

What are you doing this weekend?

Double Y plots
Figuring Bio. Data Rewrites
Archaeology Worksheet

Monday

Setup Seed Germination
Morning Lab 8:00 in Science 331
Afternoon Lab 8:25 in Science 331

Biology:

What is Life? Properties of Life

Cellular Structure: the unit of life, one or many

Metabolism: photosynthesis, respiration, fermentation,
digestion, gas exchange, secretion, excretion, circulation –
processing materials and energy

Growth: cell enlargement, cell number

Movement: intracellular, movement, locomotion

Reproduction: avoid extinction at death

Behavior: short term response to stimuli

Evolution: long term adaptation

How prokaryotes obtain carbon

- **Autotrophs**
– CO₂, CH₄
- **Heterotrophs**
– Consumption of other organisms

PHOTOGRAPH BY: www.gettyimages.com

PHOTOGRAPH BY: www.gettyimages.com

Prokaryote Nutrition

Nutrition Mode	Energy Source	Carbon Source
Photoautotroph		
Chemoautotroph		
Photoheterotroph		
Chemoheterotroph		

Nutrition Mode	Energy Source	Carbon Source
autotroph		CO₂

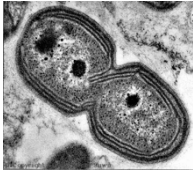

- Cyanobacteria

$$\text{CO}_2 + \text{H}_2\text{O} \xrightarrow[\text{chlorophyll}]{\text{light}} \text{O}_2 + \text{CH}_2\text{O}$$
- Purple-sulfur bacteria

$$\text{CO}_2 + \text{H}_2\text{S} \xrightarrow[\text{bacteriochlorophyll}]{\text{light}} \text{S} + \text{CH}_2\text{O}$$

Nutrition Mode	Energy Source	Carbon Source
Chemoautotroph	Inorganic chem	CO ₂

• *Nitrosomonas* - nitrification
 $2 \text{CO}_2 + \text{NH}_4^+ \rightarrow \text{NO}^- + 2 \text{CH}_2\text{O}$

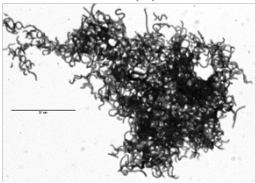



http://www.fishbase.org/SpeciesCatalogue/detail.php?speciesid=10209

Nutrition Mode	Energy Source	Carbon Source
Photoheterotroph	Light	Organic chem

$\text{C}_2\text{H}_4\text{O}_2 \xrightarrow{\text{Light}} 2 \text{CH}_2\text{O}$

Bacteriochlorophyll a



Examples:
 purple non-sulfur bacteria,
 green non-sulfur bacteria,
 and heliobacteria

http://www.acadweb.wvu.edu/courses/envr429-rm/Robin/images/envr429/1_modospirillum_600x.jpg

Nutrition Mode	Energy Source	Carbon Source
Chemoheterotroph	Organic chem	Organic chem

• and most eukaryotes including plants.

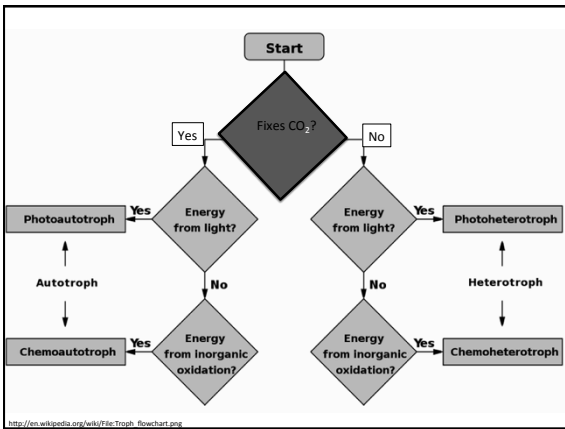
$\text{CH}_2\text{O} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{ATP}$

*Carbohydrate provides both
 the energy source
 and
 the carbon source*

Prokaryote Nutrition

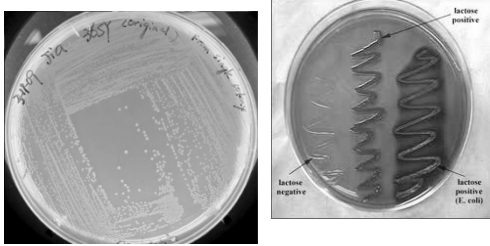
Nutrition Mode	Energy Source	Carbon Source
Photoautotroph	Light	CO ₂
Chemoautotroph	Inorganic chem	CO ₂
Photoheterotroph	Light	Organic chem
Chemoheterotroph	Organic chem	Organic chem

All of these nutritional modes are found among prokaryotes!
Eukaryotes are not as diverse in their nutritional modes.



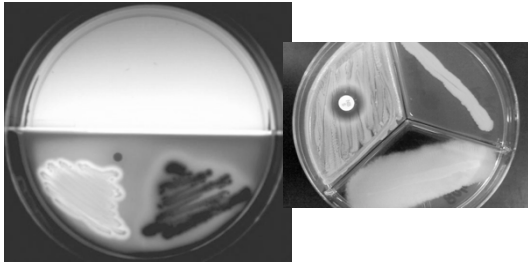
- ### Prokaryote Identification
- Prokaryotes come in all shapes and sizes, but those characters are not enough to identify the thousands of bacterial species known
 - Scientists identify bacteria based on their metabolism
 - Sugars, amino acids, nitrogen sources, gas production

Identifying bacteria based on metabolism



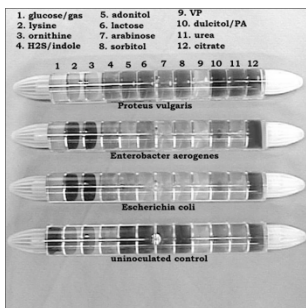
http://www.it.edu/magazine/spring_2009/sulfur_eating_bacterium.shtml <http://dtkclinic.blogspot.com/2011/07/macconkeys-medium-composition-and.html>

Identifying bacteria based on metabolism



http://biologyofmicroorganisms.blogspot.com/2010/09/01_archive.html http://indianpublicmedia.org/earthquake/food_poisoning_crime/

Enterotubes



<http://www.mesacc.edu/~johnson/labtools/Dbiochem/ent.html>

Microscan Plate



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New Frontiers - Metagenomics

- from environmental samples
- Our culture techniques are specific to bacteria that cause disease (37 ° , nutrient-rich agar)
- But less than 1% of bacterial species can be cultured in this way
"culturable"

DIRECT SEQUENCING: AN EXPERIMENTAL PROTOCOL

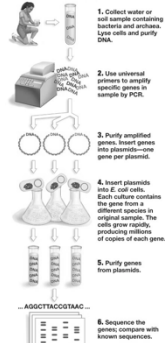


Figure 28.9 pg 575

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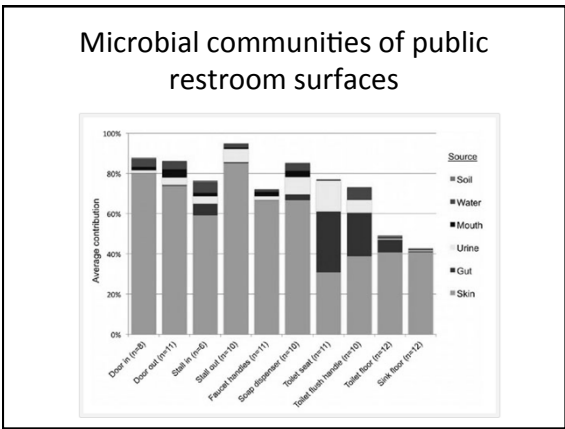
Metagenomics at work

Microbial Biogeography of Public Restroom Surfaces

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<http://cymandystdium.com/?p=451>



- ### Additional nutrient requirements
- Nitrogen
 - Amino acids and nucleic acids
 - Phosphorus
 - ATP, phospholipids
 - Sulfur
 - Amino acids
 - Other trace elements

