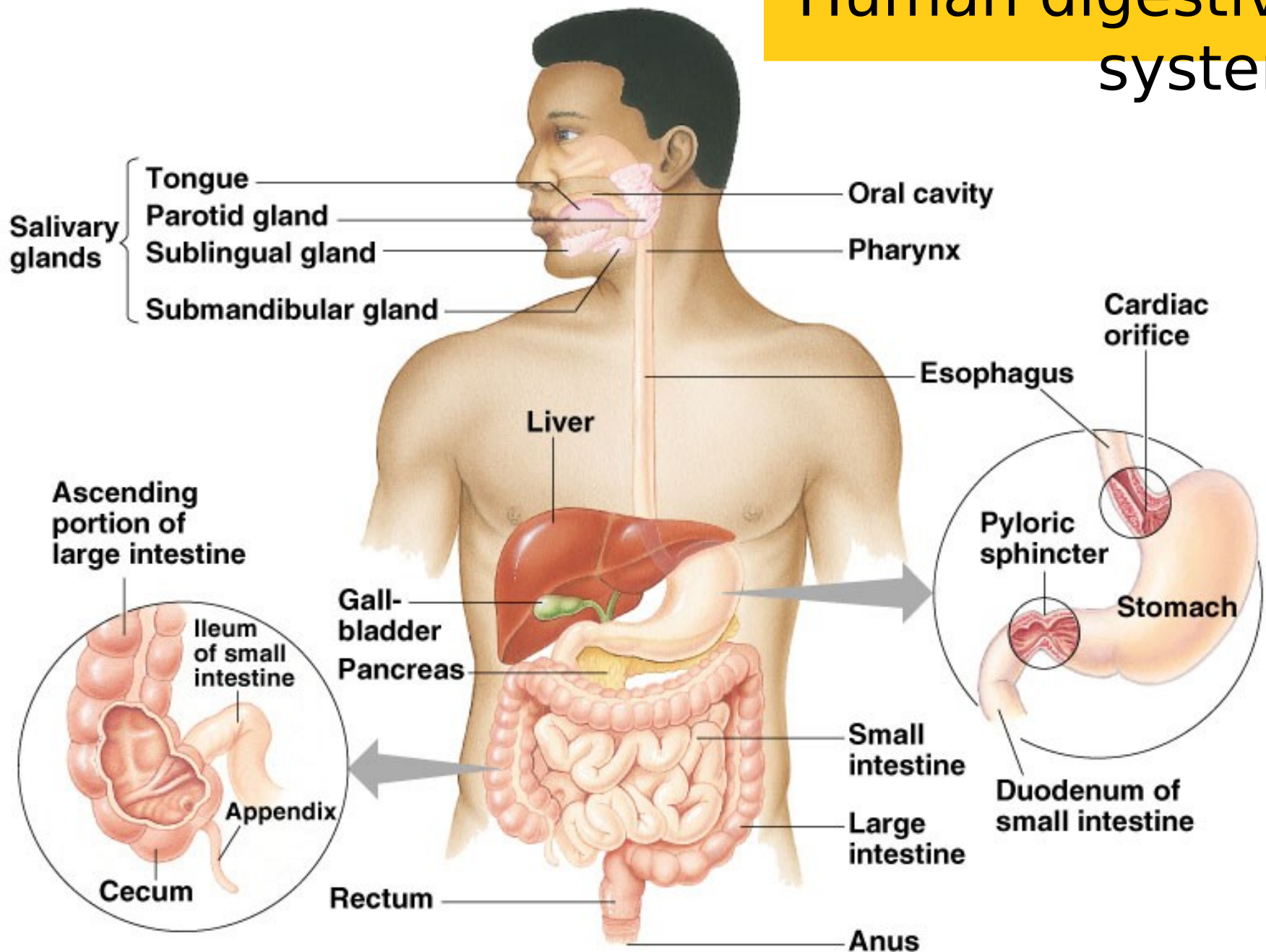


Human digestive system



**Digestion involves
mechanical breakdown of
food into particles that
can be absorbed into the
blood stream**

Digestion

There are three parts to Nutrition:

- 1. Ingestion- process of taking food into the digestive system**
- 2. Digestion- the breakdown of food (either chemically or mechanically) in order to utilize nutrients**
- 3. Egestion**

Ingestion DEFINE THIS:

- **Mouth**

- **Mechanical Digestion**

- **MASTICATION BY**

- breaking up food

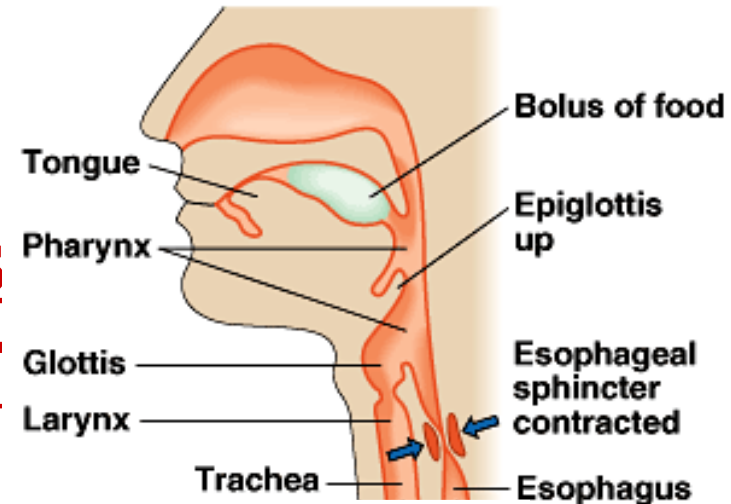
- **Chemical Digestion**

- **SALIVA CONTENTS AND GLAND**

- **amylase**

- » **enzyme digests starch to maltose**

-



- Ingestion DEFINE THIS;

- mucin

- » slippery protein
(mucus)

- » protects soft lining of
digestive system

- » lubricates food for
easier swallowing

-minerals NaHCO₄

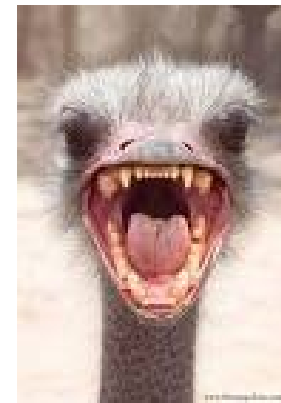
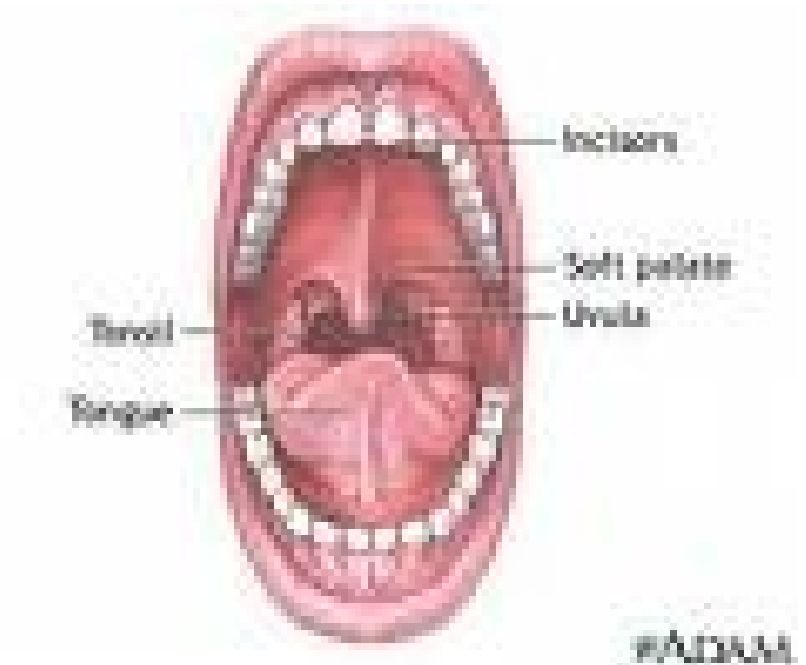
**» neutralizes acid to
prevent tooth decay**

-anti-bacterial chemicals

**» kill bacteria that
enter mouth with food**

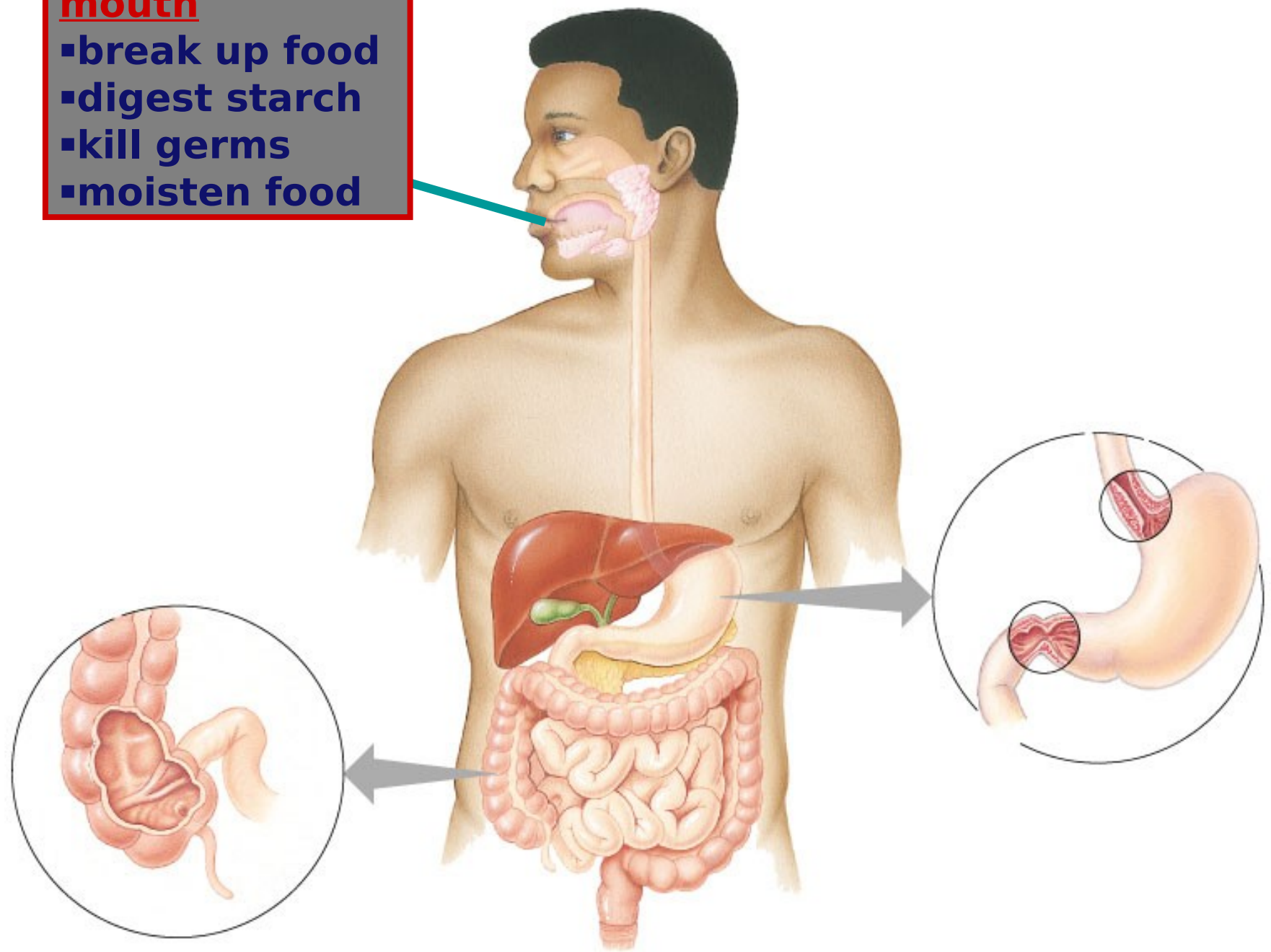
THE TONGUE

- **TONGUE ROLLS FOOD INTO SPHERICAL LIKE MASS CALLED BOLUS.**
- **THE BOLUS IS PUSHED BEHIND THE MOUTH IN SWALLOWING**



mouth

- break up food
- digest starch
- kill germs
- moisten food



DURING SWALLOWING

- **EPIGLOTTIS**

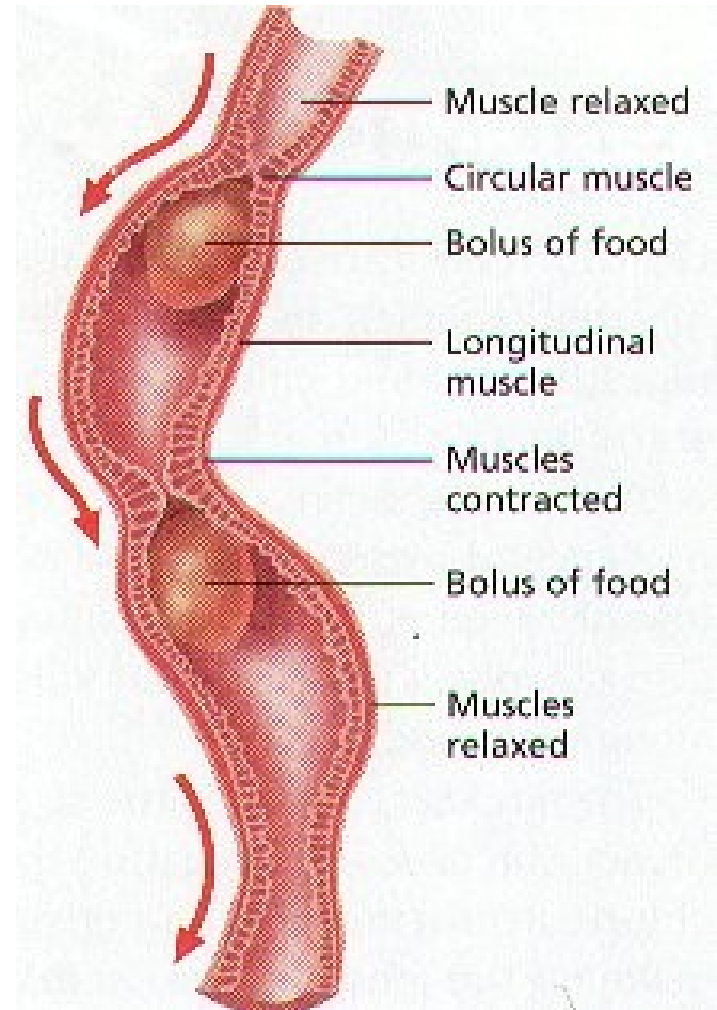
- CLOSES **TRACHEA** WHEN SWALLOWING
- IT IS A FLAP OF CARTILAGE
- FOOD TRAVELS DOWN **OESOPHAGUS**

- **PERISTALSIS**

- INVOLUNTARY MUSCLE CONTRACTIONS TO MOVE FOOD ALONG

Peristalsis

- **series of involuntary wave-like muscle contractions which move food along the digestive tract**



**FOOD ENTERS THE
STOMACH VIA THE CARDIAC
SPHINCTER**

STOMACH

- HAS A THICK MUSCULAR WALL LINED WITH A FOLDED INNER LAYER CALLED **GASTRIC MUCOSA**
- IN THE MUCOSA ARE GASTRIC PITS HAVING GASTRIC GLANDS
- THE GASTRIC GLANDS SECERATE GASTRIC JUICE

**PRESENCE OF FOOD IN
STOMACH STIMULATES THE
SECREATION OF HORMONE
GASTRIN FROM THE WALLS.**

**GASTRIN STIMULATES
SECREATION OF GASTRIC JUICE.**

GASTRIC JUICE CONTAINS

- **WATER** - DISSOLVES CONSTITUENTS
- **PEPSINOGEN** - INACTIVE FORM OF PEPSIN PRODUCED BY CHIEF CELLS.
HCl ACTIVATES IT TO **PEPSIN**.

PEPSIN BREAKS DOWN PROTEINS TO POLYPEPTIDES.

RELEASED IN AN INACTIVE FORM TO PREVENT SELF DIGESTION OF

- **PRORENNIN** – PRODUCED BY CHIEF CELLS. IT IS THE INACTIVE FORM OF RENNIN.

RENNIN CONVERTS THE SOLUBLE PROTEIN **CASEINOGEN** INTO **CASEIN**.

CASEIN IS THEN HYDROLYSED TO **PEPSIN**

IT IS IMPORTANT TO MAMMALS WHO FEED ON MILK MAINLY

- **HCl** – PRODUCED BY OXYNITIC/
PARIETAL CELLS.

**GIVES pH OF 2 OPTIMUM MEDIUM FOR
GASTRIC ENZYME.**

KILLS BACTERIA IN FOOD

**ALSO ACTIVATES PRORENNIN TO
RENIN**

- **MUCUS** - PRODUCED BY GOBLET CELLS

FORMS PROTECTIVE LAYER ON THE STOMACH WALLS

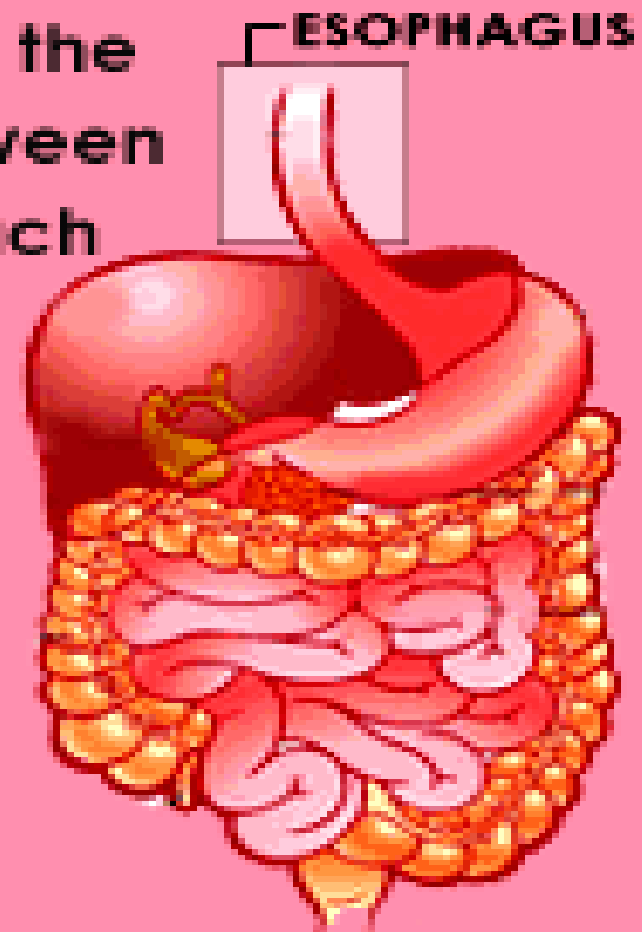
THIS PREVENTS PEPSIN AND HCL FROM BREAKING THE GASTRIC MUCOSA

MUCUS LUBRICATES THE FOOD

- **STOMACH WALLS HAS LONGITUDINAL AND CIRCULAR MUSCLES THAT HELP MIX THE FOOD.**
- **THIS PROCESS IS CALLED CHURNING**
- **THE PROCESS RESULTS TO FLUID CALLED CHYME**

Taking the Heart Out of Heartburn

The esophagus has a ring of muscles at the top and bottom. If the bottom ring of muscles doesn't keep the lower part of the esophagus tightly closed between swallows, acid from the stomach can come back up into the esophagus. This creates a burning sensation called *heartburn*, but it has nothing to do with the heart. The pain a person may feel is in the area of the heart, but it would make more sense to call it esophagus-burn!



PYLORIC SPHINCTER RELAX

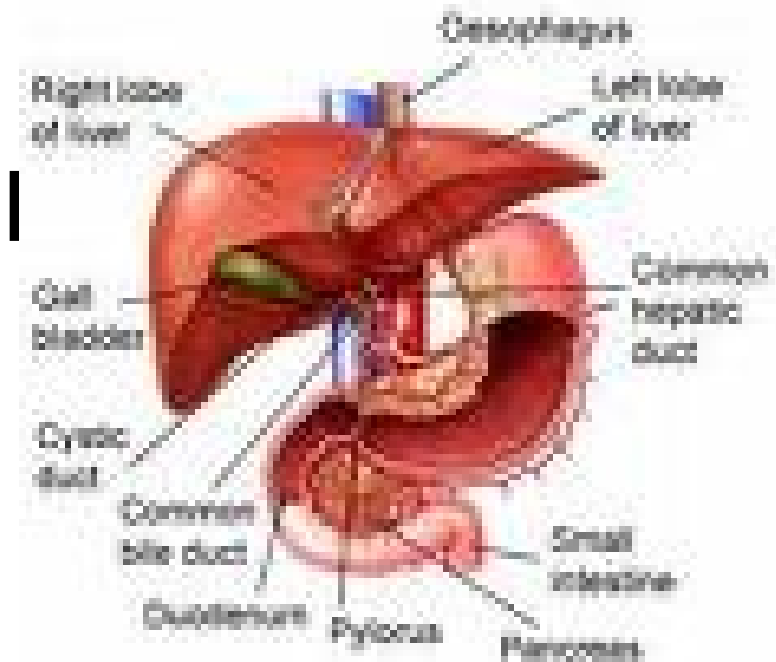
FOOD INTO DUODENUM

**CHYME IS RELEASED
GRADUALLY OVER A PERIOD
OF 3 TO 4 HOURS**

**ENABLES DUODENUM TO
WORK ON FOOD AT A TIME.**

ACCESSORY ORGANS IN DUODENUM

- Pancreas
- Gall Bladder
- Spleen



Duodenum

- **FIRST PORTION OF ILEUM**
- **25CM LONG**
- **ARRIVAL OF ACIDIC CHYME**
STIMULATES SECRETION OF
HORMONE SECRETIN FROM
PANCREAS AND
CHOLESTOKININ FROM
DUODENAL WALLS

Duodenum

- **SECRETIN** STIMULATES THE PANCREAS TO SECRETE PANCREATIC JUICE.
- IT ALSO INHIBITS SECRETION OF GASTRIC JUICE
- **CHOLESTOKININ** STIMULATES GALL BLADDER TO SECRETE BILE

PANCREATIC JUICE IS ALKALINE DUE TO NaHCO_3 TO ENABLE ITS ENZYMES TO WORK

Pancreas

- **AN ORGAN WHICH SECRETES DIGESTIVE ENZYMES (EXOCRINE) AND HORMONES (ENDOCRINE)**
 - **PANCREATIC JUICE CONTAINS ENZYMES;**
 - ❖ **AMYLASE - STARCH TO MALTOSE**
 - ❖ **LIPASE - CONVERTS LIPIDS TO FATTY ACID AND GLYCEROL**
 - ❖ **TRYPSIN - CONV PROTEINS TO PEPTIDE**
 - ❖ **CHEMOTRYPSIN - PROTEINS TO PEPTIDES**

LIVER

- **PRODUCES BILE**
- **BILE EMULSIFIES FATS.**
- **IT IS A BITTER, GREENISH-YELLOW ALKALINE FLUID,**
- **STORED IN THE GALLBLADDER DISCHARGED INTO THE DUODENUM WHERE IT AIDS THE PROCESS OF DIGESTION.**

LIVER

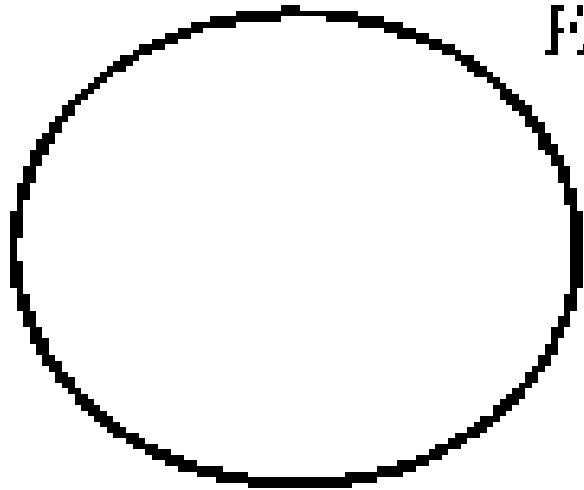
- BILE CONTAINS SALTS LIKE;

SODIUM GLYCOCHOLATE $\text{C}_{26}\text{H}_{42}\text{NNaO}_6$

SODIUM TAUROCHOLATE

$\text{C}_{26}\text{H}_{44}\text{NNaO}_7\text{S}$

TI



Large fat piece

Emulsification



Tiny droplets

DIGESTION IN ILEUM 1

- **SECOND PORTION OF SMALL INTESTINE.**
- **HAS TWO FUNCTIONS;
CHEMICAL DIGESTION
ABSORPTION**

DIGESTION IN ILEUM 1

**CHEMICAL DIGESTION; WHERE
CHEM DIGESTION IS
COMPLETED**

**ENZYMES RESPONSIBLE ARE IN
THE INTESTINAL JUICE OR
SUCCUS ENTERICUS**

DIGESTION IN ILEUM 2
THE INTESTINAL JUICE OR
SUCCUS ENTERICUS ARE
SECRETED FROM GLANDS
IN WALLS OF CRYPT OF
LIEBKUHN.

DIGESTION IN ILEUM 2

**THERE ARE ALSO BRUNNER'S
GLANDS SECRETING MUCUS
RICH ALKALINE FLUID.**

**SECREATIONS ARE
STIMULATED BY ARRIVAL OF
CHYME.**

INTESTINAL JUICE CONTAINS FIVE MAIN ENZYMES BELOW;

LIPASE – BREAKS LIPIDS TO FATTY
ACIDS AND GLYCEROLS

MALTASE – BREAKS MALTOSE TO
GLUCOSE

SUCRASE OR INVERTASE – BREAKS
SUCROSE INTO FRUCTOSE AND GLUCOSE

DIGESTION IN ILEUM 4

**PEPTIDASE - BREAKS
PEPTIDES TO AMINO ACIDS**

**LACTASE - BREAKS
LACTOSE TO GALACTOSE AND
GLUCOSE**

DIGESTION IN ILEUM 5

**WALLS OF ILEUM HAVE
GOBLET CELLS SECRETING
MUCUS**

THE MUCUS;

- LUBRICATES FOOD**
- PROTECT SELF DIGESTION OF
ILEUM**

DIGESTION IN ILEUM 5

**RESULTING EMULSION IS
CALLED CHYLE
CONTAINING DIGESTIVE
PRODUCTS
FOLLOWING IS
ABSORPTION.**

ABSORPTION

**GLUCOSE, FRUCTOSE,
GALACTOSE AND AMINO
ACIDS ARE ABSORBED BY
DIFFUSION AND ACTIVE
TRANSPORT INTO BLOOD
CAPILLARIES.**

ABSORPTION

**THE CAPILLARIES MERGE
FORMING HEPATIC PORTAL
VEIN TRANSPORTING THE
NUTRIENTS TO LIVER.**

**FATTY ACIDS AND GLYCEROL
ARE ABSORBED INTO
EPITHELIAL CELLS OF LACTEALS**

ABSORPTION 2

**LACTEALS MERGE INTO
LYMPH VESSELS THAT
TRANSPORT LIPIDS TO THE
BODY.**

**THE OIL GIVE THE LACTEALS
A MILKY APPEARANCE
HENCE NAME LACTEALS.**

ABSORPTION 2

**SUBSTANCES LIKE WATER,
ALCOHOL, SOLUBLE
VITAMIN B AND C, SALTS
AND SOME MEDICINES ARE
ABSORBED INTO STOMACH
AND DUODENAL WALLS.**

ABSORPTION 3

**SUBSTANCES NOT
ABSORBED ARE PASSED ON
TO THE LARGE INTESTINE
OR THE COLON.**

ADAPTATIONS OF ILEUM 1

- **LONG** ABOUT 6M PROVIDING LARGE SURFACE AREA FOR DIGESTION AND ABSORPTION
- **NARROW** BRINGING DIGESTED FOOD CLOSE TO THE WALLS FOR FASTER DIGESTION AND ABSORPTION

ADAPTATIONS OF ILEUM 1

- **HIGHLY COILED;**
- ❖ **SLOWS DOWN FOOD MOVEMENT TO ALLOW MORE TIME FOR DIGESTION**
- ❖ **INCREASE SURFACE AREA FOR ABSORPTION**

ADAPTATIONS OF ILEUM 2

- **THIN EPITHELIUM** FOR
**FASTER ABSORPTION OF
MATERIALS**
- **DENSE CAPILLARIES** FOR
**ABSORPTION AND
TRANSPORT OF
ABSORBED FOOD**

ADAPTATIONS OF ILEUM 2

- **HAS LACTEALS** FOR THE
ABSORPTION OF FATTY ACIDS
AND GLYCEROL
- **NUMEROUS VILLI AND
MICRO-VILLI** FOR
ABSORPTION OF MATERIALS.

ROLE OF THE COLON 1

- **ABSORBS WATER FROM UNDIGESTED AND INDIGESTIBLE MATTER.**
- **THE INDIGESTIBLE MATTER ARE**
 - ❖ **DEAD BACTERIA**

ROLE OF THE COLON 1

❖ **DEAD CELLS**

❖ **ROUGHAGES**

❖ **MUCUS**

**THESE CONTRIBUTE TO A
SEMI SOLID MATTER
CALLED FAECES.**

ROLE OF THE COLON 2

**EPITHELIAL CELLS
SECRETE MUCUS THAT
LUBRICATE SOLIDIFYING
FAECES FOR EASIER
MOVEMENT.**

ROLE OF THE COLON 2

**LIVING IN LARGE INTESTINE
ARE BACTERIA I.E**

**E. COLI - PRODUCING VITAMIN
K AND B1 B2 B12**

**THEY GENERATE METHANE
AND HYDROGEN SULPHIDE
GAS AS BI-PRODUCT**

CAECUM AND APPENDIX

- **THEY HAVE NO FUNCTION IN HUMANS.**
- **IN HERBIVORES I.E RODENTS IT IS WELL DEVELOPED**

CAECUM AND APPENDIX

- **IT HAS SYMBIOTIC BACTERIA** SECREATING CELLULASE WHICH DIGEST CELLULOSE TO GLUCOSE.
- **IN RUMINANTS ITS FOUND IN THE RUMEN.**

RECTUM

- **FAECES TEMPORARILY
STORED BEFORE**

**REMOVAL BY EGESTION
OR DEFECATION.**

ASSIMILATION 1

- THIS IS THE **INCORPORATION OF THE PRODUCTS OF DIGESTION INTO CELL**
- **PRODUCTS ASSIMILATED ARE;**
- **GLUCOSE** - TRANSPORTED TO THE LIVER WHERE EXCESS CONVERTED TO GLYCOGEN AND STORED

ASSIMILATION 1

- ❖ SOME IS **CIRCULATED ON BODY CELLS** AND **OXIDISED DURING RESPIRATION**
- ❖ EXCESS IS CONVERTED TO **FATS** AND STORED UNDER THE SKIN OR AROUND THE ORGANS

ASSIMILATION 2

- **AMINO ACIDS** - USED IN THE SYNTHESIS OF PROTEINS.
- ❖ **EXCESS ARE DEAMINATED IN THE LIVER AND USED TO PROVIDE ENERGY.**
- ❖ **THE AMINO GROUP IS CONVERTED TO AMMONIA GAS**

ASSIMILATION 3

- **FATTY ACID AND GLYCEROL** - THEY ARE OXIDISED TO PROVIDE ENERGY;
- ❖ THEY COMBINE TO **FORM BODY FATS**
- ❖ THE **FATS FORMS ADIPOSE TISSUE** WHICH ACTS AS HEAT INSULATOR AND SHOCK ABSORBER
- ❖ THEY ARE **USED TO SYNTHESIZE PHOSPHOLIPIDS** MAKING UP THE CELL MEMBRANE

ROLES OF WATER IN BODY

- **FACILLITATES CHEMICAL DIGESTION BY HYDROLYSIS REACTIONS**
- **FACILLITATES MECHANICAL DIGESTION BY SOFTENING FOOD**
- **PROVIDE A MEDIUM BIOCHEMICAL PROCESS TAKES PLACE.**
- **ACTS AS A TRANSPORT MEDIUM**
- **ACTS AS A COOLANT**

ROLES OF ROUGHAGE

- **ADDS BULK TO THE FOOD PROMOTING PERISTALSIS. THIS PREVENTS CONSTIPATION**
- **ABSORBS TOXINS IN BODY WHICH ARE THEN EGESTED**

VITAMINS 1

- **VITAMIN IS AN ORGANIC NUTRIENT REQUIRED BY AN ORGANISM IN SMALL AMOUNTS.**
- **THEY ARE NOT STORED AND MUST BE INCLUDED IN THE DIET.**
- **VITAMINS B AND C ARE SOLUBLE IN WATER, THE REST ARE SOLUBLE IN FAT.**
- **VARIOUS VITAMINS ARE USED IN DIFFERENT WAYS.**

IMPORTANCE OF VITAMINS

2

- **VITAMIN A** - LIVER, EGG YOLK, CARROTS, SPINACH, MILK
 - ❖ SYNTHESIZE RHODOPSIN GROWTH
 - ❖ CONTROL GROWTH OF EPITHELIUM
- **DEFICIENCY** LEADS TO HARDENING CONES OF THE EYE.
 - ❖ POOR NIGHT VISION
 - ❖ POOR RESISTANCE TO DISEASE

IMPORTANCE OF VITAMINS

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IMPORTANCE OF VITAMINS

3

- **VITAMIN B** - YEAST, WHOLE GRAIN, LIVER, KIDNEY, BEANS, MEAT, SPINACH
- USED IN FORMATION OF ENZYME CARBOXYLASE FOR CONVERTING PYRUVIC ACID IN RESPIRATION
- **DEFICIENCY** LEADS TO **BERI BERI**, **SLOW HEART BEAT** AND **INTESTINAL DISORDER**

ETC.. THE TABLE WILL BE PROVIDED

FACTORS DETERMINING ENERGY REQUIREMENTS IN HUMANS

- **AGE** - YOUNG CHILDREN HAVE MANY **ACTIVE DIVIDING CELLS** HENCE HAVE A HIGHER BMR. THEY ARE ALSO **PHYSICALLY ACTIVE**
- **GENDER** - MALES ARE **MUSCULAR AND ACTIVE** THAN FEMALES HENCE REQUIRE MORE ENERGY
- **STATE OF HEALTH** - SICK PEOPLE REQUIRE MORE ENERGY TO HELP **REMOVE TOXINS FROM THE PATHOGENS** OFF THEIR BODIES, AND ALSO **MANUFACTURE NEW CELLS** FROM ALREADY DESTROYED
- **OCCUPATION** - MANUAL WORK NEEDS MORE ENERGY

BALANCED DIET 1

- **DIET COMPRISING ALL TYPES OF FOOD IN THE RIGHT PROPORTIONS.**
- **IT CONSTITUTES PROTEINS, VITAMINS, LIPIDS, CARBOHYDRATES, MINERAL SALTS, WATER AND ROUGHAGE**
- **THERE ARE DISEASES THAT COME FROM LACK OF BALANCED DIET;**
- **EXAMPLE; #TABLE#**

BALANCED DIET 2

- **KWASHIAKOR** - IN CHILDREN
CAUSED BY LACK OF PROTEIN IN DIET
- **SIGNS AND SYMPTOMS** -
 - ❖ **SWOLLEN BELLY,**
 - ❖ **SCALY SKIN WITH RASHES,**
 - ❖ **WASTING OF MUSCLES IN LIMBS
AND AROUND **NECK,****
 - ❖ **HAIR LOSS,**
 - ❖ **ANAEMIA**
 - ❖ **MENTAL RETARDATION**

BALANCED DIET 3

- **TREATMENT - GIVE SUFFICIENT PROTEINS AND VITAMINS IF AVAILABLE.**

BALANCED DIET 4

- **MARASMUS** - CAUSED BY STARVATION EXCPECIALLY IN CHILDREN.
- **SIGNS AND SYMPTOMS** -
 - ❖ **SWOLLEN BODY**
 - ❖ **SKINNY**
 - ❖ **LARGE HEAD**
 - ❖ **DIARRHOEA**
 - ❖ **ANAEMIA**
 - ❖ **MENTAL RETARDATION**

BALANCED DIET 5

- **TREATMENT - GIVE SUFFICIENT FOOD AND BALANCED DIET.**

BALANCED DIET 6

- **CONSTIPATION - LOW ROUGHAGE IN THE BODY**
- **SIGNS AND SYMPTOMS -**
 - ❖ **RETENTION OF WASTE AND FAECES IN THE BODY**
 - ❖ **DISORDERS IN INTESTINES (ACHES)**

BALANCED DIET 7

- **TREATMENT - EAT ENOUGH ROUGHAGE**
- **VEGETABLES, FRUITS AND GRAINS**

BALANCED DIET 8

- **OBESITY** - THIS IS TAKING IN TOO MUCH FAT AND CARBOHYDRATE IN DIET
- ALSO CAUSED BY LACK OF PHYSICAL EXERCISE LEADING TO ACCUMULATION OF FATS IN THE BODY
- **SIGNS AND SYMPTOMS -**
 - ❖ THE PERSON RISK HAVING HIGH BLOOD PRESSURE
 - ❖ PERSON DISPLAYS LAZINESS FOR OR IN EXERCISE
 - ❖ MAY DEVELOP HEART DISEASE

BALANCED DIET 9

- **TREATMENT** - EAT FOOD LESS OF FATS AND CARBOHYDRATES

❖ DO PHYSICAL EXERCISE

END OF FORM 1

