



## Crack Notes [Biology 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)



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### 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 care

-> 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



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### 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  $\text{H}_2\text{S}$ ,  $\text{NH}_3$ ,  $\text{CH}_4$

-> *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 +  $\text{CO}_2$  ->  $\text{O}_2$  + 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