Welcome to Bio 2!

• Plant and Animal Interactions
• Second Semester Majors Course
• A course on Taxonomy, Evolution, Biodiversity, Ecology, Conservation, Comparative Anatomy and Physiology
• What have you heard??...you won’t be the same!
• Powerpoint
  • Notes – instruction.mtsac.edu/trevell
  • Coming to class
  • Camera!
  • Everything in the powerpoints is fair game for lecture quizzes/exams!
You need HELP!

• SI/Coaching
• How to Study?
• How to Plan? – BALANCE
• Camera for lab - cell phone but space!
General Rules

• Your cell phone is a useful tool but it is also your enemy. Put it away. Pay attention

• Read your syllabus

• Asking appropriate questions? – A new idea, a new thought, something I just said that you didn’t quite understand? – ASK!
  • Something that is written down elsewhere, something I already covered but you were late, you were absent, you weren’t paying attention – ask another student. Is it in the syllabus...is it an obvious answer. Are you not even trying? Do you want me to read your notes or watch your videos! NO! That is your job!
Student A

- Ask questions but only after they have tried
- Complains almost never.
- Never shows up late to lecture or lab.
- Rarely leaves early.
- Always helping others.
- Is aware that there are other people in the class/work environment
- Listens and understands the rules and follows them and accepts the consequences of not following them.
- Knows their place in the hierarchy of education/work/life

My efforts will be to push the class this way!

Your cell phone, while a very powerful tool, is also your enemy!

Chesca Barrios, MD
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Ben Song, DVM
Rajni Bopari, MD
Bryan Cozart, 2nd year MD
Stephanie Dreikhorn, MD
Jasmine Heyer, 1st MD

Dec 1, Fall 2018 – Order 66
I am available:

• By email Monday-Thursday. I check my email often unless I am teaching, in office hours with a student, or driving. I do not answer emails from Friday afternoon until Sunday night.

• Office Hours.
Carl Linneaus

- Father of “______________”
- Swedish botanist, physician, and zoologist
- Wrote *Systema Naturae* in 1735
- The science concerned with naming and classifying the diverse forms of life

Usually (not necessarily always), the **red** words would make a good study guide for fill-ins or short essay

It’s a GAME!!!!
Cladistics/Taxonomy Combo

- ________________ chart showing relationship of organisms.
- Based on "synapomorphies".
- Can use “Clade” or “Group” AND/OR traditional taxonomic levels.

Taxa

Kingdom

Phylum

Class...
Cladograms/Ultrametric Trees

- Monophyletic groups not paraphyletic or polyphyletic

Include Time
Each Group is defined by the presence of certain characteristics produced through evolutionary history.

The 3 Domains (higher than Kingdom)

Carl Woese 1977.... (Kingdom’s)

1990’s... (Domain’s)
Evolution

Charles Darwin (1859)
*Origin of Species*

Differential reproductive success... A genetic change in a group of organisms over time... (Farm Animals)
Microevolution vs. Macroevolution

Small levels of genetic change over relatively short periods of time...

Speciation = Anagenesis vs. Cladogenesis

Fossils
DNA
Homologous Structures Vs. Analogous Structures
Evolution

• Gradualism vs Punctuated Equilibrium
Evolution

• Allopatric vs Sympatric
Evolution – Gene Flow....

Figure 24.14 Formation of a hybrid zone and possible outcomes for hybrids over time.
HGT
(Horizontal Gene Transfer)
DNA
Bones
Fossil Record
Characteristics of Domain Bacteria

- Prokaryotic cells
- Nucleoid Region
  - single circular chromosome
  - plasmids
- No membrane-bound organelles
- Ribosomes (70S)
- Plasma membrane

- Cell wall

- Capsule
  - glycocalyx
- Flagella
Classification

• Shape (**Cocci or Rod**)
• Staining
  • Gram
  • Spore
  • Acid-fast
• Oxygen requirements
• Feeding strategies
Shapes

• Sperical (Cocci)
• Rod-Shaped (Bacillus)
• Spiral (Spirochetes)
Shapes and Arrangements

Cocci:
- Spherical
- _______ – in lines
- _______ – in grape like clusters
Shapes and Arrangements

Helical
Spirillium
Spiral Shaped
Shapes and Arrangements

Filamentous
Stains (several)

• Gram Stain
  • ________ = gram positive
  • ________ = gram negative
• Han Christian Gram (19th Century - Danish Physician)
(a) Gram-positive bacteria: peptidoglycan traps crystal violet.

(b) Gram-negative bacteria: crystal violet is easily rinsed away, revealing red dye.

Cell wall
Peptidoglycan layer
Plasma membrane

Gram-positive bacteria

10 μm

Outer membrane
Peptidoglycan layer
Plasma membrane

Carbohydrate portion of lipopolysaccharide

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Acid-fast Stain

- *Mycobacterium leprae, M. tuberculosis*
- *(Acid-Fast “+” Red,)
- *(Acid-Fast “-” Blue)*
Spore Stain
Oxygen Requirements

• **Obligate aerobes** – require oxygen
• **Obligate anaerobes** – require no oxygen
• ________________________ – can grow with or without oxygen
• **Aerotolerant Anaerobes** – only anaerobic growth but oxygen does not harm.
• ________________________ – aerobic growth in low oxygen concentrations.
<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Obligate Aerobes</td>
<td>Only aerobic growth; oxygen required.</td>
</tr>
<tr>
<td>b. Facultative Anaerobes</td>
<td>Both aerobic and anaerobic growth; greater growth in presence of oxygen.</td>
</tr>
<tr>
<td>c. Obligate Anaerobes</td>
<td>Only anaerobic growth; ceases in presence of oxygen.</td>
</tr>
<tr>
<td>d. Aerotolerant Anaerobes</td>
<td>Only anaerobic growth; but continues in presence of oxygen.</td>
</tr>
<tr>
<td>e. Microaerophiles</td>
<td>Only aerobic growth; oxygen required in low concentration.</td>
</tr>
</tbody>
</table>
Feeding Strategies

• Based on energy and carbon sources
  • Photoautotrophs
  • Chemoautotrophs
  • Photoheterotrophs
  • Chemoheterotrophs
### Table 27.1 Major Nutritional Modes

<table>
<thead>
<tr>
<th>Mode of Nutrition</th>
<th>Energy Source</th>
<th>Carbon Source</th>
<th>Types of Organisms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autotroph</td>
<td>Light</td>
<td>CO₂</td>
<td>Photosynthetic prokaryotes (for example, cyanobacteria); plants; certain protists (algae)</td>
</tr>
<tr>
<td></td>
<td>Inorganic chemicals</td>
<td>CO₂</td>
<td>Certain prokaryotes (for example, <em>Sulfolobus</em>)</td>
</tr>
<tr>
<td>Heterotroph</td>
<td>Light</td>
<td>Organic compounds</td>
<td>Certain prokaryotes (for example, <em>Rhodobacter, Chloroflexus</em>)</td>
</tr>
<tr>
<td></td>
<td>Organic compounds</td>
<td>Organic compounds</td>
<td>Many prokaryotes (for example, <em>Clostridium</em>) and protists; fungi; animals; some plants</td>
</tr>
</tbody>
</table>

Good essay Question!
Nitrogen Metabolism
Law of Parsimony or Occam’s Razor

Hypothesis (a): Photosynthesis evolved many times.
Hypothesis (b): Photosynthesis evolved once.

Which tree is most parsimonious?
5 Groups of Bacteria:
1) Proteobacteria
2) Gram + bacteria
3) Chlamydias
4) Spirochetes
5) Cyanobacteria
(or 5 Clades or 5 Kingdom’s?)
Domain: Bacteria

• Group: Proteobacteria
  • Salmonella
• bacillus shape, gram negative, facultative anaerobe
• Diarrhea, nausea – (chicken and reptiles)
• ______________ – caused by cell wall
Domain: Bacteria

- Group: Proteobacteria
  - *E. coli*
- bacillus shape, gram negative, facultative anaerobe
- Diarrhea
- _________________ – releases proteins that cause illness
Domain: Bacteria

- Group: Gram-positive bacteria
  - *Clostridium*
- Bacillus shape
- **endospore**
- Obligate anaerobes - exotoxins
- Causes gangrene,
  ____________ (strongest poison in the world! – 1 gram can kill 1 million people!)
Domain: Bacteria

- Group: Gram-positive bacteria
  - *Bacillus anthracis*
- Bacillus shape (endospore)
- Aerobic
- Causes pustules, pneumonia
Domain: Bacteria

- Group: Gram-positive bacteria
  - *Streptococcus*

- Coccus shape & gram positive, anaerobic but are air tolerant

- necrotizing fasciitis, strep throat, scarlet fever
Domain: Bacteria

- Group: Gram-positive bacteria
  - *Staphylococcus, MRSA*
- Coccus shape & gram positive, facultative anaerobe
- Most common type of food poisoning, toxic shock syndrome
- Dangerous in hospitals (__________ infections)
  - *Iatrogenic*
Domain: Bacteria

- **Group:** Cyanobacteria
  - Contains Chlorophyll A and phycocyanin
- Only organism on planet that can fix nitrogen and release oxygen
- pools
Domain: Bacteria

- **Group: Spirochetes**
  - ______________________
    - Syphilis
    - anaerobic
  - ______________________
    - Lyme Disease
    - Microaerophile

Genus alone is okay except in rare cases when we learn two or more in the same genus...
Domain: Bacteria

- Group: Chlamydias
  - *Chlamydia*
- Coccus shape & gram negative
- Causes blindness and is one of the most common STD’s in U.S.
- Oxygen requirement uncertain