Biology Lecture 9 - Populations

Mendelian Genetics

Definitions
Phenotype: expression of a trait (what organism looks like)
Genotype: genetic makeup of a trait (what organism's genes are)
Allele: for diploid organisms, each gene has two variations, each variation is an allele
-> Usually we simplify it to be one of two types: dominant or recessive
Dominance: when one allele is expressed in phenotype regardless of what other allele is
Homozygous: when individual has two of the same allele, i.e. two dominant/two recessive
Heterozygous: when individual has one dominant, one recessive allele

Mendel's Laws
Law of Segregation: each gamete has same chance of receiving either allele
-> Phenotype is dominant if one or two dominant alleles, recessive if two recessive alleles
Law of Independent Assortment: genes on different chromosomes will assort independently

Punnett Square
Write down possible alleles for one parent along top, possible alleles for other parent along left; center of table has all possible offspring
Monohybrid cross: 3:1
Dihybrid cross: 9:3:3:1
Sex-linked traits: if traits are on sex chromosome, they can only be on X
-> So Dad will have XH/Xh and Y gametes, Mom will have two XH/Xh gametes
-> If Mom's gamete is recessive/has the disease, then all sons must have it
Carrier: if Mom has a dominant and recessive allele for a sex-linked trait, she won't express the recessive phenotype but her sons might

Pedigrees
Is the condition dominant or recessive? (look for skipped generations)
Is the condition sex-linked? (look for more males than females having the condition)

Biology Lecture 9 - Populations

Examkrackers MCAT Comprehensive Course, Charles Feng
fenguin@gmail.com / (224) 532-0039

Evolution
Gene pool: all alleles in a population
Evolution: change in the gene pool

Taxonomic Classification
"King Philip Came Over For Great Sex" Kingdom-phylum-class-order-family-genus-species
We're in phylum chordata, subphylum vertebrata, class mammalia
Plants/fungi: replace phylum with divisions
Domains: bacteria, archaea, eukarya (which contains protista, fungi, plantae, animalia)
Species: organisms that reproduce fertile offspring with each other in the wild

Populations
Niche: how a species occupies its environment (location, food, etc)
Survival of the fittest: only one species can survive in a niche over a long period of time
r-selection: reproductive strategy where you make lots of offspring with no parental care
-> Exponential growth curve, usually organisms in rapidly changing environments
K-selection: reproductive strategy where you make few offspring with lots of parental fare
-> Sigmoidal growth curve leveling off at *carrying capacity*

Evolution
Speciation: how new species are formed
-> *Adaptive radiation*: when one species, when separated, evolves into multiple species
Bottleneck: when many organisms die in a population, so that allele frequencies change
Divergent evolution: two or more species with common ancestor share structure of ancestor
Convergent evolution: similar structures evolve in two or more species with different ancestors
-> Wings in bats and birds, fins in whales and fish
Polymorphism: occurrence of distinct forms/phenotypes within a species
Genetic drift: in a small population, allelic frequencies can shift over time

Symbiosis - relationship between two species
Mutualism: benefits both
Commensalism: benefits one, does not affect the other
Parasitism: benefits one, hurts the other

Hardy-Weinberg Equilibrium $p^2 + 2pq + q^2$ frequency of gene w/ two alleles, $p + q = 1$

Large population, mutational equilibrium, no significant immigration/emigration (no gene pool changes), random mating, no selection for fittest organism

Biology Lecture 9 - Populations

Origin of Life
12-15 billion years ago: Big Bang, start of Universe
4.6 billion years ago: start of solar system
4.5 billion years ago: start of Earth
-> Atmosphere has H_2S, NH_3, CH_4
-> *Urey-Miller experiment* created amino acids, etc from these conditions
-> *Coacervates*: bubbles of lipids/proteins that evolved into cells
3.6 billion years ago: first microorganisms - heterotrophs that eat organic compounds
2.3 billion years ago: first photosynthetic bacteria (sunlight + water + CO_2 -> O_2 + organic)
1.5 billion years ago: first eukaryotes
470 million years ago: first fish
300 million years ago: first reptiles
220 million years ago: first birds, first mammals

Chordates are deuterostomes, and during their development have a coelom, notochord, pharyngeal slits, a dorsal/hollow nerve cord, and a tail