It all comes down to this. Let us reflect on what has been one helluva ride.

Remember the feeling *before* that first bio lecture you were all excited about?! Remember the feeling *after* that first bio lecture you were all confused about?! Remember that first workshop TPS you bombed and thought, wait, is this really worth like 40% of my grade?! Remember the nervousness you felt logging in to your course gradebook after you got the news that exam scores were out?! Most importantly, remember that first moment you stumbled upon my shining glory, my pride and joy, my life's work that is BIALIGY.com?!

All of these, and many other moments, have defined your semester in this always difficult, ever-challenging course. However, I sincerely hope that no matter how good or how bad this final exam is, no matter how good or how bad your final grade is, you've at least enjoyed learning about the unbelievable intricacies that govern our lives. That's why I made the site. That's why I do what I do. I *love* seeing students do well, don't get me wrong, but I *LIVE* for students fostering an appreciation (there it is!) for the study of life. Because what else really even matters?

I wish you all nothing but success on the final, in the course, and in every single thing you do. I hope to teach all of you again in Bio 2, and if not, it's been real

Like the Facebook page here.
Subscribe to the YouTube channel here.

Cannot say it enough, you are truly amazing and i would have been so lost if it wasn't for you. See you next semester for bio 2! :)

Thank you so much!!

I've added a form that you can fill out on the homepage. I'd love to hear your testimonials about the site, so if you have the time, please fill it out! Your testimonial may be featured on the site's Testimonials page!

Bio 115: Final Exam - Review

Day: 12/15/17
Time: 6PM to 9PM
Place: Let's try **Beck Hall** auditorium (if it's occupied, somewhere in Tillett Hall)
Beck Hall. We're there.

- This will NOT be a lecture-style review of content...if you have any questions about content, add them to this doc and I'll answer them in blue.
- Instead, this will be a comprehensive review consisting of PRACTICE PROBLEMS from NEW lecture material (lectures 19-28). Therefore, it is critical that you come ALREADY

prepared with adequate content knowledge that so that you can APPLY thighs knowledge to answering exam-like questions!

The Final Exam is comprehensive and will have 140 questions; at least half will be Upper Level questions; students will be expected to make linkages between all the material. 60 questions will emphasize the material from the *Bio/Learn* through *Darwinian Evolution* lectures. 80 questions will emphasize the material from *Darwinian Evolution* through *Conservation Biology* lectures but will also include questions linking the new material with the older material.

Bio 115: Final Exam - Q&A`

Exam 1 Q&A doc **PLEASE look at this before you ask an E xam 1 related question**
Exam 2 Q&A doc **PLEASE look at this before you ask an Exam 2 related question**

- Ali looked so good yesterday <3. Maybe I should sign up for one-on-one tutoring.
- What do you mean by change in allele frequencies?
    - Imagine two alleles for a gene: "A" and "a" where "A" is dominant to "a" (A>a). The allele frequency is the relative proportions of the "A" allele and the "a" allele in the population. Imagine that all the alleles are in a bag, which we'll call the "gene pool." The chance that you pick out an "A" allele from the bag/gene pool is the allele frequency of "A" (e.g. A = 0.8). The chance that you pick out an "a" from bag/gene pool is the allele frequency of "a" (e.g. a = 0.2). No matter what, you're gonna pick out either an "A" or an "a," so the TOTAL allele frequency of either "A" OR "a" will always be 1.0 (0.8 + 0.2).
- How does D,K,P,C,O,F,G,S work regarding inclusion and exclusion?
    - This image here traces where an Arabian camel falls under all of those taxonomic levels of classification. What happens as you go "down" the taxons/pyramid? The groups become more and more *exclusive* aka more and more organisms are being *excluded* in the next taxonomic level. What happens as you go "up" the taxons/pyramid? The groups become more and more *inclusive* aka more and more [organisms are being *included* in the next taxonomic level.
- Could you explain the difference between gene flow and genetic drift?
    - ^I think genetic drift is more about **small** populations having random changes in allele frequency due to factors such as habitat change or events that cause the population to be drastically reduced, whereas gene flow is simply organisms moving between locations like migration.
    - Gene flow is more of a broad term and can be defined as the transfer of alleles from one population to another, resulting from the movement of fertile individuals or their gametes. Think of it as interbreeding between populations. Genetic drift is a more specific term and can be defined as a process in which chance events cause unpredictable fluctuations in allele frequencies from one generation to the next. The effects are most pronounced in small populations. Genetic drift includes both the founder effect and the bottleneck effect.

- I understand that random mating is something that would be required in order to fulfill HWE, but why is non-random mating a bad thing? For example inbreeding decreases variation in a population, and isn't less variation something that is favorable in HWE?
    - Inbreeding implies that the breeding members of the population are preferentially choosing who they want to mate with by mating with closely related individuals. This would result in differential reproductive success (those who are more closely related breed and have offspring at a greater rate than those who are not related). The moment you have differential reproductive success (which is just another way of saying non- random mating btw), you've violated a stipulation of the HWE. Inbreeding and sexual selection are two examples of non-random mating.
- Are the cumulative parts of the final exam relatively similar in content to the first 2 Is there any chance that your review for the Final could be on a separate day from the professor's review?
    - I'll try, just depends on when I'm free. When are the professors' reviews?
        - The past two have been the friday night before the Sunday exam
- exams? Does the final reuse questions from the past exams or will it cover content from past lectures that weren't covered in past exams?
    - Yes to all of your questions. I've seen all of that.
- Stern Cardinales is at 1pm Thursday the 14th
        - Beal's is Thursday at 1:40 Thursday the 14th
- In your example of cognition and development of learned behaviors you mentioned how Fledgelings have to learn how to sing a song from their parents. So how did the parents originally learn to sing the song? Was that something that just evolved naturally over time?
    - Yes, through incredibly complex evolutionary pathways over a very long period of time.
- Is one of the five conditions for Hardy Weinberg random mating or non random mating?
    - Random mating is a condition for HW. You can also say "NO non-random mating" and it would mean the same thing.
- In regards to George Cuvier's Theory of Catastrophism, he states that each change in the strata was due to a major catastrophe. This is a major, RELIGIOUS, catastrophe, right? I know your example was Noah's flood. But what I'm trying to ask is all the catastrophe's that they believed caused this were from the Bible, correct?
    - Cuvier actually did not make any *explicit* references to biblical events, but the correlation of Noah's flood to his theory is an interesting one that I just wanted to try and use as an example.
- What's the equation to figure out what you need to get on the final to pass this course based on all the grades so far?
    - Idk.
    - http://www.benegg.net/grade_calculator.html if you go to this website and follow the instructions you can find the grade you need on the final to get whatever overall grade you want
- Could you please explain Fixed Alleles as well as Fixed Action Patterns in simple terms?
    - Fixed alleles are discussed here and here. FAPs are discussed here.

- So the textbook states, “Thus, even if a trait is heritable, if all the individuals in a population are genetically identical for that trait, evolution by natural selection cannot occur.” Does this mean that a condition of natural selection is that there must be genetic diversity that among the population for there to be evolution. Also, if natural selection is editing, if there are identical species, could it not delete or add alleles based on the environment.
    - Yes, genetic variation is an absolute prerequisite to natural selection. In regards to your second question, natural selection CANNOT delete/add alleles. This wouldn’t be editing...this would be direct manipulation of the genome. The only way to directly alter the genome is through mutation, a relatively random process. Natural selection is a process that acts on random mutations.
- Anyone know how the curve works? Is it added to your average at the end of the semester or each exam...
    - ^End of semester, and we won't know how big it is till the semester ends
    - ^i meant what is the curve added to
    - ^oh lol I'm pretty sure the curve is added to each exam
    - The curve is added to the average
- Any tips on how to study for the final? It’ll be my first time taking an exam this long and covering so much material, so I’m not exactly sure how to go about it
    - ^You should start studying now if you haven't already. Study for at least an hour a day and plan ahead. If you pace yourself, you should have more than enough time to review every lecture and allow yourself to feel comfortable with the material.
    - ^Agreed. Use your old exams as well. Conduct a thorough error analysis. Try and find the things they did *not* test you on and figure how they might test you on it this time.
- Do you have an idea of when you might have the final review session? Trying to decide when to take off from work...
    - I’m thinking Friday, 12/15 at 5 PM.
    - ^Yeah, that’s right after the Chem Final
    - What time does it end exactly?
        - The chem final’s 12-3PM
        - Maybe I’ll push it to 6 PM then.
    - Where will the review session be today?

- Quick question! You said that relative allele frequency does not change from parents to offspring→ is this in the ideal situation where the population is not evolving (HArdy-W. Equilibrium) or does that apply to all the situations at hand. I feel like im over thinking it.
    - Evolution itself can be defined as a change in allele frequency over time. If is it not changing, then evolution is not happening, then the population is in HW equilibrium. This is why we say that HW equilibrium applies to *non*-evolving populations.
- How are phylogenies determined using shared derived characterisytics if phylogenies are based on evolutionary change of shared characteristics within a common ancestor?
    - In what context or part of the lecture notes did you see this?
- Why is genetic variation needed for evolution?

Genetic variation is needed for evolution *via natural selection*. This is because natural selection can amplify or diminish only those heritable traits that *differ* among the individuals in a population. If every individual amongst the population is identical, there is nothing for natural selection to "select" per se. No members of the population are at any advantage (or disadvantage) compared to any others, and thus, differential reproductive success will never occur. Thus, even if a trait is heritable, if all the individuals in a population are genetically identical for that trait, evolution by natural selection cannot occur.

- Can you clearly define species and population?
    - Protip: Whenever you're looking for a clear definition of any term, I always advise going to the textbook glossary.
    - A species is, "A population or group of populations whose members have the potential to interbreed in nature and produce viable, fertile offspring but do not produce viable, fertile offspring with members of other such groups." Which species concept (from macroevolution) does this definition most align with?
    - A population is, "A group of individuals of the same species that live in the same area and interbreed, producing fertile offspring."
- Why does reproductive isolation need to occur? Who does it occur between?
    - In order for speciation to occur under Mayr's biological species concept, reproductive isolation is absolutely necessary. Because biological species are defined in terms of reproductive compatibility, the formation of a new species hinges on reproductive isolation—the existence of biological factors (barriers) that *impede* members of two species from interbreeding and producing viable, fertile offspring. Such barriers *block* gene flow *between* the species and limit the formation of hybrids (offspring that result from an interspecific mating). Although a single barrier may not prevent all gene flow, a combination of several barriers can effectively isolate a species' gene pool. How are these barriers generally grouped?
- When does speciation occur?
    - See above. The answer to your question also varies depending on your definition of what a species is aka which of the species concepts you are referring to.
- The Bio Final is on Saturday. Is it possible to have the bio review session earlier than the day before the final?
    - The only other day I could do would be a whole week before on Friday, 12/8.
        - I think it's better if we do it on Friday, 12/8 because then we could see what topics we're still unsure/unconfident on and we'll have a good amount of time for that. I say yes for 12/8! You should make a poll or something
        - https://goo.gl/forms/rrOfKQLUc8avyY2g1
        - ^^ At the same time though, we won't have covered the last lecture by 12/8, so it'd be difficult to answer the questions or ask for explanations on the spot
        - ^!!!!
        - That is a very valid point.
- What does this mean "evolution by natural selection cannot occur"?

    - Hmmm, I don't really know what else there is to say about that. It just means evolution via natural selection won't happen lol. What are you specifically confused about?
- Do you have the date of the final exam review yet? Could it be on reading day or the day before so we have time to study everything beforehand?
    - That's what I'm shooting for.
- Why did Darwin go to the Galápagos Islands? Because of the genetic variation which helped helped to see natural selection? Or did he not know of this?
    - Darwin was simply the naturalist aboard the *HMS Beagle*. The story of him just sort of hopping aboard the ship is pretty interesting actually.
    - From Wikipedia: HMS *Beagle* captain FitzRoy had found a need for expert advice on geology during the first voyage, and had resolved that if on a similar expedition, he would "endeavour to carry out a person qualified to examine the land; while the officers, and myself, would attend to hydrography." Command in that era could involve stress and loneliness, as shown by the suicide of Captain Stokes, and FitzRoy's own uncle Viscount Castlereagh had committed suicide under stress of overwork. His attempts to get a friend to accompany him fell through, and he asked his friend and superior, Captain Francis Beaufort, to seek a gentleman naturalist as a self-financing passenger who would give him company during the voyage. A sequence of inquiries led to Charles Darwin, a young gentleman on his way to becoming a rural clergyman, joining the voyage. FitzRoy was influenced by the physiognomy of Lavater, and Darwin recounted in his autobiography that he was nearly "rejected, on account of the shape of my nose! He was an ardent disciple of Lavater, & was convinced that he could judge a man's character by the outline of his features; & he doubted whether anyone with my nose could possess sufficient energy & determination for the voyage."
- In darwin's 2 observations, variation and overproduction, was he looking at only one population (like birds)? Also is variation referring to genetic or phenotypic variation? Or both?
    - Those two observations can be applied to any single population of organisms. Variation is referring to both phenotypic and genotypic variation. Darwin only truly talked about the existence of one of these though...which one?
    - Phenotype! Yep!
- Please fill out this poll about when I should host the final exam review: https://goo.gl/forms/rrOfKQLUc8a
- vyY2g1Could you elaborate more on how polyploidy is a mechanism for sympatric speciation?
    - ^^ http://www.sparknotes.com/biology/evolution/speciation/section2.rhtml this is super helpful in explaining allopatric and sympatric speciation
    - I talk about this here.
- Would studying and reviewing the past two exams be beneficial for the final? Or should we prioritize the last couple lectures more?
    - You need to do both. You're gonna have 65 questions on old material, so you gotta spend at least some time reviewing that. The other 85 questions will be on post-exam 2 stuff. So if you wanna be real analytical about it, 61% of your total

bio study time should be on new stuff and 39% of your total bio study time should be on old stuff!
        - In lecture, Dr. Beal said that there are going to be 30 questions from Exam 1 Lectures, 30 from Exam 2 Lectures, and 80 on everything after Exam 2.
        - That makes sense. I got my numbers from your syllabus.
- If Natural Selection is driven by competition, does natural selection occur in cases of Exponential growth/intrinsic rate of increase where there are abundant amounts of resources and there is no need for organisms to compete for them?
    - Natural selection never turns "off" *per se* because *even* in this case of abundance, there will be some members of the population that are even better than others at *acquiring* those abundant resources, and thus, satisfying the criteria of differential reproductive success. Natural selection really is an omnipresent force in all populations.
- I am having a tough time figuring out how to study such a large amount of material. Any tips or suggestions?
    - ^I've found that rewriting notes from previous lectures helps a lot in retention since when you're in lecture you're mostly just writing stuff down and don't have time to comprehend what you are writing
    - ^Agreed. You have to expose yourself to the material every day. This doesn't mean hardcore studying everyday. It just means getting really really really familiar with the lecture content by doing things like daily rereading and rewriting of lecture notes or even just rewatching the videos. Asking yourself things like "How could I be tested on this?"
- Are Habitat Isolation and allopatric speciation the same thing since they deal with the geographical barriers that make it physically impossible for them to mate? In turn, does that not make both habitat isolation and allopatric spp prezygotic mechanisms of reproductive isolation?
    - Yeah, they both have a lot of similarities and thus, they're both within the same lecture. And yes, both would be prezygotic barriers.
- You think i can get a 100 on this shit hellz yes
- -----hell yeah bruh! We all gonna ace this shiattttt ~love from a fellow student
- What's the difference between branch point and dichotomy? I know that branch point is the divergence of species from a common ancestor and a dichotomy is a two way branch point, so how can I can identify both on a phylogenetic tree?
    - I would consider both of those terms pretty much synonymous. I don't see any way you'd be asked to distinguish between the two.
- Are r and k selected species different form of iteroparity or are they examples of extremes in general?
    - Typically, r-selected species are semelparous and K-selected species are iteroparous. Just remember that both cases are ends of a spectrum and that there are different gradations throughout nature. Where would we, as humans, generally classify as?
    - We are iteroparous because we can reproduce more than once, and it doesn't happen right before we die!
    - Yes!

- What is endosymbiosis (was asked about on the first exam)
    - Endosymbiosis is a relationship between two species in which one organism lives inside the cell or cells another organism. This is related to the endosymbiont theory, which states that mitochondria and plastids, including chloroplasts, originated as prokaryotic cells engulfed by a host cell. The engulfed cell and its host cell then evolved into a single organism as shown here.
- Can you explain the differences between outgroups and in groups? I still don't understand the concepts
    - I talk about them in the beginning of this video here. Overall, an outgroup is a group of organisms that serves as a reference group when determining the evolutionary relationships of the ingroup (the set of organisms under study). The outgroup is used as a point of comparison for the ingroup and specifically allows for the phylogeny to be "rooted" as shown here.
        - So in the picture, the outgroup can also be considered as the basal taxon? Does this only apply for the this tree or for all possible tree examples?
        - Yes, the outgroup is the basal taxon, and this applies to all possible tree examples.
- Can you explain the difference between Cladistics and Phylogenetics?
    - Phylogenetics is a broad term/study and cladistics is just a subset of phylogenetics.
- Hey! SO… I was reviewing old lectures in prep for the final exam and I came across specific and nonspecific when talking about active transport. In my notes I have that exocytosis is specific, endocytosis, phagocytosis, and pinocytosis are non-specific. Also can you explain that facilitated diffusion is carrier meditates, which makes sense it uses proteins to help it transport large molecules to the other side, but is active carrier mediated or not. In my notes I have both written under active transport, I just need some clarifications. Thank You!
    - I would say that the only truly specific form of bulk transport is receptor-mediated endocytosis. It's the only one that requires the specific binding of a specific ligand to a specific membrane receptor in order to occur. The others (exocytosis, pinocytosis, and phagocytosis) are all pretty much nonspecific because they don't have this triggering ligand-receptor event.
    - Even with the help of transport proteins, facilitated diffusion is considered passive transport because the solute is moving *down* its concentration gradient, a process that requires no energy.
    - Active transport is definitely carrier-mediated because it absolutely requires the activity of a membrane protein in order to transport substances *against* their concentration gradient with an investment of ATP.
        - Thanks! That makes sense. Np.
- Can you determine a definite date please for the review?
    - 12/15/17, 6 PM.
- Anyone know anyone who still did well without the best workshop grade? :/
    - I'm sure it's still possible.
- What is the main difference between shared ancestral characters and shared derived characters? I understand that a shared ancestral character is a characteristic that was

present in the ancestors like our thumbs for example but I don't quite understand what a derived character is
    - As a result of descent with modification, organisms have characteristics they *share* with their ancestors, AND they also have characteristics that *differ* from those of their ancestors (novelties). For example, ALL mammals have backbones, BUT a backbone does NOT *distinguish* mammals from other vertebrates because all vertebrates have backbones. The backbone predates the branching of mammals from other vertebrates. Thus, for mammals, the backbone is a shared *ancestral* character, or in other words, a character that originated in an ancestor of the taxon.
    - So what "novelty" can distinguish mammals as their own clade (because a backbone doesn't work)? How about hair/fur! Hair is a character shared by ALL mammals but NOT found in all their ancestors. Thus, in mammals, hair is considered a shared *derived* character, an evolutionary *novelty* unique to the clade. Basically think of something a lot of species in a taxon (K, P, C, O, F, G) have and then think of something that only a more exclusive taxon has. Can you think of a shared ancestral and shared derived characteristic of humans?
    - Would shared ancestral be backbones and shared derived would be skull shape? yaaas
    - Or brains=shared ancestral and big brains=shared derived yaaas
    - Or legs=shared ancestral and walking on two legs=shared derived yaaas
- Without you, i probably would have switched my major, so thanks
    - It's my pleasure. Glad to make such a positive impact!
- I have a quick question… I was reviewing my old lectures. This has to do with wonderful ATP. So I understand that when ATP is hydrolyzed it is an exergonic reaction, catabolic you are breaking the bond to great ADP +Pi. In my notes it states that with coupling you can turn an endergonic reaction into an exogenic reactions because of the energy that is released. Is that what coupling is… Because I was trying to make sense of it again, and I found that if you want to build ATP from ADP +Pi you would be an endergonic reaction because you are applying energy to build ATP again. Is coupling more about where you use it like for ATP for mechanical and transport purposes. I feel as if Im confusing coupling.
    - Yeah, you pretty much have it. Coupling an endergonic (non-favorable) reaction with the exergonic (VERY favorable) ATP hydrolysis (breakdown) reaction makes the OVERALL reaction favorable. This is the whole point of coupling reactions. I explain all of this in a detailed, real-life biological example here.
- I'm a little bit confused between the relationships between taxonomy, phylogeny, and the DKPCOFGS hierarchy. Isn't the hierarchy just a longer version of the genus species naming system, since the two top levels are genus and species?
    - Taxonomy is the the naming and classifying of organisms into discrete taxa. A taxon is a named taxonomic unit (DKPCOFGS) at any given level of classification. Phylogeny is different...it isn't about naming and classifying. Phylogeny is the evolutionary history of a species or group of related species. You have to utilize "tree-thinking" in this discipline because you need to somehow figure how how species are evolutionarily related over time. This involves

analyzing shared ancestral and derived characteristics. I don't really get what you mean by your last question/statement about the hierarchy.

- In our notes, the definition of a clade is "a group which includes ancestral species and all of its descendants." Isn't that technically just a monophyletic grouping then? Why are paraphyletic clades and polyphyletic clades called "clades" if they don't fit the definition of clade?
    - You're right. A clade is group of species that includes an ancestral species and all of its descendants. A clade is equivalent to a monophyletic group. Technically, you're not supposed to say "paraphyletic clade" or "polyphyletic clade" because, as you noted, that would be a contradiction. This is why I list them in my flowchart as "groups" (i.e. paraphyletic and polyphyletic groups).
- What exactly is associative learning? I don't think we have a definition in the notes. Are classical conditioning and operant conditioning types of associative learning?
    - Associative learning is defined as the acquired ability to associate one environmental feature (such as a color) with another (such as danger). You are learning to make a clear *association* between two things. Both classical conditioning and operant conditioning are two different examples of associative learning. I talk about all of this here.
- How is a sensitive period related to cognition?
    - I think the only way these two terms are related is that they fall under the general topic of learning. A sensitive period is a limited phase in an animal's development when learning of particular behaviors can take place (imprinting). Cognition is the process of knowing that involves awareness, reasoning, recollection, and judgment. It is a type of higher-order thinking that can lead to complex behaviors like problem solving.
- Does sexual dimorphism only apply to polygamy and not to monogamy?
    - Typically, sexual dimorphism is seen mainly in polygamous species.
- Can you please explain inclusive fitness and kin selection? I don't really understand how they are related to everything else in the lecture.
    - I talk about all of this here.
- What is the difference between these two equations: delta N/delta t = B-D and r = b-m ? Don't they both show the population growth rate?
    - The first equation just leads to the second. It's a part of its derivation.
- Is this the correct equation for the logistic growth model: dN/dt=rinstN(k-N)/k ? I feel like I might have copied it down wrong.
    - Yeah, looks good.
- What is the actual definition of life history? I know that it includes things like age at first reproduction and how often they reproduce, but I don't think I actually understand what the term 'life history' means.
    - The traits that affect an organism's schedule of reproduction and survival make up its life history. Life history traits of an organism are evolutionary outcomes reflected in its development, physiology, and behavior.
- What is the difference between net secondary production and assimilation and production efficiency? Don't they both contribute to biomass (everything excluding energy to perform respiration)? Also, can you give an example on how they differ, if they do

    - Production efficiency = (net secondary production/assimilation of primary production) x 100%
    - We can measure the efficiency of animals as energy transformers using the above equation. Net secondary production is the energy stored in biomass represented by growth and reproduction. Assimilation consists of the total energy taken in, not including losses in feces, used for growth, reproduction, and respiration. Production efficiency, therefore, is the percentage of energy stored in assimilated food that is not used for respiration. I go over an example of this here.
- Why is it that DNA accounts for all diversity of life? I answered proteins because the DNA is just going to be turned into RNA and then proteins, also if there's a mutation that counts as diversity it affects a protein?
    - Because DNA is the blueprint of life. All proteins are based off of it. A change to the DNA leads is what can lead to a change in the protein. The ultimate cause of all variation and thus, all diversity, is DNA.
- Why are we doing the cross with a heterozygous individual instead of a homozygous individual?
    - Because the question said "*dihybrid* testcross." This means you must mate one individual who is homozygous recessive at the two loci (every testcross requires mating with a homozygous recessive) with one individual who is a *dihybrid* at the two loci (heterozygous at both).
- Is there a really good picture of all the parts of taxonomy, i cant find one that helps me understand
    - Try your textbook, it usually has the best figures that encapsulate a lot of material.
- In regards to phenotypic variation, you said the one type is "either-or differences" and you used hair color and eye color as examples. Why is that not a gradation along a continuum? Because it's not necessarily that you have brunette or blonde hair- you could have a dirty blonde color which would be in between the two?
    - In all honesty, an argument that could be made that nearly all phenotypic variation lays on a spectrum. I used eye color and hair color because those are familiar and obvious examples (for the most part). You can easily imagine two very contrasting variants like blue or brown eyes or blonde or black hair.
- Phenotypic variation is due to genetic variation, right?
    - For the most part, yes. But sometimes, like in the case of this caterpillar, it is not! In a human example, bodybuilders alter their phenotypes dramatically but do not pass their huge muscles on to the next generation. In general, only the genetically determined part of phenotypic variation can have evolutionary consequences. As such, genetic variation provides the raw material for evolutionary change: Without genetic variation, evolution cannot occur.
- How is competition a negative negative relationship?
    - If there was no competition, both species in question would have an easier time attaining resources. The presence of competition makes it difficult (or not as ideal as it could be in a perfect world) for both.
- To you, which is harder: chemistry or biology?
    - Chem.
- What is primary and secondary succession?

    - Take a look at this here and here.
- What exactly is biomass?
    - The amount of living matter in a given area. This can also be classified as the amount of available food to a potential consumer.
- I dont understand secondary production. What does it mean by amount of energy in consumer's food that is converted to their own new biomass?
    - GPP: The amount of energy from light converted to chemical energy of organic molecules
    - NPP: Equal to GPP minus the energy used by primary producers (autotrophs) for their autotrophic respiration (R_a)
    - NPP = GPP - Ra...on average NPP is about 1/2 GPP.
    - Now that all that's clear, let's tackle the question. Always consider GPP as an exclusive, intrinsic value related to JUST the autotroph. Its value is only meaningful to the autotroph itself. Instead of using that value when establishing trophic structures, use NPP instead because this is the actual amount of energy available to consumers, NOT GPP. In other words, GPP is NOT the amount of energy available to consumers because it doesn't take into account all the energy that the plant uses on itself to live its own life. When a consumer is consuming an autotroph, it will essentially gain the NPP of the autotroph, but this gain of energy is not 100% efficient. It doesn't get to "keep" or "store" ALL the NPP. You have to remember that the consumer also has to invest energy in its own biological processes and thus, of the NPP, aka energy, it gains by eating the autotroph, only ~10% is "kept" or "stored" as something called "biomass." This phenomenon is known as secondary production...the amount of chemical energy in consumers' food that is converted to their own biomass and thus, available as energy for the next consumer. So the other percent is used for waste and other things? Not "used," but more so "lost" as waste or assimilated for respiration.
- Can you explain Gel Electrophoresis? I'm confused between the agarose and agarose gels
    - Just watch this video here.
- Can you further explain Genomic Imprinting?
    - Genomic imprinting is the epigenetic phenomenon by which certain genes are expressed in a parent-of-origin-specific manner. If the allele inherited from the father is imprinted, it is thereby silenced, and only the allele from the mother is expressed. If the allele from the mother is imprinted, then only the allele from the father is expressed. In other words, the expression of an allele in the offspring depends on whether the allele is inherited from the male or female parent. If you want the expression of an allele, you do not methylate (imprint) the DNA of that allele. If you don't want the expression, you can make a genomic imprint, or in other words, methylate the DNA of that allele. I talk about this here and it's shown in this figure here.
- Based your prior knowledge, we're the questions on the final - regarding Exam 1 and Exam 2 - very similar to the midterms?
    - It has honestly varied from year to year.
- I'm confused how births and deaths are not affected by abiotic factors (density independent factors) are not affected? For example, if there was a volcano or a wild fire,

wouldn't that affect the amount of individuals left in the pop to have babies and would kill a lot of the pop? I know that density independent doesn't care about the number of individuals in the pop as well. Also, is r selection still a biotic factor? Small orgs/same attributes as semelparous?
    - I think you might have the wrong impression of what is meant by "density independent." Similar to the case of r-selection, a birth rate or death rate that does not change with population density is said to be density independent. In other words, this any limiting factor that affects ALL population sizes in similar ways, regardless of population size. The same *proportion* of individuals are affected at any density. In contrast, a death rate that increases with population density or a birth rate that falls with rising density is said to be density dependent, a situation similar to K-selection. I don't really get what you mean by the second part of your question, so try rewording it.
- Sympatric speciation uses disruptive selection… but shouldn't it be directional since it says homozygous individuals have greater fitness (so it's favoring one)?
    - Was this connection between disruptive/directional selection and speciation from your lecture notes?
    - It was just in my notes that sympatric speciation uses disruptive selection which doesn't make sense to me…
- What's the difference between promiscuous and monogamous mating systems?
    - In some animal species, mating is promiscuous, with no strong pair-bonds (multiple males mating with multiple females). In others, mates form a relationship of some duration that is monogamous (ONE male mating with ONE female) or polygamous (an individual of ONE sex mating with *several* of the other). Polygamous relationships involve polygyny, a single male and many females, or polyandry, a single female and multiple males.
- Doesn't nonrandom mating change the allele frequencies? If yes, how do it make sense that inbreeding, which is an example of nonrandom mating, does not change af?
    - You don't need to know why because it's beyond the scope of this course. If you really wanna know why allele frequencies stay the same even during inbreeding, take a look at pages 1 and 2 here. Again, you do NOT need to know ANY of that. Just know that inbreeding doesn't change AF, it changes GF by increasing the amount of homozygotes (aka decreases "heterozygosity"), and ultimately, is an example of non-random mating between closely related individuals.
- Does the HWE favor more or less variation? Because it requires no natural selection and no nonrandom mating, but natural selection is more variation while nonrandom mating decreases variation.
    - The HWE is a set of stipulations adhered to by NON-evolving populations. By definition, non-evolving population never have any *changes* in variation (i.e. changes in allele frequency). You don't want to look at the HWE as something that "favors" more or less variation...all it cares about is that whatever variation that is already within the population to begin with does NOT *change* aka the allele frequency does NOT change aka evolution does NOT happen.
- If HWE describes what happens in non-evolving populations and no gene flow is required for it, how does evolution occurs when there is no gene flow?

    - Evolution won't occur without adequate gene flow. The HWE requires an isolated population in which there's no emigration or immigration aka no gene flow.
- Is working memory the same as long term memory? Or is it a separate thing?
    - Working memory = short-term memory
- Primary producers get 1% energy from the sun and ½ is used for respiration and the other ½ is stored in the tissue… so 10% of *that* is passed on to the other trophic levels?
    - Yes. In other words, 10% of NPP is transferred to the biomass of the primary consumer.
- Why did you explain the nitrogen cycle only and not the other 3?
    - That's the one that's been most often emphasized in the past...not sure if that's still the case.
- My problem is that I don't know how deep I need to understand something. I asked my professor and he said use the bios forms, but that didn't help me realize how much I have to know about a specific outcome/topic. Any tips?
    - My strategy as a student was if I could reteach the entire lecture (out loud) to my friends, with little to no referencing of my lecture notes, I knew the material at the level of detail required for the exam.
    - What if you have no friends?
    - I talk to myself sometimes :(^^
- What is the difference between production efficiency and trophic efficiency?
    - Both of these terms relate to secondary production. Secondary production is the amount of chemical energy in a consumers' food that is converted to their new biomass during a given time. Production efficiency is the percentage of energy that is not used for respiration, but stored in assimilated food. Trophic efficiency is the percentage of energy transferred from one trophic level to the next. These all are effects of second production.
- Can you give an example of instantaneous growth. I'm just not sure what we'd plug in for dN and dT like i dont think im getting what "derivative N" and "derivative T" means
    - Isn't it just "change in N" and "change in T"?
    - You wouldn't need to know anything related to derivatives for the exam. Take a look at this figure here.
- What lecture do we first introduce Kin selection and what is it?
    - Animal behavior. I talk about it here.
- Are the population growth model math questions involving Delta n/Delta t commonly asked question on the final?
    - I think it would ask more about the concept than actually using the equation since that's what we talked most about (but I could be wrong.)
        - Makes sense…the math part really trips me up
    - I would definitely know what the equation is used for and what each of the variables mean. With this in mind, it's good practice to manipulate the variables (put a 0 somewhere, increase something, decrease something) and compare the results of your manipulations.
- What is primary and secondary succession?
    - Previously answered.
- There is so much to remember damn -> rt

    - True.
- Can you compare/contrast photosynthesis and cellular respiration?
    - I cannot possibly encapsulate all of this here. It's been discussed in the Exam 1 doc and there are a ton of videos out there that do this. I encourage you to try this exercise and your own.
- Where are you having the Final Review?
    - See top of doc.
- I'm scared for the final :(
    - Me too im so fucking shook
    - CONFIDENCE PLZ.
- __gene for a repressor protein/ ___ negative genetic control element/ ___ positive genetic control element/ ____ protein that can turn genes on or off. (Please fill the blanks for me. Thanks!)
    - Idk the first one, but for the rest I think it goes: (glucose, lactose, operator)
    - If by "gene" they mean the thing that causes it to not work anymore, or rather, the "inducer", then I think it would be allolactose
    - I don't really understand the first one either, but the answers above look good.
- Review: 6 pm till when? And where?
    - See top of doc. N
- Where can I get practice questions from? Anyib that are similar to the exam questions? IM SO SCARED
    - Check out the study tips section of the website.
- Why is there no crossing over in complete linkage
    - I think that there is crossing over, but the thing is that the genes are really close together on the chromosome, so even when crossing over occurs, the genes wouldn't separate from each other. If crossing over didn't occur, I think it would be a disorder.
    - Answered in Exam 2 doc linked at the top.
- What should we expect as far as higher-level questions go on the most recent material? From Darwinian Evolution on it seems pretty straightforward since it's a lot of vocab.
    - Just look up practice questions for the associated chapters from the textbook and that should give you a good sense of what to expect.
- How in depth should we review photosynthesis and cellular respiration? Like should we look into the specifics of the calvin cycle and photosystems and should we remember how much ATP is made during each part of respiration?
    - Based on the first exam, I think we would mainly know the inputs, outputs, location of each step, and purpose of each step.
    - Agreed^^^
- IM FREAKING OUT AHHHHHHHHHHH
    - ^ME TOO AHHHHH
    - IT'S GONNA BE OKAY.
- In glycolysis, dehydrogenation turns NAD+ to NADH (REDUCTION) but in pyruvate oxidation, pyruvate dehydrogenase removes a carboxyl (OXIDATION) … Why does the same word have opposite meanings?

    - Dehydrogenation in glycolysis removes an H from something (you don't need to know what) in order to pluck it onto NAD^+ forming NADH (reduction). Dehydrogenation in pyruvate oxidation also removes an H from something (and a CO_2) in order to pluck it onto NAD^+ forming NADH (reduction).
- Is Gross Primary Production (GPP) and Net Primary Production specific to producers? So an photoautotroph can turn light into photosynthetic energy (GPP) and the NPP is the remaining energy stored after cellular respiration and other metabolic functions that may reduce the energy? And so what is transferred the the following level is the energy stored which is only the NPP? This is my understanding of it, if this relates to other trophic levels or if you can explain it more clearly id appreciate it
    - Yes, this looks good! I walked through all of this in greater detail in a previous question on this doc for just look for that.
- During the nitrogen cycle:
    - How do (during assimilation) plants absorb NH3 and NH4+ if its converted to NO3- during nitrification? Does not all of it get converted, if so, why and what determines what does and does not?
    - During ammonification, what form is N in when it is converted back to NH3 and why is it "sent" to the assimilation and nitrification steps if it is backwards in the cycle? To elaborate, is the nitrogen cycle a strictly linear cycle (as in step 1 precedes step 2, step 2 precedes step 3, step 3 precedes step 4…) or can ammonification happen at any stage and is not strictly within this cycle like the other steps are? I just don't see how ammonification fits in a certain place between assimilation and denitrification because assimilation seems to be the usage of the nitrogen within the ecosystem and ammonification is just clearing the waste. Or is it that the animals assimilate THEN produce the waste and thats why its in that order? I apologize if this is alot I'm kind of considering it on my own as I type
    -
- My question here is that in production efficiency you considered to state that cellular respiration is a type of assimilation right, but in my notes the definition that I have states that Production efficiency is the fraction of energy stored in food that is not used for respiration. Can you please example this because I like how you did your example, but I am very confused. So in the textbook they have the picture and it states that the growth and assimilation and cell respiration is combined and why is that→ is it because in order for there to be growth, there must be cellular respiration that occurs, so that there is metabolic activity. So assimilation is all that is taken in and even accounting for cell resp. The textbook states: **Production efficiency**, therefore, is the percentage of energy stored in assimilated food that is *not* used for respiration. For the caterpillar in Figure 55.10, production efficiency is 33%; 67 J of the 100 J of assimilated energy is used for respiration. (The 100 J of energy lost as undigested material in feces does not count toward assimilation.)... I am really confused. So can you say that production efficiency is all the energy that is consumed in the food that is assimilated into a consumer's body (so assimilated part of the biomass, including growth and cell respiration), that is not released (respirated)
    -

- Do you have any old finals or mock finals you can post?
    - Nah.
- Is gene flow just the mixing of different populations or is it also the mixing of different A, C, T, G)?species?
    - The answer to your question depends on your definition of "species." Generally, gene flow is the transfer of alleles from one population to another, resulting from the movement of fertile individuals or their gametes.
- Regarding competitive exclusion how are they both affected negatively, because from what i understand either one dominates and causes the other species to go extinct, or they both coexist if they have different niches and don't overlap (or is it only negative for both in the second scenario because they would have less resources)?
    - The competitive exclusion principle states that two species competing for the same limiting resource cannot coexist at constant population values. When one species has even the slightest advantage over another, the one with the advantage will dominate in the long term. This leads either to the extinction of this competitor or to an evolutionary or behavioral shift toward a different ecological niche. The reason there's (initially) a negative outcome for both is that the competition itself prevents each species from reaching their fundamental niche. It is only when the conflict is settled, does each species fit into their respective realized niches.
- For those who cannot attend the review, would you be able to post the practice exam questions? It would be really helpful!
- Is the structure of DNA the same in both prokaryotes and eukaryotes (that is, both have
    - Yes. But the location and chromosomal structure in which the DNA is found is VERY different. How so?
    - Isn't it because prokaryotic cells lack organelles, so the DNA isn't found in the nucleus, but rather in the cytoplasm? And the DNA is in the shape of a circle instead of a helix?
    - What can you determine through a phylogenetic tree? Are you able to tell the shared ancestral and shared derived characteristics? What does it mean by phylogenies do not show phenotypes?
    - So, a phylogenetic tree just shows the common ancestry between species (homology), but it won't really show you their shared characteristics. That would be analogies, I think. So like, in this, it's showing you that the first two birds on the top share a common ancestor, but it's not really showing you what the birds have in common in terms of phenotype. I think that's what they mean by "phylogenies do not show phenotypes." The tree's purpose (I think) is to show the evolution of the species over time.
    - ^Very nicely said! A phylogenetic tree's purpose is to visually represent evolutionary relationships amongst species over time. It doesn't necessarily tell you any details regarding the physical characteristics (phenotypes) of the species, but rather, depicts evolutionary relatedness (or lack thereof) over time based on general criteria like homologies.
- Are there different types of operons? I know that the lac operon is made by prokaryotes in order to transcribe enzymes for lactose, but what about for glucose? Is there an operon

for that as well? Or is it just used in respiration? And if there is only a lac operon, then would that mean that prokaryotic cells only intake lactose or glucose?
    - There are many other operons (*trp* operon is the second most famous example), but you only need to know what was mentioned in lecture. For glucose, the prokaryotic cell will just use cellular respiration to break it down.
- What are we expected to do with the equations for instantaneous population growth, etc?
    - Previously answered.
- I am still confused on what character displacement is. Can you give me an example?
    - I'm confused too
    - Character displacement occurs when similar species that live in the same geographical region and occupy similar niches differentiate in order to minimize niche overlap and avoid competitive exclusion. Several species of Galapagos finches display character displacement. Each closely-related species differs in beak size and beak depth, allowing them to coexist in the same region since each species eats a different type of seed: the seed best fit for its unique beak. The finches with the deeper, stronger beaks consume large, tough seeds, while the finches with smaller beaks consume the smaller, softer seeds.
- I have a question about the Calvin Cycle: I understand that you need 6 carbon dioxide molecules in total to form 2 G3P molecules and ultimately 1 glucose molecule. I thought 3 carbon dioxide molecules entered at once per cycle but in my notes it says 3 turns of the cycle are needed for 1 G3P and 6 turns of the cycle are needed for 2 G3P. Can you please clarify how many cycles are needed to form one molecule of glucose and how many carbons enter per cycle?
    - To create 1 G3P requires 3 carbons (3 CO_2), and therefore 3 turns of the Calvin cycle. To make one glucose molecule (which can be created from 2 G3P molecules) would require 6 turns of the Calvin cycle. Take a look at this figure here.
- How many of the questions will be from Exam 1 and 2, and how many questions will be the new topics we learned after exam 2?
    - According to Dr. Beal, there are 30 questions from Exam 1, 30 questions from Exam 2, and 80 questions on everything after Exam 2
- What is the order of bonds from strongest to weakest… covalent, ionic then hydrogen correct?
    - Van der Waals is before hydrogen
    - Looks good.
- I always get those questions wrong that ask: which are polysaccharides, mono, lipids, carbs, etc…. like it's so annoying, how are we supposed to know everything under each category
    - There are key molecular structure giveaways for all of them.
- What factors are responsible for decreasing/ increasing allele frequency?
    - Evolution lol. Either via natural selection or genetic drift.
- Ali, your passion for Biology honestly inspired me a lot this semester. In high school, I wasn't a big fan of it and now, I'm seriously sooooo interested in it. I can honestly say that I love it. So thank you!!! :)
    - These are the kinds of things I live for!!! It's my pleasure.

- I love you
    - <3333
- I wanna cryyyy, just wanna be on vacation
    - FOCUS. KEEP PUSHING.
- Do you know how effective the curve is?
    - Varies on an individual-to-individual basis.
- I am having trouble figuring out Hardy Weinberg. Can we go over how to solve them in review tomorrow? I am not a numbers person :(
    - Yes, I'll have a couple HW problems.
        - Thanks!
- Would you be able to explain as to why in our notes it says that are K-selected species are close to K? If their broods arent large why would they be close to their carrying capacity?
    - K-selected populations will reach carrying capacity just as a product of being a population that is successful. In other words, even though they won't have a lot of offspring in one shot, they'll consistently have offspring (think every mating season), which will cumulatively add up until reaching the carrying capacity, after which the population will fluctuate around K (much like we, as the human species, are doing right now!).
- are you actually married??
    - Lol no.
- How much of respiration cycle do i need to know?? Im honestly having trouble memorizing this again…
    - I think someone also said something similar to this before maybe, but I recommend knowing the inputs, outputs, and locations of each step
    - ^Agreed.
- I cant do this anymore ahhhhhhhhhh!
    - YOU'RE ALMOST THERE.

- Wheres the review sesh at bae i need u in my life
    - Thirst.
        - Lmaoaoaooa this is so funny
- What does having low adult mortality rates & high adult mortality rates mean?
    - Low adult mortality rates means that there's a low rate of adult deaths, high adult mortality rates means that there's a high rate of adult deaths
    - ^Agreed.
- Are plants both semelparous & iteroparous?
    - I think it varies, depending on the plant.
    - ^Agreed.
- Explain: if a substance goes in a non-polar solvent (benzene), why doesn't it dissolve? The answer is bc it forms hydrogen bonds with polar solvents (but how did it just do that?)
    - Isnt it because in order for a substance to not dissolve with another substance that is non-polar or hydrophobic, it has to be polar like water, therefore having hydrogen bonds

    - Oh thanks/ and if its opposite? In a polar solvent… will the substance have to be nonpolar in order to not dissolve?
    - Yeah, just remember that "like dissolves like" (polar dissolves polar, non-polar dissolves non-polar)
    - ^Good rule to remember!
- Can you summarize the key differences btw poly/monosacharides, macromolecultes, lipids, polymers, polypeptides, carbs, proteins, etc.?
    - There are a lot. (They're all macromolecules, all of them are polymers except lipids) They're used for different things, they're made up of different things, their structures are really different, etc.
    - Yeah, that's pretty much the whole lecture. I think it's really important to know the monomers that make up the polymers, the smaller units of a lipid, the bonds between all of them, significant functional groups, hydrophobic or hydrophilic, etc.
- Where will the review session be held?
    - ^^^
    - I'm heading to livi now, will check if Beck Hall auditorium is empty for the time being. Otherwise, it'll be in one of the Tillett Hall rooms.
- Is protein a polymer?
    - Yes, they are polymers made of amino acids
    - ^Yep.
- Anabolic is not spontaneous right?
    - Yeah, an anabolic reaction needs energy to move forward since it's endergonic
    - Yep.
- During glycolysis, glucose is oxidized right?
    - Yeah
    - Yep. Anything reduced?
- Can exergonic reactions occur without an enzyme/catalyst?
    - All reactions can occur without an enzyme or catalyst. An enzyme/catalyst just speeds up the reaction. For exergonic reactions, it can occur without putting in any energy
    - ^Nicely said!
- Are all catabolic reactions exergonic?
    - Yeah
    - Yep.
- I can't make it to the review because of work but can you post some practice questions for the final exam?
    - Unfortunately I cannot :(
- HEY can you please go to the podium and try logging in and turning on the computer. Is it locked? We can't do beck if that is the case You can log in if you use your netID
    - So it's not locked, the screen is visible and you can use the comp?
    - Yea
- Can someone be a kind soul and email me the questions??? I'm a commuter and the roads are terrible! I know Ali can't for legal reasons but if someone could it would be so awesome… plz let me know and help a girl out

    - ^^^sameeeee please someone!
    - ^^^^ lol yes pleaseeeee
    - ^^^^^SAMEE
    - ^^^^^^ahh same i'm a commuter too couldn't make the review session bc of the snow :(
    - Sameeee
    - **If you guys are still up, I gotchu. I need numbers/emails though.**
        - If you put the pics on Google docs you could give a sharable url??
            - Yeah but problem is idk if im allowed to do that. I mean I might as well paste them into the document at that point. Which he said not to do. Ill share it with you though, put the email below.
            - shivikab99@gmail.com, thx sm!
            - Me too please ! ak1526@scarletmail.rutgers.edu THNX
            - Im uploading them - give me a few minutes.
            - sk1935@scarletmail.rutgers.edu Thank you!
        - Sent.

- Give me motivation pls.
    - YOU GOT THIS
    - If this don't motivate the hell outta you, don't @ me.
- Welp, after reviewing all the material through the Bialigy videos, doing a Que Bank of sorts, and then retrying the 2nd exam, since that is the only one I have, I can safely say….I'm gonna fail the exam :(
    - ^THIS IS ME
    - This mindset really bothers me!!!
        - ME TOO ALI, ME TOO
- Does anyone else feel like they are really good on stuff from exam one and two and thats only 60 questions???
    - Everyone probably feels that way
- Ali, this is off topic loll but when did you graduate from Rutgers??
    - Quite recently hehe ;)
- Rishta me
    - Already engaged to this beautiful lady right here.
    - RISHTA ME TOO ALI<< i already claimed, too late
    - I hate you i'm never going to your review sessions bye.
    - ^^^^^
- Can someone answer this for me?: (its #26 on the 2nd exam)... a test cross is investigating 2 genes has produced 10 offspring. 7 of the 10 offspring have the parental genotype while the rest of the offspring have a recombinant genotype. Based on the results, the two genes are… (answer was LINKED) but why? Dont like genes only produced offspring who are 100% like the parental and no recombinants?
    - Was it just "linked" or did it say "completely linked" or "incompletely linked"?
    - Just "linked"

    - Alright, so from my understanding, you have complete linkage when there is absolutely NO RECOMBINATION. Not even a 3/10 chance of it. With incomplete linkage, however, you see a little bit of recombination, but not too much of it (so maybe 3/10 will be recombined, but the majority is linked), then you know you have an incomplete linkage. If you were to have unlinked genes, then there would be equal probabilities of recombination and no recombination. Given the scenario above, it would be considered an **incomplete linkage**
    - This makes total sense, I honestly wasnt even considering incomplete and complete linkage, only completely linked and unlinked for some reason and I also forgot incompletely linked is still considered linked. Thank you!
    - No problem!
    - Dope stuff here! All looks good.
- What replaces the sequence made from the RNA primer in the lagging strand? Does DNA polymerase do this? (connect okazaki fragments)
    - The thing that connects the okazaki fragments would be ligase, and the thing that replaces the primer with legit DNA is DNA Polymerase I
    - Okay cool thats what I thought, sorry the question consists of 2 separate ideas haha thanks!
    - No problem!
    - Looks good.
- Is genotype and allele frequencies the same thing?
    - Alright so, allele frequency is constant. It is the proportion of the population possessing a particular allele. Let's say there's alleles A and a. Let's say the allele frequency in a population (hypothetically speaking) is 0.3 for a. With this equation "p+q=1", we know that the allele frequency for A is 0.7. Now, if you wanted to talk about the probabilities of individuals in a population having a particular *genotype*, then you would be using "p^2+2pq+q^2", which is (in that order) "homozygous dominant", "heterozygous", and "homozygous recessive." Here, you see the probabilities of a particular population producing certain offspring (that is, homozygous dominant, homozygous recessive, or heterozygous). So they're not really the same, but they're also linked very closely.
    - ^Good job here!
- Can you please explain the difference between the two approaches to population conservation (small population approach vs declining population approach)? Here's what it seems like so far: the small population approach emphasizes smallness itself as the cause of extinction whereas the declining pop approach emphasizes environmental factors that cause decline and seems more proactive. Is that right?
    - Yep, that's right. I discuss each approach here and here.
- All nighter anyone?
    - I do NOT suggest this lol!!!!
- So independent assortment is with unlinked right? What does its genotype look like?
    - Yes, if the genes are following Mendelian patterns of inheritance (aka his laws), they must be completely unlinked. I don't really get what you mean by "genotype." there was a problem that gave the phenotypes of lizards with a

number next to each and we had to say how they were linked (answer was incompletely) but like, how do we know based on the numbers..
    - If it's completely linked, then you'll see 100% chance of no recombination, if it's incompletely linked, you'll see a lot of variation. If it's unlinked, then you'll see equal chances for all of them to occur (therefore there would be no sign of linkage)
    - Ohh makes sense
- Did you get 100s on bio finals? You're a genius
    - Let's just say I did/do as well I did/do because I work/worked REALLY hard, NOT because I'm a genius! Thx tho. <3 inspiration
- To what extent should we know about eukaryotic gene regulation?
    - I think we need to understand the lac operon mainly, and from there everything else kind of makes more sense. (i.e that it's being used to transcribe enzymes to digest lactose, hence the term *lac* , and therefore if there's no lactose, then there's no reason for it to function or "turn on" since there's nothing for those enzymes to digest, the function of each component in it, that positive regulation refers to the presence of lactose, etc.)
- Is there any diagram/animation I can look at for Positive and Negative Regulation?
    - This is useful, as well as this (In the first one, it is negative regulation because either there's no lactose (first one) or there's lactose, but cAMP isn't present as much as the organism would prefer, making it so that very little of the enzyme is being transcribed. The second one is positive regulation because lactose is present, but depending on the amount of glucose present, the cAMP levels fluctuate (the more glucose, the less cAMP, the less enzyme being transcribed. The less glucose, the more cAMP, the more enzyme being transcribed))
- Anyone have useful diagrams of photosynthesis/ cellular respiration including inputs/outputs and where the steps are located?
    - Yes!! I need this too!! It would be so helpful

-
    - lmaoaoa bye Ali, I can't with you
    - Hahahaha.
- Wait … how did you get 4% for that owl problem?
    - 200/5000.
- This is dumb but .. if a diploid is 2n=20, haploid of that is what?
    - n=10!
    - Yep.
- Does the ploidy get halved during meiosis I or II? I think it is meiosis 1 because in meiosis1 it is going from diploid to haploid
    - Meiosis 1. Meiosis 2 is just a replication and ploidy does not change.
    - Yep.
- For "which of the following choices includes all of the others in creating global terrestrial climates?" Why is the answer differential heating on Earth's Surface and not Earth's rotation on its axis? Wouldn't rotation on axis cause the differential heating?
    - Earth's rotation on its axis causes night/day. The seasons are caused by Earth's *tilt* on its axis, which ultimately leads to differential heating, and thus, terrestrial climates.
- Why would one species with a diploid number of 16 and another with a diploid number of 12 create an organism with a diploid number of 28?
    - That's how allopolyploidy works. Nothing more to it.
- Can anyone explain the answer to this question on the first exam? "You analyze n unknown substance taken from the saliva of an elephant. You determine this substance is

a polymer comprised of several similar, but not identical monomers. Several types of bonds hold the structure together in its functional form. What type of monomer and polymer are present in the saliva"? The answer was amino acid and protein.
    - Well think, what is the monomers of protein?... amino acids right. So it is a polymer comprised of several similar, but not identical monomers. This means that the amino acids are slightly different..which you need to code for a protein. If they were all the same then the protein would not be made.
    - Thanks!
- You are literally so helpful and inspirational! Thank you so much Ali!
- For food webs, the energy that is passed on from each level is 10%. Does this mean that 90% of the E obtained and lost (heat and used up by the organism is from the **10%** given from the one before that organism, etc.?
- Biomass increases as you go up the scale right?
    - Yeah I think so
    - Doesnt it decrease since theres less energy available as you go for the mass to be supported
    - But doesn't it accumulate over time?
    - Yea i read your question wrong nvm
    - I thought biomass didnt increase/decrease at all. Only the energy taken from it, or am I wrong?
- HAHAHAH IM SO SCARED LMAO
- I fucking rocked that final, literally flew past the last 80 questions with a few missteps. Thanks Ali, couldn't have done it without your videos.
- I kinda breezed through the first section and coming out of the exam i felt pretty confident but as of now i got 15 wrong atleast :(I tried so hard. im at a 83 rn bc i bombed the last tps. (I would have been at an 86). Crying bc i cant rely on the curve
- question : can you please explain prezygotic and postzygotic??
    - Pre-zygotic is before the zygote can form, post zygotic is after the zygote has formed and has been born
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