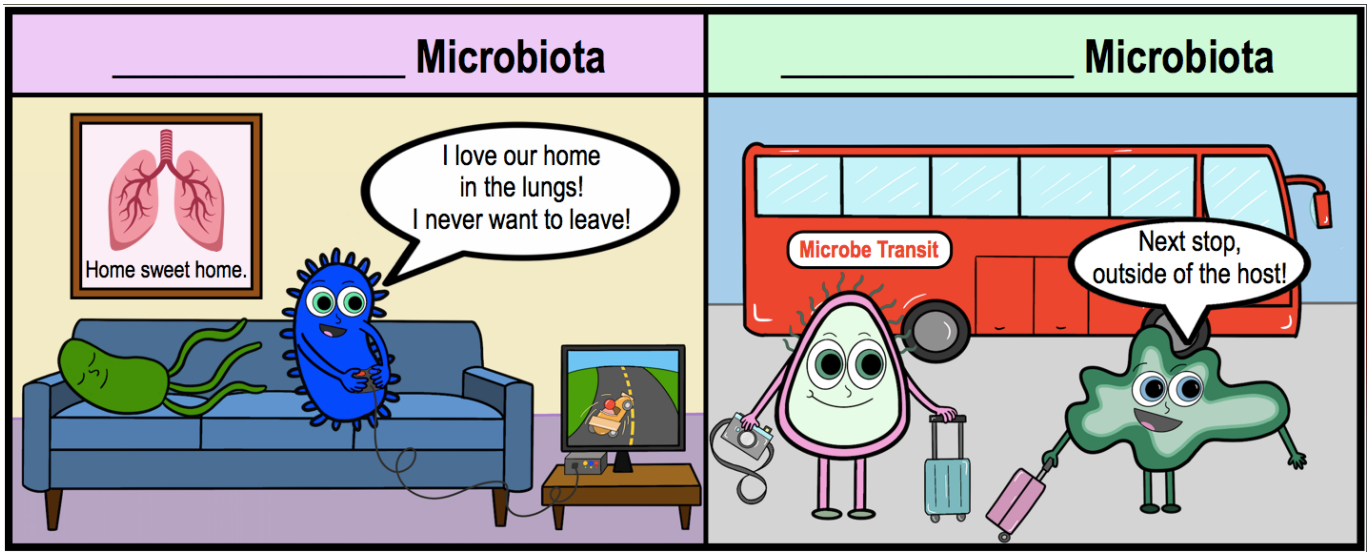
CONCEPT: THE HUMAN MICROBIOME

- *Recall:* **Microbiome (or Normal Flora):** communities of microbes that grow on/in the bodies of all humans.
  - These microbes live in *symbiotic relationships* with humans & can be further classified into _____ groups:
    - **Resident Microbiota:** microbes that are almost _____ on the host for *extended* periods of time.
    - **Transient Microbiota:** microbes that are only _____ found in the body (ex. pathogens).



PRACTICE: Scientists commonly call humans "superorganisms". What is this description referring to?

a) Humans are the most intelligent and influential organisms on the planet.
b) Each human is an ecosystem for trillions of microorganisms.
c) Humans are the only organisms that determine the success of other organism species.
d) Each human is host to a unique species of microorganism.

PRACTICE: Which of the following answers does ***not*** include an example of transient microbiota?

a) Microorganisms that inhabit certain body sites for extended periods of time.
b) Microorganisms that are able to inhabit different body sites during their lifetime.
c) Microorganisms that only occupy the body for a short period of time.
d) Microorganisms that are pathogenic and eventually removed by the body's immune system.

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Microbiome Composition

●The **Human Microbiome Project (started in 2007)** studies relationships of normal flora & various human hosts.

□ Goal is to understand how changes in a microbiome affect human health & disease.

●Humans start to develop microbiomes at _____.

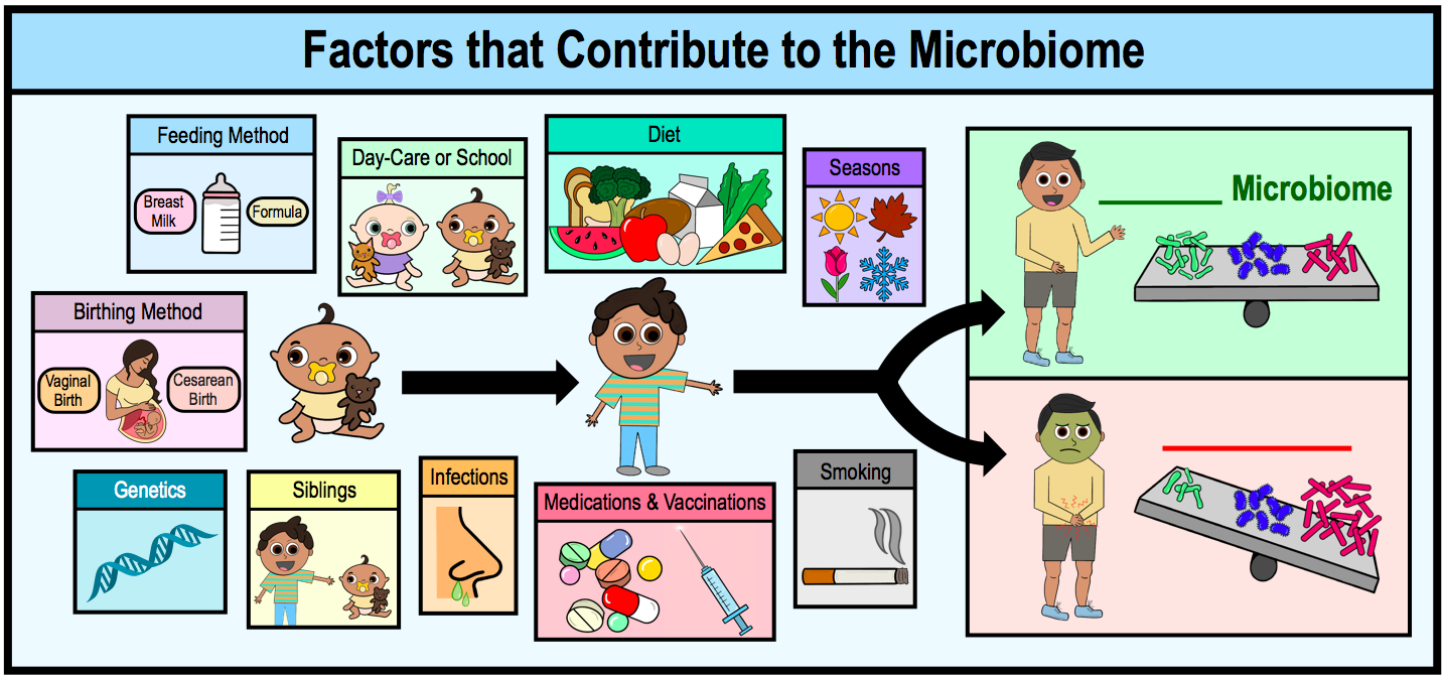
□ Breast milk contains many beneficial microbes & *carbohydrates* important for an _____ microbiome.

●In adults, many factors contribute to microbiome changes (microbiomes of *obese* adults _____ from *lean* adults).

□ Over time, a person's microbiome can _____ as they are exposed to (encounter) new microbes.

●Researchers have begun to find a correlation between microbiome compositions & _____.

□ For example: Intestinal **dysbiosis** (an imbalance of the microbiome) can lead to inflammatory bowel disease.



PRACTICE: Which of the following influences the types and amounts of microorganisms found in and on your body?

a) Your age. b) Your diet. c) Your medications. d) All of the above.

PRACTICE: Recent research suggests that babies born via cesarean section are more at risk for developing allergies. Why might this be?

a) C-sections babies are not exposed to the mother's vaginal microbiota.

b) Early exposure to normal microorganisms of the microbiome will allow a baby's microbiome to form quicker.

c) A less developed microbiome causes an individual to be more sensitive and reactive to allergens.

d) All of the above.

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PRACTICE: Newborn babies acquire the microbes of their microbiota by:

a) Passing through the birth canal.
b) Breastfeeding.
c) Contact with their mother's skin.
d) Their environment.
e) All of the above are a source of microbiota.

Microbiome Protects Against Infection

●*Recall:* The microbiome is part of innate immunity by creating a *competitive/unfavorable* environment for pathogens.

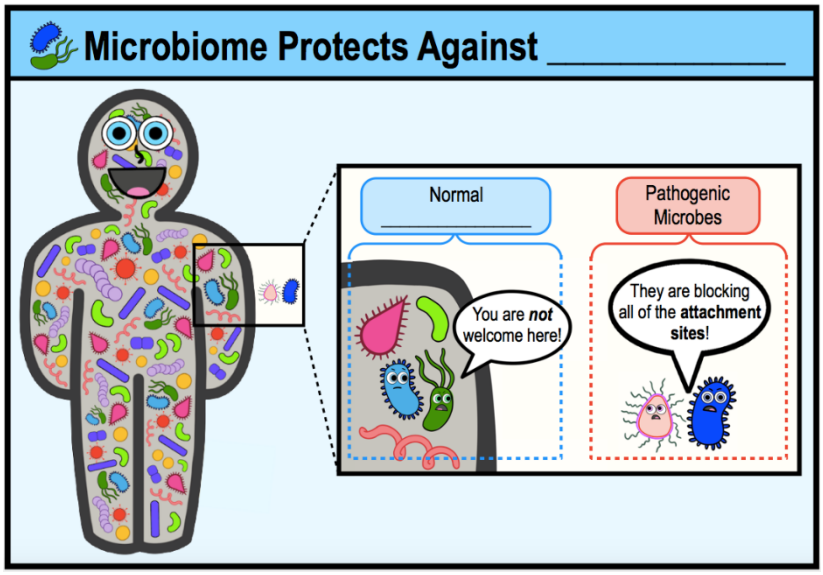
□ Some microbes _____ the attachment sites of pathogenic microbes by colonizing the area.

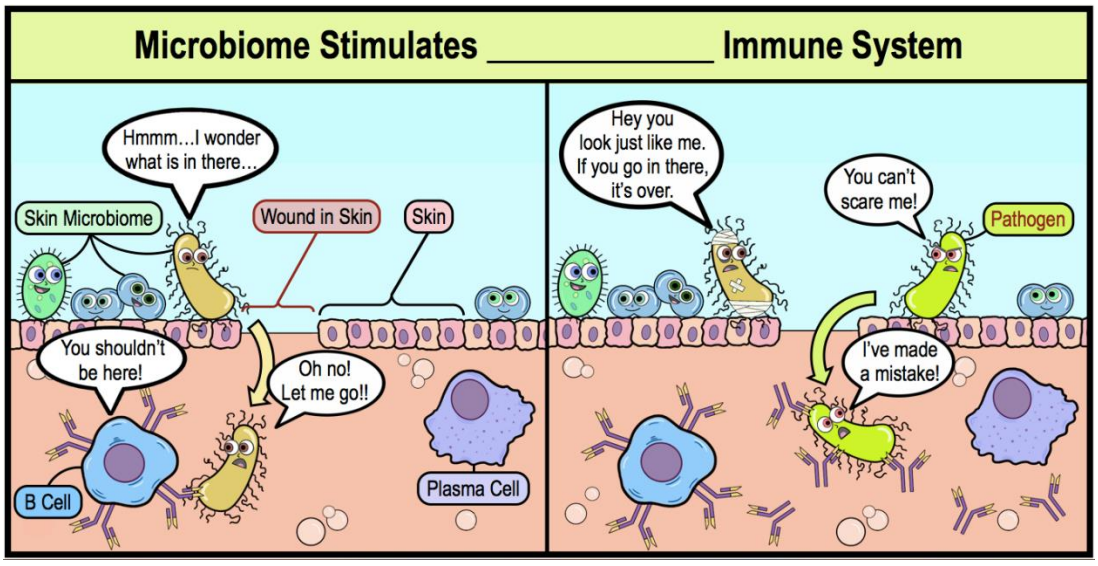
□ Other microbes of the microbiome can create _____ that are only harmful to some pathogenic microbes.

●Our microbiome can _____ the *adaptive immune system* towards pathogens we have *not yet* encountered.

□ Ex. If small numbers of skin microbiota enter our tissues via cuts, our body produces antibodies against them.

□ These antibodies may be effective against pathogens with _____ antigens to our skin microbiota.





CONCEPT: THE HUMAN MICROBIOME

PRACTICE: Which of the following is ***not*** a way in which our microbiome helps protect our bodies from pathogens?

a) Microbes of our microbiome create compounds that helps us digest our food.

b) Microbes of our microbiome create compounds that are harmful to pathogenic microbes.

c) Microbes of our microbiome outcompete pathogenic microbes for resources.

d) Microbes of our microbiome block entrances and binding sites in our bodies.

PRACTICE: Certain antibiotics inhibit the growth of *Lactobacillus* species of bacteria. Adult women who take these antibiotics commonly have vaginal yeast infections following their antibiotic treatments. Which of the following statements about the *Lactobacillus* bacteria and yeast of the vagina is ***false***?

a) The yeast is a pathogenic microbe in the vagina.

b) The *Lactobacillus* bacteria and yeast compete for resources in the healthy microbiome.

c) The antibiotics have caused an imbalance of the bacterial and yeast populations of the vagina.

Microbiome Promotes Immune Tolerance

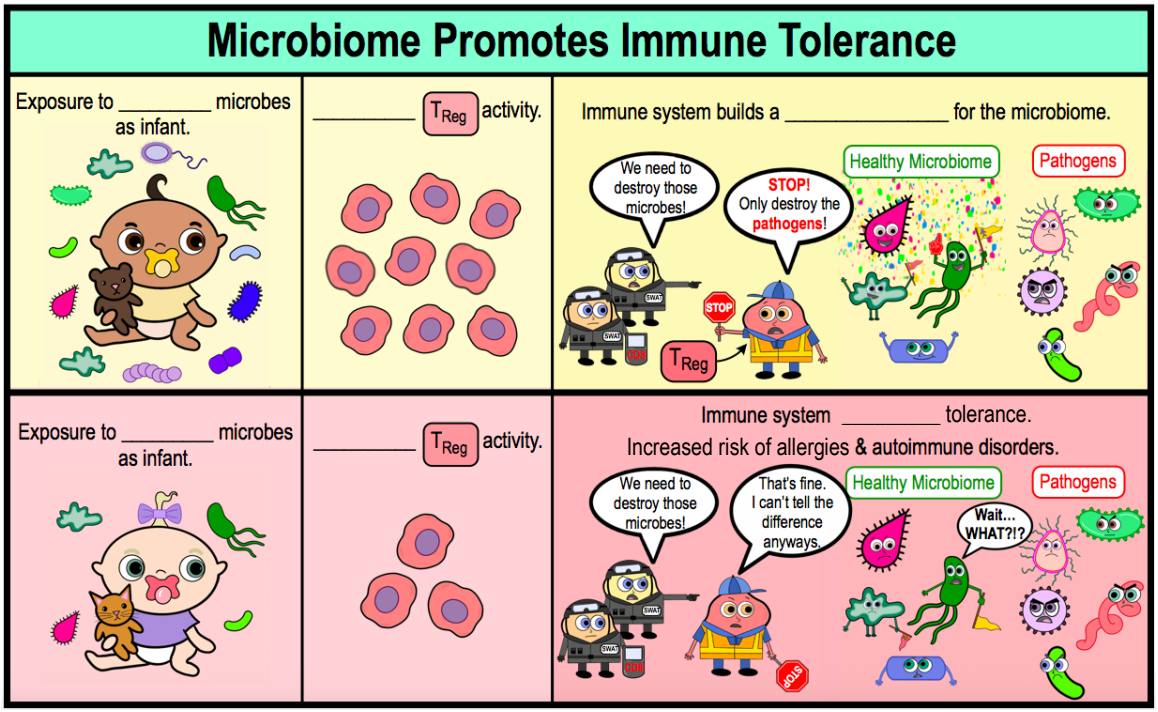
●T & B cells must build immune tolerance to our microbiome to avoid "attacking" them.

●*Recall: Immune tolerance*: ability for immune system to distinguish harmless from harmful (prevents autoimmunity).

□ T_{Reg} cells _____ activity of other T cells to prevent them from targeting host *microbiome* & *self*-cells.

●Studies have shown that *early* & *sufficient* exposure to microbes as an infant/child can _____ T_{reg} cell activity.

□ **Hygiene hypothesis:** insufficient exposure to microbes increases risk of *allergies* & an *autoimmune disorders*.



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PRACTICE: The "hygiene hypothesis" proposes that during childhood:

a) Lack of exposure to microbes can promote development of allergies.

b) Hand washing prevents against most dangerous infections.

c) The immune system develops best in a clean environment.

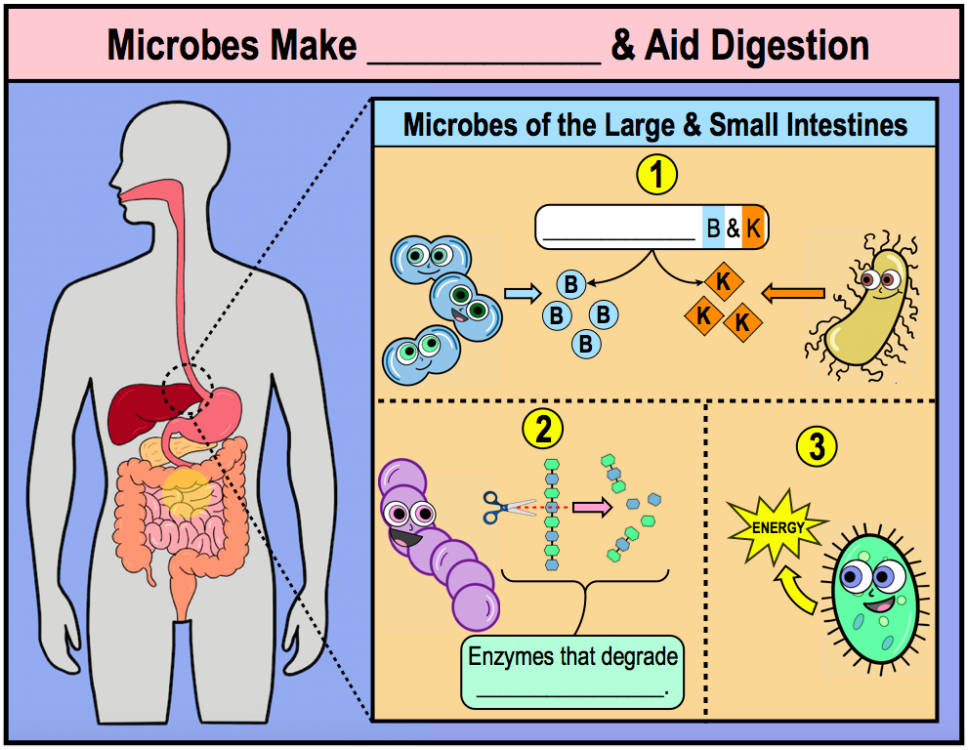
Microbiome Makes Nutrients & Aids in Host Digestion

●An important feature of microbiome is its ability to produce *essential* _____ for the host.

1) Intestinal microbiome produces Vitamins ____ & ____ that can be absorbed by the host.

2) Intestinal microbiome also produces _____ that degrade complex carbohydrates for the host.

3) Fermenting bacteria can produce _____ sources for epithelial cells.



PRACTICE: Which of the following is ***true*** about how the microbes of our microbiome help maintain our health?

a) They block pathogen attachment to host cells.

b) They establish competition for available nutrients and vitamins.

c) They produce antimicrobial substances that damage pathogenic microbes.

d) They stimulate the immune system to attack pathogenic microbes.

e) All of the choices are true.

CONCEPT: THE HUMAN MICROBIOME

PRACTICE: Humans do not possess the enzymes required to break down most dietary fibers found in whole grains, beans, and vegetables. However, some fiber can be digested in our guts. How does this happen?

a) Certain bacteria in our gut microbiome digest the fiber in our food and provide us with nutrients.
b) Certain yeasts in our gut create vitamins which help break down fiber in our food.
c) Certain bacteria in our gut induce our intestinal epithelial cells to create enzymes which can break down fiber.