

Biology Final Review

Genetics

1. Define: **Look up in back of your book**

- a. allele b. phenotype c. genotype d. recessive e. dominant
f. heterozygous g. homozygous h. autosomes i. sex chromosomes
j. Punnett square k. pedigree l. karyotype m. chromosomes
n. genes

o. linked traits **Genes that are on the same chromosome and very close together so they are very unlikely to be separated when a 'crossing over' event happens in meiosis**

p. sex-linked traits: **colorblind is one example. Any gene that is on the X or Y chromosome.**

2. How are genes, chromosomes, and DNA related? **Genes code for proteins. Many genes that are all stuck together make up one chromosome. Genes and chromosomes are made of DNA.**

What is the structure of DNA? **Double helix** What happens during replication, transcription, and translation?

Replication: DNA Polymerase makes a copy of DNA before the cell goes through mitosis. Transcription is when RNA polymerase makes an mRNA copy of DNA. Translation is when the mRNA leaves the nucleus and finds a ribosome because the ribosome will match tRNA to the mRNA so that amino acids (the building blocks to proteins) line up in the correct order. (ribosomes contain rRNA) Where does each process take place in the cell? Replication and Transcription take place in the nucleus. Translation takes place in the cytoplasm and the ribosomes.

What is a codon? **3 mRNA bases that code for a specific amino acid (example AUG codes for methionine)**

3. What is meiosis? **Cell division to make gametes (sperm or eggs). Each gamete is a little different from the other because of crossing over events. Makes 4 different cells. Cuts the number of chromosomes in half from diploid to haploid. How is it different from mitosis? Mitosis is cell division to make two identical cells. If you get a cut and need more skin your body does mitosis. What happens during meiosis I? The homologous chromosomes are separated which leaves the cells with half as much DNA (makes the cells haploid instead of diploid). What happens during meiosis II? The sister chromosomes are separated from each other. (There are still the same number of chromosomes in the cell, This step does not cut the number of chromosomes in half like Meiosis I did).**

4. What is crossing-over? **During Meiosis I chromosomes are so close together that they swap a little bit of DNA, this causes much of the variation (differences) between siblings. When during meiosis does crossing-over occur? Prophase I during Meiosis I**

5. What does it mean if genes are called 'linked'? **They are on the same chromosome and very close together, therefore when crossing over events take place they are very unlikely to be separated. Example: People with bright red (orange) hair often also have bright red/orange freckles. This is because freckles and red hair gene are on the same chromosome and right next to each other. How is a gene map constructed? Every gene is given a location by what chromosome it is on, and how many gene away it is from the centromere. For example if hair color gene is 7p14. That means it is located on the 7th chromosome, the petite (p, smaller) end of the chromosome, 14 genes away from the centromere.**

What are the sex chromosomes of a male? **XY** What are the sex chromosomes of a female? **XX** Which parent determines the sex of a child? **The father because the mother can only give an X, the father gives an X to make it a girl or a Y to make it a boy.**

6. How many chromosomes are there in a normal human cell? **46** How many chromosomes are there in a sperm or egg? **23**

7. What are genes made of? **DNA** What do genes code for? **Proteins**

8. Use a Punnett square to predict the probable outcomes of a genetic cross. **Draw the punnett square for full credit**

Ex. A: If a woman who is heterozygous brown-eyed woman marries a blue eyed man, what is the probability that they will have a brown-eyed child? **50%** What is the probability that they will have a blue-eyed child? **50%**

Ex. B: If a woman who is heterozygous for colorblindness marries a man who has normal vision, what is the probability that their son will be colorblind? **50%** What is the probability that their daughter will be colorblind? **0%**

9. What are the possible gametes that a plant with the genotype RRYy could produce? **RY or Ry**

10. What is the difference between codominance and incomplete dominance? **Co dominance is when both genes are dominant and both show in the phenotype (example: mix a brown cow and a white cow, you get a brown and white spotted cow.) Incomplete dominance is when the dominant gene is not completely dominant so some of the 'recessive' gene shows through. (example: mix white flower with red flower and get a pink flower. If this was co dominance it would have been a red and white flower, but with incomplete, the phenotype you get is not like either of the parents, it is more of a blending of the genes. Give an example of each.**

11. Can a man be a carrier for a sex-linked trait found on the X chromosome? **No, a man either has, or does not have an X-linked trait. The girls have a 'back up' X chromosome, so if one doesn't work, the other will be used, but if a guy gets a bad copy, he only has the Y to rely on, and the Y chromosome has totally different genes. Example color vision is not on the Y chrom. So if you're a guy and get a bad X, you don't have another X with a good color vision gene.** What are Barr bodies? **Girls rely on one X chromosome, the other one sits around not used, so it condenses into a dense mass of DNA. The dense un-used X chromosome is a Barr body.**
12. Why are men more likely to be affected by sex-linked disorders? **They do not have a 'back up' X. (See #11)**
13. What is sickle cell disease? **A genetic disease that makes red blood cells shaped like a crescent moon or 'sickle' instead of a normal round shape.** What is the probability that a child of two carriers for sickle cell disease will also be a carrier? **50%**
14. What is a polygenic trait? **A trait that is controlled by more than one gene.** Give examples of polygenic traits and single gene traits. **Acne (pimples), skin color**

Biotech

1. Define:
 - a. Plasmids: **Circular rings of DNA found in bacteria**
 - b. Restriction enzymes: **enzymes that break the sugar-phosphate covalent bond in the DNA backbone at specific base sequences on DNA**
 - c. Ligase: **enzyme that catalyzes the covalent bonds on the backbone between two pieces of DNA**
 - d. Recombinant DNA: **DNA molecules formed in a lab using multiple sources**
 - e. Gel Electrophoresis: **A way to analyze DNA using electrical charges. Small, lighter pieces move farther**
 - f. Column Chromatography: **a way to separate chemical compounds/substances and purify our protein of interest using its hydrophobic characteristics**

Evolution

1. Who is Charles Darwin? **An Englishman that was born in 1809, and came up with the theory of natural selection.** What was his theory? **Natural Selection: The animals that are best suited for their environment will survive the best and therefore, have more offspring, passing on the characteristics that are beneficial in that particular environment.** How was his theory different from the previous theory of Lamarck's? **Acquired Characteristics: (using or not using an appendage or body part, made it disappear over generations, or made it change its function over generations). This theory did not take genes into account, because DNA had not been discovered yet. Even Darwin did not know what DNA was, yet he was able to come up with the idea for natural selection.**
2. Define: **Look in your text book**

a. natural selection	b. gene pool	c. fitness	d. adaptation
e. evolution	f. homologous structures	g. vestigial organs	
h. variation	i. species	j. geographic isolation	k. behavioral Isolation
l. temporal isolation	m. bottleneck effect	n. founder effect	o. fossils
p. mutation	q. gene shuffling	r. artificial selection	s. coevolution
t. convergent evolution	u. prokaryotes	v. eukaryotes	
w. mass extinction	x. index fossil		
3. Describe 5 types of evidence for evolution.

The fossil record, Geographic distribution of living species, homologous body structures, and similarities in early development. (see more detail on page 382-385)
6. What types of things can be fossils? **Anything can become frozen, Mostly hard materials become fossils: ex: shells and bone. Soft materials can become fossils with imprints: leaf imprint in the mud for example. Or things can get covered in amber (tree sap) like bugs. What is the difference between absolute dating and relative dating? Absolute dating is when you use Carbon 14 Dating, special machines analyze material to see how old it is. Relative dating, is when you compare a fossil to something of a known date to guess how old it is. For example. If you know that this fossil was found in the same layer of dirt as a dinosaur, you can assume it is about the same age as the dinosaur. What is an index fossil? **A collection of all of the fossils that have been found to this day.****
7. What is a population? **A group of organisms that are the same species and live close enough to eachother to be able to mate with one another.** What is a species? **Two animals are the same species if they can mate with eachother and produce viable offspring (offspring that can have babies).** What are the sources of variation within a population? **Mutation causes variation in traits within a population.**

8. How does natural selection work? There is a struggle for survival (not all animals can live, only the ones that are best fit to their environment). The surviving animals are obviously the ones that had genes gave them a phenotype that improved their ability to survive in that given environment. Therefore, when they have babies, they will pass on their “good” genes, therefore, their offspring will inherit those genes that made the parents more capable of surviving. This makes all the future animals of this kind more adapt to their environment, because only the most adapt survive to pass on their genes. Natural selection acts on phenotype not genotype. What conditions are necessary for natural selection to occur? Struggle for existence, survival of the fittest, descent with modification (page 380) What is meant by the phrase “survival of the fittest?” fitness is the ability to successfully reproduce, so the fittest is the one that has and raises the most babies.
9. What is the relationship between fitness and mortality (death rate)? There is always a limited number of resources in any environment, which means there is a limited amount of food/shelter/water/other necessary materials, to sustain an unlimited population size. Therefore, when fitness is increased, more babies are born, but the number of resources is limited, so some of the babies must die. The ones that are least fit to their current environmental factors will die first.
10. What does it mean if two animals have similar amino acid sequences for a specific protein? They are probably more closely related to each other than an animal that has a different amino acid sequence for that same specific protein.
11. Identify graphs showing directional selection, disruptive selection, and stabilizing selection. See page 398 and 399 in your books.
12. What is genetic drift? Page 400 in book: When the allele frequency of a population changes. What are the founder effect and the bottleneck effect? Both are types of genetic drift. Founder effect is when one small group is taken to a new location and only some of the variation of the original population is represented FIGURE 16-9 page 400, Fruitflies on the Hawaiian Islands. Bottleneck effect: a catastrophe kills off all but a few of a species, leaving much less variation in the population. Ex: Elephant seals hunted to near extinction.
13. What is a cladogram? A diagram that shows how organisms are related to one another. (page 439 has a drawing like a cladogram, but they are using it to talk about punctuated equilibrium.)
14. What were the first living organisms on Earth like and where did they develop? Single celled organisms that could do photosynthesis developed in the water. What was the early Earth like? Many storms: lightning, less oxygen, varying temperatures.
15. How did eukaryotic cells develop? Probably developed from a prokaryote that engulfed another prokaryote. The inner-prokaryote lived symbiotically inside the other, becoming the first of many cell organelles.
16. Which is bigger – a period or an era? An era contains many periods, therefore an era is bigger, see page 421 figure 17-5. Also page 461
17. During what era did dinosaurs live? Mesozoic Were humans alive at this time? No
18. What are the levels of classification, in order? Kingdom, Phylum, Class, Order, Family, Genus, Species. What are the two parts of a scientific name? The genus and the species name. How should a scientific name be written? *Ursus arctos*: genus written first, with the first letter capitalized, species name second all in lower case. Both should be italicized.
19. Which two kingdoms contain only heterotrophs? Animalia, and Protista, (look up protests if you don’t know what they are) Which kingdoms contain only eukaryotes? Archaeobacteria and eubacteria. Which kingdom contains organisms with no cell wall? Animalia
20. What is the basic structure of a bacterium? Cell wall, cell membrane, plasmid ring of DNA, small, simple with few organelles and no nucleus a virus? Non-living, composed of protein and DNA. a fungus? Has nucleus and cell wall, more complex than bacteria, heterotrophs. a protist? Small one celled organism with a nucleus. Any eukaryote that is not a plant, animal or fungus. What is the role of each in the environment? Bacteria and fungus are decomposers. Protists are heterotrophs. Viruses are not alive, but may introduce new DNA into an organism, and therefore increase genetic variation. What diseases are caused by each? (You don’t need to know this)
21. What are antibiotics and what kinds of diseases can they treat? Only diseases caused by bacterial infections. They do not help treat fungal or viral diseases.

Human Body Systems

1. Describe the basic structures and functions of the major systems: skeletal, nervous, integumentary, muscular, digestive, excretory, circulatory, respiratory, endocrine, reproductive AND Lymphatic!! All are listed in a very easy to read way on page 892-893.

2. What is homeostasis? **Maintaining a constant internal environment.** Why is it important? **The enzymes and other chemical reactions that happen in our body require a specific pH, salt concentration and temperature. All these things need to be maintained for our bodies to function correctly.**
3. What are the layers of skin? **Epidermis and Dermis** Which structures are found in each layer of skin? **Epidermis: pores (openings) melanocytes, quick dividing cells, dead Keratin filled cells. Dermis: sweat and oil glands, blood vessels, smooth muscle, hair and hair follicle.**
4. What are melanocytes? **Cells that make the protein melanin to protect you from getting skin cancer from the sun.** Do people with dark skin have more melanocytes than those with light colored skin? **NO, they just make more melanin.** What are hair follicles? **Cell that make your hair.** What are sebaceous glands? **Small organs in the skin that make oil.** What are sweat glands? **Organs in the skin that make sweat, also part of the excretory system.** How does sweating keep you cool? **The evaporation of water helps you lose heat to the environment, therefore cooling you down.**
5. What are the three types of muscle? Where is each located? How is each type of muscle controlled? **Cardiac muscle, found in heart, involuntary (controlled subconsciously by the brainstem). Skeletal Muscle, found attached to your skeleton to create movement, voluntary. Smooth muscle, found in blood vessels and throughout the digestive system to move food and blood throughout the body, involuntary.**
6. Define: **see book**
 - a. central nervous system
 - b. peripheral nervous system
 - c. neuron
 - d. neurotransmitter
 - e. axon
 - f. synapse
7. Draw a neuron and label the cell body, nucleus, dendrites, and axon. **Page 897**
8. What is the difference between motor neurons and sensory neurons? **Motor neurons send a message from the brain to the skeletal muscle causing movement. Sensory neurons take information from a sense organ (eyes, ears, nose, tongue, skin) and relay the information to the brain.** What is a reflex? **An involuntary response to stimuli. Ex: you blink if bug flies by your face.**
9. What is a neurotransmitter? **Chemicals used by a neuron to transmit an impulse across a synapse to another cell. Page 900.**
10. How is the endocrine system similar to the nervous system? **Both are using chemicals to cause a reaction in the body.** How are the endocrine and nervous systems different? **(you don't need to know this)**
11. What are the functions of the skeletal system? **Create movement, protect organs/body.** What is the difference between the axial skeleton and the appendicular skeleton? **Axial are things in the middle that don't really move. Example: ribs, pelvis attached to the spine and head. Appendicular are arms, legs, fingers, toes.** What are joints?
12. Identify and describe cartilage: **flexible tissue found between joints and in nose and ears, and a few other places in the body. Allow joints not to rub together.**, spongy bone: **hole filled inner part of bone, less dense, where bone marrow is made**, periosteum: **tough layer of connective tissue on outside of bone**, compact bone: **dense outer layer of bone, surrounds spongy bone.**
13. What are the parts of the circulatory system? **Blood vessels, Heart, Blood** What are the three types of blood vessels? **Veins, arteries and capillaries.** Which blood vessels carry blood to the heart? **Veins.** Which blood vessels carry blood away from the heart? **Arteries.**
14. What is the function of the circulatory system? **Bring food and nutrients to the cells of your body.** Trace the path of blood through the heart, body, and lungs. **Blood enters the heart through the vena cava which leads to the right atrium. Then passes through the tricuspid valve into the right ventricle. The R. Vent. pumps the blood to the lungs through the pulmonary artery to get oxygen. From the lungs blood travels through the pulmonary vein to the left atrium. Passes by the mitral (or bicuspid) valve into the L. Ventricle. The left ventricle then pumps all the oxygenated blood out through the aorta to the entire body.** What are the four chambers of the heart? **Left and Right Ventricles and Left and Right Atrium.** Which chamber has the thickest walls? **Left Ventricle** Why? **It needs to pump large volumes of blood long distances. If the walls were thin the heart may explode when it pumped.**
15. What is blood made of? **Plasma (water and salt/nutrients) and blood cells (red, white, and platelets)**
16. What is hemoglobin? **A protein that binds onto oxygen.** What type of cells is it found in? **red blood cells.**
17. Describe the structure of the lungs. **Branches of smaller air sacs.** What is the function of the respiratory system? **Bring oxygen to the blood cells** How and where does gas exchange take place? **Diffusion between alveoli (tiny air sacs in the lungs) and capillaries (tiny blood vessels)**
18. What is the epiglottis? **A small 'flap' that separates the trachea and esophagus in the pharynx.** What is the trachea? **The windpipe (brings oxygen from nose/mouth to lungs)**
19. What are the six major types of nutrients that your body needs? **Don't need to know.** What do Calories measure? **The amount of energy stored in the molecules of food.** Which types of nutrients have Calories? **Carbohydrates.**

20. What are the major parts of the digestive system? **Mouth, esophagus, stomach, small intestine, large intestine, Liver, pancreas, salivary glands, gallbladder.** Where does most chemical digestion take place? **Stomach** Where does absorption of nutrients take place? **Small intestine.** Describe the inner surface of the small intestine. **Lined with villi, small fingerlike projections that help increase the surface area used for absorbing nutrients.** Why does it look this way? **Increase surface area for absorbing nutrients.**
21. Where is water reabsorbed from digested food? **Large intestine.** Why is this process important? **Absorbs needed water to maintain blood volume. Helps body form solid waste (instead of diarrhea)**
22. Why are the bacteria that live in your digestive system important? **Help us digest our food, without them we could not properly digest material, so we would not get as much nutritional value from them.**
23. What organs function in excretion? **Skin, lungs and kidneys.**
24. How does your body defend itself against pathogens? What is your first line of defense? **Skin, mucus, tears, sweat** What is your second line of defense? **Immune system, white blood cells**
25. What are the steps in a specific immune response? **Don't worry about this** What are antigens? What are antibodies?
26. How do you develop immunity against a disease? **When your body fights a disease it makes memory cells to remember how to fight it any time you are exposed to it.** How do vaccines work? **Gives your body a weak dose of a disease so your body can learn to fight the disease and make memory cells, but you don't actually get sick with the disease.**