Similarities between mechanical and chemical digestion biology essay

Mechanical digestion is the breakdown of solid food into smaller particles and readies the substance for further breakdown in order for the body to obtain nourishment. Chemical digestion is the breakdown of food into smaller substances, nutrients, which can be absorbed by the body.

Mechanical and chemical digestion are processes that occur in the alimentary canal and serve a common goal of providing the body with nutrients, ions, vitamins and water by breaking down food in different ways. Both digestive processes start in the mouth and occur in the stomach, small intestine and large intestine.

The two processes differ in the ways that food is broken down. The body mechanically digests food by first tearing it into pieces using the teeth. The tongue assists in creating a bolus which is swallowed and travels down the pharynx and esophagus. Once in the stomach, the food is macerated and mixing waves break the food apart even more and is now called chyme. The chyme eventually arrives in the small intestine where peristalsis propels it towards the ileocecal sphincter. Finally, the leftover chyme experiences haustral churning in the large intestine and experiences mass peristalsis and eventually is defecated.

Like mechanical digestion, chemical digestion first occurs in the mouth; however, the salivary glands are responsible for the first step in chemical digestion. The parotid, sublingual, and submandibular glands have ducts that lead into the mouth and secrete amylase laden saliva. Amylase breaks down starch and converts it to sugars. The food eventually makes its way to the stomach where gastric juices break the food down into smaller substances.

Gastric juices are secreted from the mucus covered walls of the stomach and is a highly acidic solution (1. 5-3. 5 pH) that is comprised of hydrochloric acid as well as pepsin. The duodenum, liver, gallbladder and pancreas contribute to an environment that allows enzymes to digest carbohydrates, proteins, triglycerides, and nucleic acids. Most nutrients are able to pass to the circulatory and lymph systems once the enzymes in the small intestine break down food and absorb the nutrients. The large intestine continues to break down the substances even more by absorbing water through intestinal walls and allowing bacteria to assist in further breakdown. Whatever products are left are defecated.

Describe the structures of the liver. What are the functions of the individual structures? Describe the overall function of the liver. What is the pathway of blood flow into, through, and out of the liver?

The liver is the largest internal organ in the human body and serves a multitude of functions. It is responsible for carbohydrate, lipid, and protein metabolism, processing of drugs and hormones, excretion of bilirubin, synthesis of bile salts, vitamin and mineral storage, phagocytosis and activation of vitamin D.

The structures of the liver are divided into two main lobes, a larger right and smaller left lobe, separated by the falciform ligament. Continuations of the left lobe include the quadrate and caudate lobe. The hepatic artery and portal veins are important liver structures that lie inferior to the organ. The hepatic artery obtains oxygenated blood from the heart and the hepatic portal vein receives deoxygenated blood from the small intestine which

contains digested nutrients, drugs, and toxins. The liver’s lobes are divided into many lobules which are hexagonal structures containing specialized liver cells called hepatocytes. Hepatocytes make up 70% of the liver’s mass and are mainly responsible for protein synthesis and storage, hydrolysis of carbohydrates, manufacturing of cholesterol, bile salts, and phospholipids, as well as the production and secretion of bile. In other words, hepatocytes are the basic metabolic cell units. Between hepatocytes, bile canaliculi are present and act as channels for bile to empty into bile ducts. Eventually bile ducts within the liver unite and exit the organ as the newly formed common hepatic duct which then joins the gallbladder’s cystic duct to form the common bile duct.

The hepatic artery and hepatic portal vein have branches that are responsible for delivering blood to highly permeable capillaries called sinusoids. In the sinusoids, the hepatocytes carry out their metabolic tasks and collect the nutrients in the blood for synthesis and manufacturing of products. End products from the hepatocytes are sent back into the blood for delivery to other body cells via the central and then hepatic vein. In the corners of liver lobues, portal triads are present and consist of hepatic portal vein and hepatic artery branches that run alongside bile ducts. After the blood reaches the hepatic vein, it flows into the inferior vena cava then eventually reaches the right atrium of the heart.

What is the difference between digestion and absorption? Where does each occur and what structures are involved in each process? What is a nutrient? What are the general functions of carbohydrates, lipids, proteins, and minerals? Are they important to your body?

Digestion is the process of breaking down food into molecules to ready the body for absorption of nutrients. Absorption occurs when nutrient-rich molecules enter the blood and lymph to provide life-sustaining nourishment to body cells.

Digestion first occurs in the mouth where food is ripped and ground by the teeth and tongue and amylase breaks down food into simpler compounds. Food passes through the mucus-lined pharynx and esophagus and reaches the stomach for further digestion. Once in the stomach, peristaltic movements called mixing waves steadily macerate food. The stomach contains gastric glands which open into narrow channels called gastric pits. Gastric secretions, including pepsinogen, gastric lipase, hydrochloric acid, mucus, and intrinsic factor, mix with the macerated food and reduces it to a thick liquid called chyme. Mixing waves become more vigorous and intensifies so that a small amount of chyme reaches the duodenum. Little by little, chyme is emptied into the duodenum where the pH is increased. The small intestine is where a critical part of digestion occurs because mechanical and chemical digestions occur in this location as well. Pancreatic juice is a liquid consisting of water, salts, sodium bicarbonate and a few enzymes while intestinal juice is a liquid consisting of slightly alkaline mucus and water. Together, the two juices help absorption of nutrients from chyme as it comes into contact with microvilli, tiny projections of absorptive cells in

the small intestine. The absorptive cells synthesize several digestive enzymes (brush border enzymes) which digest carbohydrates, proteins, and nucleotides. Segmentation, a mixing contraction, mixes chyme with digestive juices and promotes contact with mucosa for absorption. Once most nutrients are absorbed, segmentation stops and peristalsis begins. The peristaltic waves push the chyme further along the small intestine.

Active transport, passive diffusion, facilitated diffusion and pinocytois or phagocytosis are the four ways in which nutrient molecules are absorbed into the body. Nutrients are classified as any substance that can be metabolized by the body to provide energy and build tissue. Absorption first occurs in the stomach, however, the stomach is limited to absorbing just a small percentage of alcohol and some short-chain fatty acids. 90% of absorption occurs in the small intestine. Carbohydrates, nutrients that act as the body’s main source of energy, are broken down into monosaccharides which are sent into cells of villi via facilitated diffusion. Afterwards, monosaccharides enter capillaries of the villi via facilitated diffusion. Proteins, nutrients that are responsible for growth of muscles, bones, antibodies, metabolism, and digestion, can be brought in as dipeptides and tripeptides with hydrogen. A symporter hydrolyzes the peptides into single amino acids that enter capillaries by diffusion. Lipids, nutrients responsible for cell membrane and hormone formation, are absorbed via simple diffusion after they are emulsified, and broken down into fatty acids and monoglycerides. Ions, nutrients responsible for neurological functions, are actively transported in and out of cells via pumps. For example, the sodium-potassium pump actively transports ions through cell membranes. Minerals,

or elements, are absorbed by simple diffusion and water is absorbed via osmosis. Minerals are important in the body because they provide a foundation for many metabolic activities to build upon and structures like bones, for bodily support. Carbohydrates, minerals, lipids and proteins are essential to the body for the reasons given above.

What are the structures of the kidneys; describe their functions. What is the overall function of the kidney? Describe the path of blood from its entrance into the kidney to its exit from the kidney. Describe the path of urine from the nephron to the urinary bladder.

Kidneys regulate blood ionic composition, blood pH, blood pressure, glucose level, produce hormones, and excrete wastes and foreign substances.

Kidneys have several important structures that allow their overall function. Each kidney has three layers of tissues that surround it: renal capsule which serves as a barrier against trauma, adipose capsule which cushions from trauma, and renal fascia which anchors the organ to the abdominal wall. Two distinct areas in the kidney are the renal cortex and renal medulla. Inside of the renal medulla are several cone shaped pyramids separated by renal columns. Renal lobes are comprised of a renal pyramid, the adjacent renal cortex, and apart of the renal column. The importance of the renal cortex and pyramids lies in the fact that nephrons, small tubules that are the excretory units of the kidney, are abundant in this area. Nephrons form urine which drain into papillary ducts that pass through a pyramid’s renal papillae. The minor and major calyces acts as drains for the papillary ducts and

channel the urine into the renal pelvis which functions as a cavity that controls the flow to the ureter.

The renal artery provides the kidney with blood. This artery splits into segmental arteries that supply different areas of the kidney. The segmental arteries branch off into interlobar arteries found in the renal columns. Interlobar arteries arch around the renal pyramids between the renal cortex and renal medulla and are called arcuate arteries. Interlobar arteries branch off into the renal cortex and become afferent arterioles. Each nephron has one afferent arteriole that splits off into a small network of capillaries called a glomerus. The capillaries reunite and are called efferent arterioles which carry the blood out of the nephron. These efferent arterioles divide and are called peritubular capillaries that can be found surrounding tube-like nephron parts in the renal cortex. Vasa recta, capillaries that are loop-like, provide tubular parts of the nephron in the renal cortex with blood. Finally, peritubular capillaries come together at the interlobular veins, drain through the arcuate veins, then into the interlobar veins. The interlobar veins come together at the renal vein and blood leaves the kidney and merges with the inferior vena cava.

Urine is formed by glomular filtration, tubular secretion, and tubular reabsorption. First, blood must be filtered by leaving glomular capillaries and entering the glomerular capsule. Urine is filtrated out of the blood in the glomerular capsule and enters the proximal convoluted tubule, enters the descending limb (Loop of Henle), then thin ascending limb which turns into the thick ascending limb. Urine then passes through the distal convoluted tubule, that turns into a collecting duct. The collecting duct turns into the

papillary duct that passes through the minor calyx. The urine is channeled to the major calyx and then the renal pelvis. Urine finally reaches the ureter which drains into the bladder.

How are waste products urea and ammonia removed from the blood? In which part of the nephron does this occur? Describe the structures and functions that are involved in these processes. [EXTRA CREDIT ESSAY]

Ammonia is a toxic substance that must be removed from the body. Enzymes in the liver convert ammonia to urea by adding carbon dioxide molecules. The water and solutes in unfiltered blood plasma first travel to the renal corpuscle located in the nephron. The fluid then leave the glomerular capillaries, enter into the glomerular capsule and end up in the renal tubule. In the renal tubule and collecting duct, cells in the two structures reabsorb the water and solutes. In other words, water and solutes are returned to the blood stream in the peritubular capillaries. The waste contents in the peritubular capillaries produce a secretion that flows into the renal tubule and collecting duct, so the secretion essentially cleans the blood by removing wastes. These wastes make their way through the renal pelvis and then ureter for storage in the bladder and eventual removal from the body via the urethra.