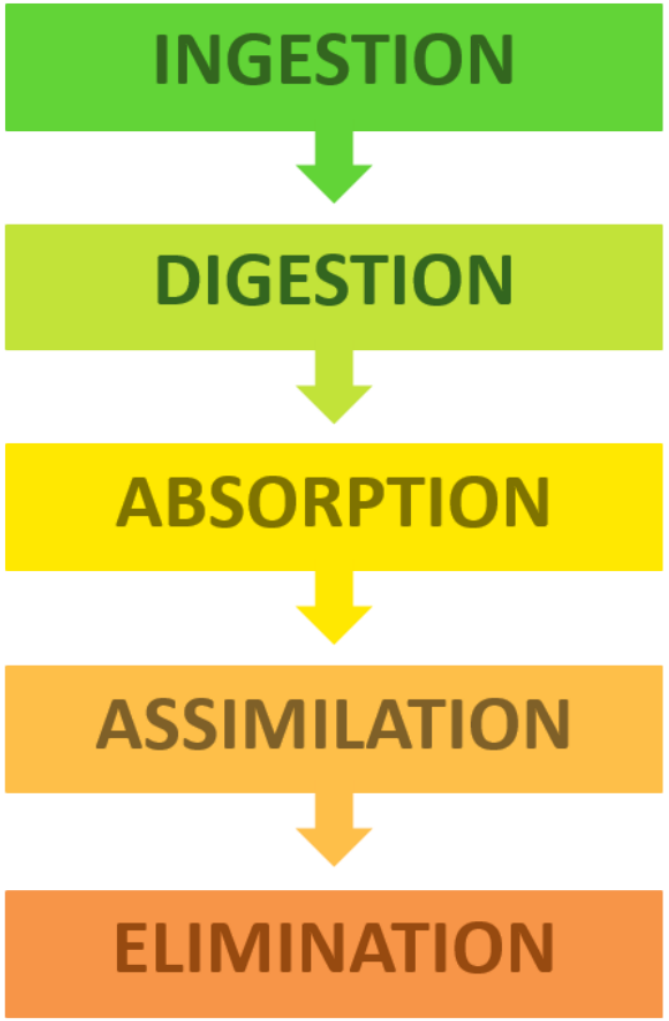
CHAPTER

6.1 Digestive System

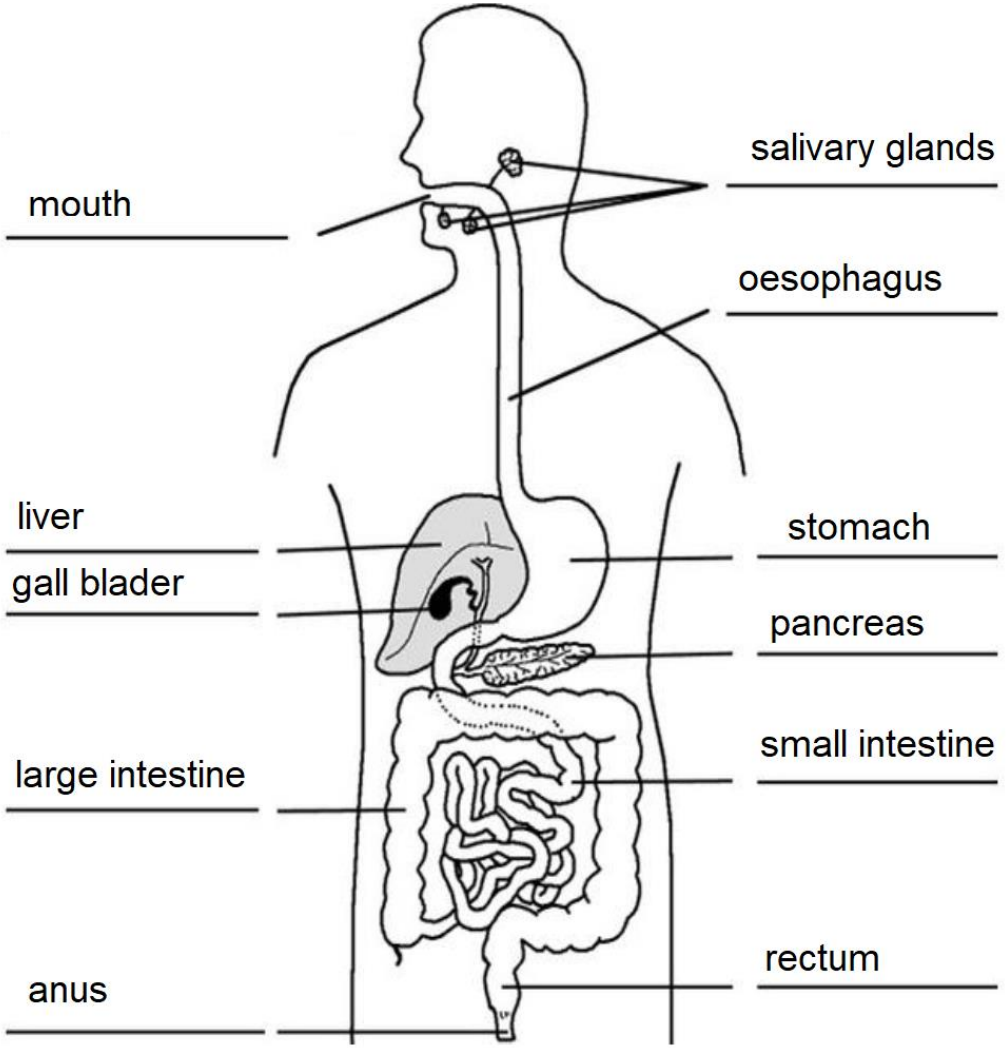
FOOD PROCESSING



THE HUMAN DIGESTIVE SYSTEM

Label the worksheet about the human digestive system.

THE HUMAN DIGESTIVE SYSTEM

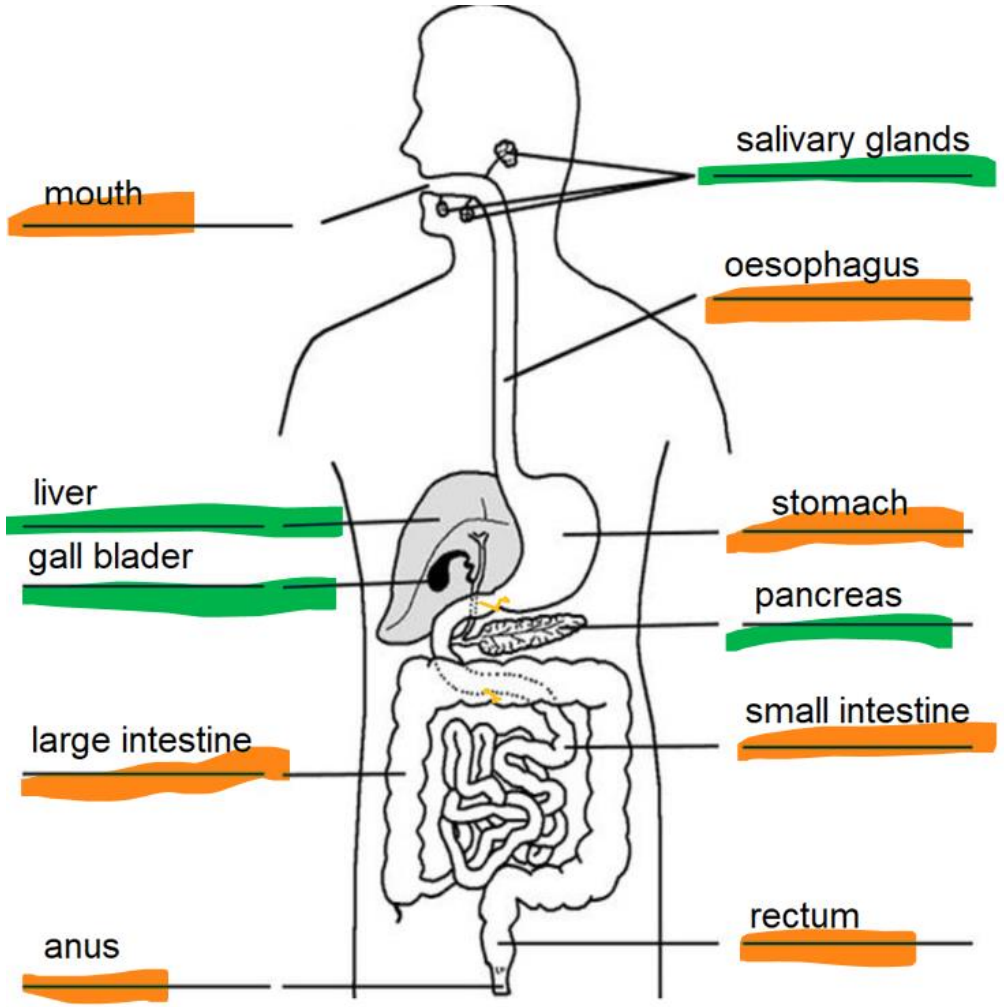


ALIMENTARY CANAL VS ACCESSORY ORGANS

Underline organs that belong to the *alimentary canal* (food passes through these organs) orange.

Underline organs that belong to the *accessory organs* (aid in digestion, food does not pass through these organs) green.

ALIMENTARY CANAL VS ACCESSORY ORGANS



STRUCTURE AND FUNCTION OF THE DIGESTIVE SYSTEM

Oesophagus: Tube connecting oral cavity to stomach

- Food is mixed (with saliva) into a bolus and moved via peristalsis

Stomach: Temporary storage tank

- Releases digestive juices and maintains a highly acidic environment

Small Intestine: Absorbs usable food substances (nutrients)

- Consists of three sections – the duodenum, jejunum and ileum

Large Intestine: Absorbs water and dissolved minerals

- Converts undigested material into a semi-solid faeces for excretion

STRUCTURE AND FUNCTION OF THE DIGESTIVE SYSTEM

Salivary Glands: Releases saliva to moisten food

- Includes parotid gland, submandibular gland and sublingual gland

Pancreas: Produces digestive enzymes and hormones

- Enzymes are released into the small intestine via the duodenum

Liver: Converts absorbed materials into usable chemicals

- Roles include detoxification, metabolism, storage and bile production

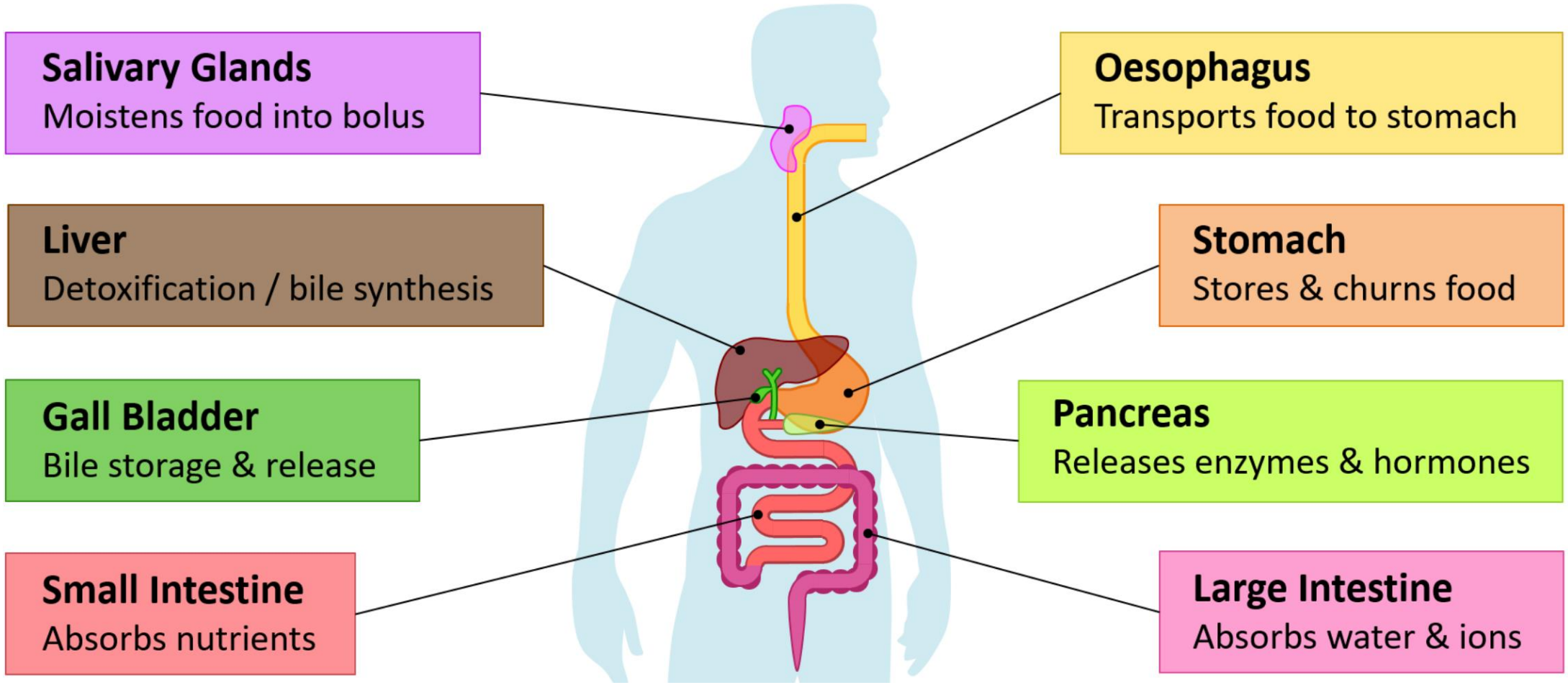
Gall Bladder: Stores and releases bile (produced by liver)

- Bile salts are released via the bile duct and are used to emulsify fats

DRAWING OF A HUMAN DIGESTIVE SYSTEM

Draw a labelled diagram of a human digestive system

DRAWING OF A HUMAN DIGESTIVE SYSTEM



DRAWING OF A HUMAN DIGESTIVE SYSTEM:

PRO-Tips:

- stomach = J-shaped bag + connected to oesophagus and small intestine

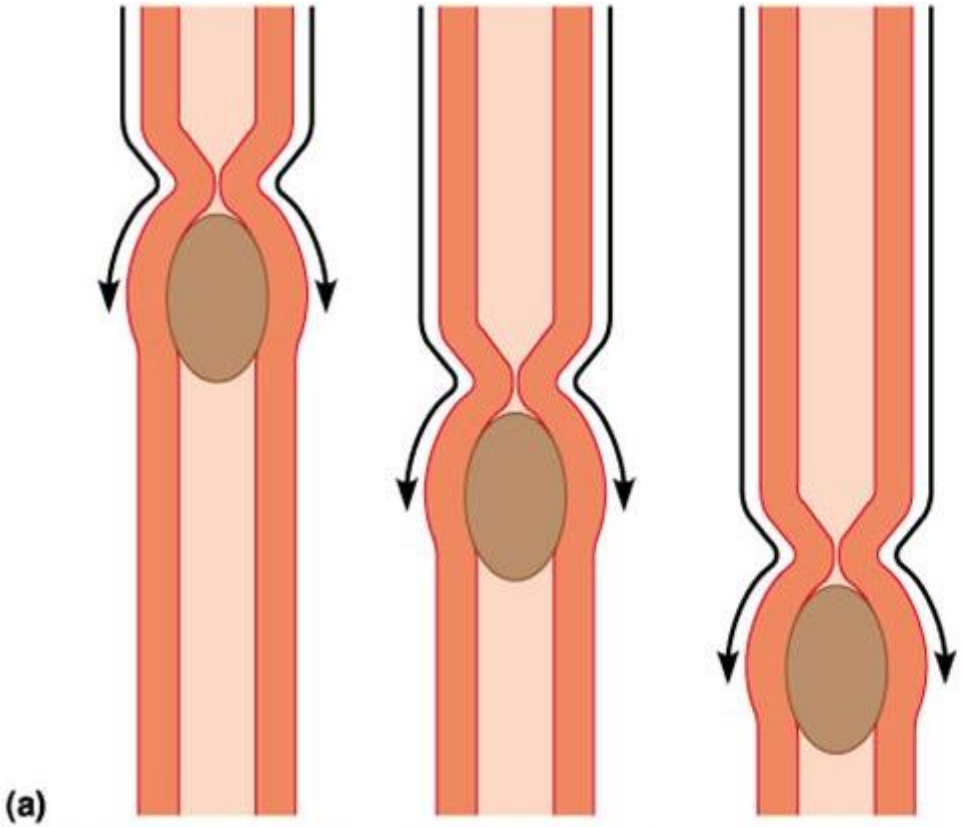
- liver = right-angled triangle + superimposed to the left of stomach

- bile duct + pancreatic duct = feed into u shaped bend of small intestine

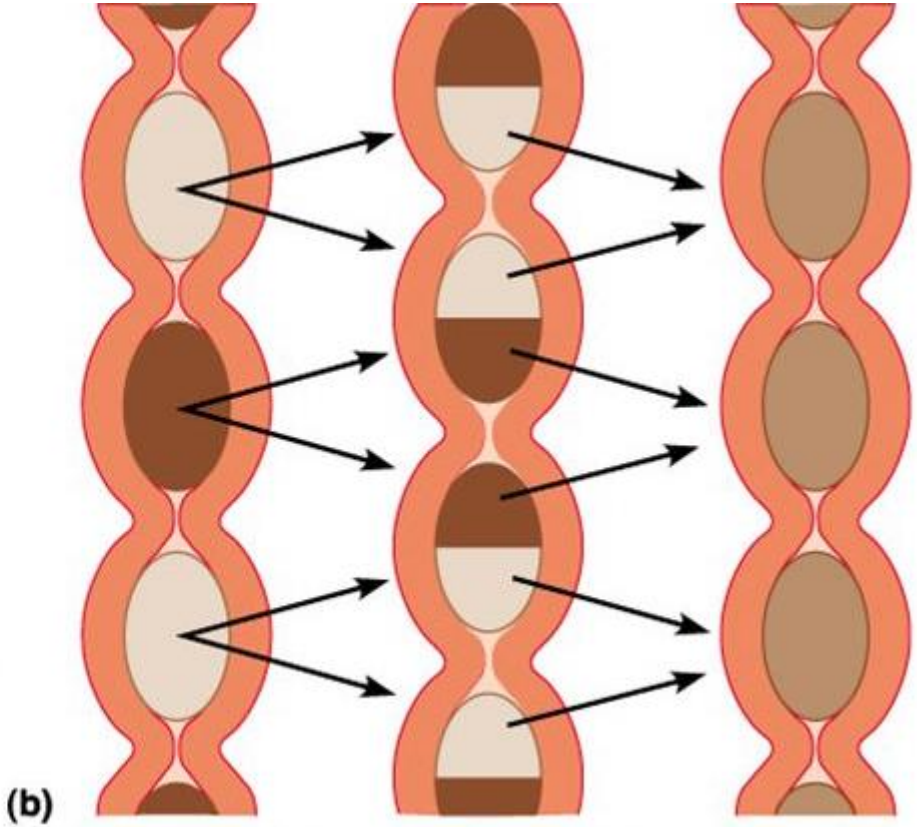
- small intestine = thinner than large intestine

DIGESTIVE MOVEMENTS

Peristalsis



Segmentation



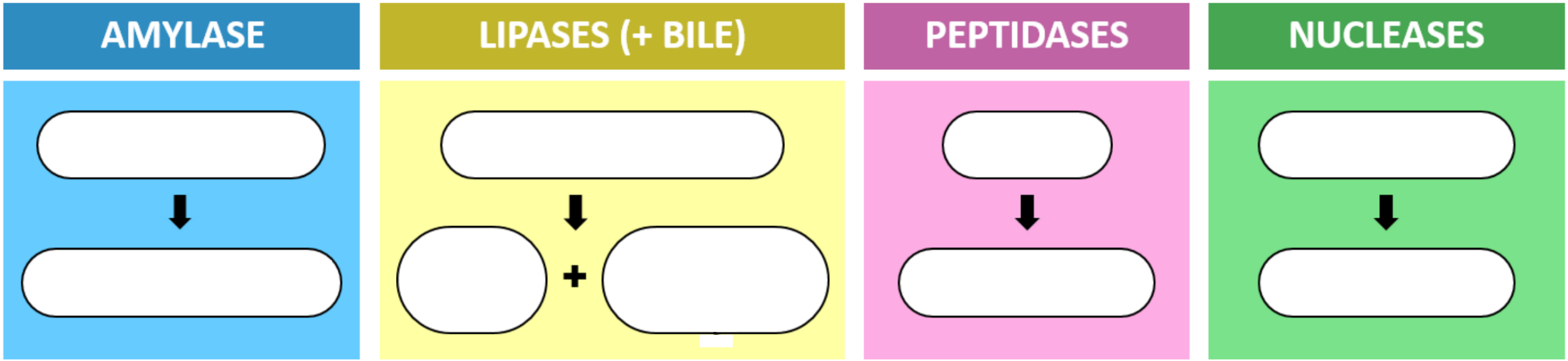
PROCESS OF DIGESTION

Mechanical:

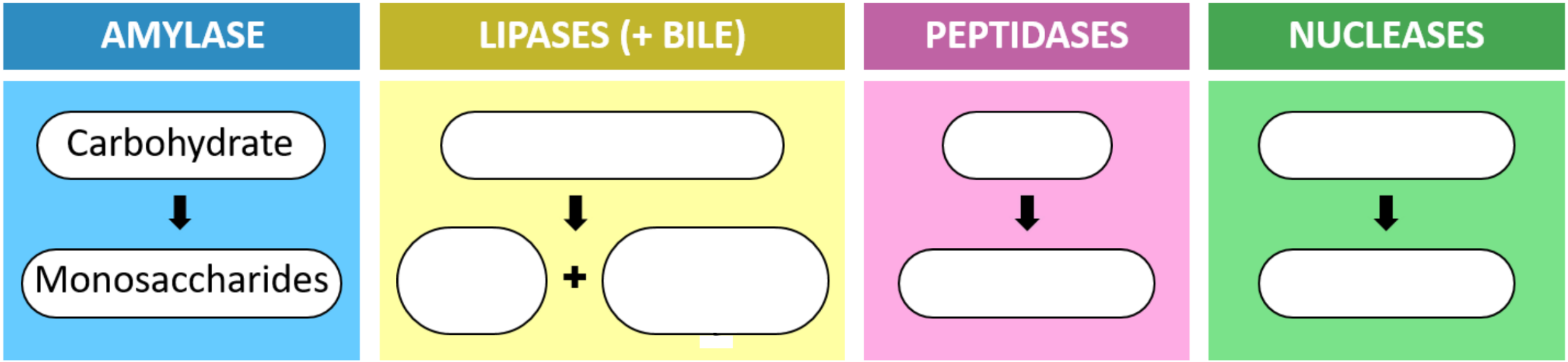
Vs

Chemical

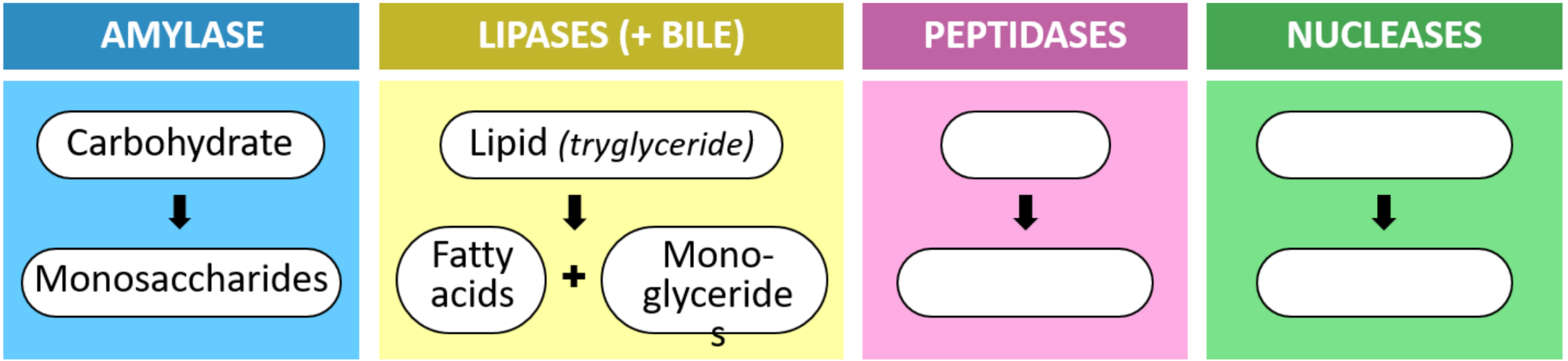
DIGESTIVE ENZYMES



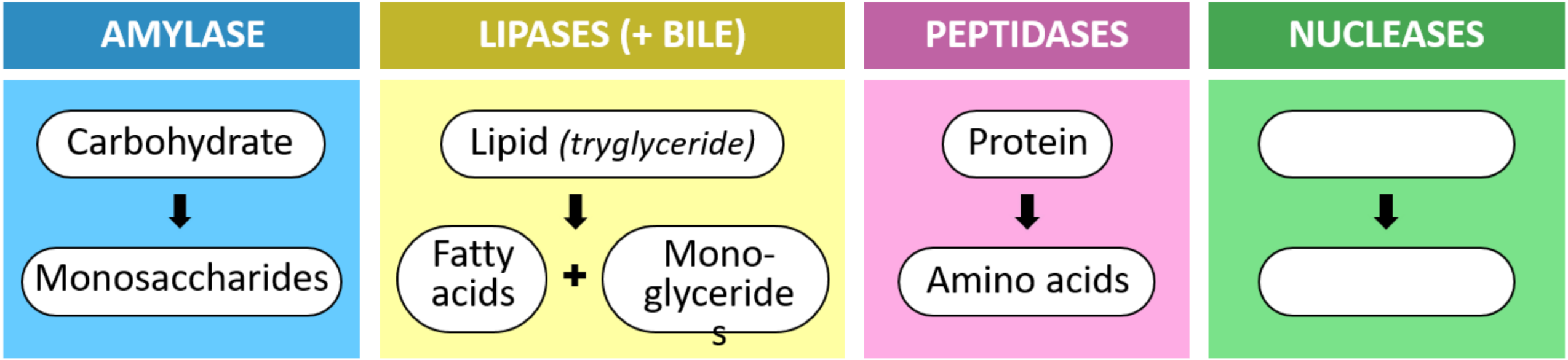
DIGESTIVE ENZYMES



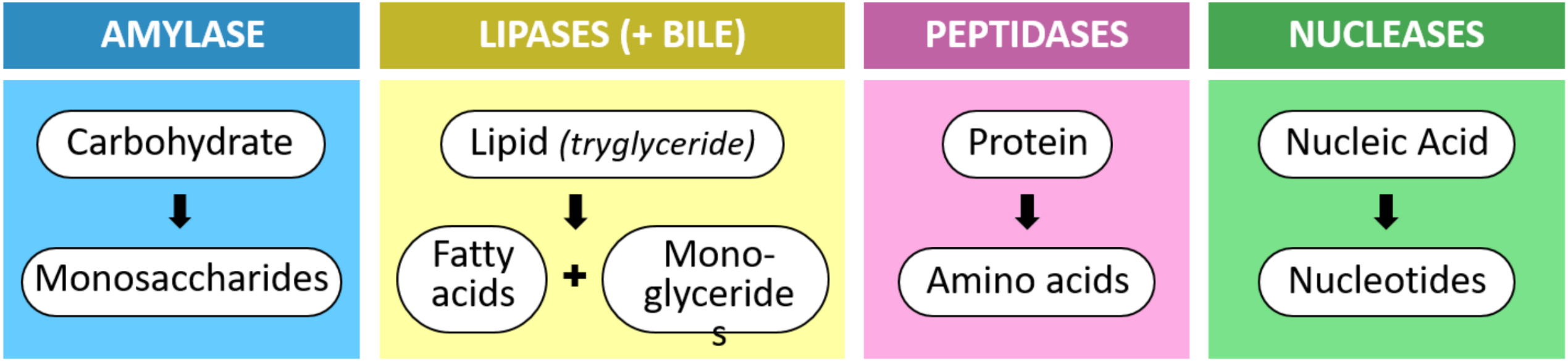
DIGESTIVE ENZYMES



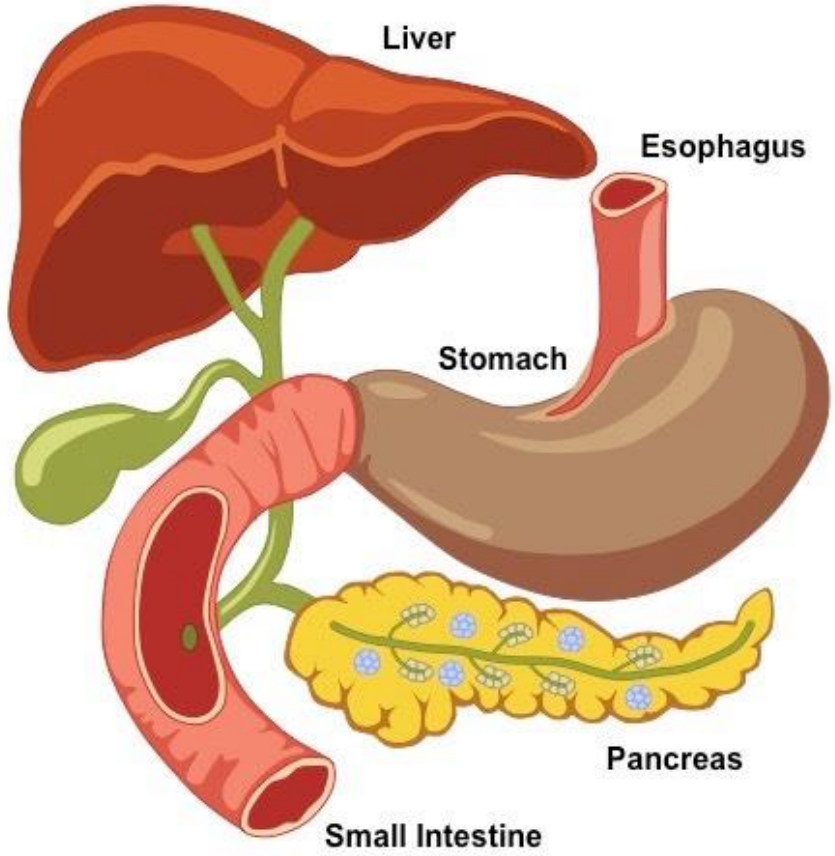
DIGESTIVE ENZYMES



DIGESTIVE ENZYMES



LOCATION OF ENZYMATIC DIGESTION



Esophagus
- Salivary amylase *(starch → maltose)*

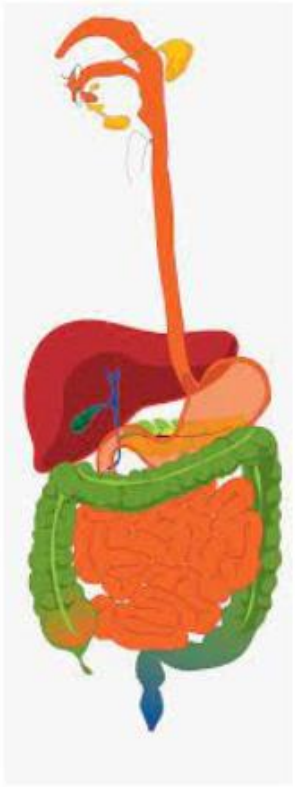
Stomach
- Proteases *(protein → polypeptides)*
- Stomach acids *(chemical digestion)*

Liver / Gall Bladder
- Bile salts *(emulsification of lipids)*

Pancreas
- Amylase *(starch → maltose)*
- Lipase *(triglycerides → fatty acids)*
- Endopeptidase *(peptides → amino acids)*
- Nuclease *(DNA / RNA → nucleosides)*
- Bicarbonate ions *(neutralise stomach acid)*

Small Intestine
- Membrane-bound enzymes *(e.g. maltase)*

WHO WOULD WIN?



The extremely complex and highly evolved human digestive system

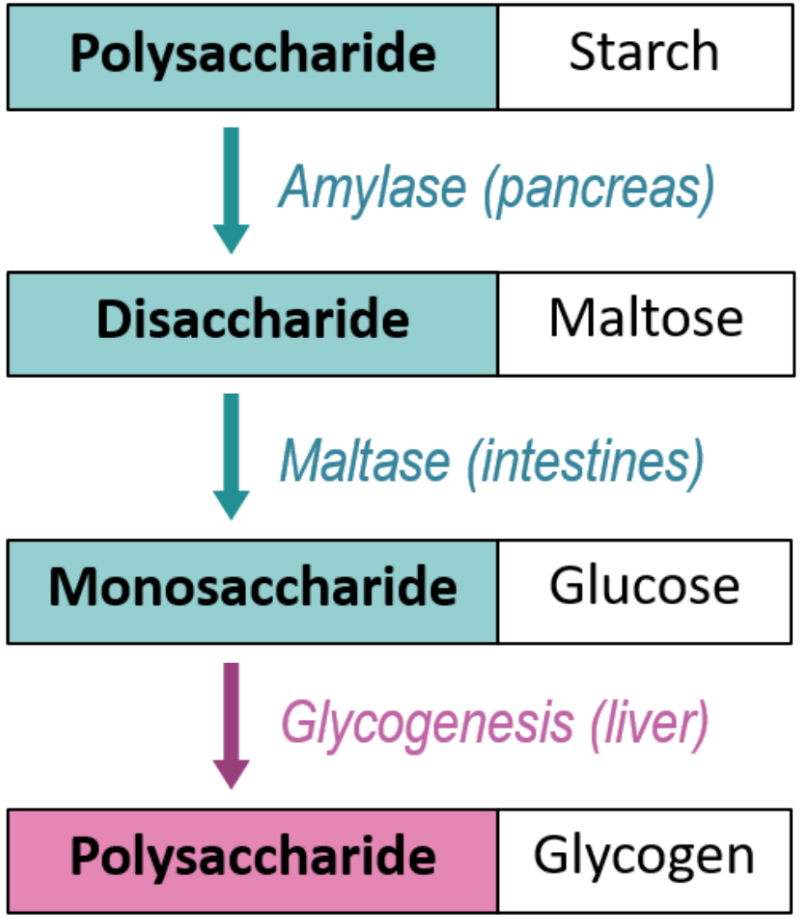
One 4 a.m.
Chili's Kebap

PRAL

CARBOHYDRATE DIGESTION

Starch is main polysaccharide in human diets.

Amylose vs Amylopectin



PROTEIN DIGESTION

Proteases vs zymogens

Active vs inactive

Protease	Site of Synthesis	Precursor	Activation Method	Site of Use
Pepsin	Stomach *(chief cells)*	Pepsinogen	Hydrochloric Acid	Stomach
Trypsin	Pancreas *(acinar cells)*	Trypsinogen	Enterokinase	Intestine

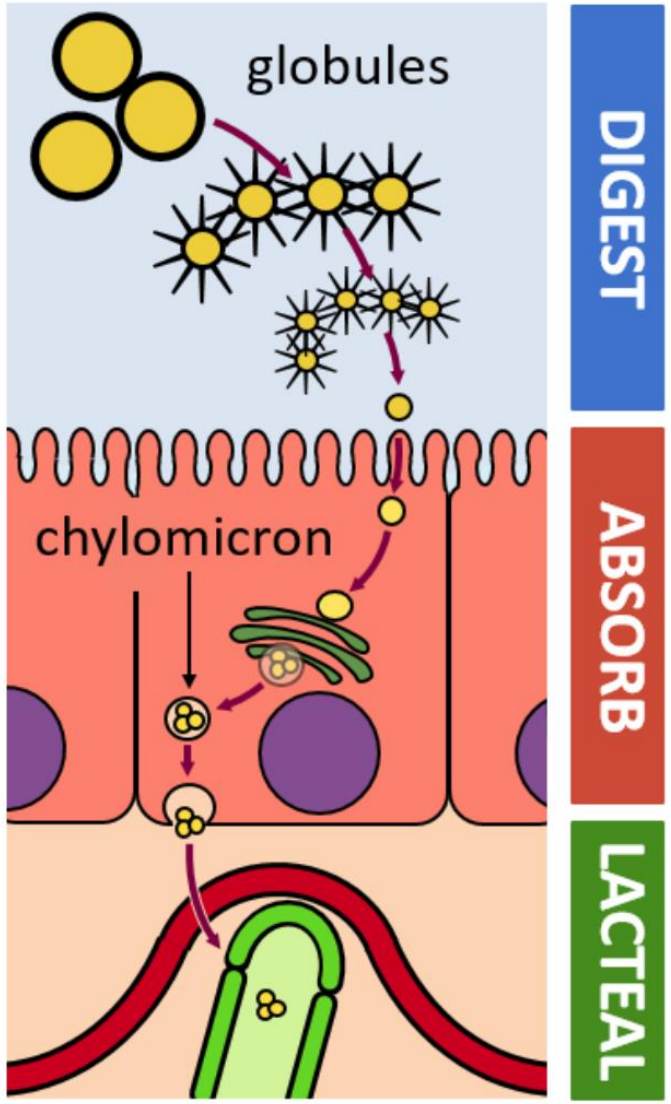
LIPID DIGESTION

Lipid = insoluble in water → proteins needed → transported in blood

Lipid globules → emulsified by bile salts → chemically digested by lipases

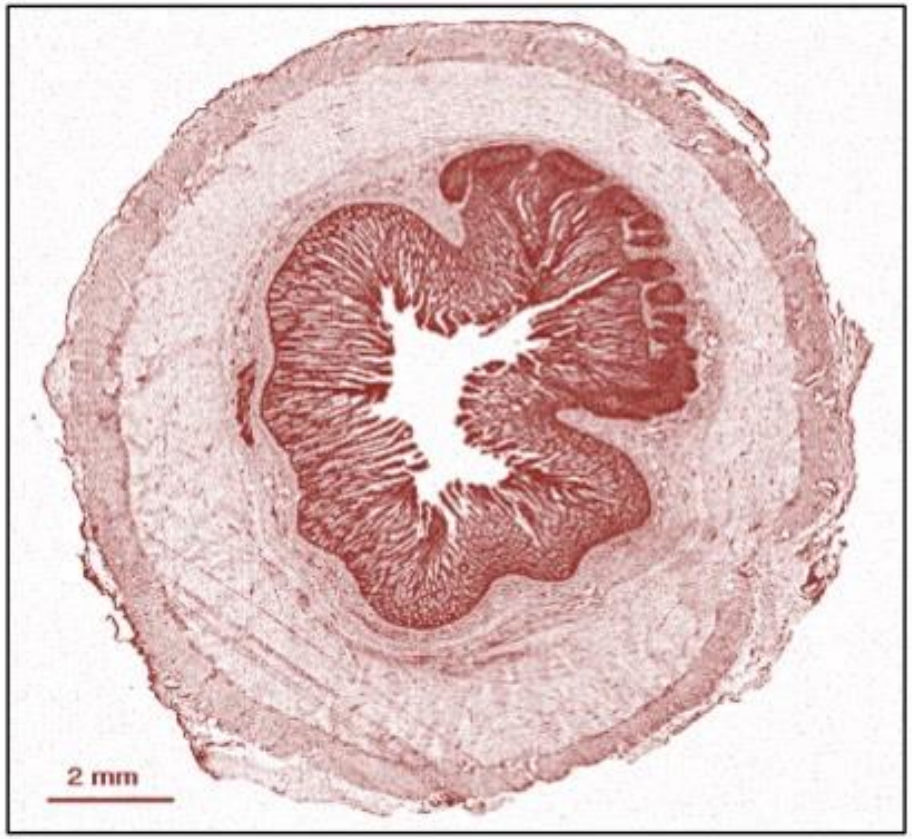
Components combined with protein → chylomicrons → transported to liver

Liver → chylomicrons into soluble lipoproteins



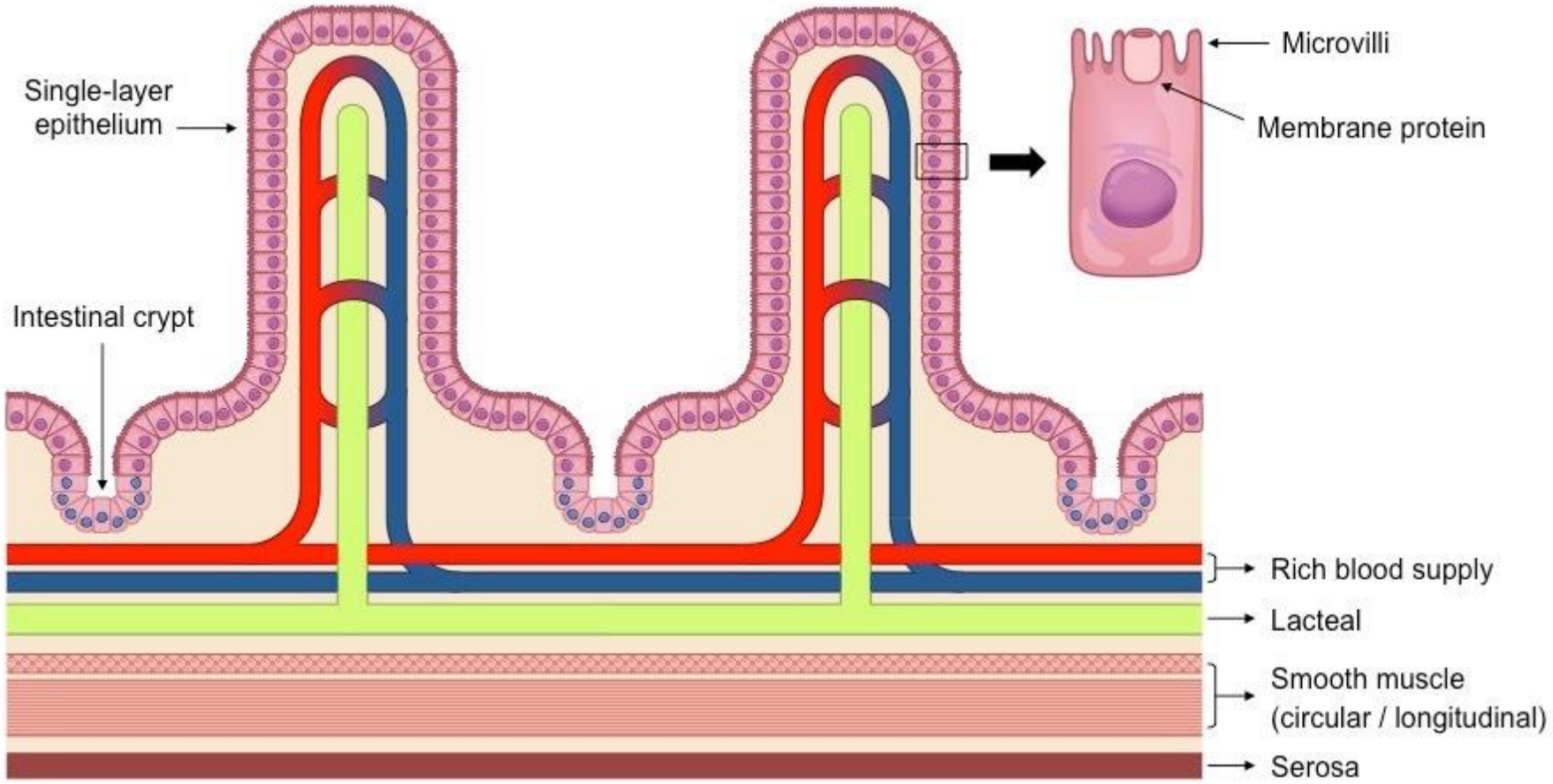
SMALL INTESTINE

Transverse Cross Section



Longitudinal Cross Section

FEATURES OF INTESTINAL VILI



REVISION: MEMBRANE TRANSPORT

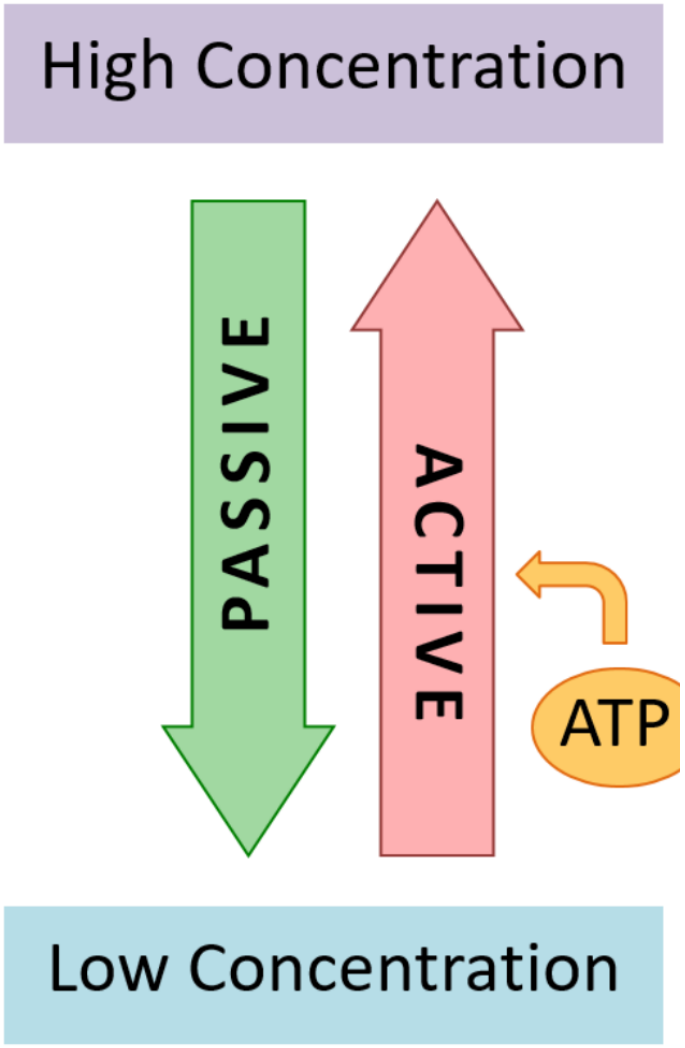
TYPES OF MEMBRANE TRANSPORT

Passive Transport:

- involves movement along a concentration gradient
- does NOT require energy in form of ATP

Active Transport:

- involves movement against a concentration gradient
- requires energy in form of ATP



PASSIVE TRANSPORT

Three main types of passive transport:

Simple Diffusion:

- small or lipophilic molecules can freely cross the plasma membrane

Facilitated Diffusion:

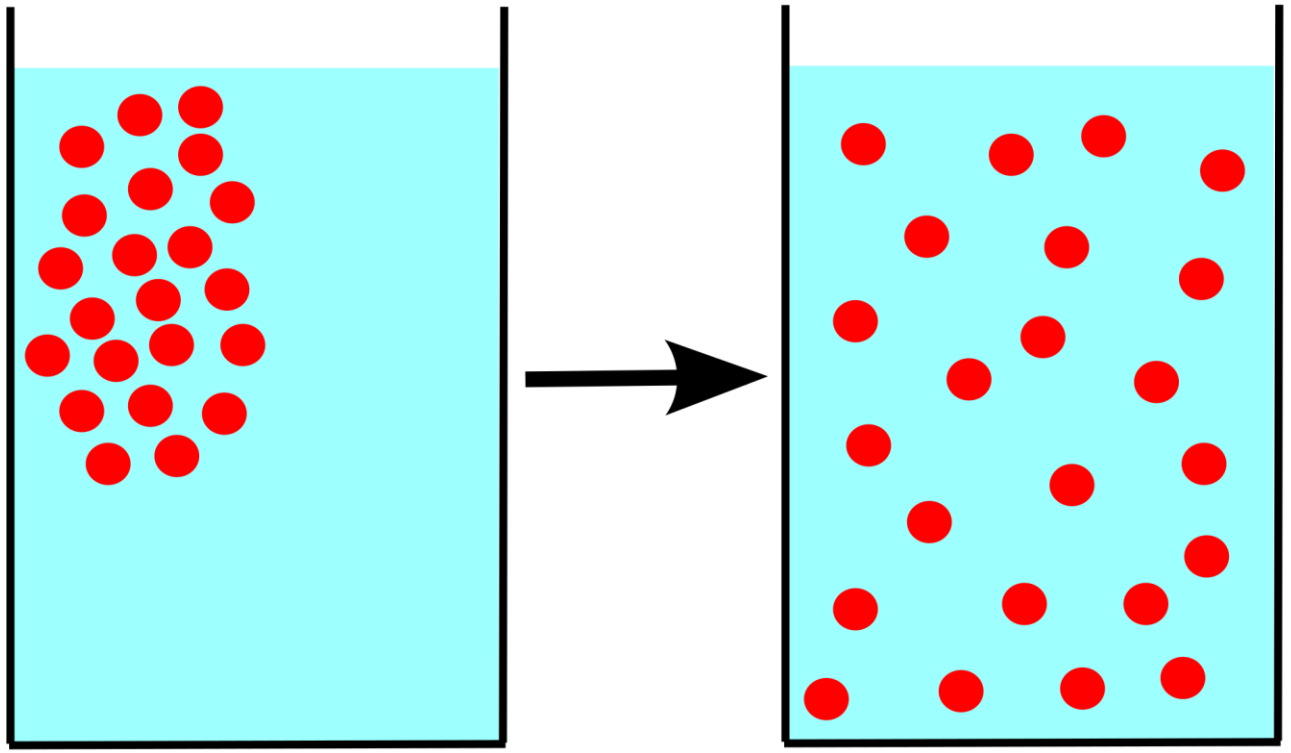
- large or charged molecules require transport via membrane proteins

Osmosis:

- Water movement → depending on relative solute concentration

SIMPLE DIFFUSION

The net movement of particles from a region of high concentration to a region of low concentration (along a concentration gradient) until equilibrium is reached.



FACILITATED DIFFUSION

Certain substances cannot freely cross a plasma membrane (e.g. ions).

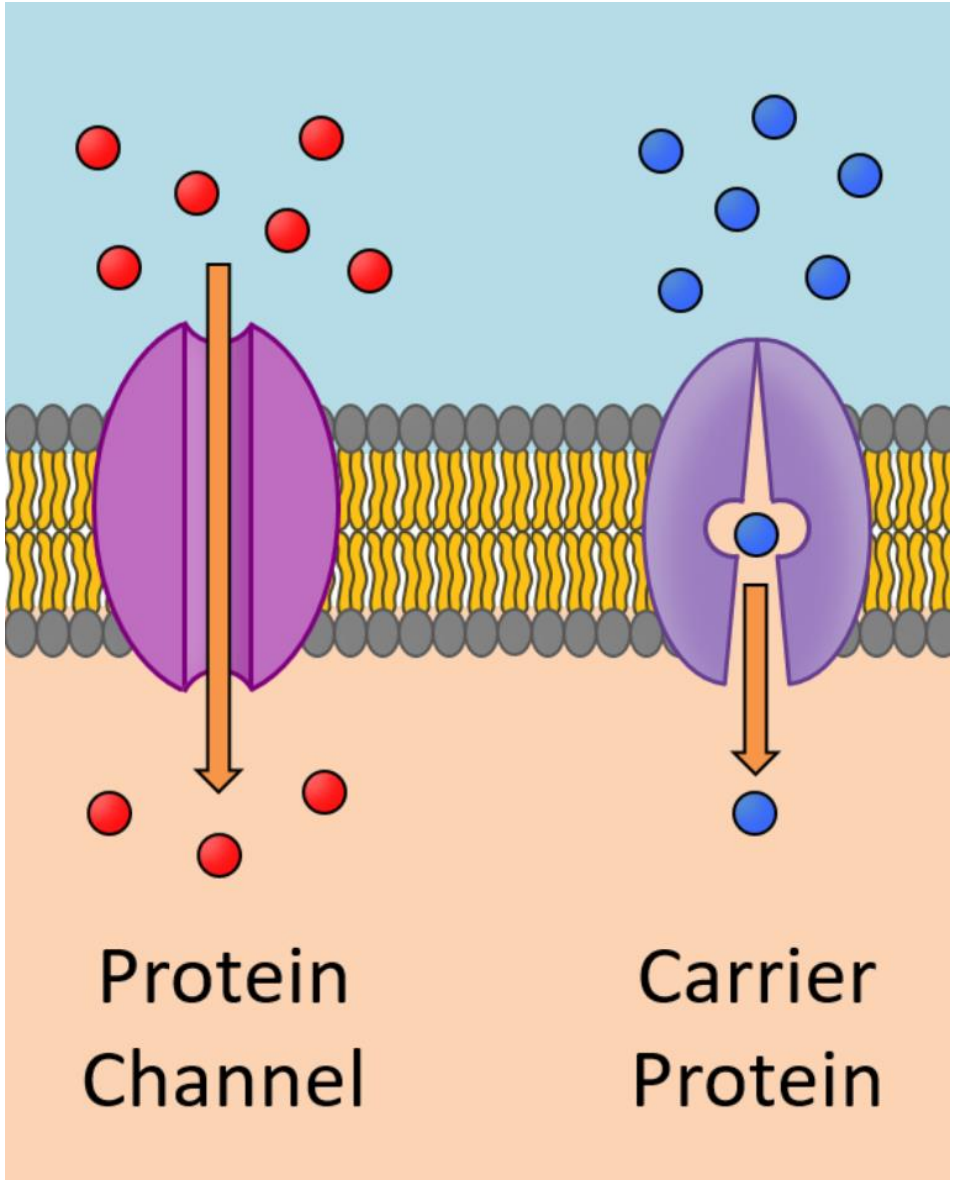
Membrane proteins facilitate their transport.

Protein channles:

hydrophilic pores → allow passage of ions

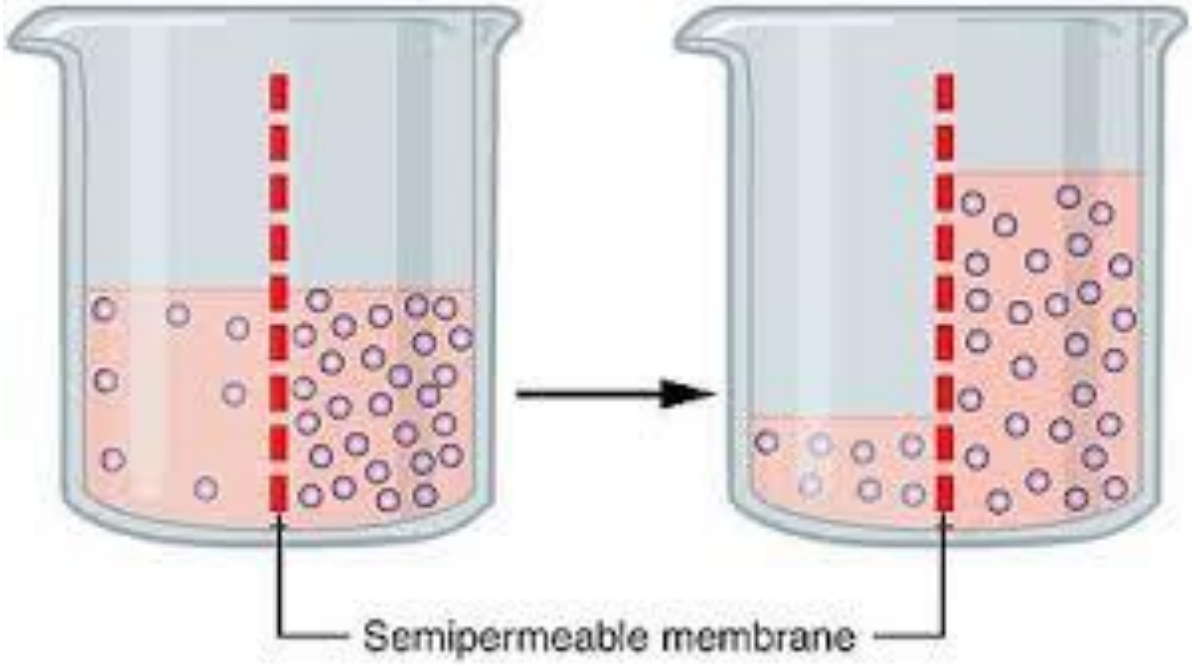
Carrier proteins:

conformational change → translocation



OSMOSIS

The net movement of free water molecules across a semi-permeable membrane from a region of low solute concentration to a region of high solute concentration.



ACTIVE TRANSPORT

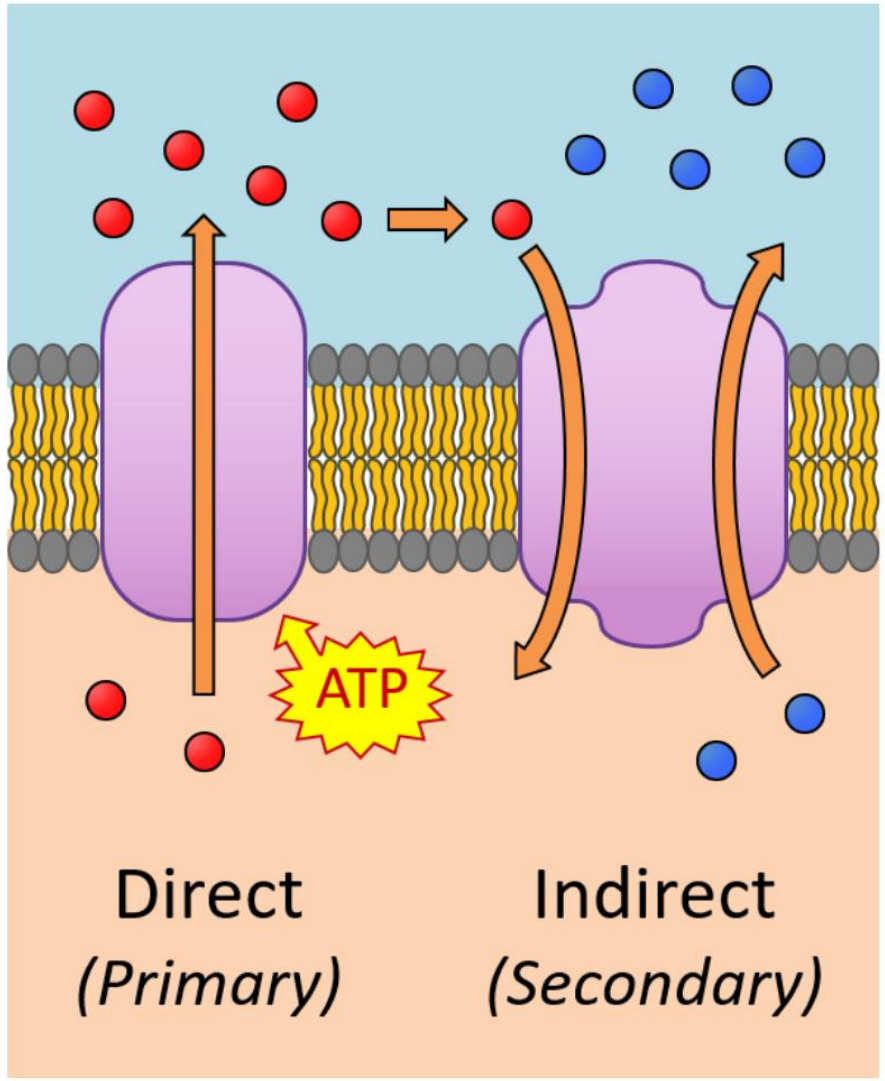
uses energy to transport molecules AGAINST concentration gradient (low → high)

Direct Active Transport (Primary):

- ATP hydrolysis → transport

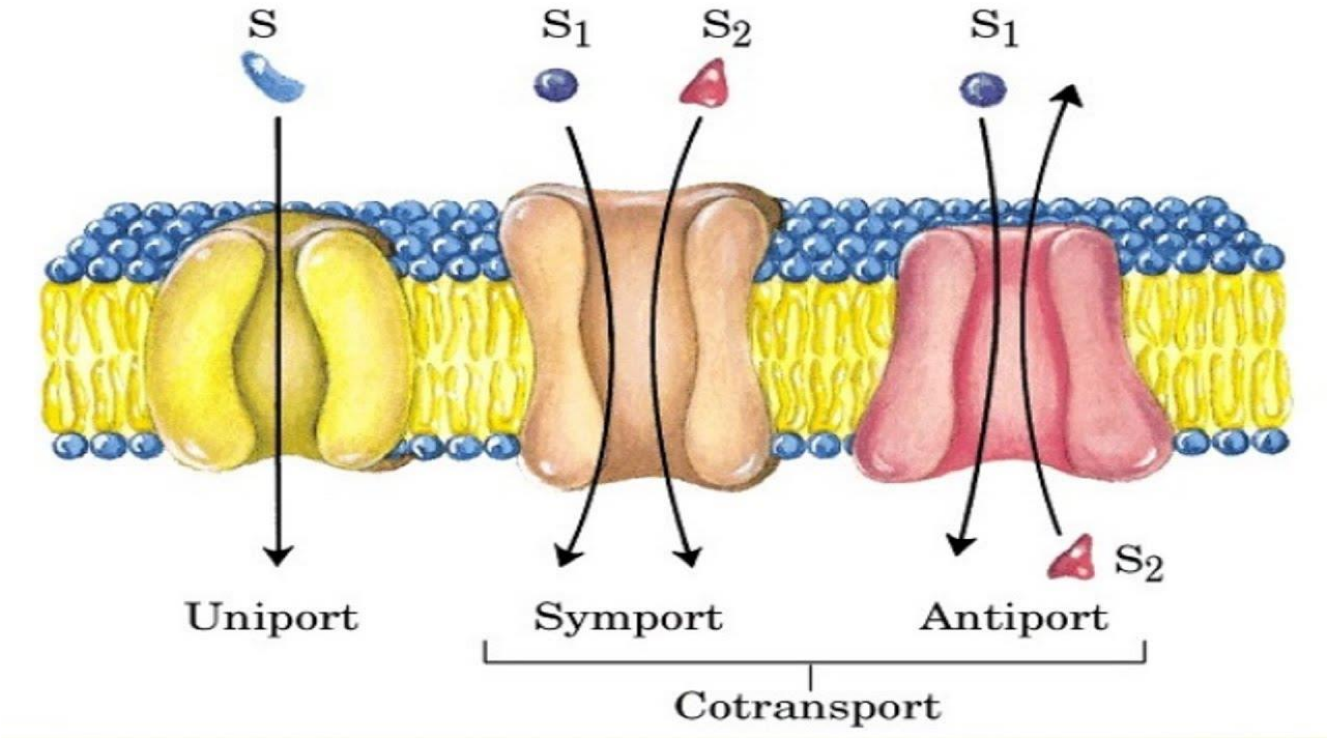
Indirect Active Transport (Secondary):

- transport coupled to another molecule moving along an electrochemical gradient (=cotransport)

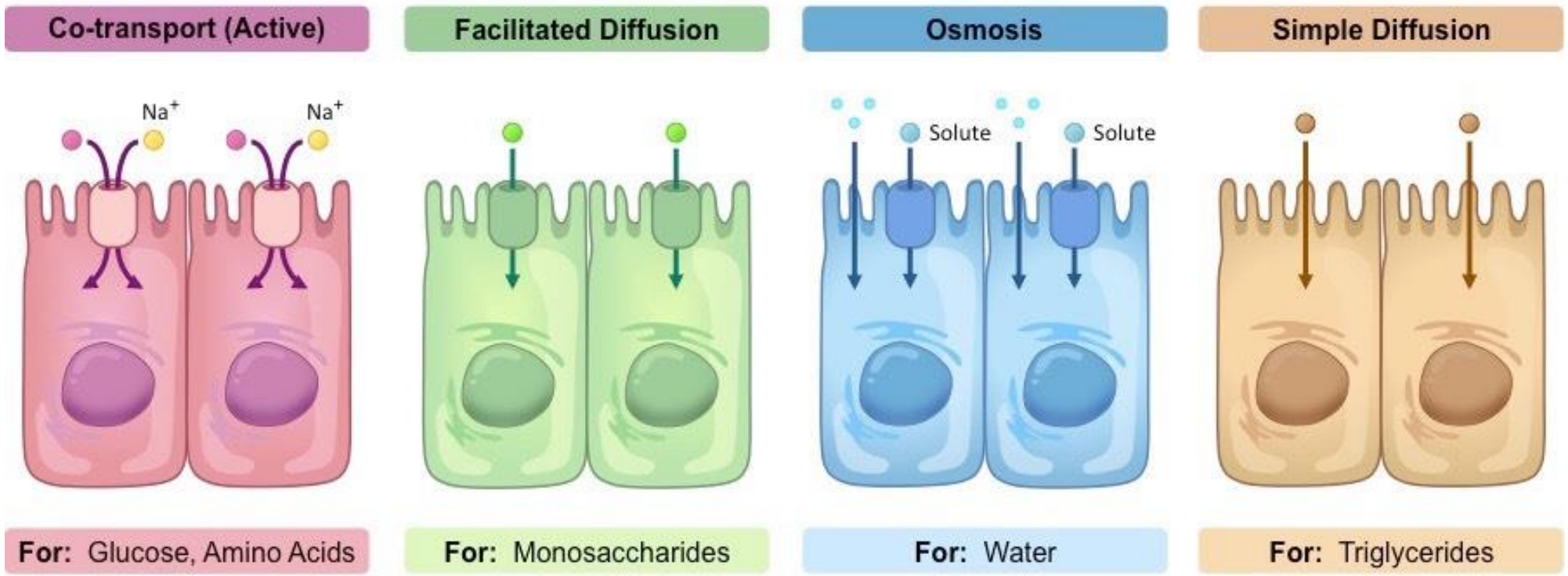


ACTIVE TRANSPORT

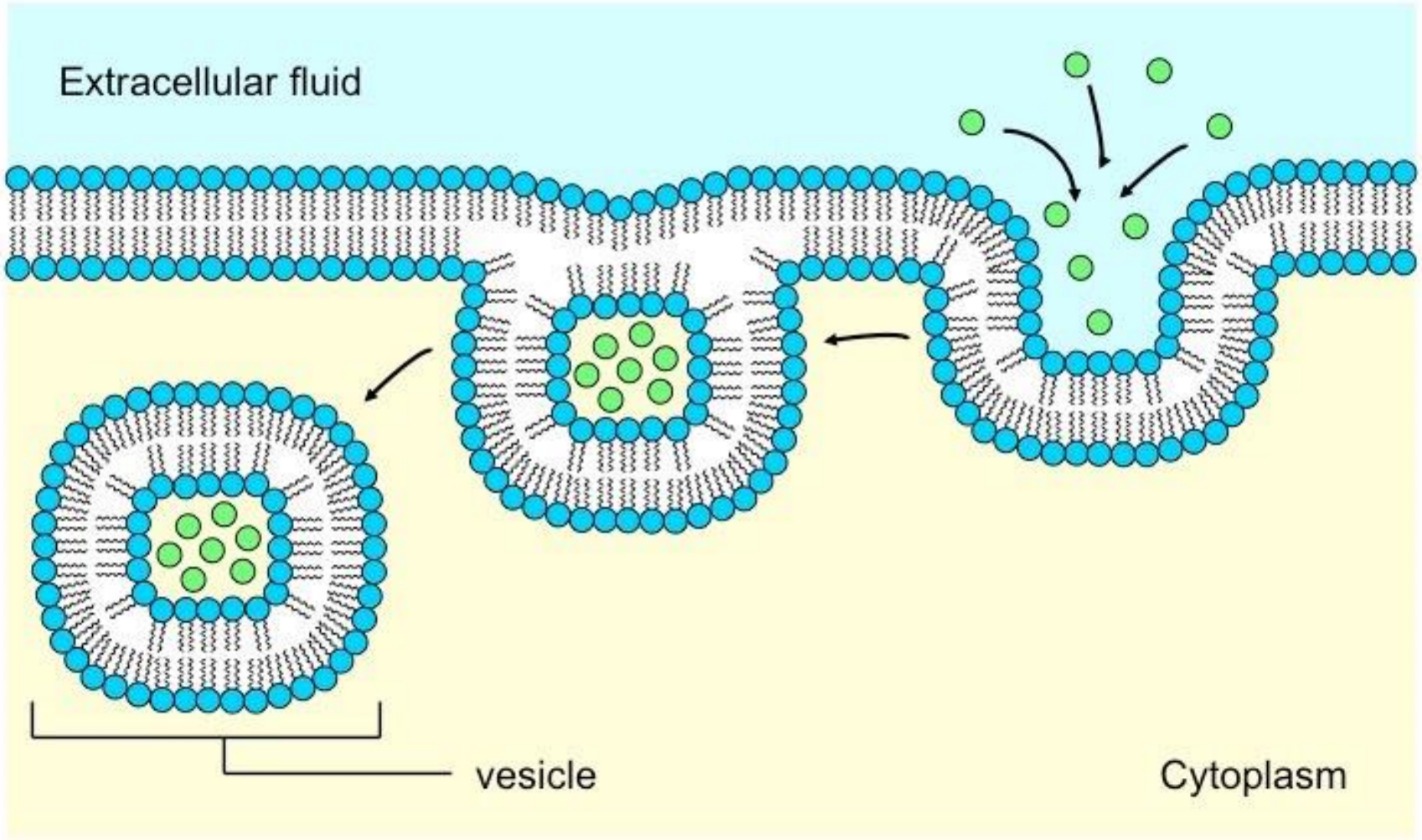
Active Transport uses energy from the hydrolysis of ATP to pump molecules against the concentration gradient.



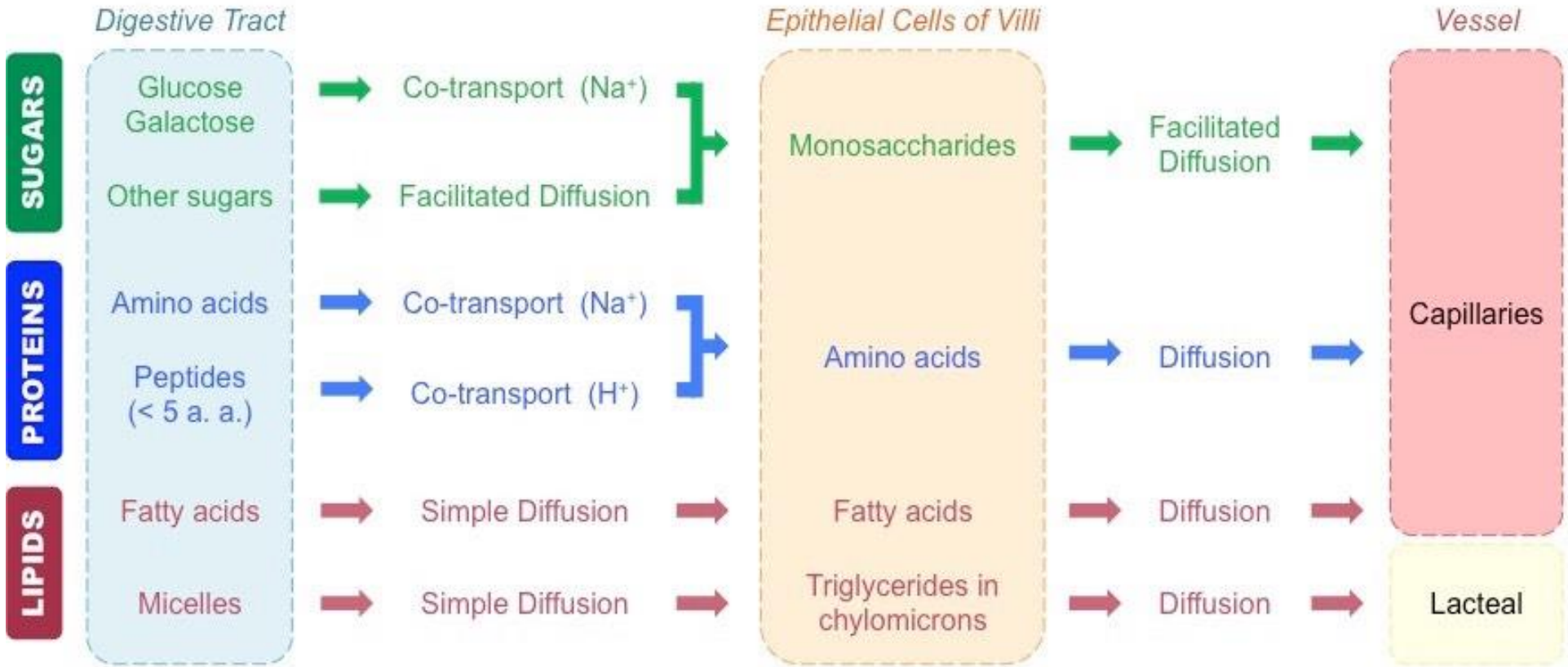
DIGESTIVE SYSTEM: MEMBRANE TRANSPORT



REVISION: BULK TRANSPORT



ABSORPTION MECHANISMS:



ABSORPTION AND ASSIMILATION

Food material broken down via digestion --> absorbed into bloodstream --> transported to cells (via liver) for assimilation.

Liver stores and metabolizes nutrients --> regulates chemical composition

Nutrients mainly absorbed in small intestine, water and minerals in large intestine

Absorption --> movement of fluid (or dissolved substance) across membrane

Assimilation --> Conversion of nutrients into a fluid or solid part of an organism