

Study Guide for Exam 1

Biol-1, revised Fall 2017

Test Preparation Suggestions

- If you need more background to address the items below, consider looking over relevant sections of your textbook. There are also lots of guiding resources available online. Feel free to ask about them.
- Before our exam, be able to describe and explain the following structures and ideas, respectively.
- Be able to place these topics in the broader context of biology. (For example: Why do we care?)
- Expect a few questions from our discussions in class. It is not possible to predict what issues may arise, but these discussions are certainly worth reviewing.
- Expect a few "challenge questions" which reach across multiple topics, and require your independent critical thinking. One strategy to prepare for these is to identify themes in the course.
- Stick with it! I'm counting on you to come to me with your questions.

Terms used in these guides:

Identify: Write the name.

Describe: Write a sentence.

Recognize: Given a list, be able to identify.

Distinguish: Given a list, be able to describe differences.

Explain: Write a description of why particular things happen.

Be able to...

Introduction to Biology

1. Describe the parts of the scientific method (observation, question, hypothesis, experiment, control group, variable, conclusion).
2. Describe what it means for a hypothesis to be testable and falsifiable.
3. Distinguish between an experimental group and a control group.
4. Explain why control groups are used in experiments.
5. Describe where, ideally, authority originates in scientific investigations.
 - How do scientific investigators get answers to their questions?
6. Describe what "theory" means, in science.
7. Describe some aspects of the overall philosophy of science.
8. List criteria for deciding whether something is alive.
9. Place in order the various levels of organization in living things (atom, molecule, organelle, cell, tissue, organ, organ system, organism, population, community, and ecosystem).
 - Give an example of each. (You may need to look at later lecture topics.)
10. Describe qualities you would consider when assessing the reliability of an information source.
11. Describe conflicts of interest.
12. Use a list of word roots to interpret words.
13. Describe several general biological patterns and themes.
 - Cell theory, evolutionary theory, structure and function, emergent properties, shared features, central dogma.
14. Discuss several common logical fallacies.
15. Distinguish science from pseudoscience.

Chemistry for Biologists

16. Distinguish among protons, neutrons, and electrons.
17. Describe a chemical element, and recognize those important to most living things (H, O, N, C).
18. Draw a diagram of a water molecule.
 - Show also that it is a polar molecule
 - Show how hydrogen bonds form between polar molecules.
19. Describe these important properties of water for living things: solvent, high specific heat, expansion with freezing, cohesion, and surface tension.
 - How do each of these properties come from hydrogen bonds?
 - Why are each of these important to living things?

Major Biological Molecules

20. Name a specific example and a unique function of each of the four groups of biological macromolecules (carbohydrates, proteins, lipids, and nucleic acids).
21. Describe the monomers for each type of macromolecule.
22. Describe the functions of each of the four major types of complex carbohydrates (starch, glycogen, cellulose, and chitin).
23. Explain why the sequence of amino acids in a protein is important.
24. Distinguish between saturated and unsaturated fats. Connect this to the term "hydrogenation."

General Cells

25. Distinguish between prokaryotic and eukaryotic cells.
26. Diagram (in a eukaryotic cell) how DNA directs the

synthesis of proteins. In your diagram, label the DNA, mRNA, ribosomes, proteins, the nucleus, a nuclear pore, and the cytoplasm.

27. Describe what ribosomes do.
28. Describe what the organelles of the endomembrane system do and how they are connected or related. (nuclear membrane, SER, RER, golgi, lysosome, vacuole)
29. Describe some unusual features of mitochondria and chloroplasts, as compared with other organelles in the cell.
30. Describe what endosymbiosis means, in relation to mitochondria and chloroplasts.

Plasma Membrane and Transport

31. Describe a phospholipid with words and a diagram.
32. Draw a generalized plasma membrane with an embedded protein, and label the hydrophilic and hydrophobic regions.
33. Name three general functions of membrane proteins.

Energy

34. Distinguish potential vs. kinetic energy.
35. Describe, draw, and label a diagram of the structure of ATP.
36. Explain why it requires energy to move a substance across a membrane against a concentration gradient.
37. Explain how the structure of ATP allows it to store potential energy.
38. Describe enzyme function, two ways to inhibit enzymes, and why this inhibition can be important.
39. Describe what it means to denature an enzyme.

Cellular Respiration

40. Label a diagram of the electron transport chain (ETC), such as discussed in class.
41. Describe how ATP synthase (the enzyme) works, in general.
42. Describe what the ETC does.
43. Describe how your breathing is related to cellular respiration (same gases? same scale?).
44. Distinguish between cellular respiration and fermentation.

Photosynthesis

45. Compare photosynthesis to cellular respiration.
 - Can you outline both of these general processes? (energy sources, starting materials, final products, purposes)
 - What do these processes have in common?
46. Explain why it makes sense for plant cells to have both chloroplasts and mitochondria.

This exam will not include material on Phylogenetics or Taxonomy.

Additional objectives we may be able to address during this course

In lab

47. Design an experiment.
48. Use metric measurements and convert from one unit to another.
49. Use scientific number notations (powers of 10, logarithms).
50. Work with basic statistics (mean, median, p-value, chi-squared test, t-test).
51. Create graphs from data.

In field observation

52. Get outside.
53. Closely observe surroundings.
54. Experience a sense of connection with other living things.
55. Experience a sense of wonder at the natural world and living things.

In article critique and response paper

56. Assess the reliability of information.
57. Get practice reading scientific articles.
58. Write for a general audience.
59. Skeptically analyze the ideas of others.
60. Reflect on self and society.
61. Cultivate awareness of current events.
62. Explore personal interests and connect them to biology.

In class or through other assignments

63. Distinguish scientific from non-scientific questions.
64. Recognize the scientific method as a valuable source of truths.
65. Identify common Greek and Latin word roots.
66. Find authoritative reference sources for various fields, such as medicine and health.
67. Develop a sense of a personal role in the direction of society, such as through voting, or influence on representatives, corporations, and institutions.
68. Experience a sense of empowerment to find one's own information, and to answer one's own questions.
69. Build optimism about the potential for improving the human condition.
70. Encounter biology from a variety of sources, such as novels, poetry, art, music, magazines, newspapers, essays, and legislation.
71. Experience a sense of ecological interdependence.
72. Consider other miscellaneous projects, such as starting a compost pile, or determining one's energy footprint.
73. Certainly: Enjoy class, and have some fun!