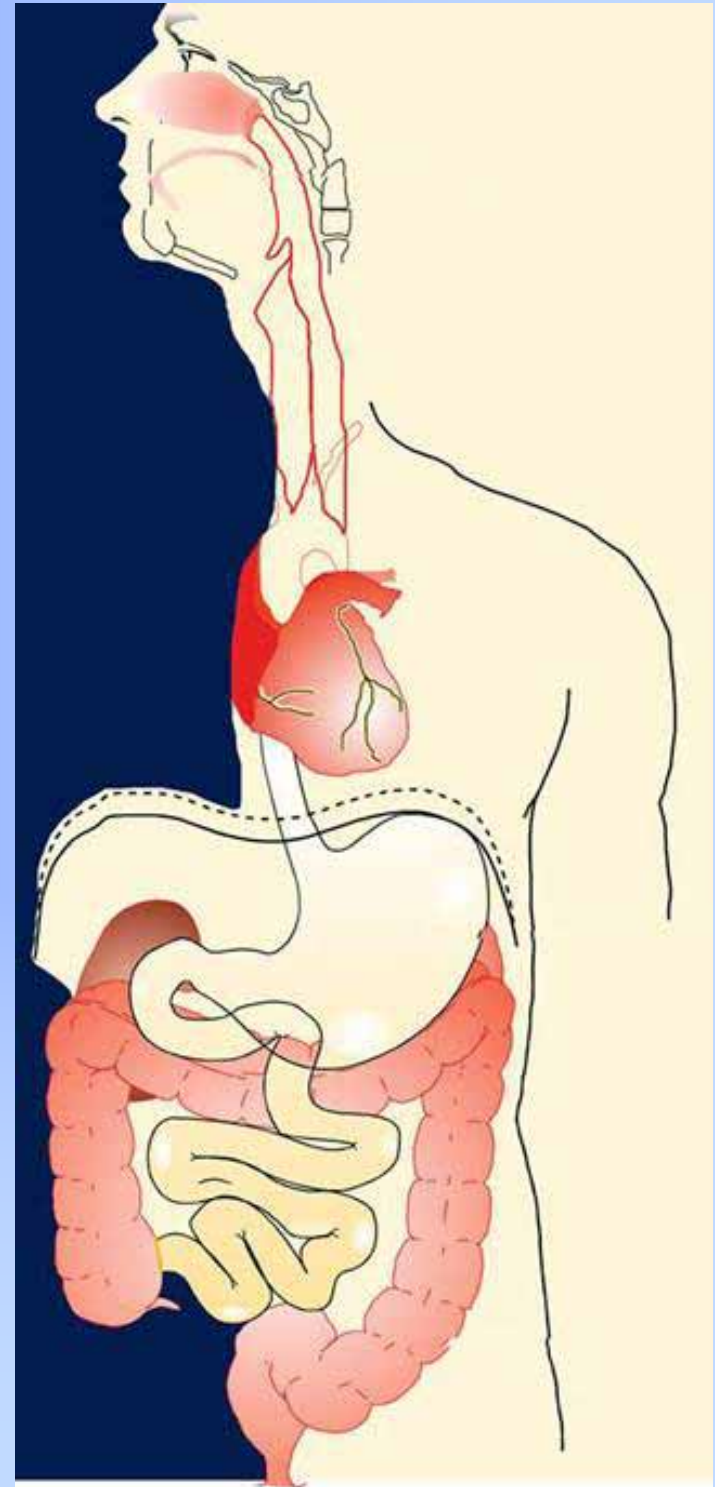




*Institute Open Days
7-9 September 2006*

Food and Digestion

Martin Wickham



Why do we eat?



- Because we are hungry and it makes us feel good
- We need materials to build new organic molecules
- We need Vitamins and Minerals
- We need essential nutrients – nutrients that our bodies can NOT make from any raw material – Essential Amino Acids and Fatty Acids
- We need fuel- energy for all cellular/bodily functions

Role of digestion

- Digestion is defined as the breakdown of nutrients
- We consume:
 - Proteins
 - Carbohydrates
 - Fats
 - All broken down into their simplest forms
- Water
- Vitamins and minerals



From start to finish

Mouth

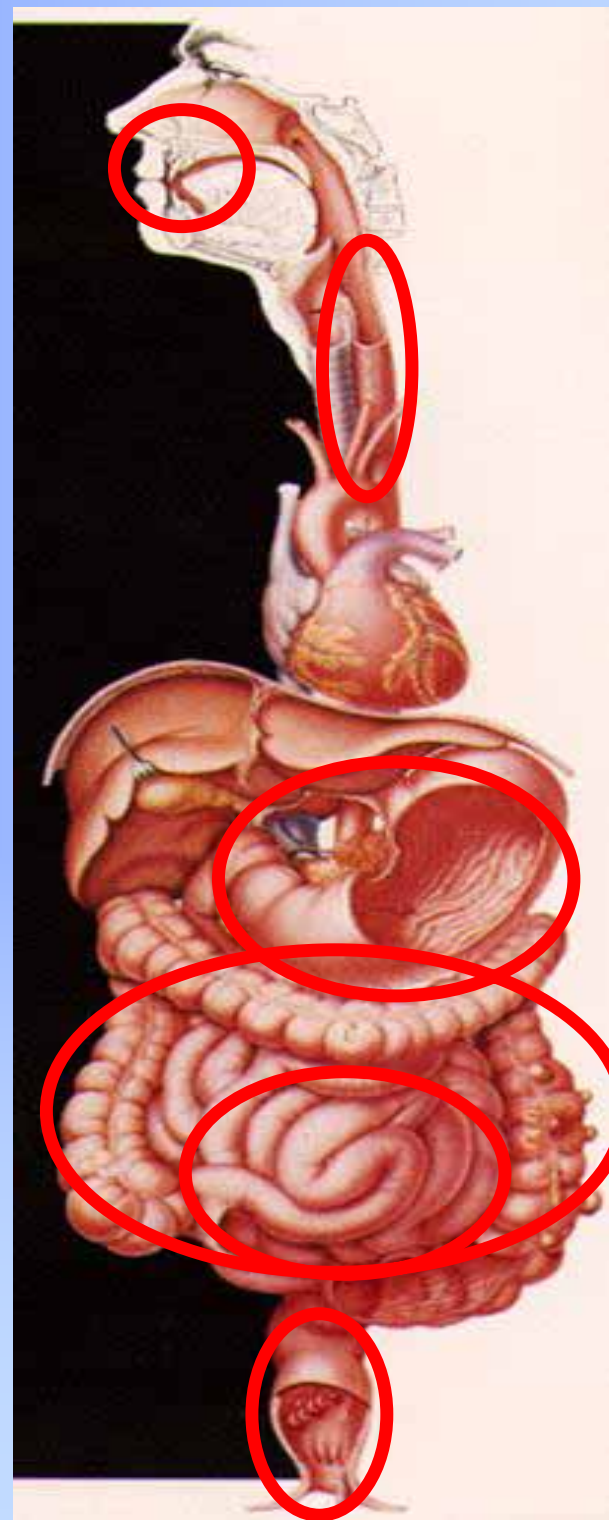
Oesophagus

Stomach

Small intestine

Large intestine

Anus



Gut facts

The average male will eat about 50 tons of food during his lifetime in order to sustain a weight of 150 lbs

Food takes between 24-36 hours to pass through the Gastrointestinal Tract

There are 1000 times as many bacteria in our gut than there are stars in the milky way (100 trillion vs. 100 billion)

We secrete more than one liter of saliva every day

The entire gut from mouth to anus measures 9 meters (30 feet) in length





In the mouth



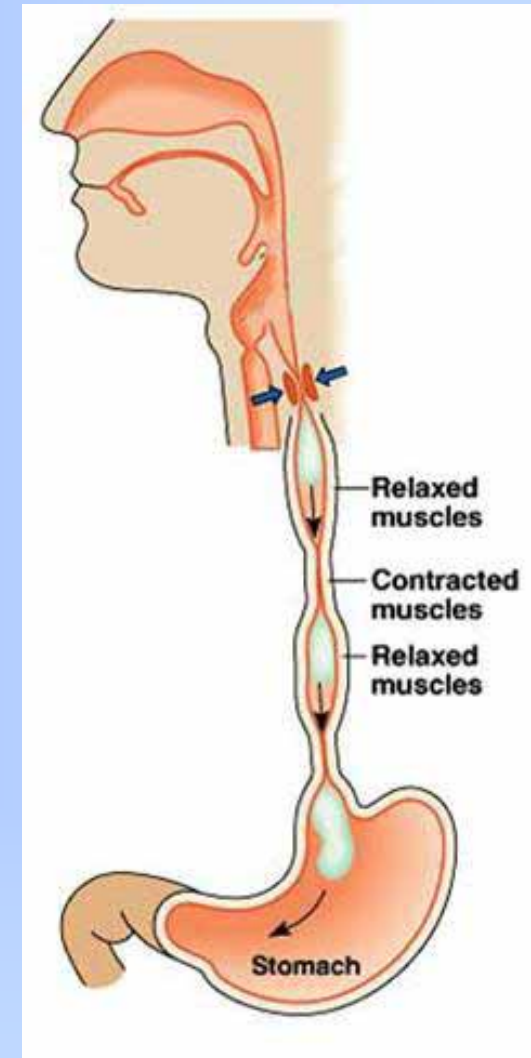
- Role - a ball (**bolus**) of moistened, partially digested food
- Saliva - lubricates (glycoproteins), buffers to neutralize acid and antibacterial agents
- **Mechanical digestion**: the act of chewing
- **Chemical digestion**: enzymes breaking down starches
- **Carbohydrate** digestion begins here - Salivary Amylase – breaks down complex carbohydrates into simple sugars



'Down the hatch' - The Oesophagus



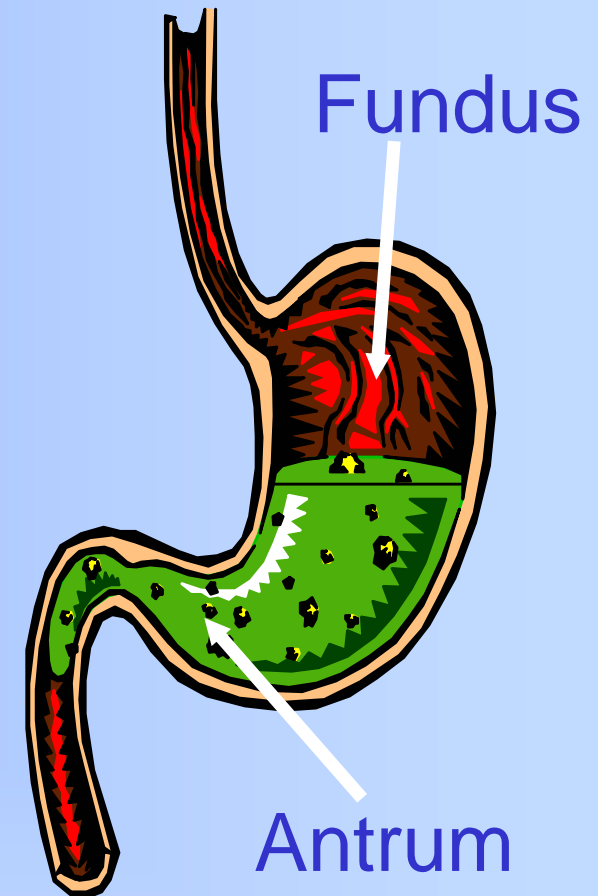
- Muscular tube that takes food from your pharynx to your stomach
 - approx 27cm (10 inches) long
- No digestion, no absorption
 - expressway to stomach
 - some mucus secretion
- The rhythmic contraction of muscles pushes the food down, known as **Peristalsis**
- To swallow food we use 22 muscles and we can even swallow standing on our heads



In the stomach..



- The stomach can hold anything from 50ml to 4 litres of liquid
- Both types of digestion are occurring in the stomach: **Chemical and Mechanical**
- The enzyme activity is considered chemical digestion
- The churning of the stomach is considered mechanical digestion



The Fundus of the stomach



- Numerous deep pits in the stomach wall that secrete gastric juice
- Main components are:
 - Hydrochloric acid (1.5 litres a day) gives the gastric juice a pH of 2 – breaks the food apart and kills most of the bacteria that you swallow
 - Pepsin - Protein digestion begins here - proteins broken down into smaller polypeptide chains
 - Gastric Lipase – fat digestion begins here

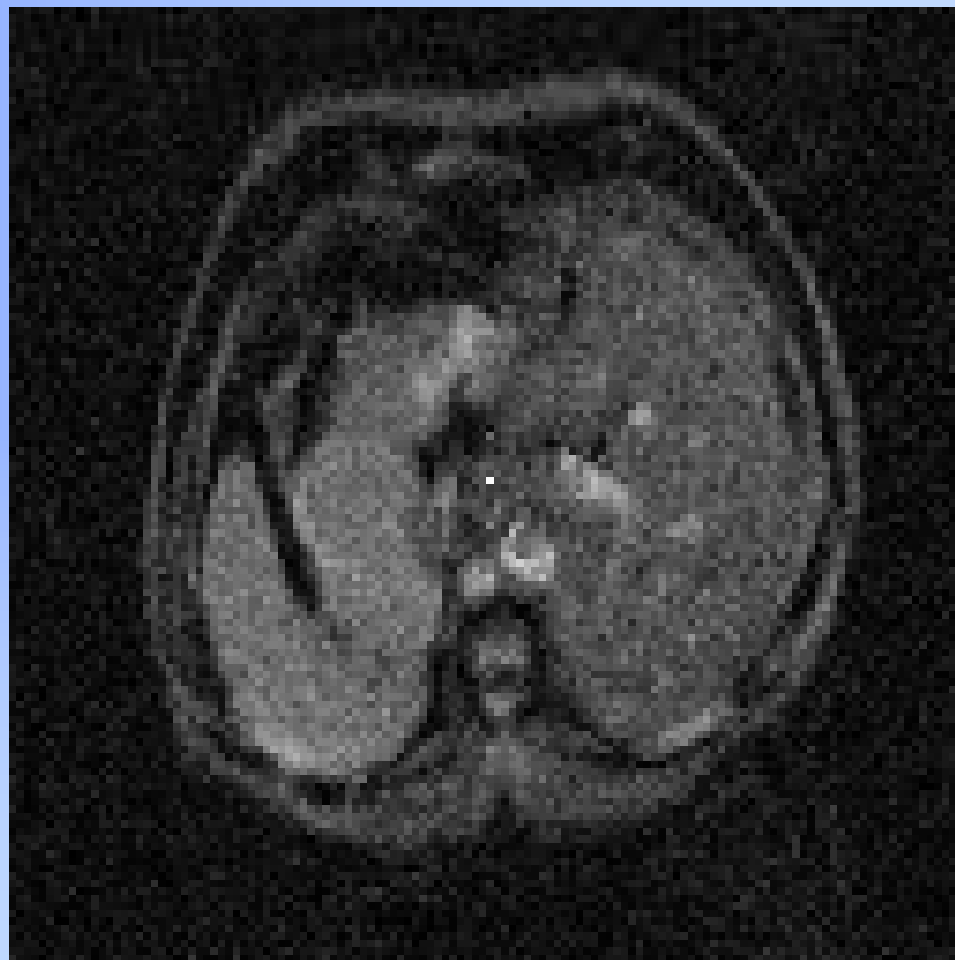


The Antrum of the stomach

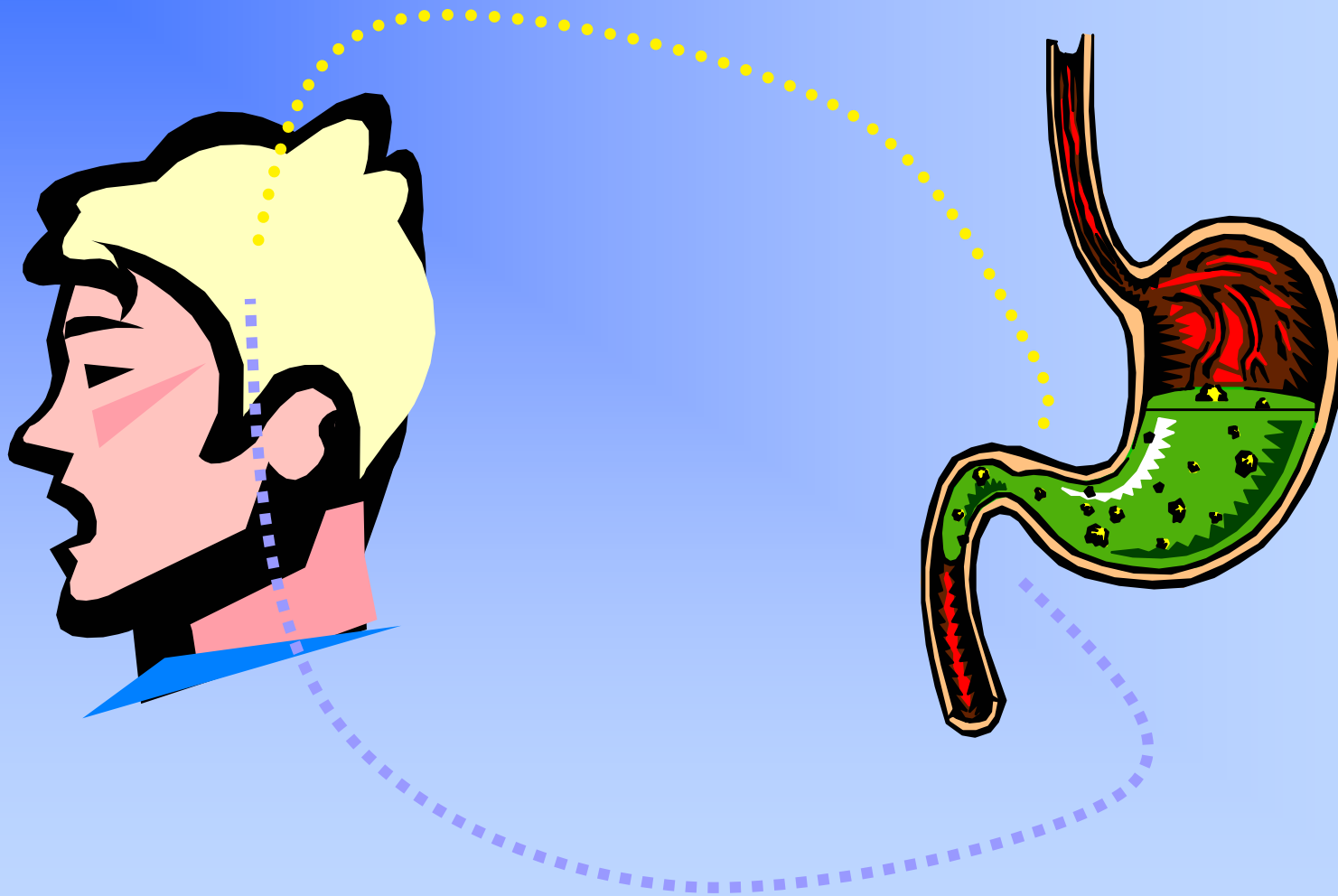


Lower part of
the stomach

- Breaks down large food material in to small particles
- Selectively empties the small particles and retains the large
- Reduced to a paste



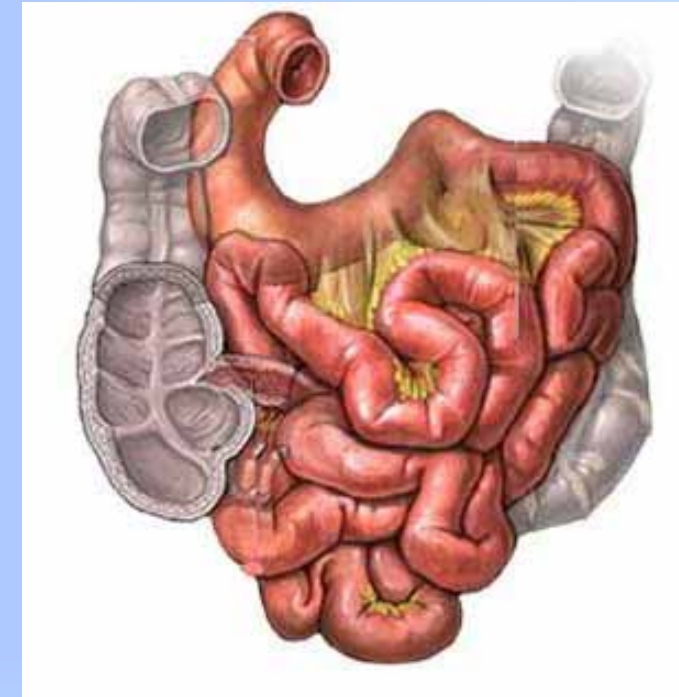
Response: release intestinal enzymes, empty stomach, satiety signal - 'that's enough food for now'



Hormone (chemical) Signal

The Small Intestine

- Small in diameter, long in length (6.6 meters / 22 feet long)
- Digestive fluids
 - bile from gall bladder (surfactants)
 - pancreas (bicarbonate & enzymes)
 - intestinal enzymes
- Chemical and Mechanical digestion
 - carbohydrate, protein and fat digestion continues
 - peristalsis



Enzymes and Surfactants



- Enzymes are like scissors that snip the food molecules into smaller and smaller pieces
- Surfactants then come along and clear all of the pieces away



- Amylase broken-down the starches in the wheat into simple sugars
- Gluten is all that left (no protein digestion in the mouth)

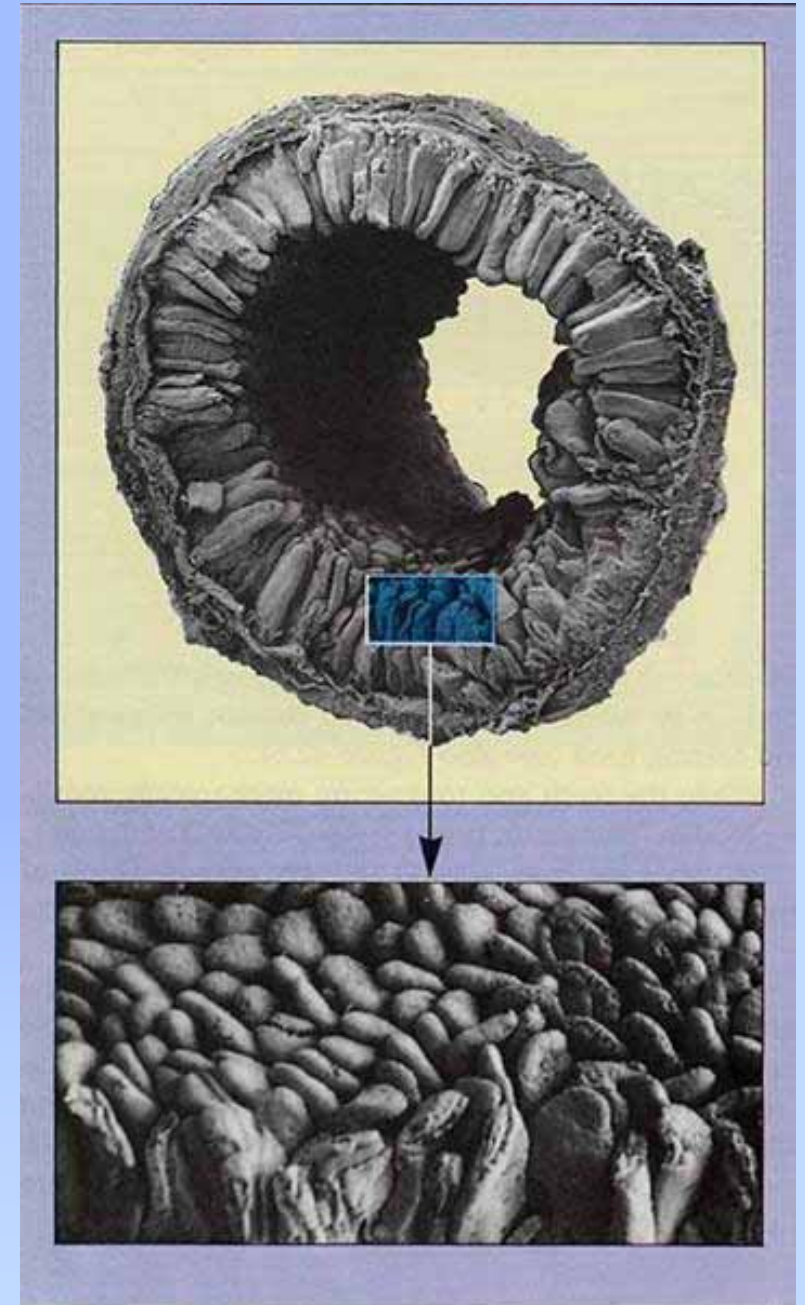
Absorption - The Villi

- **Villi** and **microvilli** increase surface area - 10 billion microvilli
- Surface area of SI = 2 tennis courts



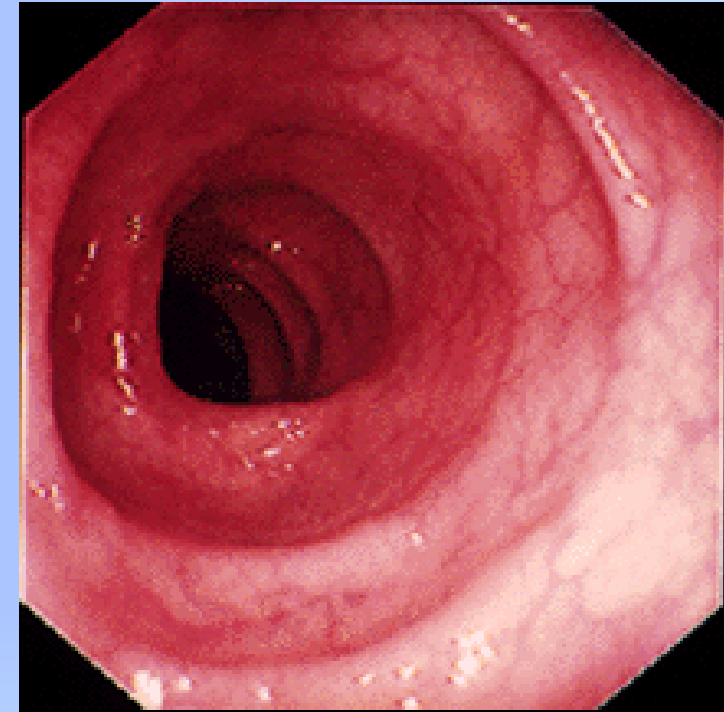
absorb products of digestion
(water, salts, sugars, amino
acids, fatty acids, vitamins,
micronutrients etc)

90% of nutrient absorption
occurs here (some easy,
some helped and some
dragged)



The large intestine

- **1.5 meters (5 feet) long**
- **Absorbs water**
 - main function
 - 7 liters a day
- **Absorbs vitamins, ions**
- **No enzymes**
- **Stores waste for elimination**

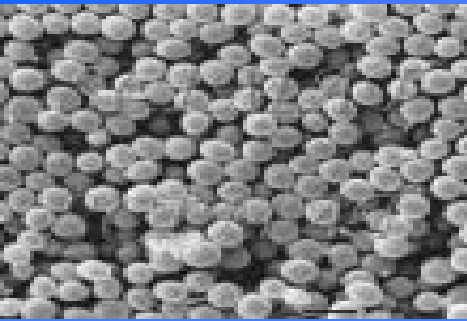


What goes into the colon?

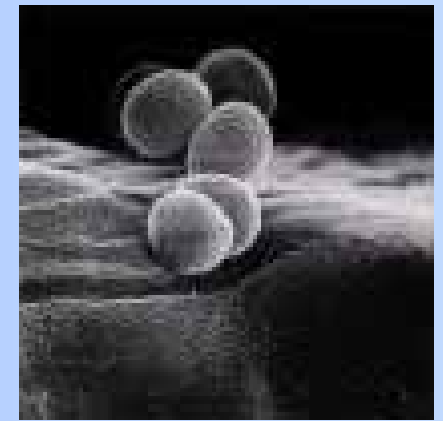
Undigested raw carrot



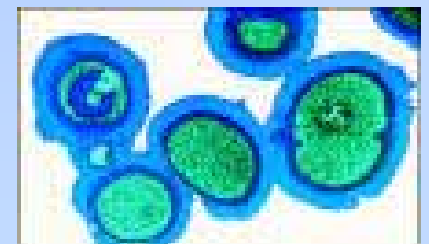
After stomach and small intestinal digestion



It's a bugs life



- Full of trillions of bacteria
 - more bacteria in your colon at this moment than there are human beings who have ever lived.
 - 400 different types
 - 1.5 kg
- Provide health benefits, for example:
 - Reduce cholesterol in the blood.
 - Reduce high blood pressure.
 - Assist in elimination of ailments such as constipation, diarrhoea and acne.
 - Strengthen the immune system.
 - Produce natural anti-bacterial agents (antibiotics)



The Anus - the end.....

