

Honor pledge: "I have neither given nor received unauthorized aid on this test."

Signed : \_\_\_\_\_

Date : \_\_\_\_\_

Name : \_\_\_\_\_

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

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Multiple choice (1 point each)

2. \_\_\_\_ Which of the following is most likely to cause the upper barrier for life at high temperatures?
- A. nucleic acid denaturation
  - B. protein denaturation
  - C. membrane integrity
  - D. small molecule decomposition
  - E. amino-acid racemization
3. \_\_\_\_ Which of the following is *not* a carbon fixation pathway?
- A. the Calvin cycle
  - B. the methanogenic pathway
  - C. the reductive TCA cycle
  - D. the hydroxypropionate pathway
  - E. the reductive acetyl-coA pathway
4. \_\_\_\_ The wide range of metabolic capabilities of the proteobacteria are based on what fundamental system?
- A. the electron transport chain
  - B. photosystem I
  - C. the TCA cycle
  - D. glycolysis and gluconeogenesis
  - E. none of the above
5. \_\_\_\_ A secondary metabolite is produced ...
- A. only during logarithmic growth
  - B. during all phases of growth
  - C. during growth spurts
  - D. only during stationary phase
  - E. secondary metabolites are unrelated to growth
6. \_\_\_\_ The secretion of polysaccharides from pores in the cell to drive motility is one form of ...
- A. gliding motility
  - B. twitching motility
  - C. writhing motility
  - D. flagellar motility
  - E. spirochaete motility
7. \_\_\_\_ Reductive evolution is most commonly seen in ...
- A. obligate autotrophs
  - B. facultative phototrophs
  - C. multicellular organisms
  - D. strict oligotrophs
  - E. obligate parasites

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8. \_\_\_\_ What fraction of species in the microbial world have been characterized?
- A. most of them (75-100%)
  - B. about half (25-75%)
  - C. a good bit less than half (10-25%)
  - D. a lot, but a lot yet to go (1-10%)
  - E. a very small fraction (less than 1%)
9. \_\_\_\_ What group of organisms seem to be primitive, deep relatives of the eukaryotes?
- A. *Thermotoga*
  - B. Bacteria
  - C. Archaea
  - D. Excavates
  - E. none of the above
10. \_\_\_\_ Which main division (super-Kingdom) of Eukarya do humans belong to?
- A. Excavates
  - B. Rhizaria
  - C. Unikonts
  - D. Plants
  - E. Chromalveolates
11. \_\_\_\_ Which of the following is **not** a virus, viroid, or virusoid?
- A. bacteriophage Mu
  - B. hepatitis delta virus
  - C. Rice Yellow Mottle Virus-associated viroid
  - D. Mimivirus
  - E. F plasmid
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12. **Describe one** the three major possibilities for the origin of viruses. (5 points)



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

14. Briefly describe a representative of the Proteobacteria. You cannot use the organism you've described in the previous answer. (5 points)

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15. Briefly describe a representative of the Archaea. You cannot use an organism you've described in any previous answer. (5 points)

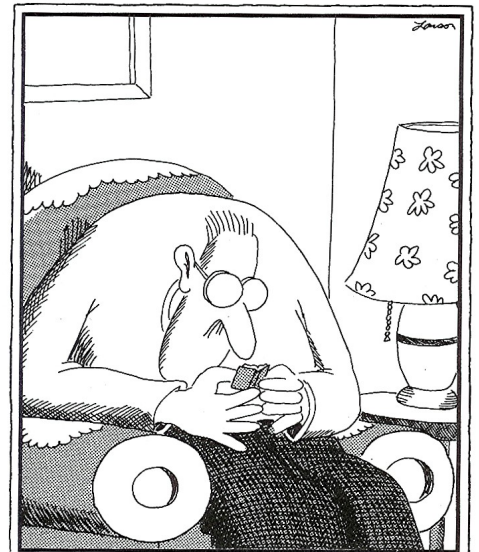
16. Briefly describe a representative phototrophic bacterium. You cannot use an organism you've described in any previous answer. (5 points)

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17. Briefly describe a representative eukaryote. You cannot use an organism you've described in any previous answer. (5 points)

18. Briefly describe any organism that has been characterized but never been grown in pure culture. You cannot use an organism you've described in any previous answer. (5 points)

Use this area to complete any answers that don't fit in the exam space allotted.



Roger crams for his microbiology midterm.

Gary Larson

<b>Organisms we've talked about in class</b>			
<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>Euglypha 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>Thermodesulfovibacterium</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 giganthium</i>	<i>Prostheco bacter 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 breve</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>Cryosomallon squamiferum</i>	<i>Magnetobacterium bavaricum</i>	<i>Rhodomicrobium vannielii</i>	<i>Wolbachia pipientis</i>

**The rules:** You are free to use 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 (face-to-face students) or in the DELTA offices (DE students).

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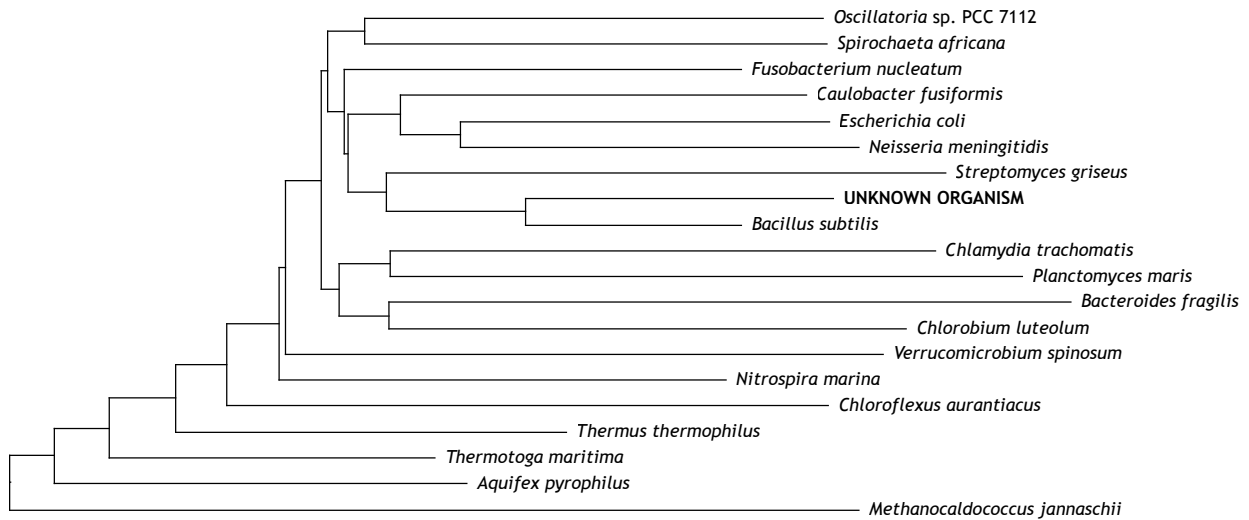
1. For each of the phylogenetic groups listed, provide the name of one organism (genus or species) in that group, and something unique or unusual about it (½ point each):

Phylogenetic group	Genus	Something about it
Crenarchaea		
Euryarchaea		
Excavates		
Chromalveolates		
Verrucomicrobia		
Deinococci		
Chlamydia		
Planctomycetes		

Phylogenetic group	Genus	Something about it
Spirochaetes		
Bacteroids		
Firmicutes		
Actinobacteria		
alpha-proteobacteria		
beta-proteobacteria		
gamma-proteobacteria		
Cyanobacteria		
Chlorobi		
Chloroflexi		
Thermotogae		
Aquificae		



2. You been given an unknown organism in lab. The student who isolated it is no longer around and you do not have their notes, so you don't know anything about it: where it came from, what the cells or colonies look like, of how you grew it. But your ssu-rRNA PCR was successful, and you have good sequence data. From this sequence, you generate the following tree:

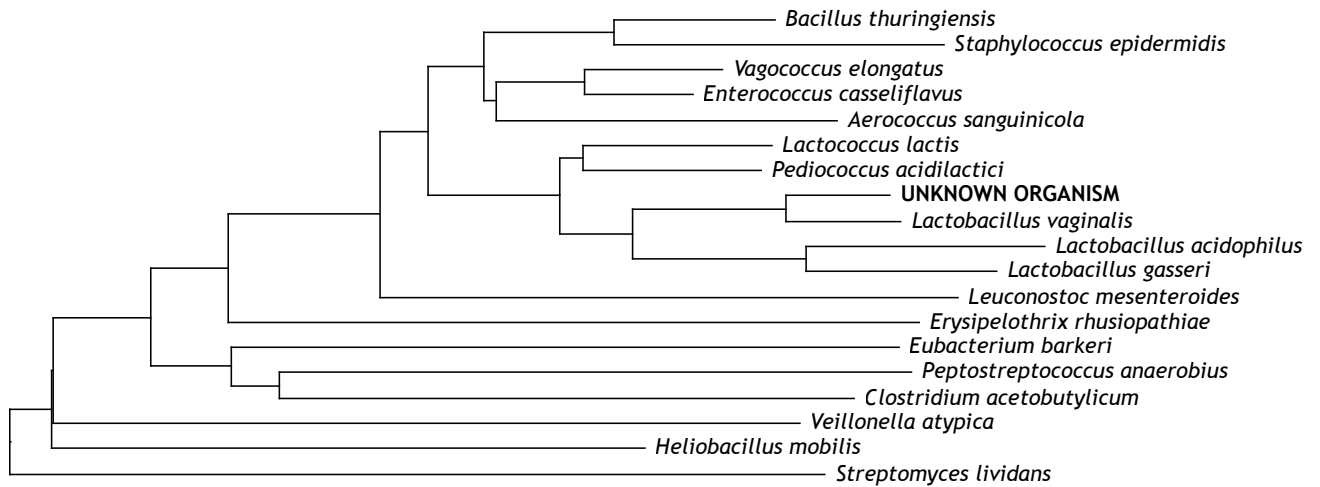


List 5 things you *can* or *can't* predict with reasonable confidence about this organism based on this information (2 points each). Common features of Bacteria, or life in general, will not accepted, e.g. "it has DNA", "it doesn't have Golgi", or "don't know what country it comes from".

*Hint* : If the organism had tree'ed out as a mammal, you could predict it had a bony skeleton and at least some hair, but unless it tree'ed specifically out with a particular kind of mammal, you couldn't predict it whether it was a carnivore or herbivore.

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 (2 points each):

3.1.
3.2.
3.3.
3.4.
3.5.

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4. Both Chloroflexi (green non-sulfur Bacteria) and Chlorobi (green sulfur bacteria) 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)