Middle and High School Curriculum

# NUTRITION 101

LESSON ONE

**THE DIGESTIVE SYSTEM**

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# NUTRITION 101

## LESSON 1
## The Digestive System

### INSTRUCTIONAL OBJECTIVE

Students will demonstrate a working knowledge of the digestive system, enzymes, hydrochloric acid, and probiotics that they can apply to their own lives to create a healthy lifestyle.

### STUDENT-FRIENDLY OBJECTIVE

I will examine how foods are absorbed, what is needed for this food absorption (hydrochloric acid, enzymes, probiotics), and how my food choices affect my mood.

### HANDOUTS

- *The Unhealthy Truth* Discussion Question Handout
- **Socratic Seminar Guidelines** Handout
- **Whole Food Presentation and Suggested Food List** Handout (final presentation – lesson 8)
- **Food Mood Journal** Handout
- Optional: **Cornell Note Taking** Handout and **Student Notes**

### MATERIALS

- Refer to Notebook Organization found in, **A Note to Teacher** PDF
- *Simple Minds Plus*: Free ipad app

Link: <http://itunes.apple.com/us/app/simplemind -mind-mapping/id305727658?mt=8>.

### SUGGESTED VIDEOS

1. Health Digestive System 101
http://www.youtube.com/watch?v=qyJx_UVEgQI&feature=related

2. Enzymes and Digestion
http://video.about.com/nutrition/Enzymes-and-Digestion.htm

3. Digestive Enzymes, Nutrition and Your Health
https://www.youtube.com/watch?v=uSkLR50Ce7g&feature=related
http://www.sophia.org/animals-human-digestive-system/animals-human-digestive-system--4-tutorial

## OVERVIEW OF CONTENT

- Introduction to the digestive system
- Where are foods absorbed
- What is needed for food absorption
- Enzymes
- Hydrochloric acid
- Probiotics
- Correlation between food and mood
- Review, Q&A, conclusion

## DIRECT INSTRUCTIONS

- To begin, have the students label their notebook according to the **Notebook Organization PDF**.
- Students may use either the Cornell Note Taking format or the Student Notes as you present the following information regarding "The Digestive System."

# PART 1
# The Basics of The Digestive System

- The digestive system is similar to your household plumbing pipes, carrying water into and out of your house. If something is "plugged up" everything will shut down or not work optimally.
- The digestive system is one long tube extending from the mouth all the way down through the large intestine (mouth, esophagus, stomach, small intestine, large intestine, liver, gallbladder and pancreas).
- The digestive tubes actively absorb, secret, sends signals and metabolize.
- A well-nourished digestive system keeps us smarter, stronger and disease free.
- We are eating a variety and quantity of foods that we assume our plumbing system can handle... and it does to a certain degree.
- The digestive system doesn't appreciate the fast food (or other crazy things we may eat when dared) and we will experience digestive problems.

Note to teacher

Briefly go over the section below spending more time on the small intestine where absorption occurs.

Interesting side note

The tongue is a strong muscle and according to traditional Chinese medicine, provides great insight into how your body is functioning. For example, poor dental hygiene may lead to bumps on your tongue, called papilla, or if the tip of your tongue is very red and swollen, this may indicate heart problems.

- It's optimal to chew food between 25 to 50 times (or sing Happy Birthday before swallowing). The team combination of saliva and chewing allows a perfect start in the digestion process.
- The uvula, the dangling piece of tissue at the back of your mouth, does some food directing. It makes sure food does not go up nasal passage and into your nose. Discuss how the nose smells food and sends a message to the brain to prepare the salivary glands.
- The salivary glands, located in the mouth, will begin to secret saliva. Saliva contains water and chemical enzymes which help break down the food and make it soft and wet so it can be swallowed.
- This liquidy food is called chyme. A ball of chyme is called a bolus.
- After food leaves the mouth it goes down the esophagus.
- The stomach is about the size of a pear and can be called the body's blender. It chops, dices and makes swallowed food a more liquidy chyme.

- It does this with the help of enzymes called gastric juices. There are different types of gastric juices that break down different types of food. Pepsin helps break down protein for example.

- Hydrochloric acid is secreted to help protect the stomach from germ invaders that might be present in foods. It is quite powerful and could easily burn your outside skin but the stomach is lined with mucus to make sure that doesn't happen.

- Although nutrients are absorbed throughout the digestive track, most nutrients are absorbed in the small intestine.

- Explore the 3 sections of the small intestine: duodenum, jejunum and ilium. Most of the nutrients are absorbed in the jejunum because the villi are much longer here and more plentiful. The small intestine is approximately 4.6 meters (15 feet) and is 2.5 to 3 cm wide.

- Villi are finger-like projections located in the small intestine. There are millions of them. The food particles/nutrients in the chyme will travel up the villi towards the blood vessels where they will be absorbed into the bloodstream and used to fuel your body or be stored in the liver until needed.

- The pancreas is located on your left side of your body by the stomach. It secretes pancreatic juices—chemicals called enzymes that help to further break down the chyme—into the small intestine to help digest food.

- The liver is on your right side and it has hundreds of jobs in the body such as storing nutrients, making bile to be stored in the gallbladder, helps clear the body of toxins from drugs and even helps fight off bacteria and viruses. The liver weighs about 3 pounds and is shaped similar to a rounded triangle.

- The gallbladder is located on top of your liver and it stores bile, which aids in breaking down fat.

- The large intestine is much smaller than the small intestine in length but bigger in width. It is approximately 1.5 meters (5 feet) long and is 10 centimeters (4 inches) wide. Similar to the small intestine, it has main 3 sections: cecum, colon, and rectum. Its job is to absorb water from food into the body. The left over waste (stool) that the body can't use will be pushed out of the body (bowel movement).

# PART 2
# Food Absorption

## INTRODUCE HYDROCHLORIC ACID (HCL)

- The parietal cells of the stomach produce HCl and secrete it primarily in response to ingested protein or fat.
- Aids the immune system: Hydrochloric acid is secreted to help protect the stomach from germ invaders that might be present in foods.
- It is quite powerful and could easily burn your outside skin but the stomach is lined with mucus to make sure that doesn't happen.

*Side note*
*Decreased HCL production (from a poor diet consisting of processed foods) may lead to digestive problems such as bloating, heartburn, and gas.*

## INTRODUCE ENZYMES

Teacher's side note
As in a later discussion on the importance of minerals in the body, make note that close to 95% of the body's activity are dependent on minerals. This is important to mention as one of minerals tasks are to make enzymes.

- Enzymes are chemical substances, mostly proteins, that act as catalysts to bring about a specific chemical reaction, in this case allowing for digestive processes to occur optimally and efficiently. Many enzymes in the body aid the body from digesting foods, detoxification and to brain activity (released by different glands and organs). They are major players in controlling how our bodies will function. There are three main types:

1) **Digestive enzymes** breakdown food into smaller pieces to allow for absorption. There are 3 main categories: Amylase breaks down carbohydrates, pepsin (proteolytic) breaks down proteins, and lipase breaks down fats.

- **Mouth.** This is where the break down of food will initially occur. Chewing your foods thoroughly sets the stage for optimally digestion.
- The enzyme amylase, found in saliva, will begin the break down of starch. This is a quick and simple breakdown.

- **Stomach.** There are 2 important enzymes in the stomach that assist hydrochloric acid: Gastric amylase and pepsin. The amylase will continue to break down starch foods (converting them into glucose) and pepsin will break down protein (converting them into amino acids).
- **Small intestine.** The pancreas will release the bulk of 3 classes of enzymes to further breakdown carbohydrates, proteins and fats and digestion of foods. Lipase will be secreted to break down fats.

*Side note*

*Deficiency in any of these enzymes, at any stage, will lead to indigestion - bloating, stomachaches, and malabsorption of nutrients.*

2) **Metabolic enzymes.** These enzymes allow for almost every biochemical reaction in the body. They repair every cell in the body, aid in detoxification and give an overall maintenance to our cells.

*Side note*

*Enzymes require nutrients, especially minerals, to allow for the chemical reaction to occur. For example, to get from A to B, the body needs zinc.*

3) **Food enzymes.** These are the enzymes that food will provide us when we eat them. We get most of our food enzymes from eating raw foods - another good reason to eat more raw fruits and vegetables.

Teacher side note

Dr. Francis Pottenger, in the early 1900's, conducted a study with cats. Group 1 cats were given raw meat and milk (unpasteurized) and the group 2 were given cooked meat and pasteurized milk. The cats in group 1 thrived and were disease free during the 10 year study. Discuss this with your students.

* When food is cooked or processed the enzymes in foods are destroyed, sometimes completely.

Activity option

Research pasteurization (who developed it and why) and then have the students debate the pros and cons.

### INTRODUCE PROBIOTICS

The digestive system contains 75% of the immune system. There are good and bad bacteria in the gut, and they have important roles in the immune system. The good bacteria keep the bad bacteria in balance. Stress, allergies, poor eating habits, and antibiotic use may decrease the good bacteria levels. Below are the benefits probiotic benefits:

- boosts the immune system (helps with eczema and allergies)
- improves vitamin and mineral absorption
- aids in most digestive ailments (lactose intolerance, constipation, diarrhea or irritable bowel syndrome)
- aids in manufacturing B vitamins and vitamin K
- protects the mucous lining of the intestines

Lactobacillus and bifidobacterium are the 2 probiotics you may be familiar with and are in most probiotic formulas. You may also be able to obtain your probiotics from foods like kefir, yogurt and miso.

# PART 3
# Food and Mood

### ACTIVITY

- Encourage the students to think about how certain foods make them feel. Are they full, tired, grumpy, happy, do they have a stomachache?

- Hand out Food Mood Journal, and explain where to record foods and where to record emotions.

- For one week, students will record what they eat for lunch, and also the physical feelings and emotions they feel during and after.

*Side note*

*Symptoms may last up to 72 hours in the body so let them be aware of this.*

## SUMMARY ACTIVITY

- Lesson 2 presents: Vitamins and Minerals.
- Present the following quotation to students at the conclusion of Lesson 1. They are to consider its meaning and prepare to make comments in a classroom discussion before beginning Lesson 2.

## QUOTATION

"*Let food be thy medicine and medicine be thy food.*" Hippocrates

Who was Hippocrates?
What are some foods that promote health with certain illnesses?

## SUGGESTED HOMEWORK

Using your notes, create a Mind Map using the free app, Simple Minds Plus.

## HANDOUTS

Lesson 7 involves **Socratic Seminar** regarding the book, *The Unhealthy Truth*. As students begin reading this book in preparation for the seminar, give them the Discussion Question Handout and **Guidelines for Participants in a Socratic Seminar**. See Lesson 7.

Lesson 8 involves a final project. As students begin preparing for this project, they will need to choose a whole food from the provided list (**Suggested Food List** handout) and be given the project instructions. See Lesson 8.

Both Lesson 7 and 8 are lengthy and time consuming and beginning early is advised.