Biology 112 Exam Review

Cell Theory

1. From ancient times until the middle ages, it was generally accepted that life arose from non-living matter. This was known as the theory of Spontaneous generation.
2. In the 17 c. a scientist named Redi experimented with flies and rotting meat in order to disprove the theory of spontaneous generation. He concluded that flies were needed to produce other flies.
3. The theory of spontaneous generation was again challenged when Needham boiled broth for a short time in a loosely sealed flask. He concluded that spontaneous generation could occur with microorganisms, but was later proven incorrect.
4. Spallanzani attempted to improve on Needham's experiment by boiling the broth for a long time and sealing the flask. He concluded that spontaneous generation was impossible.
5. However, it was not until Pasteur performed an experiment involving a swan-necked flask and proved once and for all that spontaneous generation did not occur.
6. In a well designed scientific experiment, it is important to always have a control group. Otherwise, you cannot tell what caused your results!
7. In Redi's experiment, the manipulated variable was whether the jars were sealed or not, and the responding variable was whether or not flies appeared. Variables that were kept the same, or controlled, included the type of meat, the type of jars, temperature, location, etc.
8. Robert Hooke coined the term "cell" when he observed thin slices of cork under a microscope.
9. Anton van Leeuwenhoek was the first person to observe living cells.
10. Matthias Schleiden concluded that all plants are made of cells.
11. Theodor Schwann concluded that all animals are made of cells.
12. Rudolph Virchow concluded that new cells are only made from other living cells.
13. The modern cell theory states that: 1) All living things are made of cells; 2) Cells are the basic unit of structure and function in living things; 3) New cells are produced from existing cells.
14. A prokaryote is a cell that does not contain a nucleus.
15. Eukaryotic cells contain a nucleus.

Microscopes

16. In class, we used Compound light microscopes to observe living cells.
17. Electron microscopes can be used to observe cells at a much higher magnification, but cannot observe living cells.
18. There are two types of electron microscopes: TEM and SEM.
19. When focusing a microscope, you should start by adjusting the coarse focus, then use the fine focus to make small adjustments.
20. At 100 X magnification, the field of view is 2 mm, which is equal to 2000 µm.
21. At 500 X magnification, the field of view is 0.4 mm, which is equal to 400 µm.

Cell Structure & Function

22. The nucleus is the control centre of the cell, and contains the cell's DNA, or chromosomes.
23. Inside the nucleus is a dense region where ribosome are produced, known as the nucleolus.
24. Everything outside of the nucleus in a cell is called the cytoplasm.
25. In plants, but not animals, there is a thick layer called the cell wall that surrounds the cell membrane.

26. Ribosomes are tiny, protein-producing structure found throughout the cell.
27. The endoplasmic reticulum is a network of tubes in the cell, and is found in two type: RER and SER, depending on whether or not it's covered in ribosomes.
28. The Golgi looks like a stack of pancakes and sorts, modifies and packages cell products.
29. Lysosomes are tiny organelles filled with enzymes which break down food particles or old organelles.
30. Sac-like structures that may be used to store water, food or wastes are called vacuoles.
31. Mitochondria are bean-shaped organelles that convert sugar into a usable form of energy for the cell.
32. Plants contain green organelles called chloroplasts which capture energy from the sun and use it to make food.
33. Cells contain a network of protein filament and tubules that provide support and allow movement, known as the cytoskeleton.
34. The cytoskeleton is made of two major types of protein strands: micro-filaments and microtubules.
35. In animal cells, but not plant cells, centrioles help to organize cell division.

Cellular Respiration & Photosynthesis

36. During cellular respiration, food is used for energy in cells.
37. During photosynthesis, cells use chloroplasts to produce high energy compounds (food).
38. Glucose, a type of sugar, starts being broken down in the cytoplasm of the cell during glycolysis.
39. After glycolysis, cellular respiration continue on the surface of mitochondria.
40. The equation for cellular respiration is: $C_6H_{12}O_6 + 6\,O_2 \rightarrow 6\,CO_2 + 6\,H_2O$
41. The equation for photosynthesis is: $6\,CO_2 + 6\,H_2O \rightarrow C_6H_{12}O_6 + 6\,O_2$

Cell Membranes and Cellular Transport

42. All cells are surrounded by a thin, flexible cell membrane that consists of a lipid bilayer (double layer of lipid molecules).
43. Throughout the lipid bilayer are protein and carbohydrate molecules.
44. The cell wall of plant cells is porous to allow oxygen, carbon dioxide and water through.
45. Cell membranes must regulate the movement of dissolved molecules from one side to the other.
46. Substances, like salt or sugar, are called solutes, and they are dissolved in the solvent, like water, making a solution.
47. All particles are in constant, random motion.
48. During diffusion, particles tend to move from areas of high concentration to areas of low concentration.
49. Once particles have reached equal concentration throughout the solution, the system has reached equilibrium.
50. Simple diffusion depends on random movement of particles, and does NOT require energy.
51. If a particle can cross the cell membrane, we say the membrane is permeable to that substance.
52. Most biological membranes are selectively permeable, meaning some substances can cross, but others cannot.
53. Osmosis is a special kind of diffusion that refers to the movement of water across a selectively permeable membrane.
54. If two concentrations are equal, they are isotonic.

55. A more highly concentrated solution is hypertonic, while a relatively lower concentrated solution is hypotonic.
56. Both simple diffusion and facilitated diffusion do not require energy use by the cell to move particles across the cell membrane, and are considered types of passive transport.
57. When a cell must use energy, working against the concentration gradient, to move particles across the cell membrane, it is considered active transport.
58. Large molecules and clumps of material can be moved into the cell during endocytosis, and moved out of the cell during exocytosis.
59. There are two types of endocytosis: pinocytosis, and phagocytosis.
60. Pinocytosis involves the intake of liquids, or "cell drinking," while phagocytosis involves the intake of larger particles (food, solids, etc.), or "cell eating."

Classification

61. To study the diversity of life, biologists use a classification system to name and group organisms in a logical manner.
62. Taxonomy: the science of classification
63. Aristotle attempted to classify organisms based on where they lived – land, water or air.
64. A major step in classification was taken by Carlolus Linnaeus, who developed binomial nomenclature (a two-name naming system).
65. In Linnaeus's system, organisms were classified into 7 taxonomic categories: Kingdom, Phylum, Class, Order, Family, Genus and Species.
66. Members of the same species are organisms that look alike and interbreed under natural conditions.
67. Linnaeus's two kingdoms, Animalia and Plantae did not adequately represent the diversity of life.
68. Microorganisms later became the kingdom Protista.
69. Mushrooms, molds and yeasts were placed in the kingdom Fungi.
70. Later, bacteria were named Monera.
71. More recently, kingdom Monera was subdivided into two groups: Eubacteria and Archaebacteria
72. The three domains of life, as defined by today's modern system of classification, include: Eukarya (organisms with a nucleus), Bacteria (true bacteria, with peptidoglycan in their cell walls), and Archaea ("ancient" bacteria, lack peptidoglycan).

Bacteria & Viruses

73. Prokaryotes are identified by characteristics such as cell shape, the way they move, and they way they obtain food.
74. Some bacteria cause disease by releasing toxins that harm other organisms.
75. Bacteria are found in three main shapes: bacilli, or rod-shaped cells; cocci, or spherical cells, and spirilla, spiral/corkscrew shaped cells.
76. Some prokaryotes do not move; others move using flagella (whip-like tails) or cilia (tiny hairs).
77. Organisms that are heterotrophic must consume organic molecules; they cannot make their own food.
78. Organisms that are autotrophic are able to use light or chemical energy to make their own food.

79. One method of bacterial reproduction is called binary fission; this occurs when the cell copies its DNA and then splits into two cells.
80. Two bacterial cells may form a hollow bridge between them and exchange DNA; this is known as conjugation.
81. If growth conditions are unfavorable, an endospore may form to protect the bacterial DNA.
82. Viruses are particles of DNA or RNA surrounded by proteins and/or lipids.
83. Viruses can only reproduce by infecting living cells.
84. Once inside a cell, a virus takes over the cell's organelles in order to produce more viruses.
85. Viruses have some of the characteristics of living things, but are not made of cells. Therefore, according to the cell theory, they are non-living.

Protista

86. Protists are eukaryotic organisms that are not members of the Plant, Animal or Fungi kingdoms.
87. Most, but not all protists are unicellular.
88. Heterotrophs are animal-like protists.
89. Photosynthesizers are called plant-like protists.
90. Decomposers and parasites are fungus-like protists.
91. There are four phyla of animal-like protists: zooflagellates (swim using flagella); sarcodines (use pseudopods, like *Amoeba*); ciliates (use cilia, like *Paramecia*); and sporozoans (parasites that do not move on their own).
92. *Amoeba* move by creating temporary extensions of cytoplasm called pseudopod, or "false feet."
93. In order to prevent their cells from bursting, *Paramecia* use contractile vacuoles to expel excess water.
94. Plant-like protests are commonly called algae.
95. The plant-like Protists Euglena have eyespots to help them detect light for photosynthesis.
96. Slime molds and water molds are grouped with the fungus-like protists.

Plants

97. Plants are multicellular eukaryotes that have cell walls containing cellulose.
98. They develop from multicellular embryos, and carry out photosynthesis using the green pigment chlorophyll.
99. Diffusion and specialized tissues help move water and nutrients to all cells of the plant.
100. There are four main divisions of plants: Bryophytes (mosses), seedless vascular plants (ferns), gymnosperms (cone-bearing plants), and angiosperms (flower-bearing plants).
101. Bryophytes do not contain vascular tissue, or produce seeds.
102. Mosses cannot grow very high because they rely on osmosis to get water to all their cells.
103. Ferns have vascular tissue, which is made of two types: xylem, which transports water, and phloem, which transports solutions of dissolved nutrients.
104. The two types of plants that produce seeds are gymnosperms (naked seeds), and angiosperms (enclosed seeds).

105. Adaptations that allow plants to reproduce without water include cones or flowers the transfer of sperm by pollen, and the protection of embryos in seeds.

106. Gymnosperms bear their seeds directly on cones, while angiosperms produce flowers and fruit to enclose their seeds.

107. Flowers contain seeds, which develop into fruit.

108. The female parts of a plant include the stigma, style, and ovary (the carpel, or pistil), while the male parts consist of the anther and filament (the stamen).

Animals

109. Animals are multicellular, eukaryotic heterotrophs whose cells lack cell walls.

110. Over 95% of all animal species are invertebrates, or animals without backbones.

111. Animals carry out the following essential functions: feeding, respiration, circulation, excretion, response, movement, and reproduction.

112. As more complex animals evolved, specialized cells, tissues, organs, and organ systems evolved.

113. Except for sponges, all animals exhibit some type of symmetry.

114. Radial symmetry: any number of imaginary planes of symmetry can be drawn through the animal.

115. Bilateral symmetry: one plane of symmetry divides the animal into a left and right side.

116. Most animals have a coelom, which is a fluid-filled space that lies between the digestive tract and body wall.

117. The cells of most animals develop from three germs layers: endoderm (innermost layer), mesoderm (middle layer), and ectoderm (outer layer).

118. Animals with bilateral symmetry usually exhibit cephalization - the concentration of sense organs and nerves at the anterior end of the body.

Please see your recent class notes and questions to review Sponges, Cnidarians, Annelids, Echinoderms, and Amphibians.

Mollusks Chordates