agMOOCs

Digestion, absorption and utilization of Nutrients-2

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Hello. Last class we have seen what are the various salivary glands, what are the type of enzymes that are produced in the stomach, up to stomach we have seen and what are the sphincters, what is the peristalsis movement and let us continue with the digestion, absorption of nutrients.

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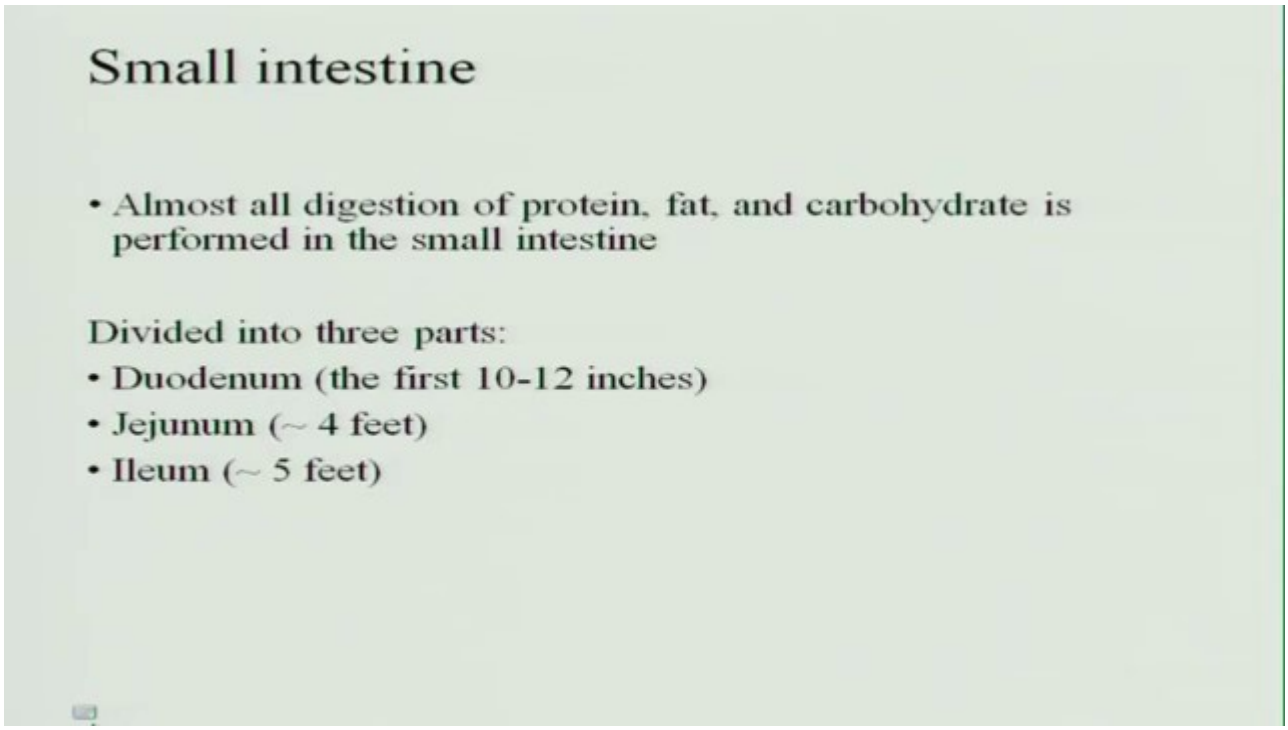

So after this stomach is the food goes into the small intestine. So after the digestion of all the digestion of proteins, fat and carbohydrate is performed in the small intestine. The small intestine is divided into three parts. We have the duodenum which is the first 10 to 12 inches. Then we will have the jejunum, it is four feet in length and followed by the ileum which is five feet in length.

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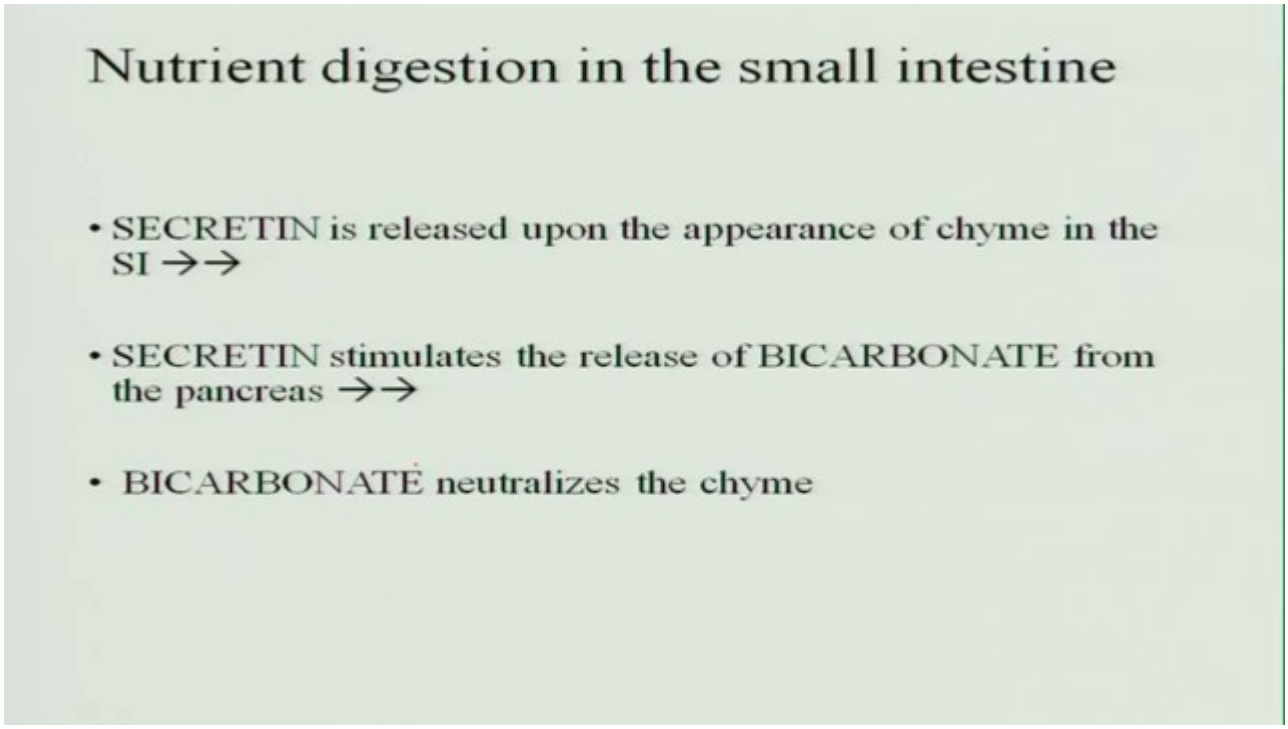

So nutrient digestion in the small intestine occurs because of the enzyme that is secretin which is released upon the up here, the moment the food enters into the small intestine secretin is secreted and this stimulates the release of the bicarbonate, I told you which is produced by the pancreas and required to change the acidity, I mean the pH of the contents in this small intestine. So this bicarbonate it neutralizes the chyme.

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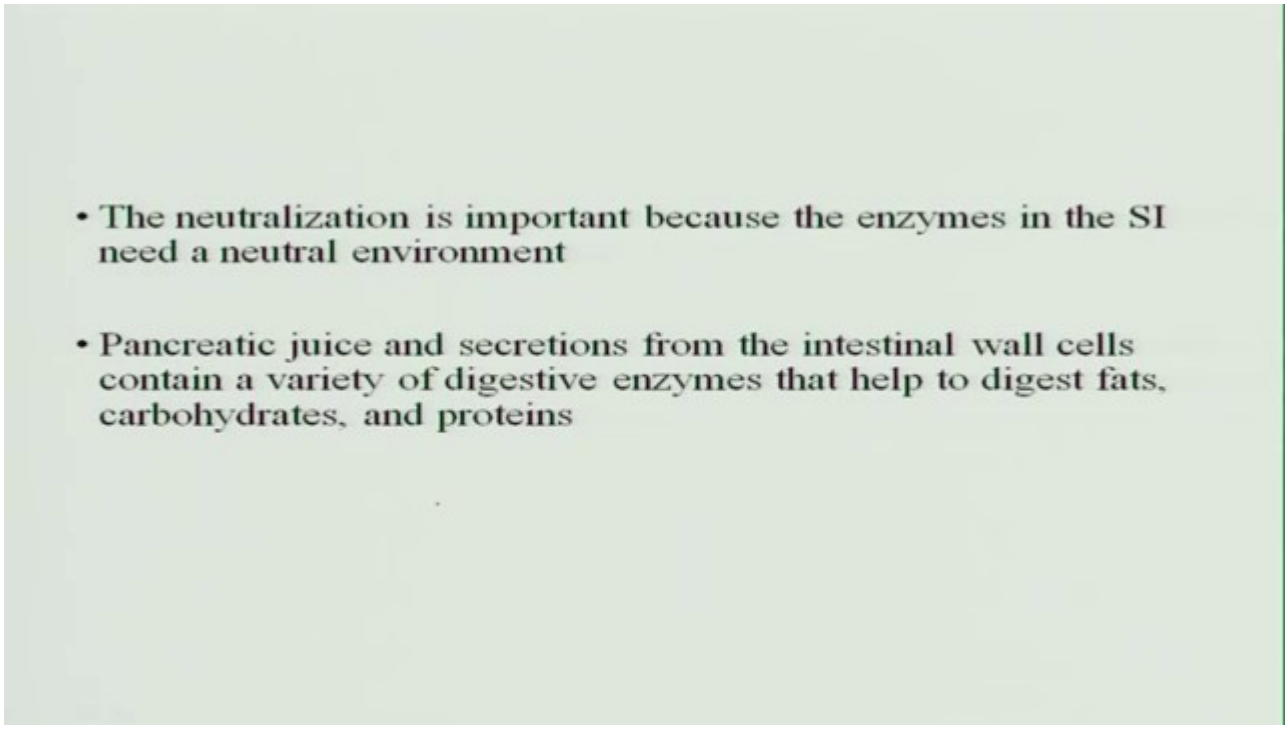

And neutralization is very important because the enzymes in the small intestine they need a neutral environment. They cannot work with acidic environment. Now pancreatic juices and

the secretions from the intestinal wall they contain a variety of digestive enzymes which helps to digest the fat, carbohydrates and proteins.
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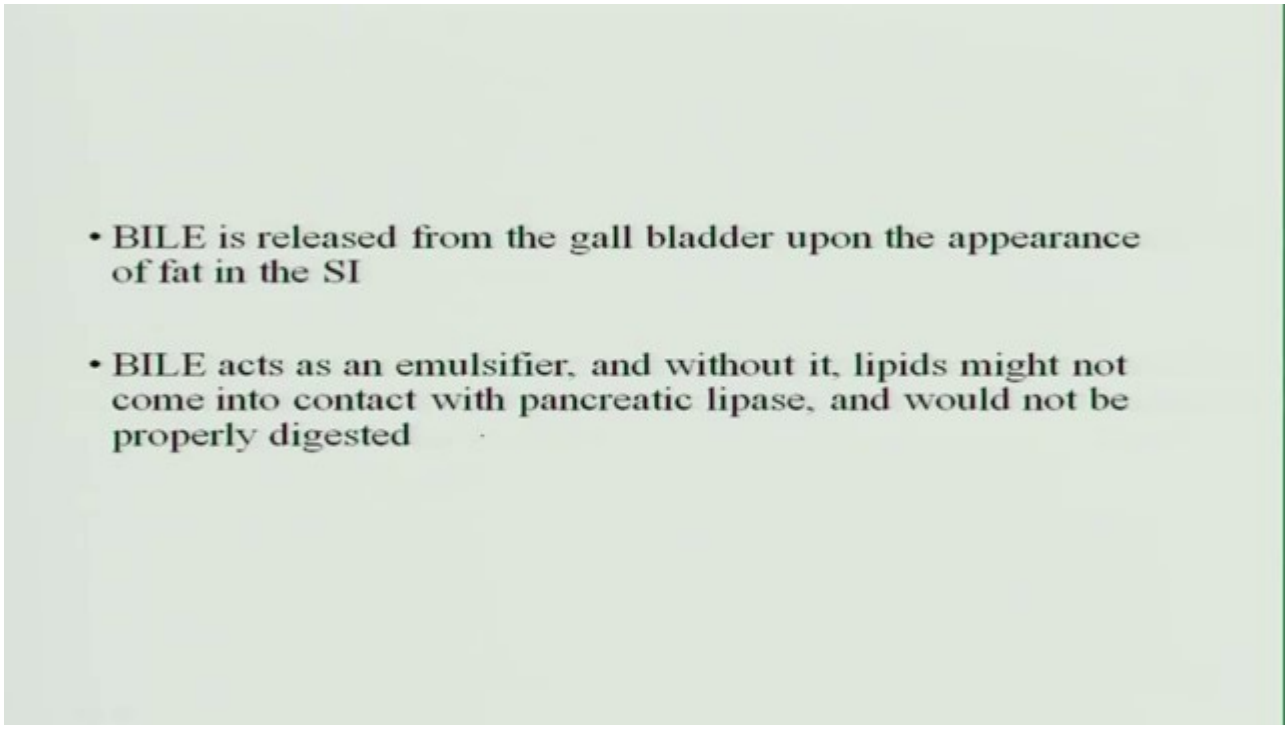

Bile is released from the gall bladder upon the appearance of fat into the small intestine. The moment the food starts from the stomach and enters the small intestine, if the food is fatty food then bile is released. Then this acts as an emulsifier and without it the lipid will not come into contact with the pancreatic lipase, lipase is the one enzyme which digests the fact. So fats would not be digested properly if bile does not get released.
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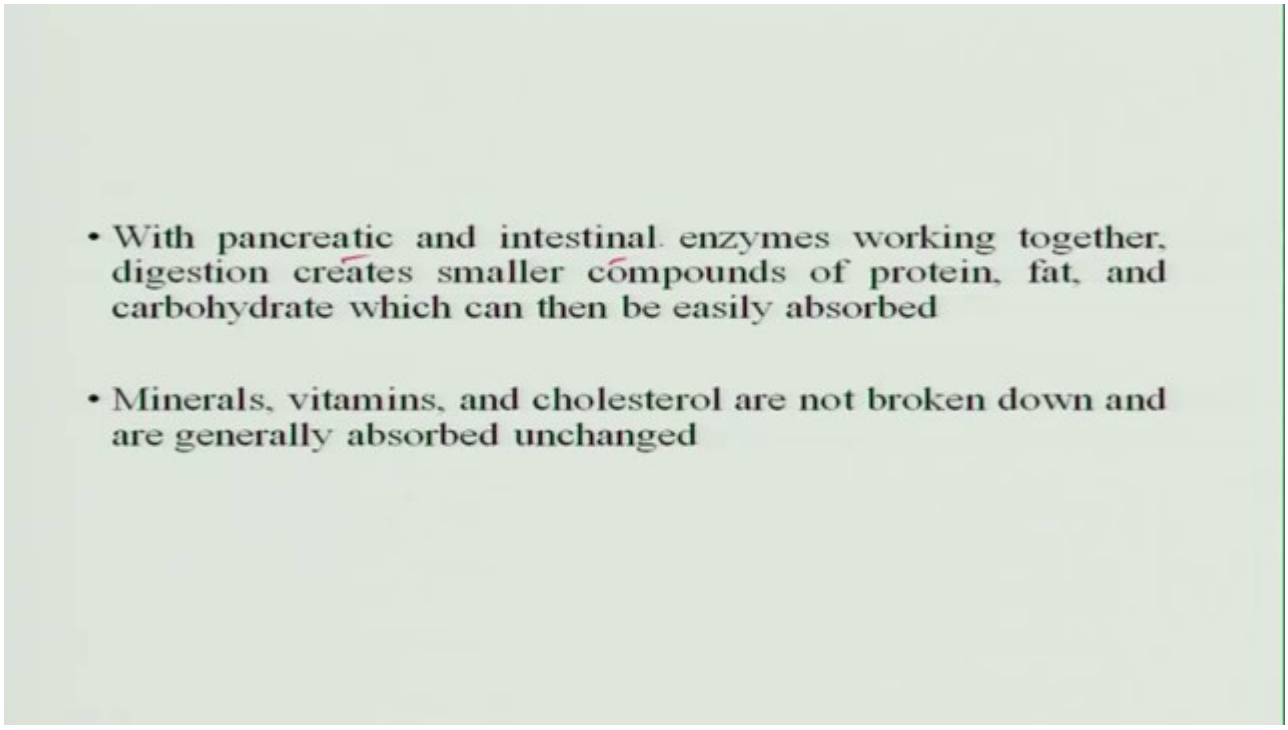

So with the pancreatic and the intestinal enzymes working together the digestion creates smaller compounds of protein fat and carbohydrate that is comes down to its functional units like the glucose, amino acids, and fatty acids which can be easily absorbed. Now minerals, vitamins and cholesterol are not broken down and they are generally absorbed unchanged.
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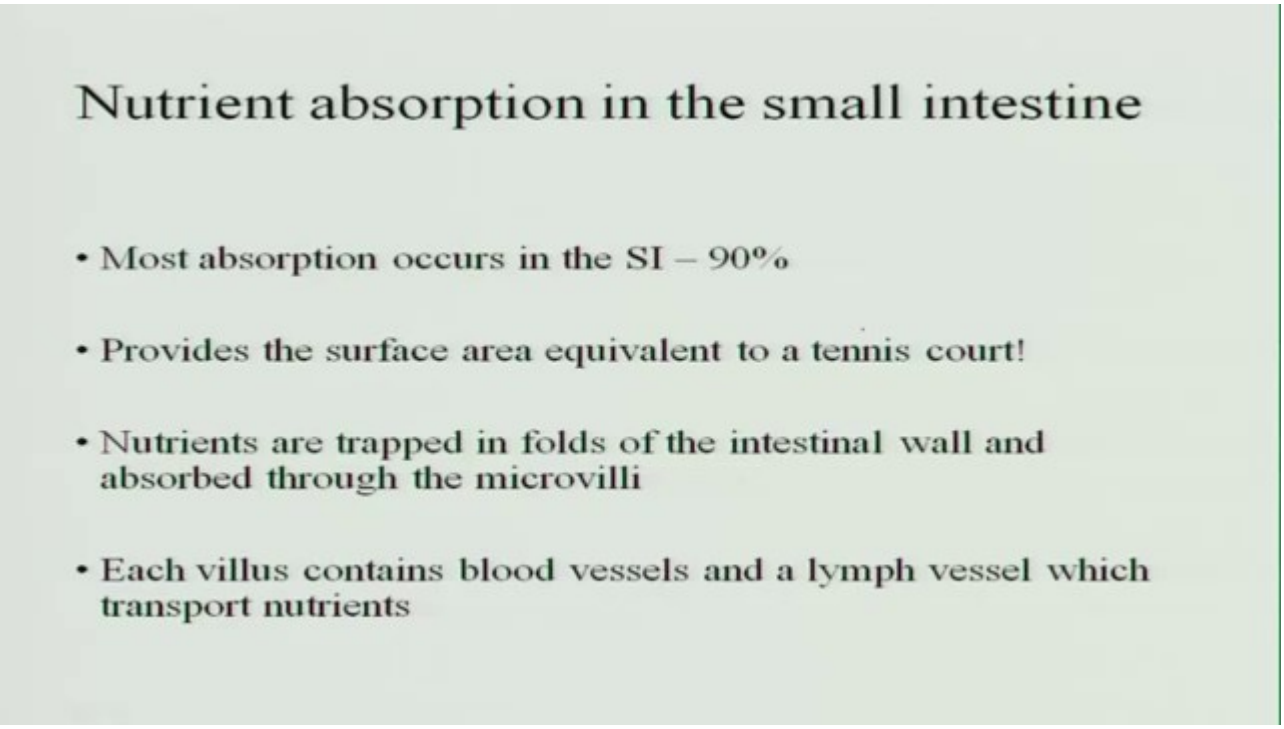

Our nutrient absorption in small intestines, we have seen the digestion, now the absorption. Most absorption occurs almost 90% of the absorption of all the nutrients occurs in small intestine. So it provides the surface area that is equivalent to a tennis court. If you open these small intestine and put it across the length the area is such large for absorption. So nutrients are trapped in the folds of the intestinal wall. They have a lining like this which are called as villi. So these nutrients are trapped in the folds and absorbed through these microvilli. So each villus contains blood vessels and lymph vessels which help it transporting the nutrients.
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- Water-soluble nutrients are absorbed directly into the bloodstream
- Fat-soluble lipid compounds are absorbed into the lymph rather than the blood

Now water soluble nutrients are absorbed directly into the bloodstream. Whereas fat soluble compounds, they are absorbed into the lymph. The entire fat and the fat soluble nutrients are absorbed through the lymph tract and then they enter into the blood. They do not enter into the blood directly.

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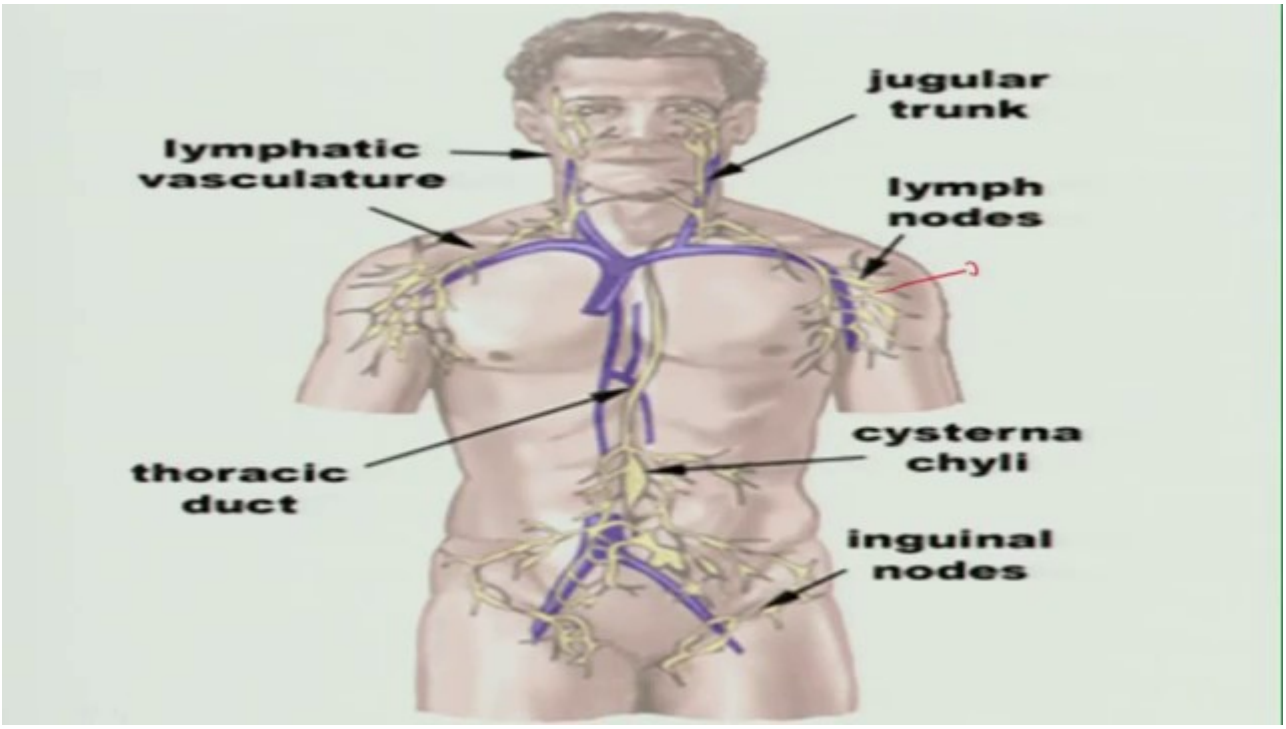

So this these are the lymph nodes, all the yellow part of the figure that shows the lymphatic glands from through which the fat is absorbed. And finally here it joins the thoracic duct into the bloodstream.

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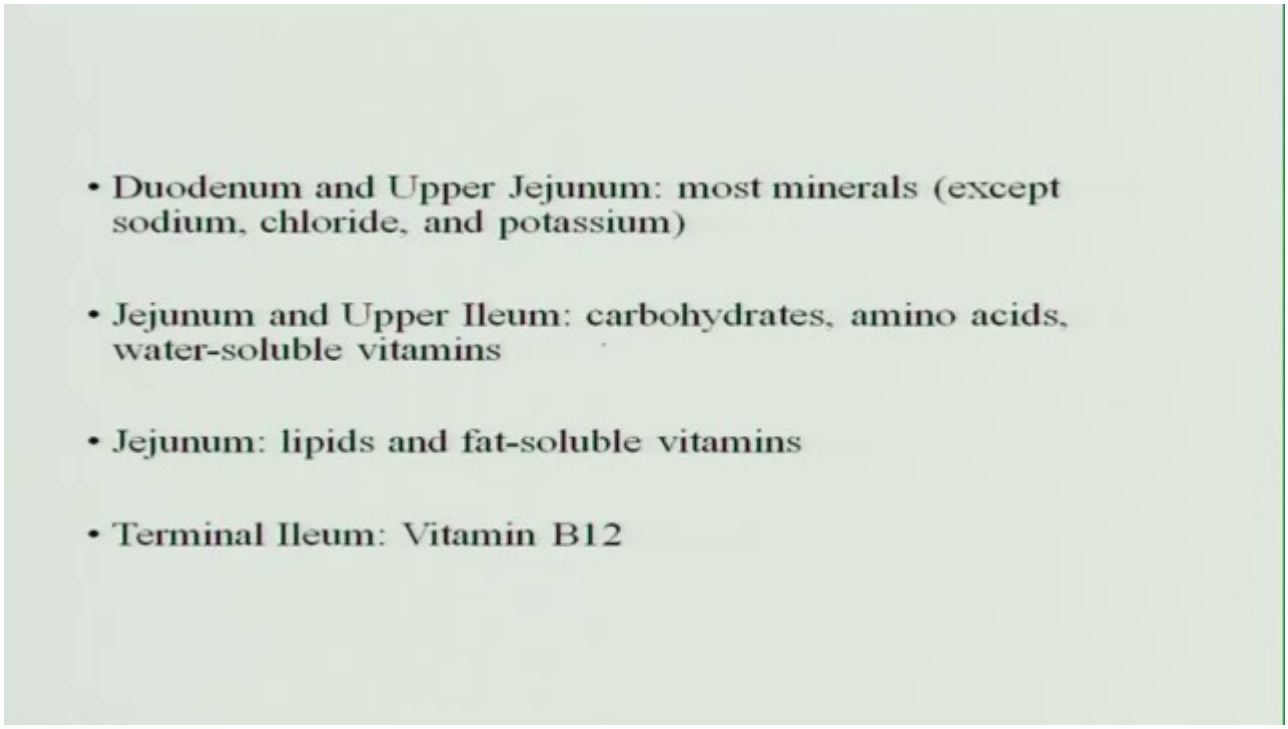

Now duodenum and the upper jejunum, the most of the minerals except sodium chloride and potassium are absorbed in the upper part of the small intestine that is the duodenum and the jejunum. Jejunum and upper area you have the carbohydrates, amino acids, and water-soluble vitamins getting absorbed into the bloodstream. And jejunum from the part of the jejunum lipids and fat soluble vitamins absorb here if you remember I told you vitamin B12 is absorbed only in the stomach. But here again I am talking about vitamin B12 that means this vitamin B12 is synthesized by the bacteria that are present in the intestine and this is not observed here, but it is only present.

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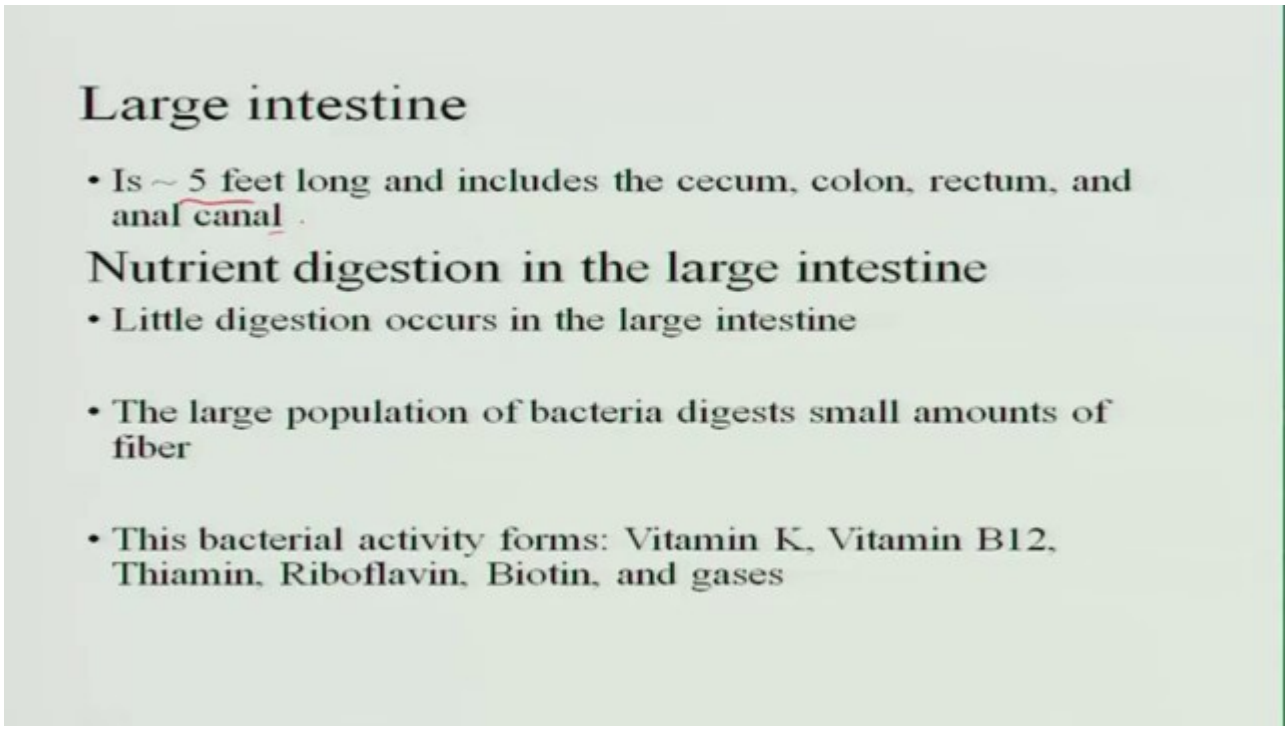

The large intestine, it's the last five feet long and includes cecum, colon, rectum and anal canal, very little digestion occurs in the large intestine. There is no digestion actually in the large intestine. So large population of bacteria that are present in the large intestine digest very small amounts of fiber and release very little amount of energy, so bacterial activity it helps in synthesizing vitamin K vitamin B12, Thiamin, Riboflavin, Biotin and some the gases.

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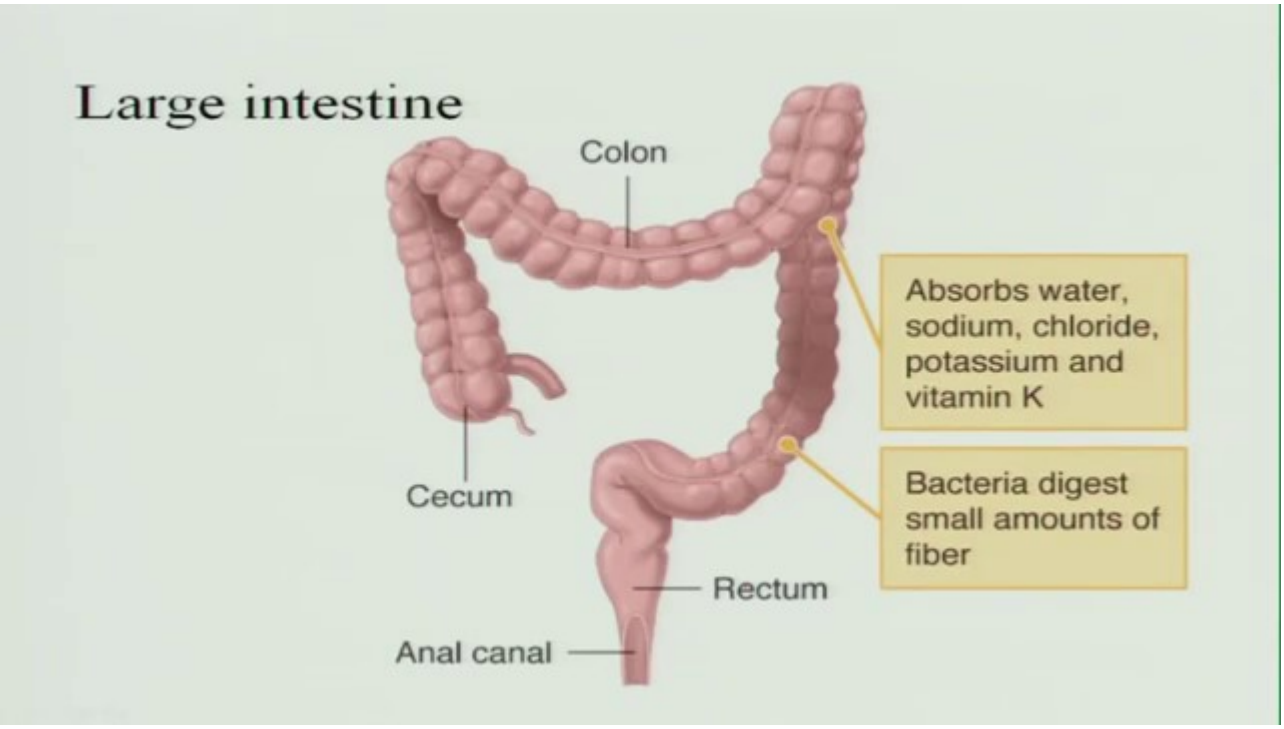

So here you can see the large intestine, the parts of the large, the cecum, the colon and the rectum. So the main function of the large intestine is to absorb water, sodium, chloride, potassium and vitamin K and bacteria whatever residue is left over undigested a few of them especially the fiber is digested by the bacteria that are present in the large intestine.

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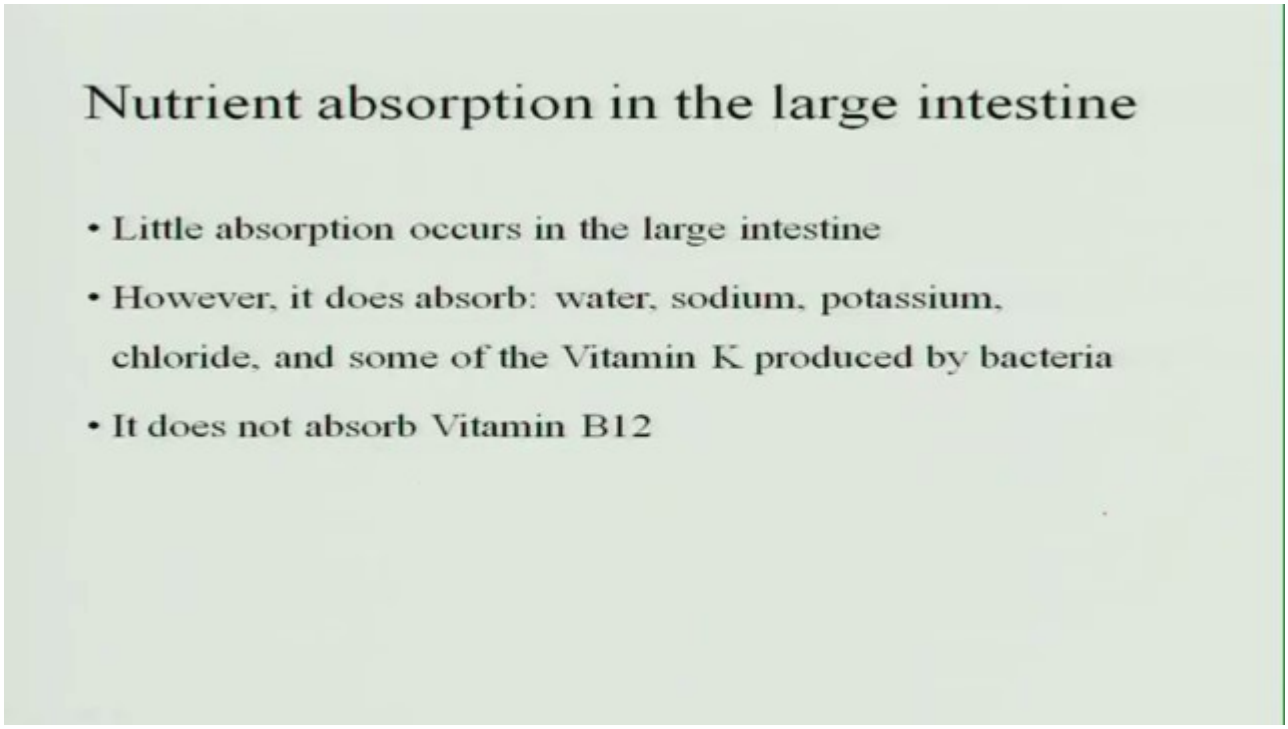

Now nutrient absorption, I told you very little absorption of nutrients occur then mainly the absorption of water, sodium, potassium and chloride and the vitamin K that is produced are absorbed, but it does not absorb only synthesizes but does not absorb vitamin B12. So whatever is synthesized in the large intestine is not of much use in the large intestine.

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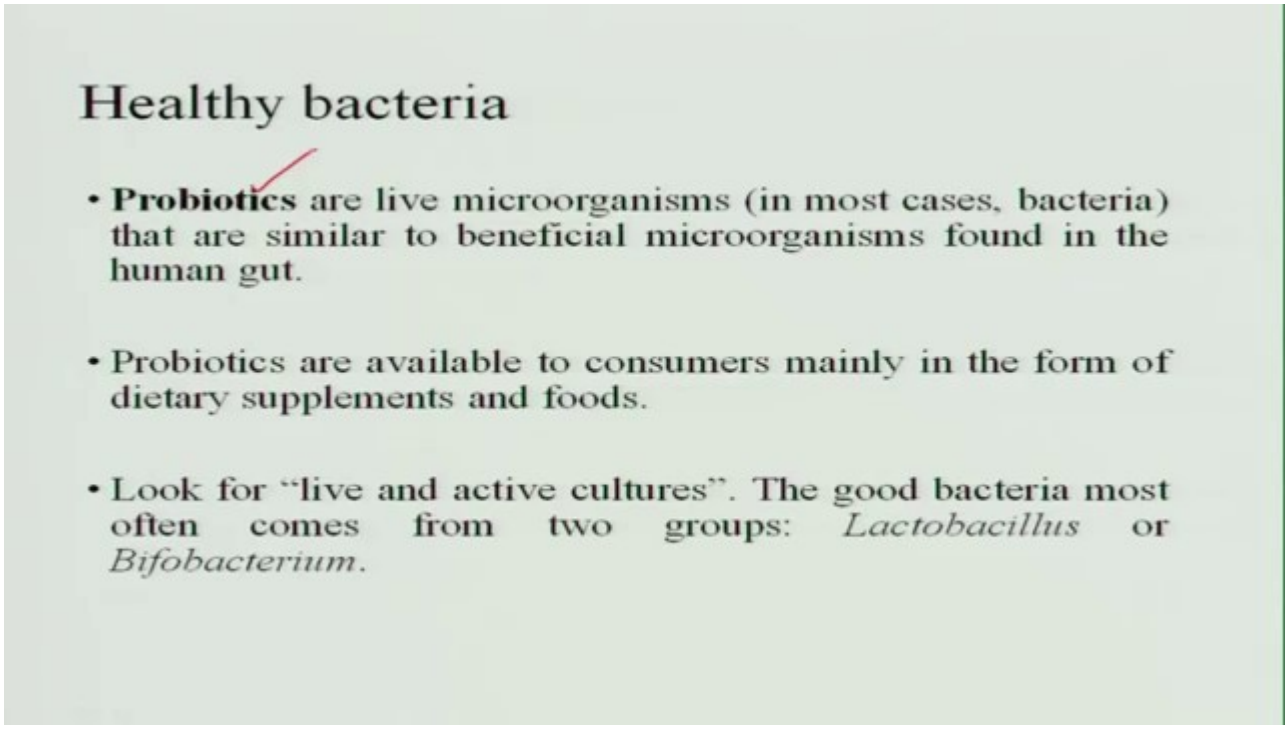

Now there are healthy bacteria that are produced in the large intestine and the intestinal tract you have the probiotics, probiotics are the live organisms that are present in the, they are mostly bacteria and they are similar to the bacteria that are present in the human gut. So now we ask the people to take curds which have probiotics in them. So these are now available to

the consumers in the form of dietary supplements and also in the form of foods. So these probiotics are healthy and beneficial bacteria that represent in the intestine. So you should always look for live and active cultures when you purchase probiotic food. So good bacteria most oftenly comes in two forms. The probiotics mainly they are lactobacillus and bifidobacterium. And whatever fermented foods we prepare, so you prepare some batter and leave it for fermentation most of it develops lactobacillus and bifidobacterium. That is why the fermented foods are very good for health.

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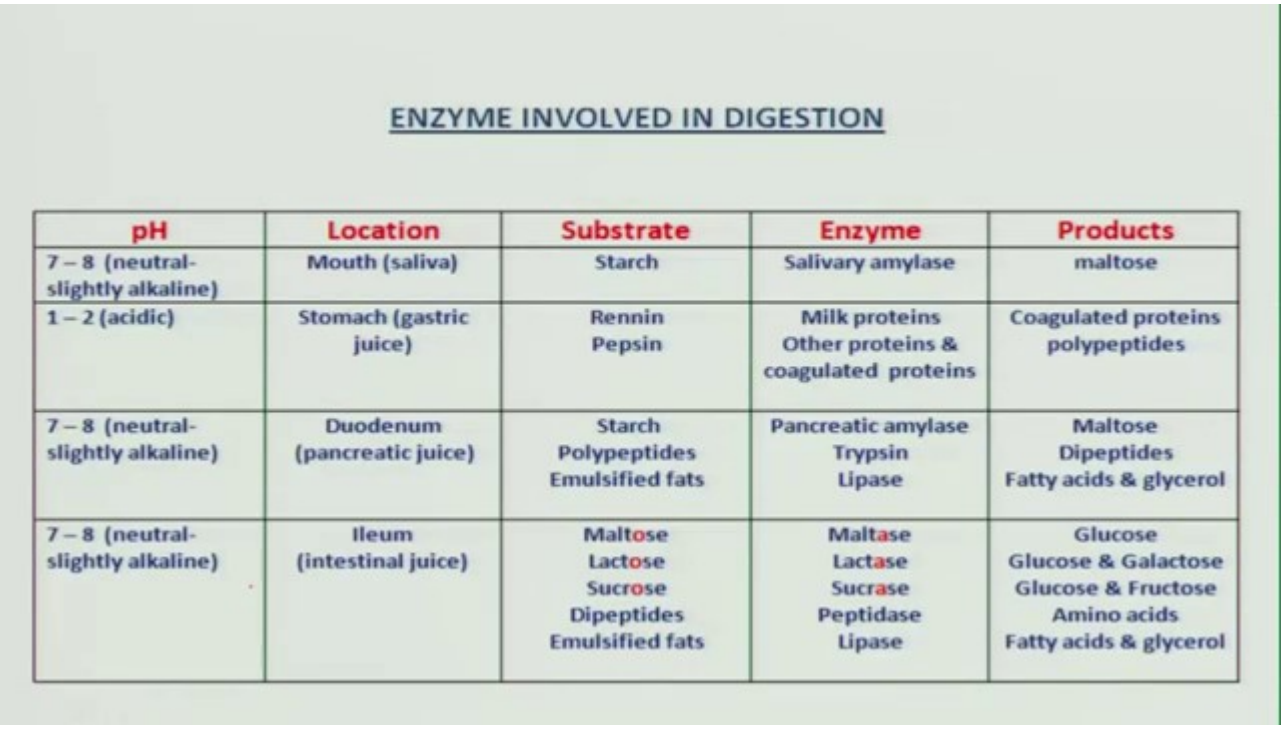

ENZYME INVOLVED IN DIGESTION

pH	Location	Substrate	Enzyme	Products
7 – 8 (neutral-slightly alkaline)	Mouth (saliva)	Starch	Salivary amylase	maltose
1 – 2 (acidic)	Stomach (gastric juice)	Rennin Pepsin	Milk proteins Other proteins & coagulated proteins	Coagulated proteins polypeptides
7 – 8 (neutral-slightly alkaline)	Duodenum (pancreatic juice)	Starch Polypeptides Emulsified fats	Pancreatic amylase Trypsin Lipase	Maltose Dipeptides Fatty acids & glycerol
7 – 8 (neutral-slightly alkaline)	Ileum (intestinal juice)	Maltose Lactose Sucrose Dipeptides Emulsified fats	Maltase Lactase Sucrase Peptidase Lipase	Glucose Glucose & Galactose Glucose & Fructose Amino acids Fatty acids & glycerol

Now the enzymes that are involved in digestion you have in the form of see, in the mouth you produce the saliva which is slightly alkaline and it acts on starch then the enzyme that is produce is salivary amylase and it breaks down the starch into maltose and dextrose. So after breaking down then it reaches the stomach where the acidity is 1 to 2 pH. So the enzymes that are produced are rennin and pepsin which rennin is present only in children which digests the milk protein. Whereas pepsin digests the other proteins and coagulated proteins and then it breaks them to coagulated proteins and polypeptides.

Then the food enters the duodenum, the first part of the intestine which again the media is alkali and it acts on starch, polypeptides which are got from the stomach and emulsified fats. Then the pancreatic amylase trypsin and lipase are produced by the pancreas which also enter into the duodenum and they result in maltose, dipeptides and fatty acids and glycerol. Here the fatty acid -- the fat digestion is over. Then the food reaches the ileum, the intestinal, large part of the understand where the pH is again neutral and it acts on the maltose, lactose, sucrose, dipeptides, emulsified fats which are I mean pushed into the small intestine, the ileum part and by the enzymes Maltase, lactase, sucrase, peptidase and lipase they act on these substrates and final products that are produced are glucose. See glucose and galactose again this galactose is converted into glucose and glucose and fructose which again is

converted into glucose, then amino acids from the proteins, fatty acids and glycerol from the fats. This is the in brief the enzymes that are involved in the digestion of the food that is eaten and which is converted into simpler form. You can see how they are broken down from each stage to the final stage when it comes to the ileum and get absorbed.

So we have seen the digestion absorption and utilization of nutrients throughout the gastrointestinal tract. And with this we complete the digestion part of the food. Thank you.