
Final Exam : In-class questions | MB 451 Microbial Diversity

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

Name : _____

Date : _____

4. What are the 3 primary branches of life? (5 points)

Multiple-choice questions (1 points each)

5. ____ Which best represents how the pink filamentous organism in Yellowstone hot springs was identified as a relative of *Aquifex* before cultivation?
- A. rRNA PCR -> sequence -> UNIFRAC
 - B. label -> rRNA PCR -> centrifuge -> DGGE
 - C. enrichment -> isolation -> rRNA PCR
 - D. rRNA PCR -> clone -> sequence -> FISH
 - E. sequence genome -> identify rRNA gene
6. ____ Once cultivated, this pink filamentous organism was named:
- A. *Thermocrinis ruber*
 - B. *Thermus aquaticus*
 - C. *Thermotoga maritima*
 - D. *Thermomonospora brevis*
 - E. *Thermofilum washburnii*
7. ____ The scaly snail autotrophic endosymbionts live in which one of its organs?
- A. surface scales
 - B. gills
 - C. esophageal glands
 - D. bacterome
 - E. brain
8. ____ The most abundant bacteria living on most of the skin of humans are:
- A. Staphylococci
 - B. Proprionibacteria
 - C. Lactobacilli
 - D. Clostridia
 - E. Cyanobacteria
9. ____ The most abundant bacteria living in the lower gut (feces) of humans are:
- A. Lactobacilli
 - B. Spirochaetes
 - C. Pseudomonads
 - D. Enterics
 - E. Bacteroids
10. ____ Which of the following was the *major* approach used by Sakamoto, et al, to characterize the microbiota of teeth and saliva before and after periodontal treatment?
- A. terminal-RFLP
 - B. denaturing gradient gel electrophoresis
 - C. realtime PCR
 - D. fluorescent *in situ* hybridization
 - E. high-throughput sequencing
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11. ____ What stable isotope-labeled compound did Moreno, et al, use to label autotrophic ammonia oxidizers (and in turn, the protists that eat them)?

- A. $^{15}\text{NH}_4^+$ (ammonia)
- B. $^{15}\text{O}_2$ (molecular oxygen)
- C. ^{32}P -GMP (guanosine monophosphate)
- D. $^{13}\text{CO}_3^-$ (carbonate)

12. ____ What protist did Moreno, et al, discover was the primary grazer of autotrophic ammonia oxidizers?

- A. *Sphyraena*
- B. *Paramecium*
- C. *Spumoni*
- D. *Chaos*
- E. *Epistylis*

13. ____ Proteorhodopsin is a...

- A. light-driven proton pump
- B. sensory opsin
- C. light-driven chloride pump
- D. antenna-complex pigment
- E. reaction-center chlorophyll

14. ____ A fossilized deep-sea hydrothermal vent is called a ...

- A. stromatolite
- B. black smoker
- C. methane-hydrate deposit
- D. massive sulfide deposit
- E. banded iron formation

Short-answer question (5 points each)

15. How are PCR *chimeras* generated in an environmental ssu-rRNA PCR reaction?

16. **Describe** the most interesting thing you learned from any of the papers we reviewed in class. Make sure to include why you think this is interesting - what does it mean to you? This is a substantial question - please give a substantial answer.

18. Describe **one** of the following technologies: UniFrac, 454 sequencing, stable-isotope probing (SIP), terminal RFLP (tRFLP), or denaturing gradient gel electrophoresis (DGGE).

Essay question (10 points)

19. Describe any single paper we've discussed in this course. You *are* allowed to use papers we reviewed in the Discussion session if you wish.

Purpose:

Background:

Approach/Methods:

Results:

Conclusion:

USE THIS PAGE TO FINISH ANY ANSWERS YOU'RE BEING LONG-WINDED ABOUT

Papers reviewed in class:

- Reysenbach AL, Wickham GS & Pace NR 1994 Phylogenetic analysis of the hyperthermophilic pink filament community in Octopus Spring, Yellowstone National Park. *Appl. Env. Microbiol.* 60:2133-2199
- Huber R, et al. 1998 *Thermocrinus ruber*, gen. nov., sp. nov., a pink-filament-forming hyperthermophilic bacterium isolated from Yellowstone National Park. *Appl. Env. Microbiol.* 64:3576-3583
- Goffredi SK, Waren A, Orphan VJ, Van Dover CL & Vrijenhoek RC 2004 Novel forms of structural integration between microbes and a hydrothermal vent gastropod from the Indian Ocean. *Appl Env Microbiol* 70:3082-3090
- Costello EK, Lauber CL, Hamady M, Fierer N, Gordon JI & Knight R 2009 Bacterial community variation in human body habitats across space and time. *Science* 326:1694-1697
- Sakamoto M, Huang Y, Ohnishi M, Umeda M, Ishikawa I & Benno Y. 2004 Changes in oral microbial profiles after periodontal treatment as determined by molecular analysis of 16S rRNA genes. *J. Med. Microbiol.* 53:563-571.
- Moreno AM, Matz C, Kjelleberg S & Manefield M 2010 Identification of ciliate grazers of autotrophic Bacteria in ammonia-oxidizing activated sludge by RNA stable isotope probing. *AEM* 76:2203-2211
- Beja O, et al. 2000 Bacterial rhodopsin: Evidence for a new type of phototrophy in the sea. *Science* 289:1902-1906.
- Rasmussen, B. 2000 Filamentous microfossils in a 3,235-million-year-old volcanogenic massive sulphide deposit. *Nature* 405:676-679

Papers reviewed in the Discussion sessions this semester (you can use these if you wish):

- Pye RJ, Pemberton D, Tovar C, Tubio JM, Dun KA, Fox S, Darby J, Hayes D, Knowles GW, Kreiss A, Siddle HV, Swift K, Lyons AB, Murchison EP, Woods GM. 2016. A second transmissible cancer in Tasmanian devils. 2016. *Proc Natl Acad Sci U S A.* 113(2):374-9
- Mina MJ, Metcalf CJE, de Swart RL, Osterhaus ADME and Grenfell BT 2017. Long-term measles-induced immunomodulation increases overall childhood infectious disease mortality. *Science* 348:694
- Giovannoni SJ, et al. 2005 Genome streamlining in a cosmopolitan oceanic bacterium. *Science* 309:1242
- Rault D, et al. 2008 Nanobacteria are mineralo fetuin complexes. *PLOS Pathogens* 4:e41
- Schuergers N, et al. 2016. Cyanobacteria use micro-optics to sense light direction. *eLife* 5:e12620
- Rasmussen et al. 2015. Early divergent strains of *Yersinia pestis* in Eurasia 5,000 years ago. *Cell* 163:571-582
- Hug LA, et al. 2016. A new view of the tree of life. *Nat. Microbiol.* 48: Article 16048 (11 April 2016)
- Fierer N, Hamady M, Lauber CL and R Knight 2008 The influence of sex, handedness, and washing on the diversity of hand surface bacteria. *PNAS* 105:17994-17999