Jonathan Quang 10/29/14

Biology

Part I

LO1: The six major categories of nutrients are carbohydrates, lipids, proteins, minerals, vitamins, and water. Carbohydrates and lipids are the major source of energy for the human body. Carbohydrates are a form of quick, short-term energy. Lipids are the most concentrated source of energy. Fats specifically are used by many animals to store energy and to be used as insulation. Proteins (and the amino acids that make up the proteins) are necessary to form and use muscle, connective tissue, nails, hair, enzymes, receptors on cell membranes, and antibodies. Minerals are necessary elements needed in animals, such as calcium, magnesium, and phosphorus for bones and teeth. No animal can synthesize minerals. Vitamins are a diverse group of organic molecules that animals cannot synthesize, but are necessary for cell function, growth, and development.

LO2: Energy in the diet comes from mainly carbohydrates and lipids. 60% of the energy in food is released as heat. The remaining 40% is captured in ATP. Food energy is measured in calories. A single calorie is the amount of energy required to raise the temperature of 1 gram of water by 1oC. The body stores energy as body fat, which also acts as insulation.

LO3:The first task that all digestive systems must accomplish is ingestion. Food is brought into the digestive tract through an opening, usually designated as a mouth. The second task is mechanical digestion. Food is physically broken into smaller pieces to allow for more efficient digestion by providing a larger surface area. The third task is chemical digestion. Particles of food are exposed to enzymes and other digestive secretions that break down large molecules into smaller ones. The fourth task is absorption. The smaller molecules are transported out of the digestive tract and into the body through cells lining the tract. This is where nutrients actually enter the body. The fifth task is elimination of indigestible materials from the body.

LO4: One mode of digestion in invertebrates is the single chamber system. In some animals, the digestive chamber is called the gastrovascular cavity. There is a single opening where food comes in and waste is ejected. When prey ends up in this chamber, gland cells secrete enzymes that begin digesting the pret. Cells lining the cavity absorb the nutrients and engulf partly digested food particles by phagocytosis. Further digestion is intracellular through the food vacuoles in the cells lining the cavity. Another mode of digestion in invertebrates is the tubular digestive systems. An earthworm is a good example. The worm ingests soil and small particles of plant matter through the esophagus, a muscular tube leading from the mouth to the crop. The crop is an expandable sac where food is stored. The material is then gradually released into the gizzard where ingested sad grains and muscular contractions mechanically break down the food. In the intestine, enzymes break the food particles into small molecules absorbed into the worm's body. Remaining soil and undigested matter is expelled through the anus. Another mode of digestion is used by sponges. It is intracellular digestion, where all digestion occurs within individual cells. Specialized collar cells inside the sponge filter microscopic organisms from the water and consume them through phagocytosis. The food is temporarily enclosed in a food vacuole. The vacuole fuses with a lysosome, a packet full of digestive enzymes. Food is broken down within the vacuole inter smaller molecules that can be absorbed into the cell cytoplasm. Any unusable waste is ejected through exocytosis.

LO5: The digestive specializations of herbivorous vertebrates include an upper incisor repleased by a leathery dental pad, large flexible tongues (if ruminant) and well-developed incisors for snipping plants (if not ruminant). The premolars and molars of herbivores have large surfaces for grinding plants. The digestive specializations of carnivorous vertebrates include small incisors, greatly enlarged canines, and sharp edged molars and premolars. Omnivores, or at least humans, have cutting incisors, reduced canines, and flattened premolars and molars. The digestive system of a bird is special because it eats its food whole, which is stored and moistened in the crop. In the first stomach chamber, protein-digesting enzymes are secreted and proteins begin digestion. Then the second stomach chamber (the gizzard) mechanically breaks down the food using muscular contractions and swallowed stones or sand. The digestive system of the cow is special because it has multiple stomach chambers. The first chamber is the rumen, which can hold about 150 liters. The microbes help break down cellulose and other carbohydrates and then ferment the resulting sugars. This accounts for at least half the cow's energy, which is absorbed through the rumen wall. After the partial digestion, the plant material enters the reticulum where it becomes masses called cud. Cud is regurgitated, chewed, and swallowed back into the rumen. The extra chewing exsposes more cellulose and cell contents. Eventually, the partially digested plant material enters the omasum where water salts, and small organic molecules are absorbed. Then it enters the abomasum where plant proteins and the accompanying microorganisms are digested. Most of the products are absorbed through the small intestine.

LO6: Food begins in the mouth where it is mechanical digested through chewing. It is also partially broken down by enzymes such as amylase. The chewed food is brought into the pharynx by the tongue which is then brought into the stomach through peristalsis in the esophagus. The stomach contains the food using sphincter muscles. The stomach releases food gradually into the small intestine, produces a variety of contractions that breaks up chunks of food, beings protein breakdown using secretions from the gastric glands, and secretes hormones to regulate digestive activity. The food is gradually converted into chyme. Peristaltic waves propel the chyme toward the small intestine. The small intestine receives several other chemicals from other organs. Bile from the liver disperses lipids in chyme. Pancreatic juice from the pancreas neutralizes the pH of chyme and breaks down carbohydrates, lipids, proteins, and peptides. Microvilli bear enzymes that break down peptides. The huge surface area of the small intestine absorbs nutrients. Once it ends up in the large intestine, the leftovers are absorbed, and anything else is excreted as feces.

LO7: The mouth chews the food, breaking it down and compacting the food. Amylase in saliva breaks down starches into disaccharides and the saliva dissolves some molecules. Once in the stomach, muscle contractions break down the food as well as secretions from the gastric glands (specilized cells that line microscopic pits in the stomach that secrete mucus, hydrochloric acid, and pesinogen. The HCL iss very acidic and destroys many microbes. Pepsinogen is activated into protease to break proteins into peptides. The chyme produced is propelled into the small intestine. Bile from the liver contains bile salts, which have a hydrophilic end that is attracted to water and a hydrophobic end that interacts with fats, dispersing the fats. This provides a large surface area for lipases (lipid digesting enzymes) to work on. Bile is stored in the gallbladder which is released according to hormone signals. Pancreatic juice from the pancreas contains water, sodium bicarbonate to neutralize the acidic chyme, and several previously mentioned or self explanatory enzymes, amylase, lipase, and proteases. Finally, the microvilli in the small intestine bears enzymes called peptidases that break down peptides into amino acids and disaccharidases (which are then broken down into monosaccharides).

LO8: The small intestine has a very large surface area because of the folding of villi into microvilli. This large surface area provides a large area for absorption. Monosaccharides, amino acids, short peptides, fatty acids, vitamins, and minerals enter by diffusion or active transport. Water enters in through osmosis. Fatty acids clustered with cholesterol and fat-soluble vitamins diffuse into epithelial cell membranes where they are assembled and coated with proteins to form chylomicrons. This diffuses into a lymph capillary which eventually ends up in the heart.

LO9: Feces are produced in the large intestine. Indigestible material ends up here. Some bacteria can synthesize vitamins, thiamin, and riboflavin from this, which the large intestine absorbs as well as water and salts. Any remaining material is compacted into feces, which consists of water, indigestible wastes, mucus, some unabsorbed nutrients, and bacteria. This is expelled through peristaltic movements until it reaches the rectum. Expansion of this chamber makes the urge to defecate.

LO10: Hormones regulate digestion by making a person or animal more hungry, less hungry, to produce or release bile, to produce more HCL, and controlling the speed of digestion. The nervous system regulates digestion by making a person or animal actually get the food and put it into the mouth, chew the food, swallow the food, produce the necessary muscle contractions to swallow the food and move it to a different organ, and to allow for the final decision whether to excrete the feces or not.

Part II:  
1. energy, raw materials, vitamins, minerals, essential  
2.intracellular, gastrovascular cavity, tubular, cellulose  
3. amylase, starch, protein, pepsinogen, pepsin, small intestine  
4. ingestion, mechanical digestion, chemical digestion, absorption, elimination  
5.pharynx, digestive, respiratory, epiglottis, swallowing, peristalsis, sphincters  
6. bile, liver, gallbladder, epithelial, lacteal, lymphatic  
7. gastrin ghrelin, leptin, secretin, cholecystokinin, gastrin, ghrelin, secretin, cholecystokinin

Part 3:  
2. Jason's cookies actually have less calories because artificial sweeteners tend to be absorbed less efficiently if at all. The enzymes in the human body are not suited to digest every molecule that it will come across. Most likely, the artificial sweetener would be passed off as waste because it is too large to be absorbed.  
3.Assuming the protozoa take up the space that our previous microbes took up, stronger jaw bones and muscles would be selected to mechanically break wood efficiently. The human mouth and esophagus would also have to become tougher to handle any splinters that may be consumed. There would also need to be some way to dissolve the wood within a liquid produced in the mouth.

Part 4:  
1.Malnutrition is the lack of proper nutrition due to not having enough to eat, not eating enough of the right things, and/or being unable to properly process food. Malnutrition is such a concern because widespread malnutrition, such as in India, points to an obvious problem with the way children are raised and what they have available to eat. Malnutrition also creates serious problems such as inability to grow bigger than a foot to even death.  
2.The number of hungry children in India is surprising because economic growth in India is pretty high. Somini Sengupta in " As Indian Growth Soars, Child Hunger Persists" states " More surprising, though, it found that “serious” rates of hunger persisted across Indian states that had posted enviable rates of economic growth in recent years," (Sengupta). When a country has more money, people generally expect there to be more food available. After all, food can be bought with money.  
3.Malnourished children and pregnant (or recently pregnant) mothers are of most concern to Indian officials because that is where malnourishment is happening. Mothers without proper nutrition cannot produce nutritious breast milk for their children, causing the children to not grow, have diarrhea, die, etc. The nutrition of children is often the measure of how well a country is feeding their people because they are the most vulnerable   
4. It is difficult to really tell if malnutrition exists in children over 5 years because children by then have left the stage of most vulnerability. They no longer rely on their mother's milk or substitutes.   
5.One would feel sympathetically depressed after viewing the slideshow because there are so many people who are in horrifying conditions because of malnutrition. There are those with really thin legs, babies that look shriveled, etc. What is the most interesting about the slide show is that people are either really saddened and worried or are apathetic due to having to deal with malnutrition for so long.

Biology Homework #9   
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