Molecules, Food and Body

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Structure and Function

I am creating this slideshow to document a portion of my science education. This project will demonstrate that I have proficiency in the Molecules, Food and Body performance indicator, which reads, “Make connections between molecules found in the food we eat and how they are rearranged to function within the human body.” I will be giving a very general overview of the assimilation process of each macromolecule in the body, stopping with the small intestine, as that covers the basics of how molecules are processed on a cellular level.

What are Macromolecules anyway?

Macromolecules refers to the bulk of the molecules found within cells (the dry weight, at least, water being the majority of the wet weight). There are four macromolecules, Carbs, Lipids, Proteins and Nucleic Acids. I'm not gonna be referring to nucleic acids at all though, as they are not as applicable to the digestive system.

Carbs

Short-form for carbohydrates, carbs are also known as sugars, starches, etc. They get converted to ATP in cells, which is the cellular currency of energy.

Proteins

Made up of amino acids, proteins are used to build and repair tissues. Meat, dairy products and eggs are common forms of protein, but it is abundant in plant-based sources as well, such as, soy, hemp, chickpeas, lentils, quinoa, and most nuts seeds and beans.

Lipids / Fats

I will only be writing about fats because it's applicable to the food we eat, but lipids is the more overarching term. Their functions in the human body include storing energy, insulation, cell membranes, and being the building blocks of hormones!

INTRODUCING...

The gastrointestinal tract (which is just a fancy word for the path food takes through your body)! We are going to be taking this Food's Journey momentarily, to discover what really goes on in there.

Mouth

The main function of the mouth is to turn food into a bolus, which is kinda just a round ball, to make it easier to digest later on. Obviously we've got teeth and spit, but if we look a bit closer there's a lot more going on! We have 4 different glands in our mouths responsible for the release of enzymes to process food. The main enzymes are amylase (breaks down carbs) and lipase (breaks down fats).

Esophagus

I didn't want to include the Esophagus, but thought it would be confusing with a missing link. I was so bored learning about this part! Pretty much it's just there as a segway to the stomach, or more like a propellor of that bolus ball to the stomach! It also has sphincters!

Stomach

Here we get to the real juice of the matter. The goal of the stomach (if nature has goals anyway!) is to turn that beautiful bolus into chyme! It goes about this in two main ways, physically churning around the bolus, and with the insane amount of juices its got goin' on! The stomach wall has three types of cells to help achieve this chyme.

Stomach Cells

1. Mucus Cells - Release Mucin, which is a type of coating around the stomach lining to keep it safe from corrosions from the stomach juices.
2. Parietal Cells - Release Hydrochloric acid / HCL, this breaks down pepsinogen into its active form, pepsin.
3. Chief Cells - Release Pepsinogen, this allows hydrolysis to occur (for our purposes, meaning enzyme assisted breakdown)

Small Intestine

So much goes on in here we've gotta break this section up into smaller chunks! We will start by continuing to break up our macromolecules.

Hydrolysis

- Proteins - The pancreas releases trypsinogen, and chymotrypsinogen to break these down. The enzymes are converted by an enzyme in the small intestine, enteropeptidase into their practical form.
- Carbs - The pancreas releases amylase, and the small intestine releases lactase (specifically for lactose).
- Fats - The liver and gallbladder release bile to emulsify/organize fats, and the pancreas releases lipase.

Small Intestine Absorption

Here is where we finally get to see how our food ends up in cells, where it can be utilized by the body as needed. I'm gonna break this section up by macromolecule to make it easier.

Carbs

A complicated process called an ion gradient occurs here, which creates energy for sugar to enter into the intestinal wall itself, into an Enterocyte, which is the fancy name for intestinal cell.

Proteins

There is a protein on the outside of Enterocytes that breaks down ATP. After this is done, protein may enter. It gets a little makeover in the cells, and is then released into the bloodstream where it floats around until needed.

Fats

Due to the amphipathic nature of both fat molecules and cell membranes, fat pretty much has a free ride into cells. This means they have certain parts that like water, and others that do not. If the fat aligns the parts right, it’s in. Once in, fat is reorganized into chylomicrons, essentially, it’s storage.

Homeostatic Conclusion bringing it all together

Homeostasis is the constant battle for balance our bodies engage in. It is our bodies form of checks and balances. All of the processes I touched on today are forms of achieving homeostasis. For example, if the body were unable to assimilate carbs, we would have no energy!