2017 Mentor Invitational
Microbe Mission

STATION 1

1. Variolation was an early attempt to control:
   A. cholera
   B. syphilis
   C. plague
   D. cowpox
   E. smallpox

2. Which of the following is NOT considered a microorganism?
   A. virus
   B. bacteria
   C. protozoa
   D. fungi
   E. mosquito

3. Which of the following is NOT true of viruses:
   A. replicated only when inside host cells
   B. too small to be seen in a light microscope
   C. all cause human disease
   D. contain only one type of nucleic acid
   E. acellular

4. All bacteria:
   A. lack nuclei
   B. lack a cell structure
   C. cause disease
   D. absorb nutrients
   E. are motile

5. What is the purpose of the condenser on a light microscope?
   A. allows viewer to change light intensity
   B. concentrates the light beams on the specimen
   C. moves the microscope slide
   D. focuses the image magnified by the objective lens
   E. magnifies the microscope slide

6. How do you determine the total magnification of a light microscope?
   A. wavelength of light x 2/numerical aperture
   B. magnification of ocular lens x condenser
   C. magnification of objective lens x condenser
   D. magnification of objective lens x ocular lens
   E. magnification of objective lens x diaphragm

7. Which of the following not only reveals cell morphology but will provide additional information about the specimen:
   A. crystal violet stain
   B. Gram stain
   C. India ink
   D. simple stain
   E. methylene blue stain

8. What dye in the Gram stain do Gram positive bacteria retain?
   A. iodine
   B. malachite green
   C. sarfanin
   D. crystal violet
   E. methylene blue

9. The peptidoglycan molecule is responsible for the:
   A. entry and exit of molecules into and from the cell
   B. flexibility of the cytoplasmic membrane
   C. motility of the bacterial cell
   D. genetic characteristics of the bacterial cell
   E. semirigid cell wall structure of prokaryotes

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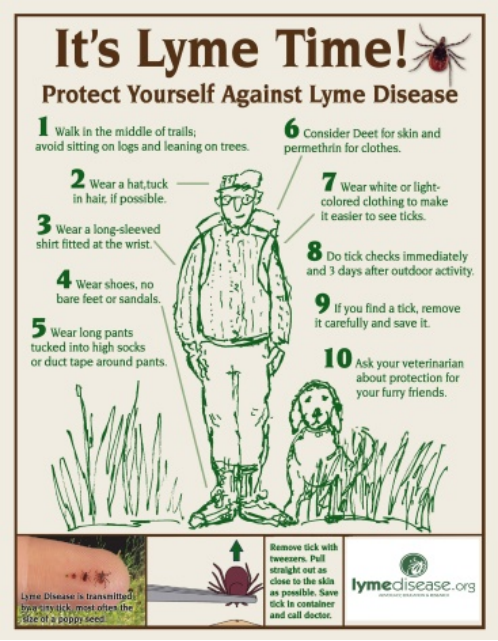
STATION 1



10. List the three stages of Lyme disease. What other spirochete disease does this resemble?

STATION 2

11. The Gram stain is based on differences in the _____ of bacteria.
    A. cell wall
    B. sportes
    C. flagella
    D. nuclear membrane
    E. ribosomes

12. The average diameter of prokaryotic cells is:
    A. 10.0 to 15.0 um
    B. 100 to 200 um
    C. 1.0 to 2.0 um
    D. 10 to 50 nm
    E. 0.5 to 2.0 um

13. Formation of endospores:
    A. can be triggered by adverse environmental conditions
    B. allows bacterial reproduction
    C. occurs when the cell has excess polyphosphate
    D. is called germination
    E. occurs in all bacterial cells

14. Which of the following is mismatched:
    A. vibrio - comma-shape
    B. coccobacilli - intermediate between round and rod
    C. coccus - round
    D. bacillus - flexible and wavy
    E. spirillum - corkscrew-shape

15. What would you expect to see if you prepare a gram stain slide of the gram negative bacillus, Escherichia coli:
    A. comma-shaped, red cells
    B. rod-shaped, red cells
    C. corkscrew-shaped, purple cells
    D. rod-shaped, green cells
    E. round, purple cells

16. Which of the following would NOT be found in both prokaryotic and eukaryotic cells:
    A. cytoplasm
    B. mitochondria
    C. ribosomes
    D. DNA
    E. plasma membrane

17. Which one of the following microscopes has the greatest resolving power?
    A. compound light
    B. fluorescent
    C. phase
    D. scanning electron
    E. transmission electron

18. Which of the following stains would be most suitable for microscopic study of bacterial cells that have a high lipid content in their cell walls:
    A. negative stain
    B. spore stain
    C. acid-fast stain
    D. Gram stain
    E. flagellar stain

STATION 2

19. The gram stain:
    A. will differentiate bacterial cells based on chemical differences in their cell walls
    B. requires acid alcohol as decolorizer
    C. requires the use of steam heat while staining the cells on the slide
    D. can be used to determine if a bacterial cell is capable of photosynthesis
    E. uses acidic dyes

20. Which is true of bacterial cell walls:
    A. contain cellulose
    B. protects against osmotic shock
    C. selectively permeable
    D. chemically identical in all bacterial cells
    E. also called capsules

21. How do the neurological effects of botulinum toxin differ from those of tetanus toxin?

STATION 3

22. Which one of the following allows bacterial cell motility?
    A. cilia
    B. plasmid
    C. flagella
    D. capsule
    E. pili

23. Which term is used to describe flagella that are found all over the surface of the bacterial cell:
    A. peritrichous
    B. monotrichous
    C. amphitrichous
    D. atrichous
    E. lophotrichous

24. The parasitic sac fungus that grows on rye and other grains and contains the hallucinogenic chemical lysergic acid is
    A. *Aspergillus.*
    B. *Penicillin*.
    C. *Rhizopus*.
    D. *Saccharomyces.*
    E. ergot.

25. The fungi that parasitize cereal crops such as corn, wheat, oats, and rye, are the
    A. stinkhorns.
    B. yeasts.
    C. truffles.
    D. ichens.
    E. rusts and smuts.

26. Which is NOT a correct association of a fungus and product?
    A. *Aspergillus*–soy sauce
    B. Rusts and smuts–truffles
    C. *Saccharomyces cerevisiae*–beer and wine
    D. *Penicillium*–antibiotics
    E. *Aspergillus*–citric and gallic acid

27. Asexual reproduction in the ascomycota involves the production of
    A. Ascospores.
    B. Conidiospores.
    C. Zygospores.
    D. Basidiospores.

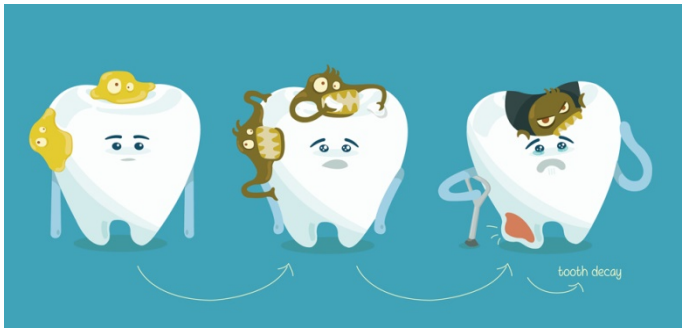
28. Yeasts are
    A. members of the ascomycota.
    B. reproduce asexually by budding; budding yeasts include brewers yeast.
    C. are responsible for beer, wine, and bread production.
    D. are important organisms in genetic engineering experiments on eukaryotic cells.
    E. all of the previous.

29. Which of the following fungal diseases is NOT caused by a club fungus?
    A. smuts
    B. rusts
    C. Dutch elm disease
    D. all of the previous are caused by a club fungus

30. Fungal poisonous or physiologically active chemicals include all of the following EXCEPT
    A. muscarine and muscaridine.
    B. psilocybin, a structural analog of LSD and mescaline.
    C. ergotaminine.
    D. digitoxin.

STATION 3

31. Pasteur chose the Latin root word for “virus” meaning
    A. extremely small.
    B. non-living.
    C. poison.
    D. contagious.
    E. particle.



32. How is tooth enamel demineralized by bacterial growth?

STATION 4

33. The innermost portion of a virus's structure is made up of
    A. a membranous envelope.
    B. both DNA and RNA.
    C. either DNA or RNA.
    D. a protein capsid.
    E. a protein spore coat.

34. Many animal parasites and bacterial disease agents infect a fairly broad range of hosts, but viruses are often very specific to one type of tissue in one or a few species because
    A. a virus must be recognized and "taken in" by a host cell.
    B. different host cells vary greatly in the DNA or RNA they will replicate.
    C. some viruses may have evolved from nucleic acids from these host cell genomes.
    D. Both A and B are correct.
    E. All of the above are correct.

35. Influenza strains that sweep around the world often carry names such as Shanghai H_1N_1 or Mexico City H_2N_2. The viruses vary in H and N surface proteins because
    A. the viruses reproduce on their own and attack people in cities more often.
    B. these viruses emerged as stray DNA from the genomes of people in these cities.
    C. this is where the antibodies of immune people began to break down and the old virus was again virulent.
    D. infected people develop immunity to the present strain, and strains that mutate sufficiently to be outside the range of immunity are soon spread in highly populated areas.

36. Viruses that transform a cell so it undergoes continuous cell divisions–or is cancerous–are
    A. bacteriophages.
    B. retroviruses.
    C. carrying oncogenes.
    D. viroids.
    E. preventing DNA transcription.

37. If a virus is latent, it
    A. cannot be a retrovirus.
    B. has not entered a lytic cycle.
    C. has not entered a lysogenic cycle.
    D. is gaining a new envelope via "budding.''
    E. is easy to develop immunity against it.

38. Some, but not all, viruses contain _____, located on their outer surface.
    A. a membranous envelope
    B. both DNA and RNA
    C. either DNA or RNA
    D. a protein capsid
    E. a protein spore coat

39. In order to infect a cell, a virus must
    A. inject its protein into the cell while the nucleic acid remains attached to the host cell surface.
    B. have a special protein on its surface that can interact with a protein on the surface of the host cell.
    C. actively burrow through the cell wall or cell membrane of the host cell to reach the cell's nucleus.
    D. produce a special extension of its cytoplasm when it comes into contact with the appropriate host cell.

STATION 4

40. The cycle of viral infection of a bacterial cell that will cause its death most rapidly is called the _____ cycle.
    A. lysogenic
    B. lysozyme
    C. lytic
    D. lysol
    E. lysosome

41. The cycle of viral infection that will cause the viral DNA to become integrated into the bacterial DNA is called the _____ cycle.
    A. lysogenic
    B. lysozyme
    C. lytic
    D. lysol
    E. lysosome

42. Which statement is NOT true about a retrovirus?
    A. It may cause cancer or AIDS.
    B. It contains reverse transcriptase.
    C. It is known to cause diseases only in animals, not in humans.
    D. It has the capacity to integrate cDNA into the host DNA of the cell it infects.

43. When an enveloped animal virus enters a cell, then
    A. the next thing it does is assemble a new virus.
    B. the envelope is removed after the virus is inside the cell's nucleus.
    C. the protein capsid is removed through uncoating to expose the viral genome.
    D. it immediately integrates its nucleic acid genome into the host chromosomes.

44. Other than serving as a flavoring, what is the purpose of salt in curing meat?

STATION 5

45. Prokaryotic cells are characterized by
    A. the lack of an organized nucleus.
    B. cells that can move by flagella.
    C. the lack of membrane bound organelles.
    D. all of the previous.

46. Chemoautotrophs use which of the following compounds to obtain energy?
    A. hydrogen gas
    B. hydrogen sulfide
    C. ammonia
    D. all of the previous

47. The parasitic sac fungus that grows on rye and other grains and contains the hallucinogenic chemical lysergic acid is
    A. *Aspergillus.*
    B. *Penicillin*.
    C. *Rhizopus*.
    D. *Saccharomyces.*
    E. ergot.

48. The fungi that parasitize cereal crops such as corn, wheat, oats, and rye, are the
    A. rusts and smuts.
    B. yeasts.
    C. truffles.
    D. lichens.
    E. stinkhorns.

49. Which is NOT a correct association of a fungus and product?
    A. *Aspergillus*–soy sauce
    B. *Aspergillus*–citric and gallic acid
    C. Rusts and smuts–truffles
    D. *Penicillium*–antibiotics
    E. *Saccharomyces cerevisiae*–beer and wine

50. Asexual reproduction in the ascomycota involves the production of
    A. Ascospores.
    B. Conidiospores.
    C. Zygospores.
    D. Basidiospores.

51. Yeasts are
    A. members of the ascomycota.
    B. reproduce asexually by budding; budding yeasts include brewers yeast.
    C. are responsible for beer, wine, and bread production.
    D. are important organisms in genetic engineering experiments on eukaryotic cells.
    E. all of the previous.

52. Which of the following fungal diseases is NOT caused by a club fungus?
    A. smuts
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    C. Dutch elm disease
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53. Fungal poisonous or physiologically active chemicals include all of the following EXCEPT
    A. muscarine and muscaridine.
    B. psilocybin, a structural analog of LSD and mescaline.
    C. ergotaminine.
    D. digitoxin.

54. Which protist is NOT correctly linked to the type of movement it shows?
    A. amoeboids–pseudopodia
    B. ciliates–cilia
    C. zooflagellates–flagella
    D. sporozoa–flexing the pellicle

STATION 5

55. Protist reproduction
    A. is always asexual fission.
    B. is always sexual with the adult haploid.
    C. is always sexual with the adult diploid.
    D. is always sexual with alternation of haploid and diploid generations.
    E. may be asexual or any of the above sexual cycles.

56. A member of the green algae is
    A. *Amoeba proteus.*
    B. *Plasmodium vivax.*
    C. *Chlamydomonas.*
    D. *Penicillium.*
    E. *Paramecium.*

57. An example of a colonial green alga is
    A. *Ulva*.
    B. *Chlamydomonas*.
    C. *Volvox*.
    D. *Spirogyra*.
    E. *Fucus*.

58. "Red tides'' are produced by massive blooms of
    A. diatoms.
    B. dinoflagellates.
    C. red algae.
    D. brown algae.
    E. multicellular green algae.

STATION 6

59. One bacterial cell passes DNA to a second cell in the process of
    A. transformation.
    B. transduction.
    C. conjugation.
    D. infection.
    E. replication.

60. Bacteriophages carry portions of bacterial DNA from one cell to another in a process called
    A. transformation.
    B. transduction.
    C. conjugation.
    D. infection.
    E. replication.

61. Which statement is true about prokaryotes?
    A. They contain a nucleus.
    B. They lack ribosomes.
    C. They usually lack a cell wall.
    D. They do not divide by mitosis.
    E. They contain a single circular DNA molecule as the genetic material.

62. Which of these is a correct description of a form of genetic recombination in bacteria?
    A. Crossing-over occurs between paired chromosomes in meiosis.
    B. Conjugation occurs when a cell passes DNA to another cell by means of a sex pilus.
    C. Transformation occurs when a bacteriophage carries a bit of DNA from a previous host cell to a new host cell.
    D. Transduction occurs when a live bacterium picks up DNA from dead bacteria that have shed it into the environment of the living cell.
    E. is hidden within the many recessive genes and polygenic traits that reside in the diploid genome.

63. Prokaryotae are now divided into the
    A. archaea and cyanobacteria.
    B. bacteria and cyanobacteria.
    C. photosynthetic bacteria and chemosynthetic bacteria.
    D. archaea and bacteria.
    E. autotrophs and heterotrophs.

64. The archaea include all of the following EXCEPT the
    A. methanogens.
    B. rickettsia.
    C. halophiles.
    D. hermoacidophiles.

65. Which of the following is a characteristic of the photosynthetic cyanobacteria?
    A. does not release oxygen
    B. contains only photosystem I
    C. contains a unique form of chlorophyll
    D. uses hydrogen or hydrogen sulfide as an electron donor
    E. contains pigments that may mask the chlorophyll and cause the bacteria to be red or black in color

66. To be sure you have sterilized water, you must boil it for a long time in a pressure cooker because
    A. bacteria are facultative anaerobes.
    B. bacteria produce very resistant endospores.
    C. peptidoglycan is resistant to boiling water.
    D. bacteria can otherwise regenerate living cells from nonliving.

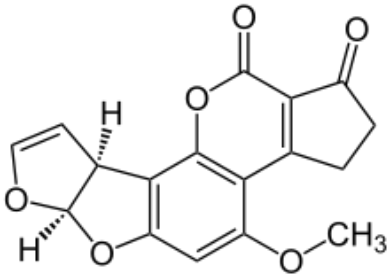
STATION 6

67. To be an effective antibiotic or chemotherapeutic agent, it is necessary
    A. not to kill the human host.
    B. to be able to kill a bacterial cell only.
    C. Both A and B are correct.
    D. to change the genome of the bacterial disease agent.
    E. to stop any universal living cell process.

68. To which of the following domains do viruses belong?
    A. Bacteria
    B. Archae
    C. Eukarya
    D. none of the previous

69. Viruses are characterized by all of the following EXCEPT
    A. they are obligate intracellular parasites
    B. a specific virus will only infect a specific cell type
    C. the fact that they most likely evolved after cells
    D. viruses can mutate
    E. all of the previous characterize viruses

70. Which of the following characterize prions?
    A. prions are simply protein molecules
    B. they cause Cruetzfeld-Jakob and Kuru
    C. prions are linked to spongiform encephalopathy and scrapie
    D. all of the previous



71. What foods are most prone to aflatoxin contamination?

STATION 7

72. A member of the ciliate group of protists is
    A. *Amoeba proteus.*
    B. *Plasmodium* vivax.
    C. *Chlamydomonas*.
    D. *Penicillium*.
    E. *Paramecium*.

73. The main function of the contractile vacuole is
    A. chlorophyll production.
    B. synthesis of carbohydrate.
    C. eliminating excess water.
    D. to be a photoreceptor to detect light.
    E. resistance for survival during winter and times of drought.

74. The *Paramecium* contains both a macronucleus and one or more small micronuclei. What are the functions of these bodies?
    A. The macronucleus undergoes meiosis to produce haploid micronuclei that are exchanged in conjugation; this then produces a micronucleus for general cell housekeeping.
    B. The micronucleus undergoes meiosis to produce haploid micronuclei that are exchanged in conjugation; this then produces a macronucleus for general cell housekeeping.
    C. The diploid micronuclei control the cell and the haploid macronuclei are exchanged in conjugation for reproduction.
    D. The micronucleus is always 1n for conjugative reproduction, the macronucleus functions for general cell coding, and the two are otherwise unrelated.

75. A member of the sporozoan group of protists is
    A. *Amoeba proteus.*
    B. *Plasmodium vivax.*
    C. *Chlamydomonas.*
    D. *Penicillium.*
    E. *Paramecium.*

76. Which form of protist has a complicated parasitic life cycle that nearly always involves the production of infective spores?
    A. sporozoans
    B. zooflagellates
    C. slime molds
    D. diatoms
    E. ciliates.

77. Which can have a cellular form as well as an acellular (plasmodial) form with multiple nuclei?
    A. sporozoa
    B. zooflagellates
    C. slime molds
    D. diatoms
    E. ciliates

78. The endosymbiont hypothesis proposes
    A. an origin of eukaryotic metabolic organelles.
    B. mitochondria are thought to have developed through engulfment of an aerobic bacterium by a nucleated cell.
    C. chloroplasts originated when a nucleated cell engulfed a cyanobacterium.
    D. all of the previous.

79. A cyst
    A. is a dormant cell with a resistant outer covering.
    B. helps protists over winter.
    C. aids a parasite in the survival of the host's digestive tract.
    D. all of the previous.

STATION 7

80. In the protozoans, which of the following is mismatched as to the disease that it causes?
    A. *Alexandrium tamarense* – paralytic shellfish poisoning
    B. *Pfiesteria piscicida* – estuary associated syndrome
    C. *Entamoeba histolytica* - amoebic dysentery
    D. *Giardia lamblia* – cryptosporidiosis

81. Examples of cellular organelles with their own chromosomes and ribosomes include
    A. Mitochondria and chloroplasts
    B. Endoplasmic reticulum and lysosomes
    C. Ribosomal subunits
    D. Cytoplasm and cytoskeleton

82. Which of the following reproductive methods is common to the bacteria?
    A. Binary fission
    B. Budding
    C. Formation of uninucleoid spores
    D. All of the above

83. Replication of the bacterial chromosome is
    A. Unidirectional
    B. Bidirectional
    C. Random
    D. None of the above

84. Cells begin synthesizing new components during the _____ phase.
    A. Lag
    B. Exponential
    C. Stationary
    D. Death

85. During the _____ phase, microorganisms grow and divide at their maximum rate.
    A. Log
    B. Exponential
    C. Lag
    D. Death

STATION 8

86. Balanced growth in which all cellular constituents are manufactured at a constant rate, occurs during the _____ phase.
    A. Lag B. Exponential C. Stationary D. Death

87. A balance between cell division and cell death occurs in the _____ phase.
    A. Lag B. Exponential C. Stationary D. Death

88. Why do microbial populations enter the stationary phase?
    A. Nutrient limitation
    B. Accumulation of toxic waste products
    C. Limited oxygen availability
    D. All of the above

89. Proteins that make the cell more resistant to damage by starvation are called
    A. Starvation proteins C. Survival proteins
    B. Heat-shock proteins D. Endospores

90. The number of viable cells decreases exponentially in the _____ phase.
    A. Lag B. Exponential C. Stationary D. Death

91. In death phase,
    A. The number of living cells declines exponentially
    B. Cells become viable but non-culturable (VBNC)
    C. Undergo programmed cell death
    D. All of the above

92. The number of generations per unit time is defined as
    A. The mean growth rate C. The mean doubling time
    B. The mean generation time D. Exponential growth

93. Which of the following variables is important to calculating the microbial mean growth rate?
    A. Initial population number
    B. The population number at time, t
    C. The number of generations in time t
    D. All of the above

94. If a bacterial cell is placed into a hypertonic solution, then
    A. Water will move into the cell and the cell will shrink
    B. Water will move into the cell and the cell will expand
    C. Water will move out of the cell and the cell will shrink
    D. Water will move out of the cell and cell will lyse

STATION 8

95. Organisms that do not require oxygen for growth but grow better in its presence are called
    A. Obligate aerobes
    B. Facultative anaerobe
    C. Aerotolerant anaerobe
    D. Obligate anaerobe

96. Organisms that grow optimally at temperatures at 55?C or higher are called
    A. Psychrophiles
    B. Psychrotrophs
    C. Mesophiles
    D. Thermophiles

97. Name two features that make these bacteria well suited for milk fermentation.

STATION 9

98. Organisms that grow optimally within a pH range of 0 and 5.5 are called
    A. Acidophiles B. Neutrophiles C. Alkalophiles D. Halophiles

99. Acidophiles survive in low pH environments by
    A. Increasing their cell size
    B. Pumping protons outside the cell if they get in
    C. Making the plasma membrane permeable to water
    D. None of the above

100. Microbes are vulnerable to high temperatures because
    A. High temperatures disrupt the cell wall
    B. High temperatures decrease the amount of oxygen available to the cell
    C. High temperatures inactivate enzymes responsible for metabolism
    D. None of the above

101. Photosynthetic protists are most likely
    A. Obligate aerobes
    B. Facultative anaerobes
    C. Obligate anaerobes
    D. Aerotolerant anaerobes

102. Which of the following enzymes protect microbes against toxic oxygen (O2) products?
    A. Catalase
    B. Permease
    C. Hydrolase
    D. All of the above

103. Organisms that grow in the deepest trench of the Pacific Ocean are classified as
    A. Barotolerant
    B. Piezophilic
    C. Barophobic
    D. None of the above

104. Which of the following forms of radiation is most harmful to microbes?
    A. Visible light
    B. Infrared rays
    C. Ionizing radiation
    D. Radio waves

105. Ultraviolet (UV) radiation can kill microorganisms because it
    A. Damages the cell wall by creating pores
    B. Damages DNA by forming thymine dimers
    C. Damages the plasma membrane by disrupting hydrophobic interactions
    D. All of the above

106. A density-dependent chemical communication between microbes is known as
    A. Autoinducing
    B. Quorum sensing
    C. Group translocation
    D. Phosphorelay systems

107. Which of the following intrinsic factors influences food spoilage?
    A. Temperature
    B. Humidity
    C. Food composition
    D. All of the above

STATION 9

108. Which of the following extrinsic factors influences food spoilage?
   A. Temperature
   B. Physical structure of food
   C. Food composition
   D. All of the above

109. The anaerobic breakdown of proteins in foods by bacteria is called
   A. Hydrolysis
   B. Putrefaction
   C. Peptidation
   D. None of the above

110. Yeast and molds responsible for food spoilage prefer _____ pH.
   A. Low
   B. Neutral
   C. High
   D. Extremely high

111. Which scientist established the modern era of food microbiology?
   A. Joseph Lister
   B. Robert Koch
   C. Louis Pasteur
   D. Alexander Fleming

112. Which of the following methods of controlling food spoilage involves heating food to a temperature that kills pathogens and substantially reduces the levels of spoilage organisms?
   A. Pasteurization
   B. Lyophilization
   C. Refrigeration
   D. Preservation

STATION 10

113. Which of the following methods of controlling food spoilage involves the removal of water from foods?
   A. Pasteurization
   B. Lyophilization
   C. Refrigeration
   D. Preservation

114. Repeated exposure to aflatoxins can lead to which type of cancer?
   A. Cervical cancer
   B. Liver cancer
   C. Lymphoma
   D. Leukemia

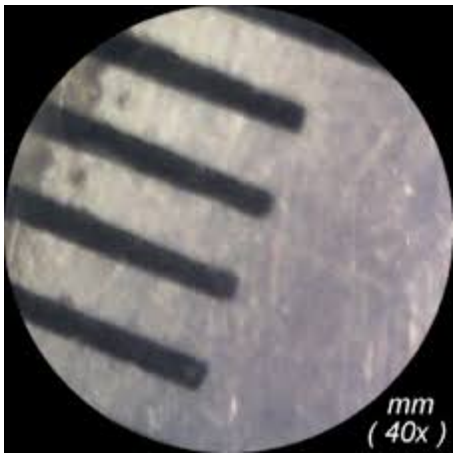
115. Which of the following bacterial species ferment skim milk to produce buttermilk and ferment cream to produce sour cream?
   A. Streptococcus salivarius and Lactobacillus delbrueckii
   B. Bifidobacterium spp.
   C. Lactobacillus spp. and Lactococcus lactis
   D. Saccharomyces cerevisiae

116. In order for a microbe to be a probiotic, it must be
   A. In a dormant state and confer health benefits
   B. In a dormant state, which when administered in adequate amounts, confer a health benefit to the host
   C. Live microorganisms and confer health benefits
   D. Live microorganisms, which when administered in adequate amounts, confer a health benefit to the host

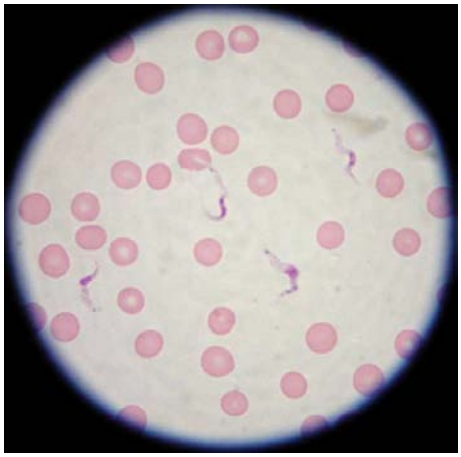
117. Which of the following is a probiotic that may contribute to the prevention of colon cancer?
   A. Bifidobacterium spp.
   B. Lactobacillus acidophilus
   C. Lactococcus spp.
   D. Streptococcus salivarius

118. Which of the following bacteria is used as a starter culture for a number of cheeses?
   A. Lactococcus spp.
   B. Lactobacillus acidophilus
   C. Lactobacillus lactis
   D. Bifidobacterium spp.

STATION 10



119. The image shows a millimeter ruler under a microscope at 40X. What is the field of view?



120. The image shows red blood cells under a microscope at 1000X. Based on your response in question 119, estimate the diameter of the cells in µm.