NUTRITION AND DIGESTION

Our bodies are built up from the food we eat. There is a constant breaking down of the tissues of the body; every movement of every organ involves waste, and this waste is repaired from our food. Each organ of the body requires its share of nutrition. The brain must be supplied with its portion; the bones, muscles, and nerves demand theirs. It is a wonderful process that transforms the food into blood and uses this blood to build up the varied parts of the body; but this process is going on continually, supplying with life and strength each nerve, muscle, and tissue.

Diet and Health (by Ellen G. White)

There is some truth to the saying “You are what you eat.” ... Like an assembly line in reverse, the digestive system takes the food we eat and breaks the complex organic molecules into their chemical subunits. The subunits are molecules small enough to be absorbed into the bloodstream and delivered to body cells. Food molecules ultimately meet one of two fates: they may be used to provide energy for daily activities or they may provide materials for growth and repair of the body.

Nutrition

1. Draw and explain the food pyramid guide in its various forms. List the number of servings required from each group each day. Why is it important to eat a balanced diet?
2. Explain the difference between the following:
   a. Lacto-ovo vegetarian
   b. Ovo vegetarian
   c. Vegan vegetarian
3. Plan a two-day menu containing a balanced lacto-ovo vegetarian diet utilizing the food guide pyramid.
4. What is another name for:
   a. Vitamin B1
   b. Vitamin B2
5. List at least three significant food sources of the following nutrients:
   a. Vitamin C
   b. Vitamin A
   c. Vitamin B1
   d. Vitamin B2
   e. Iron
   f. Calcium
6. Why is it important to drink plenty of water every day?
7. How much water should you drink every day?
8. Name three common diseases that can be controlled by diet.
9. What is the difference between whole wheat flour and white flour, and which one has the higher nutritive value?
10. What does RDA mean?

Digestion

1. Have the Nutrition Honor.
2. Keep a record of what and how much food you eat for two weeks. Compare your diet to that of the food pyramid.
3. What is digestion? What is another name for the human digestive system?
4. Where does saliva come from? What are the three functions of saliva?
5. Be able to identify the following parts of the tooth: enamel, dentin, pulp, gum, cementum, and periodontal membrane. What role do the teeth play in digestion?
6. Be able to label a diagram or model of all the organs that help with digestion, starting from where the food goes into the mouth to where it is expelled from the anus.
7. Know the difference between food bolus and chyme.
8. Where does bile come from? Where is it stored? What does it do in the duodenum?
9. What are villi? What makes them absorb the nutrients so quickly? At what point are all the nutrients removed from the food/chyme? Compare the amount of water absorbed by plain paper compared to a similar sized paper towel using an 1/8 cup (17.2 ml) of water.
10. What happens if too much water is present in the large intestine? What happens if not enough water is present?
11. How does fiber in your diet aid in digestion? How long should food remain in the digestive tract? What happens if food stays in the digestive system too long?
12. Demonstrate the digestion of starch into simple sugar using the iodine test.
13. What are the six basic nutrients that are essential for life and where does the bulk of their digestion/absorption take place?
14. Know the difference between monosaccharide, disaccharide, and polysaccharide. What is the most important carbohydrate?
15. What are amino acids? How many are needed to make all the proteins in the body? What is meant by essential amino acids? How many of them are essential? Where can you get all the essential amino acids?
16. What is ATP? What is it used for? What does your body make ATP from? What three sets of chemical reactions make ATP in your body? Why do we need to breathe oxygen?
17. Know the difference between water and fat soluble vitamins. What are two common vitamins that are fat soluble? What are two vitamins that are water soluble?
18. List four Bible texts that refer to digestion.
19. List five E.G. White references that promote proper digestion. Choose a variety of topics.
Grains Group: Any food made from wheat, rice, oats, cornmeal, barley or another cereal grain is a grain product. Bread, pasta, oatmeal, breakfast cereals, tortillas, and grits are examples of grain products. Grains are divided into 2 subgroups, whole grains and refined grains. Whole grains contain the entire grain kernel — the bran, germ, and endosperm. Refined grains have been milled, a process that removes the bran and germ. This is done to give grains a finer texture and improve their shelf life, but it also removes dietary fiber, iron, and many B vitamins.

Vegetable Group: Any vegetable or 100% vegetable juice counts as a member of the Vegetable Group. Vegetables may be raw or cooked; fresh, frozen, canned, or dried/dehydrated; and may be whole, cut-up, or mashed. Vegetables are organized into 5 subgroups, based on their nutrient content: Dark Green Vegetables, Red-Orange Vegetables, Beans and Peas, Starchy Vegetables, Other Vegetables.

Fruit Group: Any fruit or 100% fruit juice counts as part of the Fruit Group. Fruits may be fresh, canned, frozen, or dried, and may be whole, cut-up, or pureed.

Dairy Group: All fluid milk products and many foods made from milk are considered part of this food group. Most Dairy Group choices should be fat-free or low-fat. Foods made from milk that retain their calcium content are part of the group. Foods made from milk that have little to no calcium, such as cream cheese, cream, and butter, are not. Calcium-fortified soymilk (soy beverage) is also part of the Dairy Group.

Protein Group: Protein sources from the Protein Foods Group for vegetarians include eggs (for ovo-vegetarians), beans and peas, nuts, nut butters, and soy products (tofu, tempeh, veggie burgers). Vegetarians get enough protein from this group as long as the variety and amounts of foods selected are adequate.

(From USDA)
1. **Think about protein**
   Your protein needs can easily be met by eating a variety of plant foods. Sources of protein for vegetarians include beans and peas, nuts, and soy products (such as tofu, tempeh). Lacto-ovo vegetarians also get protein from eggs and dairy foods.

2. **Bone up on sources of calcium**
   Calcium is used for building bones and teeth. Some vegetarians consume dairy products, which are excellent sources of calcium. Other sources of calcium for vegetarians include calcium-fortified soymilk (soy beverage), tofu made with calcium sulfate, calcium-fortified breakfast cereals and orange juice, and some dark-green leafy vegetables (collard, turnip, and mustard greens; and bok choy).

3. **Make simple changes**
   Many popular main dishes are or can be vegetarian—such as pasta primavera, pasta with marinara or pesto sauce, veggie pizza, vegetable lasagna, tofu-vegetable stir-fry, and bean burritos.

4. **Enjoy a cookout**
   For barbecues, try veggie or soy burgers, soy hot dogs, marinated tofu or tempeh, and fruit kabobs. Grilled veggies are great, too!

5. **Include beans and peas**
   Because of their high nutrient content, consuming beans and peas is recommended for everyone, vegetarians and non-vegetarians alike. Enjoy some vegetarian chili, three bean salad, or split pea soup. Make a hummus-filled pita sandwich.

6. **Try different veggie versions**
   A variety of vegetarian products look—and may taste—like their non-vegetarian counterparts but are usually lower in saturated fat and contain no cholesterol. For breakfast, try soy-based sausage patties or links. For dinner, rather than hamburgers, try bean burgers or falafel (chickpea patties).

7. **Make some small changes at restaurants**
   Most restaurants can make vegetarian modifications to menu items by substituting meatless sauces or non-meat items, such as tofu and beans for meat, and adding vegetables or pasta in place of meat. Ask about available vegetarian options.

8. **Nuts make great snacks**
   Choose unsalted nuts as a snack and use them in salads or main dishes. Add almonds, walnuts, or pecans instead of cheese or meat to a green salad.

9. **Get your vitamin B₁₂**
   Vitamin B₁₂ is naturally found only in animal products. Vegetarians should choose fortified foods such as cereals or soy products, or take a vitamin B₁₂ supplement if they do not consume any animal products. Check the Nutrition Facts label for vitamin B₁₂ in fortified products.

10. **Find a vegetarian pattern for you**
    Go to [www.dietaryguidelines.gov](http://www.dietaryguidelines.gov) and check appendices 8 and 9 of the *Dietary Guidelines for Americans, 2010* for vegetarian adaptations of the USDA food patterns at 12 calorie levels.

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*A vegetarian eating pattern can be a healthy option.* The key is to consume a variety of foods and the right amount of foods to meet your calorie and nutrient needs.

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Go to [www.choosemyplate.gov](http://www.choosemyplate.gov) for more information.

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USDA Center for Nutrition Policy and Promotion

DG TipSheet No. 8
June 2011
USDA is an equal opportunity provider and employer.
A few notes from the Seventh-day Adventist Dietetic Association:

For more than 130 years Seventh-day Adventists (SDAs) have practiced a vegetarian dietary lifestyle because of their belief in the holistic nature of humankind. Whatever is done in eating or drinking should honor and glorify God and preserve the health of the body, mind and spirit.

Since 1954 more than 250 articles have been published in scientific journals on the Seventh-day Adventist lifestyle and health. In the 1960s, Loma Linda University, in cooperation with the National Cancer Institute, began to study the health of SDAs. Later, in the 1970s and 1980s, data on the Seventh-day Adventist lifestyle was collected and analyzed under contract with the National Institutes of Health.

SDAs in general, have 50% less risk of heart disease, certain types of cancers, strokes, and diabetes. More specifically, recent data suggests that vegetarian men under 40 can expect to live more than eight years longer and women more than seven years longer than the general population. SDA vegetarian men live more than three years longer than SDA men who eat meat.

Researchers believe this added length of life and quality of health is due in particular to the consumption of whole grains, fruits and vegetables as well as the avoidance of meat, alcohol, coffee and tobacco.

Current evidence demonstrates that the more closely a person follows the lacto-ovo-vegetarian diet the lower the risks of major diseases.

Different types of vegetarian diets

Lacto: Milk
Ovo: Egg

Lacto-Ovo Vegetarian: Supplements a non-meat diet with milk and milk products and eggs.

Ovo Vegetarian: Supplements a non-meat diet with eggs, but no milk or milk products

Vegan Vegetarian: Does not eat any animal products (no milk, eggs, and in some cases no honey or other animal-derived products)

Some Vitamins and Minerals

Vitamin A: A component of the eye pigment that assists in black-and-white vision. Also assists in cell differentiation. Found in egg yolks, fortified dairy products, and from carotene (in deep yellow vegetables and deep green leafy vegetables).

Vitamin B1 (Thiamine): A coenzyme for energy metabolism and nerve function. Found in Legumes, whole grains, leafy green vegetables.


Vitamin C (Ascorbic Acid): Improves iron absorption, assists in collagen synthesis. Found in citrus fruits, broccoli, cabbage, green peppers, tomatoes, cantaloupes and strawberries.

Calcium: Hardens bones, contributes to tooth formation, assists in blood clotting, nerve and muscle action. Found in milk, cheese, legumes and dark green vegetables.

Iron: A component of hemoglobin in blood, as well as myoglobin, a oxygen binder in muscle tissue.

Dihydrogen Monoxide (H₂O): Water is an essential mineral, transporting waste and hormones, breaking up nutrients in digestion, lubricating joints, cushioning the brain and spinal cord, regulating body temperature and serving as a medium and component of chemical reactions. Water is available in most foods. The general recommendation is the equivalent of eight cups a day, but water needs vary with activity, metabolism and other factors.
Basic Nutrients for Life

**Carbohydrates**: Carbohydrates include sugars, starches and dietary fiber. The basic carbohydrate (and ultimately the most important) is the monosaccharide, a single sugar molecule. Disaccharides are two sugar molecules combined. Polysaccharides are multiple sugar molecules combined. The body must break down Poly- and Di-Saccharides into Monosaccharides for use. Carbohydrate digestion begins in the mouth, and continues through the small intestine. Carbohydrates are primarily consumed as a precursor to the production of energy. Cells mostly use the monosaccharide Glucose for fuel. Fiber provides bulk to food, allowing it to move more smoothly and quickly through the digestive system. Carbohydrate digestion begins in the mouth, and continues through the small intestine, where most absorption takes place.

**Proteins**: Proteins are chains of Amino Acids, which are sometimes called the building blocks of life. Human bodies make proteins from 20 different Amino Acids, but the body can only synthesize 11 of these. The remaining 9 must be acquired from food, and are referred to as the Essential Amino Acids. They include: histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine. Particularly with vegetarian diets, it is important to eat a variety of protein sources to acquire sufficient amounts of each of the essential amino acids. Certain complementary combinations of incomplete proteins, for example mixing nuts with legumes, can provide the complete set of essential amino acids. Protein digestion begins in the stomach and continues through the small intestine.

**Lipids**: Lipids include fats, oils and cholesterol. Fat is an excellent source of energy storage for the body, assist in the absorption of certain vitamins. Fat intake should be moderate, with limits particularly on saturated fats such as butter or solid shortening. Unsaturated and Polyunsaturated fats are better sources of nutrients for the body. These can be found in olive, soy and sunflower oils, among others. Bile helps to emulsify fats in the digestive system, and digestion and absorption primarily takes place in the small intestine.

**Vitamins**: Vitamins are organic compounds that often serve as coenzymes, assisting various chemical reactions in the body. There are 13 Vitamins necessary for human life. These come in two varieties. Fat Soluble Vitamins are be stored in body fat and include Vitamins A, D, E, K. Water Soluble Vitamins must be replenished daily in sufficient amounts, as excess vitamins are washed through the system and excreted as waste. These include Vitamins C (Ascorbic Acid), B1 (Thiamin), B2 (Riboflavin), B3 (Niacin) B6, Pantothenic Acid, Folic Acid, B12, Biotin. Vitamins are primarily absorbed in the small intestine, though some (like Vitamin K) are absorbed in the large intestine.

**Minerals**: Minerals are inorganic substances that are necessary for bodily chemical functions. The seven major minerals (those that are required in relatively large quantities) comprise Calcium, Phosphorus, Magnesium, Potassium, Sulfur, Sodium and Chloride. There are several trace minerals that are also necessary, though in substantially smaller doses. Among these are Iron, Iodine, Fluoride, Copper, Zinc and Manganese. Minerals are absorbed in the small intestine.

**Water**: Technically classified as a mineral, water has a unique chemical formula that makes it essential for life processes. It is a solvent, it serves as a transport fluid, it is part of many chemical reactions in the body, it can serve to lubricate joints, protect the eyes and spinal column and is an important component in body temperature regulation. At birth, an infant is some 85 percent water, though that decreases to approximately 65 percent with age. People can only live about three days without water, but can last some eight weeks without food. Water is absorbed primarily in the large intestine.
DRIs, RDAs, RDIs

How do you know how much of a particular vitamin or mineral you need to ingest each day? One way is to look at the Dietary Reference Intakes (DRI), a set of recommendations made by the Food and Nutrition Board of the Institute of Medicine. The DRI, developed between 1997 and 2001, replaces the Recommended Daily Allowances (RDA), which were first presented in 1968 as a way to encourage Americans to get proper nutrition. The Food and Drug Administration used the first set of RDA guidelines to establish the Reference Daily Intake (RDI), a measurement used for labeling food products. Despite the different names, and some slight changes in recommendations over time, each of these systems are designed to assist you in ensuring proper balanced nutrition.

Can you have too much of a vitamin or mineral?

Even with properly balanced menus, you may find that you do not get enough of certain vitamins or minerals. In that case, one answer is to take vitamin supplements. It is possible to have too much of certain nutrients, though. For most water-soluble vitamins (including C, B₁, and B₂), excess consumption will simply be flushed out in urine. Fat-soluble vitamins (including A, D, E, and K) can accumulate in the body and cause problems. Excessive doses of minerals can also cause problems. Excessive calcium or phosphorus (two minerals critical for bone formations) can inhibit the absorption of other minerals. Excessive Vitamin E or Potassium can trigger muscle weakness. By combining a healthy, balanced diet with attention to the quantities of particular vitamins and minerals intake, you can effect the right balance of nutrients to maintain optimal health.

White or Wheat?

Be sure to have at least half of your grains whole grains. Whole Wheat Flour uses all three parts of the wheat berry – the bran, the germ and the endosperm. White Flour comes only from the endosperm. It has a lower nutritional value, and a lower fiber content. Look for whole grains in your breads, cereals and snacks. In addition to the added nutrients, the higher fiber content is good for proper digestion, and can help reduce risks of heart disease. Fiber also ensures food moves at the proper pace through the digestive system.

Diet and Disease

Cancer Prevention: According to the American Dietetic Association, proper nutrition can reduce risks of cancer. Recommendations include maintaining proper weight, eating plenty of vegetables, fruits, whole grains and legumes, limiting intake of red meats and processed meats, and consuming less salt.

Diabetes: Onset of Type 2 Diabetes can be triggered in part by improper diet and excessive weight. Proper diet, in consultation with a medical professional or registered dietician, can assist in control of diabetes. Meals should be eaten on a regular basis, with a focus on balanced diet and maintaining proper weight. Carbohydrates, in particular, need monitored closely.

Heart Disease: Heart disease is one of the leading causes of death in America. Diet plays a key role in lowering risks of heart and cardiovascular disease. In addition to maintaining a healthy weight and getting sufficient exercise, diet should be low in saturated fats and trans fats, low in sugar and salt, high in fiber and high in omega-3 fatty acids, like those found in olive oil.

Kidney Disease: Healthful eating and living can reduce risks of kidney disease. This includes controlling blood sugar levels and blood pressure, eating a balanced diet and remaining physically active. Diet is also one of the tools in managing existing kidney disease, and includes carefully managing the amount of protein, sodium and potassium intake.

Osteoporosis: Diet and physical activity play a key role in preventing or reducing the likelihood of osteoporosis. In order to process calcium into bone, the body also needs sufficient Vitamin D, Vitamin K, Potassium, Fluoride and Magnesium.

More information on diet and disease can be found at:
http://www.eatright.org/diseasemanagement/
Prepared for SAIL Pathfinders by R. Baker

Planning and Tracking Diet and Exercise

Determining your daily nutrient and calorie requirement must take into consideration your age and gender, body size and style, and activity level. The USDA offers an online tool to assist you in building your daily food plan: http://www.choosemyplate.gov/myplate/index.aspx.

The USDA also offers a menu planner online that assists you in building out a balanced diet matching your needs and your preferred foods: http://www.mypyramidtracker.gov/planner/launchPage.aspx.

A final useful tool the USDA helps you track what you eat, the nutrient and calorie content of the foods: http://www.mypyramidtracker.gov/.

With these tools, you can determine your personal dietary needs, assist in planning a healthy and balanced menu, and track your progress as you work toward a healthier lifestyle. It is important to remember, also, that you should not only focus on the calorie intake, but also the calories burned through activities. The President’s Challenge is a program that helps encourage an active lifestyle, and lets you track your physical activity: http://www.presidentschallenge.org/index.shtml.

Eating Disorders

Overweight and Obesity: Obesity is considered an eating disorder involving the intake of too much food, coupled with insufficient burning of calories. While there are many factors that lead to obesity and overweight, diet and exercise are two of the most important. The Centers for Disease Control and Prevention offer information regarding overweight and obesity at http://www.cdc.gov/obesity/. There, you can use their basic tools to determine your Body Mass index (BMI), which roughly correlates to your percent of body fat, and thus helps determine if you fall under the categories of overweight or obese. It is important to have a balance between the intake of calories, and the burning of calories. A balance will lead to a stable weight. More calories coming in than being used will lead to gained weight, as the extra calories are stored in fat in the body. Burning more calories than you take in contributes to weight loss. Why should you be concerned about your weight? Research shows that you have increased risks of the following conditions if you are overweight or obese: Coronary heart disease, Type 2 diabetes, Cancers, Hypertension, Dyslipidemia, Stroke, Liver and Gallbladder disease, Sleep apnea and respiratory problems, Osteoarthritis, and Gynecological problems. Diet and exercise combined can reduce the risks of these and several other health conditions.

Anorexia Nervosa: A disorder leading to self-starvation, and body weight below 85 percent or less for their gender, age, height and weight. Anorexics often have a distorted image of their body, and never feel thin enough. Anorexia leads to malnutrition, which can trigger a decrease in bone health, very low blood pressure, heart irregularities and dehydration.

Bulimia Nervosa: An eating disorder with cycles of binging on large quantities of food, followed by self-induced purging (vomiting, laxatives, etc). Bulimia can lead to dehydration, electrolyte imbalances, kidney damage, an irregular heartbeat and even cardiac arrest. Repeated vomiting can damage the lining of the esophagus and mouth, accelerate tooth decay, and cause sores in the mouth and on the lips.

Anorexia and Bulimia are life-threatening conditions, and professional treatment should be sought immediately. Eating disorders have some of the highest death rates of all psychiatric disorders. Without treatment, up to 20 percent of people with serious eating disorders die prematurely, and even with treatment, two to three percent die. Even with proper treatment, there can be lasting physical and emotional damage.

“Or do you not know that your body is the temple of the Holy Spirit who is in you, whom you have from God, and you are not your own?” 1 Cor. 6:19 (NKJV)
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**Digestive System (Gastrointestinal Tract)**

**Mouth**: Primary site of mechanical digestion and early chemical digestion of starches. Includes *Teeth*, *Tongue* and *Salivary Glands*. Chewed food mixed with saliva and ready to swallow is called *Bolus*.

**Pharynx**: Common canal for air and food.

**Esophagus**: Transport of food from Mouth to Stomach through rhythmic muscle movement (peristalsis).

**Stomach**: Liquefies and stores food, some mechanical digestion, chemical digestion of proteins begins. *Gastric Glands* produce *Hydrochloric Acid*, which helps break down food into a liquid mixture called *Chyme*.

**Small Intestine**: The primary site of digestion and absorption. Composed of three sections: *Duodenum, Jejunum, and Ileum*. In the duodenum, Chyme from the stomach mixes with digestive juices from the *Pancreas* and the *Liver* (via the *Gall Bladder*). Most digestion and absorption takes place in the Jejunum and Ileum. The Small Intestine is lined with *Villi*, small hair-like projects that significantly increase surface area for absorption.

**Pancreas**: An accessory organ, its juices enzymes, water, and *Bicarbonate Ions* that help neutralize the acids in Chyme.

**Liver**: An accessory organ that produces *Bile* (which helps emulsify fats), manages blood glucose levels, and removes poisonous substances.

**Gall Bladder**: An accessory organ that stores *Bile* and delivers it to the Duodenum.

**Large Intestine**: Composed of four sections: *Cecum, Colon, Rectum, Anal Canal*. The primary function of the colon is to remove water from the indigestible food residue, and to eliminate solid waste from the body. The Colon is divided into three regions: the *Ascending Colon*, the *Transverse Colon*, and the *Descending Colon*. Bacteria within the large intestine also produce certain critical vitamins, which are absorbed through the Colon walls.

**Appendix**: Although not known to play a role in digestion, the Appendix is a small organ hanging off the Cecum that may play a role in the immune system.
What Happens to My Food?

Even before you take a bite of that pizza, the body is preparing for the digestion of the food. The smell, and at times even the thought, of food can signal the nervous system to send a signal to the salivary glands to begin producing saliva. The teeth slice (incisors), tear (canines) and crush (premolars and molars) the food, as the tongue manipulates the ball of food inside the mouth, mixing it with saliva and shaping it into a ball for swallowing. Saliva adds water to moisten food, and Salivary Amylase, an enzyme, that begins breaking the starches down while the food is still in the mouth. The chewed ball of food, mixed with saliva, is called Bolus, and the tongue maneuvers this Bolus to the throat for swallowing. Once the Tongue moves the Bolus to the Pharynx, an involuntary muscle movement is started. Muscles in the Pharynx contract to move the Bolus into the Esophagus, while at the same time other muscles move the Voice Box (“Adam’s Apple) upward, pushing the Epiglottis to cover the path to the Glottis, or airways. This prevents food from entering the respiratory tract, where it would cause choking. Once the food reaches the Esophagus, a series of rhythmic muscle contractions, referred to as Peristalsis, moves the Bolus down the Esophagus, where a Sphincter (a sort of circular gate) relaxes and opens, and allows the food to enter the Stomach.

The food is processed inside the stomach for three to five hours. Gastric Glands of different sorts secrete chemicals and enzymes, including Hydrochloric Acid (which helps break down connective tissues in meats) and Pepsinogen, a precursor enzyme that becomes Pepsin (which serves to digest Proteins). Together, the Hydrochloric Acid and Pepsin form the bulk of Gastric Juice, which is mixed with the Bolus as the stomach muscles contract and relax, churning the contents of the stomach into a soupy mixture called Chyme. If food remains in the stomach too long, it begins to ferment, or may even cause bile to back up the esophagus.

The liquid Chyme is released through another Stomach Sphincter into the Small Intestine, where it is processed for another two to six hours. In the first section of the Small Intestine, called the Duodenum, the Chyme is mixed with Pancreatic Juices and Bile. Pancreatic Juices, secreted from the Pancreas, include water and Bicarbonate Ions, which help neutralize the acid in the Chyme. Other Pancreatic Enzymes help break down Proteins, Polysaccharides and Fats. Bile, stored in the Gall Bladder, is produced by the Liver. One of the primary purposes of Bile is to assist in the digestion and absorption of Fats. As this processed food continues through the Jejunum and Ileum regions of the Small Intestine, nearly all breakdown of complex molecules and absorption of nutrients takes place. The Small Intestine is lined with Villi, tiny hair-like protrusions that vastly increase the surface area of the inside of the Small Intestine, facilitating the absorption of nutrients into the blood stream. The nutrient-laden blood is passed through the Liver to remove impurities and regulate glucose levels, and then passed on into the blood stream again to distribute nutrients and energy-fueling molecules to their destination or storage areas.

Meanwhile, the remaining indigestible material from the Small intestine are passed into the Large Intestine, where bacteria further break down material the body could not. Certain nutrients, like Vitamin K, are produced by these bacteria, and absorbed through the wall of the Large Intestine. The Large Intestine primarily serves as a place for the re-absorption of water from the processed food, with material passing through in between six and seventy-two hours. If the processed food moves too slowly through the Large Intestine, too much water may be absorbed, leaving the waste too dry, triggering a condition called Constipation. If the processed food moves too quickly through the Large Intestine, not enough water is absorbed, leading to a condition referred to as Diarrhea. Once the material has moved through the Colon (the major portion of the Large Intestine), and the water is largely removed, the remaining material is called feces. It is moved into the Rectum, and when it stretches the Rectum, it triggers a Defecation Reflex, which moves the Feces through the Anal Canal and out through the Anal Sphincter.

And that is what happens to your food.
Parts of a Tooth:

- **Enamel**: A calcium-rich hard substance that covers the tooth crown. Enamel protects the tooth, and is considered among the hardest natural substances in the body.

- **Dentin**: The hard, bone-like portion of the tooth, surrounding the Pulp. It provides structural integrity.

- **Pulp**: The material at the center of the tooth. It is the living portion of the tooth, and contains the blood vessels and nerves.

- **Gum (Gingiva)**: The tissue covering the jaw and surrounding the tooth roots.

- **Cementum**: A calcified, living connective tissue covering the tooth root.

- **Periodontal Membrane**: The connective tissue between the tooth and tooth socket in the jaw.

- **Crown**: The portion of the tooth above the gum line.

- **Root**: The part of the tooth below the gum line. The root fits into sockets in the jawbone.

- **Root Canal**: A narrow cavity through the root of the teeth, through which the blood vessels and nerves connect between the jaw and the tooth pulp cavity.

Types of Teeth:

- **Incisor**: For slicing
- **Canine**: For tearing
- **Premolar**: For grinding and crushing
- **Molar**: For grinding and crushing
ATP, the cell’s rechargeable battery

Adenosine triphosphate (ATP) is a molecule that stores a large amount of energy in the bonds of its phosphate groups. ATP in some sense is like a rechargeable battery. Separating a single phosphate group (converting from ATP to Adenosine diphosphate, or ADP) releases this energy, for use by the cells. Through different chemical processes, cells can add a phosphate to ADP molecules, converting them back into ATP and effectively “recharging” the molecule.

Glycolysis is one process of building ATP molecules from available ADP. A glucose molecule, through a series of steps, has phosphates added, is rearranged, broken apart, and transfers its phosphate groups to ADP molecules, rebuilding ATP. In glycolysis, a cell must consume two ATP molecules to assist in the breakdown of the glucose, but the process recharges four ATP molecules, so the net is a gain of two ATP molecules of stored energy.

The Krebs Cycle (Tricarboxylic Acid cycle or Citric Acid cycle) takes place in the mitochondria. It begins with pyruvate, the byproduct of glycolysis, and breaks this by removing a carbon dioxide molecule to leave Acetic Acid. This is converted to Citrate, and moved through an eight-step chemical cycle. The output of the cycle is one molecule of guanosine triphosphate (GTP), which donates a phosphate to ADP to form ATP. The process also releases molecules of NADH and FADH\textsubscript{2}, which donate their electrons into an electron chain that provides a significant amount of energy that is stored in ATP.

Oxidative phosphorylation is the process by which the mitochondria take the NADH and FADH\textsubscript{2} leftover from the Krebs Cycle, and flow their electrons across a membrane to help form O\textsubscript{2}. As the electrons build up across the protein membrane, they build up and trigger protons to flow out of the mitochondrial matrix. This proton pump occurs until it reaches a point at which the proton flow reverses. As the protons move back through the membrane, the energy released is captured in the conversion of ADP to ATP.

Through these three connected cycles, a single glucose molecule eventually contributes to the creation of 30 ATP molecules, two in Glycolysis, two in the Krebs Cycle (which runs twice, as there are two pyruvate molecules from one glucose), and the remaining 26 from oxidative phosphorylation. The byproduct of the process is CO\textsubscript{2} and H\textsubscript{2}O, the carbon dioxide and water.
One reason why many have become discouraged in practicing health reform is that they have not learned how to cook so that proper food, simply prepared, would supply the place of the diet to which they have been accustomed. They become disgusted with the poorly prepared dishes, and next we hear them say that they have tried the health reform and cannot live in that way. Many attempt to follow out meager instructions in health reform and make such sad work that it results in injury to digestion, and in discouragement to all concerned in the attempt. You profess to be health reformers, and for this very reason you should become good cooks. Those who can avail themselves of the advantages of properly conducted hygienic cooking schools will find it a great benefit both in their own practice and in teaching others.- Counsels on Health, pp. 450, 451.

Masticate slowly, and allow the saliva to mingle with the food. In order to secure healthy digestion, food should be eaten slowly. Those who wish to avoid dyspepsia, and those who realize their obligation to keep all their powers in a condition which will enable them to render the best service to God, will do well to remember this. If your time to eat is limited, do not bolt your food, but eat less, and masticate slowly. The benefit derived from food does not depend so much on the quantity eaten, as on its thorough digestion; nor the gratification of taste so much on the amount of food swallowed, as on the length of time it remains in the mouth. - Testimony Studies on Diet and Food Chapter 27

The stomach, when we lie down to rest, should have its work all done, that it may enjoy rest, as well as other portions of the body. The work of digestion should not be carried on through any period of the sleeping hours. After the stomach, which has been overtaxed, has performed its task, it becomes exhausted, which causes faintness. Here many are deceived, and think that it is the want of food which produces such feelings, and without giving the stomach time to rest, they take more food, which for the time removes the faintness. And the more the appetite is indulged, the more will be its clamors for gratification. This faintness is generally the result of meat-eating, and eating frequently, and too much. The stomach becomes weary by being kept constantly at work, disposing of food not the most healthful. Having no time for rest, the digestive organs become enfeebled, hence the sense of “goneness,” and desire for frequent eating. The remedy such require, is to eat less frequently and less liberally, and be satisfied with plain, simple food, eating twice, or, at most, three times a day. The stomach must have its regular periods for labor and rest, hence eating irregularly and between meals, is a most pernicious violation of the laws of health. With regular habits, and proper food, the stomach will gradually recover. - Selected Messages Book 2. pp 415-416

Exercise aids the dyspeptic by giving the digestive organs a healthy tone. To engage in deep study or violent exercise immediately after eating, hinders the digestive process; for the vitality of the system, which is needed to carry on the work of digestion, is called away to other parts. But a short walk after a meal, with the head erect and the shoulders back, exercising moderately, is a great benefit. The mind is diverted from self to the beauties of nature. The less the attention is called to the stomach, the better. If you are in constant fear that your food will hurt you, it most assuredly will. Forget your troubles; think of something cheerful. – Counsels on Diet and Food. P. 161

Irregularities in eating destroy the healthful tone of the digestive organs, to the detriment of health and cheerfulness. In no case should meals be irregular. If dinner is eaten an hour or two before the usual time, the stomach is unprepared for the new burden; for it has not yet disposed of the food eaten at the previous meal and has not vital force for the new work. Thus the system is overtaxed. Neither should meals be delayed one or two hours, to suit circumstances, or in order that a certain amount of work may be accomplished. The stomach calls for food at the time it is accustomed to receive it. If that time is delayed, the vitality of the system decreases and finally reaches so low an ebb that the appetite is entirely gone. If food is then taken, the stomach is unable to properly care for it. The food cannot be converted into good blood. If all would eat at regular periods, not tasting anything between meals, they would be ready for their meals and would find a pleasure in eating that would repay them for their effort. – Child Guidance, pp 388-389
And God said, “See, I have given you every herb that yields seed which is on the face of all the earth, and every tree whose fruit yields seed; to you it shall be for food.” – Genesis 1:29 (NKJV)

Then as he lay and slept under a broom tree, suddenly an angel touched him, and said to him, “Arise and eat.” Then he looked, and there by his head was a cake baked on coals, and a jar of water. So he ate and drank, and lay down again. And the angel of the LORD came back the second time, and touched him, and said, “Arise and eat, because the journey is too great for you.” So he arose, and ate and drank; and he went in the strength of that food forty days and forty nights as far as Horeb, the mountain of God. – 1 Kings 19:5-8 (NKJV)

Can flavorless food be eaten without salt? Or is there any taste in the white of an egg? – Job 6:6 (NKJV)

“Please test your servants for ten days, and let them give us vegetables to eat and water to drink. Then let our appearance be examined before you, and the appearance of the young men who eat the portion of the king’s delicacies; and as you see fit, so deal with your servants.” So he consented with them in this matter, and tested them ten days. And at the end of ten days their features appeared better and fatter in flesh than all the young men who ate the portion of the king’s delicacies. Thus the steward took away their portion of delicacies and the wine that they were to drink, and gave them vegetables. – Daniel 1:12-16 (NKJV)

So when he had received food, he was strengthened. Then Saul spent some days with the disciples at Damascus. – Acts 9:19 (NKJV)

And as day was about to dawn, Paul implored them all to take food, saying, “Today is the fourteenth day you have waited and continued without food, and eaten nothing. Therefore I urge you to take nourishment, for this is for your survival, since not a hair will fall from the head of any of you.” And when he had said these things, he took bread and gave thanks to God in the presence of them all; and when he had broken it he began to eat. Then they were all encouraged, and also took food themselves. And in all we were two hundred and seventy-six persons on the ship. So when they had eaten enough, they lightened the ship and threw out the wheat into the sea. – Acts 27:33-38 (NKJV)

I fed you with milk and not with solid food; for until now you were not able to receive it, and even now you are still not able – 1 Corinthians 3:2 (NKJV)

Do you not yet understand that whatever enters the mouth goes into the stomach and is eliminated? – Matthew 15:17 (NKJV)