QUIZ: Wednesday, September 20th

mate choice very contributive to evolution
- probably less directional changes with this one since it's based in instinct?
mate choice must lead to high fitness or otherwise the alleles causing mate choice will be deleterious and worked out

gene flow - alleles moving from one population to another
- populations not totally absolutely 100 000 00% separate, some potential for movement
- changes frequency of source and destination populations
- critically important in preventing inbreeding depression in small pops
- greater genetic diversity → greater capacity for evolution
- is genetic diversity ever disadvantageous?
- gene flow is random, doesn't happen on purpose
- genetic diversity from gene flow ~~dont~~ doesn't always persist (new alleles may be deleterious and be worked out)

genetic drift - chance change in allele frequency, not adaptive
random
- potentially important in small populations
- when a few individuals of a species colonize a new area (founder effect) and when they've decreased to a small pop ~~b/c of endangerment~~ (bottleneck) (almost dies off - only a few survive)
- little genetic drift in large populations
- not all times when most of pop dies = founder effect
- has to be random event not related to natural selection
- ~~word of~~
- see examples on slides

creatures continually & constantly subjected to selection pressure
- why doesn't this decrease genetic diversity? ~~????~~

5 reasons why natural selection doesn't eliminate genetic variation

1) diploidy (recessive alleles hidden in heterozygotes)
2) the environment changes so selection pressure changes

3) sometimes heterozygotes better than either homozygote
- one sickle cell allele protects against malaria (+) but two are very harmful (-) - sometimes hetero has diff. phenotype than homo dom - not always dom + recessive
4) not all genetic variation affects individual fitness
5) mutations

evolution does not create perfect organism

NO!

evolutionary trade-offs (can't prioritize both if they are in conflict)
natural selection can only act upon existing genetic variation
- creatures constrained by their past evolution
mutations random, not adaptive
lag between evolution (response) and environment (selective forces)
- extinction b/c they can't evolve as fast as were creating a problem
gene regulation problems (epigenetic processes) interfere w/ fitness
- turn on and off 4) ?

Q don't get it

- download lab documents to smartphone & read before class on Friday
- tell him genie missing - ask him about WD
- go to OH on Monday to ask about how much detail is necessary in quizzes / how can I write more effectively

speciation

→ 09/20 lecture

formation of new species

so far we've been talking about small evolutionary changes
~~between~~ populations of same species undergoing evolution in different selective pressures for long enough (separate environments) may speciate
or one species evolves massively over time until it's a new species
don't get too hung up on definition of species, it's a concept we've made up
gene pools have to stay separate for speciation
- sometimes same species don't recognize their ability to mate

species group of individual organisms that have the potential to interbreed [and produce fertile offspring [under natural circumstances]]
- 2 different species cannot produce fertile offspring (ie mule)
- this definition can't always be used
- separate species are reproductively isolated ~~have different~~ (also relevant to two populations of the same species) gene flow b/ pops means they're not reproductively isolated
- cannot just go by appearance to differentiate b/ species

population was ∝ opportunity to interbreed
# of pops vary among species

another way biologists distinguish species:
1) morphology or 2) genetics (unique DNA sequences)
- universally the same across species and universally different among other species, not necessarily the most obvious, not necessarily every difference (look at slide six)
- sometimes confuses long-isolated populations and actual separate species
- does it even matter? eh not really

origin of new species

allopatric - two populations are physically separated; different environments means different selective conditions meaning differences in evolution
in plants, sometimes reproduction error can create a new species in one generation

allopatric
speciation requires a long period of reproductive isolation
sympatric speciation - two populations become isolated even though they occur in the same area

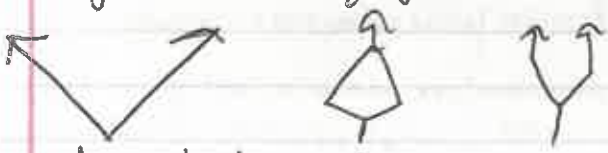
18.2 formation of new species

hybrid - infertile cross between two species
sexually reproducing organisms can only pass on DNA thru gametes
typically not interbreeding w/ species in the wild
- hybrids in nature suggest descent from common ancestor (interbreeding species)
typically homogenous (2) gene pool for geographically continuous species because of free gene flow
allopatric processes < dispersal - a few members of a species move to a new geographic area
vicariance - natural situation physically separates organisms
- the further the distance, the more likely speciation
- probably more difference along latitude than longitude (I think)
adaptive radiation - many adaptations from single part of organism (creates several new species) ↳ founder species
- different orgs of one pop e/ find a niche in a new area
aneuploidy - error occurs during cell div (2n+1 or 2n-1 chromosomes)
- diploid (2n)
- polyploidy (4n), tetraploid (org w/ 4n, can self pollinate)
(allopolyploid gamete from two diff species combine
conjunction species 1 -> normal gamete → first mating → polyploid → self pollinate → second mating
species 2 -> polyploid gamete → polyploid gamete
high rate of polyploidy in plants
temporal isolation - difference in breeding time
behavioral isolation - gametic barrier

18.3 reconnection and speciation rates

hybrid zone - two closely related species continue to interact and reproduce

- speciation reinforcement if hybrids are less fit (how can a hybrid have any fitness if it cannot reproduce)



reinforcement fusion stability

gradual speciation - like a ramp

punctuated equilibrium (doesn't exclude gradualism)
- like a staircase

~~rate of~~ changes in environment determine speciation rate

09/15 Reflection

1) Feynman technique, but I didn't actually explain it to a separate person, just myself.
2) Pretty much, yeah. I imagined I would need to do some specific research or targeted review, but I was satisfied in my ability to explain everything.
3) answered in second sentence of (2)
4) I was confident yes!
5) I was not at all intentional about blocking out time specifically to study.
6) more intentionality in scheduling and listing objectives but I was pretty comfortable with my readiness and maintain that having taken the quiz even without receiving a grade yet. A bad grade would definitely undermine my confidence though.
very little method in my studying for this test

punt flowers + trees workbook

Speciation → 09/25 lecture (Monday)

factors that increase the likelihood of allopatric speciation:
1) diff selective pressures in diff locations (will evolve differently)
- virtually no gene flow between populations (very small amount of gene flow can make two "populations" indistinguishable
2) many different populations, not just two
- this is not rare
- species have certain specific habitat requirements
- just easier to study with island barriers
3) initial allele frequency differences b/ populations
- ex. deer larger at higher latitudes and smaller closer to equator
the two different pops have diff allele frequencies for size (part #1 too)
- founder effect can cause this factor (e) I was right about temp reg :P
- inbreeding depression can apply to individual, not only population; not only relevant at population level, really referring to individual fitness
- I don't know that my quiz answers majorly reflected that, but this specific verbiage is kind of new to me

Hawaiian archipelago
- 1) each islands have very different environments
- 2) islands far enough away from each other for birds to interbreed not likely

archipelagos often sites of adaptive radiation (= from one species to many as a result of ~~different~~ adaptation to different selective pressures, lots of allopatric speciation, many species resulting, & b/ adaptations to new environment)
ie one Asian bird → 54 Hawaiian honeycreepers
- crazy to me how the different Galapagos Islands have such different environments - is understanding how the magnitude of these differences occurs necessary?

- is timeline a qualifier at all for adaptive radiation? Is it just kind of relative what we call adaptive radiation since all life is a product of evolution from a common ancestor?
- 800 cichlid species in Lake Victoria example
- when water levels so low, became isolated populations - adaptive radiation, now all in one lake

sympatric speciation" harder to study and for animals, probably not very important"

- not a physical barrier but don't interact
- harder to know they didn't speciate somewhere else and then end up here (Cryptus hectles)

nondisjunction of chromosomes during meiosis

- don't need to know the nitty gritty of meiosis

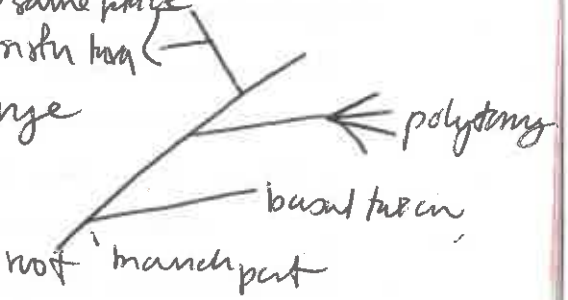
20.1 Organizing Life on Earth

phylogeny = evolutionary history, provide info on shared ancestry

phylogenetic tree, hypothesis of genetic past (can change over time (and do))

- rooted trees do show a common ancestor
- branch point: where a single lineage evolved into a distinct new one
- basal taxa: lineage that evolved early from the root (common ancestor) but remains unbranched
- sister taxa: two lineages stemming from the same place
- polytomy: branch w/ >2 lineages

rotation at branch points does not change the information" use for sim 4



systematics - the field organizing + classifying orgs based on evolutionary relationships

both show of relationship than physical similarity

branch length not related to time unless stated

three domains: Bacteria, Archaea, Eukarya

- then kingdom > phylum > class > order > family > genus > species (also subspecies ;))
- each level specific name for an organisms classification = taxon

20.3 Perspectives on the Phylogenetic Tree

limitations to classic model: genes transferring b/t unrelated species

horizontal gene transfer (HGT)

- occurs in ~~Bacteria~~ Prokaryotes, also some in Eukaryotes
- gene transfer other than parent to offspring (vertical gene transfer)

gene transfer among common bacteria mechanisms:

1) transformation

2) transduction: a virus transfers the genes

3) conjugation: hollow tube (pilus) transfers genes between organisms

gene transfer agents (GTAs) transfer random genome segments between prokaryotic species to another

genome fusion: when symbiotic prokaryotic species become endosymbiotic

HGT has formed web of life model over tree of life, ring of life also in the mix
theme: limitations of models + scientific advances
★ question: how to this at all w/i the scope of an class?
what do I actually need to know for the purposes of this class here?

27.4 Evolutionary History of the Animal Kingdom

Q what specific fossil listing do I actually need to know?
Cambrian explosion - rapid diversification of animals, most rapid evolution of new animal phyla + animal diversity ever
- trilobite from this time
new ecological niches → adaptation of existing species
environment changes → new niches → speciation and diversity
mass extinction sometimes wipes the slate

47.1 Biodiversity Change + Geological Time

speciation and extinction equilibrium = # of species on planet
birth & death rates of macroevolution
# of species on earth change as these change
five mass extinctions (>1/2 all species disappear from fossil record)
- there are lesser extinction events

more than likely, a portion of this will not be on the test