>> Steve Langjahr: Today is May 10th, this is lecture 25, we're deep into unit 5. And we're going to begin our journey and complete our journey at the large intestine which is indeed large in diameter. However, it's not really involved with digestion because most of that process is accomplished and completed in the small intestine. So, if that's true, what then is there left for the large intestine to do? Basically, it's involved in absorbing water, electrolytes and vitamins. It also stores and compacts feces so that water loss is minimized, but those are the primary functions that we could indicate right off the bat. This system that is this portion of the intestine essentially begins where the small intestine ends and the proximal piece of it is called the cecum. Now the word cecum means a pouch. In animals, other than humans the cecum is actually quite large, quite stomach like. You might recall the rat that you dissected. But in the human, it's not that impressive, but it does feature an interesting structure called the vermiform appendix. The word vermiform means like a worm and so this is a wormlike appendage which is attached to the cecum. It used to be that we knew nothing about its importance, in fact it was assumed to have no importance whatsoever. But now we think that it's a site for bacterial storage, good bacteria which provide probiotics or pro nutrients for your body. You can live without it and of course, in some cases it becomes infected, what's that called? An infected appendix, it's called appendicitis. And some of you may have had your appendix removed. So essentially, the proximal colon receives material from the ilium and it passes through a sphincter, a smooth muscle valve called the ileocecal sphincter, also known as the ileocecal valve. Then this material goes up through peristalsis, it travels up the right side and that's called the ascending colon. And then it travels across from right to left, that piece is called the transverse colon. Going down the left side descending colon and then finally, into a little S-shaped segment maybe 6 or 8 inches long called the sigmoid. The word sigma is a Greek letter resembling an S, so this is an S-shaped segment that leads of course into the rectum. The large intestine is mainly made of simple columnar epithelium, but no villi because remember a villus was designed to increase surface area to enhance absorption and absorption here is minimal, unimportant except for the absorption of water and a few vitamins. Now as you look at the large intestine, especially in humans, and you'll get a chance with the cadavers that we have, you'll find that they are kind of broken into segments, actually pouches or bulges which are referred to as haustra. The word haustra Latin for a drawer or a recess and you can see them in this x-ray study, especially along the transverse colon. The function of the haustra is basically to slow down the movement of material and allow more time for the reabsorption of water. It basically helps to compact the feces and therefore minimize water loss. Now aside from that, what causes the haustra are strips of smooth muscle which are referred to as taenia coli. The word taenia means tape, T-A-P-E just like masking tape or scotch tape. And these are stripes of longitudinal smooth muscle which actually constrict the large intestine and therefore essentially cause this bulging or bunching up. It's very much like elastic in a pair of shorts right, a pair of underwear, what does that elastic do to the fabric, doesn't it bring it together and bunch it up. So, the taenia coli exerting contraction create these bulges called haustra which are

only seen in the large intestine. And incidentally, not very easy to see at all in the cat's large intestine so this is something distinctly human. So, these pouches called haustra help to concentrate, compact the feces therefore allowing better water absorption so that our feces are solid rather than liquid. Now along the large intestine that is outside the large intestine there are visibly yellow bodies which are called epiploic, also called omental appendages. And really, there's nothing to say about these they're just fat, but they're very odd looking that is they're kind of button like and they're found only where, only here on the large intestine. Their function is just to store energy as in any case of adipose. So, the epiploic appendages are basically fat filled bodies which cling to, which are attached to the outside of the large intestine. So, that takes us mouth to the rectum, which is the home stretch. The rectum is about 6 or 7 inches long and the word rectum comes from Latin, we've used it before it means straight. And is the rectum straight, indeed? It's the organ of defecation, to defecate means to eliminate feces which you do I hope once a day, maybe more often. Defecation is its only function, there's no absorption, certainly no digestion going on here. And is your rectum normally full or empty? I hope yours is empty, if it's full you probably want to excuse yourself because you've got that urge which naturally we all have once a day. It's lined with stratified squamous epithelium, which is interesting and somewhat ironic because how did this system begin, what is the histology of your mouth, stratified squamous epithelium so it begins and ends with stratified squamous epithelium. It's very vascular and therefore can be used medically. What's the rectum used for in medical context? Some of you know there are medicines that you can put up your rectum yes? And those are called, suppositories? And you might say, why would I want to put that up my rectum. Well, it allows for absorption of these nutrients, especially when you're vomiting or otherwise throwing up and can't keep down a pill, so it's a handy and useful way to administer medicine. The rectum is also very vascular, especially around the final opening and what's the final opening? Here it is you know it, it's called the anus. The anus is surrounded by two muscles overlapping, the inner one's called the internal sphincter, the outer one's called the external sphincter. Internal is made of smooth muscle and so you don't have any control over that, but you've all learned how to master your external sphincter and you probably learned that at age 2 or 3 at the latest. In other words, you learned how to control defecation and that was a big day for your parents because they were able to stop buying diapers. Now there's a lot of blood vessels, especially veins down here. And veins in this location, veins in any location are carrying blood back to the heart. Veins are thin-walled, can they dilate and what do you call a dilated or twisted vein, V word, varicose? Can you have varicose veins down here? What's it called, hemorrhoids? Are they painful, can they bleed, of course? And they're created by straining on the toilet that means pressing too hard and naturally they can be well disturbing. Also in passing it's common knowledge that the anus can be used for copulation. I hope I'm not breaking any news here. And why do I even mention that? Well there are veins here that can be easily injured and so in copulation, anal sex could there be easy transmission of virus and bacteria by this route, yes? So, I'm not commenting

on this other than from an anatomical standpoint, it's somewhat risky. Moving on, let's talk about digestive processes, which of course involve digestion and absorption and where these things happen. But before we do we need to talk about related organs, that is organs that we didn't actually name or consider on our first pass through this system. For instance, we took you from the mouth all the way through to the anus, but there are some organs that we didn't mention and so we need to back up and consider them now because they are attached to and have a contribution to this particular system. Here's a look at a human cadaver and just for reference, what's this muscle that divides the thorax from the abdomen? And so, the first thing that we can spot, the first organs that are visible, this one here in the upper left quadrant stomach and this one here on the upper right quadrant is the liver. We spoke of the stomach and we'll certainly cover the liver today, but this is the basic appearance of the abdominal cavity without any actual exploration. The first thing that we know, in fact we've known for some time, you've known for some time is that this cavity is lined and defined by a serous membrane. What's the name of the serous membrane in this location, which creates or otherwise defines the abdominal space, peritoneum? The peritoneum is a serous membrane that means it has two layers, visceral and parietal, and it basically encloses this cavity and also clings to, attaches to the organs of the digestive system. The function of the peritoneum then is to support, physically anchor and hold in place the organs. It also has the function that you know for any serous membrane, what is the primary attribute, the primary function for any serous membrane? Lubricates and therefore reduces the F word. And finally, the peritoneum helps to contain that means enclose and what are we containing, what are we excluding, what is being kept out? Think of any serous membrane, this is a barrier to the I word, infection. Is the abdominal cavity sterile, is it devoid of bacteria? What if you plunge a knife in there is that going to introduce bacteria into your abdomen and that will cause infection of this membrane, what might it be called, peritonitis? And can that spread throughout the abdominal cavity and actually be lethal, yes? Incidentally, a ruptured appendix also causes peritonitis because it scatters bacteria into this otherwise sterile space. So, backing up, functions of the peritoneum, lubricate, support that means hold in place and to contain and exclude materials from this space. The peritoneum is no simple sleeve it's quite complicated, it has many layers or subparts. So, let's go into them. First, like any serous membrane there's going to be a visceral and a parietal. The parietal actually clings to the abdominal walls. The visceral portions surround and cling to the visceral, meaning the intestinal tract and in that location known then as the tunica serous. The tunica serous is synonymous with the visceral peritoneum. So just as an example, if I had the small intestine here and I scraped the surface outside that would be the peritoneum, but what part of the peritoneum, that would be the V word, visceral and it's also known in that location as the tunica serous. So, let's talk about the subparts because there are names given to certain components that are actually created by the peritoneum. Many of these you've seen and maybe read about and the first is what's called the mesentery proper, sometimes just called the mesentery. Already in the cat

and certainly from your memory of the rat you might've held up the small intestine and noticed this transparent curtain with all sorts of beautiful blood vessels going to and from. So, the mesentery is described and is in fact a part of the peritoneum, it's a fan-shaped double layer of visceral peritoneum. Now you can memorize that, but what does it mean. Here's just a piece of plastic which I folded over, how many layers here? Two layers and this tube is going to represent the small intestine. I'll lay it on the table and now I'll take this plastic and gather it up. So now don't I have a fan-shaped, fan-shaped what, how many layers here, two, a fan-shaped double layer of visceral peritoneum. That is the mesentery, also known as the mesentery proper. It encircles and supports and anchors not all of the small intestine, but only the jejunum and the ileum. What's the other part of the small intestine then which is not supported by the mesentery D word, duodenum. So, only the jejunum and the ileum are supported by the mesentery. Essentially, it anchors them to the dorsal body wall and more importantly, it serves as a surface for blood vessel conduction that is it sandwiches blood vessels, which otherwise would get tangled and kinked and probably injured. So, it acts as a surface for blood vessel conduction, arteries to, veins from the small intestine. And a particularly interesting function is that it prevents entanglement and that can't be overstated. Let's say this is the small intestine without what, without the mesentery. Could it over time essentially loop itself into a knot, yes. That happens to me all the time when I go to get an extension cord you know what I mean. You shove it in the closet and you get it out and guess what it's all tangled up. Is that a bad thing when it comes to the small intestine, would that obstruct the flow of material, could it be lethal, indeed? So, preventing entanglement is no small function and one of its two functions, the other being to support, to anchor and to provide for blood vessel conduction. As you look to the interior of the abdomen we already mentioned you see the stomach easily and the liver can be pulled out of you as here. But the most striking thing that you see at once, rather grotesque really, is a rather thick apron of what appears to be fat and it's hanging from apparently the stomach and the transverse colon. You've seen it in your cat and often in lab if I don't get around to a table fast enough I'll find this laying on the dissection tray and I'll say oh no and they'll say what, we thought that was just fat. Well it's not just fat it's what, it's the greater omentum. It does contain a lot of fat, but exactly what is it for and how would you describe it. First, we're going to describe it as apron-shaped and not two layers, but what, four. And it's again made of the peritoneum. So here as an example, I have a loop of paper towel, got it so far? And so, this is going to represent the stomach and this is going to represent the transverse colon which we have to bring up to say this position. So now, how many layers of peritoneum do we have, two going up, two going down, how many layers, four? Is that a kind of apron, can we lift it up, yeah? So, that's the definition an apron-shaped quadruple layer of visceral peritoneum. You should draw this, it's certainly indicated in your textbook. S stands for stomach, TC stands for transverse colon. How many layers going down, how many layers coming back up, how many layers all the way through, four that's the definition of the greater omentum. It does contain a

lot of adipose and is brightly colored, brightly yellow colored as you've probably seen already if you've explored the abdominal cavity. Okay great, we know what it is, we know where it is, what's it for? The adipose is self-explanatory, what is adipose for anywhere? Adipose is for storage of energy, but this membrane also exudes or releases fluid. Therefore, it fills the abdominal cavity with serous fluid and therefore the L word what's that, lubricates. Pretty important because otherwise the intestinal segments would dry out and then they would stick to each other, does that sound good? No, so it prevents adhesion of many of these components. Now if there's a lesson, excuse me if there's a greater omentum chances are there's going to be a? And the word lesser means smaller in this case. The lesser omentum is not four, but two layers of peritoneum, which basically span that means connect the liver to the stomach. So, up here I've got the liver and there's a cross-section of the stomach. So, what's this coming across which is two layers that's the lesser omentum. You can see the lesser omentum in your cat, but it won't last long, what does that mean? People digging and scratching in there and lesser omentum is going to go pretty quick, so you need to get a fresh cat and get a glimpse of it. It extends across the gulf between the liver and the stomach. Its function again, it's kind of like a sandwich, a sandwich is two pieces of bread with something in between right. So, this encloses the bile duct, it encloses and protects the hepatic artery and it encloses and protects the portal vein. So that's its function. Finally, the fourth and final segment of the peritoneum is called the mesocolon. The prefix meso or meso means middle and this is basically two layers of visceral peritoneum that wrap around the transverse colon and connect it to the dorsal body wall. In fact, if you ponder this, it makes perfect sense. What's this segment of large intestine that goes up the right side called?

>> Ascending.

>> Steve Langjahr: Ascending then it goes what.

>> Transverse.

>> Steve Langjahr: Then it goes what? And you probably wonder what keeps the transverse supported, why doesn't it just sort of sag. What supports and maintains the position of the transverse colon is the mesocolon. So, it basically supports it from gravity or resistance, sagging if you will. So, good let's go to the liver. The liver has many functions and is legitimately a part of many systems, but we discuss it here because it does have some pretty vital digestive functions. What are they? Well you already know and this is off-topic, but doesn't the liver make fibrinogen and prothrombin, important in blood coagulation and albumin and so forth. But okay, it also produces bile and stores that bile outside of itself in a pouch called the gallbladder. And so, bile you'll learn more about in physiology, but basically is important in the emulsification of fat. It liquefies fat and therefore improves its ability to be digested and therefore absorbed. Do we need fat in our diet, does it have to be digested in order to be absorbed, what helps bile? It also is a site, an organ for storing fat soluble vitamins and fat itself. In short, the liver is a kind of fatty organ. It also stores iron because

you already know that hemoglobin is broken down in this organ called the liver and is the iron recycled, is the iron put back into making new hemoglobin? And in fact, you might have known that already because do people eat liver? And what's the justification or the usual defense from a nutritional standpoint? Oh yeah, parents will say oh yeah, it's rich in iron. So yeah, it's true, it does contain a lot of iron. And it also stores fat and here you go, what fat-soluble vitamins which include vitamins A, D, E and K so those are functions worth mentioning. But really what the liver is it's kind of a chem lab, a chemistry lab because it's quite capable of transforming organic molecules from this to that. Yes, it stores and removes glucose and therefore is a big factor in determining blood sugar. Is blood sugar something that's very rigorously regulated or does your blood sugar just go all over the place? So, the liver is responsible for maintaining normal healthy blood sugar levels and it receives glucose, it receives almost everything through the portal circulation. So, it's very important in that regard. And it also has the capacity to convert nutrients, e.g. that means in other words, carbs to what? So, is it possible to convert a carbohydrate to a fat, yes? Where is that done, the liver? Can you live without the liver, no? Can livers be transplanted, yet? But let's get down to its anatomy, it's the largest internal organ, it's held up against the diaphragm on the upper right side of the abdominal cavity. And it's held there by a ligament which is actually just an extension of the peritoneum. In this drawing the red line is the diaphragm and this bridge across to the liver is the falciform ligament. The word falciform obscure I'm sure, but it means in Latin sickle-shaped which means crescent-shaped or C-shaped. And basically, as you can see, this is the falciform ligament which runs right down the center of the liver dividing it into two parts and these are two of the four lobes that the liver has. In the human being, there are four lobes, the one on the left side is called left, that's good. The one on the right side, right so far pretty easy. Then if you tip the liver up you'll see two more that are hidden, one is right up against the vena cava and resembles a tail of an animal and therefore it's called the caudate. The word caudate means tail-like. The other one is basically sandwiched or wedged in between the falciform ligament and the gallbladder it's called the quadrate. You'll get to see this and appreciate it in lab because do we have a bunch of human livers, naturally? So, it's called the quadrate because it has how many sides, quad how many sides, four? So, to repeat the largest is the right lobe, certainly the smallest is the caudate, and then the left and quadrate lobes are somewhat in between in size. Naturally, the liver is the source or I should say the site where blood returns from the GI tract. In fact, you already know the name of this vein which carries most of the blood from the gastrointestinal tract to the liver, the name of that vein is the portal vein. And part of that system that you know is called the hepatic portal system. In fetal life, in fetal life you receive blood from your placenta. You might not remember it was dark in there. But you know there's this thing called the placenta and this thing connecting to your belly that was called the umbilical cord. And in that there's one vein coming from the placenta, which goes straight to your liver. Now all of you have lost your umbilical cord I guess and so that vein is no longer connected to anything, but it still exists, it changes names it's now called

the round ligament, it's not a ligament at all. It used to be a vein that used to be called the umbilical vein and it used to carry oxygenated blood from your placenta to your liver. So, we say it's a vestige, meaning a leftover piece which has no function certainly in newborns or adults. So, just to recap, what's the name of the artery which supplies oxygenated blood to the liver and you know that's the celiac. What's the name of the vein that collects all of the blood from the GI tract that's called the portal vein. How does blood get out of the liver? Well, it goes out through the hepatic veins which dump into the inferior vena cava. And of course, the gallbladder is shown here which is where we're going right now. A poor name I think, I'd rather call it the bile bladder, but nobody listens. It's called what, gallbladder? It doesn't produce gall, it doesn't even produce bile, where is bile produced, in the liver? And it's stored in the gallbladder somewhat as shown. The gallbladder has one way in and one way out and the name of that path is the cystic duct which is at the mouth of the gallbladder. Bile is actually made in the liver and trickles out through what are called hepatic ducts. Normally this bile would go south that means it would go down and be introduced into the small intestine, specifically the duodenum. And actually, it goes through a nipple there, the word for nipple is papilla, we've used it before, we've use that word. What were those nipple-like muscles inside the ventricles called, papillary muscles? So, this is called the papilla, it used to be named after its discoverer his name was Vater, not Vader as in Darth, but Vater V-A-T-E-R. So, it's called the papilla of Vater. But its more proper name as awful as it sounds is what? Here it is hepatopancreatic papilla which is a perfectly good name because hepato means liver, pancreatic means pancreas. So, right here label this as the hepato what?

>> Pancreatic.

>> Steve Langjahr: Hepatopancreatic papilla, also known as the papilla of Vader. It's a nipple or nozzle through which bile passes and also enzymes from the pancreas. So, there's a question, I can see it on the exam. What two things go through the hepatopancreatic papilla, answer bile and enzymes, enzymes from the pancreas, but we'll get to that in a minute. Now you know that bile can precipitate that means it can develop rocks and what are those rocks called as they may form in the gallbladder, gallstones? You must know somebody that's had trouble with gallstones and you might think well they're probably removed, but no. Why don't they just remove the gallstones, well if they do they're just going to come back? So, what's the easiest way to prevent gallstones from ever happening again? Take out the whole gallbladder. The process is called a cholecystectomy and I'm sure it's being done as we speak in one of the many hospitals in the Antelope Valley, a very common surgery, very common for women, especially after menopause, but men are afflicted to. Basically, detected by pain in the upper right quadrant. Today this can be done with laparoscopic tools so it's an inpatient, I should say an outpatient procedure, in in the morning, out in the afternoon, on your way. Anyway, let's follow the path of bile. Bile is not produced in the gallbladder it's produced in the liver and travels first through and into the hepatic ducts. Then it goes straightaway down into

the common bile duct and very often it turns around at the hepatopancreatic papilla because there's a sphincter here which is normally closed. So, if bile can't get into the duodenum it'll backup and it will go through the cystic duct and therefore fill the gallbladder. The gallbladder empties after a fatty meal and squirts bile then into the duodenum through the hepatopancreatic papilla. We mentioned gallstones and many of you probably have some and don't even know. They can vary from the size of a grain of rice or even smaller and they can be huge. I laid this challenge out to the morning group, probably nobody googled it. But what's the world's largest gallstone that's ever been removed? I happen to have that fact. Anybody want to guess? Well okay would you say half a pound? Let's speak in English terms here, half a pound, a quarter of a pound, 10 pounds. Actually, it's 13 pounds, yes 13 pounds, 14 ounces and if you think about it that's a bowling ball. Aren't bowling balls about that size and weight? Now you think OMG how is that possible. Well some people just don't really care about their body, you know, they say well something's there I'm not sure, but it's not bothering me. You think you should go to the doctor, no I don't want to go to the doctor it will go away, apparently not. All right, so yeah 13 pounds, 14 ounces, whoa. Moving on to the pancreas, can you live without a pancreas, absolutely not? And if you've heard of the pancreas and the average American probably has only by virtue of what probable connection pancreatic cancer, deadly cancer, kiss of death pretty much. And so besides that, what is the value, what is the location, what is the structure, what is the importance of the pancreas? It does have a couple of digestive functions and that is to secrete a whole spectrum of enzymes, not hormones, what's the word here, enzymes. Now don't get me wrong the pancreas does produce hormones, one that you know by name I'm sure insulin, but we're looking and focusing on its digestive functions. It is not only in exocrine gland it's also an endocrine gland and we'll defer that information, that is we'll talk about its endocrine role when we get to the endocrine system. So, what about it structure? The word pancreas means all flesh because it's very fleshy looking, often described as a fish or a hammer, you can use your own description. It has a kind of head and it has a kind of tail, it's attached to the inner curvature of the duodenum, maybe 4 to 8 inches long. Look for it in your cat. In fact, I'll say this, the pancreas is the most overlooked organ in the cat and we invariably put it on the practical why? Because people don't bother to look for it. Where is it? It's in the inner curvature of the duodenum. Ask me to show it to you because it's very camouflaged, what's that mean camouflaged? Kind of hard to see, but if you go here, if you go to the curvature of the duodenum you'll find it. It has multiple ducts inside which lead to this orifice which we've already given a name to, the papilla of Vader. And so, what goes through the papilla of Vader is not only bile, but also enzymes from the pancreas. And this is clinically relevant because can a gallstone get all the way down here to the papilla of Vader and could it block the flow through that nipple and would it block bile then, yes? Would it block enzymes from the pancreas, yes? And the worst effect is not the bile, but rather the enzymes that can't get through and that's going to cause pancreatitis, pain, discomfort, death. If bile doesn't get into the duodenum then it backs up

into the blood and you know bile is what color, maybe we overlooked that but I thought it was obvious, bile is green. It's green by virtue of the bilirubin which is the bulk of its composition. And when bile gets into the blood it causes your mucous membranes, your sclera, your nailbeds to turn what color, yellow? And there's a name for that, everybody knows, jaundice. Jaundice is a buildup of bile, bilirubin actually in the bloodstream and often an indication of gallstones then. All right, let's go down the home stretch, this seems like a lot to do in two minutes, but we'll do it. What are the functions that this so-called digestive system provides? Certainly, it allows us to ingest and all of us love this, it's the most popular, well one of the most popular things that we do in life, eating. And eating involves not just putting food in the mouth, but chewing it up normally, although that's optional. And involves mechanical breakdown, what are the mechanical components that assist in mastication? Obviously, muscles but do you need teeth? Well you don't absolutely need them, but it certainly helps and the tongue and so forth. So, ingestion is what we enjoy three times a day or more. Digestion is what the system is really named after and it involves two things, molecular, molecular breakdown of all sorts of organic molecules, carbohydrates and proteins. Are there elements of the GI tract that enhance and make possible digestion, yes? What do the salivary glands do? What does the stomach do in this regard? What does the pancreas do in this regard? What does the duodenum do in this regard? It's all in your textbook. Essentially, then breaking down fats, excuse me breaking down carbohydrates and proteins are made possible by the numerous secretions from these sites along the way. And then fats are also part of our diet and they're handled by the contribution made by the liver. What from the liver is involved in fat breakdown, bile? And so, not only bile but enzymes from the pancreas. But still the importance of this system is not digestion, although digestion makes possible item C, what's item C? This system ought to be called the absorptive system, but nobody listens to me. Because what's important about it is not digestion, but the absorption that means getting things out of the nutrients that we consume and putting them into the lymphatic or circulatory system. Molecules transported then into vessels and mainly this occurs along the small intestine. So, sugars such as glucose, fructose, lactose, galactose, all of these sugars are obtained by breaking down larger molecules called carbohydrates, you learned this in biology. And proteins are broken down into organic molecules called amino acids and these are absorbed along the small intestine, specifically and first they're taken into the cells, the epithelial cells, the columnar epithelial cells of the villi. Then they're carried down to what are called the capillaries deep within the lamina propria. You have to go back and pick up this information from Monday's lecture. Then they move into venules of the tunica submucosa then they go into the superior mesenteric vein and from here you know because the superior mesenteric vein goes to the portal vein and therefore to the liver. Now fats take a totally different route and you know this too because in the small intestine there are lymph capillaries called lacteals. And so, fats don't go into the portal system they are carried and transported and absorbed into the L word, lacteals. From there they go into the lymph vessels of the submucosa then they go into

the thoracic duct which you know empties into the left subclavian vein. So just to make this very clear, if you were to look in the portal vein would you find glucose and other sugars, yes? Would you find amino acids, yes? Would you find any fat, no because fats don't go through the portal vein they enter first the hepatic, I should say the lymphatic system by way of lacteals? Finally, what's the end of the story, we began with ingestion what's the opposite of ingestion, egestion which is also known as defecation? To defecate means to eliminate what are of course feces. And we often hear feces described as waste, human waste, actually it's not so much waste. What is the bulk of that stuff that we call poop? Well it's basically stuff that didn't get D word, didn't get what?

>> Digested.

>> Steve Langjahr: Digested because we don't have the enzymes to do so. And so, are there materials in our food that are non-digestible? I usually say corn and people get it, so I'll say corn, oh yeah. Because I know you've all looked at your feces don't be coy with me and you should be looking at your feces, why? You want to see if they're firm, if they're light-colored, dark-colored, could they be bloody, are these important things that you should pay attention to, yeah? Actually, though apart from non-digested food stuff the bulk of your feces are actually from your body, they're sloughed what, intestinal cells? And a lot of M word and a very large a lot of that. So, these are not waste so much as they are stuff that comes off the abdominal wall. And I know I'm out of time, but are there things in your diet that make it into the large intestine that can trigger molecular changes in the epithelium? What am I hinting at? Are there things in your diet which are toxic which are carcinogenic? What's the number two cause of cancer deaths in the US of A, colon cancer? And why is it so deadly, not because it is because it can be treated, but usually it's discovered what, too late and it's metastasized? So, run out today, make a scheduled colonoscopy. No, I'm just joking, don't waste your money until your late 40's early 50's, but then absolutely get it done.