**SCIENCE TREK 1803 PROGRAM DIGESTIVE SYSTEM**

Transcribed by Nancy Poore 10/24/16

ANNOUNCER: Presentation of Science Trek on Idaho Public Television is made possible through the generous support of the Laura Moore Cunningham Foundation, committed to fulfilling the Moore and Bettis family legacy of building the great state of Idaho; by the Idaho National Laboratory, mentoring talent and finding solutions for energy and security challenges; by the Friends of Idaho Public Television; and by the Corporation for Public Broadcasting.

JOAN CARTAN-HANSEN, HOST: Your body needs food to stay healthy, but food needs to be broken down into a substance your body can use, and that's the job of your digestive system. Find out how it works. Stay tuned. Science Trek is next.

(MUSIC)

Hi, I'm Joan CartanHansen, and welcome to Science Trek. And welcome to the offices of Idaho Gastroenterology, here in Meridian. Scientists are standing by to answer your questions about the digestive system. And later on the show we'll talk about body waste products. That's right, poop and pee. But first, let's learn a little bit more about the digestive system.

STUDENT 1: "Boy, I'm hungry."

STUDENT 2: "Yeah, me, too. The food here smells great."

CARTAN-HANSEN: Did you know your digestive system starts working even before you eat?

Ouch, don't throw that at me. I'm here to tell you how your digestive system works.

STUDENT 1: "Okay. Mind if we eat?"

CARTAN-HANSEN: Go right ahead. When humans, like you and most animals, are hungry and see food, their digestive system starts gearing up. You begin to salivate or produce saliva. As you bite, your tongue positions food in your mouth, your teeth starts tearing it and grinding it up into tiny bits. Saliva or spit, helps soften the food, and your tongue forms the food into little balls called "bolus" and pushes them toward the back of your throat.

STUDENT 1: "Is that when you swallow?"

CARTAN-HANSEN: Yes. But you have to be careful. Your trachea or windpipe sits right behind your mouth, and sometimes food or liquid can slip in, and you cough. You need to chew your food thoroughly.

STUDENT 2: "Good advice."

STUDENT 1: "Yeah, thanks. What happens next?"

CARTAN-HANSEN: Well, now you swallow, and the small balls of food go into the esophagus. The esophagus is a tube made up of an elastic muscular wall. It's about 10 inches long and can expand to move food into your stomach. There are rings of strong muscles around the esophagus, and they squeeze behind each lump and push food along. This process of muscles pushing food along is called "peristalsis," and you find the same action along the digestive system. From the esophagus, your lumps of food go into your stomach. Your stomach is a bagshaped organ about the size of a fist when it's empty, but it can expand to the size of a melon when full. Once food reaches your stomach, juices containing a strong acid start to dissolve the lumps.

STUDENT 1: "If your stomach produces acid strong enough to dissolve food, how come it doesn't dissolve itself?"

CARTAN-HANSEN: Well, the stomach has a lining that releases a thick, slimy goo that coats and protects it from the acid. Bands of muscles around the stomach squeeze and shift the food particles around until they dissolve into a liquid called "chyme." At the bottom of the stomach is a ring of muscles called the pyloric sphincter. Once food turns into chyme, it squirts through the sphincter and into the small intestine. The small intestine is a tube about an inch in diameter and about 20 feet long. It loops around inside your abdomen. The small intestine is lined with millions of tiny, fingershaped villi that contain enzymes that break down the chyme into nutrients or food chemicals. As the nutrients move along, they go into the blood vessels inside the villi and out to the rest of the body. What's left goes into the large intestine. The large intestine is shorter and wider than the small intestine. Hey, do you want to see what one actually looks like?

STUDENT 2: "Sure."

CARTAN-HANSEN: This is my large intestine. It was filmed during a colonoscopy. That's a procedure where a doctor takes a very small camera and inspects the large intestine for any signs of disease. The large intestine is a rubbery tube of muscle with a slippery lining. Its job is to suck water and salty chemicals out of the remaining food sludge. It's a slow job. Food sludge can spend more than 12 hours traveling through your large intestine. As you can see, my large intestine looks just fine.

STUDENT 2: "Oh, yes, very nice. Then what happens?"

CARTAN-HANSEN: The large intestine collects the food bits your body can't digest. This is dietary fiber from things like vegetable skins. Fiber is important because as it sweeps through your system, it helps keep things clean and you healthY.

There are other organs that are important to your digestive system. The pancreas is a long, yellowish organ that releases enzymes into the small intestine to help break down food. Your gallbladder is next to the stomach, and it holds a greenish-yellowish substance called "bile." The gallbladder releases bile into the small intestine to help digest fatty foods. And most important is the liver. It's the biggest organ inside your body and does more than 500 biological functions, like releasing hormones that help you grow, breaking down medicine and even poisons that enter in your body, storing vitamins for your body to use, and catching and killing some types of germs.

Also inside your large intestines, and even throughout your body, are bacteria. There are about 100 trillion bacterial cells inside your guts, known as "gut flora." Gut flora can make up as much as 30 percent of your body weight. Gut flora helps us digest our food and turn it into nutrients.

At the end of the large intestine is an area called the rectum. Food wastes, or what you might call "poop," is stored there. Liquid wastes made up of water and waste chemicals collected by your blood are filtered by your kidneys and sent to a stretchy bag called the "bladder." When your bladder or rectum is full, your body sends you a signal telling you it's time to go to the bathroom.

STUDENT 1: "Really?"

STUDENT 2: "Really. Now, would you excuse me?"

CARTAN-HANSEN: Good job. You should always wash your hands after going to the bathroom. Gut flora is fine when it's in the gut, but if you swallow any you can get sick. Gut flora comes out when you go to the bathroom, and you can get some on your hands. So washing your hands with warm water and soap every time you go to the bathroom protects you and others from getting sick.

You know, your digestive system is really important. Your body needs 13 vitamins and more than 20 minerals and lots of other important things you get from food and drink. Your digestive system takes the food you eat and soaks up all those nutrients and sends them around your body. These are chemicals you need to give you energy, to heal cuts and scrapes, to help you stay warm, to help you grow and stay healthy, so eat right.

STUDENT 2: "We will.

STUDENT 1: Won't you join us?"

CARTAN-HANSEN: Don't mind if I do.

And joining me now to answer your questions about the digestive system are Dr. Matthew Sericati and Dr. Brian Story. They're gastroenterologists, doctors that specialize in the digestive system.

Thank you both for joining us.

DR. STORY: Thanks for having us.

DR. SERICATI: Pleasure to be here.

CARTAN-HANSEN: Okay, let's go to your questions.

(MUSIC)

AIDEN: Hi, my name is Aiden. And how does food break down?   
DR. SERICATI: So food breaking down is a pretty complicated process, and it involves multiple different steps. The first step is you have to think about eating food, and when you do that the brain sends signals that turn on a bunch of hormones, and it turns on the saliva in your mouth and makes it wet till you start getting ready to eat food.

Once the food enters your mouth, you chew it, and that helps break it down. But we also have enzymes in the saliva, or the spit, that helps break nutrition down, as well. And we swallow it down into our stomach where all the digestion occurs.

RAFAEL: My name is Rafael. And my question is what does your stomach look like?   
DR. STORY: So your stomach generally is about the size of a fist when it has no food within it. It's generally about the size of a balloon, so about a mediumsized balloon, about the size of your fist.

HIRAM: Hi, my name is Hiram. I have a question: How long does it take your digestive system to go through the whole cycle?   
DR. SERICATI: So food goes through the cycle for different people at different times. Some people it goes much quicker, and other people it takes a lot longer to get food through. On average, food can take anywhere as little as two hours to make it from your mouth to your bottom, or it can go as long as several days.

And if you really want to do a cool experiment at home, alls you have to do is eat some corn, because your body doesn't digest corn, and you can tell how long it takes to come out from below. That will tell you how long your food is in your system for.

JAYLEN: Hi, my name is Jaylen. My question is how does food keep from getting stuck in the esophagus?   
DR. STORY: So food goes through a number of different steps as it enters the mouth. So first thing that happens is our saliva is initiated, and it helps to lubricate the food that we eat. We also chew our food as much as we can, and that helps to keep the food that's going down into our esophagus in small pieces and prevents it from getting stuck.

Once it goes down into the esophagus, we have a process called peristalsis, which helps to slowly squeeze food from the upper esophagus all the way down into the stomach in a coordinated manner.

GABI: Hi, my name is GABI. My question is how can we eat and breathe at the same time?   
DR. SERICATI: So you have two different tubes that you use, one for breathing, and one for eating. Your breathing tube doesn't like when there's food or liquid down it. It has a little flap there called the "epiglottis." That flap, when you swallow, will cover up your breathing tube so food and water don't go down the wrong way. And then you have your swallow tube, also known as the "esophagus," which allows you to swallow the food down.

SIREN: Hi, my name is SIREN. And my question is how does my tongue gum taste food?   
DR. STORY: The tongue has a number of what are called "tastebuds." And it helps us to better taste sweet, sour, and bitter types of foods, which allow us to get the sensation within our brain of what exactly we're tasting.

(MUSIC)  
CARTAN-HANSEN: Not every animal has a digestive system like humans. Cows and other ruminants have a fourchambered stomach for extra help digesting plants. And some animals, like seahorses, have no stomach at all. Their food goes from the esophagus straight into the intestines.

(MUSIC)

JOSE: My name is José. And what causes hiccups?   
DR. SERICATI: So hiccups are caused when a little muscle, called the "diaphragm," that helps you breathe, decides to have spasms in it. And when that happens, it causes air to get sucked down into your stomach quickly, and you burp it back out. These hiccups can happen repeatedly, over and over. And there's several different things that can cause them. One of the more common reasons that we see are people eat too much food.

EVIE: Hi, my name is Evie. My question is what happens to your brain when you eat?   
DR. STORY: The brain is really the first process or the first organ that helps us to or helps us in our digestion of food. So the brain understands when it's starting to get hungry and starts to release hormones into the GI tract. At that point, the air and fluid within our GI tract can then start to move around with the squeezing of the stomach and the small intestine. So the brain really starts the whole process.

MYA: Hi, my name is MYa. My question is if we measured our digestive system, how long would it be?   
DR. SERICATI: So your digestive system is really quite long, as it turns out. And when you add it all up, it's probably about 30 feet. And to give you an idea what 30 feet would look like, it's a little taller than the averagesized flagpole with the flag on top. If you like dinosaurs, it's about the length of a Stegosaurus. And if you like bowling, it's about half the length of a bowling alley.

CORA: Hi, my name is Cora. And what makes people throw up?   
DR. STORY: So there are a number of reasons why people throw up. There are a number of things that can happen, whether it be involved with your brain or with your gastrointestinal tract that can stimulate our urge to vomit. Sometimes it can be as simple as eating too much food, and at that point our stomach really doesn't feel good and wants to evacuate all the food that's in there.

LUCCA: Hi, my name is LuCca. I have a question: How does your saliva break down the chemicals in your food?   
DR. SERICATI: So saliva, also kind of known as spit, starts the process to break food down by having what are called enzymes in there. Enzymes are fancy proteins that are made to break down other forms of protein. So proteins are the building blocks of nutrition. And these fancy enzymes will start breaking down the bonds between these proteins, which starts to soften the food and starts the digestive process. It also moistens the food to get it ready for its trip down into the stomach.

(MUSIC)

CARTAN-HANSEN: Poop and pee are just two of your body's many waste products. As long as we're talking about the digestive system, we thought we'd tell you a little bit more about body waste products and why they're so important, keeping you healthy.

STUDENT: "Stop. You can't show that, that's disgusting."

STUDENT: "No, it's not. Waste products are part of the way your body keeps itself healthy."

CARTAN-HANSEN: That's right. Living creatures take in food, water, and oxygen, and then get rid of what their bodies don't need. Body wastes are kind of divided into two groups, things that help protect your body and things that are left over.

When you eat and drink the food and liquid go into your stomach where it's turned into a milkshake sort of liquid called "chyme." Next, chyme passes into the small intestine where your body absorbs the nutrients. The leftover solids then move into the large intestine and eventually pass out of your body.

STUDENT: "It takes about 24 hours from the time you put food in your mouth until it passes out as poop."

CARTAN-HANSEN: Urine, or pee, is an important body waste, too. The liquids you drink are absorbed into your bloodstream and your small intestines. Then your blood carries that liquid to all the cells in your body. The blood then collects the waste products from the cells and passes them back to the kidneys. The kidneys then take the waste products and make urine, which is stored in your bladder until you're ready to go to the bathroom. Some of the liquids you drink are also used to help the solid waste in your large intestines to move along.

STUDENT: "The more water that you drink, the clearer the color of your urine. If your pee is deep yellow, you may need to drink more liquids."

CARTAN-HANSEN: Breathing creates a body waste, too.

(BREATHING DEEPLY)

When we inhale, or breathe in, we take in oxygen into our lungs. That oxygen is transferred to our blood where it's carried out to all the cells in the body. The cells then use the oxygen and produce carbon dioxide. The blood then carries carbon dioxide back to the lungs, and you exhale or breathe it out.

STUDENT: "Plants sort of breathe in, too. They take in carbon dioxide and get rid of oxygen."

CARTAN-HANSEN: One of the other body wastes produced when you digest your food is, well, gas. Millions of microscopic creatures called "bacteria" live in your intestines. They help break down your food. They also make gas. And some of that gas escapes as a burp.

STUDENT: "[Burp.] Excuse me."

CARTAN-HANSEN: Some gas makes its way out of your bottom. That's known as flatulence or a fart.

STUDENT: "Farts can be quiet or loud. They're smellier than burps because gases have more time to build up in your body before it escapes. Oops, sorry."

STUDENTS: "Yuck."

CARTAN-HANSEN: Pus is another body waste. When you get a cut or when you get a pimple, that means some bad bacteria has gotten under your skin. When that happens special white blood cells come in. They eat up the bad bacteria and die. The pus left behind is made up of dead skin cells, dead bacteria, and other stuff your body's trying to get rid of.

STUDENT: "Pus is a good thing because it shows your body is healthy enough to fight off the bad bacteria."

CARTAN-HANSEN: So those are the group of body wastes that are things your body wants to get rid of. So now let's talk about wastes that help protect your body.

More than just sound can get into your ears. You produce ear wax to catch any dirt or other materials so they can't get into your body. Ear wax also protects the skin, keeping it moist and clean. You should never put anything in your ear. Just washing your hair regularly should be enough to clean out any extra ear wax.

Snot, or mucus, protects your nose the way ear wax protects your ears. That sticky stuff is there to keep dust and other bad things from getting into your body. When you catch a cold, the mucus membranes, the things that make mucus, go into overdrive. All that goo traps the germs making you sick so you can get rid of them. By swallowing them most of the mucus goes down to your stomach and the rest you drip or sneeze out.

STUDENT: "Now, our mucus is 95 percent water, 2 to 3 percent salt, and 2 percent mucin, a special kind of protein that is used to make some kinds of glue."

CARTAN-HANSEN: Your eyes create tears to help wash away dirt and other unwanted objects from your eyes. They also keep your eyes moist. And you sweat to help regulate your body temperature.

STUDENT: "And you vomit because your body wants to get rid of something, either bad food or a virus or a germ is part of your body's defense system trying to keep you healthy."

STUDENT: "So body waste helps prevent illness, clean us from the inside out, protect us and help us get rid of stuff our bodies don't need. Oh, excuse me."

(MUSIC)

MIRIAM: Hi, my name is Miriam. And why does the acid in our stomach not burn us like other acids would?   
DR. STORY: That's a very good question. So the juice within our stomachs that is produced is very acidic. We have lots and lots of acid, and it's very, very strong. But uniquely, our stomachs do a very nice job of protecting itself from this strong acid. It has a number of barriers, such as a mucus layer. It has other types of solutions that help to neutralize that acid and to prevent further damage to the tissue, itself, within the stomach.

MEGAN: Hi, my name is Megan. And how do you swallow?   
DR. SERICATI: So swallowing is a very complicated process that occurs without you even having to think about it. That's why babies are born and know how to swallow milk. What has to happen is there's a lot of different muscles in your mouth that have to be coordinated or timed out just correctly for you to get the food from the back of your mouth all the way down into your stomach. And you remember, you chew very well so you can break that food down, and it's not too big.

The other important process in there is that fancy flap, called the "epiglottis," which folds over the airway tube so the food can't go down there when you do swallow.

aviEn: Hi, my name is AviEn. And my question is what is the maximum you can digest at the same time?   
DR. STORY: That's a pretty complicated question and a good one. Essentially, I think it really comes down to you can digest as much as you can fit into your stomach at any one time without vomiting.

OLIVER: Hi, my name is Oliver. My question is what is an ulcer?   
DR. SERICATI: So an ulcer is just a crater or a pit in a lining that shouldn't be there. And the most common thing you hear about are ulcers in the stomach. So that nice lining that protects you from acid layers gets worn away, and it creates a little pit in there. And that's what can cause pain and discomfort. But it is important to know that ulcers can occur anywhere in your body or on your skin surface, as well.

QUINN: Hi, my name is Quinn. And I want to know how you get stomach aches.   
DR. STORY: So stomach aches are a pretty general term. And they can happen from a whole bunch of different reasons. So stomach aches can be simply discomfort or pain within the belly. It can be due to bloating. It can be due to a side ache when you run fast. As far as the gastrointestinal tract, there's a lot of different reasons for us getting stomach aches, like getting an ulcer. We can get stomach aches from infections. We can get stomach aches from eating the wrong food or inflammation.

There's a lot of different reasons that can cause stomach aches. And that's part of what we do as gastroenterologists, is try to figure out why patients are having difficulties with their stomachs.

RUBY: My name is Ruby. And my question is why do some animals have pointy teeth?   
DR. SERICATI: So animals have pointy teeth usually means that they eat meat as their food source. So pointy teeth are used to cut into the meat of either another animal or another object. And the pointy teeth are sharp cutting teeth.

There are other types of animals that eat plants. And if you notice, their types of teeth are usually flat. And that means they usually don't have to bite into meat or other things. They're eating leaves and other things, so their teeth could be a lot more flat.

(MUSIC)

CARTAN-HANSEN: You have cells called "neurons" in your brain and in your digestive system. When you get nervous our fearful, blood get diverted away from the gut, and then the mini brain in your stomach and intestines signals to the brain in your head and protests. That's why you sometimes feel strange or have what's called butterflies in your stomach.

(MUSIC)

CHARITY: Hi, my name is Charity. My question is why does your stomach rumble when you're hungry?   
DR. STORY: That's a great question. So the stomach can start to grumble when you're hungry. First off, it starts by the hormones that are released when the brain tells the GI tract to start releasing these hormones, which triggers the GI tract to start squeezing and contracting, which then starts to move around the fluid and the air that's already present within our intestines and our stomach. And that's when we hear this rumbling sound within our abdomen. So it's a very common process. They seem to be very linked where we start getting hungry, and then we start hearing this rumbling because of that air and fluid within the GI tract.

EVA: My name is Eva. And my question is what happens if your the food goes down the wrong tube?   
DR. SERICATI: So when food goes down the wrong tube, you're going to cough and choke a lot. The lungs really only want to suck in air, not fluid and not food. And when that happens, the lungs realize that it's getting food or fluid down it, and it coughs very, very strongly or chokes very, very heavily in order to push the air and blow that food or water back out of the lungs.

FINN: My name is Finn. And why do you burp?   
DR. STORY: Burping is a process to try to get rid of excess air that begins to get trapped within the stomach. And there's a number of different reasons why we develop that air. The biggest reason is actually we probably eat too fast. So when we eat lots of food, we start to swallow air with the food we eat, which then goes down into our stomach, and then we have all this excess air there that really doesn't want to go down into the intestines like the food we eat. As a result, we need to let that air go back up through the esophagus and out through our mouth again.

The other possible cause for burping and development of air in the stomach is actually from the food we eat. As that food gets digested, some of the bacteria that help us digest our food will start to release some gas, and that allows us to accumulate air in the stomach, as well. Eventually, again, we try to burp that out.

ITHAN: Hi, my name is Ithan. And my question is how long does it take for food to dissolve in your stomach?   
DR. SERICATI: Food, generally, will dissolve in the stomach anywhere from two hours to six hours. For most people, within the first two to four hours the food will be adequately dissolved. Some people can go much faster than that, too. The other thing that it depends on is what type of food and how much food you're eating. So the more food you eat, the longer it's going to take to empty your stomach. The smaller meal that you have, the quicker it's going to go through.

orlando: My name is Orlando. And what causes heartburn?   
DR. STORY: Heartburn is usually the result of acid from our stomach, which moves up into the esophagus. Sometimes when we're trying to burp, sometimes the acid comes up with that air that's trying to get out through the mouth. Sometimes the acid comes up into the esophagus. And that can burn the esophagus, because the esophagus doesn't have the protective barriers that the stomach does.

CARTAN-HANSEN: I'm sorry, we've run out of time. I'd like to thank Drs. Sericati and Story for answering students questions today.   
DR. SERICATI: Thanks for having us. We had a blast.   
DR. STORY: Thank you. It was great.

CARTAN-HANSEN: My thanks also to the folks here at Idaho Gastroenterology for hosting us.

You can learn more about the digestive system and lots of other scientific topics on the Science Trek website. We'll answer more questions about the digestive system on Science Trek: The Web Show.

And if you want to submit a question for Science Trek, it's easy. You can send it as an email or as a video question, record it on your webcam or cell phone. And if you're an educator, we'll even lend you a camera. And each week check out my blog for the latest science news for kids. You'll find all the details at idahoptv.org/sciencetrek.

Thanks for joining us. We'll see you next time on Science Trek.

(MUSIC)

ANNOUNCER: Presentation of Science Trek on Idaho Public Television is made possible through the generous support of the Laura Moore Cunningham Foundation, committed to fulfilling the Moore and Bettis family legacy of building the great state of Idaho; by the Idaho National Laboratory, mentoring talent and finding solutions for energy and security challenges; by the Friends of Idaho Public Television; and by the Corporation for Public Broadcasting.

CARTAN-HANSEN: If you want to learn more about this topic or watch our videos, check out the Science Trek website at idahoptv.org/sciencetrek.