Microbiology 101

The Short Course
Microbiology 101

What we commonly call germs are the most plentiful and essential part of the ecosystem.

There is a “we’ve got to kill them all” mentality

All final biodegradation is accomplished by bacteria in the soil and water. Waste + bacteria = H2O/CO2/CH4

Microbes are not biodegradable – Microbes are the Biodegrader!

BACTERIA = MICROBES = GERMS
Question 1

As a sales person, which word are you going to use when you present the product?

Bacteria = Microbes = Germs

Microbes!
A short history of poop

- Civilizations arise when awareness of septic sanitation allows people to segregate their waste from their living space.
  - Open trench toilets
  - “Men to the woods, Women to the barn”
  - Night pots
  - Outhouses – early 1800’s
  - The Crapper invented 1778
  - Septic “tank” / Leach fields
  - Sanitary sewers

- 1/3 of the world’s current population still defecates on the ground.

- What is that smell? Skatole
Types of Microbes

Two kinds of Microbes

Aerobic – air

Anaerobic – no air
Shape of Microbes

EcoClear Uses only aerobic Bacillus (rod) – Class 1 (none toxic)

Photo: http://www.bio.miami.edu/~cmallery/150/proceuc/c27x3proc_shapes.jpg
The Cell – no nucleus
Bacteria
Question 2

• What kind of bacteria do we sell?

• Aerobic – Bacillus (Rod Shape)- Class 1
Problem - I have food around me, I have no mouth.

- Microbes make a chemical (called an enzyme) that can cut the food molecules into smaller pieces.
- Microbes can move small molecules through the cell wall and inside where they can digest it. (Respiration)
What is an enzyme?

- A very **specific** chemical molecule. It can “cut” a **specific** “food” molecule – making them smaller and easier to absorb
- Lipase cuts lipids (fats)
- Amylase cuts starch
- Protease cuts proteins
- Cellulase cuts cellulose

X RAY Crystallography of LIPASE COMPLEX WITH OLEIC ACID

- Lock and Key specific reactions, no substitutions
- Where could I get all these different enzymes?
BACTERIA ARE ENZYME FACTORIES

• Responding to the food environment, the bacteria makes the specific enzyme it needs to feed on the source material (food).
Question 3

• Why don’t we sell enzymes?

• Too specific, too expensive, food source too varied
The Four Conditions

• Water
  – anything above ambient humidity

• Temperature
  – If it’s a nice day for you, it’s a nice day for Bacteria.
  – Warm is better than cold. (That’s why we live in the South.)

• Oxygen
  – O2 in the form of Dissolved Oxygen – If it’s a nice day for the fish, it’s a nice day for Bacteria.

• pH
  – Between 6.5 and 8.5 – If it can held in your mouth, It’s a nice pH for Bacteria.
The Two Nutrients

• Phosphorous
  – essential for respiration
  – what iron (Fe) is to blood hemoglobin, Phosphorous (P) is to microbial respiration

• Organic Nitrogen in an available form
  – Urea and nitrogen containing amino acids
  – Breakdown products of protein decomposition
Question 4

• Name 2 conditions and 1 nutrient that microbes need to thrive.
Thank You!