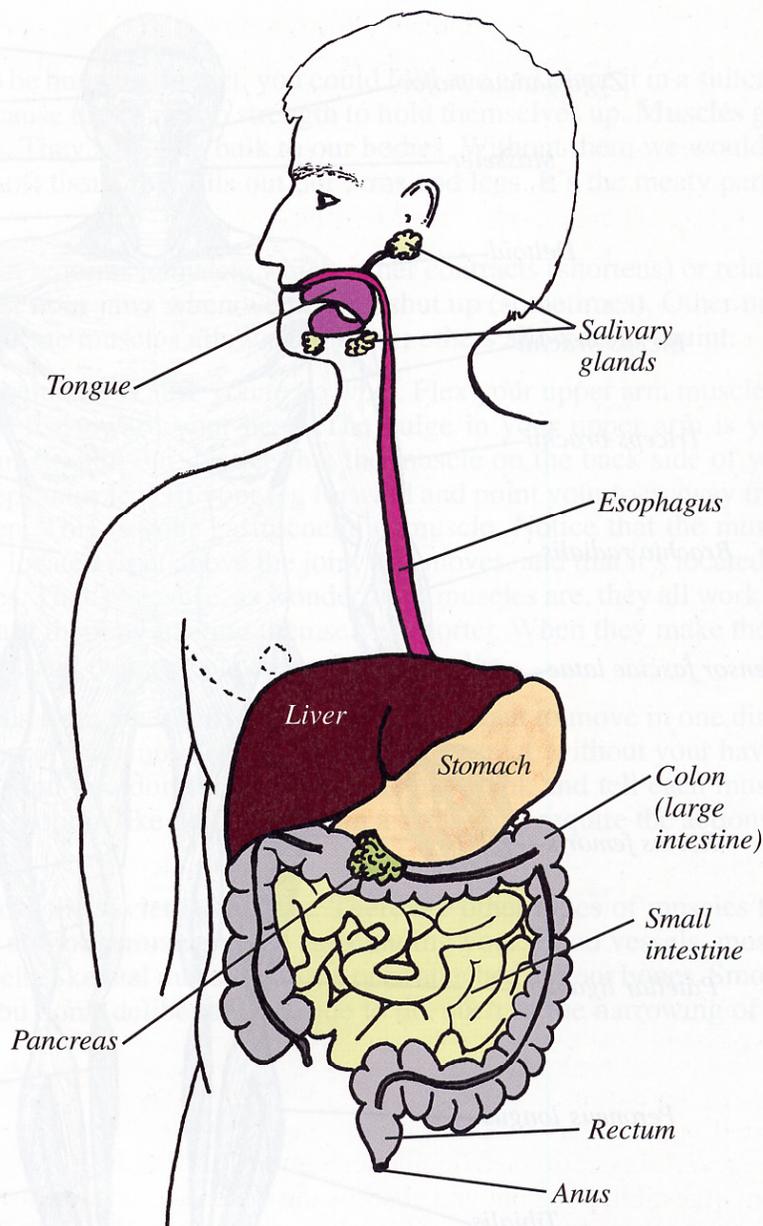


### 33: Digestive System

In the chemistry section you learned that our bodies operate on energy which we get from the chemical bonds in compounds that make up the food that we eat. But we can't send our bodies' cells a whole chicken! How could they bring it inside and use it? It's bigger than the cells themselves. Obviously we have to send our cells something much smaller than they are. But we can't bite off molecule-sized bites of food. Somehow our bodies have to take in food and break it down into molecules that our cells can use. This is the function of our digestive system; it's a big food processor.

We put bites of chicken into our mouths and chew. This does three things: it reduces the size of the pieces of food, it increases the surface area of the food, and it mixes **saliva** into the food. Saliva is the liquid substance in your mouth that comes from glands located around your mouth. Teeth don't make the food molecule-sized, but they do break it into smaller pieces to get started. Teeth have a variety of shapes that allow them to perform different functions. The front **incisors** are for cutting, the pointy **canines** are for holding and tearing, and the **premolars** and **molars** are for crushing and grinding.

Surface area is important in digestion because the chemicals that **digest** or break down the food can't do their jobs if they can't reach it. The chemicals have to be on or close to the surface of a food



*The human digestive system receives food and breaks it down into smaller and smaller pieces, then into individual molecules that can be used by the body's cells. The mouth, stomach and small intestine are the processing chambers. The liver, gall bladder and pancreas add chemicals (acids, enzymes and emulsifiers, for example) that help in the digestion of various types of food. The large intestine receives and processes the solid waste. The rectum receives the waste and holds it until it is passed through the anus to exit the body.*

particle. This is why your mother always tells you to chew your food well. You can't digest big wads of food very efficiently. Big wads go right through your digestive system because the insides of the wads aren't exposed to the chemicals that can break them up.

Remember when we said that enzymes are important proteins in human cells because they make chemical reactions take place so fast? Enzymes are used to break the chemical bonds in a small piece of chicken to make it fall apart. Many enzymes take part in digestion; the first ones are found in your saliva and are mixed into the food while you chew.

Next, with a push from the back of the tongue, your food leaves your mouth and is directed into your throat. Your throat is like a funnel that leads into a tube. In an adult the tube, called the **esophagus**, is about a foot long. It has muscles along the path that push the food downward from your throat to your **stomach**. If you get something in your stomach that your body rejects, these muscles work in the opposite direction to get rid of it. The stomach is a stretchy bag surrounded by muscles and chemical-releasing glands. It is a reaction chamber where chemical reactions continue to break down the food into molecules. Digestive juices high in enzymes are added to the food in the stomach. Yellow-green **bile** comes from your **gall bladder** into your stomach. This is an **emulsifier** to bring the hydrophobic ("water-fearing") chemicals such as oils into contact with the digestive juices. The **pancreas** also adds digestive fluids to the stomach. Contraction of the muscles surrounding the stomach helps the process along by continually mixing the chemicals. Acid is released into the stomach to help break down the chemicals in foods.

After the stomach is finished adding these chemicals, mixing them, and giving them time to react, it squeezes all of the digested materials into the **small intestine**. The intestine is a curved tube approximately six meters long and two to three centimeters in diameter—with about the same amount of surface area as a tennis court. How can a tube with these dimensions have such a huge surface area? The inside walls of the intestines have little folds in them that greatly increase the surface area of the inner wall, just as the fibers on a carpet have more surface area than a flat floor. With all of this surface area the chemicals that were released and continue to be released for digestion are taken up by the intestinal walls where the blood waits to take these chemicals away to the body parts that need them. But the digestion is not yet complete. The blood carries these chemicals to the **liver** where sugars can be stored until they are needed.

Any undigested food passes from the small intestine into the **large intestine**, also known as the greater bowel or colon. The colon is the body's recycler and waste handler. It is a somewhat larger tube about six centimeters in diameter and about 1.5 meters in length. It receives the waste materials from digestion, pulls out and absorbs the water, wraps the waste in mucus (slime), and squeezes the waste into the **rectum** where it awaits passage from the body. This is the waste that is eliminated to the toilet when we have a bowel movement. The **anus** is the muscle which surrounds the opening that empties the rectum.