

Student Name _____
ID _____

MICR*2420 Midterm 1 (example exam)
Examiner: Emma Allen-Vercoc
Molecular and Cellular Biology

Please read all the questions carefully before answering.

Section A (Multiple choice questions), there is only one right choice for each question. (30 questions, 1 mark per question). Use **pencil** to fill the Scantron/computer answer card for Questions 1-30. Use **pen** to circle the letter corresponding to the correct answer directly on the exam sheet.

Section B, Fill in the blanks. **Write in pen. Answers written in pencil cannot be re-graded.** (5 questions, 2 marks per question)

Illegible writing and typographical errors *could be marked as incorrect* (so use your best handwriting!).

The examination is worth 40 marks and will count towards 20% of your final course grade.

<i>Examiner use only</i>	
<i>Section A (30 questions)</i>	<i>/30</i>
<i>Section B (5 questions)</i>	<i>/10</i>
<i>Total</i>	<i>/40</i>

Section A. Multiple choice questions (1 mark each; 30 total): **Attempt ALL 30 questions.** For each question, circle the *single* choice that best represents the correct answer. *Mark your choices on the scantron (use pencil for the scantron)*

1) **Edward Jenner vaccinated against smallpox using:**

- a) Killed smallpox virus
- b) A recombinant protein derived from smallpox
- c) Live cowpox virus
- d) Killed cowpox virus
- e) A toxoid

2) **Lithotrophs are:**

- a) Organisms that use light to obtain energy
- b) Organisms that prefer to live under high pressure
- c) Organisms that use minerals for biosynthesis
- d) Usually protists
- e) Always able to survive at high temperatures

3. **Treating cows with antibiotics against cellulolytic bacteria:**

- a) Would prevent shedding of pathogens such as *Escherichia coli* 0157:H7 by the cows
- b) Would permit the cows to obtain sufficient nutrition from plant materials
- c) Would have an overall beneficial effect on the microbiota
- d) Would inhibit the ability of the cow to obtain sufficient nutrition from foods such as hay
- e) Would improve the health of the animals

4. **Carl Woese pioneered:**

- a) The use of mitochondria in endosymbiotic theory
- b) A method to sequence DNA
- c) The use of Gram staining in identifying bacteria
- d) The study of molecular biology
- e) The use of rRNA to build phylogenetic trees

5. **Bacteriorhodopsin is:**

- a) A retinal-containing transmembrane protein
- b) A retinal-containing cytoplasmic protein
- c) A chlorophyll-containing cytoplasmic protein
- d) A chlorophyll-containing transmembrane protein
- e) Only found in bacteria

6) **Fungi:**

- a) Benefit animals and plants
- b) Mainly harm plants and benefit animals
- c) Mainly harm animals and benefit plants
- d) Neither benefit nor harm animals or plants
- e) Can both benefit and harm animals and plants

7. The Protozoa are _____ and usually _____:

- a) Prokaryotes / Unicellular
- b) Eukaryotes / Unicellular
- c) Eukaryotes / Amitochondriate
- d) Eukaryotes / Multicellular
- e) Parasitic / Saprophytes

8. Organisms A, B and C are all found in one community. Organism A utilizes glucose and generates lactate. Organism B converts lactate to $\text{CO}_2 + \text{Hydrogen}$, and organism C generates methane from the hydrogen and CO . This relationship between organisms A, B and C is called:

- a) Metabolism
- b) Commensalism
- c) Syntropism
- d) Competition
- e) Ecosystem

9. Viroids are:

- a) Small stretches of RNA encased in a primitive capsid
- b) Small stretches of DNA encased in a primitive capsid
- c) Infectious particles that usually infect archaea
- d) 'Naked' infectious RNA molecules
- e) 'Naked' infectious DNA molecules

10. Prokaryotes called _____ do not have a cell wall, and the _____ do not have peptidoglycan.

- a) Archaea / Mycobacteria
- b) Mycoplasma / Archaea
- c) Mycobacteria / Gram-negative bacteria
- d) *Streptococcus* / *Pseudomonas aeruginosa*
- e) *Plasmodium* / slime molds

11. In a lichen, the _____ provides protection, and the Cyanobacterium provides _____:

- a) algae / vitamins
- b) fungus / sunlight
- c) *Rhizobium* / nitrogen compound
- d) fungus / organic molecules
- e) algae / organic molecules

12. Acid fast bacteria can be stained in the Ziehl-Neelsen procedure using:

- a) carbolfuschin
- b) saffranin
- c) India ink
- d) phenol red
- e) crystal violet

13) **If you had a cell with the structures listed below, what would be the *outermost* layer of this hypothetical cell?**

- a) Outer membrane
- b) Capsule
- c) Surface (S)-layer
- d) LPS
- e) Arabinogalactan

14. **Which terms describe a prokaryote that grows best at 100°C at pH 2 and has specific requirement for light and carbon dioxide?**

- a) Photoautotrophic, acidophilic, hyperthermophile
- b) Photoautotrophic, acidophilic, thermophile
- c) Hyperthermophilic, barophilic, chemolithotroph
- d) Thermophilic, alkaliphilic, autotroph
- e) Hyperthermophilic, alkaliphilic, phototroph

15. **Which terms describe a prokaryote that grows best at 25°C at pH 10 and has a specific requirement for organic carbon for growth?**

- a) Psychrophilic, heterotrophic, alkaliphilic
- b) Mesophilic, chemolithotrophic, alkaliphilic
- c) Photosynthetic, psychrophilic, heterotrophic
- d) Mesophilic, heterotrophic, alkaliphilic
- e) Thermophilic, autotrophic, alkaliphilic

16. **Thylakoids are:**

- a) Sites of photosynthesis in chloroplasts and cyanobacteria
- b) Storage granules specifically found inside photoautotrophs
- c) Membranes of mitochondria
- d) Often associated with the nucleoids of bacteria
- e) Ancient precursors of chloroplasts

17. **Teichoic acids are:**

- a) Found in Gram negative cells only
- b) Found in Gram positive cells only
- c) Are a form of bacterial lipid
- d) A cytoplasmic molecule
- e) A stabilization factor for the bacterial nucleoid

18. **A bacterial cell with a tuft of flagella emerging from one pole only is said to be:**

- a) Monotrichous
- b) Piliated
- c) Peritrichous
- d) Non-motile
- e) Lophotrichous

19. **Bacterial flagella are usually:**

- a) Long, helical, flexible
- b) Powered by ATP
- c) Short, helical, inflexible
- d) Powered by a proton motive force
- e) Made of microtubules

20) **Nitrogen fixing bacteria:**

- a) Are always associated with legumes encased in their root nodules
- b) Convert nitrate to nitrogen gas
- c) Contribute to atmospheric pollution
- d) Convert nitrogen gas to ammonia
- e) Are always anaerobic

21) **Animals are most closely related to:**

- a) Choanoflagellates
- b) Amoeba
- c) Green algae
- d) Fungi
- e) Diatoms

22) **Protists are:**

- a) Always unicellular
- b) A paraphyletic group of organisms
- c) Usually photosynthetic
- d) A group that excludes protozoa
- e) Only able to reproduce asexually

23) **The *node* of a phylogenetic tree:**

- a) Demonstrates early divergence from an ancestral cell
- b) Demonstrates recent divergence from an ancestral cell
- c) Is always drawn as a vertical line
- d) Is the root, indicating the most distantly related species
- e) Represents the last common ancestor of the associated branches, which no longer exists

24) **A *girus* is a giant virus that:**

- a) Has a peptidoglycan cell wall
- b) Is able to replicate outside of a host cell
- c) Has an unusually large genome
- d) Is known to infect metazoans
- e) All of the above

25) **The bacterial slime layer, or capsule, is:**

- a) A slippery outer layer of loosely bound polysaccharides
- b) Also known as S-layer
- c) Made of murein
- d) Easily stained with crystal violet
- e) Used by the bacterium to prevent desiccation

26) **The part of a bacterial cell that is being investigated for use as a biodegradable plastic is:**

- a) Plasma membrane
- b) Storage granule
- c) Magnetosome
- d) Carboxysome
- e) Teichoic acid

27) **Group IV viruses in the Baltimore classification system are viruses that are:**

- a) Single stranded, positive sense RNA viruses
- b) Retroviruses
- c) Double stranded DNA viruses
- d) Single stranded, negative sense RNA viruses
- e) Single stranded DNA viruses

28) **Which of the following is not a DNA virus?**

- a) parvovirus
- b) bacteriophage M13
- c) rhinovirus
- d) Smallpox virus
- e) bacteriophage T4

29) **Burst size is:**

- a) The number of bacterial cells lysed by a virulent phage
- b) The number of viral particles released by a phage during the lytic phase
- c) The capacity of a bacterial cell cytoplasm for hosting assembled bacteriophage
- d) The number of bacterial cells required in order to visualize a plaque
- e) Always higher for archaea than bacteria

30) **Which of the following statements is *false* about mycorrhizae?**

- a) Mycorrhizae are essential to all plant life
- b) Mycorrhizae help plants to assimilate extra nutrients from the soil
- c) In return for mycorrhizae activity, plants reward the associated fungus with nutrients such as sugars
- d) The mycorrhizae from a single fungus can stretch underground for several kilometers
- e) Mycorrhizae aid in nutrient assimilation from soil because they offer a much larger surface area for absorption than plant roots.

Section B: Fill in the blanks. Please use pen. Attempt all questions.

36. The _____ is a term that refers to the collection of micro-organisms in a given niche.

The _____ refers to the collective genetic material of this community.

37. _____ gene transfer refers to inheritance of genes from a parent.

_____ gene transfer refers to acquisition of genes from the environment.

38. The bacteriophage cycle that results only in destruction of host cells is called the _____ cycle, and infecting phage are referred to as _____ phage.

39. The fungal toxin, alpha-amantin, is a lethal toxin that kills cells by binding to and blocking the activity of _____. Phalloidin is another fungal toxin that binds to _____ in the intoxicated cell.

40. _____ and _____ are examples of secondary endosymbiotic algae.