 8g	

Vitamin A 0% • Vitamin C 0% • Calcium 0% • Iron 2%

INGREDIENTS: PEANUTS, DEXTROSE, HYDROGENATED VEGETABLE OIL (RAPESEED, COTTONSEED, SOYBEAN), SALT.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #R25-ES10738-01, NIEHS #P30 ES012072, and a University of New Mexico College of Medicine La Tierra Sagrada Society Grant).

1. Refer to the food labels on page 137. What are the fat, carbohydrate, protein, and calorie values for lunch 1 and 2? Fill in the table below.

Lunch			Total Fat (grams)	Total Carbohydrate (grams)	Protein (grams)	Calories
Lunch 1	Pizza (x 2)					
	Candy Bar (x 3)					
	Soda (1 can)					
	TOTAL LUNCH 1					
Lunch 2	PBJ on whole wheat	Peanut Butter (2 tbsp)				
		Jelly (1 tbsp)				
		2 slices of whole wheat bread				
	Apple					
	Water		0	0	0	0
	TOTAL LUNCH 2					

2. What is the difference in caloric values between the 2 lunches?

3. Based on a 2000-calorie diet, what percentage of the daily caloric allowance is from lunch 1 and lunch 2? (calories from lunch/2000 calories x 100)

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4. Add your lunch calorie totals to the following two scenarios to get a total caloric intake for a day.

	Breakfast	Lunch	Dinner	Snacks	Total Calories
Whole Day Calories Example 1	Hot cakes, syrup, butter, sausage, and orange juice	Lunch 1:	Large cheeseburger, French fries, and soda	Tortilla chips, chocolate chip cookies, soda	
Calories	517		1120	696	
Whole Day Calories Example 2	Raisin bran, 1% low-fat milk, low-fat ham steak	Lunch 2:	Grilled chicken breast, broccoli, brown rice, water	Yogurt (fat-free, fruit), dry-roasted almonds, carrots, 3 stalks celery, water	
Calories	514		325	325	

Section 2, Energy Out:

- Put a check next to the activities you participated in yesterday, then calculate the total calories you used or expended. The listed number of calories burned is for approximately 30 minutes of activity. If you did an activity for an hour, then multiply the number of calories by 2. If you did the activity for 15 minutes, then multiply the number of calories by 0.5.
- The resting metabolic rate is the base number of calories burned for your body to function. For example, energy is used to keep your body temperature ay 98.6° F, it's used for your heart to beat, for your cellular processes, and even thinking. The resting metabolic rate varies from person to person, but for this example we will assume everyone has a resting metabolic rate of 1100 calories.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #R25-ES10738-01, NIEHS #P30 ES012072, and a University of New Mexico College of Medicine La Tierra Sagrada Society Grant).

Activity	Length of Time You Did the Activity (in hours)	Calories Used in 1 Hour(multiply by the length of time in hours)	Total Calories Used
☐ Aerobics		270	
☐ Baseball		234	
☐ Basketball		270	
☐ Bicycling		294	
☐ Dancing		128	
☐ Housecleaning		262	
☐ Football		366	
☐ Jogging		450	
☐ Soccer		312	
☐ Sweeping		112	
☐ Swimming		402	
☐ Walking – briskly		264	
☐ Walking – Normal		130	
☐ Watching TV		48	
☐ Weight lifting		312	
☐ Yoga		240	
Resting metabolic rate			1100
		TOTAL CALORIES USED	

- Answer the following questions:

1. Did your activities from yesterday burn off calories from the Whole Day Calories Example 1 or Whole Day Calories Example 2? Show your calculation and explain.

2. What kind of activity and for how long is needed to burn off calories from the whole day's caloric intake? Show your calculations.

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Math

BALANCING ACT: Homework

Student Handout #3

Student Handout

Name _____

Date _____

1. Use the table below to keep track of the following information for 1 day. When possible, look at the food labels to get the total calories for each food you eat. Be sure to pay attention to the serving size! The serving size for cookies may be 2 cookies, but if you eat 4 cookies you have to multiply the number of calories listed on the package by 2.

   Refer to the Student Handout #5: Calories of Common Foods for calorie values.

Time of Day	Food Eaten	Calories Eaten	Activity	Calories Used	Food and/or Activity Alternatives
Morning Wake-up-11 a.m.					
Mid-Day 11 a.m.-2 p.m.					
Evening 5 p.m.-bedtime					
	TOTAL CALORIES EATEN		TOTAL CALORIES USED		

2. Write a self-reflection summary of what you learned about your own eating and activity level. Discuss the impact your behaviors may have on your general health, overall well-being, risk of diabetes, and self-esteem.

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #R25-ES10738-01, NIEHS #P30 ES012072, and a University of New Mexico College of Medicine La Tierra Sagrada Society Grant).

BALANCING ACT: Calories of Common Fast Foods

Student Handout #4

Student Handout

Name _____

Date _____

Reference: http://www.annecollins.com/calories/calories-fast-food.htm
This website has calories for many other foods as well.
Index of Nutrition and Calories in Food: http://www.calorie-counter.net/nutrition-calories-in-food.htm
Calorie-count.com: http://www.calorie-count.com/calories/item/8013.html

Food	Calories
Beans – refried (3.5 oz)	
Beans – Red Kidney (3.5 oz, canned)	
Beans – Garbanzo (4 oz)	
Breakfast - Cheerios	
Breakfast - Pop Tarts	
Breakfast - Nutrigrain cereal bar	
Breakfast – pancakes w/ butter and syrup	
Breakfast - Raisin Bran	
Breakfast – 1 Krispy Kreme Glazed	
Condiments - Ranch Dressing (1 pkg)	
Condiments – Catsup (3.5 oz)	
Dairy - Cottage cheese (low fat, 3.5 oz)	
Dairy - Nacho cheese (3.5 oz)	

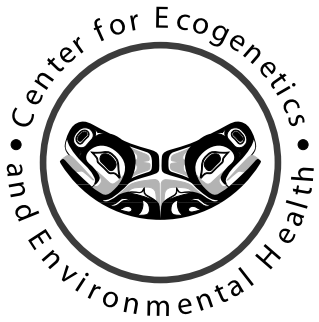
Food	Calories
Meat - Chicken Nuggets (No Sauce)	
Meat - Hot Dog (with Chili meat & bun)	
Meat - Chicken breast, oven roasted	
Meat - Burrito, beef	
Meat - Beef, Sirloin	
Meat - Bologna	
Meat - Turkey, lunch meat	
Meat - Salmon steak (6 oz)	
Meat - Canned Tuna (3.5 oz)	
Meat - Fish sticks	
Meat - Cheeseburger (Large)	
Meat - Hamburger (Large)	
Meat - Fried Chicken	

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #R25-ES10738-01, NIEHS #P30 ES012072, and a University of New Mexico College of Medicine La Tierra Sagrada Society Grant).

Food	Calories
Dairy - Eggs (1 large)	
Dessert - Hot Fudge Sundae	
Dessert – Brownie (3.5 oz)	
Dessert – Chocolate Chip Cookie (3.5 oz)	
Fruit – apple (1 medium)	
Fruit – Banana (1 medium0	
Fruit - Orange	
Grain - Rice	
Grain- Noodles (1 cup)	
Juice – Orange (3.5 oz)	
Juice – Apple (3.5 oz)	

Food	Calories
Other - Pizza – (Pepperoni, one 14” slice)	
Other – Cheese Enchilada (3.5 oz.)	
Other – Nachos w/ cheese	
Vegetables - French Fries (Large)	
Vegetable - Baked potato (w/ skin)	
Vegetable - Asparagus (3.5 oz)	
Vegetable - Broccoli (3.5 oz)	
Vegetable - Carrots (3.5 oz)	
Vegetable - Celery (1 stalk)	
Vegetable - Corn-on-the-cob (with butter)	
Vegetable - Green Salad (no dressing)	

Materials developed by the Integrated Environmental Health Middle School Project (NIEHS Grant #R25-ES10738-01, NIEHS #P30 ES012072, and a University of New Mexico College of Medicine La Tierra Sagrada Society Grant).



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