THE LONG AND WINDING TUBE

Peppi and Bollo are gradually moving downward as the contractions of the stomach continue. Looking down, they see a round black hole. The hole suddenly grows larger.

Whoosh! Peppi and Bollo pass through the opening, which quickly closes.

"Another sphincter," says Peppi. "Those muscles are powerful. That one was the pyloric sphincter. It's the gateway to the next important part of the digestive system, the small intestine."

"This is the duodenum," says Peppi. "It's a special name for the first 25 centimeters of the small intestine. It's hard to see from this perspective, but the small intestine is about 7 meters long."

"You've got to be kidding," says Bollo. "How can it all fit into that small space? And why do they call it the 'small' intestine if it's so long?"

"It fits because it's folded and tucked away," replies Peppi. "Even though it is long, it is probably called 'small' because of its diameter—only about 2.5 centimeters. Let's go along for the ride and see what happens."

Peppi helps Bollo in a squeeze. It's the sphincter muscle that's causing his problem!

A Change of Atmosphere

Peppi and Bollo are assaulted on all sides by spurts of liquid. One spurt comes from the direction of the pancreas.

"Pancreatic juice," Peppi explains, "is packed with enzymes that help digest carbohydrates, proteins, and fats. Each day, the pancreas secretes about 1.5 liters of juice.

"As food enters the duodenum, the gall bladder swings into action, contracting and pumping out greenish-yellow liquid bile. It's been stored there since it was manufactured in the liver. The liver, the largest organ in the body, performs many other functions as well."

"The pancreatic juice is different from the juices in the stomach," says Bollo. "It's not acidic. What's going on?"

"The juice from the pancreas is not acidic," says Peppi. "In fact, it's just the opposite: It is alkaline, or basic. It neutralizes the acid from the stomach and then starts off on some work of its own. Because digesting food is a big job, there's still more specialization.

"Foods get customized treatment at this point.

"Proteins, which were partially digested in the stomach, are acted on by intestinal and pancreatic juices. Eventually, they break down into amino acids.

"Carbohydrates, already well on their way to being digested, complete the change to simple sugars as a result of interaction with intestinal and pancreatic juices.

"Fats get a big dose of bile, courtesy of the liver and gall bladder. Bile works like dishwashing detergent. It breaks large fat droplets into smaller ones so they can mix more easily with the juices from the small intestine and pancreas. Fat eventually gets broken down into fatty acids and glycerol."

"More specialization!" says Bollo.

"Right!" says Peppi. "Both pancreatic and intestinal juices contain enzymes. Remember that enzymes are specific. What does that mean?"

"Each enzyme can digest only one type of nutrient," says Bollo.

"Right you are!" says Peppi. "At some point during the pizza's journey through the small intestine, digestion is complete. The pizza has been transformed into a soupy mixture of sugars, amino acids, fatty acids, vitamins, and minerals. The particles are now simple enough to be absorbed through the lining of the small intestine."

"How does this stuff actually get out into the body?" says Bollo.

"We're going to find out," says Peppi. "But first, let's take a break. The pace of activity in the small intestine has worn me out."