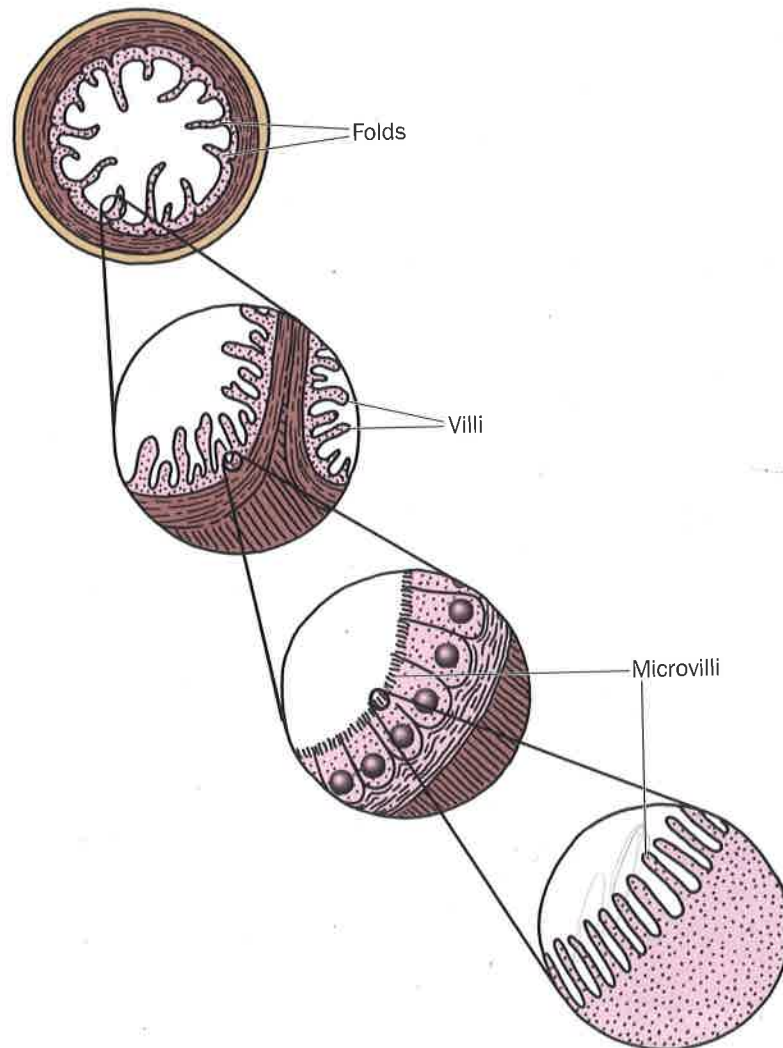


# SURFACE AREA: Your Intestine Isn't Small at All

What's the best way to get the most out of the nutrients in your food? It is to make sure that most of those nutrients get into the right places in your body.

Your digestive system has some special features to make this happen. First, it has ways of making sure the surface area of the foods you eat is as large as possible. Second, your digestive system packs as large a surface area as possible into a limited space.

As soon as you begin to chew your food, you start to increase its surface area. Your teeth break the food into smaller and smaller pieces. The surface area of the food continues to increase, allowing the digestive enzymes greater access to them. When the food gets to your stomach, it is broken into even smaller pieces by gastric juices and muscular action. Then the food mixture moves into your small intestine.



*Lining of the small intestine, shown with increasing magnification*

The small intestine is a hollow tube about 7.0 meters long and 2.5 to 5.0 centimeters in diameter. The first 25 centimeters of the small intestine is known as the duodenum. That's where most digestion is completed. As the digested carbohydrates, proteins, and fats move through the remainder of the small intestine, they are absorbed through the intestinal wall into your bloodstream. If its inside wall were smooth, your small intestine would have an internal surface area that is about the same as about the top of a dinner table. That's a lot, but it's not enough to let all the nutrients you need pass into your bloodstream.

So maybe it's not surprising to learn that the inside of your small intestine isn't smooth. Instead, it is packed with wrinkles and folds. The surface of these folds is covered with tiny projections called villi. The villi are covered with even tinier projections known as microvilli.

The folds, villi, and microvilli may be compared with the fluffy threads of a bath towel. Just like the threads of a terry cloth towel absorb water better than a flat cloth, the villi allow your intestine to absorb more nutrients than a smooth surface would.

The folds, villi, and microvilli increase the internal surface area of the intestine by about 600 times. In fact, scientists estimate that if you could flatten out the surface of your small intestine, it would almost cover a football field. That's a lot bigger than a table top. □



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*Microscopic, fingerlike villi line the walls of the small intestine and increase its surface area (SEM  $\times$  140).*