Required disclaimer: The information given in this book is for educational purposes only and is not intended as diagnosis, treatment or prescription for any disease. This is a compilation of the author’s beliefs based on independent research and professional and personal experiences. The reader is advised to seek the advice of his or her chosen health professional before adhering to any health regimen. The authors and publisher bear no responsibility for the use or misuse of any of this information. The decision to use or not to use any of this information is the sole responsibility of the reader.

If you have a health-related question or a health challenge, please seek the guidance of the health professional of your choice. Growing Healthy Homes LLC is not able to answer health questions.
Dedicated to all the families who read and implement the healthy living suggestions outlined in *Nutrition 101: Choose Life!* so they may have the physical and emotional health to fulfill God’s calling on their lives.
Introduction

The study of nutrition is more than just a look into food and its nutrients. It is an in-depth look at how we eat, what we eat, how the body works, and how these foods affect the body. This book is not a rehash of biology or science, but a discovery of how the body systems are affected by the foods – good or bad – we eat. Research, recipes, and projects will make *Nutrition 101: Choose Life!* fun for the whole family and establish lifelong habits and desires to eat wholesome foods that support great health. This corroborates III John 2: “Beloved, I wish above all things that thou mayest prosper and be in health, even as thy soul prospereth.”

The 12 main body systems will be covered in six units.

- **Unit 1** – The Brain and Nervous System
- **Unit 2** – The Digestive System
- **Unit 3** – The Respiratory, Olfactory, Auditory, and Visual Systems
- **Unit 4** – The Muscular and Skeletal Systems
- **Unit 5** – The Cardiovascular and Immune Systems
- **Unit 6** – The Endocrine System & Emotions

If the principles in *Nutrition 101: Choose Life!* are already a part of your family’s lifestyle, use it to enhance your food preparation and meal time experiences. This teaches the whys of eating the way you do. Rather than, “Mom said I can’t have that,” they can say “I choose not to eat that because I know what it does to my body.”

**This book was written for you.**

“Train up a child in the way he should go: and when he is old, he will not depart from it.” Proverbs 22:6

There are many textbooks written on the subjects of science and biology, explaining the various body systems and organs, how they work, where they are located, and the jobs they perform. Still more books cover health issues and various theories about longevity.

Every student, whether public, private, or home educated, is required to read and study these subjects. If this is so, then why is disease increasing at an alarming rate in this country? Why are children stricken with cancers today more than...
in years past? Why has diabetes risen to near epidemic levels? Why is heart disease, even with advancements in modern medicine, still the number one killer in America and now prevalent in our teenagers? Why, with a myriad of pharmaceutical drugs and state-of-the-art diagnostic tools, are we sicker now than ever before? (See Health Statistics in the United States in Appendix A.)

The American Diabetes Association, the American Heart Association, and the National Institutes of Cancer all state the most important thing we can do to prevent and even cure these diseases is...CHANGE THE WAY WE EAT!

If we are listening to these experts, why are we not making progress?

This is precisely why Nutrition 101: Choose Life! was created. We, the authors, have a mandate to assist families, especially those with children, to understand the real relationship food has on our “fearfully and wonderfully made” bodies, as referenced in Psalm 139:14.

The Bible gives us clear direction about taking instruction and gaining wisdom. “My people are destroyed for a lack of knowledge,” states Hosea 4:6. So we encourage families to heed the advice of Proverbs 4:13, “Take firm hold of instruction, do not let go; Keep her, for she is your life.”

Would you like to feed your family more nutritiously but have no idea where to start? Have you tried telling your family the importance of eating right, only to slip back into the fast food maze? Do you think the cost of eating nutritiously is out of your budget? Would you like some biblically sound help from real families and expert counsel about real food and real world eating? Do you have solid nutritional habits in your family but want to pass along the “whys” to your children?

That is the purpose of Nutrition 101: Choose Life! Written by a team of four mothers, this book is designed for positive, effective, long-term, healthy lifestyle changes.

Is This Even Possible?

Absolutely! Romans 8:28-39 is well known for encouraging believers that they are more than conquerors, but the preceding statement in verses 26 and 27 are less quoted and equally contextual for this book: “In the same way, the Spirit helps us in our weakness. We do not know what we ought to pray for, but the Spirit himself intercedes for us with groans that words cannot express. And He who searches our hearts knows the mind of the Spirit, because the Spirit intercedes for the saints in accordance with God's will.”

Perhaps you have prayed for the answers you will find in this study without even knowing it. When we pray for wisdom and discernment and healing, God loves us and wants to grant our request. When He grants it, He does so knowing that we are fully equipped to receive it.

As you equip your family by implementing the information in this book, you most likely will encounter adversity and be tempted in moments of weakness. The following sections are intended to encourage you in those times and prepare you with ideas for your own proactive action plan.
About the Authors

Debra Raybern, N.D., M.H., C.N.C., I.C.A. (retired naturopath, Master Herbalist, Certified Nutritional Counselor, Internationally Certified Aromatherapist), is a veteran homeschool mother and author and shares from nearly two decades of personal and professional experience in helping families just like yours to regain and maintain optimum health. Assisting thousands of people overcome minor and life threatening illness, Debra knows the importance of proper, body system specific nutrition, and supplementation.

“I know that Nutrition 101: Choose Life! will change your life, as the information shared has already proven to change the way people look at food and has given them the health to enjoy life and serve their community, church, and God. Since I cannot personally counsel everyone, this book is a way for me to enter your home and help you be successful in keeping your family feeling their best and ‘be-ing’ in health.”

Sera Johnson, B.Mu., is a wife, homeschool mother of four, author, health and wellness educator, and founder of Choosing Healthy Life, Inc. As the self-labeled “Former Fast Food Queen,” she and her husband realized their family’s health was in great jeopardy and sought the Lord for wisdom about what to do. After being introduced to Debra Raybern and learning about better health through eating God’s food, Sera’s family is now healthier than ever and looking forward to living out full, healthy, abundant lives for the Glory of God. Her heart is to share with mothers what she has learned and that it is never too late to teach your family how to eat and love God’s food.

Laura Hopkins, B.S., is a wife, homeschool mother, author, and professional communicator with a decade of experience in the public and private sectors, including a Fortune 8 global energy company. As the cofounders of Thrivensity Inc., she and her husband Jonathan encourage thousands to thrive in life with healthy bodies, minds, and spirits. Laura strives to model for her own family that, as children of God, it is crucial to maintain a hunger for His provision and make daily choices that impact abundant living. She loves to share the love of God by feeding others with and teaching other about His food.

Karen Hopkins, B.S., is a wife, mother, grandmother, author, and former Home Economics teacher who developed diabetes at the age of 45 due to S.A.D. (Standard American Diet). Traditional nutrition courses did not prepare her for the onslaught of processed, fast food eating habits, and the busy lifestyle of a growing family. Forced to face the reality of a short lifespan due to excessively high blood sugar levels, Karen reversed the prognosis in six short months without medication through the use of specific natural supplements, diet, and exercise. She founded Growing Healthy Homes LLC in 2007 to educate and train families about God’s desire for His children to prosper in health even as their souls prosper (III John 2). Today, she and her husband Max operate multiple successful companies and frequently speak around the U.S. and internationally about God’s plan for wellness, purpose, and abundance.
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Getting Started

The information in *Nutrition 101: Choose Life!* can be utilized daily by all families whether as a curriculum or during meal planning and food preparation. It also can be used in homeschool co-ops, private schools, church groups, family home groups, and extracurricular clubs, like the Girl Scouts and Boy Scouts. Multiple users licenses and permission to print more than one copy of the program can be obtained from the publisher by e-mailing orders@growinghealthyhomes.com.

*Nutrition 101: Choose Life!* is a unit study in that it encompasses all ages from toddlers to adults. It covers a wide variety of subjects like science, anatomy, biology, nutrition, and health, and can be implemented in a daily or weekly schedule. Use grocery shopping, meal preparation, and meal time as opportunities to incorporate this information to allow children to learn as they live. This should be an organic process that makes healthy choices second-nature.

Some of the material throughout the study may be too in depth for some children. In such cases, parents should read through the material in each chapter, highlight the important parts with the children, and enforce these simple facts through the activities.

Chapters are structured to be completed in a week. However, feel free to extend it an extra week for the longer, more in-depth chapters. It is fine to focus on a particular chapter if your family enjoys that topic or wants to do extra activities. All six units were designed to be completed in a year. Because there are so many activities, the entire program can be repeated and modified each year to reinforce or refresh what already has been learned.

Each unit contains:

**Chapters** – Each one includes information about body systems or how food affects them.

**Discussion Questions** Try to answer these questions with the whole family. See how answers vary from children to adults.

**Activities** Pick and choose...or do them all. Extend the time spent in the chapter to finish activities or save them for next year as reinforcement. The activities are structured to allow children to progress as they mature.

**Additional Resources** These are optional and can be a great way to dive deeper into learning, especially if a family member takes a particular interest in something.

**“Power” Recipes and Additional Recipes** Use the “Power” Recipe to enhance the topics covered in the chapter and incorporate the additional recipes throughout the course of the unit.

**Activity Guide** Located before the Appendix, this is an answer key for all activities.

**Appendix** This contains charts, tables, and articles that elaborate on the text and give direction for some of the discussion and activities.
Here is an example of how to implement a chapter in a week:

**Monday** – Read over the chapter and the “Discussion Questions” and choose from the “Activities”.

**Tuesday** – Review chapter highlights and shop for or collect ingredients for the “Power” Recipe.

**Wednesday** – Prepare the “Power” Recipe for snack or meal time.

**Thursday** – Choose activities from the “Power” Recipe.

**Friday** – Share highlights from the week during family meal time.

As your family progresses through *Nutrition 101: Choose Life!*, we want each person to be encouraged to take responsibility for his or her health. With a plethora of recipes, activities, and resources for independent study, every member of the family can get involved and understand how food affects the human body. Now is the best time to start making necessary changes to the family diet that will have long-term, positive, and habit-forming benefits.

**What About Picky Eaters?**

Co-author Sera Johnson is the self-proclaimed “Former Fast Food Queen.” She dealt with the struggles of introducing completely new foods and a new healthy lifestyle to her family. Over the past several years, it was not easy, but her family is eating healthier than ever and has made huge strides toward better health. People ask her all the time, “How did you do it? My child is so picky! They will NEVER eat healthy food!” Here are Sera’s suggestions in her own words.

“I had the princess of picky eaters! My oldest daughter, Julia, only ate three kinds of food at home – boxed mac and cheese, frozen personal size pizzas, and ramen noodles – all of which I introduced to her and to which I allowed her to become addicted. Yes, addicted. The only other food she would eat were chicken nuggets from only two particular fast food restaurants and none others. If I ever attempted to offer her a vegetable at dinner and ask her to take one bite, we were in for several hours of agony for the whole family. The Lord opened my eyes and showed me that several of my children were already headed down a path to destruction in their health. I learned that my responsibility to my family included their health and helping them establish long-term healthy eating habits. I knew I had to make drastic changes! Here are some of the initial things I did to help us get on the right track:

1. **Get rid of the junk!** I immediately got rid of all the processed food and junk food in my house. I knew that it would be better if those choices were completely taken out of the picture.

2. **Make a list.** Then, I sat down with each of my children, and we wrote down all the vegetables, fruits, grains, and healthy proteins that they liked. At first the list was very short, especially for Julia, but it was a start. We focused on what she did like – broccoli, apples, grapes, and oranges.

3. **Eat the healthy foods you do like.** For the next several days and even weeks, we ate lots of broccoli, apples, grapes, and oranges. Julia did get very upset that her normal choices were no longer available, but I knew that she would at least eat the things she did like and would probably eat just about anything if she got hungry enough. I knew she wouldn't starve.

4. **Make positive confessions.** At mealtime, I had Julia pray aloud with me, ‘Lord, thank you for this good food You made and thank you for helping me to love Your food.’ At first, she didn't believe her own words, but the more we prayed and the more she spoke those positive words out of her own mouth, the more it helped her in trying new foods and opening up her heart to what God had provided for her to eat for her health.

5. **Try at least one new thing at each meal.** Statistics say that if a child doesn't like a new food at first, trying it again at least 10 more times in a row will help him or her develop a taste for it. The more new foods Julia tried, the more she realized she did, in fact, like. She didn't like everything and still doesn't, but she started developing a confidence in at least trying new foods. After a while, she took pride in her ever-growing list of good food. Children will pick up on your language and facial expressions, so parents should be
leaders in trying foods on their not-so-favorite list. This curriculum will guide you in healthy ways to make some foods more palatable.

6. **Find healthy alternatives to those old favorites.** Although Julia didn’t like them as much at first, I found and created healthier, homemade versions of those old foods she once loved. The chicken nugget recipe featured in Unit 4 helped take the place of the fast food version and is now a beloved family favorite, even for Julia. We now make homemade pizza with freshly made crust and sauce, which the children help make and tout as being the ‘best ever made.’

The next steps were to work on me. Although I do like just about every kind of food, my challenge was changing my mindset that I was just too busy to cook. When I did find the time, I didn’t know what to cook. That is where I asked the Lord to help me change my thinking, help me to prioritize my life to find time to plan some meals, and basically teach me about what my family needed to eat for their health. I felt like I was at ground zero and had so much to learn and so much to unlearn, but the Lord led me to some great resources that included my mother, Karen Hopkins, and my friend, Debra Raybern. I truly wish I had *Nutrition 101: Choose Life!* back then! It would have made things easier and a lot more fun! However, we have come a long way and are still a work in progress. My family is healthier than ever, and I give God all the glory for it. I hope you can learn from my experiences and be encouraged that change can happen!”

**Let’s Get Started …**

By the time your family completes this book and implements new food choices and strategies, you may be surprised by the improvements you may begin to experience. Some families may choose to keep a journal or photo essay of their journey. We pray God’s blessings on your family as you learn to love His food and respect your bodies as He has created them to function. May this Scripture encourage you, “Who satisfies thy mouth with good things, so that thy youth is renewed like the eagle’s.” Psalm 103:5.
Unit 1

The Brain and Nervous System

Without our brains and , we would not be alive. The brain and nervous system are the control centers for everything – thinking, learning, walking, talking, breathing, and more. They tell the heart to beat and the muscles to contract when we want to run. They tell us to quickly move our hands away if we have touched something hot. Psalm 139:14 declares, “I praise you because I am fearfully and wonderfully made; your works are wonderful, I know that full well.” God made our brains and nervous systems to do some amazing things! However, they cannot do those things alone.

We all need good air to breathe, good water to drink, and good food to eat. Along with exercise and proper sleep, the food we put into our body affects how well it functions. This is especially true for the brain and nervous system. Not all food is the same; some foods help us, and other foods hurt us. As good stewards of the bodies God has given us, we need to learn how our bodies work and how food affects them. This knowledge will allow us to make wise choices about what to eat and in turn we can have long, healthy, abundant lives.
Unit 1 Chapter 1

The Brain

“Let this mind be in you which was also in Christ Jesus.” Philippians 2:5

Our brain is so amazing and complex that experts don't even fully understand how it works. However, they agree that good nutrition is key to healthy brain development. This process begins at about three weeks after conception as a baby develops in his mother’s womb and is dependent upon her diet. Fats (Omega-3, Omega-6, and Omega-9), protein, complex carbohydrates, vitamins, minerals, and water are crucial for proper brain development. If nutrients are scarce for the developing baby, then his or her brain will receive them at the expense of the other organs. Some part of the baby's brain development will be curtailed, some structures will go unbuilt, and some functions will not be performed if proper nutrition is not available.

The nutrient requirements of the brain are constant and continue all the way through adulthood, meaning nutrition is vital for a healthy brain no matter a person's age. To fully understand the needs of this fascinating organ and how nutrition affects it, we must first know more about the structure and function of the brain.

What is the Brain?

Weighing about three pounds in the average adult, the brain is part of the nervous system. It has been likened to a computer with its many functions. However, no computer – not even a super computer – has ever come close to matching the human brain's capabilities. The brain is the site of thinking and the control center for the rest of the body. The brain coordinates our ability to move, walk, jump, run, touch, smell, hear, speak, and see. It allows us to understand and to perform functions such as adding and subtracting, thinking ahead, reasoning, and even daydreaming. The brain receives input – what we hear, see, touch, smell, and taste – analyzes the input and then responds. The brain also adjusts to emotions and mood.

The brain of both babies and adults is estimated to have about 10 trillion cells! One hundred billion of these cells are called neurons. The neurons act as on and off switches, similar in function to light switches and produce chemicals that trigger other neurons. Different neurons require and use different types of chemicals. These chemicals are called neurotransmitters or messengers and are given names like epinephrine, norepinephrine, or dopamine.

In 1998, a team of American and Swedish scientists demonstrated for the first time that new brain cells are generated in the hippocampus (memory and learning area) of adult humans ages 55 to 70. (November 1998, Nature Medicine)

**WORD POWER**

**Cognitive**

Pronunciation: \käg-na-tiv\  
Function: adjective  
Date: 1586  
1: of, relating to, being, or involving conscious intellectual activity (as thinking, reasoning, or remembering)  
<cognitive impairment>  
2: based on or capable of being reduced to empirical factual knowledge  
– cog·ni·tive·ly adverb
The brain needs a constant stream of nourishment and oxygen. About 20 percent of our oxygen-rich blood continuously flows from the heart to the brain. A loss of blood flow to the brain for more than 10 seconds can lead to a loss of consciousness. Abnormally low blood levels or high levels of a toxic substance can cause the brain to malfunction within seconds, but thankfully God has created within the brain a built-in mechanism called the blood-brain barrier (BBB) to keep most toxins from causing severe damage. It is important to note that the BBB was made to protect us from unknown harmful toxins and should not be used as an excuse to expose ourselves to known toxins.

**What are the parts of the brain and what do they do?**

The brain has three main components: the cerebellum, cerebrum, and brain stem.

The **cerebellum** (Fig. 1) is the bottom part of the brain. It controls balance and coordination and helps the body make smooth, precise movements when reaching, throwing, walking, turning, and bending.

The **cerebrum** or cerebral cortex is the top and largest portion of the brain. It is divided into two halves: the right hemisphere or right brain and the left hemisphere or left brain. The right hemisphere of the brain deals with visual activities and plays a role in identification. It takes visual information, puts it together, and says, “That is a dog.” The left hemisphere is the analytical portion. It manages details, analyzes information collected by the right brain and applies critical thinking to it. The right hemisphere sees a dog, but the left hemisphere says, “I know whose dog that is.” The cerebral hemispheres account for 85 percent of the brain’s weight and are further divided into four lobes.

The **frontal lobe** is involved in motor function, speech, thoughts, planning, and mood. In most people, the left frontal lobe controls language-related movement, while the right frontal lobe controls non-verbal skills. The also are where we process organizational skills and the completion of simple tasks. If this area of the brain is damaged or undernourished a person may become less motivated or lethargic and may struggle just to get out of bed. The frontal lobe also has a role in behavior and prevents people from saying things that may be threatening, inappropriate, or bizarre. Damage to the frontal lobe may result in people doing things that are completely out of character, like swearing, undressing, or urinating in public and other inappropriate behavior.

The **parietal lobe** interprets sensory data input from the rest of the body. It has an important role in dealing with our senses. In most people, the left side of the parietal lobe is considered dominant because of the way it helps us to do everyday tasks such as reading, writing, making calculations, and speaking. Areas within the parietal lobe on the non-dominant side of the brain, the right side, control spatial orientation. From these areas, we derive our ability to know where we are in space, and we know how to find our way from one place to another. Damage to the non-dominant parietal hemisphere may result in the inability to read maps and the loss of the ability to stay oriented even in familiar places. A peculiar condition called spatial neglect causes victims of parietal damage to ignore one half of the environment. They may neglect to shave one half the face, eat portions on one half of the dinner plate only, or ignore people conversing standing or sitting on one side of the body but not the other.
The **occipital lobe** processes our vision. While it is the eyes that see objects, it is the occipital lobe that makes sense of what we are seeing. Damage to this lobe may lead to loss of vision or the inability to fully comprehend what is being seen.

The **temporal lobe** generates emotions and memory. It allows us to recognize objects and people, process short- and long-term memory, and initiate communication. Because of the temporal lobe, we can remember where we left a book or recall details from last year’s picnic.

At the base of the cerebrum lie a collection of nerve cells called the basal ganglia, thalamus, and hypothalamus. See Figure 2 below.

The **basal ganglia** help to smooth out movement.

The **thalamus** organizes sensory data messages to and from the highest level of the brain, the cerebrum.

The **hypothalamus** lies under the thalamus and coordinates the more automatic functions of the body like sleep, temperature, and water balance. It issues instructions to correct any imbalances, including hormone irregularity.

The **limbic system** links the brain stem with the higher reasoning elements of the cerebral cortex. It controls emotions and instinctive behavior. This also is where the sense of smell is located.

The **hippocampus** is important for learning and short-term memory. This part of the brain is considered to be the site where short-term memories are converted into long-term memories for storage in other brain areas.

The **brain stem** lies at the base of the brain near the top of the neck. Even though it is the smallest segment of the brain, it is critical to our survival. It connects the brain and spinal cord. All information to and from the body passes through the brain stem. It controls our heart rate, blood pressure, breathing, and sense of balance. Sleeping and daydreaming also are functions controlled by the brain stem.

![Fig. 2](image-url)
**Unit 1 Chapter 1**

### Discussion Questions

1. What does it mean to be “fearfully and wonderfully made”?
2. What other scripture references support what we’ve learned about the brain?
3. How does a healthy brain make a healthy body? How healthy is your brain?
4. Why is it so important to wear your helmet while bicycling or roller blading?
5. How is your brain like a computer? How is your brain better than a computer?
6. Do you think playing video games exercises your brain? Why or why not?

### Activities - plus the Guacamole “Power” Recipe and activities

#### Elementary

1. In the morning, brush your teeth with your non-dominant hand. At night, brush your teeth with your dominant hand. Was this hard or easy? Why? Try to use your non-dominant hand at other tasks, such as eating and writing.
2. Using the game 20 Questions as a framework, families can use their own memories to stimulate the brain and have fun. Have one family member recall a family memory and let others ask questions and guess. In addition to recollecting good memories, younger family members get to hear stories they may not remember first hand. It also may help clarify memories with details that others may have forgotten.
3. One family member should collect five household items that are used or known by every family member. Try to find objects that stimulate all of the senses, except sight. Using a blindfold, the other family members should take turns identifying the objects.
4. Find and memorize three scriptures associated with the mind.
5. Play the game Memory.

#### Secondary

Choose any from above plus

1. Take the following learning style quiz (or find your own) to help you understand your style and how those around you learn: [http://www.educationplanner.org/students/self-assessments/learning-styles-quiz.shtml](http://www.educationplanner.org/students/self-assessments/learning-styles-quiz.shtml)
2. Research the word lobe. From which language was it derived?
3. What are the careers specifically focused on the brain or the study of the brain?
4. Read the following article by neuroscientist Dr. David DeWitt: [http://creation.com/david-dewitt-interview-brain-scientist](http://creation.com/david-dewitt-interview-brain-scientist). Do you believe the composition of the brain supports intelligent design? Why?

### Additional Resources

#### Websites:

1. Neuroscience for Kids is produced by Eric Chudler, Ph.D., Director of Education and Outreach at the University of Washington Engineered Biomaterials. ([http://faculty.washington.edu/chudler/neurok.html](http://faculty.washington.edu/chudler/neurok.html)).

#### Books:

“Power” Recipes and Activities

Proverbs 9:10 says “The fear of the Lord is the beginning of wisdom: and the knowledge of the holy is understanding.” It is very important to learn how our bodies work and how food affects them; it is even more important to apply that knowledge. The best way to do that is to get in the kitchen!

This may be the most popular portion of Nutrition 101: Choose Life!

The following “Power” Recipe and the subsequent “Power” Recipes following each chapter are accompanied by engaging and exciting activities that will enhance the learning experience beyond the recipes. Start by reading about the basic food groups as defined in the Nutrition 101: Choose Life! Food Pyramid in Appendix B. Then, prepare the “Power” recipe from the week’s corresponding chapter. Feel free to make any of the other recipes in the Additional Recipes section. Another option is to pick out some of your favorite family recipes and see how you can incorporate any of the good brain or nervous system foods from the lists in the previous chapters or how you can make healthier substitutions specific to your family’s needs for some of the ingredients.

This will help you equip your children with incredibly valuable tools such as planning a meal, selecting fresh produce (see Appendix D), following a recipe, and preparing a meal. Then, the entire family can enjoy the fruits and vegetables of your collective labor.

1. Study the Nutrition 101: Choose Life! Food Pyramid (Appendix B).
2. Pick out one of the “Power” Recipes with activities.
3. Use “How to Select Fresh Produce” (Appendix D) and the “Nutrition 101: Choose Life! Shopping List” (Appendix C) when shopping for your ingredients. Buy organic and local when possible. See Appendix D to find out more about organic and local food.
4. Read through “Kitchen Safety” (Appendix E).
5. Get in the kitchen!
6. Discuss the body and good foods for the body while preparing the meal! Emphasize and reinforce the things learned in that week’s chapter. Meal preparation and/or meal times are great opportunities for the discussion questions from the chapter. Talk about how each ingredient is beneficial. Point out skills used to complete a recipe once the ingredients are gathered. This includes knowing kitchen materials/tools, reading, comprehending, counting, measuring, telling time, and appropriate portions for all family members.
7. Pick and choose from the listed activities that go along with the recipes.
8. Enjoying your time cooking? Choose more recipes to make from the Additional Recipes section.
9. Pick favorite family recipes, incorporate good body system supporting foods, and make healthy substitutions where necessary.
10. Make up your own recipes from the good foods lists.
11. Have fun!
Avocados

Did you know that avocados are fruit and NOT vegetables? Avocados are a source of good, Brain Power fat!

Guacamole

4 - 5 ripe avocados
2 Tbs. fresh cilantro finely chopped
2 Tbs. onion finely chopped
1/2 cup tomato finely chopped
Juice of one small lemon
1 clove garlic or 1/2 tsp. minced garlic
Salt and pepper to taste

Peel and scoop out the flesh of the avocado into a bowl and mash with a fork. Add remaining ingredients and stir. Serve with fresh veggies and/or baked whole grain pita chips or crackers of your choice. Makes eight servings.

Activities

Elementary
1. At the grocery store, learn how to pick out fresh, ripe and ready-to-eat produce for the recipe. Refer to Appendix D.
2. Help make the guacamole by measuring and adding the ingredients while learning or reviewing fractions.
3. Experiment to find out how to make avocados ripen faster with some unripened avocados, an apple, and a small paper bag. Compare the process with a regular avocado sitting by itself next to the bag. Is there a difference? Give your findings in an oral or written report.
4. Grow an avocado plant.

Secondary
Choose any from above plus
1. Why and how does activity #3 above work? Give your findings in an oral or written report.
2. Use a banana rather than an avocado in the experiment and see if it changes your results and why. Give your findings in an oral or written report.
3. Calculate how many grams of fat are in one serving of the guacamole above.
4. Find out what kind of fat is an avocado.
Nutrition plays a large role in the development and performance of our brains. For example, short-term memory depends on adequate intake of vitamin B12, vitamin C, and vitamin E. Problem solving tasks rely on adequate intake of riboflavin, folate, B12, and vitamin C. Overall mental health relies on thiamin, niacin, zinc, and folate. Cognitive functions work best with folate, vitamin B6, vitamin B12, iron, and vitamin E. Without proper nutrition, the brain cannot function optimally and is left vulnerable to various health issues.

**Brain Health Issues**

**Dementia** is a decline in mental ability which generally progresses slowly. Memory, thinking, judgment, and even the ability to learn and pay attention also may deteriorate. For some individuals even their personalities change. While there are many causes (age, injury, toxins that destroy brain cells, disease), dementia is not considered to be a normal part of aging.

**Alzheimer’s** is the most common form of dementia in which certain parts of the brain degenerate, destroying brain cells. Remaining brain cells are no longer responsive to chemicals that transmit signals to the brain. Alzheimer’s can be caused by successive strokes, the formation of plaque in the brain, abnormal proteins in the brain, and neurofibrillary tangles, which have been seen in the autopsies of Alzheimer’s patients. While it is most common form of dementia in those over the age of 65 according to the National Institute for Neurological Disorders and Stroke, only an autopsy after death can confirm Alzheimer’s.

**Autism** is a term used to describe a spectrum of neural disorders that affect thousands of Americans. Typically evident in early childhood, there are varying levels of severity and combinations of symptoms within the autism spectrum. While the causes of autism still are not fully understood, there are many theories in regard to its cause or contributing factors, including vaccinations, toxic chemicals in foods, and environmental toxics. For some children, genetics or chromosomal damage may play a role in their diagnosis. Many children have improved and even eliminated Autistic behaviors with proper nutrition.

**Attention-Deficit/Hyperactive Disorder (ADHD)** generally are not regarded as illnesses, but rather the tendency to exhibit poor concentration and focus, generally observed during the early school years. At times, inappropriate and impulsive behavior also is exhibited with or without hyperactivity. Although medical professionals have observed and studied this condition since the mid 1800s, it is much more prolific in modern society with more than 1 in 10 (11%) U.S. school-aged children received an ADHD diagnosis by a health care provider by 2011.1

**Epilepsy** is a disorder characterized by the tendency to have seizures that reoccur randomly. The cause in adults is related to abnormal electrical activity in the brain due to scarring. In many young people, no reason can be found for the seizures, which may be triggered by certain sounds, flashing lights, and even video games. Low blood

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sugars also have been implicated in some epileptic seizures. Some seizures can be very mild and affect only certain parts of the body such as hands or feet. The most severe form, status epilepticus, requires immediate medical attention to avoid permanent organ damage or even death.

**Nutrition and the Brain**

Because our brains are more than 60 percent fat, fats are the most important nutrient for optimal brain power. Fats are often considered bad for us, causing weight gain or high cholesterol. Yes, the wrong kinds of fats can be damaging. However, the right kinds of fats are highly important to maintaining healthy brains and bodies.

**What are fats?**

**Fats** are compounds made up of oxygen, hydrogen, and carbon and belong to a group of substances called lipids. **Lipids**, which are all found in some combination in most foods, have three basic forms:

1. **Triglycerides**, which account for about 95 percent of the weight of fats in foods. Fatty acids are components of triglycerides and are the simplest forms of fat.
2. **Phospholipids** are water soluble, found in plants and animals, and provide protection for the cell membrane.
3. **Sterols** are manufactured mostly in the body, including cholesterol and hormones, because it is difficult to get significant amounts of sterols in your diet from foods.

Fats are a common name for triglycerides and can be split into two groups:

1. **Saturated fats**
2. **Unsaturated fats** – includes monounsaturated and polyunsaturated fats, which can be further split into fatty acids.
   - **Omega-3 fatty acids**
   - **Omega-6 fatty acids**

**Is fat different from oil?**

Generally, **fats** are solid at room temperature, while **oils** are liquid at room temperature. However, some oils like coconut oil have a very low melting point at 76° F, so, in a cool room, it appears as a solid.

**What does unsaturated and saturated mean?**

The terms unsaturated and saturated have to do with the chemistry of fats, specifically hydrogen atoms.

**Unsaturated fats** are not saturated with hydrogen atoms. They have one or more double bonds in the fatty acid chain. Where there are double bonds, hydrogen atoms are eliminated. Monounsaturated fats have one bond, and polyunsaturated fats have two or more bonds. As polyunsaturated fats include Omega-3 and Omega-6 fatty acids, they are essential to the diet. Sources of monounsaturated fats are olive, canola and peanut oils and avocados. Sources of polyunsaturated fats are safflower, sesame, soy, corn, and sunflower seed oils, and nuts and seeds.
**Saturated fats** have no double bonds, thus they are saturated with hydrogen atoms. Hydrogen-carbon bonds are broken down through cellular metabolism to create energy. So saturated fats, which have more hydrogen atoms, create more energy and have more calories. Saturated fats are found in foods from animals, such as dairy products and meat, and in plant sources, such as coconut, palm fruit, and palm kernel. While much modern dietary advice says to avoid saturated fats altogether, significant research supports the contrary.² Saturated fats from coconut oil and from animals raised organically in their natural surroundings do have health benefits.

**What are hydrogenated and trans fats?**

**Hydrogenation** occurs in a laboratory when hydrogen is added to unsaturated vegetable oils to create fully or partially hydrogenated fat, or **trans fat**. Margarine and shortening contain trans fats as do most processed, commercially baked, and fried foods.

Trans fat has a longer shelf life, which is why so many commercial food manufacturers use it in their processed food products in place of unsaturated fats. The molecules of unsaturated fats can break down and go rancid through a process known as **oxidation**. This is when oxygen molecules mix with atoms in the fat. Trans fat molecules are more stable and can make processed food last so much longer.

No amounts of trans fats from hydrogenated oils are healthy because they are unnatural to the human body.

The body does not even recognize trans fats as food and cannot use them for any type of nutrition. They cannot be metabolized, so they are stored as toxins in the body’s fat cells. Trans fats raise bad LDL cholesterol and lower good HDL cholesterol in the blood.³ European studies have shown that women with breast cancer have higher levels of trans fats in their tissues than those without the disease.⁴

**What do our bodies do with fat?**

- Fats supply a continuing source of fuel. They are converted into energy for the ability to function throughout the day when we move, walk, and exercise. Energy from excess foods eaten and not used is stored as fat. Fat surrounds vital organs, such as kidneys, acting as a shock absorber and providing structural support.
- Fats, or lipids, are the components of cell membranes.
- Fats help insulate us, holding in heat, and are present in all cells.
- Fats help us absorb fat soluble vitamins A, E, D, and K.
- Body fat can hold unabsorbed drugs, even those taken years ago.
- Fats hold toxins that our bodies were unable to eliminate.

How much fat and what kind do we need?

Fat intake varies by age, gender, and individual needs. While pregnant or nursing moms and young children, may have greater need for daily intake, fat is crucial for all people. The authors believe a reasonable amount for most Americans would be 30-40 grams or less per day with no more than one-third of our total intake of fat from saturated fats, and at least two-thirds from polyunsaturated Omega-6 and the Omega-3 fatty acids. See Appendix J for more detailed information about the different types of fats and oils and Appendix J for Recommended Daily Allowances.

What are Omega Fatty Acids?

Omega-3 and Omega-6—also known as essential fatty acids—were given their name when researchers found they were essential to normal growth in young children and animals.

Omega-3 Fatty Acids

There are three types of Omega-3 fatty acids: eicosapentaenoic acids EPA, docosahexaenoic acids DHA, and alpha-linolenic acids ALA. They are termed essential because the body cannot make Omega-3 fatty acids and they are needed for our growth, development, and general health.

EPA and DHA can be found primarily in fish, beef, and wild game and are synthesized by the body from ALA. ALA is found in the oil of nuts and seeds from plants. However, ALA is poorly converted to DHA and EPA with only a small percent being converted.

DHA is essential for brain development, brain function, and vision. It can positively affect learning abilities, coordination, and mood. A diet rich in DHA is necessary for a pregnant woman because it is vital to the development of her baby’s growing brain. Lower DHA content in mother’s milk and lower consumption of seafood have been linked with higher rates of postpartum depression5.

EPA is needed for hormone production. EPA and DHA reduce blood stickiness, control cholesterol and fat levels, improve immune function and metabolism, reduce inflammation, and provide water balance.

The best source for Omega-3 is fish. Adequate plant sources are chia, flax, and pumpkin, all of which contain ALA and must undergo conversion to EPA and DHA. Again, only a small percent of the ALA actually is converted to EPA and DHA.

Omega-6 Fatty Acids

Key Omega-6 fatty acids are arachidonic acid AA and linoleic acid LA, which is a precursor to AA. LA is also converted in the body to gamma-linolenic acid GLA. However, not everyone has the enzymes necessary for the conversion to GLA. Evening primrose and borage oil are the richest source of GLA. Daily intake of GLA should be about 150 mg.

Omega-6 oils help keep the blood thin, balance elevated blood pressure, improve nerve and immune system function, relax blood vessels, and aid in blood sugar balance.

**The Omega-6 fatty acids come from vegetable oils such as pumpkin, safflower, sesame, corn, walnut, soybean, and wheat germ.**

**How much Omega-3 and Omega-6 should we have in our diets?**

Our ancestors ate much better than we do today by growing many of their vegetables and fruits and raising livestock. A diet with a 1:1 ratio of Omega-6 to Omega-3 was the norm. Currently, with fast food addictions, eat-out-of-a-box mentalities, and the commercially raised beef we consume, it is estimated that ratio is now 15:1 to 16.7:1 Omega-6 to Omega-3. This imbalance increases the risk of coronary heart disease and also heightens the body’s natural inflammatory process.

**The optimum ratio suggested by today’s health professionals is 2:1 to 4:1 Omega-6 to Omega-3.**

**So why do we need to eat more Omega-3 fatty acids?**

First of all, Omega-3s are heart protective; nourish the brain, skin, nails, and hair; and support the immune system. Secondly, it is too easy to get too much Omega-6 in our diet. Chips, fries, fried foods, commercially baked goods, cookies, cakes, crackers, and commercially raised beef all have excess Omega-6. Another reason why we get too much Omega-6 is due to the slow conversion process of the plant based ALA Omega-3 into EPA and DHA.

Omega-6s *when not in proper balance* to Omega-3s can stir up toxins in our bodies and can cause inflammation. Arachidonic acid (AA), which is a form of Omega-6, was discovered in 1965 to be converted by the body into prostaglandins, a pro-inflammatory agent. AA is found in high levels in beef products.

Disorders of the brain that have a link to Omega-3 deficiency include Attention Deficit Disorder (ADD), Attention Deficit Hyperactive Disorder (ADHD), Alzheimer’s Disease, and Parkinson’s Disease.

The American Heart Association says Omega-3s reduce the risk of cardiovascular disease. With heart disease the number one killer of American adults and childhood heart disease on the rise, it is evident that we should all be consuming more Omega-3s.

Even if we take drastic measures to reduce the amount of Omega-6s we eat and increase Omega-3s, most likely we will need to supplement our diets with a quality Omega-3. This is especially true for those who do not like the taste of fish.

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How to Choose the Right Supplements for Your Brain

Omega-3 Supplements

Fish Sources

Most supplements, even if using pharmaceutical grade fish oil, must remove toxins and heavy metals from the fish oil. Then, a flavoring is added to lessen the fishy taste during digestion or indigestion (burping).

A better choice is a supplement that:

- Uses fish oil from fish with higher concentrations of EPA-DHA, where the fish live in clean water free of heavy metals and toxins.
- Is enteric coated so digestion doesn’t begin until it reaches the small intestine.
- Is enhanced with a blend of plant compounds known to fight inflammation, a chief culprit of excess Omega-6 consumption.

Vegetarian Sources

While it is true that fish are the best food source of EPA- and DHA-rich Omega-3s, several plants have rich sources of ALA, which a properly functioning body can convert a small percentage into usable EPA and DHA through several processes. Be aware, though, that these sources alone might not end up providing enough of the daily required EPA and DHA.

**Flaxseed**

In 1955, German biochemist Dr. Johanna Budwig became the first author to publish information on the role of flax oil in healing cancer and degenerative disease. She also warned about the detrimental effects of trans fats.11

Flaxseed has long been researched for its potential to fight diseases such as cancer and digestive disorders. Constipation and intestinal issues often are abated by adding either ground flax or flax oil to the diet because of its high fiber content. See the Fiber Chart in Appendix K. It is an affordable addition to daily meals, due to its relatively low cost and availability in the market.

The University of Toronto’s Dr. Stephen Cunnane showed that flax prevented the growth of new cancer cells and lowered blood cholesterol levels.12 The U.S. Food and Drug Administration has endorsed flaxseed as a possible food for prevention of disease.

Flaxseed soaked in warm water will turn into a mucilage, or slimy, gruel. As strange as it may look, when eaten this gruel brings gentle relief from all sorts of intestinal discomfort.

Flaxseed is approximately 48 to 64 percent ALA Omega-3 and 26 to 34 percent Omega-6.

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10 Please see the authors’ recommendations in Appendix DD.
Chia Seed

Chia Seed is emerging as an even better plant choice than flax. As Chia (Salvia hispanica L.) seed is very high in soluble fiber, it is the richest plant source of Omega-3 fatty acids known and contains natural antioxidants. Originating in southern Mexico and Guatemala, the plant is a member of the mint family. There are two seed colors: white and black. Both seeds contain essentially the same amount of Omega-3, protein, fiber, and other nutrients.

As part of an effort lead by the University of Arizona in the 1990s to establish new crops in northwestern Argentina, the chia plant was brought back after being lost for five centuries. This project led to successful commercialization of chia as a crop, making it more widely available today.

Unlike flax, chia seeds do not need to be ground. They can be eaten as is, or they can be added to juices, yogurt, broths, salads, omelets, and cereals. They can also be mixed, either ground or whole, with flour and used for making baked goods like bread, pizza dough, and muffins. Chia seeds may be found in most health food stores. For more information on chia seeds, see the Additional Resources at the end of this chapter.

As the daily recommended amount of Omega-3 is one to three grams per day for the general population; two tablespoons of chia seed provide four grams of ALA Omega-3.

Although the body may not convert all of the ALA into EPA and DHA, chia seeds also are a great source of fiber, protein, calcium, and other nutrients.

Omega-3 Deficiency Symptoms

- Hampered growth
- Insulin resistance
- Change in behavior
- Depression
- Leaky gut
- Learning problems
- Water retention
- High blood pressure
- Dry or inflamed skin
- Allergies
- Low energy and general weakness
- Low metabolism
- High triglycerides
- Low thyroid function
- Tingling in the arms and legs
- Low adrenal function
- Poor motor coordination
- Hyperactivity
- Poor vision
- Psoriasis
- Platelets sticking, which causes clots to form and leads to heart attack or stroke
- Eczema
- Acne
- Attention deficit
- Low metabolism
- Low thyroid function
- Low adrenal function
- Hyperactivity
- Poor vision
- Slow wound healing

Good Brain Foods
Avocados, bananas, lean beef, brewer's yeast, broccoli, brown rice, Brussels sprouts, cantaloupe, chia seeds, chicken, collard greens, eggs, flaxseed oil, legumes, oatmeal, oranges, almonds, cashew or walnut butter, peas, potatoes, romaine lettuce, salmon, spinach, tuna, turkey, and wheat germ

Bad Brain Foods
Alcohol, artificial colors and flavors,* artificial sweeteners,* caffeine, cakes, candy, corn syrup,* dairy, fried foods, hydrogenated fats and oils,* high fructose corn syrup,* margarine, partially hydrogenated oils,* shortenings, sodas, sugar, sweet baked goods, and trans fats*

*These contain unnatural chemicals, which cannot be digested and turn to toxins in the body.

Omega-6 Supplements
Omega-6 fatty acids come from some vegetable sources like corn, sunflower, safflower, soybean, cottonseed, nuts, and seeds. Omega-6 also is common from lean meat, eggs, and poultry. Animals fed diets rich in flaxseed meal will have better Omega-3 to Omega-6 ratios, but it is known that grass-fed, free-ranging animals have better ratios naturally.

Omega-6 Deficiency Symptoms
- Eczema
- Sterility in males
- Dry skin and hair
- Dry eyes
- Elevated cholesterol
- Susceptible to infection
- Kidney malfunction
- Drying up of the glands
- Fatty liver
- Miscarriage in females
- Hair loss
- Excessive sweating

Having the right balance of both Omega-3 and Omega-6 fatty acids is crucial for our health. A deficiency of the Omega-6 is more difficult to identify because Omega-3 can cover for an Omega-6 deficiency, but Omega-6 cannot cover for Omega-3. Proper intake of Omega-3 rich foods, which contain both Omega-3 and Omega-6, is essential.

For a healthier body, better brain function and to prevent disease, there may be no better health choice than to eat foods rich in both Omega-3 and Omega-6 with a predominance of Omega-3s and supplement with either a quality fish oil supplement and/or chia or flaxseed.

Fun Fact
Olive oil contains no appreciable amounts of Omega-3 or Omega-6, but is an excellent heart protective oil, none the less.
Discussing Questions

1. Do you think that what you eat as a child affects your brain when you are an adult? Why or why not?
2. Can you think of health problems in the elderly that may suggest brain conditions?
3. Why are hydrogenated and trans fats bad for us and detrimental to future health? What happens when an oil is heated above its smoke point?
4. Of the good brain foods listed in Chapter 3, which ones are your favorites?

Activities - plus the Greek Salad “Power” Recipe and activities

Elementary

1. Eat one of the foods from the “Good Brain Foods” list each day for a week. You must eat a different food each day. Describe their taste, texture, smell, etc. Make a chart to keep track of what you ate and your observations.
2. Write or give an oral presentation on the best three foods for the brain.
3. If you can find an item with trans fat or hydrogenated fat in your cupboard, experiment to see how long it takes until it begins to go bad. If you do not have any selections in the house, you can purchase a small bag of French fries from most fast food chains. Put the item in a plastic bag and use a permanent marker to write the date the item was purchased.
4. Write a poem about your favorite brain food. It can be funny or serious.
5. Visit your local produce stand and identify all of the good brain foods. If you have the opportunity, ask an employee how the fruits and vegetables are grown.

Secondary

Choose any from above plus

1. Create a breakfast using three of the foods from the Good Brain Foods list.
2. Refer to the Omega Chart in Appendix J. Find the top plant and fish sources for Omega-3.
3. Look up the meaning of the word “omega.” Based on the meaning, why do you believe scientists named them Omega fatty acids? Research the naming and see if you are correct. Share this information with your family during a meal or snack that includes good Omega-3s.
4. Interview someone (preferably over 70) who grew up on a farm. Ask him or her what kind of foods they grew, what animals they raised, and what it was like to live on a farm. Write a report about how it is similar to or different from how your family gets food.
5. Create a daily menu including the highest Omega-3 foods. Use the Nutrition 101: Choose Life! Food Pyramid to include a variety of foods from all of the food groups and make sure it contains the daily recommendation of one to three grams of Omega-3. It should also be tasty. Refer to the charts in Appendices B and E.
6. Research the process used to remove oil from a seed. How does this impact the price of various types of products, such as vegetable oil, sunflower seed oil, olive oil, and flaxseed oil?
7. Research organic versus non-organic farming to learn the differences in the seeds, soil cultivation, and harvesting. What are the pros or cons of either type of farming regarding brain health? Provide your findings in a written report.
8. Print out the chart in Appendix J and the Bad Brain Food List in this chapter. Go to the grocery store and find three packaged foods that are labeled as containing “added Omega-3”. Compare the label to Appendix J to find the Omega-3 ingredient. Then, compare it to the Bad Brain Foods List to see if it contains any of those ingredients. Do you feel this food would truly promote better brain power?

Additional Resources

Website: Eat This!, part of the Health Diaries of food information, commentary on Chia, http://www.healthdiaries.com/eatthis/15-facts-about-chia-seeds.html

Olive Oil

While olive oil has minimal amounts of Omega-3 and Omega-6 fatty acids, it is still a great Brain Power fat and helps protect the heart.

Greek Salad

One head of green or red leaf lettuce, washed and crisped, torn into small pieces.
3 tomatoes, diced or 10-12 cherry tomatoes halved
1 cucumber, diced
10-20 green or black olives
1 Tbs. fresh oregano, finely diced
1 red onion, sliced thin and cut into half rings
1 cup feta cheese
1 tsp. balsamic vinegar
5 Tbs. olive oil
Salt, pepper, and garlic powder to taste

Combine all ingredients in a salad bowl and toss.

Activities

Elementary
1. Experiment with the oil and vinegar in a smaller bowl. Do they combine or separate? Why do you think this happened?
2. Find the expiration date on the bottle of olive oil. Why does this product have an expiration date? What other ingredients can go rancid?
3. Use two lettuce leaves to try an extended experiment. Take one leaf and tear it in half. Then use a pen or marker to label both pieces with “T” for tear. Cut the other leaf in half with a knife and mark both pieces with “C” for cut. Refrigerate the pieces on a plate. For the next three days, check the leaves and note any differences. The object is to see whether tearing or cutting the lettuce will allow it to last longer.

Secondary
Choose any from above plus
1. Experiment with the oil and vinegar in a smaller bowl. Then, observe what the ingredients do when mixed with the other ingredients in the recipe. Explain what happens in a written or oral report.
2. What are the different varieties of green leafy vegetables available at your local market? Research the nutritional value of each one.
3. Create your own healthy salad using at least five of your favorite ingredients (good brain foods and no bad brain foods). If you are pleased with the results, write down the recipe to share with family and friends.
Like other systems in the body, the nervous system is composed of organs, principally the brain, spinal cord, and a huge network of threadlike nerves. Together, with the endocrine system, which we will learn more about in Unit 6, the nervous system is responsible for regulating and maintaining homeostasis – a normal state of the body. Just like our brains, our nervous system needs proper nutrition and certain key nutrients to function optimally. In order to understand how nutrition affects it, we need to first understand what our nervous system is and how it works.

What are Nerves?

Nerves are communication pathways connecting the brain and spinal cord to various parts of your body. These threadlike nerve cells are called neurons. Your nervous system has billions of neurons and your brain alone has 100 billion! These neurons run all throughout your body and transmit information in the form of electrical signals, kind of like telephone lines. As a matter of fact, your nervous system has as many connections as in the world’s telephone system, one of the most complex networks on the planet.

Neurons have many different, specialized jobs or functions. These various functions can be divided into three groups: sensory, integrative, and motor.

Sensory

Through its specialized neurons called sensory receptors, the nervous system keeps us in touch with our environment, both external through our sense organs or receptor organs – eyes, ears, nose, tongue, and skin – and internal organs. They monitor things outside the body such as temperature, sound, and light, as well as those inside the body like pH (see Unit 2 Chapter 2), pressure, carbon dioxide concentration, and levels of various electrolytes. This sensory input is converted into electrical signals called nerve impulses that travel across synapses (see Fig. 1 below) from one sensory neuron to the next and then to the brain. Here the signals are brought together to create sensations, to produce thoughts, or to add to memory. This is the sensory function.

Integrative

Decisions, or integrations, are made by a system of cells, tissues and organs that regulate the body’s response to sensory information. This system, or integration center, consists of the brain, spinal cord, nerves, ganglia, and parts of the receptor and effector organs. They decide what messages or signals will be sent to the rest of the body. This is the integrative function.

Motor

The nervous system then sends signals away from the brain to muscles and glands through motor neurons. The motor neurons cause muscles to contract or glands
to produce secretions based on the sensory integration (decisions) from the brain. Muscles and glands are called effector organs because they cause an effect in response to directions from the nervous system. This is the motor output or motor function.

When learning about neurons, glial cells, or simply glia, cannot be ignored. While they do not carry messages in the brain, they are the heroes of neurons. The job of glia is to support neurons by transporting nutrients to them, holding the neurons in place, cleaning up debris in the brain, and even digesting parts of other dead neurons.

### What are the parts of the Nervous System and what do they do?

The nervous system is comprised of two separate systems: the central nervous system and the peripheral nervous system.

The central nervous system (CNS) includes the brain and spinal cord.

- The brain: see Chapter 1 of this unit.
- The spinal cord acts as the pathway for sending messages to and from the brain. It is protected by the spinal or vertebral column, which is a collection of bones known as vertebra that run down the center of the back.

The peripheral nervous system (PNS) is the network of nerves that lead to and from the brain and the spinal cord (see Fig. 2 on next page). It is divided into two major parts: the somatic nervous system and the autonomic nervous system.

- The somatic nervous system, or voluntary nervous system, controls conscious movements of the skeletal muscles. When a person picks up an apple to take a bite, his somatic nervous system is at work telling the muscles in his arm and hand to contract and actually pick up the apple to put it in his mouth.

- The autonomic nervous system, or involuntary nervous system, is responsible for controlling unconscious body processes. This includes the actions we almost never need to think about, like breathing, digestion, sweating, and shivering. After the central nervous system has received information from the outside environment, the autonomic system responds by regulating the internal environment. For instance, if a person goes outside on a hot summer day, her central nervous system would gather that information and say, “Hey, it’s hot outside!” Her autonomic nervous system would sense the body temperature rising and then tell her sweat glands to produce sweat to cool off the body.

The autonomic nervous system has three parts: the sympathetic, the parasympathetic, and the enteric nervous systems.

The sympathetic nervous system is what gives us our fight-or-flight response during stressful conditions. Blood flow increases in the body and up to as much as 1200% in the skeletal muscles, the lungs open for greater oxygen exchange, the heart rate increases, and the pupils dilate.

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The **parasympathetic nervous system** promotes a calming of the nerves and causes them to return to their normal state. It also is involved in temperature control, heart rate, and digestion. The parasympathetic nervous system stimulates salivary gland secretion and accelerates peristalsis – the wave like motion of the intestines helping you to have regular bowel movements.

The **enteric nervous system** is not well known. It is the digestive system’s very own nervous system and is very complex. There are as many neurons in the enteric nervous system as there are in the spinal cord. The enteric nervous system works autonomously, or by itself, but it is also linked to the central nervous system via the sympathetic and parasympathetic nervous systems. While it can function by itself to carry out regular digestive processes, sometimes the central nervous system carries a message directly to the digestive system. For example, the sight of good food can make your stomach growl. The central nervous system received external information via the sight sensory receptors, and then the central nervous system sent a message to stimulate secretion in the stomach.

**What are reflexes?**

**Reflexes** are involuntary, or automatic, actions that our bodies take to protect us from harm. For example, when a person touches something hot, his hand jerks away before his brain even gets the message, “That's hot!” Doctors test the reflexes by hitting a rubber hammer on the knee to see if the leg kicks. By testing that reflex, called the **knee-jerk reflex**, a doctor is able to see if your central nervous system is functioning properly. Likewise, when the doctor shines a bright light into the eye, he or she is checking to make sure that the pupil constricts to protect the eye from being damaged by the bright light. If it does not constrict, then the doctor knows that there is a problem with the nervous system. The body has many reflexes. Some other reflexes are coughing and sneezing; these are the body’s way of clearing excess mucus from the system.
Unit I Chapter 3

Discussion Questions
1. What is homeostasis? What do you think that means for our bodies?
2. If there are 100 billion neurons in the brain, then about how many glial cells are there? About how many neurons and glia are there together?
3. Name some receptor organs.
4. Name some effector organs.
5. Why do we have reflexes? What are some of the other reflexes of our body not mentioned in this chapter?
6. When does your sympathetic nervous system respond? Give an example of the fight or flight response.

Activities - plus the Potato Salad “Power” Recipe and activities

Elementary
1. Using your fingernail, gently poke on your forearm, big toe, outer thigh, and shoulder to see which place is the most sensitive.
2. Using a feather, stroke the faces of your family members with their eyes closed. Use the lightest touch possible. Ask them how it feels and how long the feeling lasts. Most people will report that the tickling sensation lingers several minutes.
3. Roll out a large piece of butcher paper on the floor, have a partner trace your body. Then, draw your brain and nervous system based on the illustrations in Unit 1.
4. Have an adult check your reflexes by using his or her hand in a precise karate chop motion on the knee. Completely relax and see how much the leg jerks. Record the findings on all family members.
5. Hold an icepack in your hand or place it on an exposed area of skin. Using a stop watch or second hand on the watch, see how long before the area goes numb. Repeat on your calf.

Secondary
1. Choose any from the above plus
2. Write down 10 specific examples from your daily activities that illustrate the three functions of neurons.
3. Learn more about neurons by going to http://faculty.washington.edu/chudler/cells.html, read the fascinating information about neurons and then take the quiz, the review test or even build a neuron!
4. Learn more about glia at http://faculty.washington.edu/chudler/glia.html
5. Research the Stroop Effect and conduct your own experiments with friends and family members.

Additional Resources

Websites:
1. Neuroscience for Kids (http://faculty.washington.edu/chudler/neurok.html)
Potato Salad with Flaxseed Oil - Hold the Mayo

8 medium sized golden Yukon potatoes, or 20 Red Russet potatoes, cooked, peeled and diced
3 hard boiled eggs, peeled and diced
4 Tbs. flaxseed oil
2 Tbs. nut oil (walnut, sesame, pumpkin)
1 tsp. apple cider vinegar
1 medium onion, diced
1 stalk celery, chopped fine
1 tsp. vegetable or beef broth powder
Salt, pepper, and garlic powder to taste
Tomato slices and parsley to garnish

Combine all items in a large bowl. Garnish with 2 Tbs. fresh chopped parsley chopped and tomato wedges.

Activities

Elementary
1. Identify which specific ingredients in the recipe are good for the brain.
2. A nut is a seed, but a seed is not necessarily a nut. True or false? How is a seed different from a nut?
3. What is flax? Where does it grow? How is it harvested and processed?
4. Find the amount of ounces contained in the bottle of flaxseed oil. Find out how many tablespoons equal an ounce. Now find out how many tablespoons are in the container.

Secondary
Choose any from above plus
1. Research how oil is taken from seeds, nuts, and vegetables. Are the processes similar or different?
2. In what kind of containers are your flaxseed oil and nut oil? Research the difference between glass and plastic containers. Is one superior?
3. What is the difference between a fluid ounce and a dry ounce?
“For I delight in the law of God after the inward man: But I see another law in my members, warring against the law of my mind, and bringing me into captivity to the law of sin which is in my members.” Romans 7:22-23

While there are some specific nutrients to consider, all known nutrients in our diets can influence the function of our nervous system. Some of the most important are proteins, amino acids, the B-complex vitamins, and minerals – iron, iodine, calcium, and magnesium. Without these important nutrients, the nervous system may not be able to function optimally.

Nervous System Health Issues

**Multiple Sclerosis** (MS) is a disorder where the nerves in the eye, brain, and spinal cord lose patches of myelin. It is so named because of the multiple areas of scarring (sclerosis) representing these patches. Brain and spinal scans often show lesions, which are indicators that the symptoms match the diagnosis. Symptoms usually appear between the ages of 20 and 40 years of age and include tingling, numbness, and weakness in the arms and legs. Sudden double vision, loss of vision, and pain in one eye also are first indicators. While the exact cause is unknown, it is widely accepted that some virus or unknown antigen triggers an autoimmune process. Interestingly, MS occurs in one out of 2,000 people who spend the first decade of life in a temperate climate, but only one out of 10,000 of those born in a tropical climate and almost never occurs in people who grow up near the equator.

**Parkinson's** is a slow progressing disease of the nervous system. It is characterized by shaking when at rest, sluggish movements, and muscle rigidity. Approximately 60,000 Americans are diagnosed with Parkinson's disease each year. Men are one and a half times more likely to have Parkinson's than women. The area of the brain affected is the basal ganglia where movement and coordination initiate.

Nutrition and the Nervous System

**Proteins** and **amino acids** play an important role in normal brain and nervous system function, particularly before birth when the concentrations in the blood of the developing baby can be three times greater than in the mother. Most of the essential chemical substances in the brain and central nervous system are neurotransmitters, such as dopamine and serotonin. These are produced in the body from amino acids.

It is essential for newborn infants and young children to have an adequate supply of amino acids, which are derived from proteins. Foods that are complete proteins with these essential amino acids include meat, fish, eggs, milk, and dairy products.

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Plants also have protein but may not contain as much or may not exist in a complete state providing the amino acids. Vegans, those who do not eat animals or animal products, or strict vegetarians should supplement with specific foods or food combinations to achieve the complete proteins the body needs, like eating legumes and grains together, such as beans and rice, chia, quinoa, buckwheat, or hemp seed.

Conditions that affect adequate protein intake – very low energy diets, vegan or macrobiotic diets, alcoholism, or anorexia – or conditions that increase the requirement for protein when intakes may be inadequate – pregnancy, lactation, periods of growth, or illnesses that exhaust protein supplies – can lead to an imbalance in the supply of amino acids to the brain and central nervous system. This can result in neurological symptoms and damage.

**What are Amino Acids?**

Amino acids are the building blocks of the body; constructing cells, forming nerves, and repairing tissue, they also form antibodies to combat invading bacteria and viruses. In addition, amino acids also build nucleoproteins (RNA & DNA), carry oxygen throughout the body and participate in muscle activity.

When protein is broken down properly by digestion, the result is 21 known amino acids of proteins. Amino acids are found in all meats (beef, pork, chicken, fish, turkey, eggs, etc.), dairy products (milk, yogurt, cottage cheese, etc.), and in smaller amounts in fruits and vegetables. Vegetarians need to be sure and supplement with natural amino acids, as many times their protein intake is too low to supply all the necessary amino acids.

The body, through assimilation of amino acids, produces over 50,000 proteins and over 15,000 enzymes. Amino acids not only are responsible for the production of all the body’s enzymes, including digestive enzymes, but they also play a key role in the nervous system in normalizing moods, concentration, aggression, attention, and sleep.

Digestive enzymes break down the proteins we consume into amino acids. Then, individual amino acids are used to create necessary body proteins and enzymes. Scientists, experts, and medical professionals agree that getting enough amino acids in our diets is an important factor in maintaining good nutrition.

Textbooks differ as to the exact number – either eight or nine – of essential amino acids, ones that cannot be manufactured by the body. Non-essential amino acids can be manufactured by the body with proper nutrition.

<table>
<thead>
<tr>
<th>Nervous system disorder symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety, convulsions, depression, numbness, muscles twitching, muscle weakness, pain, paralysis, feeling of pins and needles, ticks, and tremors</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Some plant food sources of amino acids</th>
</tr>
</thead>
<tbody>
<tr>
<td>apple, papaya, apricot, pineapple, pears, grapes, pomegranates, wolfberry, Brazil nuts, almonds, hazelnuts, olive, flax, legumes, hemp, carrots, radish, parsley, celery, okra, tomato, green vegetables, Brussels sprouts, spinach, avocado, and quinoa</td>
</tr>
</tbody>
</table>

**What are the 21 amino acids and what do they do?**

1. **Tryptophan** (Essential Amino Acid)

A natural relaxant, tryptophan helps alleviate insomnia by inducing normal sleep and reducing anxiety and depression. It helps treat migraine headaches, boost the immune system, reduce the risk of artery and heart spasms, and also works with lysine in reducing cholesterol levels.
2. **Lysine** (Essential Amino Acid)
This amino acid ensures the adequate absorption of calcium and helps form collagen, which makes up bone cartilage and connective tissues, and also aids in the production of antibodies, hormones, and enzymes. Recent studies have shown that lysine may be effective against herpes by improving the balance of nutrients that reduce viral growth. A deficiency may result in tiredness, the inability to concentrate, irritability, bloodshot eyes, retarded growth, hair loss, anemia, and reproductive problems.

3. **Methionine** (Essential Amino Acid)
A principle supplier of sulfur, which prevents disorders of the hair, skin, and nails, methionine helps lower cholesterol levels by increasing the liver’s production of lecithin, reduces liver fat, and protects the kidneys. Serving as a natural chelating agent for heavy metals, it regulates the formation of ammonia and creates ammonia-free urine, which reduces bladder irritation, and also influences hair follicles and promotes hair growth.

4. **Phenylalaine** (Essential Amino Acid)
Used by the brain to produce norepinephrine, a chemical that transmits signals between nerve cells and the brain, phenylalaine keeps us awake and alert, reduces hunger pains, functions as an antidepressant, and helps improve memory.

5. **Threonine** (Essential Amino Acid)
This is an important constituent of collagen, elastin, and enamel protein. Threonine also aids the prevention of fat build-up in the liver, helps the digestive and intestinal tracts function more smoothly, and assists metabolism and assimilation.

6. **Valine** (Essential Amino Acid)
It promotes mental vigor, muscle coordination, and calm emotions.

7. **Histidine** (Essential Amino Acid)
Found abundantly in hemoglobin, histidine has been used in the treatment of rheumatoid arthritis, allergic diseases, ulcers, and anemia. A deficiency can cause poor hearing.

8. **Leucine** and 9. **Isoleucine** (Essential Amino Acids)
These provide ingredients to manufacture other essential biochemical components in the body, some of which are utilized for the production of energy, as stimulants to the upper brain, and to help us to be more alert.
10. **Arginine** (Non-Essential Amino Acid)
Studies have shown that arginine has improved immune responses to bacteria, viruses, and tumor cells. Arginine promotes wound healing and regeneration of the liver, causes the release of growth hormones, and is considered crucial for optimal muscle growth and tissue repair. It also has been shown to have significant cardiovascular benefits for restoring and retaining elasticity in blood vessels.

11. **Tyrosine** (Non-Essential Amino Acid)
By transmitting nerve impulses to the brain, tyrosine helps overcome depression, improves memory, increases mental alertness, and promotes the healthy functioning of the thyroid, adrenal, and pituitary glands.

12. **Glycine** (Non-Essential Amino Acid)
Glycine helps trigger the release of oxygen to the energy-requiring, cell-making process. It is important in the manufacturing of hormones responsible for a strong immune system.

13. **Serine** (Non-Essential Amino Acid)
A storage source of glucose by the liver and muscles, serine helps strengthen the immune system by providing antibodies and synthesizing fatty acid sheath around nerve fibers.

14. **Glutamic acid** (Non-Essential Amino Acid)
This amino acid is considered to be nature's brain food because it improves mental capacities. It also aids in the healing of ulcers, gives a lift from fatigue, and helps control alcoholism, schizophrenia, and the craving for sugar.

15. **Glutamine** (Non-Essential Amino Acid)
The most abundant of all free amino acids, it aids in muscle building and recovery from surgery, especially abdominal, and it replenishes amino acid stores. This is the main reason glutamine is recommended during fasting or for people who suffer from physical trauma, immune deficiencies, or cancer.

16. **Aspartic acid** and 17. **Asparagine** (Non-Essential Amino Acids)
These aid in the expulsion of harmful ammonia from the body. When ammonia enters the circulatory system it acts as a highly toxic substance, which can be harmful to the central nervous system. Recent studies have shown that aspartic acid may increase resistance to fatigue and increase endurance.

18. **Taurine** (Non-Essential Amino Acid)
It helps stabilize the excitability of membranes, which is very important in the control of epileptic seizures, and aids in the clearing of free radical wastes. Taurine and sulfur are considered to be factors necessary for the control of many biochemical changes that take place in the aging process.

19. **Cystine** (Non-Essential Amino Acid)
Cystine functions as an antioxidant and is a powerful aid to the body in protecting against radiation and pollution. It can help slow down the aging process, deactivate free radicals, neutralize toxins, aid in protein synthesis, and present cellular change. It is necessary for the formation of the skin, which aids in the recovery from burns and surgical operations. Hair and skin are 10% to 14% cystine.
20. **Proline** (Non-Essential Amino Acid)
It is extremely important for the proper functioning of joints and tendons and helps maintain and strengthen heart muscles. Another non-proteinogenic amino acid is hydroxyproline, which plays a great role in collagen assembly, and is a derivative of proline.

21. **Alanine** (Non-Essential Amino Acid)
An important source of energy for muscle tissue, the brain and central nervous system, alanine strengthens the immune system by producing antibodies and aids in the metabolism of sugars and organic acids.

### B-Complex Vitamins

The B-complex vitamins are a large group of water-soluble vitamins that play a role in healthy nerve function. Of the many B vitamins, thiamin, riboflavin, niacin, and pyridoxine are most important to the nervous system.

#### Thiamin - Vitamin B1

A deficiency in thiamin (vitamin B1) can interfere with the production of certain neurotransmitter amino acids, as well as glucose metabolism.

Mild thiamin deficiency can manifest as numbness in the legs, the feeling of pins and needles, calf muscle tenderness, and loss of appetite. Extreme vitamin B1 deficiency causes beriberi, which is characterized by edema, shortness of breath, and sensory disturbances with paralysis. Muscle weakness, irritability, loss of memory, convulsions, and permanent brain damage also may develop. While beriberi is not very common, lack of adequate B1 does cause imbalances within the delicate nervous system.

- **Foods rich in thiamin**: unrefined or minimally processed cereals and grains such as brown rice, whole wheat bread, nuts, legumes (dry beans, peas, and lentils), romaine lettuce, asparagus, spinach, sunflower seeds, tuna, green peas, tomatoes, Brussels sprouts, cabbage, winter squash, and black beans.

#### Niacin - Vitamin B3

Niacin, or vitamin B3, is another one of the B-complex vitamins that is important to neurological function. Mild niacin deficiency is associated with weakness, tremor, anxiety, depression, and irritability. In severe niacin deficiency, a person may develop pellagra, characterized by the three D’s – delirium, dementia, and death. The human body is capable of manufacturing niacin from the amino acid tryptophan. Thus, patients with a niacin deficiency will benefit from adequate intakes of high-quality protein foods.

- **Foods rich in niacin**: tuna, chicken, turkey, salmon, green peas, peanuts, broccoli, whole grains, oats, brown rice or crushed wheat, and tortillas made from maize treated with limewater. When maize is soaked in limewater, it releases the tryptophan and makes it available for niacin production in the human body.
Riboflavin - Vitamin B2

A lack of riboflavin, or vitamin B2, can retard the growth of children and infants with typical symptoms such as anemia, rashes around the nose, cracks on the outer edges of the mouth, and a red, inflamed tongue. While a riboflavin deficiency is not as directly linked to neurological fallout and damage as thiamin and niacin, the anemia associated with a lack of B2 can have neurological consequences.

Foods rich in riboflavin: dairy products such as milk, yogurt, and cheese, lean meat and poultry, fish, eggs, broccoli, spinach, asparagus, and whole grains.

Pyridoxine - Vitamin B6

Pyridoxine, or vitamin B6, is essential for the synthesis or metabolism of practically all the neurotransmitters, which are chemicals which help to transmit messages in the central nervous system. Pyridoxine is especially important to women in that it helps to balance female hormones. Deficiency of pyridoxine causes symptoms such as tiredness, nervousness, irritability, depression, insomnia, and difficulty with walking. In addition, vitamin B6 deficiency is linked to dizziness, neuritis, neuralgia, and carpal tunnel syndrome – the loss of feeling or pins and needles in the hands caused by swelling of connective tissue in the wrist which presses on nerves. Several drugs are known to lower pyridoxine levels in the blood and cause irritability, peripheral neuropathy, and convulsions.

Food rich in pyridoxine: lean meat, tuna, potatoes, bananas, and legumes, such as dry beans, peas, and lentils.

How to Choose the Right Supplements for Your Nervous System

Protein

While many plant foods are high in protein, people who choose to supplement protein will find one of three types available: un-denatured whey (dairy), rice bran, or albumin (egg whites). Un-denatured whey protein is allergen free and easily digested even by people who are lactose intolerant. Look for companies that use hormone-free whey. Rice bran protein powders use the protein found in rice bran for a vegetarian-friendly version. Albumin or egg white protein powders typically are the best choice, except the price generally keeps people from supplementing with this form. It is important to read the many other ingredients listed in a protein powder to assure quality.

Amino acids

Amino acids come from protein rich sources such as meat, fish, dairy products, vegetables (such as peas), legumes, and grains. There are many types of amino acid supplements on the market. Many come primarily from a milk-protein source.

Those who could benefit from amino acid supplementation are vegetarians and those with allergies, stress-related fatigue, or hypoglycemia. Trouble digesting food could be a signal of a diminishment in the production of digestive enzymes. This could lead to poor nutrition because the body cannot digest food at full capacity. In essence, our bodies need amino acids in order to obtain and utilize amino acids from food.

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16 Those who have a chronic runny nose, upper respiratory issues, allergies and other similar symptoms, should consider eliminating dairy from the diet as they may contribute to these issues.

17 Please see the authors' recommendations in Appendix DD.
Two of the essential amino acids, lysine, and tryptophan, are poorly represented in most plant proteins. Thus strict vegetarians should ensure that their diet contains sufficient amounts of these two amino acids.

Supplement amino acids by eating all the amino acid-rich food possible, but those who want an actual specific supplement should seek the advice of a trusted health care professional.

**B-Complex Vitamin Supplements**

When choosing a B vitamin to supplement, it is best to choose a whole food sourced B-complex rather than a synthetic. This is a tablet or capsule with all of the B vitamins in proper ratio to each other.

**Avoid the hot pricklies!**

Some people have taken B vitamins with niacin only to experience hot flushes and redness of the skin. No harm done, but it can be uncomfortable and quite a sight. This sensation is termed a niacin flush. It happens when the niacin is synthetic or out of proportion to the other B vitamins. If this occurs, a person should research the source of the niacin to determine if it is synthetic. If it is a quality product, cut back on future doses by cutting the tablet in half and be sure to take with adequate food. Niacin is a blood vessel dilator and is often used to aid in cholesterol control.

### Good Nervous System Foods
- Asparagus
- Cabbage
- Citrus fruit
- Chia seeds
- Eggs
- Fish
- Flaxseed
- Kidney beans
- Lecithin granules
- Pine nuts
- Rice bran
- Sprouts
- Sunflower seeds
- Turnips
- Vitamin C rich foods
- Vitamin B rich foods
- Whole grains
- Wheat germ

### Bad Nervous System Foods
- Alcohol
- Artificial colors and flavors
- Artificial sweeteners
- Caffeine
- Cakes
- Candy
- Dairy
- Excessive red meat
- Fried foods
- Hydrogenated fats and oils
- Margarine
- Shortenings
- Sodas
- Sugar
- Sweet baked goods
- Trans fats
Unit 1 Chapter 4

Discussion Questions

1. What is raw milk?
2. What is a vegetarian? What is a vegan?
3. Have you known anyone who has changed the way he or she feels by eating healthy food? If not, do you believe it is possible?
4. What does RDA stand for?

Activities - plus the Stuffed Eggs “Power” Recipe and activities

Elementary

1. Eat one of the foods from the Good Nervous System Foods list each day for a week. You must eat a different food each day. Describe their taste, texture, smell, etc. Make a chart to keep track.
2. Comparing the list of good foods for the nervous system, try to find at least three things these have in common. Do the same thing for the bad foods list.
3. Do you have any plant sources of amino acids in your refrigerator? If so, draw a picture of them.
4. If there are any foods on the lists that you do not recognize, ask your parent/teacher to help you learn about them.
5. Write a song about how important food is for your nervous system and sing it for your family.
6. Create a lunch using three of the foods from the Good Nervous System Foods list.
7. Prepare a snack food using only three riboflavin-rich foods.
8. List three foods high in pyridoxine.

Secondary

Choose any from above plus

1. Write or give an oral presentation on three good foods for the nervous system and explain why they are good.
2. Refer to Appendix I. Using the chart below, create a complete dinner menu with the RDA of thiamin for your entire family. Use a variety of foods, include all food groups, and make it tasty. You cannot use more than two servings of a single food. You may refer to other nutritional books and websites for more foods rich in thiamin. Then, prepare the dinner for the family to eat.
3. For your next co-op or church event, prepare a side dish or snack that contains foods from the Good Nervous System Foods list.
4. Find out how the U.S. RDA standards are set and how often they are amended.
5. Help organize an outdoor fun time for your family or a group of children that features games that utilize the nervous system. Check the following site for ideas like Synaptic Tag or Neuron Jump Rope: http://faculty.washington.edu/chudler/outside.html.
6. Look up the word locavore. Are you a locavore? What kind of effort does it take to become a locavore? Compile your findings in an oral or written report and share it with your family. After sharing, take a poll to see if they consider themselves locavores or want to do a locavore family trial for a set period of time.
Flaxseed Oil

Stuffed Eggs - Hold the Mayo

6-8 hard boiled eggs, peeled, halved, and the yolks set aside in a small bowl
2 Tbs. sweet pickle relish
2 Tbs. diced white onion
1 Tbs. mustard
Salt and pepper to taste
Flaxseed or olive oil
Paprika (optional)

Combine the yolks, pickles, mustard, and onions in a food processor or bowl. Slowly drizzle in the flaxseed or olive oil, just until mixture is smooth. Spoon into egg halves. Garnish with paprika or pepper.

Activities

Elementary
1. Using a blindfold, try to identify the ingredients of this recipe with your other four senses.
2. Commonly, mayonnaise is used for stuffed egg recipes. Look up the ingredients for a mayonnaise brand available at your local market. Does it contain good fats or bad fats?
3. Choose an ingredient from the recipe and make it an acronym with each letter representing a characteristic of the ingredient or with the letters combining to form a supporting sentence. For example: E.G.G.S. = Elliptical, gentle handling, good fatty acids, scrumptious! or Eating gets gooey … splat!
4. Identify other recipes that call for mayonnaise and substitute flaxseed oil or olive oil. Help prepare the dish and serve it at the next family meal.

Secondary
Choose any from above plus
1. Make a nutritional comparison between a mayonnaise brand available at your local market and both flaxseed oil and olive oil.
2. Determine the cost per ounce of the mayonnaise versus the flaxseed oil and olive oil. Which costs more per ounce? Considering the short- and long-term nutritional impact of the products, which has more value?
3. Research what happens when flaxseed oil and olive oil are heated.
Use organic ingredients when possible.

**Chia Pancakes**

1 cup of freshly milled whole wheat flour (soft wheat is best), gluten-free flour or Einkorn flour
2 Tbs. Chia seeds
2 tsp. baking powder
1/4 tsp. sea salt
1 Tbs. raw honey
1 Tbs. light olive oil
1 egg
1 cup water

Combine ingredients in a blender and mix at medium speed. May mix manually with a whisk. Mix well until batter is smooth. Ladle on hot griddle or waffle iron and cook until golden brown. Top with organic maple syrup, honey, or fruit.

**Brain Power Smoothie**

1 cup ice
1 cup frozen fruit (peaches, strawberries, grapes, blueberries, etc.)
2 Tbs. Chia Seeds
1 cup water
2 heaping Tbs. quality protein powder

Blend well in blender.

**Trail Mix**

This is the most delicious and easiest to prepare granola/trail mix you can have for breakfast or snacks. Kids love to help prepare this one.

1/4 cup flax seeds
1/4 cup sunflower seeds
1/2 cup wheat germ
1/2 cup whole or sliced almonds
1/2 Tbs. cinnamon
2 1/4 cups fresh rolled oats
1/4 cup raw honey
1/4 cup coconut oil

Combine all ingredients in large bowl and mix well. Spread on an un-greased cookie sheet and place in a preheated 300°F oven for 30 minutes. Halfway through the cooking, stir the granola. Remove and let cool. Store in an airtight container. Keeps for about one month.

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18 Please see the authors’ recommendations in Appendix DD.