

Part II: The gut and its inhabitants

1- How we digest food

2- Our microbial organ and its functions

1. How we digest food

Digestion is the process of ***mechanical*** and ***chemical*** breakdown of food into smaller components that can be absorbed and used by the cells of our body.

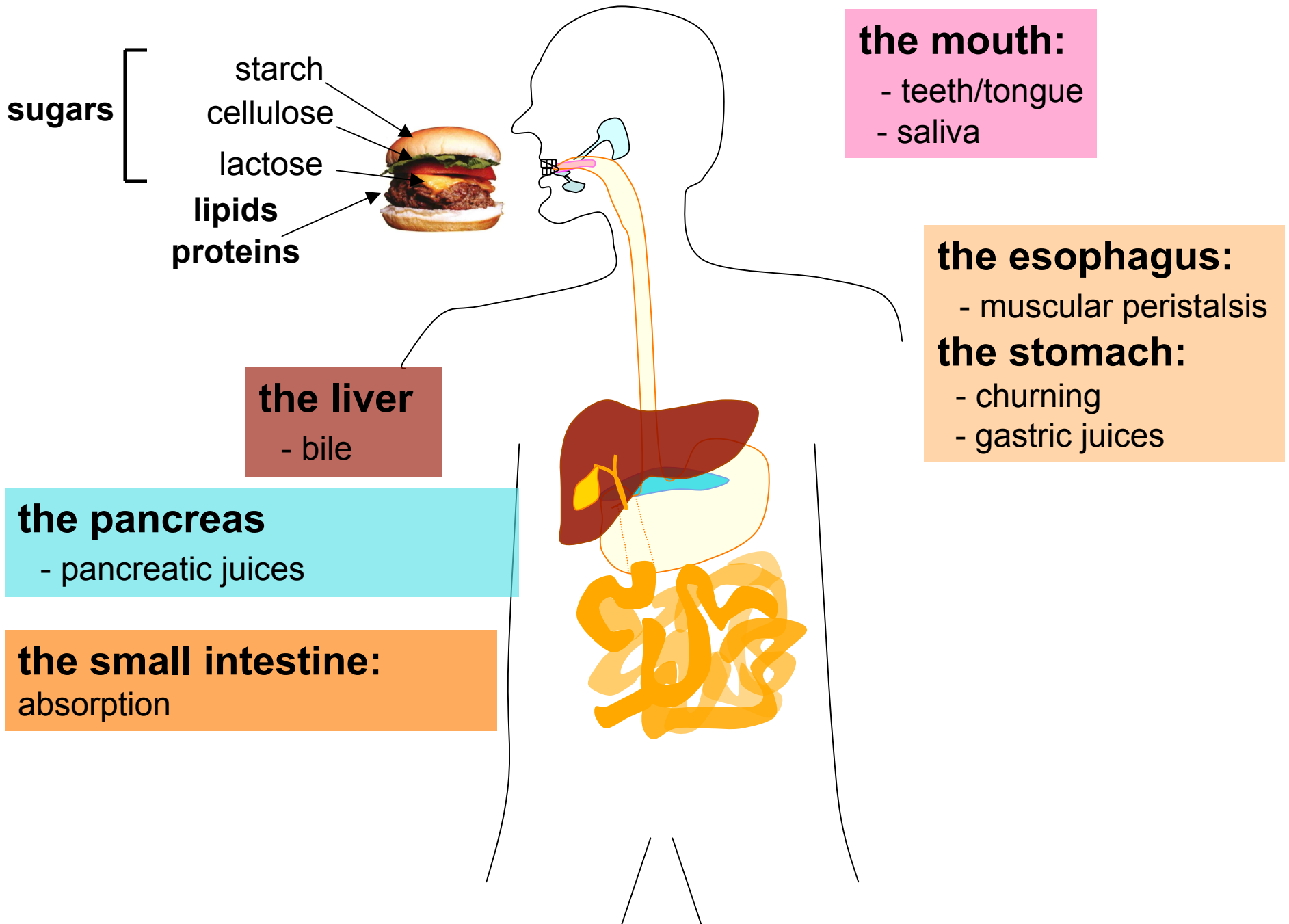


enzymes

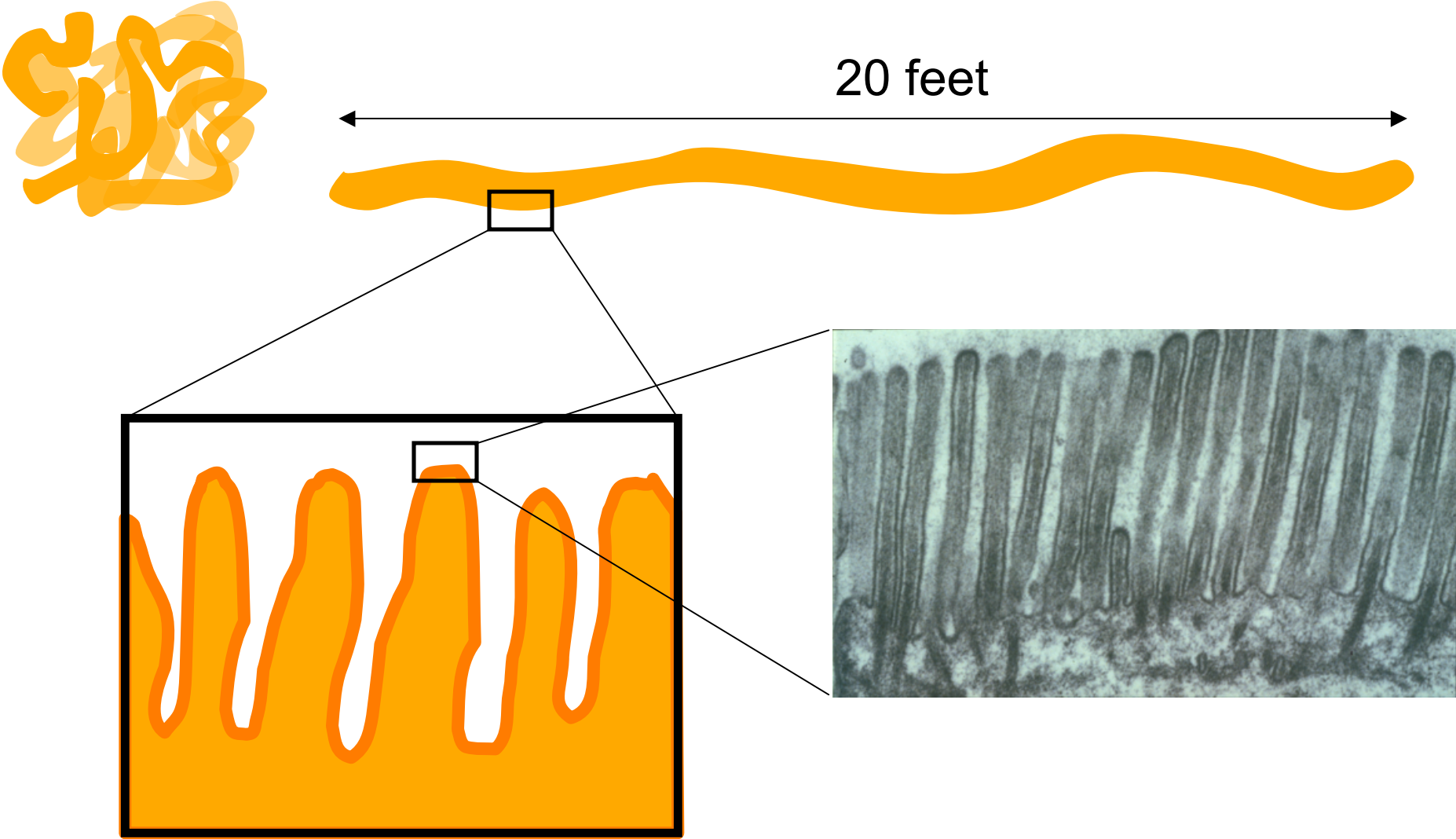


DIGESTION



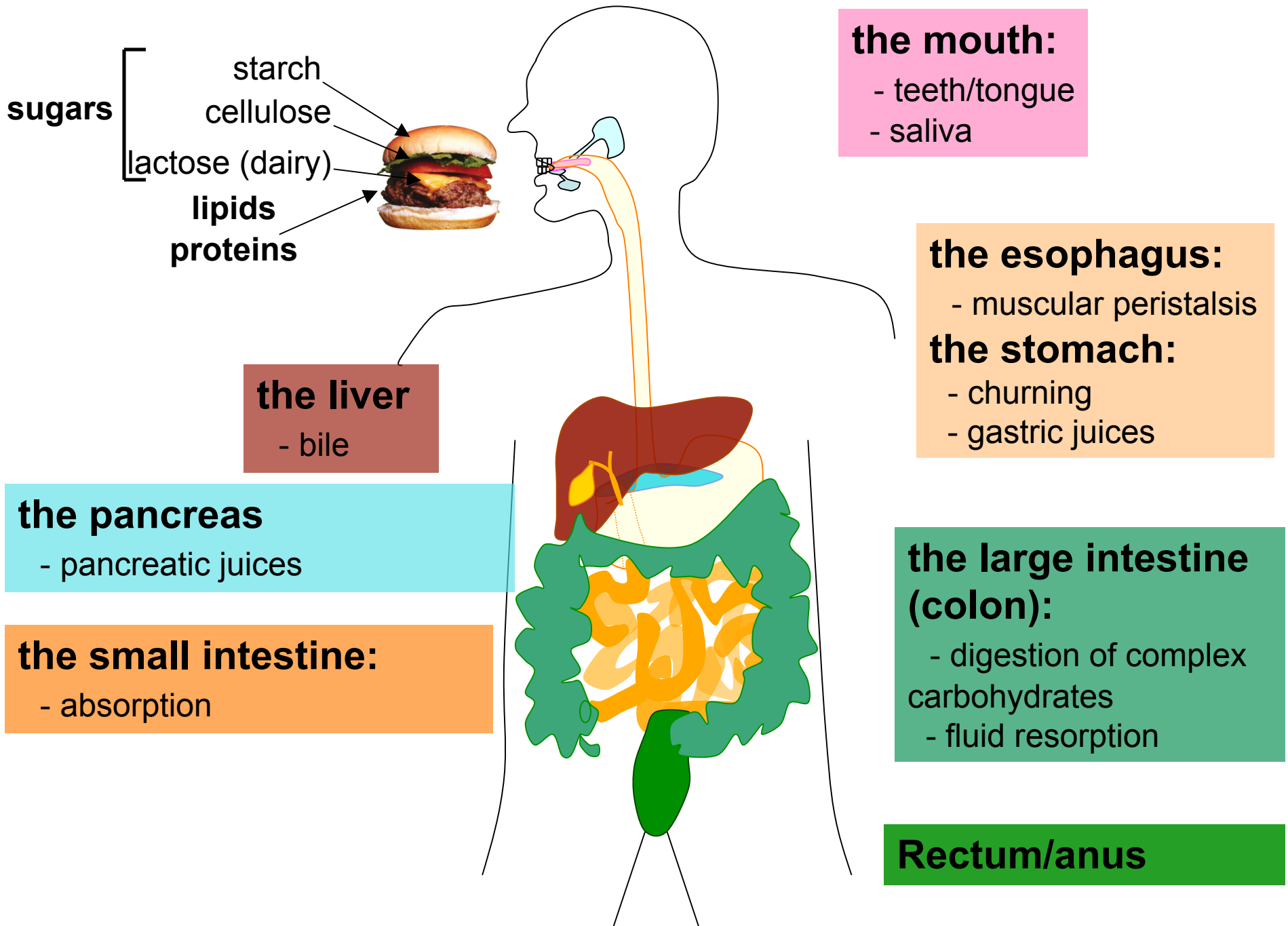


The small intestine

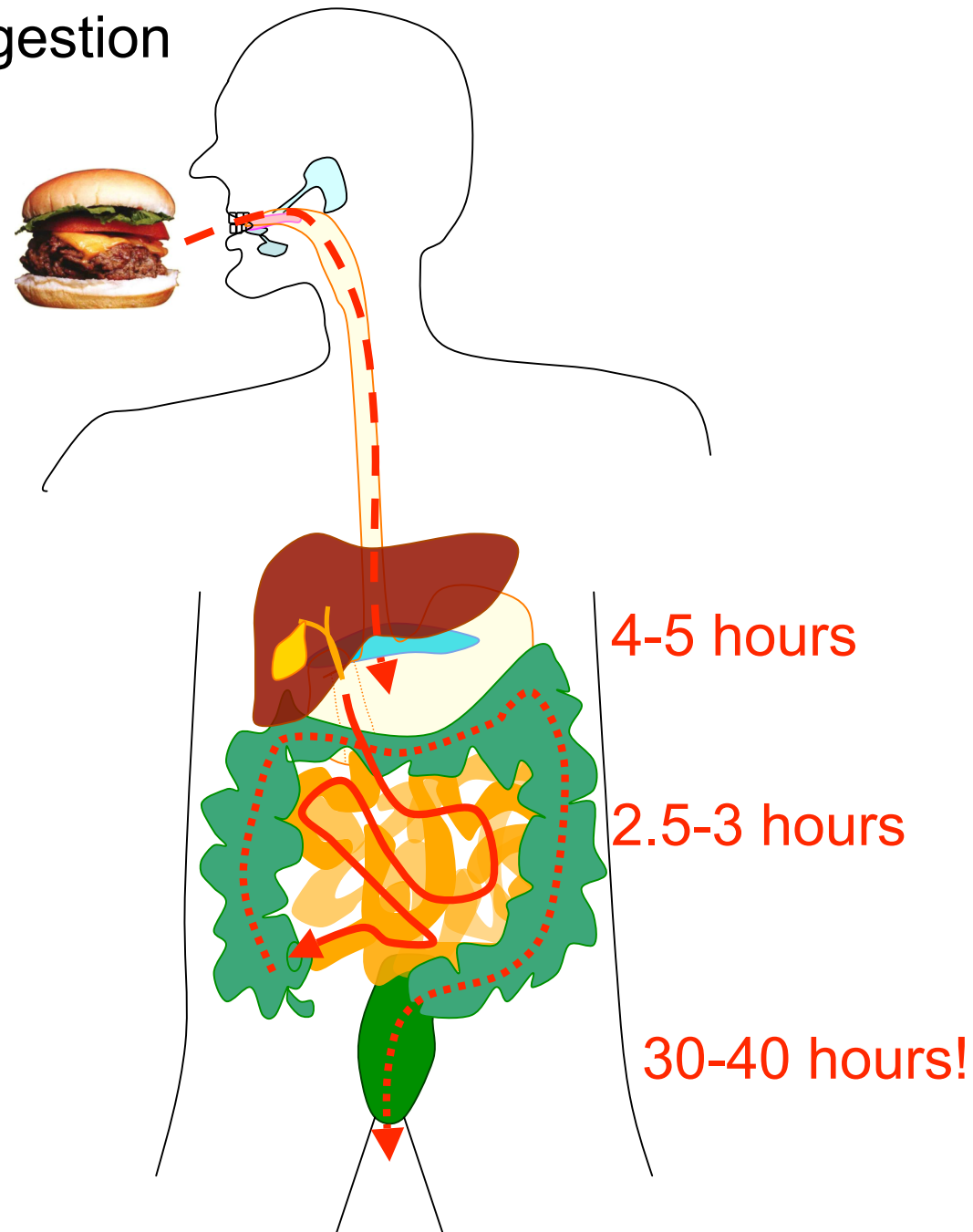


The “small” intestine =





How long does digestion
take?

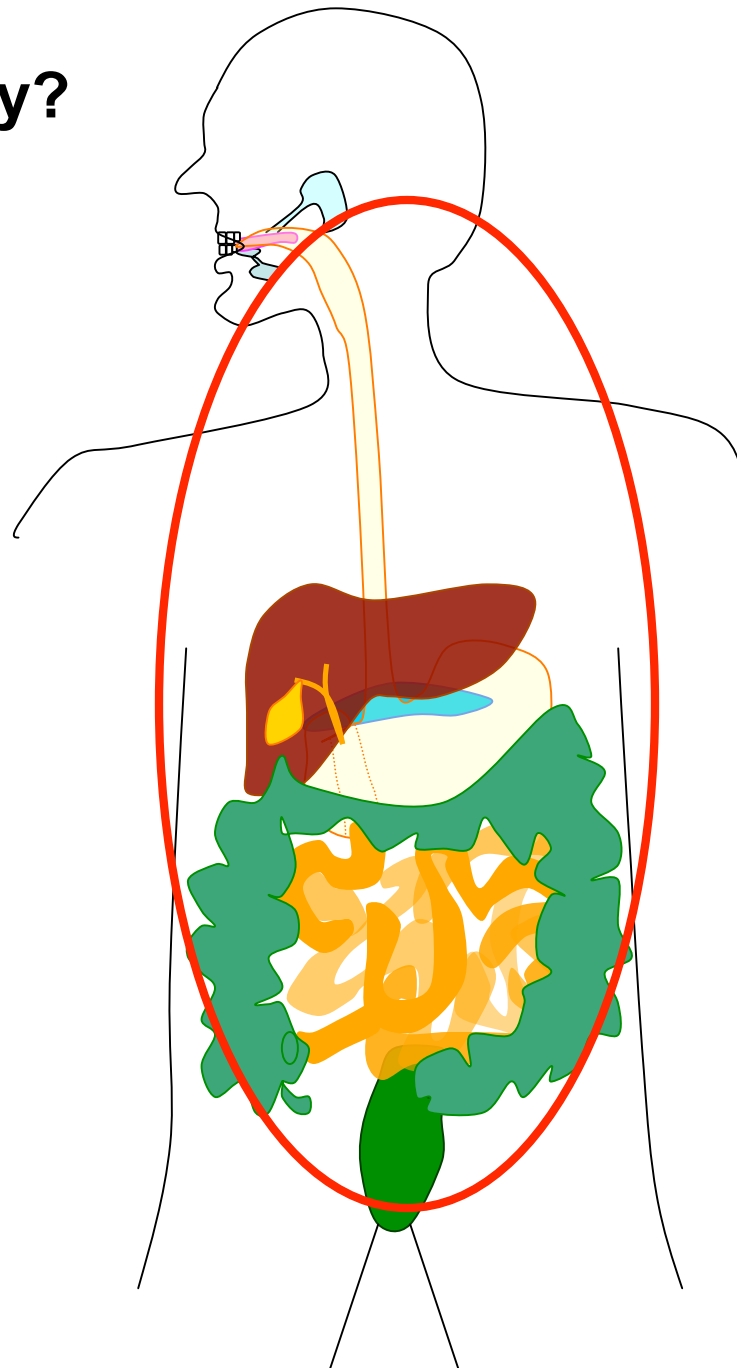


2. Our Microbial organ and it's functions

There are 10 times more bacteria in our body than human cells!

1. Where are they?

They are present
all along the
digestive tract...



...but are by far
most abundant in
the colon

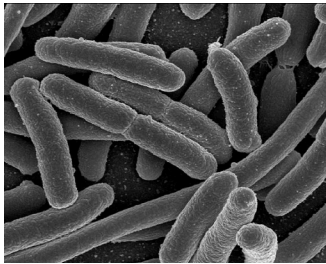
2. Who are they?

2. Who are they?

500-1000 species of **bacteria** from a few major groups:

Proteobacteria

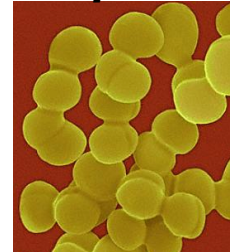
Enterobacteria



E.coli

Firmicutes

Streptococci



S. viridans

Enterococci



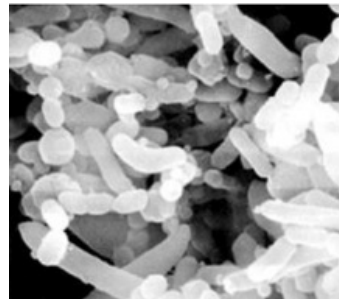
E. faecalis

Actinobacteria

Bifidobacteria

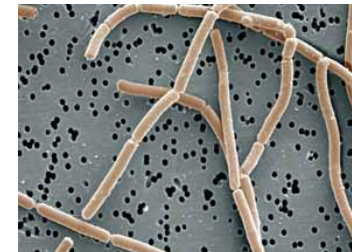


Bacteroidetes



B. thetaiotaomicron

Lactobacilli

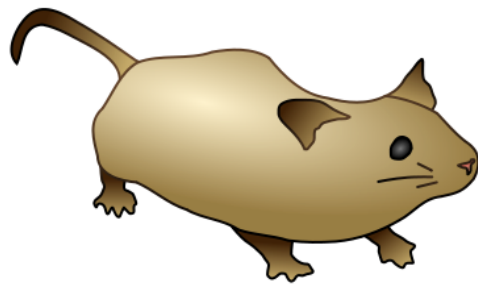


L. bulgaricus

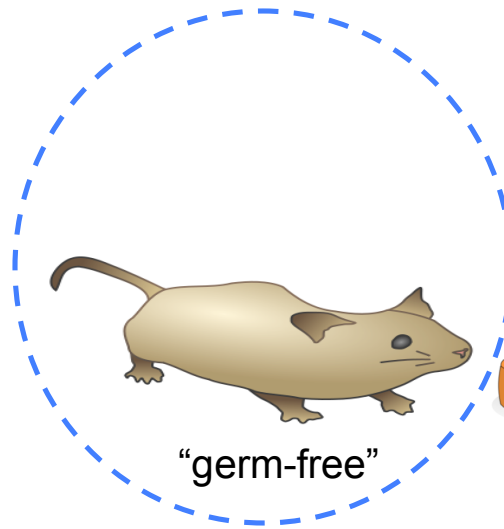
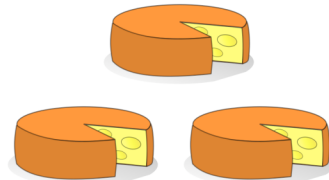
3. What do they do?

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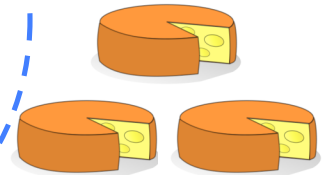
Observation #1:



normal microbiota

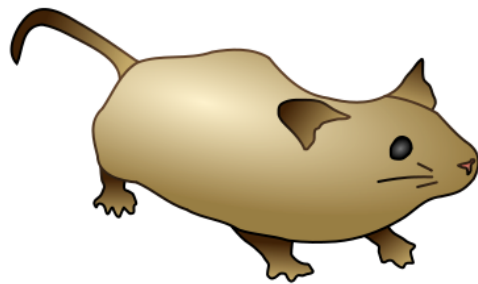


“germ-free”

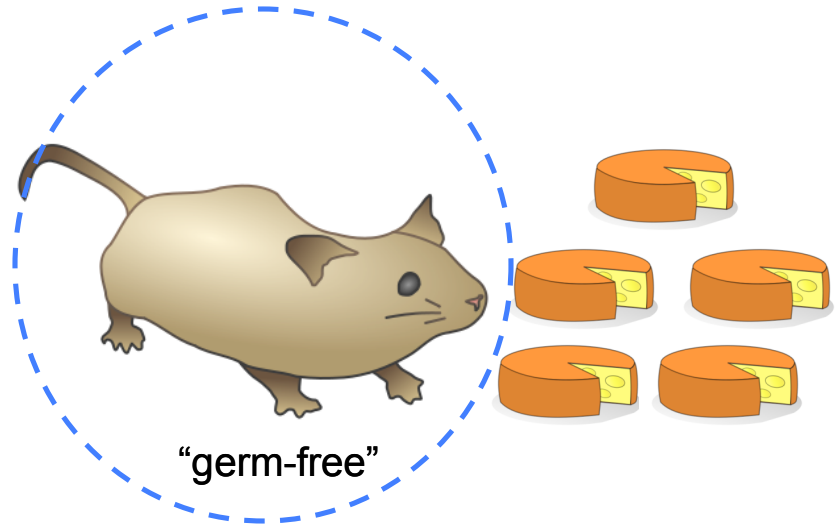
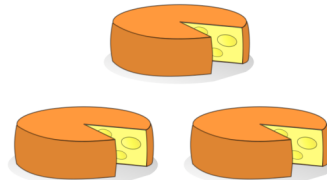


3. What do they do?

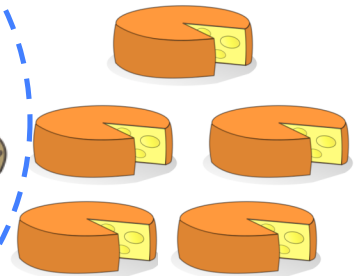
Observation #1:



normal microbiota

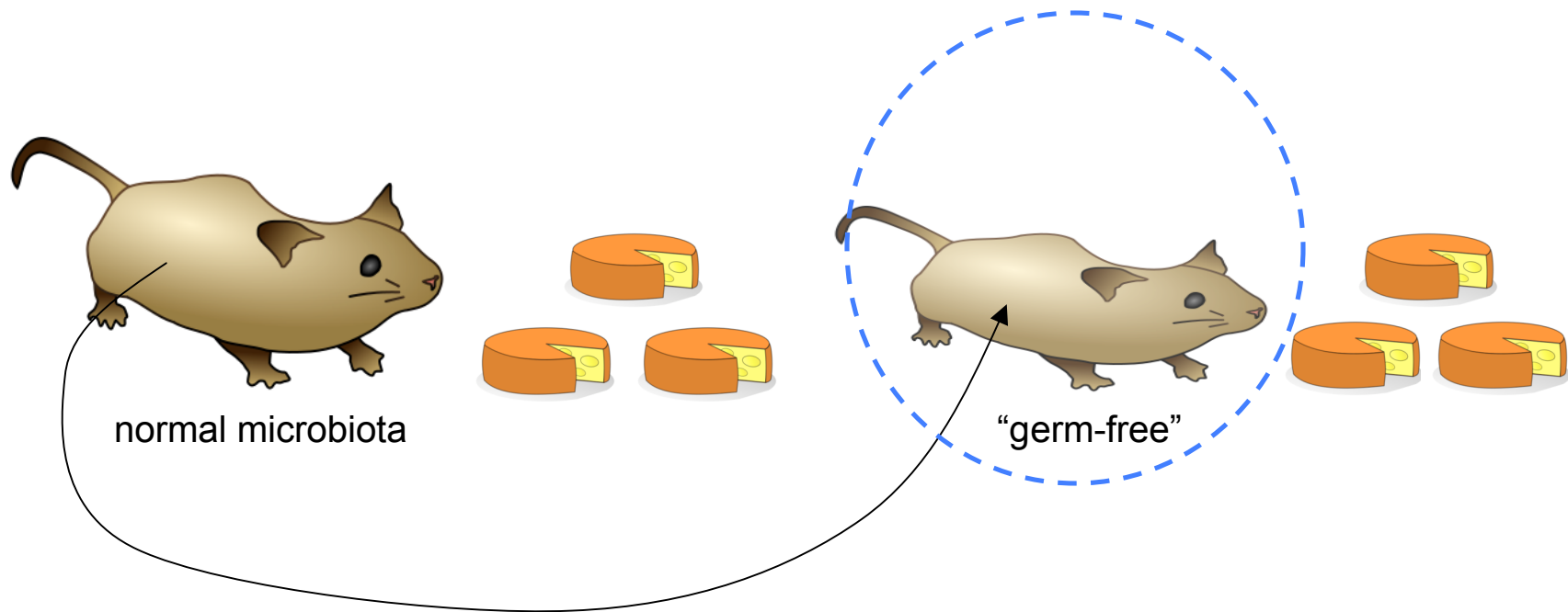


“germ-free”



3. What do they do?

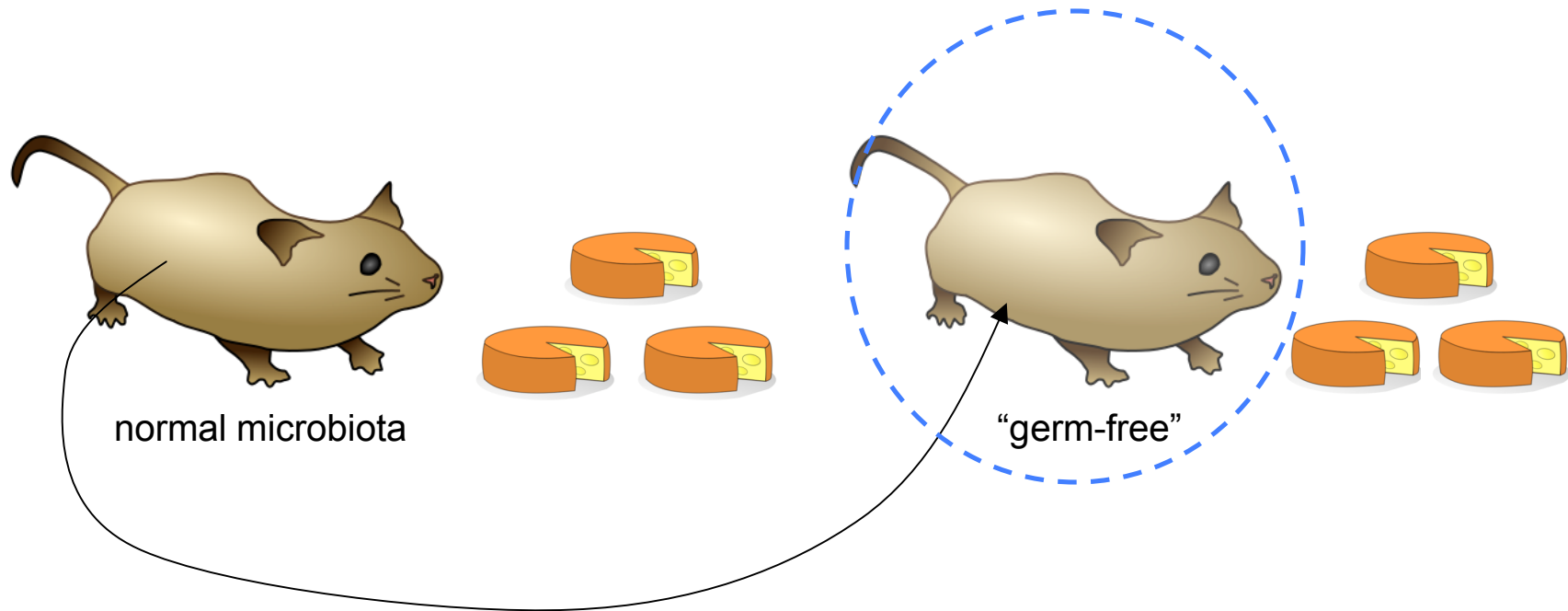
Observation #1:



Transplantation of distal gut microbiota

3. What do they do?

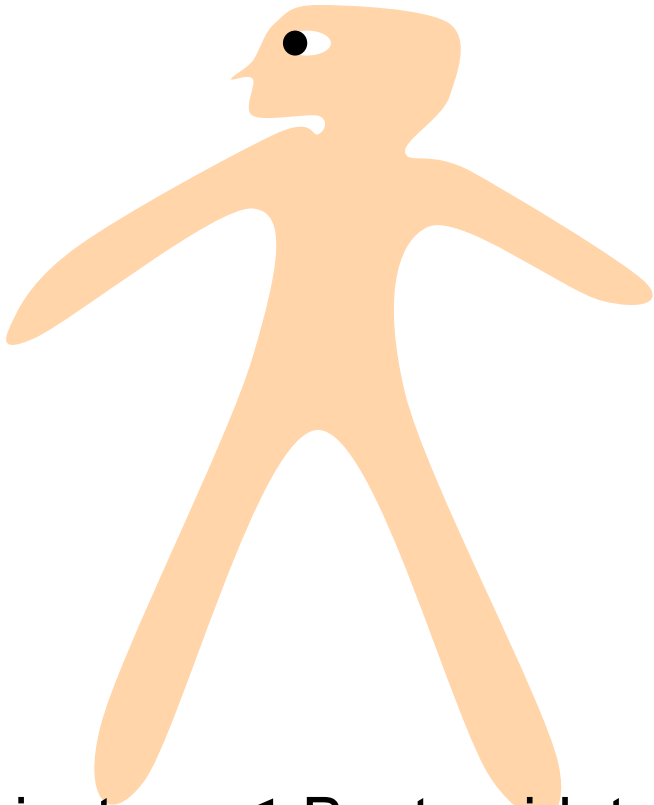
Observation #1:



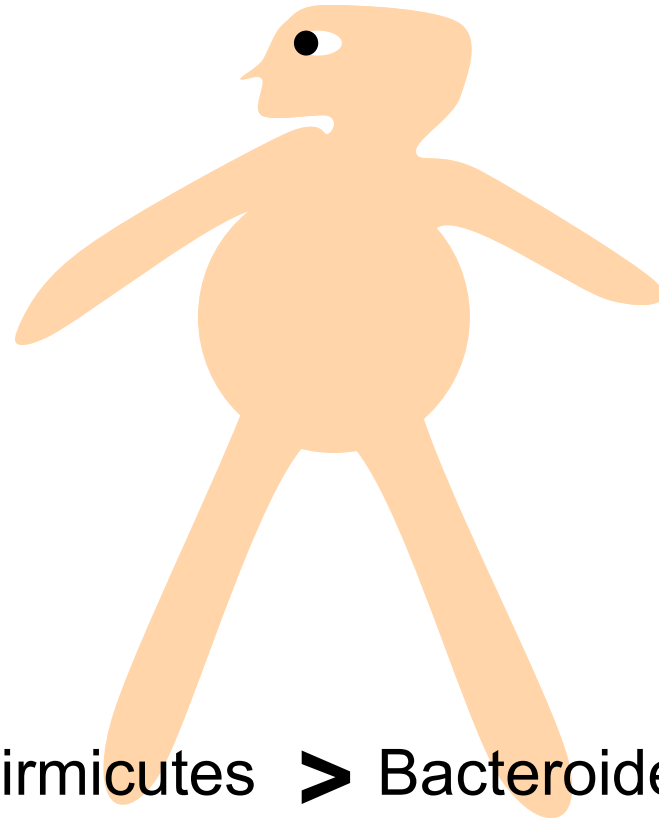
Transplantation of distal gut microbiota

3. What do they do?

Observation #2:



Firmicutes < Bacteroidetes



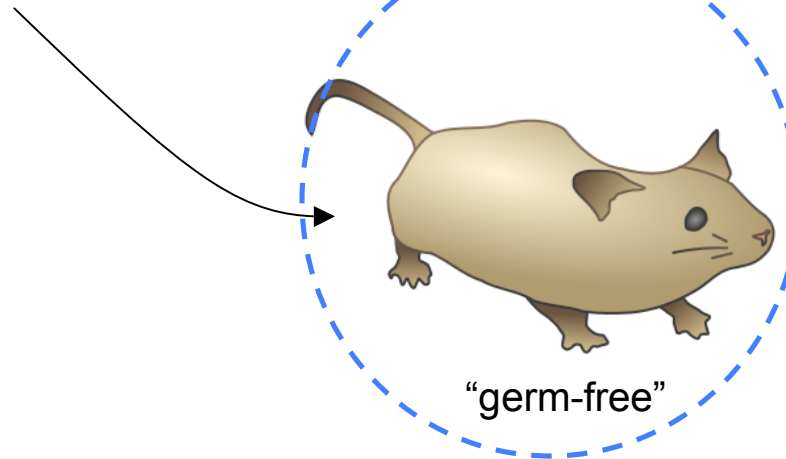
Firmicutes > Bacteroidetes

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3. What do they do?

Observation #2:

obese microbiota



more fat storage

3. What do they do?

A. Role in digestion and metabolism

3. What do they do?

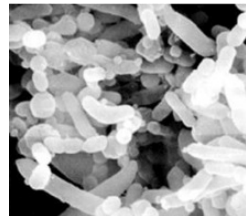
A. Role in digestion and metabolism

Many bacteria in our gut have **enzymes** that breakdown complex molecules that are otherwise difficult to digest, or indigestible to humans:

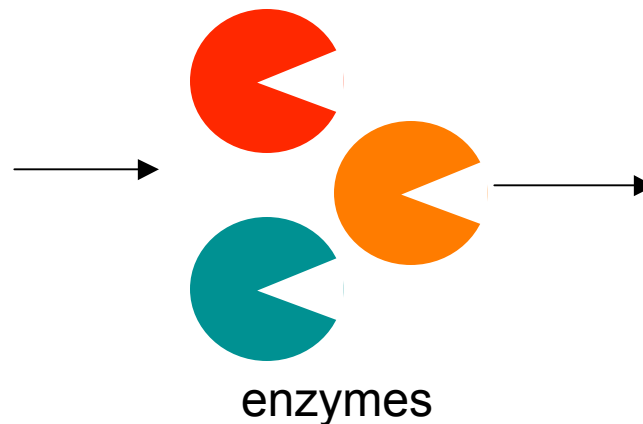
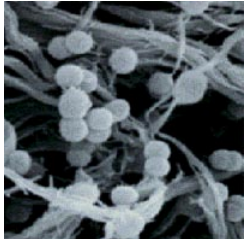
Bifidobacteria



Bacteroides



Ruminococcus

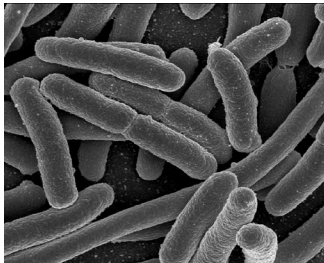


eg. dietary fiber

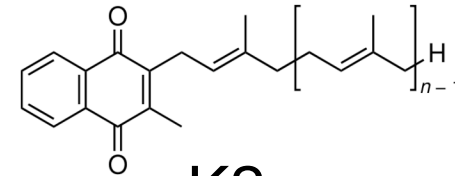
3. What do they do?

A. Role in digestion and metabolism

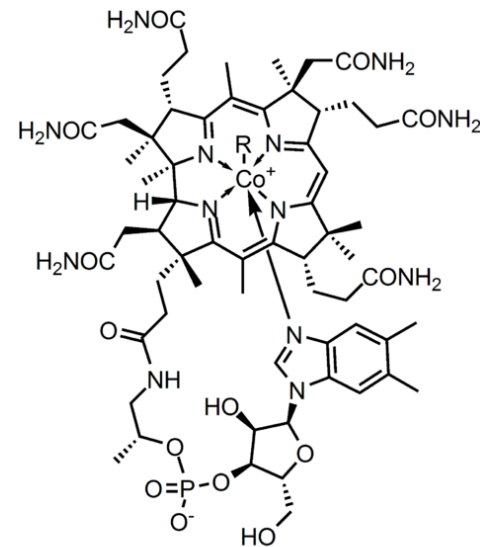
Bacteria can also produce vitamins:



E.coli



K2

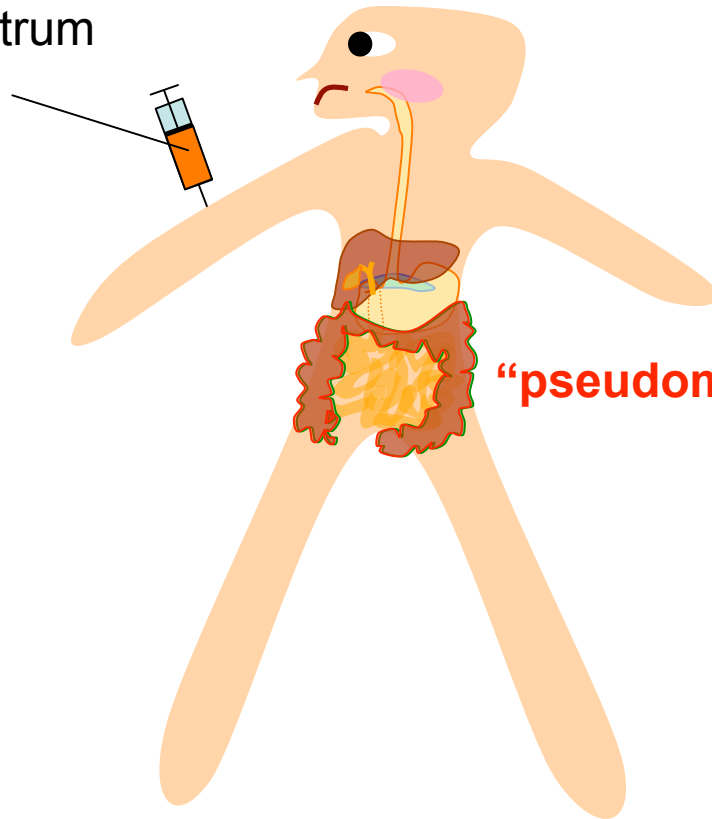


B12

3. What do they do?

Observation #3

broad-spectrum
antibiotics



“pseudomembranous colitis”



Clostridium difficile

3. What do they do?

B. Barrier function against infection

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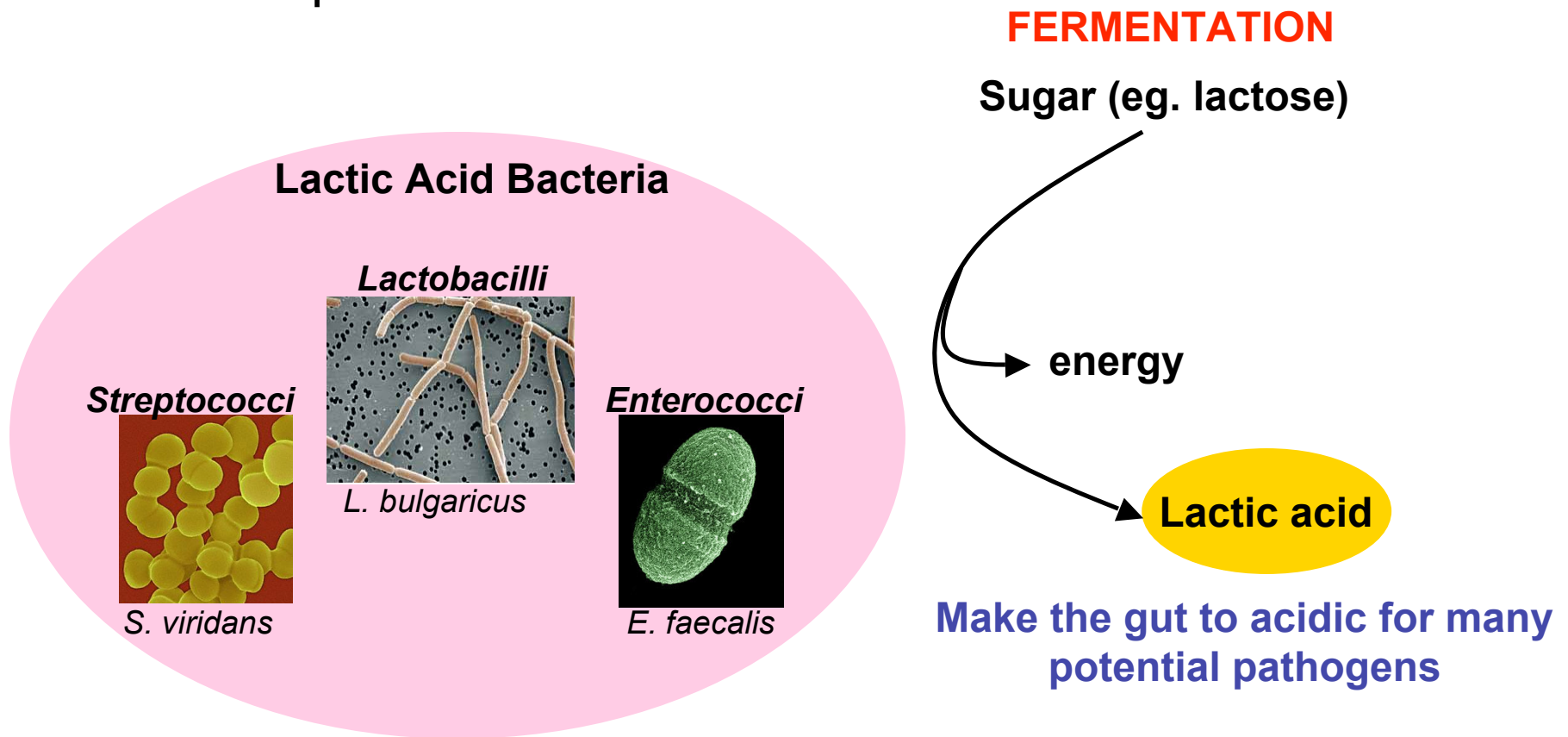
Occupation of the **ecological niche** (limited food and space) by the normal gut flora prevents intruders from colonizing the gut.



3. What do they do?

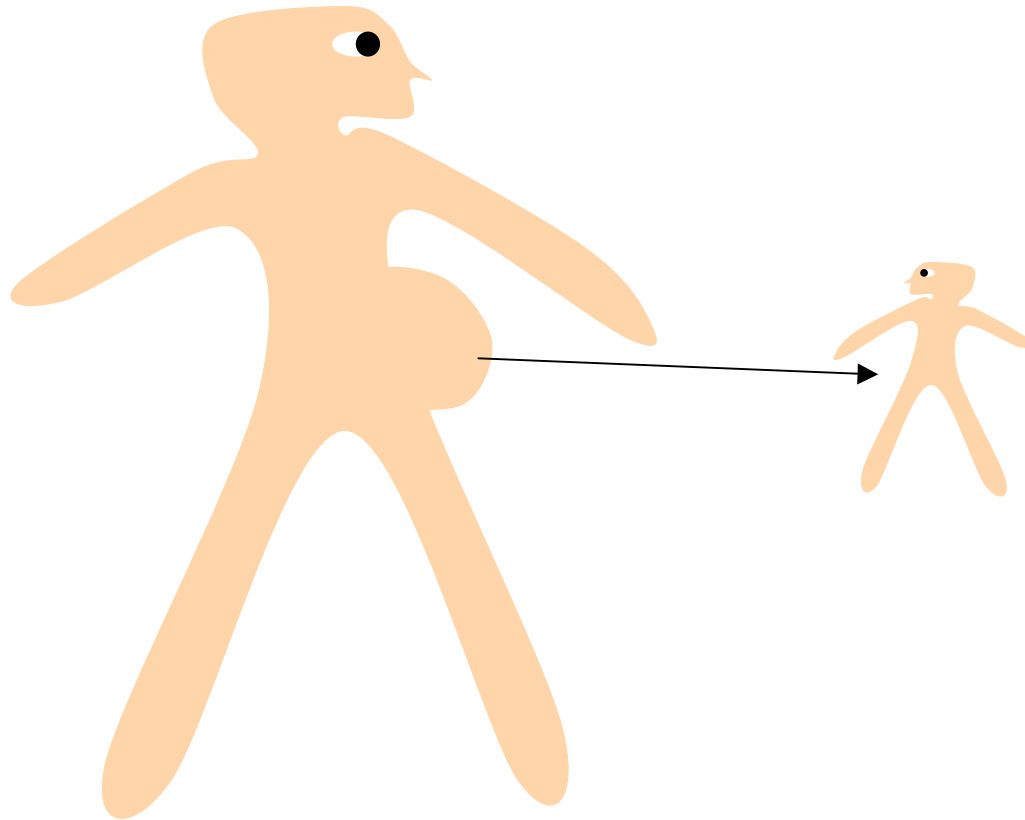
B. Barrier function against infection

Certain bacteria produce compounds that limit the growth of other species:



3. What do they do?

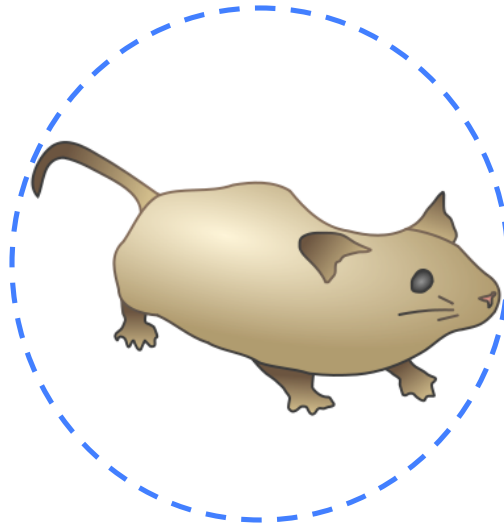
Observation #4



Babies delivered by C-section have higher risk of childhood asthma or allergies.

3. What do they do?

Is our gut microflora important for training our immune system?



Germ-free animals have under-developed and dysfunctionnal immune systems.

Part II: Summary

1- How we digest food

- **Mechanical** and **chemical** breakdown of food by the different parts of the digestive system

2- Our microbial organ and it's functions

- The colon is one of the most densely populated microbial ecosystem on earth!
- commensal microbes in the gut promote:
 1. **Digestion** of complex molecules
 2. **Protection** against infections
 3. **Immune functions?**