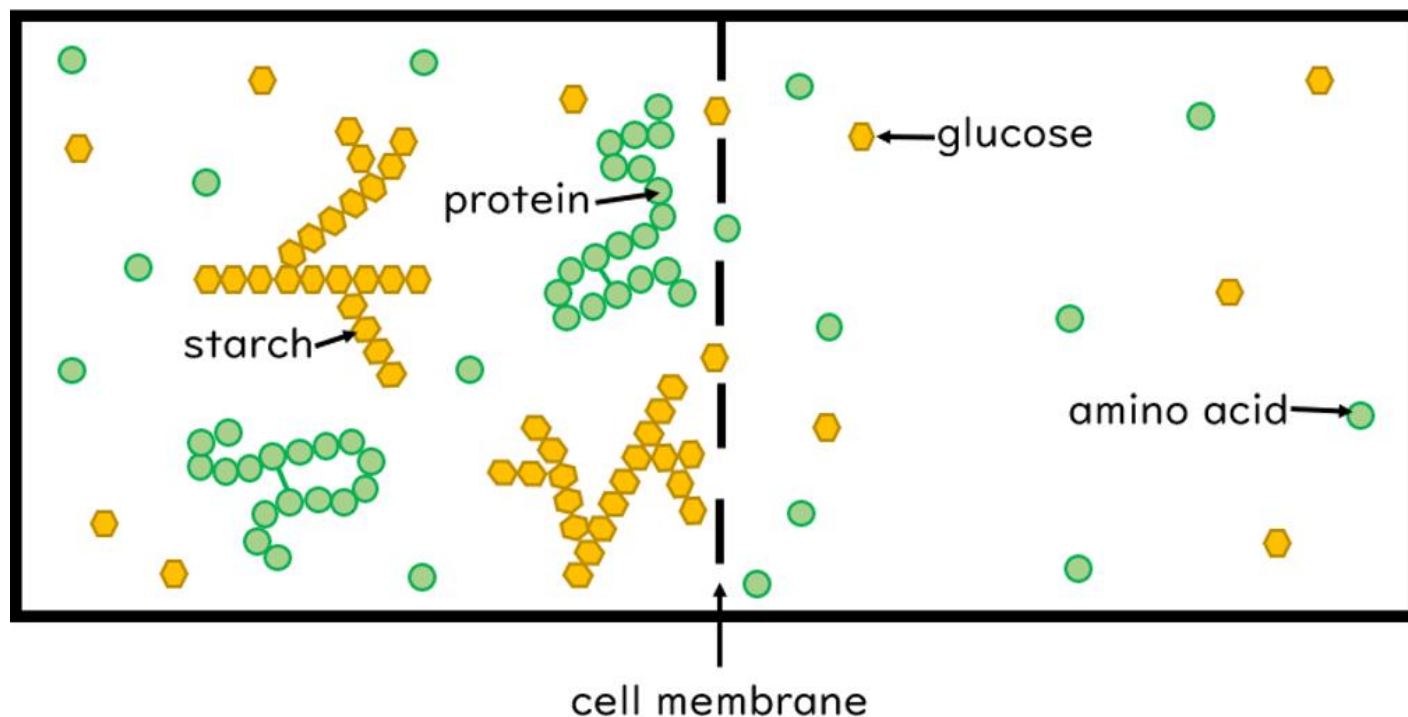
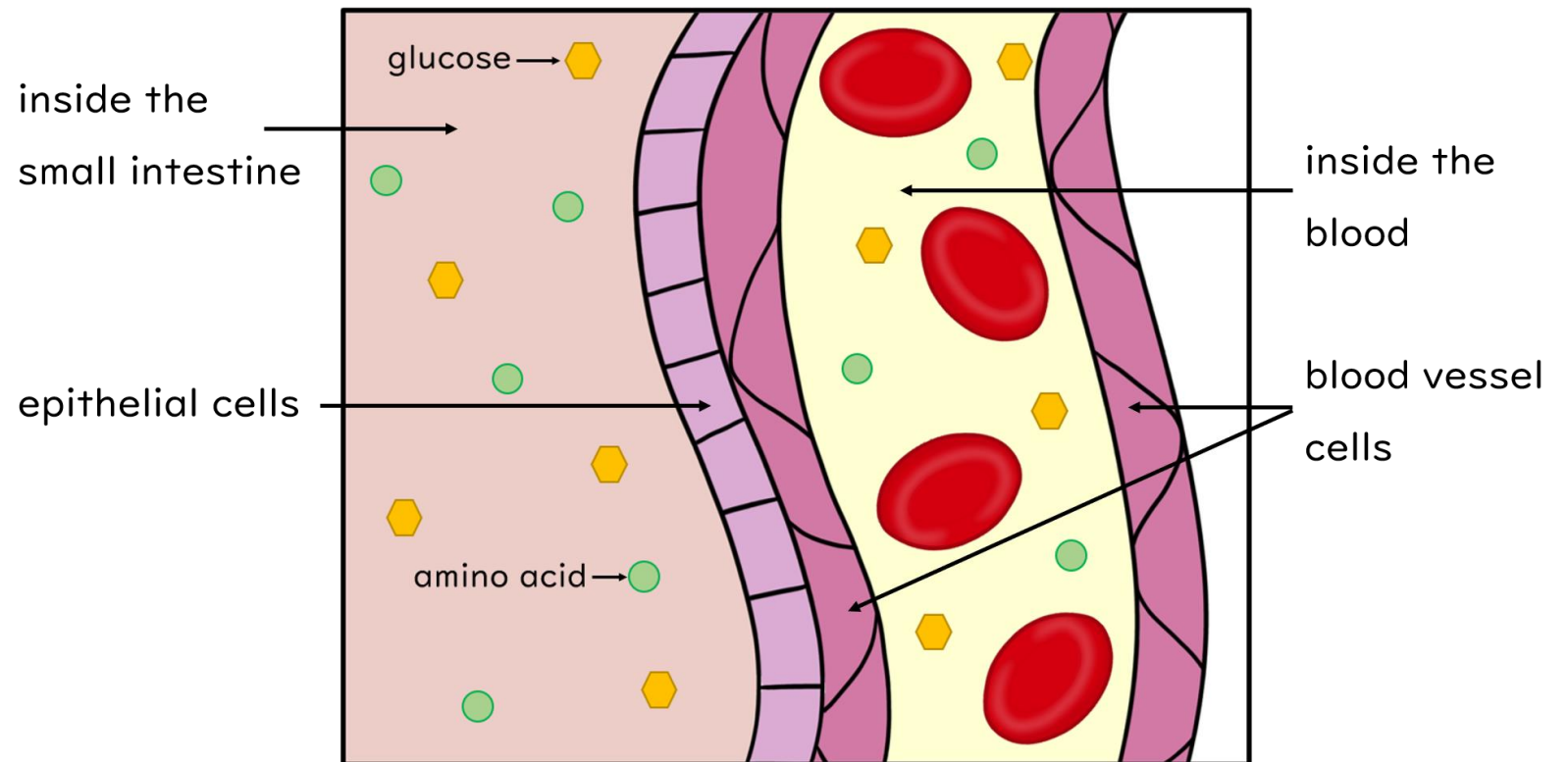


Recap: small intestine

Nutrients from food have to be absorbed from the inside of the small intestine and into the blood.

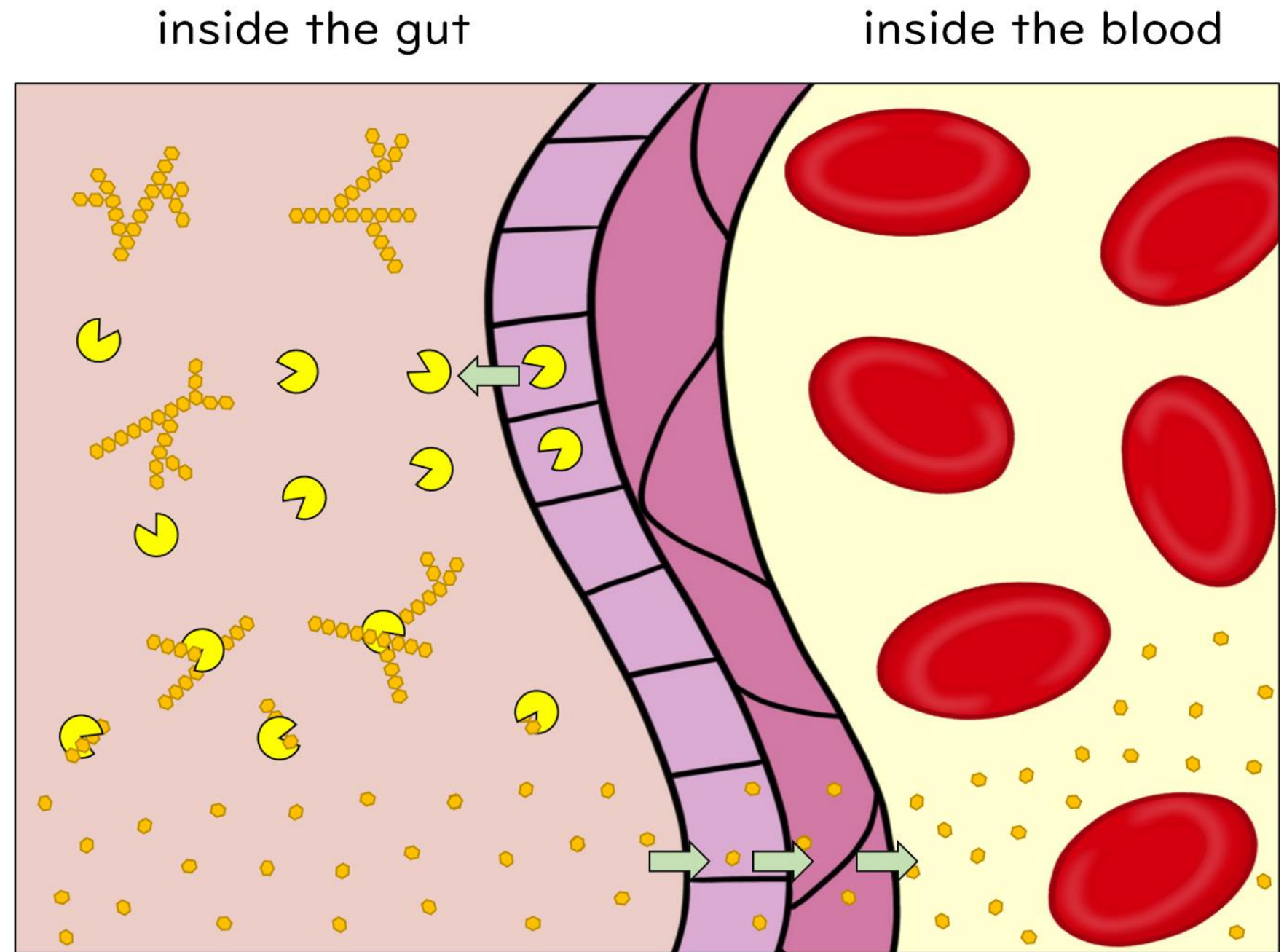


Starch, fats and proteins are large molecules. In order to be absorbed they must be broken down into smaller components.

This breakdown is done by special proteins called **enzymes**.

Enzymes are made by the cells and secreted into the gut where they mix with food.

1. Large nutrients in the gut cannot be absorbed.
2. Cells lining the gut secrete enzymes which mix with food.
3. The enzymes break the large nutrients down into smaller components.
4. The small molecules can pass into the blood.



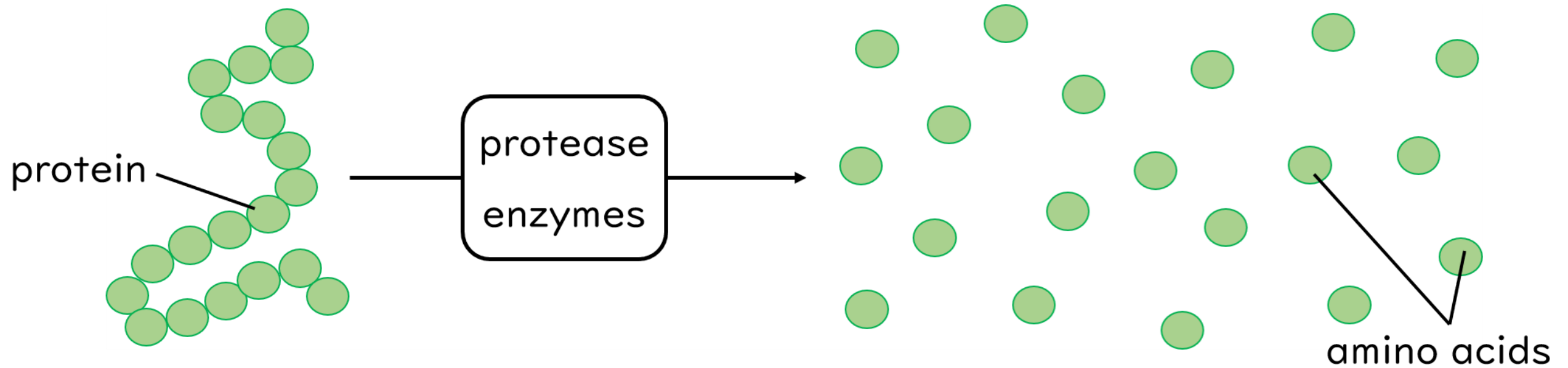
Enzymes are specific. An enzyme which breaks down starch cannot also break down fats. There are a few different digestive enzymes to learn about in this course.

Prior knowledge check:

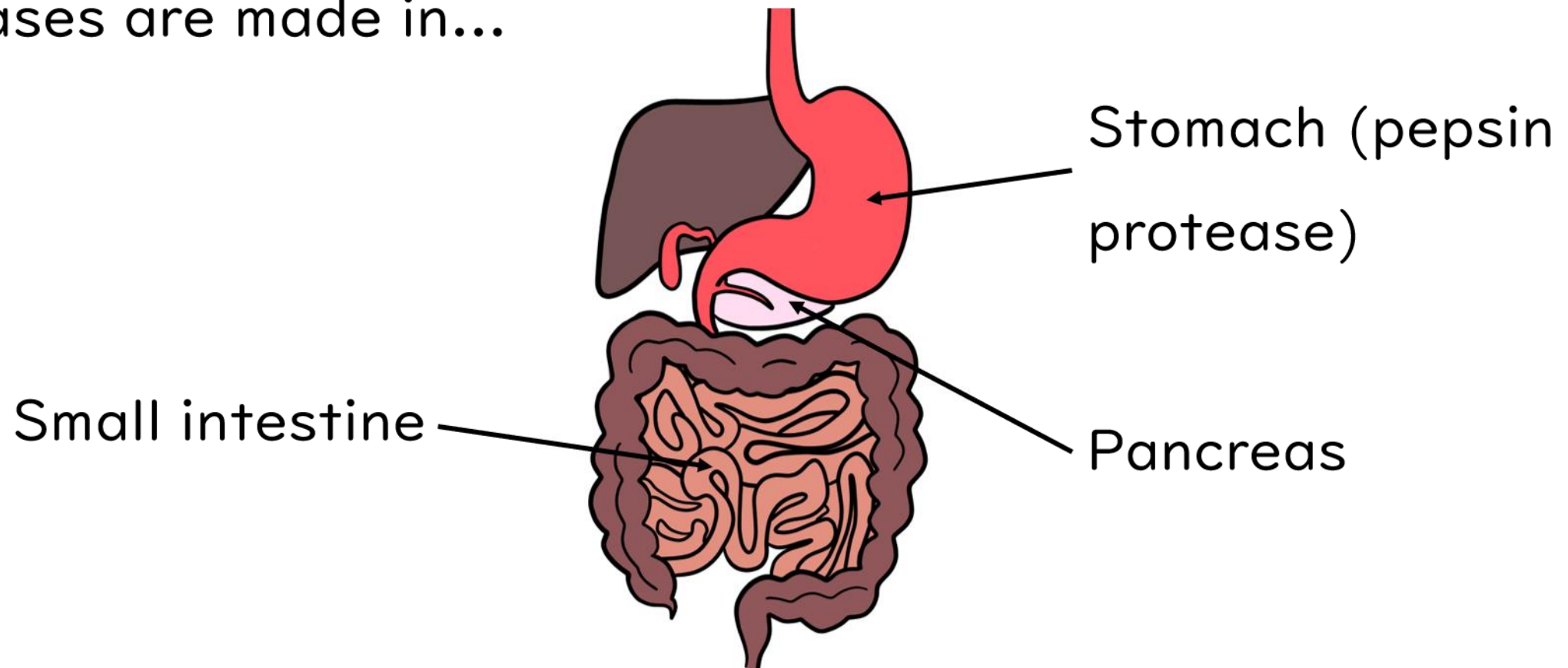
What are some examples of types of enzyme?

- Proteases (e.g. pepsin)
- Lipases
- Carbohydrases (e.g. amylase)

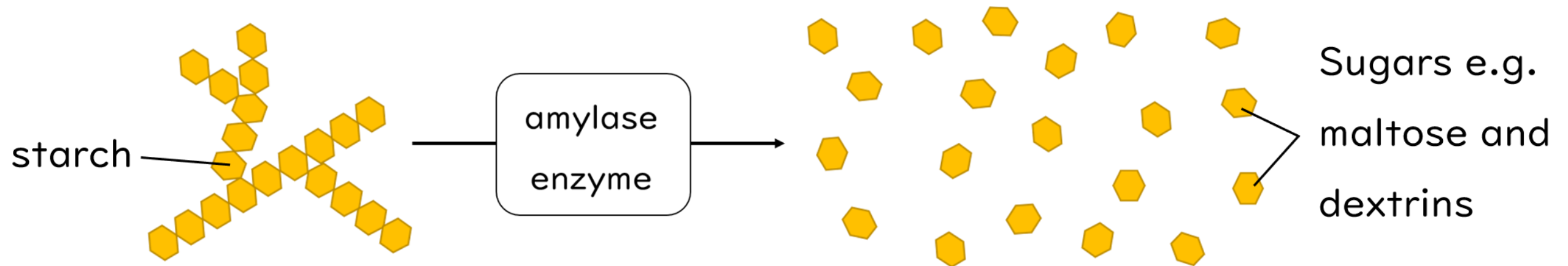
Proteases convert proteins into amino acids.



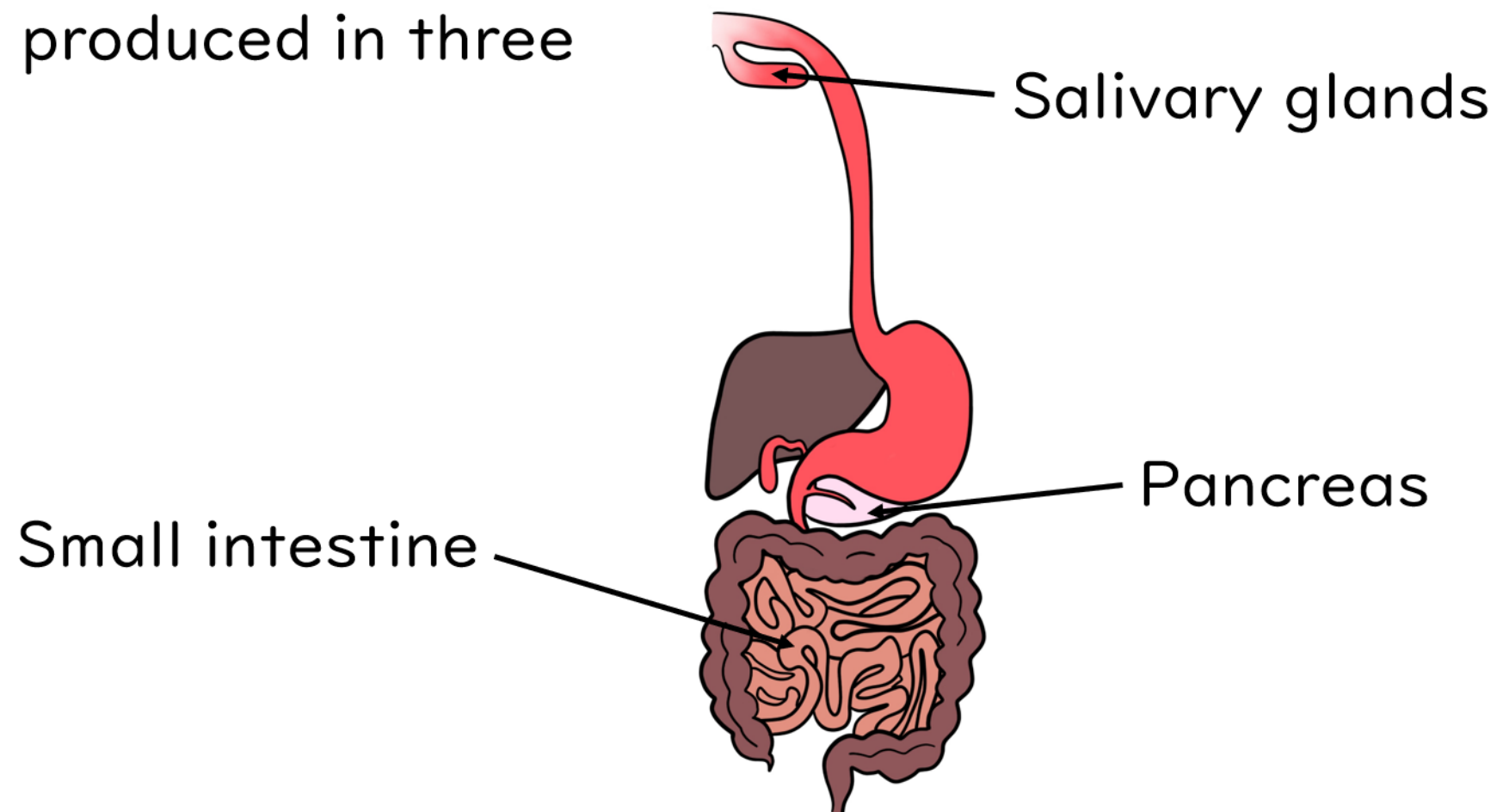
Proteases are made in...



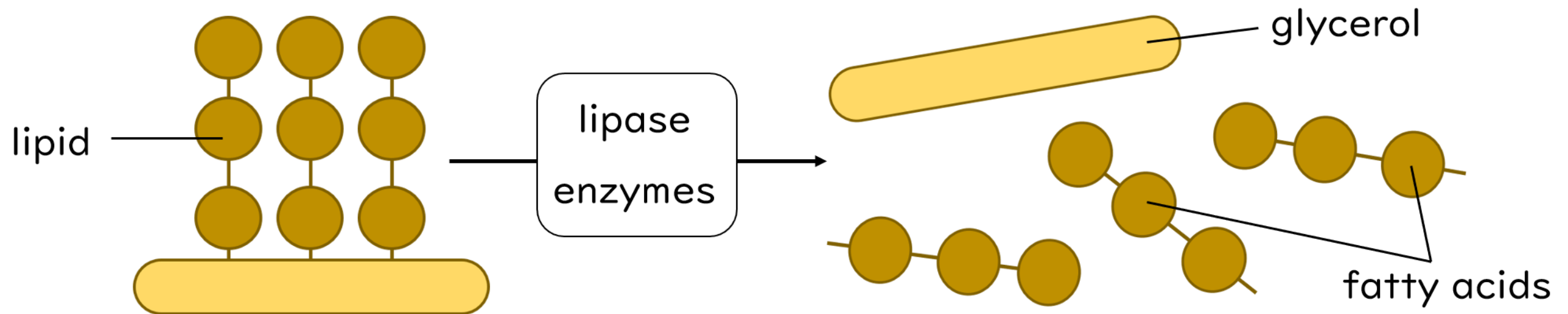
Carbohydrases convert carbohydrates into simple sugars, e.g. amylase which converts the carbohydrate starch into maltose and other sugars.



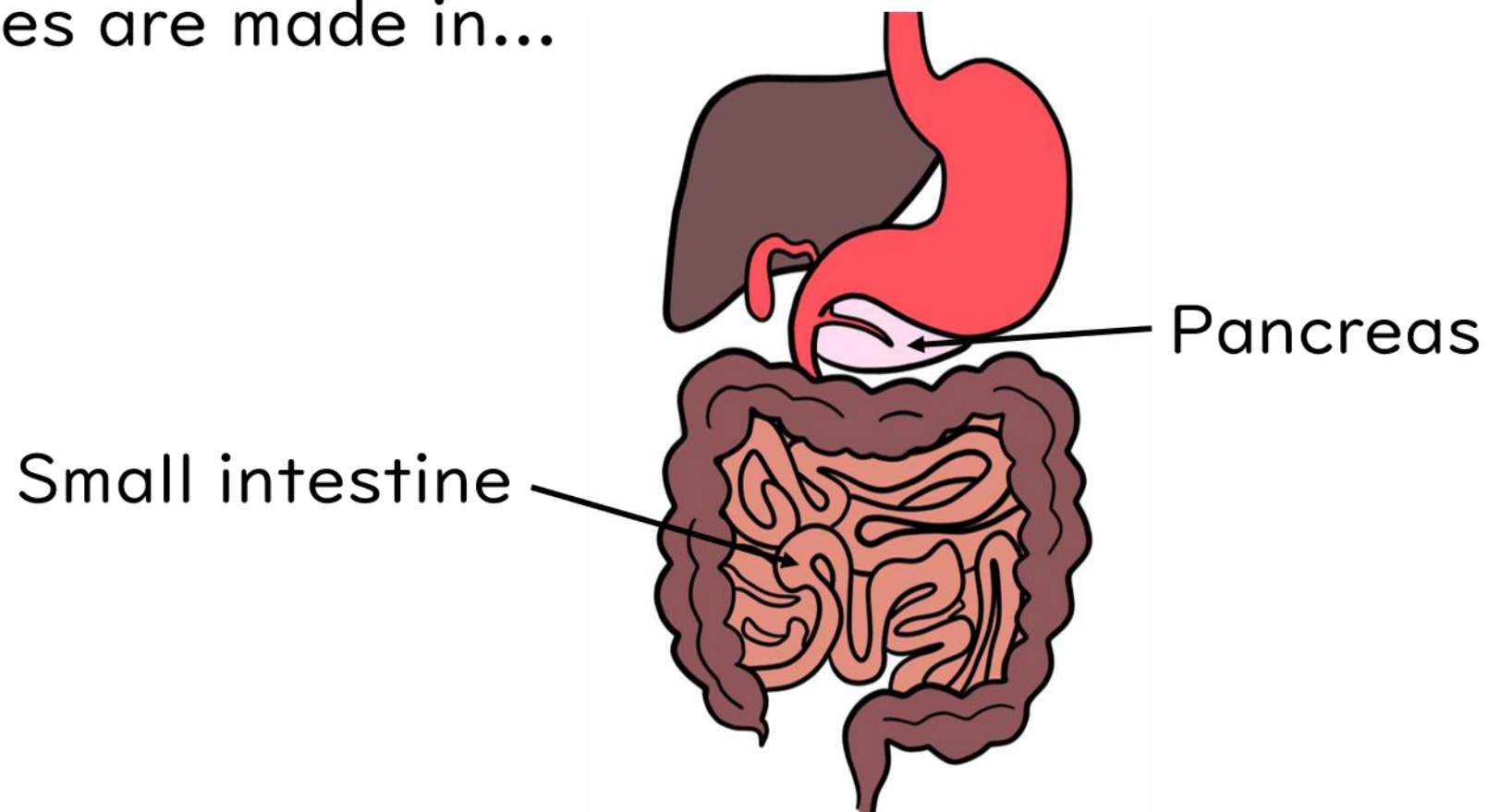
Amylase is produced in three places...



Lipases convert lipids into glycerol and fatty acids.



Lipases are made in...



Salivary glands

- Amylase produced in saliva

Gullet

- AKA oesophagus

Liver

- Produces bile
- Bile neutralises stomach acid so that the pH is right for enzymes in the small intestine
- Bile also emulsifies fat

Gall bladder

- Bile is stored here before it is released into the small intestine

Large intestine

- Excess water is absorbed from food

Stomach

- Muscular walls churn food, mixing it with stomach acid and pepsin
- Stomach produces the protease pepsin
- Produces stomach acid (hydrochloric acid) which kills bacteria and lowers the pH to 2.0 (the right pH for pepsin to work)

Pancreas

- Produces amylase, protease and lipase enzymes which it releases into the small intestine

Small intestine

- Absorbs the digested food into the blood
- Also produces amylase, protease and lipase enzymes to finish off digestion

Rectum stores faeces until they exit through the anus



Bile is not an enzyme but a greenish-brown fluid which aids in digestion. It is produced in the liver, stored in the gall bladder and then released into the small intestine where it performs two roles.

1. Bile is alkaline, and it neutralises the stomach acid before food passes to the small intestine. Enzymes in the intestine cannot work at stomach pH (pH 2).
2. Bile emulsifies fat (breaks it up into smaller droplets) which makes it easier to digest.

Why would smaller droplets be easier to digest?

Higher surface area for enzymes to access.