


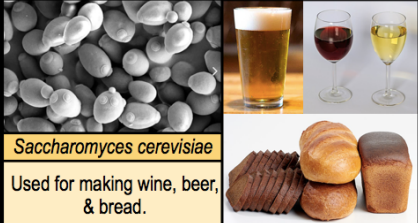

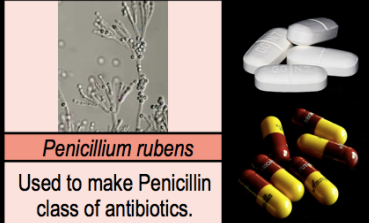
CONCEPT: IMPORTANCE OF MICROORGANISMS

- Microorganisms are incredibly _____ to all living organisms, especially humans.
 - We cannot survive without microorganisms, but yet they have killed more people through disease than war.
 - Microorganisms have important roles *commercially, environmentally, as research tools, & in health.*

Commercial Benefits of Microorganisms

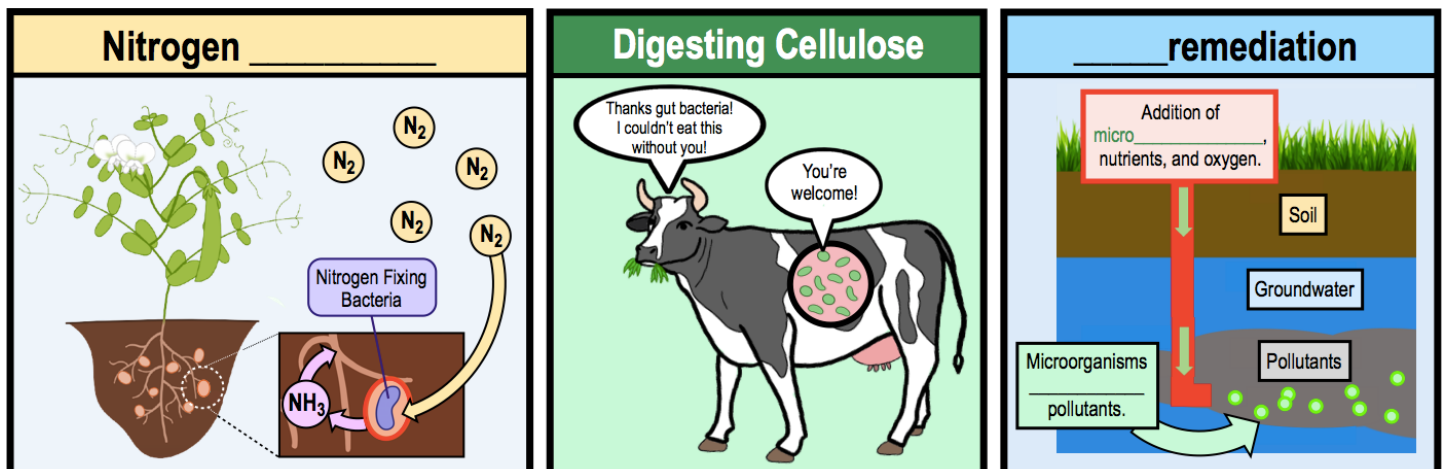
- Microorganisms can be used by humans to make _____ !!!!!!!! 
- They can be used by humans to make valuable products that can be bought & sold to make a profit!
- Microorganisms are used in _____ production (ex. bread, beer, milk, yogurt, & cheeses).
- Can also be used to make antibiotics, dietary supplements, biofuels, insecticides, or molecules to make plastics.

Commercial Uses of Microorganisms

Baker's & Brewer's Yeast	Blue Cheese Mold	Penicillin Antibiotics
 <i>Saccharomyces cerevisiae</i> Used for making wine, beer, & bread.	 <i>Penicillium roqueforti</i> Used in cheese making.	 <i>Penicillium rubens</i> Used to make Penicillin class of antibiotics.

Environmental Benefits of Microorganisms

- Microorganisms play critical roles in *maintaining* an environment that supports the life of other organisms.
 - Some are cable of _____ fixation (converting N_2 into forms of nitrogen other organisms can use).
 - Some capable of degrading cellulose in animal guts & in environment (so fallen leaves & trees don't pile up).
 - Some can be used for **bioremediation** to degrade various environmental pollutants & toxic chemicals.



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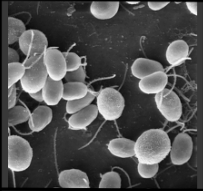
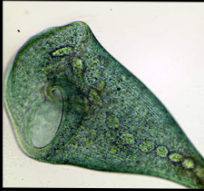
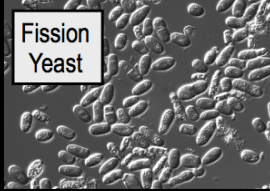
Microorganisms as Research Tools

- Microorganisms have the _____ fundamental metabolic & genetic features as complex multicellular organisms.
 - All cells are made of the same chemical elements; build & perform similar cell structures & metabolic pathways.
 - Microorganisms are inexpensive to grow very quickly, making them excellent research tools!
 - Can be used as _____ **Organisms:** non-human species studied to provide insight into other organisms.

EXAMPLE: Research with Model Organisms.



Model Microorganisms

What scientists study with these organisms	Bacterium	Alga	Protozoan	Fungus
				
	<i>Escherichia coli</i>	<i>Chlamydomonas reinhardtii</i>	<i>Stentor coeruleus</i>	<i>Schizosaccharomyces pombe</i>
	Molecular genetics.	Photosynthesis & flagella motility.	Single-cell regeneration.	Cell cycle & cell division.

PRACTICE: Which of the following is a beneficial activity of microorganisms?

- Some microorganisms are used in the creation of food and drink.
- Some microorganisms remove carbon dioxide from the atmosphere.
- Some microorganisms provide nitrogen for plant growth.
- Some microorganisms are used in sewage treatment processes.
- Some microorganisms are used to remove pollutants from the environment.
- All of the above.

PRACTICE: Which of the following is an example of bioremediation?

- Using oil-degrading bacteria to clean up an oil spill.
- Microorganisms in soil providing usable Nitrogen to plants.
- Using bacteria in a laboratory to create human proteins and hormones, such as insulin.
- All of the above.

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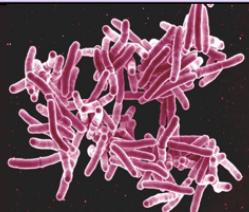


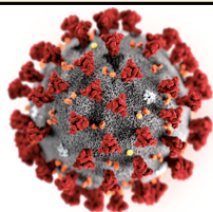
Microorganisms in Health & Disease

- Human bodies carry an enormous population of microorganisms, referred to as the *normal* _____.
 - _____ **Microbiota** or **Flora**: trillions of microbes that live on & in the bodies of multicellular organisms.
 - Normal microbiota plays important roles in human _____ by competing with disease causing microbes.
 - **Human Microbiome Project**: coordinated studies using technology to characterize microbes inhabiting humans.
- Microorganisms are important for health, but can also act as _____ (*disease-causing* microbes).



Human Diseases



Bacterial Diseases	Fungal Diseases	Protozoan Diseases	Viral Diseases
Strep Throat Tuberculosis Gonorrhea Tetanus Pneumonia Syphilis	Ringworm Athlete's Foot Candidiasis Yeast Infections Fungal Nail Infections "Valley Fever"	Malaria Giardiasis "Sleeping Sickness" Toxoplasmosis "Traveler's Diarrhea"	Common Cold Flu Covid-19 Ebola HIV / AIDS Measles & Mumps
			
<i>Mycobacterium tuberculosis</i> (Tuberculosis)	<i>Trichophyton rubrum</i> (Ringworm & Athlete's Foot)	<i>Giardia duodenalis</i> (Giardiasis)	SARS-CoV-2 (Covid 19)

PRACTICE: Which of the following is true of the normal human microbiota?

- It consists of only dangerous pathogens that cause harm to humans.
- It consists of a small subset of viruses that do not cause harm to humans.
- It consists of trillions of microorganisms living on and in the human body that have a beneficial role in human health.
- It consists of only of microbes that normally flourish in the absence of oxygen.