Unit 8 Honors Bio Study Guide

Chapter 10

Natural Selection

Natural selection acts on	**PHENOTYPES**
Natural selection	**Environment is selective agent** (variation, overproduction, adaptation, descent w/ modification): over time, organisms with variations well-suited to environment survive, reproduce, and pass on beneficial adaptation
Hutton & Lyell	Said the Earth was very old
Artificial selection	Humans change a species by breeding it for certain traits (eg dog breeds)
Variation	Driving force behind evolution
Descent w/ modification	natural selection results in species with adaptations well-suited for survival
Fitness	How suited to the environment an organism is and how well it survives
What did Darwin notice about Galapagos tortoises?	Their necks got longer and their shell shapes changed so they could reach their food source, which was high up. Darwin noticed that these variations were well-suited to their environment and helped the tortoises survive well.

Structures

Homologous structures	Same structure, different function: eg leg bones in humans and fin bones in whales
Analogous struc.	Same function, different structure (origin): eg bat and insect wings
Vestigial structures	structures/organs often reduced in size that seem to lack any useful function but functioned in an early ancestor: eg ostrich wings, appendix, front legs in whales

Evidence of Evolution

Fossils	Show gradual change of organisms over time
Geography	New traits developed on different islands
Embryology	Similarities in embryos shows relationships btwn organisms and common ancestor Eg gills, arm and leg stubs, large heads, tails, nasal structures, etc.
Anatomy	Comparing body parts of different species
Molecular & genetic evidence	**DNA sequence analysis:** related organisms have similar DNA **Pseudogenes:** look at genes that no longer function **Protein comparisons:** similarities in proteins

Peppered Moth Lab

Industrial melanism	Peppered moths darkened over a short period of time to blend in with pollution, which darkened trees during the Industrial Revolution
Why did moth colors change?	Random genetic mutations
What gave dark moths fitness?	Darker color blended in with polluted forests, so made it harder for predators to spot and eat them

Chapter 11

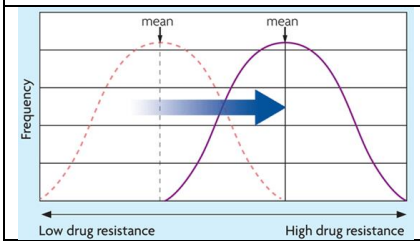
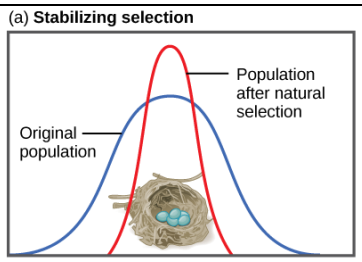
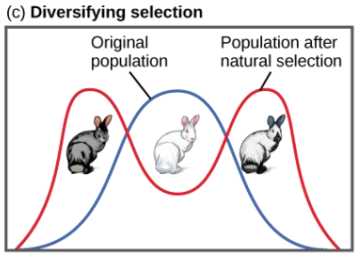
Genetic Variation

Genetic variation	Beneficial: Increases chance that species will survive in changing environment Eg Darwin's finches: beak shapes evolve to eat different food sources
Gene Pool	Genetic variation stored in population: big gene pool benefits species
Gene Frequency	Frequency that each allele appears
Mutations	Increases genetic variation: Random change in organism's DNA, can form new allele Only passes on mutations in reproductive cells
Recombination (gene shuffling)	Increases genetic variation: new allele combo form in offspring • Meiosis: new combination of parents' alleles • crossing over: entirely new chromosomes

Unit 8 Honors Bio Study Guide

Microevolution and Distribution

Microevolution	Observable change in allele frequency of small population in short time period
Macroevolution	Formation of new species (cannot interbreed)
Normal distribution	Gives classic bell-shape curve

Directional selection	**Stabilizing selection**	**Disruptive selection**
Most common: Extreme pheno. becomes more common, causing shift in mean value (eg drug-resistant bacteria, pepper moths)	Intermediate phenotype favored and becomes more common, **decreasing genetic diversity**	Extremes favored and inter-mediate selected against, can lead to **new species**
		

Evolutionary Mechanisms

Gene flow	Movement of alleles between populations (immigration): increases genetic variation of receiving population, keeps gene pools similar & reduces chance of new species
Genetic drift	Change in allele frequencies due to chance, normally in small populations • **Bottleneck effect:** occurs after a disaster wiping out over 90% of species • **Founder effect:** a few organisms colonize a new area **Effects of drift:** less genetic variation, lethal alleles become more common
Sexual selection	Certain traits increase mating success (eg mating song changes)

Hardy-Weinburg Equilibrium

Shows that equilibrium (stopping evolution) is impossible, calculates geno. frequencies; 5 conditions	
No genetic drift	Very large populations
No gene flow	No emigration/immigration
No mutations	No new alleles (impossible)
No sexual selection	Completely random mating, not based on fittest
No natural selection	All traits must be equally favored in environment (impossible)

Isolation

Speciation	Formation of new species from 1 existing species
Isolation	separating populations can result in different adaptations if can't interbreed, become increasingly different and result in new species
Reproductive isolation	Different populations no longer mate successfully w/ each other (types below)
Behavioral iso.	Isolation caused by diffs in courtship/mating behavior (songs, chemicals, etc)
Geographic	Physical barriers divide populations (mountains, rivers, etc)
Temporal	Timing prevents reproduction btwn pops when reprod. periods change

Evolutionary Patterns

Convergent evolution	Evolution towards similar traits in unrelated species (eg flying squirrels)
Divergent evolution	Related species evolve in different directions, become very different
Coevolution	2+ species evolve responding to other's changes (eg when an orchid gets longer, the bird that feeds on it evolves a longer beak) **Evolutionary arms race:** coevolution can be competitive (eg snail & crab)
Extinction	Elimination of species from Earth (**mass extinction:** wipes out 70-90%)
Punctuated equilibrium	Bursts of evolutionary activity that occur suddenly
Adaptive radiation	Diversification of one ancestral species into many diff species (divergent ev.)

Unit 8 Honors Bio Study Guide

Antibiotic Resistant Bacteria Video

Bacteria	Microorganisms, first life forms on Earth found almost everywhere
Antibiotics	Fight infections, becoming less effective: random mutations make bacteria resistant, non-resistant killed off
Super bacteria	Strains of bacteria resistant to antibiotics: eg MRSA, salmonella, E.coli
Staying ahead of bacterial evol.	Scientists: new antibiotics, phage therapy (vaccines) People: stop excessively using antibiotics, sanitize to prevent hospital infections

Chapter 12

Fossils

Permineralization	Minerals carried by water depositied around or replace hard structure Most common form (others: natural casts, trace fossils, amber, preserved remains)
Sedimentary rock	Where most fossils form (in wetlands, bogs, rivers, lakebeds, floodplains)
Tiny percentage of living things become fossils	

Dating Techniques

Relative dating	Estimate of date by comparing placement of fossils in rock layers **index fossil:** organism that lived during certain time period, shows age of fossil
Radioactive dating	Technique using half-lifes of unstable isotopes (form of absolute dating) • use carbon-14, uranium • **half-life:** how long It takes for a half of an isotope to decay

Geologic Time Scale

Geologic Time Scale	Represents Earth's 4.6 billion year history, organized by major changes/events
Periods	Most common, lasts tens of millions of years
Eras:	Separated by mass extinctions; types below:
Precambrian Era	Single-celled life
Paleozoic Era	Multicellular life appeared in ocean, huge diversity formed
Mesozoic Era	Reptiles and mammals, ended by meteorite
Cenozoic Era	Today! Mammals radiated

Organic Molecular Hypotheses

Miller-Urey experiment	Organic compounds could be made on early Earth showed by simulating conditions of early Earth
Meteorite hypothesis	Organic molecules arrived on Earth thru meteorite/asteroid impacts

Origin of Cellular Life

Single-celled life	Photosynthesis added oxygen to atmosphere, making aerobic life possible Reproduced asexually
Eukaryotic cells	**Endosymbiotic theory:** mitochondria and chloroplasts were once separate prokaryotes, got absorbed by other prokaryotes, formed symbiotic relationship • evidence: mito & chloro have own DNA and ribosomes sexual reproduction increased diversity, gateway to multicellular life
Multicellular life	see Paleozoic-Cenozoic era

Primate Evolution

Primates	Mammals w/ flexible hands & feet, forward eyes, enlarged brains, common ancestor w/ humans
Bipedal	Evidence: two legged or upright walking led to evolutionary success
Fossils of extinct hominids (evidence)	• Austrolopithecus afarensis (3-4mil yrs ago) • Homo habilis (2.4-1.5mil, "handy man," used crude stone tools) • Homo Neanderthalensis (200-30k yrs) • Homo sapiens (100k-now, "man-wise"; culture, tools, big brain size)