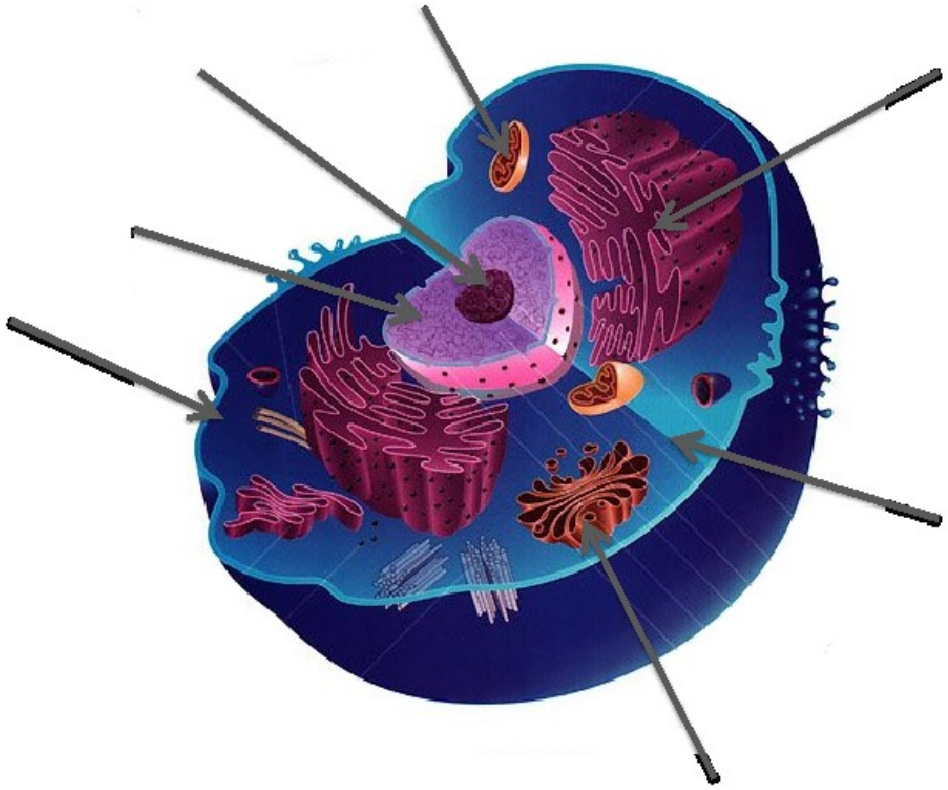
2018 Science Olympiad: Microbe Mission - Sample Tournament – Div C

Section A: Types of cells and their parts

1. Please state if the cell is prokaryotic or eukaryotic. Then label the following molecular components for each: NUCLEUS, CELL MEMBRANE, RIBOSOME, CYTOPLASM, DNA, MITOCHONDRIA, NUCLEOID, ENDOPLASMIC RETICULUM, GOLGI APPARATUS (8 pts)

Type of cell: _____



2. Which cellular component(s) store the genetic material of a cell (2 pt)?

3. In which cellular component(s) are proteins synthesized (2 pt)?

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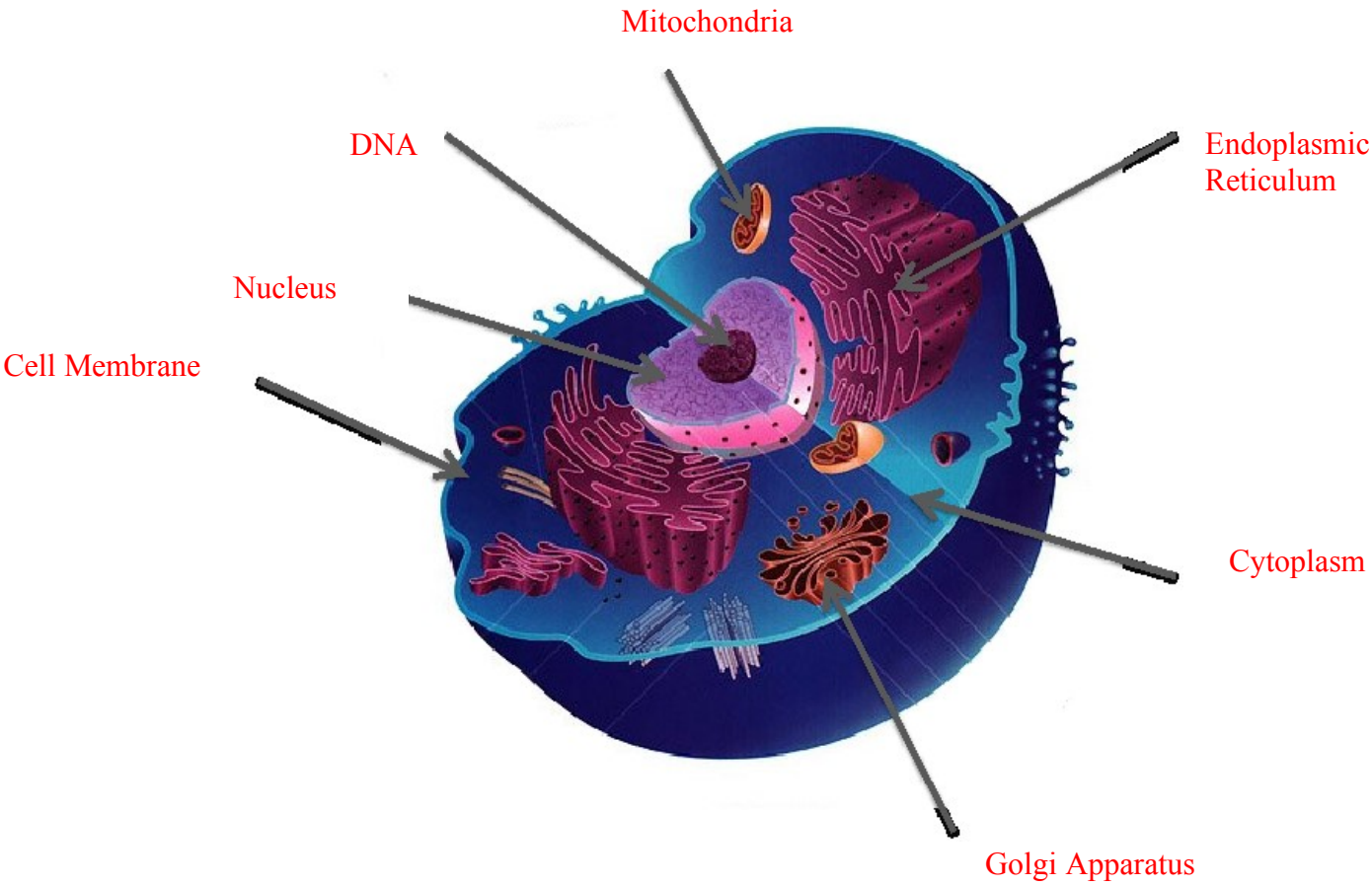
Section A: Types of cells and their parts

1. Please state if the cell is prokaryotic or eukaryotic. Then label the following molecular components for each: NUCLEUS, CELL MEMBRANE, RIBOSOME, CYTOPLASM, DNA, MITOCHONDRIA, NUCLEOID, ENDOPLASMIC RETICULUM, GOLGI APPARATUS (8 pts)

Type of cell: Eukaryote _____



2. Which cellular component(s) store the genetic material of a cell (2 pt)?
Nucleus and nucleoid

3. In which cellular component(s) are proteins synthesized (2 pt)?
Ribosome

4 .Put the following microbes in order from smallest to largest (5 pt):

A. ____	1. *Sacchromyces cerevisiae*
B. ____	2. *Clostridium botulinum*
C. ____	3. Red Blood Cell
D. ____	4. *Paramecium*
E. ____	5. *Rhinovirus*

5. Which organisms are the main decomposers of the soil (1 pt)?

A. Bacteria and Viruses
B. Fungi and Viruses
C. Fungi and Bacteria
D. Algae and Bacteria

6. A scientist discovers some cells in a deep ocean trench. This organism is most likely a: (1 pt):

A. Bacteria
B. Archaea
C. Virus
D. Protozoa
E. A & B
F. B & C

7. Which of these microbes are acellular (1 pt)?

A. Bacteria
B. Prion
C. Protozoa
D. Archea
E. Algae

4 .Put the following microbes in order from smallest to largest (5 pt):

A. _**5**_	1. *Sacchromyces cerevisiae*
B. _**2**__	2. *Clostridium botulinum*
C. _**1**__	3. Red Blood Cell
D. _**3**__	4. *Paramecium*
E. _**4**_	5. *Rhinovirus*

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7. Which of these microbes are acellular (1 pt)?

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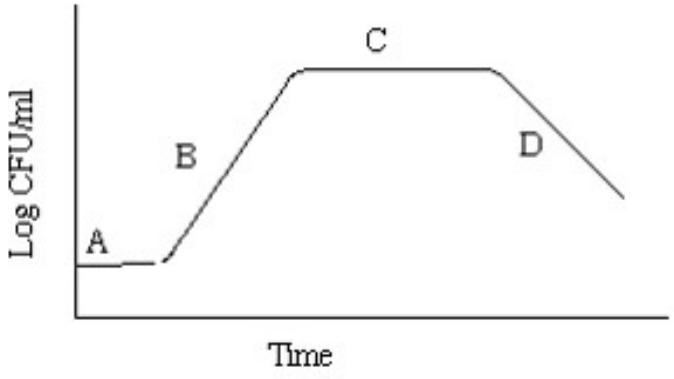
C. Protozoa
D. Archea
E. Algae

Section B: Counting and Visualizing Microbes

1. Please label the growth phases for the typical bacterial growth curve shown below (4 pts).



A. _____

B. _____

C. _____

D. _____

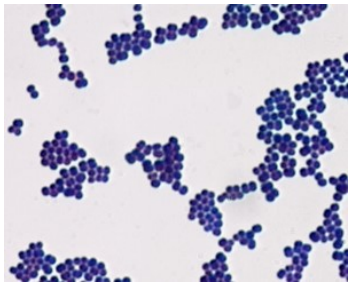
2. During which phase are the cells dividing at their maximum rate of division (1 pt)?

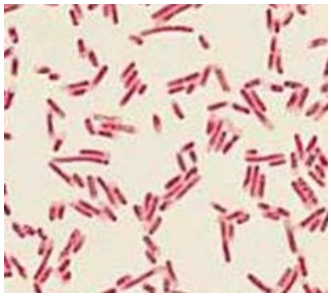
3. If you start with a population of 300 CFU/ml of a bacterium that divides every 30 minutes, what will the population be after 3 hours (2 pt)?

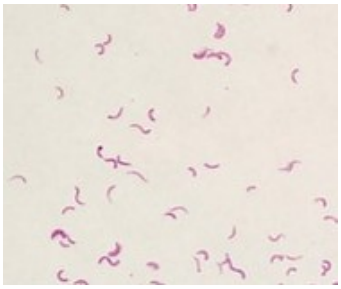
4. (10 pts)

A. What staining method is commonly used to differentiate between bacteria?

B. Label these samples as either positive or negative after using the staining method in (A).



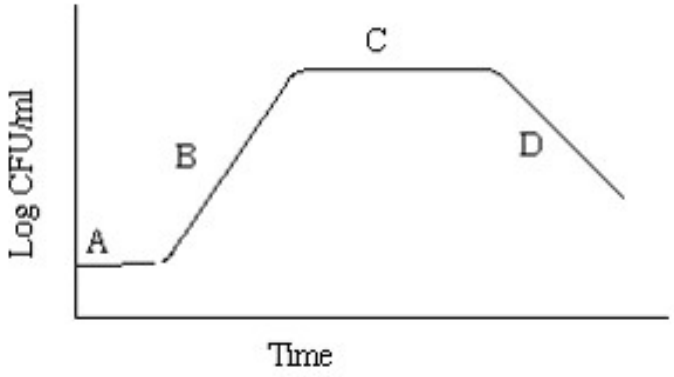




C. Label the morphology of cells in each sample

Section B: Counting and Visualizing Microbes

1. Please label the growth phases for the typical bacterial growth curve shown below (4 pts).



A. _**Lag phase** _____

B. _**Logarithmic growth**_____

C. _**Stationary phase** _____

D. _**Death phase** _____

2. During which phase are the cells dividing at their maximum rate of division (1 pt)?

Lag phase

3. If you start with a population of 300 CFU/ml of a bacterium that divides every 30 minutes, what will the population be after 3 hours (2 pt)?

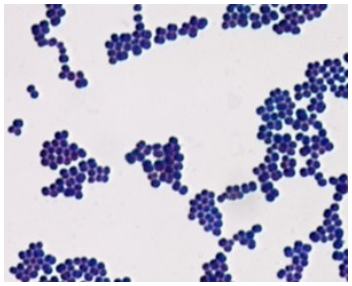
($19,200/2^6$ x 300/64 x300)

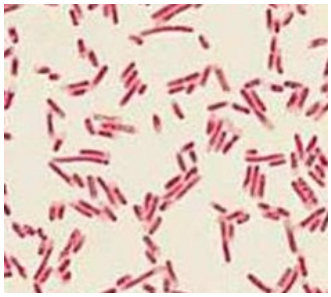
4. (10 pts)

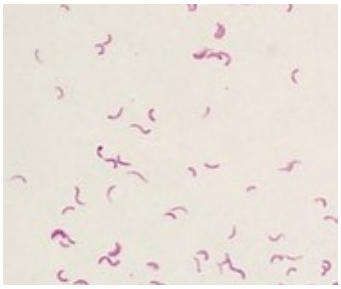
A. What staining method is commonly used to differentiate between bacteria?

Gram stain

B. Label these samples as either positive or negative after using the staining method in (A). **(A) Positive cocci (B) Negative bacilli (C) Negative curved vibrio**







C. Label the morphology of cells in each sample

(A) Positive cocci (B) Negative bacilli (C) Negative curved vibrio

Please use the microscope shown here to answer the questions below.

5. Which letter represents the objective(1 pt)?

6. What is the function of part E(1 pt)?

7. What is the final magnification for a microscope with a 10X ocular lens and a 40X objective lens (1 pt)?

8. Which type of microscope is MOST suitable for observing various microbes in pond water (1 pt)?

9. Which type of microscope is MOST suitable for examining the surface of a virus (1 pt)?

Please use the microscope shown here to answer the questions below.

5. Which letter represents the objective(1 pt)? **H**

6. What is the function of part E(1 pt)? **Illuminates the specimen**

7. What is the final magnification for a microscope with a 10X ocular lens and a 40X objective lens (1 pt)? **400X**

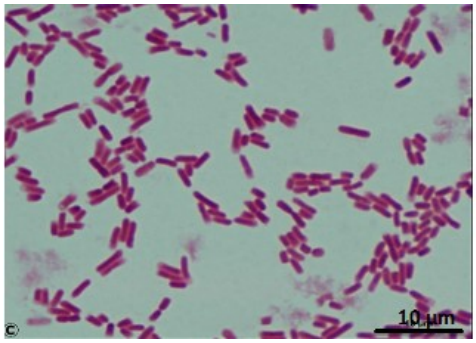
8. Which type of microscope is MOST suitable for observing various microbes in pond water (1 pt)? **Compound light**

9. Which type of microscope is MOST suitable for examining the surface of a virus (1 pt)? **SEM**

10. For the following micrographs, please state the type of microbe and type of microscope used to capture the image (2 pt each).

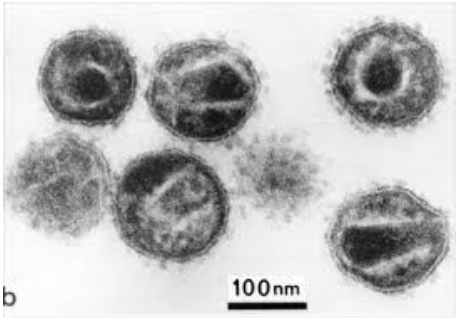
A. _____

B.



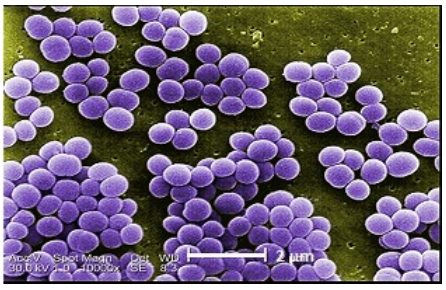
_____

C.

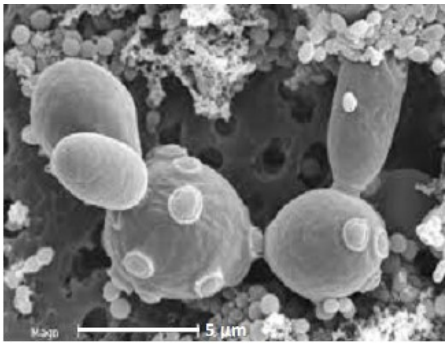


_____

D.

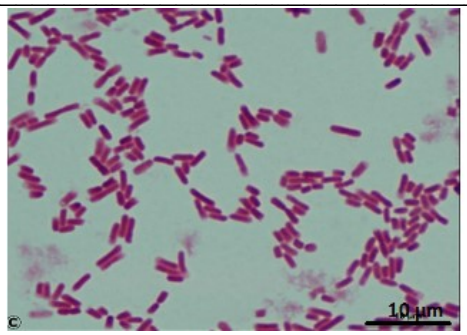


_____

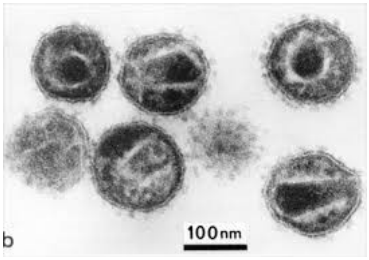


10. For the following micrographs, please state the type of microbe and type of microscope used to capture the image (2 pt each).

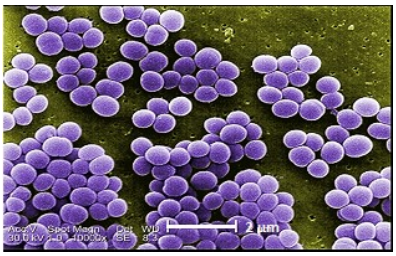
A. ___ **Light, bacteria** _____



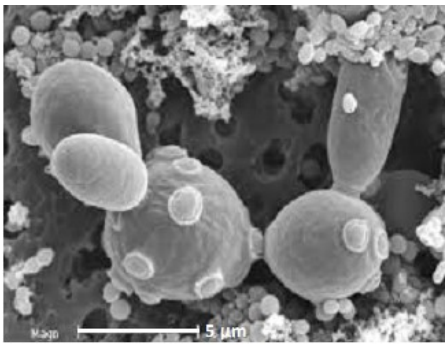
B.____ **TEM, virus** _____



C. ___ **SEM, bacteria** _____



D. ___ **SEM, yeast**_____



Section C: Bacteria & Diseases

1. Match the following microbes with their associated diseases or roles (12 pts):

A. *Saccharomyces cerevisiae*	___ Cholera
B. *Rickettsia rickettsii*	___ MRSA
C. *Rhinovirus*	___ Tetanus
D. *Vibrio cholerae*	___ Whooping cough
E. *Bacillus anthracis*	___ Legionnaire's Disease
F. *Lactobacillus*	___ Strep Throat
G. *Staphylococcus aureus*	___ Common Cold
H. *Bordatella pertussis*	___ Rocky Mountain Spotted Fever
I. *Leigionella*	___ Anthrax
J. *Varicella*	___ Making Bread
K. *Streptococcus pyogenes*	___ Chicken Pox
L. *Clostridium tetanii*	___ Making yogurt

2. A patient comes in to the hospital with a fever and an infected wound on their skin. A doctor swabs the wound and identifies the following organisms: *Corynebacterium accolens*, *Staphylococcus epidermidis*, *Staphylococcus aureus*, *Streptococcus mitis*. Which organism is likely causing the infection (1 pt)?

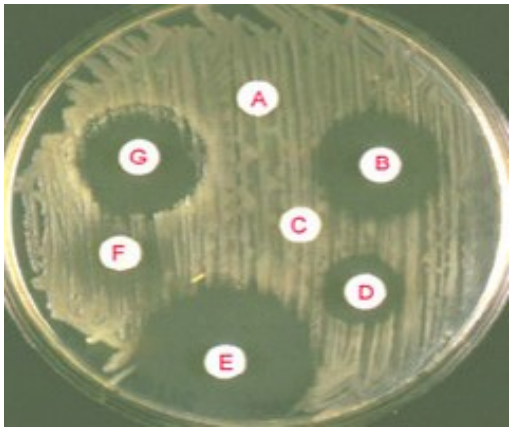
A. *Corynebacterium accolens*
B. *Staphylococcus epidermidis*
C. *Staphylococcus aureus*
D. *Streptococcus mitis*

3. For which one of these organisms would an antibiotic be effective (1 pt)?

A. *Influenza A*
B. *Staphylococcus aureus*
C. *Apergillus fumigatus*
D. Nematode

4. The effectiveness of an antibiotic against an organism can be assessed by the ability to produce a 'zone of clearing' on an agar plate. Which antibiotic (A-G) is most effective (4 pt) and why?

_____



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B. *Rickettsia rickettsii*	_**G**_ MRSA
C. *Rhinovirus*	_**L**_ Tetanus
D. *Vibrio cholerae*	_**H**_ Whooping cough
E. *Bacillus anthracis*	_**I**_ Legionnaire's Disease
F. *Lactobacillus*	_**K**_ Strep Throat
G. *Staphylococcus aureus*	_**C**_ Common Cold
H. *Bordatella pertussis*	_**B**_ Rocky Mountain Spotted Fever
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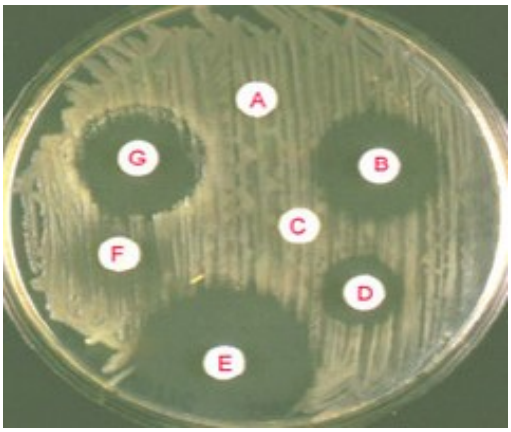
4. The effectiveness of an antibiotic against an organism can be assessed by the ability to produce a 'zone of clearing' on an agar plate. Which antibiotic (A-G) is most effective (4 pt) and why?

E – Biggest zone of clearance

_____



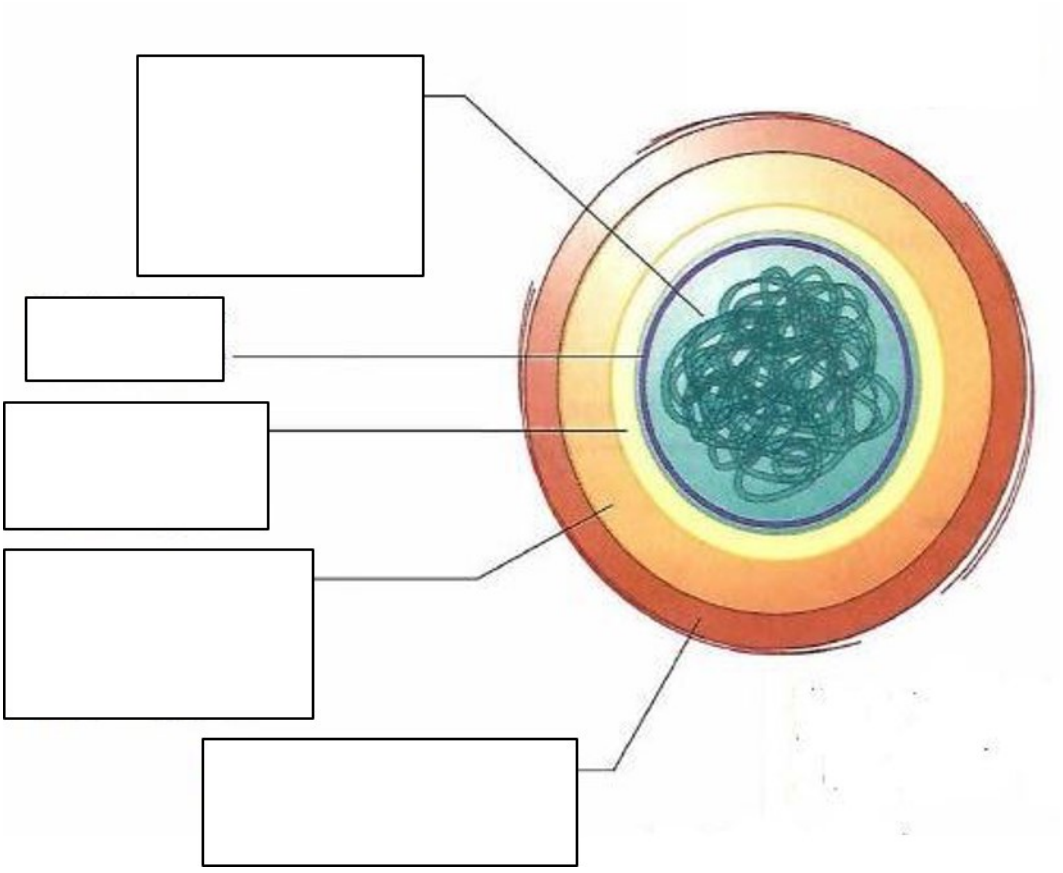
5. Approximately 48 million people in the US get a foodborne illness each year. Which organism is a primary cause of food poisoning from canned foods (1 pt)?

A. *Clostridium botulinum*
B. *Pseudomonas aeruginosa*
C. *Varicella*
D. *Candida albicans*

6A. What stage of development is believed to be responsible for the ability of some bacteria to persist and/or tolerate harsh environmental conditions (2 pt)?

_____

B. Label on the diagram below the structural components that allow this bacterial developmental stage to persist in harsh environments (10 pt).



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_____**Sporulation**_____

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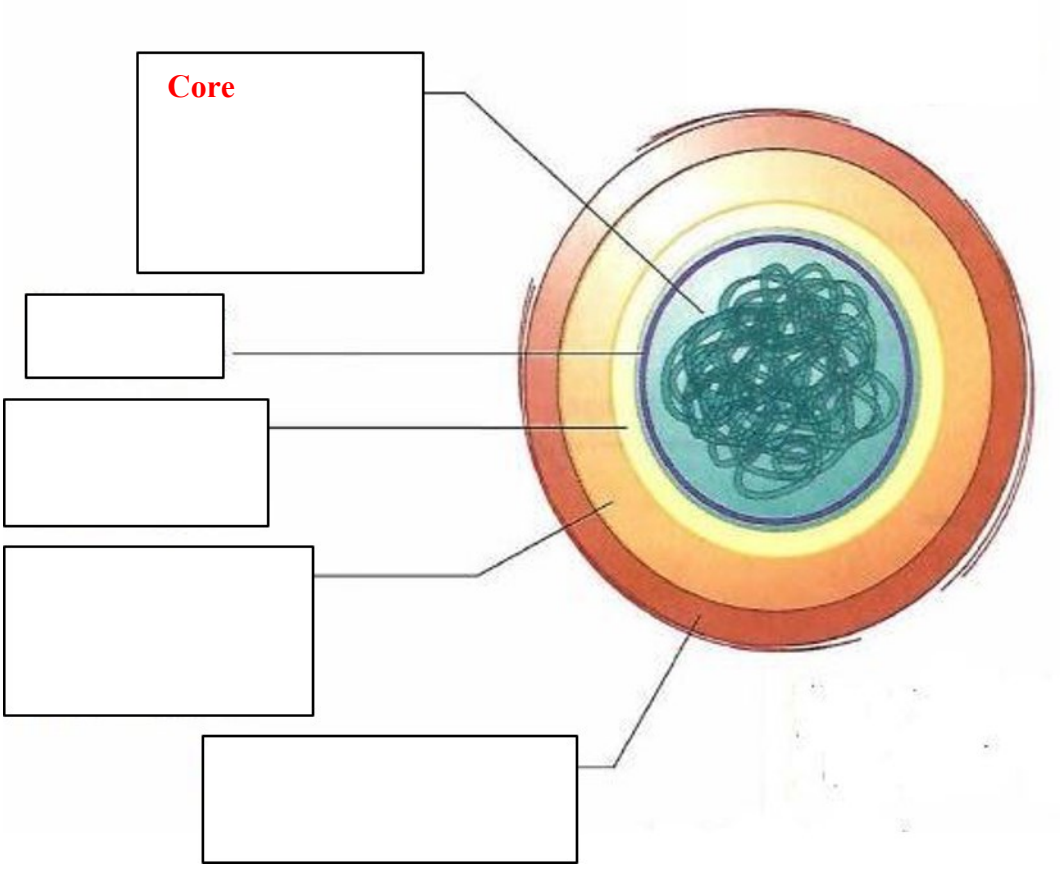
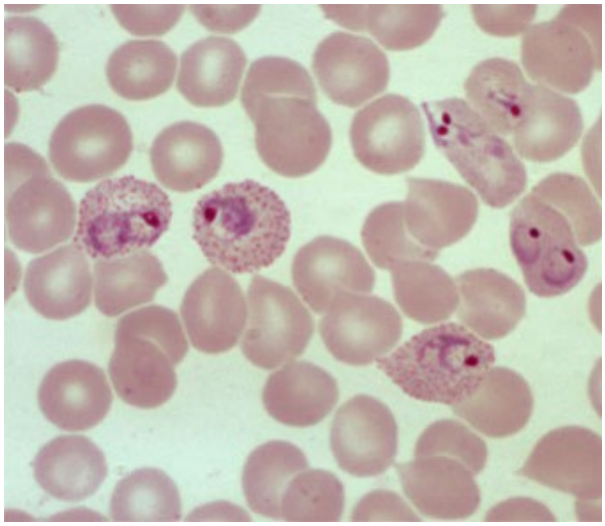


Section D: Parasites and environmental microbiology

1. A patient presents with the following symptoms after a vacation to a tropical area: High fever, headache, nausea and vomiting. A blood sample was taken and observed under the microscope (below). What is this patient infected with (2 pts)?

_____



2. What is the most effective way of preventing infections by organisms transmitted by mosquitos (2 pts)?

A. Penicillin
B. Hand washing
C. Netting
D. Sterilizing water

3. A patient presents with abdominal pain and diarrhea. A urine and stool samples were taken and observed under the microscope:
What infection does the patient have (2 pts)?

_____

What was the likely source of infection (2 pts)?

A. Undercooked meat
B. Drinking water
C. Poor hand hygiene
D. Aerosols (droplets in the air)

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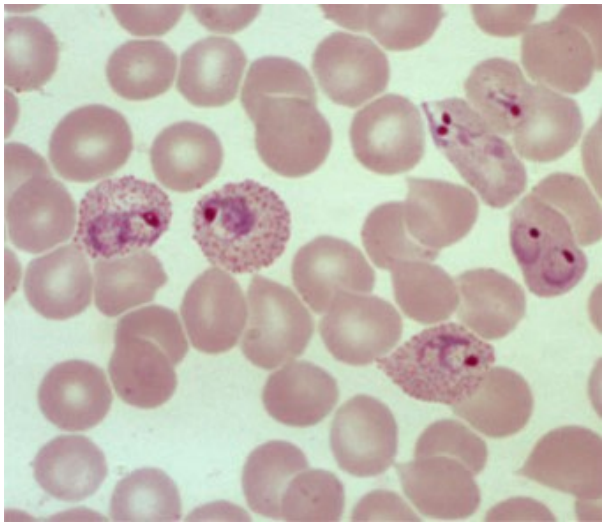
_____**Malaria**_____



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H. Sterilizing water

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What infection does the patient have (2 pts)?

____ **Schistosomiasis** _____

What was the likely source of infection (2 pts)?

E. Undercooked meat
F. Drinking water
G. Poor hand hygiene
H. Aerosols (droplets in the air)

4. Which of these environmental factors are important for the growth of algae (2 pts)?
    A. Temperature
    B. Soil composition
    C. Amount of sunlight
    D. pH
    E. Concentration of oil

Section E: Virology

1. Which of the following is not true about viruses (2 pt)?
    A. Are obligate intracellular parasites
    B. May be DNA or RNA, single or double-stranded
    C. All have a protein capsid and envelope
    D. Release virions during cell lysis and budding
    E. All are true

2. The first vaccine was discovered when Edward Jenner found that milkmaids were immune to what disease (2 pt):
    A. *Vaccinia*
    B. *Influenza*
    C. *Varicella*
    D. *Poliovirus*

3. True or False. You can get flu from the flu vaccine (1 pt). _____

4. The flu vaccine recognizes what part of the *Influenza* virus (2 pt)?
    A. DNA
    B. Surface Protein
    C. Peptidoglycan
    D. Membrane

5. In 2014, there was a large outbreak of Ebola Hemorrhagic Fever in West Africa. What type of virus is *Ebolavirus* (2 pt)?
    A. Single-stranded DNA Virus
    B. Double-stranded DNA Virus
    C. Single-stranded RNA Virus
    D. Double-stranded RNA Virus

4. Which of these environmental factors are important for the growth of algae (2 pts)?

A. Temperature
B. Soil composition
C. Amount of sunlight
D. pH
E. Concentration of oil

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C. *Varicella*
D. *Poliovirus*

3. True or False. You can get flu from the flu vaccine (1 pt). _____

4. The flu vaccine recognizes what part of the *Influenza* virus (2 pt)?

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B. Double-stranded DNA Virus
C. Single-stranded RNA Virus
D. Double-stranded RNA Virus