Toby Guenthner, Emmy Nam, Garrett Hoefer, Matt Iacovelli

Project Proposal

Description of model- Starts with a blender and food. The blender will grind the food into smaller pieces(mouth). Then pour boluses into tube(esophagus) going into a french press(stomach). Acid(from liver) is poured into the press in order to break down the food. Glass container(gall bladder) holding bile(detergent) breaks down chyme. We will have a separate area for the intestines and use dialysis to diffuse out water and other nutrients like how the digestive system does.

- Drawing: See IRL

- Functions of model- break down foods and become dissolved into waste products and water transferred out(also demonstrates the transfer of other nutrients)

- Materials we have- blender, French press, Baking soda, detergent

-Materials we need- Hydrochloric acid/Acetic acid, glass jar(use beaker), PVC tubing, water, salt water, dialysis tubing, container

- Construction plan-Mostly just getting all of the materials and physically transferring the food along the way possibly tying down tubing between each function

- Science principles used- Biology: Diffusion across semipermeable membrane. For the large intestine, the water is filtered out through the process of hypertonic diffusion. Hypertonic diffusion is when the outside concentration is greater than the concentration of the cell so the water inside the cell is forced out because of the difference in pressure.

Chemistry: Acid and detergent binds to food and breaks down nutrients.

- Unsolved issues- How to dissolve food quickly enough within stomach. Others ways to represent diffusion in small intestine(current process may be too slowly or ineffective)? Is there a way to transfer specific nutrients through dialysis tubing? How do we observe the diffusion- compare water levels?

- Special needs- Acetic acids, dialysis tubing,

Mouth- blender

Esophagus- tube to stomach(PVC)

Stomach- French press(acid in French press, pour broken down food- push down top until dissolved then pour into next organ)(Liver=container used to store acid)

Large Intestine- Dialysis tubing to diffuse water(use salt water on the other side)

Small Intestine- Dialysis tubing to diffuse nutrients(lipids, amino acids(proteins), glucose, some minerals- iron and vitamin B)

Notes:

Where nutrients are broken down-

Protein: stomach

Starches: Mouth, small intestine, pancreas

Fats: liver, pancreas

mouth- The mouth contains the teeth and saliva that serve the purpose of breaking down the food. The teeth grind food into boluses and then the salivary gland releases saliva, a

liquid triggered by the nervous system, to moisten the boluses. This saliva begins the process of the chemical digestion because it contains an enzyme called amylase, which breaks chemical bonds in starches and releases sugar. It also contains lysozyme that protects the food from bacteria. The food continues to travel to the pharynx.

pharynx- The passageway between the mouth and the esophagus that allows liquids and boluses to travel along the digestive system.

esophagus- The esophagus pulls boluses down to the stomach by contracting smooth muscles surrounding the esophagus and pulling it through the cardiac sphincter into the stomach. The cardiac sphincter is a ring of muscle between your esophagus and stomach which keeps food from moving back up into the esophagus. \*Heartburn is when stomach acid moves past the cardiac sphincter and splashes against the lining if the esophagus.

stomach- the stomach is a muscular sac that digests your food with chemical and mechanical digestion. Chemical digestion the lining of the stomach has million of microscopic gastric glands that release substances into the stomach. Some of these glands release the acids and the other glands release fluids that lubricate and protect the stomach wall. The acid interacts with pepsin and starts the complicated process of protein digestion. Your stomach can also get peptic ulcer. this is when there is a hole in your stomach wall this is caused by the bacterium helicobacter. During the stomach digestion process there is chemical digestion and mechanical digestion mechanical digestion turns the liquids with the food and create something called chyme which then enters the small intestine by the pyloric valve.

liver- The liver produces bile, which is stored in the gallbladder. The bile is composed of a fluid of lipids and salts. When chyme, a mixture of stomach acid and food, reaches the duodenum, the gallbladder releases this acidic bile which serves the purpose of breaking the fats into smaller pieces. The smaller the food particles are, the easier it is for the human body to utilize the nutrients.

pancreas- The pancreas produces the enzymes needed to break down lipids, proteins, carbohydrates, and nucleic acids. The pancreas also neutralizes stomach acid to allow enzymes to properly function and break down specific lipids and it regulates blood sugar levels.

large intestine- The main purpose is to remove water from the undigested material that is not utilized.

Appendix- Just the same as the rest of the digestive tract, the appendix is made of an inner layer of mucosa with submucosa, muscularis, and serosa layers surrounding it. Unlike the rest of the large intestine, however, the submucosa of the appendix contains a lot of lymphoid tissue. The presence of lymphoid tissue shows that the appendix may be used in the immune system in addition to the digestive system. But it is not a vital organ and it's real purpose is relatively unknown but it is believed by some to be part of cellulose digestion from plants that our vegetarian ancestors ate.

small intestine-A majority of chemical digestion occurs in the small intestine. The small intestine is an organ specifically adapted to absorbing nutrients. The interior is made up of folded surfaces covered with ‘projections’ called villi. These villi are covered in thousands of smaller villi called “microvilli”. These folded surfaces and projections grant the small intestine an enormous surface area for absorbing nutrient molecules. Slow wavelike contractions of smooth muscles slowly move the chyme along its interior surface. Products of protein and carbohydrate digestion are absorbed by capillaries in the villi, while molecules of undigested fat and some fatty acids are absorbed by lymph vessels called lacteals.

rectum- The rectum is what you would call the last portion of the colon and the rectum is connected to the anus. At the bottom of the rectum are the sphincter muscles. These muscles prevent the rectum from prematurely emptying out. When a person is ready to empty out, these sphincter muscles relax and, with straining, the poop is able to be pushed out.

anus- The rectum then leads into the anus. The anus is made out of Tough tissue called fascia that tissue surrounds the anus and attaches it to nearby structures. Circular muscles called the external sphincter ani form the wall of the anus and hold the anus closed. There are glands that release fluid into the anus to keep the surface of the anus moist. A plate-like band of muscles, called the levator ani muscles, surround the anus and form the floor of the pelvis which supports the spine, helps to maintain continence for poop and pee. A network of veins lines the skin of the anus.

Digestive System Disorders-

Cancers

Ulcers

Function of digestive system: to convert food into simpler molecules to be absorbed by the body.

Discussion from Critical Friends:

* Why separate parts
	+ easier to control and manipulate
* How to safely pour acid
	+ take precaution with glass beakers
* What do you use for saliva
	+ water- has same effect as saliva to moisten and make it easier to chew