



Curriculum Units by Fellows of the Yale-New Haven Teachers Institute  
2009 Volume IV: How We Learn about the Brain

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## **Food for Thought**

Curriculum Unit 09.04.02  
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### **Introduction**

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It is important that students understand that good food choices are essential for the growth and development of their own bodies and their functions. Food is one of humans' basic needs and we cannot live without it. Students need to realize that food enriches us with energy for everything we do such as playing sports, walking, talking, breathing and thinking. In accordance with the National Science Education Standards as well as state of Connecticut Standards, students are expected to achieve scientific literacy in an inquiry based environment that allows them to hypothesize, discuss, and evaluate data which they can apply to their everyday lives. Students around age 10 and 11 often make choices based on how they will affect their social status rather than thinking about the consequences of their actions on their own lives. This unit will allow students to feel knowledgeable enough to make smart and healthy food choices that will affect their development and function of their brain.

I teach fifth grade at Nathan Hale School in New Haven, Connecticut. My fifth grade class is in an urban district and is composed of a diverse, multicultural community of learners that embodies a wide range of achievements, interests, learning and social needs. It is a school that has a strong neighborhood support structure since the majority of the students enrolled is from the neighborhood.

The topic for this curriculum unit is "Food for Thought". My goal is to help students become aware of the effect food choice has on their development and the function of their brain. A brief scientific explanation of how the brain works and the make up of the brain will be introduced through pictorial representations and reading materials. We shall also discuss "The Six Categories of Nutrients" and how they are used by our body and brain. Finally, the students will be able to discuss the components of the Food Pyramid and use them in meal planning. This unit is designed to help teachers integrate Science and Health within their own classroom by providing the necessary background knowledge about the brain, its nutritional needs and how its functions affect our bodies. It has been designed such that it can be integrated into literacy, mathematics and science classes, giving educators the ability to integrate the subject matter within their own daily lesson plans. The needs of all learners can be met while fulfilling the curriculum standards of the school district. This unit is aimed at nurturing critical thinkers and problem solvers.

## Setting the Tone

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In this 6-week unit, students will study how food choices affect brain development. They will compare and contrast their daily diets and food choices before this unit and after. Through various activities and experiments, students will explore the composition of the brain and its function. Students will also learn about The Six Categories of Nutrients, the Food Pyramid and the impact food choice has on our brains.

The emphasis will be on what we can do to instill our body and brain with proper nutrition for a foundation for healthy learning. Helping students make healthier choices is an essential part of their education and well-being. Through this study, students will gain the ability to choose the healthiest foods, from choices that are available to them in their everyday lives, which will boost their brain development and over all improve their health.

Prior to the start of this unit students will be required to keep a daily food journal for a week and participate in a pre-test on what they know about the brain. During this time, students will familiarize themselves with the appropriate categorizes of nutrients and vocabulary dealing with the brain. Students can later connect their food choices with their own brain development.

## Overview

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### **Weeks One and Two**

In week one and two, the class will be introduced to the brain through a brief scientific explanation using pictorial representations of the brain, as well as reading materials on the brain. The students will gain an understanding of how the brain works and how the brain is made. Finally during this week students will begin to study the vocabulary associated with the brain. Vocabulary words that will be introduced and integrated throughout this unit include: synapses, neurons, dendrites and axon neurotransmitters . The students will obtain background knowledge about the brain which will be used to understand why the brain needs proper nutrients to work properly and efficiently.

### **Weeks Three and Four**

During these weeks students will analyze the six categories of nutrients for good health and brain development. In order to develop a deep understanding of the six categories, students will need to gain a deeper understanding the basis of The Food Pyramid.

### **Weeks Five and Six**

During these final two weeks of the unit students will be asked to apply their skills learned to their everyday lives. Projects and activities will allow students to apply their prior knowledge about the brain and how proper food choice can affect their own brain development. Based on their cumulative study, students can create and evaluate a daily food guide/meal plan that will help their brain work to its utmost capacity. Participating in these activities will focus on the issues dealing with good nutrition and their effects on the brain. Students will

gain an understanding of good food choice and how crucial it is for the growth and development of their brains. Students will then be evaluated on their application of the knowledge through this study.

In accordance with the Connecticut State Standards for Science, after completing this unit students' will be able to identify foods they need to stay healthy. Students will recognize what influences their healthy behaviors and decisions. Students will describe what they need to eat to keep themselves healthy. Through this unit students will recognize that the food they choose to eat will affect the development of their brain.

## Background Knowledge

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Overview of the brain and how it works

The brain has many different parts that work together. The brain gets the messages from the senses - seeing, hearing, tasting, smelling, touching and moving. The messages travel from nerve cells all over the body. They travel along nerve fibers to groups of nerve cells, called grey matter, in the brain.

There are five parts of the brain which are key players to the function of the brain and the body.

1. Cerebrum
2. Cerebellum
3. Brain Stem
4. Pituitary Gland
5. Hypothalamus

### The Biggest Part: The Cerebrum

The biggest part of the brain is the cerebrum. This part of the brain makes up about 85% of the brain's weight (Kid Health, 2007). The external part of the cerebrum, called the cortex is the site of reasoning and higher order thought processes. It also controls the voluntary muscles permitting coordinated movement. The cerebrum is required for many everyday functions such as solving math problems, figuring out video games and kicking a soccer ball. Both long and short term memory use the cerebrum.

The cerebrum has two halves or hemispheres, one on either side of the head. The right side of the brain controls movement on the left side of the body and the left side of the brain controls movement on the right side of the body.

### The Cerebellum

The cerebellum is located at the back of the brain, below the cerebrum. It's smaller than the cerebrum at only 1/8 of its size. The cerebellum controls balance, movement, and coordination.

## **Brain Stem**

The brain stem sits beneath the cerebrum and in front of the cerebellum. It connects the brain to the spinal cord, which supplies the body. The brain stem controls many of the functions the body needs to stay alive (breathing, digesting and blood circulation).

The brain stem plays a role in control of involuntary muscles. These muscles include the heart, the muscles of the digestive tract and blood vessels. The brain stem tells the heart to pump more blood when playing sports. The brainstem also controls many functions of the head and neck, including moving the face and eyes and chewing and swallowing. The brain stem transmits all the messages to and from the body and the brain.

## **Pituitary Gland**

The pituitary gland is very small about the size of a pea. The pituitary gland produces and releases hormones into the body. This little gland plays a large role with hormones; it controls the amount of sugars and water in your body. It also helps regulate metabolism. Metabolism is everything that is happening in your body to keep it alive and growing and energized. The Webster definition of metabolism is "a chemical changes in living cells by which energy is provided for vital processes and activities and new material is assimilated" (<http://www.merriam-webster.com/medical/metabolism>).

## **Hypothalamus**

The hypothalamus is the brain's thermostat (Kid's Health, 2007). The hypothalamus regulates body temperature at about 98.6 degrees Fahrenheit (37 degrees Celsius). If body temperature is too high the hypothalamus activates sweating. If body temperature is too cold the hypothalamus activates shivering. The hypothalamus also controls hunger and satiety as well as influencing the pituitary gland.

## **Spinal Cord**

The spinal cord, which is a long bundle of axons and column of neurons inside the spinal column, is made up of millions of neurons. The spinal cord is the information highway connecting the brain and body. The spinal cord in humans is protected by the spinal column. The spinal column is made up of bones called vertebrae. Although, the spinal

column is somewhat flexible, some of the vertebrae in the lower parts of the spinal column become fused.

## **Neuron**

Neurons are highly specialized nerve cells that are responsible for communicating information in both chemical and electrical forms. There are many different types of neurons responsible for different tasks in the human body.

Sensory neurons pass on information from the sensory receptor cells throughout the body to the brain. Motor neurons pass on information from the brain to the muscles of the body. Interneurons are responsible for passing on information between different neurons in the body. Each neuron has an axon (usually one). The axon (a fiber) allows for impulses to be sent outward. Each neuron also has many dendrites which are small short, hair-like fibers that receive impulses from neurons. Dendrites bring information to the cell's body.

Each tiny neuron has tiny branches which connect to many other neurons. According to many scientists when

babies are born their brains have with all the neurons they will ever have, although, many of them are not connected to each other (Kids Health, 2007). Messages that are learned go through from one neuron to another, over and over again. The brain begins to create stronger and more connections (or pathways) between the neurons. These connections allow memories to form and learning to occur.

## **Overview of the six nutrients the body and brain needs for good health**

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Most nutrients needed for good health have been divided into six categories and they are:

1. Proteins
2. Fats or lipids
3. Carbohydrates
4. Vitamins
5. Water
6. Minerals

### **Proteins**

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Every cell in the body contains proteins and they are made up of units called amino acids. Essential amino acids must be supplied by the diet because the body cannot make its own supplies. The other amino acids are called non essential amino acids and they can be synthesized by the body fast enough to meet its needs. Proteins which contain all eight essential amino acids are complete proteins and they will help the growth and maintenance of body tissues.

Proteins provide amino acids which the body needs to grow, form new tissue, maintain and repair body tissues. They also help in forming enzymes, hormones, and antibodies and provide energy. A person needs protein according to their age, body size, quality of proteins in their body, and physical state. Protein is found in meats, fish, milk and cheese. Protein provides the foundation for most of the body's tissues, nerves, internal organs (including the brain). Proteins are used to make neurotransmitters and essential to improve mental performance ("Brain Food", 2009) If the diet does not contain enough protein lack of energy, tiredness, and loss of weight may occur a child's growth may be stunted.

## Fats and Lipids

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The brain is more than 60% fat. This is because the axons that connect all the parts of the brain are covered by myelin sheath that is composed of about 75% fat. Omega 3 fatty acids are important to the optimum performance of the brain. Deficiency of omega-3 fats in the diet can lead to depression, poor memory, low IQ, learning disabilities, ADD and many more problems ("Brain Food", 2009). Oily fish like salmon, sardines, trout, tuna, mackerel and anchovies are a good source of omega 3 fatty acids.

Fats are a very important source of energy. Fat is stored in the body in special cells called adipose cells. Fats and lipids are needed by the body to act as insulation, give and reserve a supply of energy and help our vital organs such as the heart and kidneys. Too much fat can cause health problems. Fats belong to a large group of compounds called lipids which include fats and oils. Fatty acids are organic compounds containing three elements carbon, hydrogen and oxygen. They can be saturated depending upon the amount of hydrogen in the molecule. Polyunsaturated fatty acids are the ones missing four or more hydrogen atoms. Generally a healthy diet should minimize the consumption of saturated fatty acids.

Fatty acids can be produced by the body from the chemicals found in fats. A small number of essential fatty acids cannot be produced by the body and they must be obtained from the diet. Linoleic acid is an important essential fatty acid. Cholesterol, a fat-like substance is found in every cell in the body and is very important in serving to many functions in the body. It is part of the skin tissue and helps the transport of essential fatty acids in the body, and in the production of hormones. The body makes the cholesterol that it needs.

The fats also transport vitamins and serve as a source of essential fatty acids. Sources of fat are butter, margarine, salad dressings, oils, vegetable shortenings, egg yolks, many dairy products, nuts, meats and avocados.

## Carbohydrates

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Carbohydrates are the body's most important source of energy and they include starches and sugar. These energy sources are produced in plants by a process we know as photosynthesis. Carbohydrates are divided into three classes: monosaccharide, disaccharides and polysaccharides. Monosaccharide is the simplest and glucose and fructose are the two important carbohydrates. Glucose occurs naturally in corn syrup, vegetables, honey and molasses. Glucose is formed in the body when complex carbohydrates are broken down during digestion and it is then carried throughout the body by the bloodstream. It provides constant and immediate energy for all body cells and tissues, especially the brain. Fructose commonly found in molasses, fruits, vegetables and honey is the sweetest of all the sugars and also is the easiest absorbed by the body.

Carbohydrates increase the absorption of tryptophan, which is converted into serotonin in the brain ("Brain Food,"2009). Serotonin neurotransmitters are needed for normal brain function

Disaccharides include sucrose, lactose, and maltose. Sucrose is ordinary table sugar and it is found in sugar beets, maple syrup, corn syrup, molasses and sugar cane. Lactose is found in the milk of mammals. Maltose is found in sprouting cereal grains, malted milk, and malted cereals. During digestion, disaccharides are broken

down, absorbed, and used by body.

Polysaccharides are the most complex carbohydrates, and they include cellulose, starch, dextrin, and glycogen. Cellulose is a fibrous material in plants. It is indigestible by humans but it provides bulk in a diet and stimulates the action of the muscles in the digestive tract.

Starch is the most abundant carbohydrate in the diet. Starch is found in roots, seeds and tubers. It must be broken down into glucose before it can be absorbed.

Dextrin is a by-product of the breakdown of starch and it is present in the preparation of foods. Sources of dextrin are rice, wheat flour, peanuts, corn and beans.

## Vitamins

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Vitamins help to regulate the metabolic processes in the body. They are usually made up of carbon, oxygen, hydrogen, sulfur, and nitrogen. They are needed in small amounts for normal growth, maintenance and reproduction. They cannot be produced by the body. If a diet is well-balanced, usually all of the needed vitamins are provided. If not, serious vitamins deficiencies may result.

Vitamins can be either fat-soluble or water-soluble. Fat-soluble vitamins are stored in fat and they are A, D, E, and K. Vitamin A is needed for growth of bones and teeth, healthy skin tissue and is an important chemical compound for the eyes. Vitamin A is obtained in foods such as butter, fish, oils, spinach and squash. Vitamins A, C, and E are very powerful antioxidants and promote and preserve memory in the elderly ("Brain Food", 2009).

Vitamin D promotes the growth and proper mineralization of bones and teeth; it also helps the body in the use of calcium and phosphorus. Vitamin D is found in foods such as egg yolk, tuna liver, sardines and fish liver oils. Humans make 90 percent of vitamin D naturally using sunlight exposure to the skin - specifically, from ultraviolet B exposure to the skin, which initiates the conversion of cholesterol in the skin to vitamin D3. An individual probably needs from 5 to 30 minutes of exposure to the skin on the face, arms, back or legs (without sunscreen) twice every week. Since exposure to sunlight is a risk for skin cancer, a person should use sunscreen after a few minutes in the sun and even in the winter and on hazy, cloudy days (<http://digghealth.com/vitamin-sun/>.)

Relatively little is known about the role of vitamin E in the body, although it is believed that it does combine with oxygen, it is readily oxidized and it reduces that amount of oxygen inhibiting the oxidation of fatty acids, and carotene. It is commercially used to slow spoilage. Major sources are found in shortenings, margarines, salad oils, fats and other oils. Other sources are leafy green vegetables, breads and whole grain cereals.

Vitamin K is vital in blood clotting. It helps the liver make a substance known as prothrombin, a protein that blood needs to clot. If vitamin K is not available, the blood cannot clot properly. Vitamin K is found in leafy green vegetables, cauliflower, organ meats and egg yolks.

Vitamin C is water-soluble, it cannot be stored in the body and it must be supplied each day. Vitamin C helps in the formation and maintenance of collagen, helps make the walls of blood vessels firm, wounds heal and

broken bones mend. It aids in the formation of hemoglobin and helps the body fight infection. Important sources are fresh fruit and vegetables such as citrus fruits, strawberries, cantaloupe, green peppers, broccoli and cabbage.

The B vitamins are the most complex of all and are water-soluble. Although each has its own characteristics, they all work together in the body. The B complex minerals are very important for growth and functioning of the brain. This vitamin is particularly important to the brain and plays a vital role in making energy.

B-1 (thiamin) helps promote normal appetite and digestion. Forms parts of the coenzymes needed for the breakdown of carbohydrates, keeps the nervous system healthy, and helps release energy from food.

B-2 (riboflavin) aids cells in the use of oxygen, keeps tongue and lips normal, and prevents scaly, greasy areas around the mouth and nose. Riboflavin also forms part of the coenzymes needed for the breakdown of carbohydrates in the body.

Folic acid is essential for all vertebrates, including human beings. It keeps the body producing normal blood cells and plays a part in biochemical reactions in cells whereby food is converted to energy.

Niacin helps the nervous system, skin, mouth, tongue and digestive tract stay healthy, aids cells in the use of other nutrients and forms parts of two coenzymes involved in complex chemical reactions in the body.

B-6 (pyridoxine) aids in nervous tissue functioning normally, has a role in the breakdown of proteins, fats and carbohydrates, and plays a role in the regeneration of red blood cells.

B-12 protects against anemia and plays a role in the normal functioning of cells.

Sources of vitamin B complex are liver, muscles meats, poultry, fish, other meats, eggs, ice cream, whole grain bread, cereals, milk, cheese, dried beans and peas, and leafy green vegetables.

## Water

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Since about 70% of fat-free body mass is water, it's not surprising that the body must have water to function. An individual might live for month without food but only a few days without water. Water is needed for proper digestion, cell growth, and maintenance. Water also lubricates the joints, body cells, and helps regulate the body's temperature. Water is inside and outside of all cell walls. The body takes the water it needs from liquids and foods that are taken into the body. Most of the water comes from the liquids that are ingested and they can be found in the form of water, milk, coffee, tea, fruit juices, clear soups and other beverages. Eight glasses of liquid a day supplies enough water for most individuals.

The brain needs to be fully hydrated so that the circuitry works at its best. Water is also important for concentration and mental alertness. Studies have shown that most people are permanently partially dehydrated. ("Brain Food", 2009). A study by Trevor Brocklebank at Leeds University in the UKL discovered that schoolchildren with the best results in class were those who drank up to eight glasses of water a day (Lucas, 2001).



## Minerals

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Minerals are found in almost all foods. Minerals are an inorganic substance in the body. They are needed to build bones, tissues and other compounds. Several minerals are needed for development and good health. Some minerals are found in the body in large amounts. They are calcium, phosphorus, magnesium, sodium, potassium and chloride. Other minerals found in the body in small amounts are just as important. They are iron, iodine, zinc, and fluoride.

Calcium combines with phosphorus to build and strengthen bones and teeth. Approximately half of the body's magnesium is found in the skeleton. The other is found in the soft tissues and body fluids. Sodium and chloride are found in the blood plasma, in bones: some chloride is found in gastric juice: and most of the potassium is found within cells. These minerals work together to control osmosis. Important sources of minerals are milk, milk products, fish, meat, poultry, bananas, citrus fruits, and dark leafy green vegetables.

Trace elements are found in the body in very small amounts. Some are essential for good health. Iron is found in the blood. It combines with a protein to form hemoglobin. Iron in the body is used over and over again, as red blood cells die and their iron recovered. Liver is one of the best sources of iron, as well as red meat. Iodine is a nutrient stored in the thyroid gland located at the base of the neck. Iodine is an essential part of the hormone thyroxin which is produced by the thyroid gland and it increases oxidation rates in the cells. Seafood, seaweed, and iodized salt are good sources of iodine. Manganese combines with certain enzymes in order for them to function properly. A source of manganese combines with certain enzymes in order for them to function properly. A source of manganese is instant coffee, bran flakes, and shredded wheat.

Copper is another nutrient needed in the body for the formation of hemoglobin which is necessary for red blood cells. Food rich in copper are beef, pork liver, and bran flakes. Zinc is involved in the release of oxygen from the lungs and it helps in the digestion proteins. Food sources are eggs, milk, seafood, meat and poultry.

Finally fluoride, a substance found in bones and teeth, is needed for resistance to dental caries. Fluoride is most helpful during the development of teeth. Some toothpaste contains fluoride and the public drinking water contains fluoride.

## The Recommended Dietary Allowance

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People of different age groups need different amounts of nutrients. The Recommended Dietary Allowance (RDA) is dietary standard. The RDA was developed by the Food and Nutrition Board and published in 1943. A daily food guide consists of milk and milk products, bread and cereals, fruits and vegetables, and meat and meat alternatives.

A family of an individual can carry out its own daily nutrition program by making use of the Daily Food Guide and the servings according to age and needs. A six- year old does not need as much food as a twelve year old. All teenagers undergo what is called a growth spurt. This period of rapid growth varies from person to person. During the period both sexes need more energy this calls for more nutrients and calories per day. The family meal plan should be satisfactory for adolescents. Portion sizes can be increased or decreased where needed.

## Food Pyramid and Planning

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The Food Guide Pyramid is one way for people to understand how to eat healthy. A rainbow of colored, vertical stripes represents the five food groups plus fats and oils. Here's what the colors stand for:

- orange -- grains
- green -- vegetables
- red -- fruits
- yellow -- fats and oils
- blue -- milk and dairy products
- purple -- meat, beans, fish, and nuts



The U.S. Department of Agriculture (USDA) changed the pyramid in 2005 because they wanted to do a better job of telling Americans how to be healthy. The agency later released a special version for kids. The girl climbing the staircase up the side of the pyramid is a way of showing kids how important it is to exercise and be active every day (U.S. Department of Agriculture, 2009).

## Eat a variety of foods

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A balanced diet is one that incorporates all the food groups. In other words, have foods from every color, every day.

## Eat less of some foods, and more of others

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The bands for meat and protein (purple) and oils (yellow) are thinner than the others. That's because the body needs fewer of those kinds of foods than fruits, vegetables, grains, and dairy foods.

The bands start out wider and get thinner as they reach the top. That's designed to show you that not all foods are created equal, even within a healthy food group like fruit. For example, apple pie would be in the thin part of the fruit band because it has a lot of added sugar and fat.

## Lesson Plans

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Keeping a food journal is an excellent first step in assessing how you eat now and why you eat the way you do. It will help you target your current problems and look into the root of them. In the end, it will also help you to design the eating plan that is best for you. The first week and the last week of this unit the students will be asked to keep a food journal on what they eat throughout the day within a seven day week. By the end of this unit students food choices may change when they learn what foods are healthy and brain boosters.

## Lesson One: Incredible Edible Brain

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### Introduction

The central nervous system appears at the beginning of the third week of embryonic development as a slipper-shaped plate of cells, called the neural plate. The other edges of the plate develop further, elevating to form the neural folds. As the folds become more elevated, they approach each other in the midline and eventually fuse, thus forming the neural tube. This fusion begins in the neck region and proceeds in a head ward and tail ward direction. Final closure of the tube occurs at approximately 25-27 days.

The upper (cranial) end of the neural tube has three dilations known as the primary brain vesicles. The prosencephalon, or forebrain, will eventually give rise to the cerebrum. The mesencephalon becomes the midbrain (part of the brainstem). The rhombencephalon, or hindbrain, consists of two parts, the metencephalon, which later forms the pons and cerebellum, and the myelencephalon, which forms the medulla oblongata (brainstem).

Most defects of the spinal cord result from abnormal closure of the neural folds in the third to fourth week of development. Spina bifida is one example of such a neural tube defect, which may also involve the covering of the spinal cord (meninges), vertebra, muscles, and skin. A number of closure defects can now be diagnosed prenatally by the detection of elevated levels of alpha-fetoprotein in the blood or amniotic fluid, or by ultrasound scanning.

Folic acid is a B-vitamin that helps build healthy cells. During periods of rapid growth, such as pregnancy and

fetal development, the body's requirement for this vitamin increases. Research has shown that if all women who could possibly become pregnant were to take a multivitamin with folic acid, the risk of neural tube defects like spina bifida could be reduced by up to 70% (Spina Bifida Association 2009 <http://www.spinabifidaassociation.org>). Since spina bifida occurs early in pregnancy, often before a woman knows she is pregnant, it is important to take folic acid every day. Taking folic acid before and during early pregnancy reduces the risk of spina bifida and other neural tube defects.

Goals: This activity aims to teach children about the areas of the brain, the formation of the brain and spinal cord during prenatal development, and the consequences of incomplete fusion of the neural plate in utero. The unit may be connected to elementary students' personal experiences with spina bifida, or their questions about prenatal development and recent news stories on prenatal surgery.

Objectives The students will:

Share their background knowledge (and naive conceptions) related to brain structure and development.  
Construct models to represent areas of the brain and spinal cord.

Identify areas of the brain.

Impairments that result from spina bifida Science Content

The brain consists of four distinct regions.

Different parts of the brain are responsible for different functions.

The spinal cord and brain may not fully develop before birth, resulting in impairment.

Science Process Skills

Observation

Inference

Formulating hypotheses

Making Connections

Communicating

Modeling

Predicting

Reasoning

Materials

K-W-L Chart

Models or illustrations of brain

Illustrations of spina bifida

disposable sanitation gloves for everyone

paper plates

2 uncooked crescent rolls per student group

1 cannoli form

1 knife

cooking sheets

oven or toaster oven(s)

oven mitts and hot pads

spatula

ketchup

mayonnaise

cheddar easy-cheese

mustard

paper towels

baby wipes

extra trash bags

**SAFETY**

Prepare edible items wearing disposable sanitation gloves.

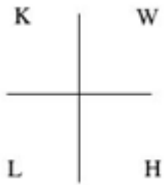
Handle hot objects with care.

Do not require students to eat their finished model.

Make and bake one crescent roll model that is not completely covered with dough to represent spina bifida caused by incomplete fusion of the neural plate.

**Procedures**

Sketch a K-W-L-H chart to indicate what Students K, What they would like to know, what they learned and how they could obtain additional information.



Discuss the student's prior knowledge of the brain and spinal cord, its regions, functions and development.

Discuss the students' prior knowledge or experience with spina bifida

Using models or diagrams clarify or extend their background knowledge. Give each child or small group of children sanitary gloves, a paper plate with 2 uncooked crescent rolls in the shape of a rectangle, and a wiener with an incomplete transverse cut in the middle. The dough represents the neural plate. The cut wiener represents the bendable spinal cord.

Have students place their models on a baking sheet in such a way that they can get their own back. Bake for approximately 10 minutes at the temperature indicated on the crescent roll package.

While the brain models are baking, explain the concept of spina bifida using the pre-made model. Use pictures, illustrations and personal examples to clarify what spina bifida looks like and how it affects people. Briefly explain that not everyone's spinal cord is completely enclosed as it should be at birth, and that many physical problems can result for the person. Explain that there are varying degrees, and that people can be helped through physical therapy. Stress that persons challenged with the effects of spina bifida should be treated with sensitivity.

After the wieners are done, distribute them to their owners. The four condiments can then be used to cover the appropriate areas of the brain and spinal cord, as illustrated on your chart.

Assess students' learning by asking them to explain their models and by following up on the K-W-L chart. Students who can respond correctly or add appropriate comments to the discussion may consume their finished product, if desired. Have students be responsible for cleaning up with paper towels, wet-wipes, and trash bags.

#### Vocabulary

Embryo - a developing baby within the mother

In utero - in the uterus (mother) before birth

Spinal cord- a cable of nerve tissue in the backbone connected to the brain at the base of the skull.

Spina bifida- means an open or incomplete spine and it is one of the most serious of all birth defects. The condition may affect a small region of the spine or a much larger area. In case of spina bifida, portions of the spinal cord are pushed outward, making them vulnerable to injury or infection.

Neural tube- neural plate folds up to become the neural tube.

Neural plate -the structure that becomes the entire nervous system,

Cerebrum - large part of the brain consisting of two large lobes or hemispheres, certain areas of which control particular processes of thought and voluntary muscular movement

Cerebellum - part of the brain that controls the coordination of the muscles.

Brain stem - is the base of the brain lying beneath the cerebrum and the cerebellum, which connects the spinal cord with the forebrain.

## **Lesson Two: Breakfast, Lunch and Dinner with Gregory**

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Grades: 1-5

Subjects: Health/Nutrition/Science

Duration: 30 minutes 1-3 days

Description: Create nutritious breakfast, lunch and dinner that will enhance Gregory the Goats brain development.

Goals: Students will recognize the importance of nutritious meals through reinforcement class activities.

Objectives: Students will locate the components for a healthy breakfast, lunch and dinner.

Materials:

- Mitchell Sharmat (1989).Gregory the Terrible Eater.
- Food pyramid
- Magazines
- Newspaper
- Paper bag
- Goat template
- Brain boosting recipes
- Foods that build the brain not drain the brain list
- Internet (optional)

Procedure:

1. (Before you begin). Enlarge an image of a goats head and stick it on a paper bag. This bag will hold the food pictures found by the students.
2. Read the story "Gregory the Terrible Eater". Gregory eats foods as we do.. How can we make sure his meals are healthy and boost his brain? Using the food pyramid, review with the students the number of servings that are allowed from each group for one day.
3. Using the list of foods that build the brain, review with children what foods they should choose to boost Gregory's brain.
4. The students will be divided into groups; each group will be assigned a different food group from the pyramid.
5. Each group will locate foods from their appropriate food group, using a magazine, newspaper, or internet,
6. Items located will be placed together on a paper plate with a heading of the meal prepared.
7. Children will discuss the foods they have found. Answering questions such as: Is that a good choice for the meal I am preparing? How will it affect brain development? Is it ok for an everyday choice? Make sure drinks are allowed in their choices.
8. The students will take turns saying where the foods belong on the food pyramid as they feed the goat.
9. Children can take the food items out of the baggie and create new meals for Gregory.

Assessments: Have students work in groups and create new meals using all of the food groups.

## **Lesson Three: The Food Groups: Food Pyramid**

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Grade Levels: 3-5

Subjects: Health/Nutrition

Duration: Two 40 minute sessions

Description: In this activity, students learn about the five food groups and how to use the food pyramid as their guide.



Goals: To learn the basics of good nutrition.

Objectives: The students will be able to:

1. List the 5 food groups that make up the food pyramid.
2. Explain orally and in writing the purpose of the food pyramid.
3. Define and give example of each food group.
4. Separate a group of mixed food into the proper food groups.

Materials:

- °x Poster of food pyramid
- °x Dictionaries

Procedure:

1. Teacher will hold up a candy bar and an apple and ask students which they think are better and healthier for their bodies.
2. Teacher will then ask the students if they ever think about what they are putting in their bodies before they eat something.
3. Teacher will then explain that in order to be healthy children should be eating more of certain foods and less of others.
4. Teacher will then list six categories shown on the food pyramid (5 food groups: grains, protein, dairy, fruits, vegetables: and sweets/fats--use sparingly) on the board.
5. Teacher will then ask six students to get a dictionary and look up each word; the definitions will then put on the board.
6. Teacher will then provide many examples and explain why they are examples of each group.
7. Teacher will then display the food pyramid poster.
8. Teacher will then explain to the class the purpose of the food pyramid and tell how many servings of each food should be eaten.
9. The teachers will then hold up more examples and ask what food groups they should be in.
10. Teacher will then restate the definitions and ask the children what they think should be added to the definition and why.
11. The students will then write each definition write 2 examples in their notebooks.

Assessment: Teacher will divide the class into 3 groups and give them each a box of assorted food products: the groups will then divide the products into correct 6 categories and list them on a separate sheet of paper.

## Lesson Four: Nutrition Plan

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Grade Level: 3-5

Subjects: Health /Nutrition

Duration: 30 minutes

Description: Students must know that food choices affect how they feel and how their brain develop. Students must be familiar with the Food Pyramid.

Objective: Students will be able to list the better food choices for a healthy brain. Students will then be able to make a menu for a fictitious restaurant that contains good food choices from each of the areas of the Food Pyramid.

Materials:

Poster of the Food Pyramid  
Menus from local restaurants  
Folders  
Writing paper  
Markers  
Pencils

Procedure:

- The students will be motivated by the teacher reading several menus from local restaurants.
1. The teacher will begin by asking the students whether those meals sounded healthy, why and why not?
  2. The students will be divided into groups of 3.
  3. The teacher will discuss with students the food pyramid and each of its areas.
  4. The teacher will discuss with class a few beginning suggestions of healthy foods they might want to see on a menu when they go out to eat.
  5. The teacher will instruct the students to plan at least two meals and/or desserts that include items from each of the groups on the Food Pyramid.

Assessment: The teacher will walk around the room and observe each student's contribution to the group, and look at each group's menu and pay attention to creativity, neatness, and how accurately each falls into the areas of the Food Pyramid.

## References

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Digg Health. (2009). Updating readers on day to day health issues one encounters in their lives. (<http://digghealth.com/vitamin-sun>)

Lucas, B. Power Up Your Mind. (2001). Discovering that school children with the best results in class were those who drank more water.

My Pyramid. (2009). My Pyramid is a site that supplies information on the Food Pyramid for all ages. (<https://www.mypyramid.gov>)

Spina Bifida Association. (2009). An organizational website that inform readers about spina bifida and the new medical advances in that area. (<http://www.spinabifidaassociation.org>)

The Nemours Foundation. (1995-2009). KidsHealth.. A kid friendly website that explains your brain and nervous system. (<http://kidshealth.org>)

The Thinking Business Limited. (2009). Brain Food An online resource for food that helps the brain develop. <http://www.thethinkingbusiness.co.uk/brainfoods.htm>

## Teachers Resources and Suggested Reading List

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1. Bingham, Jean and Riccio, Delores, The Smart Shopper's Guide To Food Buying and Preparation. New York: Charles Scribner's Sons, 1982.

This book is a primer on the four basic food groups and vitamins. It also guides one in selecting quality foods while saving money.

2. Connors, Keith, Feeding The Brain: How Food Affects Children. New York: Perscus Publishing, 1989.

How what you eat affects your brain.

3. Debruyne, L.K.F. and Raufes, S.R., Life Cycle Nutrition: Conception through Adolescence. St. Paul: West 1989.

This book holds helpful information dealing with nutrition in adolescence.

4. Healy, Jane , Your Childs Growing Mind. New York: Doubleday, 1994.

This book is a practical guide to brain development and learning from birth to adolescence.

5. Kamen, Betty and Kamen, Si, Kids Are What They Eat. New York: Arco Publishing, Inc., 1983

This book touches on good nutrition, providing regular meals and keeping junk food at a minimum.

6. Kowtaluk, Helen, Discovering Nutrition. Encino: Bennett& McKnight, 1986.

This book introduces you to the world of nutrition, relationships between nutrition and your health and how to make good food choices.

7. Plecry, Linda and Smith, Ursula, Food, Nutrition and You. New York: Charles Scribner's Sons, 1982.

How the food you eat becomes part of who you are.

8. U.S. Department of Health and Human Services and U.S. Department of Agriculture. Dietary Guidelines for Americans, 2005. 6th Edition, Washington, DC: U.S. Government Printing Office, January 2005.

The Guidelines provide authoritative advice for people two years and older about how good dietary habits can promote health and reduce risk for major chronic diseases. They serve as the basis for Federal food and nutrition education programs.

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