Figure S1 Clicker questions and their associated learning objectives and Bloom's level

Mitosis and Meiosis questions
Q1: Which of the following events does <u>not</u> occur during mitosis?
A.Breakdown of the nuclear envelope
B.Daughter cells are genetically identical
C.Condensation of the chromosomal DNA
D.Pairing of homologous chromosomes
E.All of these events occur during mitosis
Learning Objective: Differentiate between mitosis and meiosis
Bloom's: Comprehension- lower-order cognitive skill

Q2: If a dog cell has 39 chromosome pairs,
how many sister chromatids are present in G2?
A.38
B.39
C.76
D.78
E.156
Learning Objective: Predict how the DNA content changes during the cell cycle in a nonhuman species.
Bloom's: Application- higher-order cognitive skill

Q3: At which stage in meiosis does pairing of homologous chromosomes occur?
A. Prophase I
B. Anapase I
C. Prophase II
D. Anaphase II
E. I don't know
Learning Objective: Identify what occurs during each of the stages of meiosis
Bloom's: Knowledge- lower-order cognitive skill

Q4: At which stage in meiosis does independent assortment of alleles occur?
A. Prophase I
B. Anapase I
C. Prophase II
D. Anaphase II
E. I don't know
Learning Objective: Identify at which step in meiosis the homologous chromosomes separate from each other.
**Bloom's:** Comprehension- lower-order cognitive skill

Q5: A diploid cell heterozygous for Genes A and B has an error in chromosome segregation during meiosis (nondisjunction) leading to the production of the following gametes:
At which step in meiosis was there a problem?
A. Prophase I
B. Anaphase I
C. Prophase II
D. Anaphase II
E. Can't determine

Learning Objective: Given a set of unbalanced gametes, predict during which stage in meiosis there was a segregation defect.
Bloom's: Application- higher-order cognitive skill
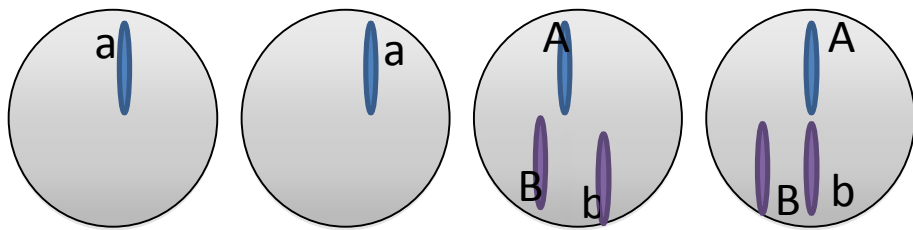
Recombination Questions
Q6 Which of the following statements about recombination is incorrect

A.Genetic maps of chromosomes are based on the average number of crossovers during meiosis
B.The recombination frequency will overestimate the genetic distance
C.One crossover event can interfere with another crossover event
D.Tightly linked genes will have a recombination frequency close to 0
E.All of the statements are correct
Learning Objective: Recognize that recombination frequency underestimates the genetic distance
Bloom's: Knowledge- lower-order cognitive skill

Q7 A female fly with long wings and a gray body, heterozygous for genes controlling body color and wing length, was crossed to a homozygous recessive mutant male with vestigial wings and black body generating the following progeny:
Long wings, Gray body   23 flies
Vestigial wings, Black body   26 flies
Long wings, Black body   124 flies
Vestigial wings, Gray body   127 flies
You interpret this to mean that
A.The genes are unlinked since the parental phenotypes are rare
B.The mother fly received the dominant allele for body from one parent and the dominant allele for wings from the other parent.
C.The genes for body and wings are on opposite ends of the chromosomes
D.The mother fly received the dominant alleles for body and wings from the same parent
E.I don't know
Learning Objective: Predict the parental genotypes given the phenotypes of the offspring
Bloom's: Application- higher-order cognitive skill

Probability and Pedigrees Questions
Q8 After completing a trihybrid genetic cross, you propose a model suggesting that the phenotypes of your progeny can be explained by three genes each with 2 alleles one dominant over the other.
How would you test your hypothesis?
A.Calculate Chi-squared value
B.Calculate the recombination frequency between each gene
C.Use the Binomial Probability formula
D. Draw a Punnett Square
E. Don't know
Learning Objective: Choose the appropriate test to evaluate a genetic model.
Bloom's: Application- higher-order cognitive skill

Q9 You cross two yellow mice and produce a mixture of yellow and agouti progeny. You propose a model predicting 3 yellow mice for every 1 agouti mouse. Do you reject your hypothesis after calculating a χ^2 statistic of 5.143?

Degree of Freedom	5% Critical Value
1	3.841
2	5.991

A. Reject since χ^2 is above the 5% critical Value for 1 Degree of Freedom
B. Don't reject since χ^2 is above the 5% critical Value for 1 Degree of Freedom
C. Reject since χ^2 is below the 5% critical value for 2 degrees of freedom
D. Don't reject since χ^2 is below the 5% critical Value for 2 Degree of Freedom
E. I don't know
Learning Objective: Know the criteria for rejection of the χ^2 statistic
Bloom's: Comprehension- lower-order cognitive skill

Q10 If an individual is homozygous for a recessive trait and has children with a carrier for the trait. What is the probability that they will have one affected child and 2 unaffected children?
A. 0

B. 1/8
C. ½
D. [(3!)/(2!1!)]X(1/2)^2(1/2)^1]
E. Can't determine
**Learning Objective:** Identify the binomial formula as the correct way to predict
Bloom's: Knowledge- lower-order cognitive skill

Q11 Assume the trait shown in the pedigree is very rare. What is the probability that the individual in the red box carries the mutant allele causing the trait?
A.0
B. ¼
C. ½
D. [(5!)/(3!2!)]X(1/2)^3(1/2)^2]
E. Can't determine
Learning Objective: Interpretation of pedigrees and use of information to determine if an individual in the pedigree is a carrier
Bloom's: Application- higher-order cognitive skill
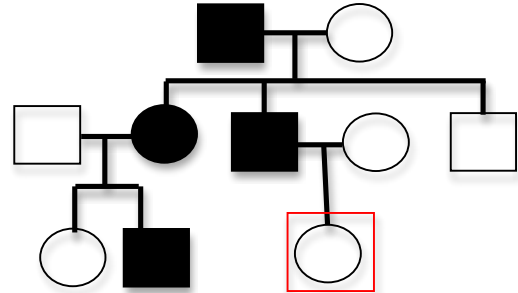
Quantitative Genetics Questions
Q12 After intercrossing the F1 produced from a cross between two inbred strains, which of the following statements about the F2 offspring is incorrect
A. **The F2 with show increased hybrid vigor over the F1.**
B. The F2 will show a decrease in heterozygosity from the F1.
C. The F2 may exhibit inbreeding depression.
D. The variance of the F2 population will be greater than the variance of the F1 population.
E. I don't know.
Learning Objective: Recognize that increased heterozygosity will result in an increase in hybrid vigor.
Bloom's: Comprehension- lower-order cognitive skill

Q13 In one study, the heritability of IQ is determined to be .7.
This means that
A. In an individual, 70% of intelligence is due to genetic factors and 30% is due to environmental factors
B.   No matter what environment you are in the heritability will be 70%
C. **70% of the variation in IQ seen in the population is due to genetic factors**
D. 70% of the average of two parents' IQs will be equal to the mean IQ of their offspring
E.   All of the above
Learning Objective: Evaluate what heritability means.
Bloom's: Analysis- higher-order cognitive skill

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