

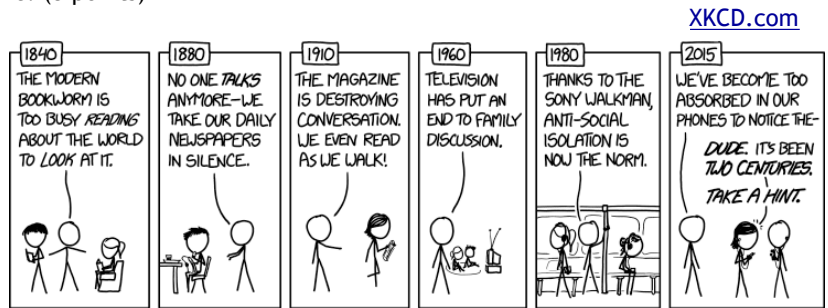
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Signed : _____

Date : _____

Name : _____

1. What are the three primary evolutionary branches of life? (5 points)



Multiple choice (1 point each, 10 points total)

_____ 2. The "deeply-branching" phyla of Bacteria, the *Aquificae* and *Thermotogae*, are ...

- A. autotrophic and acidophilic
- B. mesophilic and heterotrophic
- C. thermophilic and primitive
- D. methanogenic and symbiotic
- E. microaerophilic and photosynthetic

_____ 3. Which of the following is **not** a pathway used by phototrophic Bacteria to fix carbon?

- A. the reductive acetyl-CoA pathway
- B. cyclic photophosphorylation
- C. the reverse (reductive) TCA cycle
- D. the Calvin cycle
- E. the hydroxypropionate pathway

_____ 4. The wide variety of metabolic phenotypes found in the proteobacteria are based on ...

- A. heterotrophy
- B. autotrophic nitrogen metabolism
- C. photosynthesis
- D. the electron transport chain
- E. fermentation

_____ 5. The Gram-positive bacteria are the ...

- A. Actinobacteria and Firmicutes
- B. Bacteroides, Flavobacteria, and Cytophaga
- C. alpha-, beta-, and gamma-proteobacteria
- D. Foraminiferans and Radiolarians
- E. Archaeozoans and Alveolates

_____ 6. Sphingolipids are found in the membranes of ...

- A. Planctomycetes
- B. Spirochaetes
- C. Chlamydiae
- D. Archaea
- E. Bacterioids

_____ 7. An organism with a fibrous stalk not surrounded by the cell envelop is most likely to be ...

- A. a Crenarchaeote
- B. a Planctomycete
- C. a Spirochaete
- D. an Actinobacterium
- E. a Verrucomicrobium

_____ 8. Which of the following is *not* a phylum of Bacteria with few or no cultivated members?

- A. OP 11
- B. Acidobacteria
- C. Fusobacteria
- D. Nitrospira
- E. Bacteroids

_____ 9. In which of the following structures do Archaea generally resemble Eukarya?

- A. flagella
- B. RNA polymerase
- C. membrane lipids
- D. genome structure
- E. cellular morphology

_____ 10. The unikonts are the phylogenetic group (“Super-Kingdom”) of eukaryotes that include animals. Which of the following does *not* also belong to this group?

- A. green plants
- B. amoeba
- C. choanoflagellates
- D. slime molds
- E. fungi

_____ 11. Which if the following is *not* a potential origin of some kinds of viruses?

- A. extremely reduced previously-cellular parasites
- B. remnants of the RNA World
- C. meiotic non-disjunction
- D. plasmids or genes of their host

12. *Describe in detail* any mechanism used by Bacteria to get around (motility) *other than flagella*. (5 points)

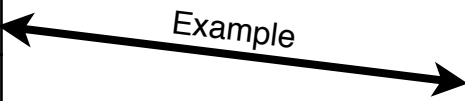
13. Briefly describe your favorite **proteobacterium**. (5 points) Be sure to include any interesting aspects, for example, of morphology, metabolism, life cycle, habitat, importance to humans, &c. (5 points)

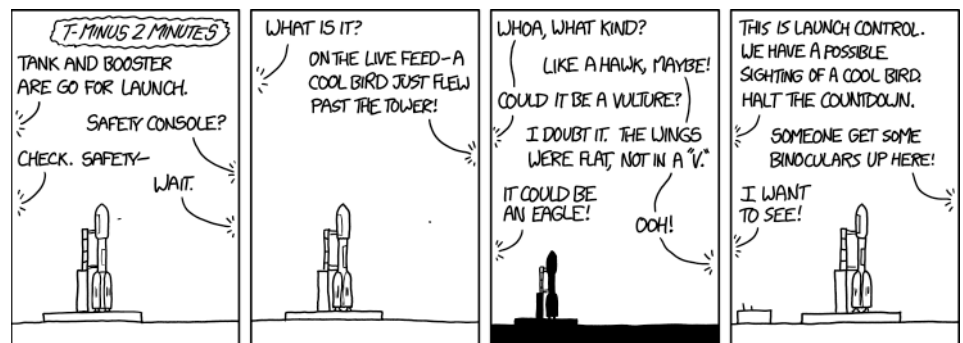
14. Briefly describe your favorite **Euryarchaeon** (*i.e.* a member of the Euryarchaea). Be sure to include any interesting aspects, for example, of morphology, metabolism, life cycle, habitat, &c. (5 points)

15. Briefly describe a **bacterium** that is a symbiont (mutualistic, commensalistic, or parasitic) of a eukaryote. You cannot use an organism you've described in any previous answer. Be sure to include any interesting aspects, for example, of morphology, metabolism, life cycle, habitat, affect on its host, &c. (5 points)

16. Briefly describe a representative **unicellular non-fungal eukaryote**. Be sure to include any interesting aspects, for example, of morphology, metabolism, life cycle, habitat, importance to humans, &c. (5 points)

17. Match the 10 of the following 12 phenotypes with the correct phylogenetic group. Use each only once, and mark the two you choose not to answer with "X"s. (1 points each, 10 points total)

Methanogenesis	<i>Example</i> 	Planctomycetes
Oxygenic photosynthesis		Euryarchaea
Internal cytoplasmic membrane		Cyanobacteria
Radiation resistance		Proteobacteria
helical or wave-shaped cell with periplasmic flagella		Chlorobi
Mycolic acid outer membrane		Actinobacteria
Purple photosynthesis		Deinococci
Green photosynthesis and sulfur oxidation		Chlamydiae
Hydrogen oxidation (Knallgas)		Spirochaetes
Loose outer membrane with large periplasm		Aquificae
Obligate intracellular parasites		Thermotogae
Endospores		Chloroflexi
Flexible unbranched filaments	Firmicutes	



Use this area to complete any answers that don't fit in the exam space allotted. (Be sure to label with the question number.)



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Organisms we've talked about in class			
<i>Acidobacterium capsulatum</i>	<i>Cytophaga hutchinsonii</i>	<i>Methanocaldococcus jannaschii</i>	<i>Roseiflexus castenholzii</i>
<i>Anabaena</i>	<i>Deinococcus radiodurans</i>	<i>Methanosarcina barkeri</i>	<i>Rotalipora globotruncanoides</i>
<i>Anaerolinea thermophila</i>	<i>Dermocarpa</i>	<i>Methanothermobacter thermoautotrophicus</i>	<i>Saccharomyces cerevisiae</i>
<i>Aquifex pyrophilus</i>	<i>Desulfovibrio desulfuricans</i>	<i>Microcystis</i>	<i>Sphaerotilus natans</i>
<i>Archaeoglobus fulgidus</i>	<i>Escherichia coli</i>	<i>Mimivirus</i>	<i>Sphyræna barracuda</i>
<i>Arthrobacter globiformis</i>	<i>Euglyphia strigosa</i>	<i>Mycobacterium ulcerans</i>	<i>Streblomastix strix</i>
<i>Azotobacter vinelandii</i>	<i>Fervisobacterium islandicum</i>	<i>Mycoplasma hominis</i>	<i>Streptomyces antibioticus</i>
<i>Bacillus cereus</i>	<i>Fischerella</i>	<i>Myxococcus xanthus</i>	<i>Sulfolobus solfataricus</i>
bacteriophage M13	<i>Flavobacterium johnsoniae</i>	<i>Nanoarchaeum equitans</i>	<i>Thalassia testinum</i>
bacteriophage Mu	<i>Fusobacterium nucleatum</i>	<i>Navicula</i>	<i>Thermocrinus ruber</i>
<i>Bacteroides thetaiotaomicron</i>	<i>Gemmata obscuriglobus</i>	<i>Nitrospira marina</i>	<i>Thermodesulfobacterium</i>
<i>Bdellovibrio bacteriovorus</i>	<i>Giardia lamblia</i>	<i>Opitutus terrae</i>	<i>Thermoleophilum album</i>
<i>Beggiatoa alba</i>	<i>Halobacterium salinarium</i>	<i>Oscillatoria</i>	<i>Thermomicrobium roseum</i>
<i>Blastopirellula marina</i>	<i>Helicobacter pylori</i>	<i>Pelodictyon phaeoclathratiforme</i>	<i>Thermoplasma acidophilum</i>
<i>Borrelia recurrentis</i>	<i>Heliobacterium chlorum</i>	<i>Physarum polycephum</i>	<i>Thermoproteus tenax</i>
<i>Brocadia anammoxidans</i>	Hepatitis delta virus	<i>Phytophthora infestans</i>	<i>Thermosiphon africanus</i>
<i>Buchnera aphidicola</i>	<i>Herpetosiphon aurantiacus</i>	<i>Prochloron</i>	<i>Thermotoga maritima</i>
<i>Caulobacter crescentus</i>	<i>Hexacontium giganteum</i>	<i>Prosthecobacter fusiformis</i>	<i>Thermus aquaticus</i>
<i>Chlamydia trachomatis</i>	<i>Isosphaera pallida</i>	<i>Protochlamydia amoebophila</i>	<i>Thiobacillus thioparus</i>
<i>Chlorobium limicola</i>	<i>Karenia brevis</i>	<i>Pyrococcus furiosus</i>	<i>Treponema denticola</i>
<i>Chloroflexus aurantiacus</i>	<i>Korarchaeum cryptofilum</i>	<i>Pyrodictium occultum</i>	<i>Trypanosoma brucei</i>
<i>Chondrus crispus</i>	<i>Leptospira biflexa</i>	<i>Ralstonia solanacearum</i>	<i>Veillonella atypica</i>
<i>Chromatium vinosum</i>	<i>Leptospirillum ferrooxidans</i>	<i>Reclinomonas americana</i>	<i>Verrucomicrobium spinosum</i>
<i>Clostridium botulinum</i>	<i>Leuconostoc mesenteroides</i>	<i>Rhizobium etli</i>	<i>Vorticella</i>
<i>Cryosmallon squamiferum</i>	<i>Magnetobacterium bavaricum</i>	<i>Rhodomicrobium vannielii</i>	<i>Wolbachia pipientis</i>

Midterm exam #2 Take-home questions

MB 451 Microbial Diversity

The rules: You are free to use any notes, books, or online material while taking this take-home exam. You are NOT allowed to get (or give) help of any kind from (or to) anybody. If you have questions about the exam, send an email to Dr. Brown at james_brown@ncsu.edu. You MUST turn this completed take-home portion of the exam in with the rest of the exam when you take it either in class or at DELTA. By signing this exam, you pledge that “I have neither given nor received unauthorized aid on this test.”

Signed : _____

Date : _____

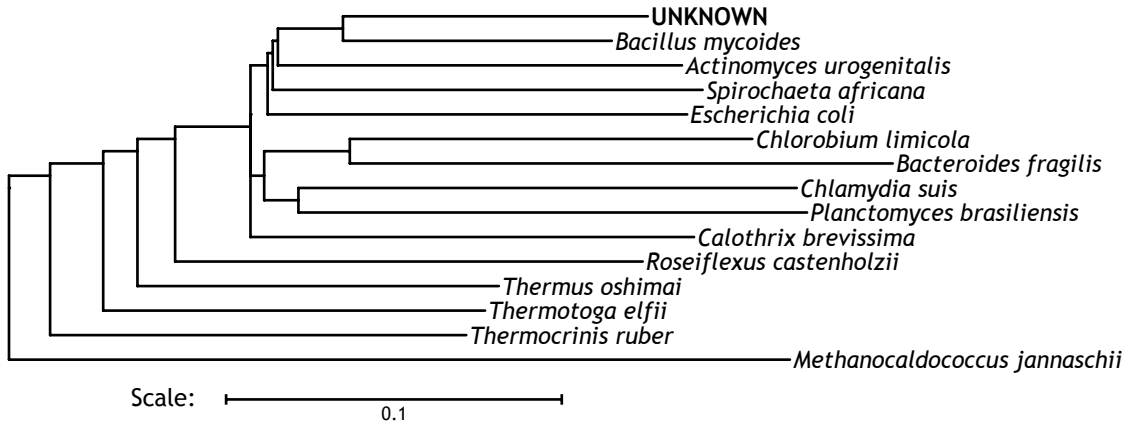
Name : _____

1. For each of the genera listed, provide the name of the phylogenetic group (phylum) of that genus, and something interesting about that specific genus. (½ point each, 20 points total):

Genus	Phylogenetic group (Phylum)	Something interesting about it
<i>Sulfolobus</i>		
<i>Rhodotorula</i>		
<i>Chlamydia</i>		
<i>Gemmata</i>		
<i>Burkholderia</i>		
<i>Peptostreptococcus</i>		
<i>Helicobacter</i>		
<i>Micrococcus</i>		

Genus	Phylogenetic group (Phylum)	Something interesting about it
<i>Cristispira</i>		
<i>Thermosipho</i>		
<i>Thermoplasma</i>		
<i>Flavobacterium</i>		
<i>Deinococcus</i>		
<i>Crithidia</i>		
<i>Stylosphaera</i>		
<i>Oscillatoria</i>		
<i>Methylobacterium</i>		
<i>Roseiflexus</i>		
<i>Azorhizophilus</i>		
<i>Allochromatium</i>		

2. You have isolated an unknown organism in lab. You've misplaced your notes and your plates, so you don't know anything about it. But your ssu-rRNA PCR was successful, and you have good sequence data. From this sequence, you generate the following tree:

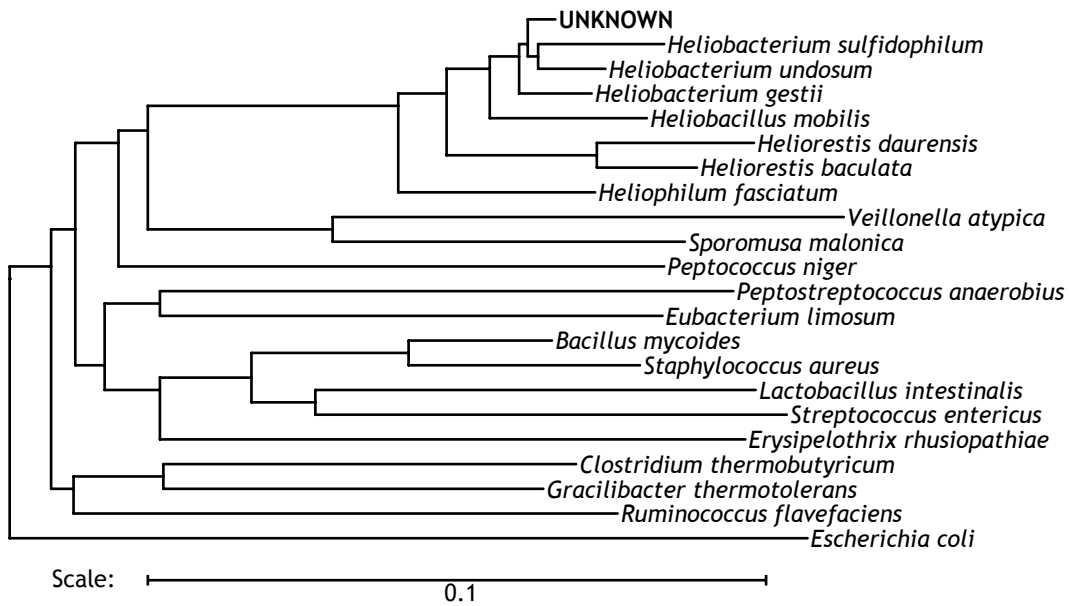


List 5 things you *can* or *can't* predict with reasonable confidence about this organism (2 points each, 10 points total). Common features of Bacteria, or life in general, will not accepted, e.g. "it has DNA", "it doesn't have Golgi", or "don't know what country it comes from". You are allowed to include taxonomic identification only once, e.g. "it's a mammal".

Hint : If it tree'ed out as a mammal, you could predict it had a bony skeleton, mammary glands (if female), and hair, but unless it tree'ed specifically within a particular group, you couldn't predict it whether it was a carnivore or herbivore, or how big it is.

2.1.
2.2.
2.3.
2.4.
2.5.

3. Based on the placement of this organism in the previous tree, you create a more detailed tree:



List 5 **new** things you *can* or *can't* predict about this organism with reasonable confidence (2 points each, 10 points total). Once again, common features of Bacteria, or life in general, will not be accepted. You are allowed to include taxonomic identification only once. These have to be **new** - something you could not have stated based on the prior tree.

3.1.
3.2.
3.3.
3.4.
3.5.

- Both Chloroflexi and Chlorobi use electrons from sulfide or hydrogen for reducing power for carbon fixation. Compare and contrast the mechanisms by which these two kinds of organisms do this. What are the advantages and disadvantages of each? Use your own words to demonstrate that you actually understand this. (10 points)