

Final Exam Review

Bio 10

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The final will take place on 5/20 in B210, and you will have the full class period to complete it (6-8:50 pm). The exam will have 40 multiple choice questions, worth 1 point each, 20 circle-ones (1 pt each), 20 fill-in-the-blanks (1 pt each), and 20 points for short-answer questions. The guide below is an overview of the topics we covered in the class; it does not necessarily cover every concept or fact we discussed, but it meant as an outline of the major concepts to help guide your studying. Good luck!

Lecture 1

In our first lecture, we discussed what science is and what it is not, defined biology as the study of life, defined what makes something alive, and discussed how science is conducted.

Review Questions:

- What is science? What is the scientific method?
- How is scientific research funded?
- What are the 7 characteristics that define life?
- How is the study of biology hierarchical?
- What are the three domains on the phylogeny of all life?
- What does it mean to establish a control in setting up an experiment?
- What is the unifying principle for all of biology?

Lecture 2

This lecture covered the chemical basis of life by exploring the properties of atoms and elements and how atoms bond to each other. Another key concept was the molecule water and how water's special properties make it fundamental to processes on Earth. We finished with a discussion of acids, bases, and pH.

Review Questions:

- Which element is the basis for all life?
- What is an atom, and what are the properties of its various parts (protons, neutrons, electrons)?
- What is the difference between atomic number and mass number?
- Know how to draw the electron shells of an atom given its atomic number.
- What determines how chemically reactive an atom is?
- What is the difference between covalent and ionic bonds?

- Draw the structure of water and show the position of the electrons shared between the oxygen and hydrogen atoms. What kind of bond holds the oxygen and hydrogen together?
- What kind of bond holds neighboring water molecules together?
- What are some of the special properties of water that result from its unique chemistry?
- What does pH measure? What is an acid? A base?

Lecture 3

Lecture 3 focused on the 4 main categories of organic molecules through the example of a chocolate-frosted donut.

Review Questions

- Why is carbon such a useful and reactive element?
- What is an organic molecule?
- What are the monomers (building blocks) of carbohydrates?
- What are the 3 examples of polysaccharides we discussed, and how are they different from each other?
- How are glycerides (fats) and steroids different from each other?
- How are saturated and unsaturated fats different from each other?
- What are anabolic steroids?
- Why is the shape of a protein important?
- What are the building blocks (monomers) of proteins?
- What is a polypeptide?
- What are the different structural levels of proteins?
- What are nucleic acids?
- What are the building blocks (monomers) of nucleic acids?

Lecture 4

This lecture provided an introduction to the parts of cells (remember the analogy to the workplace), the laws of energy, and cell respiration.

Review Questions:

- What are the main differences between prokaryotic and eukaryotic cells?
- Know the location and function of these organelles or parts of the cell: plasma membrane, cell wall, nucleus, nucleolus, nuclear envelope, chromosomes, cytoskeleton, ribosomes, endoplasmic reticulum (smooth and rough), Golgi apparatus, lysosomes.
- What are stem cells, and why is there controversy over using embryonic stem cells in research?
- What is energy?
- How are potential and kinetic energy different?

- What are the 2 laws of thermodynamics?
- What is the difference between a calorie and a kilocalorie?
- What is ATP?
- What are enzymes?

Lecture 5

The main topics of this lecture were photosynthesis and cell respiration, and we finished by discussing different energy sources and the potential to use biofuels.

- What is the point of cell respiration? Why is it so important?
- What is the chemical equation for cell respiration? What gets oxidized and what gets reduced? What does it mean to be oxidized or reduced?
- What are the 3 stages of cell respiration? Where does each stage take place?
- What is the point of photosynthesis?
- What is the chemical equation for photosynthesis?
- What are the 2 stages of photosynthesis, and where does each stage take place?
- Why do plants appear green?
- What are some of the alternative fuel sources to fossil fuels?

Lecture 6

Lecture 6 was a short lecture and focused on mitosis.

- What is mitosis? What is the ploidy of the parent cells and daughter cells in mitosis?
- Where is the DNA located in your cells?
- What are chromosomes made up of?
- What are the main phases of the cell cycle, and when do chromosomes duplicate?
- What are the different phases of mitosis, and what happens in each phase?
- What is cancer and how do we treat it?

Lecture 7

We continued our exploration of genetics and reproduction by examining meiosis and comparing it to mitosis. This led to a review of DNA structure, the pros and cons of sex, and the source of genetic variation in sexually reproducing organisms. We finished with an introduction to transcription, the first part of the process through which proteins are made.

- What is the overall point of meiosis? Where does meiosis take place, and what gets produced? What is the ploidy of the parent cells and daughter cells in meiosis?

- What are the different phases of meiosis, and what happens in each phase? How is meiosis different from mitosis?
- What is crossing over, and how does it contribute to genetic variation?
- What happens when meiosis goes wrong?
- What are the 3 main sources of genetic variation, and how does each produce variation in a population?
- What is the structure of the DNA molecule, and who discovered that structure?
- Where does transcription take place, what happens during transcription, and what are the products of transcription?

Lecture 8

In Lecture 8, we covered translation, thus finishing the process in which proteins get made. We then explored the relationship between genotype and phenotype by reviewing Mendelian genetics and how genes get passed on from one generation to the next. We finished by introducing the topic of epigenetics, which challenges the traditional view that traits acquired during one's lifetime cannot be passed on.

- What are the different steps in translation, where does it take place, and what are the products of translation?
- What is the genetic code, and how does it determine what proteins get made?
- How are genotype and phenotype different?
- What does it mean for an allele to be dominant vs. recessive? What is a wild-type allele?
- Who was Mendel, and how did he discover how genetics works?
- Given the genotypes of 2 parents, know how to draw a Punnett Square to determine the genotypes of their offspring.
- What is incomplete dominance?
- What is epigenetics?

Lecture 9

Here we finally got into evolution, first defining evolution generally as descent with modification and then reviewing the evidence for evolution having taken place.

- What are three lines of evidence supporting the existence of evolution?
- What is a phylogeny?
- What are the units of evolution? Do individuals evolve? Why/why not?
- What is microevolution?
- What is natural selection, and what is the history of the theory? Who came up with it and when? What inspired the formation of the theory?

- What was Lamarck's theory of evolution, and how was he right or wrong?
- What do you need in order for natural selection to take place?
- Why do we need to get a flu shot every year? Why don't we just get one flu shot for our whole lifetime?

Lecture 10

Continuing the discussion of evolution, we covered the other 2 mechanisms of microevolution; we also discussed sexual selection and speciation (how new species form).

- What are the 3 mechanisms of microevolution?
- Explain how genetic drift works, and how it is different from natural selection.
- What is the founder effect? What is a bottleneck?
- How does sexual dimorphism contribute to sexual selection?
- What are 3 different species concepts, and why is it so hard to have 1 species concepts that works for all life?
- What approach did Dr. B use in trying to figure out how many species of *Pseudoxops* plant bugs are in Tahiti?
- What are the 2 main ways that speciation occurs?
- What are several ways in which reproductive isolation occurs?

Lecture 11

Lecture 11 was our first lecture in the biodiversity unit of the class. After exploring the origins of the term biodiversity and why studying biodiversity is important, we covered the domains bacteria and archaea, and then introduced the eukaryotes with a review of protists.

- Who came up with the term biodiversity, and what does the term mean?
- What is biophilia?
- You should know the timeline for the major events in the history of life on Earth, such as when life first appeared, when eukaryotes first appeared, etc.
- What are the 3 main types of prokaryotes?
- How are bacteria helpful? Harmful?
- Where can we see archaea in the Bay Area?
- How do bacteria reproduce?
- What are protists and how do they feed?
- What is algae?

Lecture 12

In this lecture, we explored the unique characteristics of plants, the 4 major groups of plants, fungi, and the native biodiversity of California plant life.

- What is the origin of Earth Day?
- What were four challenges that plants encountered in their transition to land and from their origin as aquatic green algae? How did they overcome each of these challenges?
- What are characteristics of the bryophytes, how diverse are they, and what is their life cycle?
- What are the characteristics of ferns, and how is their life cycle different from bryophytes?
- What are some examples of medical ethnobotany that were presented in class?
- What key innovation occurred with the evolution of the gymnosperms?
- Where are the gametophytes in gymnosperms? The sporophytes? How do gymnosperms reproduce?
- Where are the gametophytes in angiosperms? The sporophytes? How do angiosperms reproduce?
- What are some hypotheses for why angiosperms are so diverse?
- Where do fungi fall on the phylogeny of life, closer to animals or to plants?
- How do fungi feed?

Lecture 13

Lecture 13 focused on the animal phylogeny and the key innovations that helped create all of the diversity in the animal kingdom.

- What makes an animal an animal?
- When did animals first evolve and when did a huge increase in animal diversity occur?
- How do all animals develop into embryos after fertilization?
- Be able to draw the phylogeny of the 9 animal phyla we covered in class and map on where key innovations/adaptations first appeared.
- How are radial and bilateral symmetry different?
- What is a body cavity? What is a coelom?
- What kind of organism are corals? How might global warming affect corals?
- What are the 3 parts of molluscs?
- How are flatworms and earthworms different?
- How are spiders and insects different? What phylum do they both belong to?
- What are some hypotheses for why insects are so diverse?
- How do sea cucumbers defend themselves? What phylum do they belong to?

Lecture 14

In our last lecture, we went through the chordate phylogeny and the key innovations that evolved, and finished with a discussion of human evolution.

- How are a coelom and pseudocoelom different?
- Draw the chordate phylogeny and map on the appearance of key innovations
- What 4 things do all chordates have in common? Where do these things appear in humans?
- What is convergent evolution, and what are a couple of examples?
- How do hagfish protect themselves? Tunicates?
- How are the four types of fish we covered different from each other?
- What type of fish are the transitional animals between fish and amphibians?
- When did primates first evolve, and what kind of habitat did early primates inhabit?
- Did modern humans evolve directly from chimps? Explain.
- What evolved first in humans, walking upright on 2 legs or a large brain?
- How many hominid species originated in Africa and the migrated out of Africa?
- What is the controversy over the Hobbits, *Homo floresiensis*?