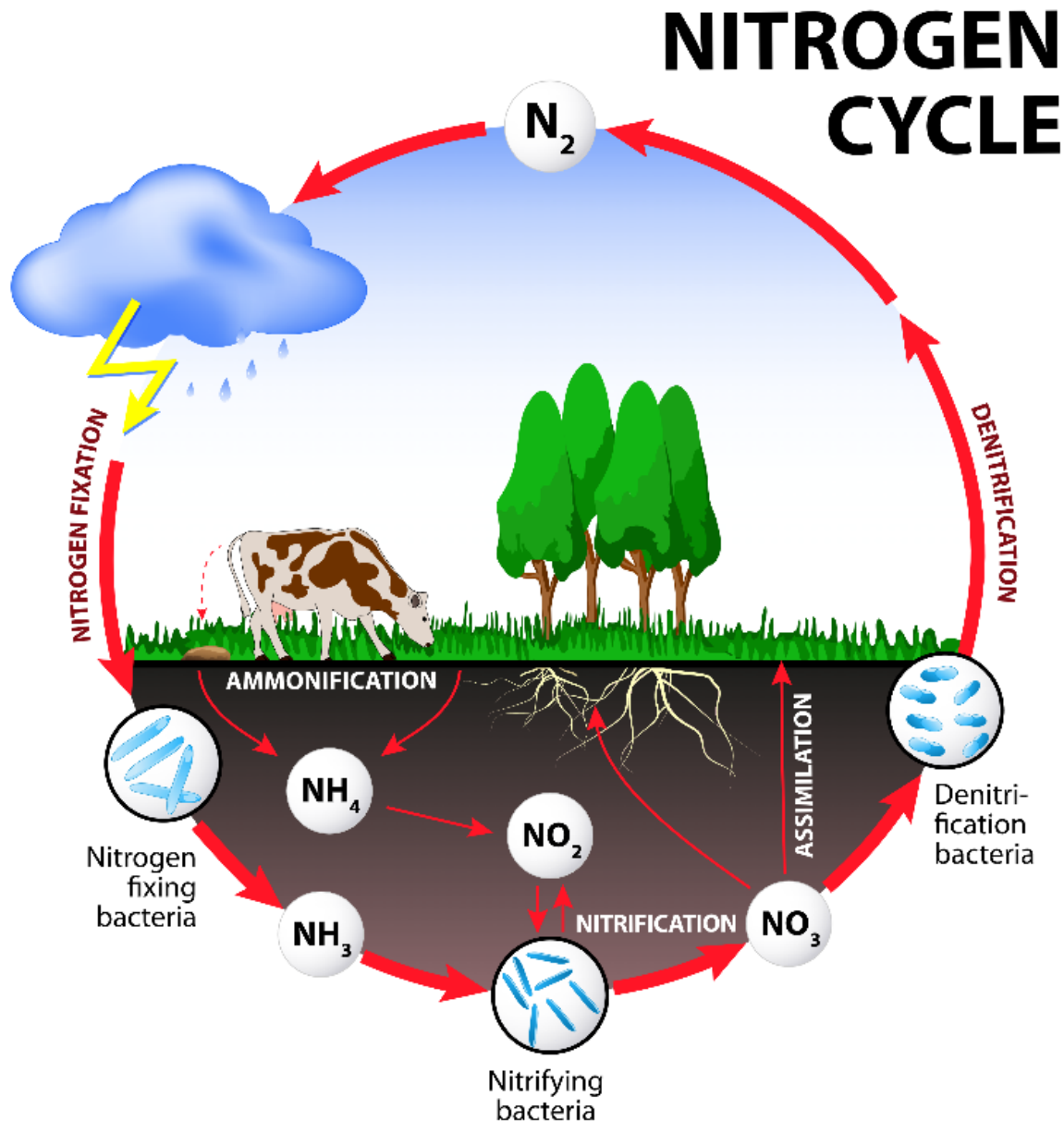


TOPIC: PROKARYOTES IN THE ENVIRONMENT

Prokaryote Ecology

- Bacteria and archaea play a crucial ecological role in the biosphere, driving nutrients and energy through various cycles
 - **Nitrogen fixation** – prokaryotes take atmospheric nitrogen (N_2) and convert it to a useable form like NH_4 or NO_2
 - Bacteria and archaea are the drivers of the nitrogen cycle on the planet
 - Photosynthetic bacteria, like cyanobacteria, produce oxygen, and generated a great deal of atmospheric oxygen
- Bacteria and archaea also play a crucial role in the internal environments of humans and ruminants

EXAMPLE:

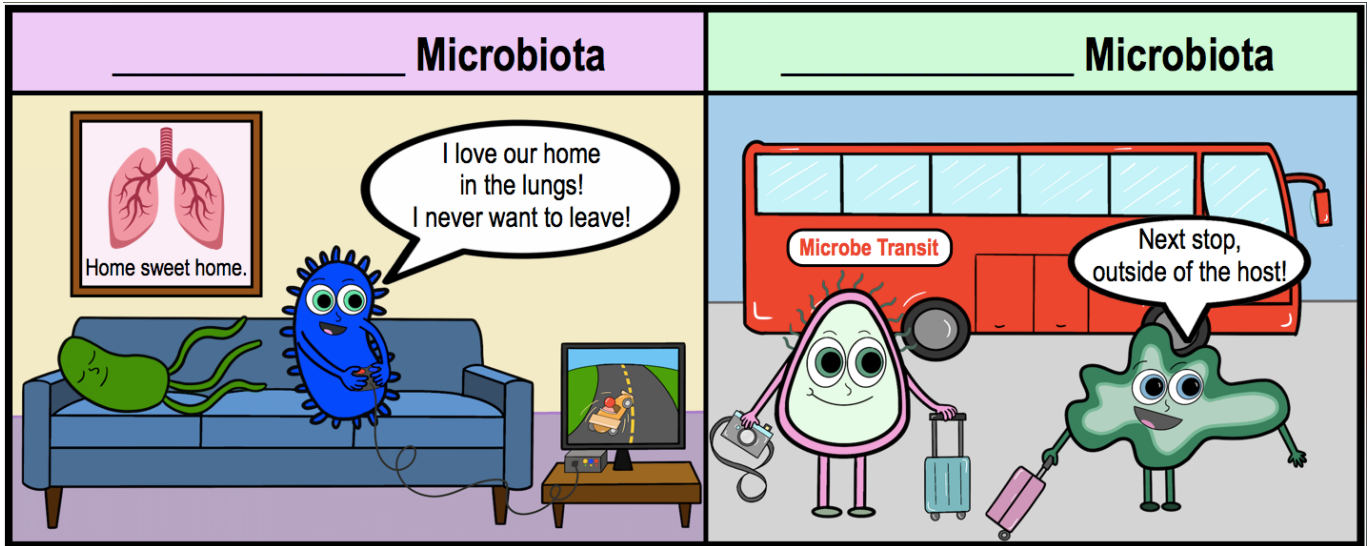


TOPIC: PROKARYOTES IN THE ENVIRONMENT

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.

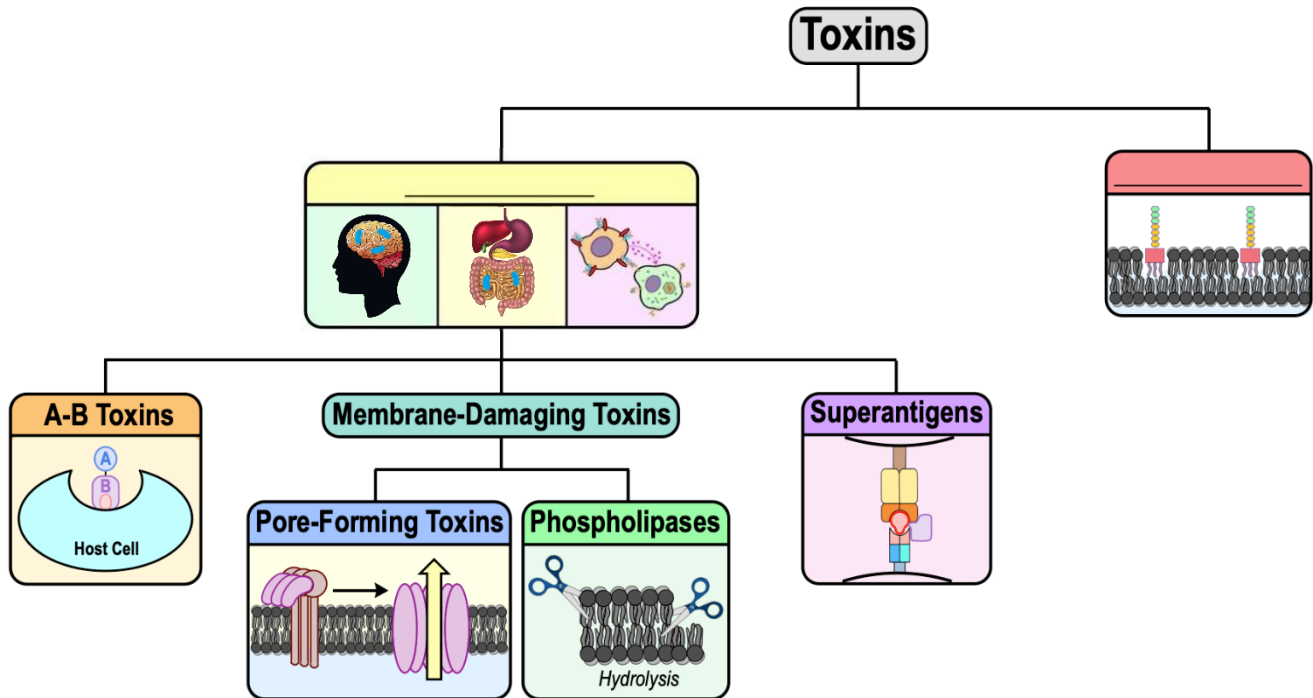
PRACTICE: Which of the following answers does **not** include an example of transient microbiota?

- 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.

TOPIC: PROKARYOTES IN THE ENVIRONMENT

Introduction to Pathogenic Toxins

- Certain pathogens produce biological poisons called _____ that allow them to invade & damage host tissues.
 - **Toxigenicity:** ability for a pathogen to produce toxins that damage host cells.
- Toxins can be classified into _____ groups:
 - 1) **Exotoxins:** soluble _____ that a pathogen releases during infection or following lysis.
 - _____ different categories of exotoxins are grouped by their different structures & functions (see image).
 - 2) **Endotoxin:** the lipopolysaccharide (LPS) found on the outer membrane of gram-_____ bacteria.



- NOTE: the host immune system is also capable of *unintended* damage to host cells when overstimulated during infection.

PRACTICE: Phospholipases are characterized by all of the following **except** which of these answers?

- a) Possess the ability to damage host cells.
- b) Are released by pathogens into host cells during infection.
- c) Are able to form pores in the cell membranes of host cells.
- d) Are able to hydrolyze cell membranes of host cells.

PRACTICE: The term endotoxin is synonymous with:

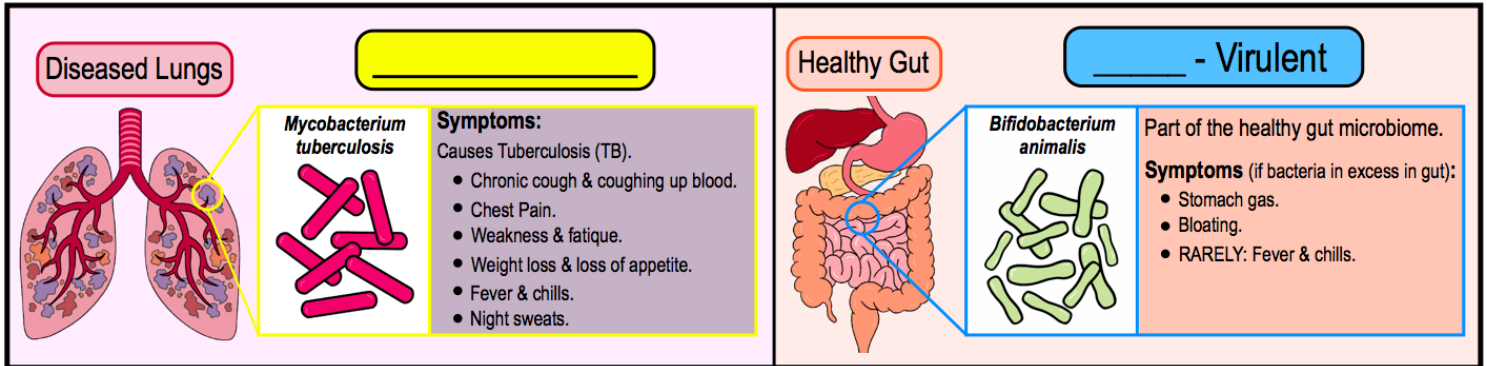
- a) A-B toxins.
- b) Lipopolysaccharide (LPS).
- c) Phospholipase.
- d) None of the above.

TOPIC: PROKARYOTES IN THE ENVIRONMENT

Virulence

● **Virulence:** the _____ of pathogenicity (disease production) of an organism.

- Organisms with *high* pathogenicity (*more* virulent) are _____ likely to cause an infection.
- **Virulence** _____: traits of an organism that allow it to cause disease (Ex. gene for toxin production).



PRACTICE: Characteristics of a pathogen that promote pathogenicity are called:

- a) Pathogen factors.
- b) Colonization factors.
- c) Infectious agents.
- d) Virulence factors.

PRACTICE: Virulent pathogens are:

- a) Less likely to cause disease.
- b) More likely to cause disease.
- c) Only able to cause disease in weakened hosts.
- d) Always cause disease whenever inside a host.

PRACTICE: Which of the following pathogen characteristics may be considered virulence factor(s)?

- A) Adhesins (molecules that allow a pathogen to adhere to a host cell).
- B) Capsules (protective coatings on the outside of certain bacteria).
- C) Endotoxins (damaging molecules created by certain bacteria).
- D) Proteases (damaging molecules created by certain bacteria).
- E) All of the choices are correct.

PRACTICE: An encapsulated bacterium can be a virulent pathogen because the capsule:

- a) Resists phagocytosis.
- b) Destroys host tissues.
- c) Is composed of endotoxins.
- d) The capsule has no effect on the virulence of a bacterium.

TOPIC: PROKARYOTES IN THE ENVIRONMENT

PRACTICE: Which of the following is a *true* statement?

- a) A successful pathogen never kills the host.
- b) Throughout disease evolution, the most virulent diseases have spread the fastest.
- c) A successful pathogen does not kill the host before it is transmitted.
- d) The primary goal of a pathogen is to kill the host.