QUIZ #1 on MONDAY 09/11

essay examples

- When you write an answer that includes a technical term from the class, define the term to demonstrate you know its meaning
- When we're answering a question, are we answering like we're explaining it to a professor (you) or to someone with zero knowledge? Who is our audience?
- Explain your reasoning. Finish your thoughts
- complete sentences
- do not use the root of a word to define a word
- examples are often helpful in explaining
- think before you write
- define terms if not common knowledge
  eg- would we define something like bacteria? probably common knowledge of its semi-meaning but not exact definition
- avoid vagueness

2:22-2:30

ch 19 the evolution of populations

19.1 Population Evolution

blending inheritance was the theory before natural selection
- but genes found to have particulate nature, passed discretely
modern synthesis: natural selection + genetics → evolution
- microevolution (pop change over time) and macroevolution (new species)
population genetics discussed in terms of allele frequencies
- genetic change → phenotypic change
natural selection affects allele frequency (=genetic change)
gene pool: sum of all alleles in a population
genetic drift - allele frequencies change w/ no advantage can critical allele frequencies (chance)
- occurs alongside natural selection
founder effect - event causing change in gf in an isolated part of the population (?) that isn't typical

19.2 Population Genetics

polymorphisms (circumstances 2, 3)
population variation - distribution of phenotypes
heritability - the part of phenotype variation from genetic variance (among individuals in a population)
- ↑ heritability, ↑ evolution
genetic variance - diversity of alleles + genotypes
inbreeding depression - inbreeding ↑ diseased offspring (greater chance of shared recessive deleterious alleles)
GID - by chance some orgs have more children
small populations more susceptible to genetic drift
- larger population = buffered effects of chance
bottleneck effect - natural events kill large portion of pop can magnify genetic drift
survivors solely determine genetic variation which is passed

by chance very different from before
founder effect also if physical barrier causes a lot of indvls leave
gene flow: flow of alleles in and out of a population due to
migration of indvls or gametes
- some pops have more gf than others
- plants spread pollen
- can intro new genetic variation
mutations
- "species evolve because of mutations accumulating over time"
- intro novel genotype & phenotype variance
- harmful sorted out by n.s., beneficial spread
- silent don't affect population variation but maybe genetic variation
nonrandom mating
- natural selection selects traits preferred by females for mating
assortative mating - one wanting to mate w/ one similar to
themselves
physical location - mate with those closer
- wouldn't def of pop kinda undermine this?
environmental variance
environment can affect phenotype (not heritable)
- what about temp dependent sex determination
geographical variation
- can lead to differences in phenotypic variation
- cline: a species population vary across an ecological gradient
- more gene flow b/ clines, less difference and vice versa

19.3 Adaptive Evolution

natural selection = adaptive evolution
- not all evolution is adaptive!!!!
- n.s acts on entire organism, not indvl alleles (takes all factors
into account)

are there other elements on other planets?

evolutionary (Darwinian fitness)
- relative fitness; fitness only matters as it compares to other organisms of the same population

stabilizing selection: if n.s. prefers average over extreme phenotypes

directional selection:
- often response to change in environment
- selects individuals on one end of the phenotype

diversifying selection
- more distinct phenotypes more fit than the intermediate
- increases genetic variance (bad)

frequency-dependent selection
- positive fds (favors common) or negative fds (favors rare)
  - ↳ decreases genetic variation
  - ↳ increases genetic variance
  - ↳ changes direction depending on allele frequencies

sexual selection
- sexual dimorphisms (especially present in animal populations)
- more variance in male reproductive success than females
- strong selective pressure on males to obtain mates
- some species sex-role reversed so VV sexual dimorphism

same traits ↑ sexual success w/o survival success - sometimes selects for sexually beneficial traits that detract from survival
- = handicap principle (those that survive w/ unfavorable sexual handicap are unusually good)

trait signals male's quality
- good genes hypothesis - impressive traits may signal genetic superiority

n.s cannot make a perfect organism, can only select not create
- limited by genetic variance, mutations, & gene flow
- net effect of alleles often reduced, less intensity of n.s.

- work on simulation (due on 11:59 on Wednesday)
  - don't have to design the experiment at the end
- review bio notes from today

modes of evolution

→ 09/11 lecture
- ☑ print off workbook
- ☑ print off periodic table

MUTATIONS, INBREEDING DEPRESSION, COMMON PATTERNS OF EVOLUTION, GENE FLOW, & GENETIC DRIFT

natural selection is not the only mechanism of evolution, but it is the most important

population: a group of individuals of the same species with opportunities to interbreed (offspring able to reproduce)
- species: the potential to interbreed (would if they had opportunity) in nature; members of same species not necessarily same population
- some species have only one ea population, but some species have lots of populations

gene: a unit of heredity made of DNA
- affects some feature of an organism

allele - a variant of a gene - e.g. a length of DNA that codes for a particular genetic trait
- variant of alleles on same gene → different effect
- natural selection concerned more w/ alleles, not genes

fitness: the relative contribution an individual makes to the gene pool of the next generation
- most fit individual leaves the most viable offspring
- sn: not on test / what is natural and what is desirable are not always the same thing
- more copies of their allele make it to the next generation
- highest fitness tends to be what survives best
- fittest ≠ strength

Processes that alter allele frequencies (cause evolution)
1) mutation (new allele = new genetic varieties = new possibilities)
2) evolution by natural or artificial selection (adapts population to current conditions)
3) gene flow
4) genetic drift (chance change in allele frequency)

• go back through WB and make full sentences

mutation - a change in the DNA sequence

random
- mutations occur randomly (not because it may be beneficial)
- create new genetic variants (only case where new happens)
- any specific mutation is extremely unlikely increase fitness
- not that many mutations are actually beneficial; not all mutations matter; random change to functional system may become common if its selected for
- more genetic diversity → more capability for evolution / capacity to adapt to new circumstances

the problems with mutations for individuals
- don't want to expose yourself to mutagens (cover yourself up when getting mutated)
- 2 copies of most genes (one from e/ parent) thus 2 alleles - same or different

genotype: individual's complete set of alleles
phenotype not solely genetically determined (eg. aging) nutrition, etc.
natural selection acts on phenotype, not genotype
- any measurable part of an individual

out of the two alleles, one may be dominant (expressed in phenotype) over the other recessive (or something more complicated) ns acts on phenotype (affected by genotype)
- don't necessarily blend
- dominant ≠ more fit

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~~so are mutations dominant or recessive or does it depend? what are the genetics of mutation?~~

☐ print WBs
☐ start Sim 4

dominant mutant - expressed; affects phenotype
recessive mutant - typically only expressed if homozygous
dominant harmful alleles rapidly eliminated quickly
- selected against with only one copy (hetero or homo)

recessive harmful alleles do not affect heterozygotes

and thus aren't voted out (ns acts on phenotype, not genotype)
so they accumulate in heterozygous individuals
- only harmful when homozygous
- here's a reason evolution doesn't lead to perfect organisms
- we're all carrying harmful recessive alleles (heterozygous)

inbreeding depression - reduction of fitness due to mating between closely related organisms (among the same species)
- how related is always a relative term in biology
- most mutations are harmful or have no consequence
- does mutation happen on the allele scale or gene scale? allele
- inbreeding increases the chance rare, recessive, harmful alleles will be passed on homozygously (carriers having children → harmful phenotype)
- deleterious recessive alleles are common but don't affect fitness in outbred populations
- Hapsburg chin
- became fashionable for German shepherds to have short back legs
- why is this included here?
- is this artificial selection or inbreeding or both?

the importance of mutations to populations

- not good on the individual level but valuable ~~for the p~~ from the population perspective because...
the same that are beneficial
new genetic material only from mutations
list of genetic diversity → capability to survive/respond to environmental change. the alternative is extinction "potential to adapt"
genetic + phenotypic variation from mutations
break until 2:20
maladaptive - selected against) (adaptive - get closer on this increases fitness
1. mutation (random, doesn't happen because it's selected for - usually leaves set of offspring better adapted to parents generation than other offspring fig
doesn't matter)

II. natural selection (not random, adaptive)
III. gene flow (not usually adaptive)
- distinction between populations can be hard to determine
- individuals (+ their alleles or gametes) move between populations
IV. genetic drift (not usually adaptive)
V. artificial selection (not usually adaptive)
- usually don't have to survive on their own

common patterns of evolution by natural selection

nonrandom

1) directional (natural) selection
- one extreme phenotype is selected for (does this assume binary traits, either/or?) quantitative phenotypes address this but what about something more qualitative?
- look at graphs in slides
- does it being a bell shaped curve mean there was a long period of stabilizing selection in the past?
- length of GI finch beaks varying with seasons is directional selection
- doesn't necessarily have to go into the same direction for a long period of time. the direction can change and change often
- longhorn: directional selection doesn't tend to go on forever
2) stabilizing selection
- intermediate phenotypes selected for; highest fitness in intermediate phenotype
3) diversifying selection (rare)
- both extremes favored are intermediates
- African black bellied seedcracker
- ~~best of both worlds~~ absolutely not

watch video before class

OH: M 3-4:30
W 10-11:30
Th 2:00-3:30

09/15

scientists to seek evidence that an idea is wrong
theory: a hypothesis that explains a lot and has survived many attempts at being proved wrong
hypotheses must be testable - potentially falsifiable - able to be supported or wrong with evidence
scientific thinking - open-minded perspective based on evidence
science based on inductive reasoning - extrapolating from specific to general; inherently limiting
- this is why stats is so important

q. is there terminology for the different degrees of certainty?
- ie, I know theories are pretty solid, but are there any words between hypothesis and theory?

q. I understand science ~~is not~~ seeks to find evidence supporting that an idea is wrong (critical, not affirmative) and that we use words like consistent and supports rather than proves - what more should I be understanding?

q. are proposed explanations scientific?
ie. we don't talk about the beginnings of life. Can we even talk about them scientifically given lack of empirical evidence?

q. is "social sciences" a misnomer?

modes of evolution

09/18

4) sexual selection - behavior and morphology
- mate choice is an aspect of natural selection - must be suited for survival and for reproduction/mating (when mating is a relevant concept. ie it isn't for bacteria)
- birds not the only weird sexual selection things
African long-tailed widowbird
- no survival fitness with long tail beyond being attractive to mates
- something that survives and doesn't reproduce is not fit
- animal phenomena
usually the females are choosier about mates because usually the female invests more energy + time into the reproduction (post consummation); at the very least, gestating
- "female fitness" more at stake because they have less chance for reproduction (ie males can mate a lot a lot a lot but female goes out of commission for a while)
  - evolutionary selective incentive
- sm: we can't really understand what animals can perceive
- female unconsciously choosing - it's instinct
- # of offspring among individual males is ~~super~~ variable
  her contribution to the next generation; her offspring are her genetic contribution - there is no fitness of an individual if their offspring don't reproduce, must produce fit offspring

exceptions where males raise the young - then males are choosier and when only one or a few males mate
- especially where females are good at getting away from males (only the 'best' males able to get to female to mate)

if the long tail were even too big, a random mutation could arise that would make females not choose them (and be successful because of the if, wouldn't arise b/c of the if)
offspring will have low fitness if females bad at choosing + w