Biology 180 Exam 1 Student full name: Skyler Hallinan

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1. A UW Farm researcher thinks that squash plants release more pollen, resulting in more squash fruits produced, if you expose them to a tuning fork that vibrates at the same frequency as a bee's wings, in addition to letting pollination occur by wind or other types of insects. *(22pts)* 21

a. What is the hypothesis? 2

Squash plants release more pollen when they are exposed to vibrations of bee's wings than when they are not.

b. What prediction follows from this hypothesis? 2

If you expose squash fruits to the tuning fork that vibrates at the same frequency as the bee's wings, and let pollination occur, they will produce more fruit than squash plants not exposed to the tuning fork

c. What is the null hypothesis? 2

Exposure to the tuning fork has no affect on the amount of fruit produced by a squash plant.

d. Design an experiment to test your prediction.

i. What are your treatment groups? 2

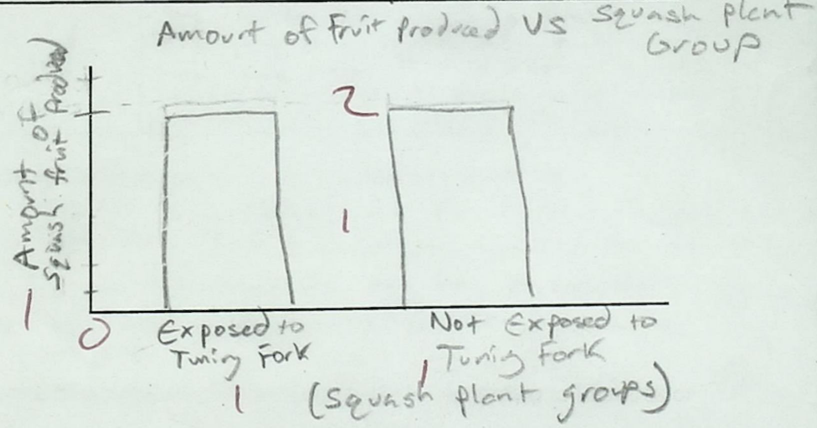
- Treatment 1: Squash plants that are exposed to the tuning fork that vibrates at the same frequency as a bee's wings.
- Treatment 2: Squash plants that are not exposed to the tuning fork. 2

ii. Name three conditions you need to control for between the experimental and control treatments:

1 Sunlight Amount | 1 Soil Type | 1 Rain received

iii. What variable will you measure? Amount of Fruit produced 2

e. Assuming that your findings support the null hypothesis, draw a graph showing the results of your experiment.



2. Which aspect of Mendel's experimental results convinced researchers that blending inheritance did not occur? *(2pts)*

0 When Mendel crossed a pure line of white and purple flowers, all of the F1 generation were purple. Blending inheritance would predict that the offspring would have the blended colors of the parental generation, which would result in a light purple offspring. However, this did not occur.

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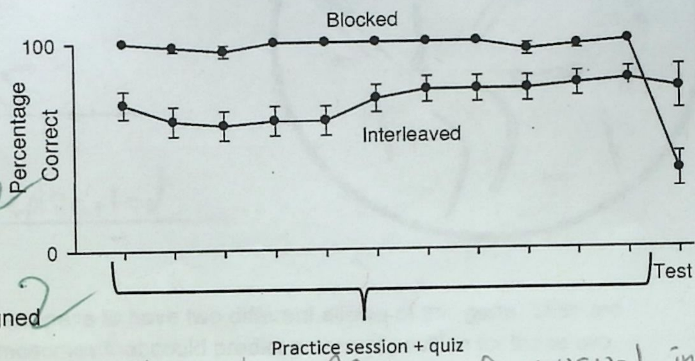
3. Researchers compared student performance on quizzes and tests, based on two modes of studying topics A, B, C, and D. In blocked studying, students did practice sessions where they worked on only topic A, or only topic B, or only topic C, or only topic D, and then took a quiz on that topic. In interleaved studying, students worked on all four topics in each practice session, then took a quiz on all four topics. After 11 of these practice-and-quiz sessions, both groups then took a final test, on topics A,B,C, and D. (7pts)



a. In this experiment, which method worked better for maximizing performance on quizzes?

6 The blocked studying. 2

b. In this experiment, which method worked better for maximizing performance on the test?

The interleaved studying. 2

c. The researchers used a large sample size and assigned students to the two treatments at random. Why? 2

* Having a large sample size ensures that the effects of unusual individuals who may affect the results are limited or lowered. Randomization of treatments ensure that differences in individuals that affect results are averaged out among both test groups.

11 4. Compare and contrast the theories of special creation, evolution by inheritance of acquired characters, and evolution by natural selection. Write ONLY in the spaces provided (inside the cells in the chart). (12pts)

a.	Pattern component	Process component
Special creation	Species are static and unrelated to eachother. They are perfectly made so that they suit the environment they ~~live~~ live in. 2	God made all of the species on earth by himself and he made them so they were perfectly suited to the environment 2
Evolution by natural selection	Over time, traits of populations change in response to environmental changes 1	There is heritable variation in a population. Some traits let individuals produce more offspring than individuals that don't have this trait, This is differential reproductive success. Over time, the frequency of this trait increases in the population 2

b. Can either special creation or evolution by natural selection be tested rigorously? Explain why or why not.

Special creation cannot be tested rigorously, as the theory is based on a supreme being creating all the species so it would be hard to reproduce in a lab. Evolution by natural selection can be, Researchers in labs can observe bacteria to see how the populations ~~change~~ change over time in response to an environmental change.

c. Write "Lamarck" or "Natural Selection" to Identify which of the following statements is correct according to Lamarck or Darwin's conception of how evolution works.

Natural Selection

Populations evolve because individuals with certain heritable traits leave more offspring than others.

Lamarck 2

Populations evolve because individuals change and evolve.

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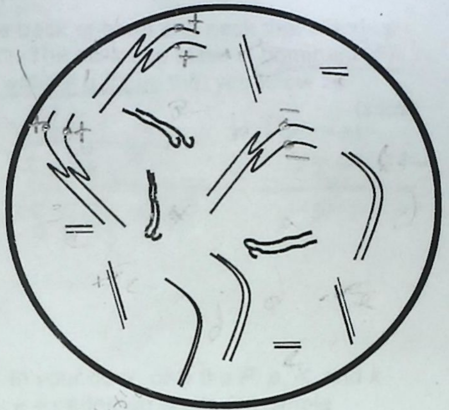
5. Analyze the chromosomes in the cell to the right. (*11pts*)



a. What is the ploidy of the cell? Triploid 2

b. What is the haploid number? 5 2

c. How many chromosomes are present, in total? 15 2

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d. Are the chromosomes replicated or unreplicated? Replicated 2

Gene is called this

e. This organism has a gene called *Vgf*. This individual happens to have two different alleles of this gene. They are called Vgf^{+} and Vgf^{-}. Label locations on any of the chromosomes that could predict a correct position for these two alleles.

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6. Researcher James Cairns grew cells of the bacterium *E. coli* that had a non-functional version of the gene for using lactose (a sugar) as a food source. Then he moved these cells to an environment where lactose was the only food source. Normally these cells would grow a little, then die of starvation. Instead, Cairns observed colonies growing well. To explain these results, he proposed that mutations that increased fitness—specifically mutations that "repaired" the gene for lactose use—occurred at extremely high frequency because the cells had been moved to the environment with lactose. (*11pts*)

a. Is Cairns' hypothesis plausible? Explain why or why not. 2

Cairn's hypothesis is not plausible. Mutations are random changes to genes. Putting colonies in an environment would not increase mutations that increase fitness, the amount and the type of mutation would remain random. The type of mutation would be random, and it would not change due to environmental factors.

b. Later experiments showed that the cells that grew with lactose happened to have extremely high mutation rates. As a result, many mutations were occurring in all genes. Does this observation explain Cairns' results? Explain why or why not. Use only the space provided. 3

This does explain his result. He was able to witness that there seemed to be a large number of positive mutations. If the mutation rate was actually truly high, then it would increase the frequency of mutations, and thus the frequency of good mutations. Thus, it would explain his results.

c. Mutation rate is a heritable trait that varies among individuals in all populations. In general, what types of environments will favor the evolution of high mutation rates? Explain your reasoning. 3

Mutation changes the individual that it affects. As a result, a constantly changing environment would favor the evolution of mutation rates, because the population would constantly need to adapt to the changing environment. An increased mutation rate would be helpful because it would allow the population to quickly adapt to change in the environment because the high mutation rate would mean that it is likely an individual would have an adaptation that increased its fitness, so it would be able to survive and reproduce.

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7. Some pigeons (a type of bird) have smooth heads. Others have feathers on the back of head and neck that stand up to form a fringe. Pigeons inherit two copies of the *fringe* gene, one from each parent. The no-fringe allele is dominant (*F*) to the fringe allele (*f*). You cross a parent pigeon with a fringe and a parent pigeon without a fringe that you know is heterozygous. (25pts)

a. List the parental genotypes: ff and Ff 2

	F	f
f	Ff	ff
f	Ff	ff

Punnett Square

b. List the genotypes of F_1 offspring, and give their frequencies:

0.5 ff, 0.5 Ff 4

c. List the phenotypes of F_1 offspring, and give their frequencies:

0.5 fringe, 0.5 no fringe 4

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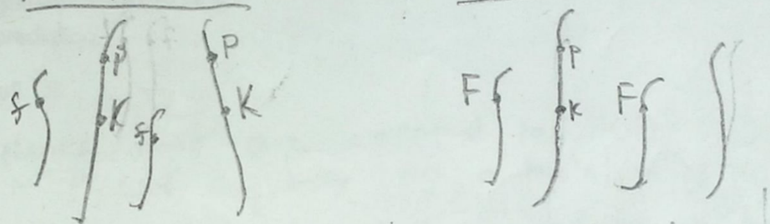
Pigeons also have X and Y sex chromosomes;* the X contains the *P* and *K* genes. In your flock, only the *P*, *p*, *K*, and *k* alleles are present. *P* = feathered toes; *p* = unfeathered toes; *K* = solid color wings; *k* = patterned wings (all simple dominant-recessive relationships). You cross a bird with the genotype $ffX^{PK}X^{PK}$ with a bird with the genotype $FFX^{pk}Y$.

d. In the space to the right, draw and label the chromosomes from each parent in the cross (put the alleles on the chromosomes).

Parent $ffX^{PK}X^{PK}$ Parent $FFX^{PK}Y$



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e. List the genotypes of F_1 offspring, and give their frequencies (show your work):

Female Male

$0.5\ FfX^{PK}X^{PK}$, $0.5\ FfX^{PK}Y$ 4

Punnett Square:

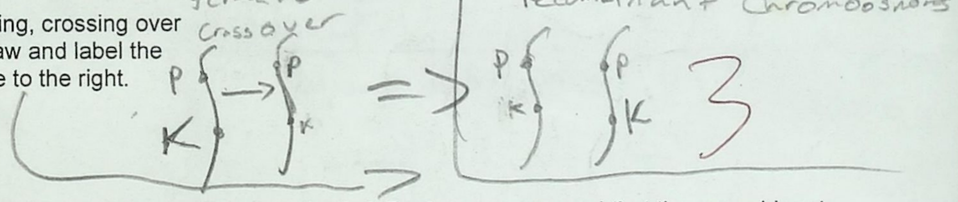
	FX^{pk}	FY
fX^{PK}	$FfX^{PK}X^{pk}$	$FfX^{PK}Y$

f. List the phenotypes of F_1 offspring, and give their frequencies:

0.5 Non fringe, feathered, solid color male

0.5 Non fringe, feathered toe, solid color female 4

g. When meiosis occurs in the F_1 offspring, crossing over occurs between the *P* and *K* genes. Draw and label the recombinant chromosomes in the space to the right.



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8. a) Recall that the gene for yellow body (Y) is at map position 0 on the fruit fly chromosome, and that the recombinant frequency for yellow body and white eye (W) is 1.4%. The small-eye gene (SE) and the yellow body gene have a recombinant frequency of 48.5%. Place W and SE on the gene map below (label both the gene, e.g. Y, and its map position, e.g. 0). (9 pts)

b) Now place the vestigial wing (V) and fuzzy-bristles (F) genes on chromosome using these recombination frequencies:
Vestigial-wing and fuzzy-bristles: 19.5% recombinants
Vestigial-wing and small-eye: 3% recombinants
Yellow-body and fuzzy-bristles: 26% recombinants

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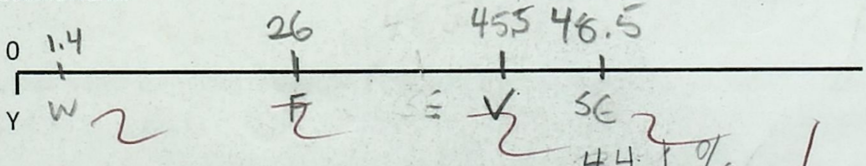

2 2 2 2

c) How often do the genes for vestigial-wing and white-eye produce recombinant offspring? 44.1% 1

*We're fibbing here to simplify things. Sex chromosomes in birds are called Z and W; males are ZZ and females are ZW.

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