Name (Last, First): Adwait More

EXAM 2 PRACTICE QUESTIONS

(Answer ALL these questions PRIOR to the in-class review session in order to earn your last Bonus Points for this quarter)

Topics:

Mendelian genetics, DNA

Evolution, New species

Behavior, Mating systems

1. Insulin is a protein that is produced by pancreatic cells and secreted into the bloodstream.

    a. Since all the cells in a person's body contain the same DNA, why do only our pancreatic cells produce insulin?

    Ans: It is because some of our cells can be turned on or off to fulfil certain functions.

    b. If we insert the human gene for insulin into bacteria, the bacteria will produce human insulin. How is this possible?

    Ans: It is because bacteria can reproduce asexually, cells can code and decode to proteins as normal humans.

2. After sequencing a molecule of DNA, you discover that 20% of the bases are cytosine (C). What percentage of the bases would you expect to be guanine (G)? What percentage of the bases would you expect to be thymine (T)?

Ans: There will be 20% Guanine because Guanine and Cytosine are complimentary, this leaves 60% to be Thymine

3. Since DNA is contained in the nucleus of eukaryotic cells but protein synthesis occurs at ribosomes outside of the nucleus, how is the information in DNA conveyed to the ribosomes?

Ans: Through mRNA and transcription

4. How many nucleotides are necessary to code for a protein that is 100 amino acids long?

Ans: 300 (1 amino acid = 3 nucleotides)

5. The **DNA coding strand** for a gene is AGT ATG GCC CGT ACA and reads from left to right. What messenger RNA would be sent to the cytoplasm? What about the amino acid (AA) sequence?

Ans: UCA UAC CGG GCA UGU

6. How many different types of gametes could a person with the genotype AABbCc produce?

Ans: **4 types of gametes**

ABC Abc ABc AbC

7. DNA paternity testing has become the most widely accepted method for establishing who the father of a child is when there are doubts. In one case the mother refused to supply a sample of her DNA, but the man claiming to be the father had his DNA and that of the baby's taken and analyzed. Is it possible to establish who the father is in this method even if the mother's DNA is not available to compare?

Ans: Yes, because the child receives equal DNA from the mother and father, because you are testing for DNA from the father the mother's DNA is not needed

8. For some time, Russian prisons have been running on drastically reduced budgets. As a result, when inmates contracted tuberculosis (TB; caused by an infection of the lungs by a particular bacteria species), treatment with antibiotics was often halted before all TB bacteria had been killed by the antibiotics in an infected prisoner. It is now observed that strains of antibiotic resistant TB have appeared in the Russian prison population. Such strains have now reached the United States when freed prisoners have emigrated. Based on what we've learned so far this semester, what might provide a scientifically valid explanation of the appearance of antibiotic-resistant TB?

Ans: They became resistant to tuberculosis because they were not given enough/strong enough treatment to eliminate TB

9. A gene for red-green color blindness (daltonism) is carried on the "X" chromosome. It is only expressed phenotypically as homozygous recessive in women but men that inherit the affected chromosome will suffer from the disorder.

    a. What are the possible genotypes for a man and woman with color blindness and for a man and woman with "normal" color vision?

Ans: **Colorblind women genotype: X^bX^b**

Colorblind men genotype: X^bY

Normal women genotype: XX, XX^b

Normal men genotype: XY

b. A color-blind woman married a man with "normal" color vision, and they have children.

A) What percent of their male children will be affected by color blindness?
Ans: 100%

B) What percent of their female children will be affected by color blindness?

Ans: 0%

c. A "normal" man is going to marry a "normal" woman who already has had a color-blind son by another man. What are the probabilities of this new marriage producing a color-blind child?

Ans: 25% chance of being colorblind

10. Genetic inheritance is being studied in a certain species of plant in which orange flower color (O) is dominant to white (o) and round leaf shape (S) is dominant to oval (s). A true-breeding orange-flowered, round-leaved male plant (Plant A) is mated with a true-breeding white-flowered, oval-leaved female plant (Plant B) to produce a dihybrid offspring plant (Plant C). Assuming normal Mendelian genetics and independent inheritance of these two traits, which gametes might be produced by Plant C?
Ans: OS, Os, oS, os

11. Suppose male fruit flies with the HHNN genotype mate with female flies with the hhnn genotype. H= hairy legs, h= hairless legs; N= normal wings, n=shriveled wings. About what percentage of offspring flies will have hairy legs and normal wings?

Ans: 100%

12. What are the mechanisms of evolution? How do they differ?

Ans: -**Mutation refers to the change in the genetic makeup of an organism affecting the gene pool of a population.**

3-**gene flow is the transferring of alleles from population to population**

-Genetic drift is the effect of chance on a population's genes pool

-Natural selection is the greater chance of survival based on favourable traits

13. Natural selection, Darwin argued, was an inevitable outcome of three principles that operated in nature. Explain each of these principles.

Ans: -**The first principle Darwin argued was that the characteristics of an organism were to be passed down from parents to their offspring.**

-The second principle was that organisms are in competition for resources because the population of organisms outweighs that of resources necessary for survival

-The last principle is that offspring who inherit characteristics better suited for their environment are more likely to survive than others with less favorable characteristics

14. The Phoenix Zoo kept the only remaining population of Arabian Oryx for ten years in captivity. Finally, when the captive population was high enough and the habitat was better protected in Arabia, some of these Oryx were shipped back to Arabia and released into the wild. In the wild most of the newly released Oryx died of starvation, overheating or were killed by predators. Why is this result not unexpected?

Ans: It is because these animals had adapted to their lifestyle in that of the zoo, they were not accustomed to the lifestyle needed to survive in the wild like hunting for food, finding shelter, and fighting diseases and predators, Because of this they could not survive once they were released.

15. Variation is important for evolution, because it provides the fitness differences upon which natural selection operates. Sexual reproduction is an important source of variation in plants and animals, but what about asexually reproducing organisms like bacteria? Where does their variation come from?

Ans: Asexual reproduction means that the offspring are exact copies of their parent organism, variation does not occur unless a mutation was to pass onto the organism

16. On a yachting trip in the South Pacific you discover a previously unknown island. You notice that there is a population of especially fluffy and particularly cute long-eared rabbits living there. These rabbits seem to have no predators at all on the island, and their mating habits seem to be perfectly random. When they are first surveyed, they have an average ear length of about 18 cm. When they are sampled again in five years, what will likely be true of their ear length? What about the offspring number?

Ans: Their ear length will likely remain the same because they have no environmental pressures forcing them to adapt in any way, this also includes how many offspring they produce. The offspring number and ear length will remain constant.

17. Consider a population of spiders. Because the particular birds that are the main predators of these spiders have trouble locating lighter spiders, the darker spiders are eaten more often than the lighter ones. However, the darker spiders have an advantage over the lighter ones in finding and catching insect prey. What is likely to happen over many generations to the coloration of the spiders?

Ans: The coloration of the spiders over generations depends on which trait/colour is fitted for the environment the best.

18. Compare and contrast various forms of learning including habituation, imprinting, associative learning and cognitive learning and recognize examples of each.

Ans: -Habituation: an animal stops responding to a stimulus, for example a dog fears a vacuum and runs away each time it comes close to it but over time the dog becomes familiar with it and no longer runs away

-Imprinting: early in an animal's life it begins forming attachments for example, a baby bird will recognise its mother and will continue to follow her around

-Associative learning: learning through interactions both consciously and unconsciously, for example touching a hot pan makes you jerk your hand away and you learn to not touch a pan while it is hot.

-Cognitive learning: learning through problem solving and critical thinking, for example asking students to reflect on what they have learned

19. Why are certain birds more likely than mammals to form monogamous pairs?

Ans: Birds are more likely to form monogamous pairs because it is more work to care for their offspring, one parent is not sufficient enough to care for their offspring, one is in charge of taking care of the eggs and the other hunting for food.

20. Among sexually reproducing species, females tend to have more choice in selecting a mate than males. Why?

Ans: Because they have more to lose if they choose poorly

Practice questions

1. What is DNA made of? What is its charge?

   Ans: Nucleotides and it is negatively charged

2. What is the synthesizing enzyme for DNA called?

Ans: The synthesizing enzyme for DNA is DNA polymerase.

3. How are genes turned on and off?

Ans: Gene expression is controlled by transcription factors, which bind to DNA sequences, including promoters and enhancers, triggering or suppressing RNA synthesis. Other mechanisms, such as RNA splicing, mRNA degradation, and post-translational modifications, modulate protein levels and activity.

4. Select the right answer AND provide an explanation.

Mix up at the Hospital

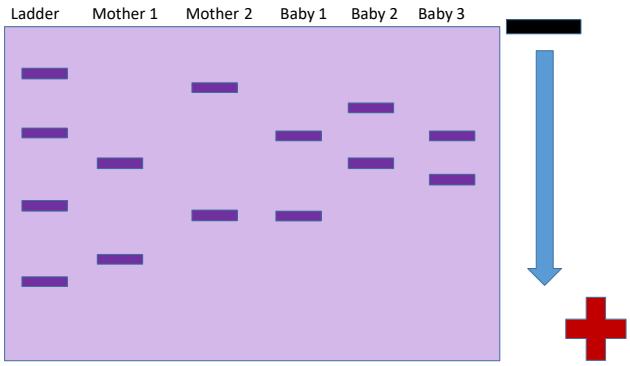
Which baby is Mother 1's and which baby is Mother 2's?

A. Mother 1 and Baby 1, Mother 2 and Baby 2

B. Mother 1 and Baby 3, Mother 2 and Baby 2

C. Mother 1 and Baby 2, Mother 2 and Baby 1

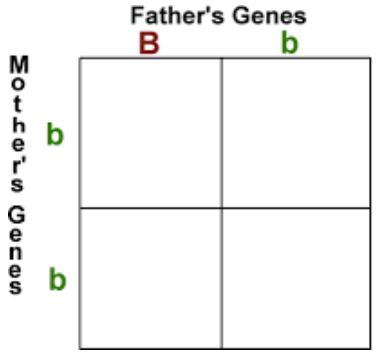
D. Mother 1 and Baby 3, Mother 2 and Baby 1

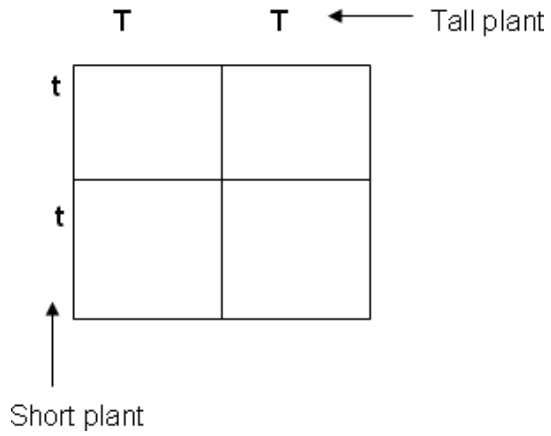


5. What are two ways of tracking traits through generations? What are some advantages and disadvantages of each method?

6. Provide an example of how an organism carries a recessive trait but it is not expressed in its phenotype.

7. Complete these Punnett squares and identify which offspring would exhibit a recessive trait in its phenotype.





8. What is speciation?

Ans: Forming of a new species

9. What is natural selection?

Ans: Higher chance of survival for individuals of a population who have more favorable heritable traits that evolve over time

10. What is convergent evolution?

Ans: Convergent evolution is when different species develop similar structures

11. What are homologous traits? Provide an example.

Ans: Homologous traits are shared traits from two species, for example, wings of a bird and an insect are homologous

12. Heritability values can range between 0 and 1. What does a value of 0.5 mean?

Ans: In a heritability value of 0.5, almost 50 percent of the variation among persons in the population is due to variation among genetic factors between them. What remains, or 50 percent, is due to environmental factors and interactions between them and genetic factors. This signifies that the trait is being influenced by the same degree by genetics and the environment.

13. How would you design an experiment to test the effect of a certain fertilizer on growth of a plant?

Ans: -The Designing of an experiment to test the effect of a fertilizer on plant growth involves the various key steps:

1. Hypothesis: To Start by formulating a clear hypothesis about the expected outcome.

Explanation:

I hypothesize that the use of Fertilizer X will result in increased overall plant growth compared to plants growing without fertilizer.

2. Variables:-

-The Independent Variable: The fertilizer type (e.g., Fertilizer X).

- The Dependent Variable: The Plant growth, which can be measured as the height, the number of leaves, or the biomass.

3. Experimental Setup

- Randomization: Randomly the assign plants to be different treatment groups to minimize the bias.

- The Control Group: Having a control group of plants that receive no fertilizer to serve as a baseline for the comparison.

- The Treatment Groups: Set up the multiple treatment groups, each of receiving a different fertilizer dosage.

4. Replication: Use a sufficient number of plant samples in each group to confirm the results are statistically significant.

5. Experimental Design:

- Use identical plant species and age to minimize variability.

- Ensure all other conditions (light, temperature, water) are consistent among the groups.

- Consider using pots or plots with uniform soil quality.

6. Data Collection:

- Measure the dependent variable (e.g., plant height) at regular intervals (e.g., weekly) for a specified period.

- Record and organize the data carefully.

7. Data Analysis:

8- Use statistical methods (e.g., t-tests, ANOVA) to compare the growth of plants in different treatment groups to the control group.

- Analyze the data to determine if there's a significant difference in growth between the groups.

8. Conclusion:

- Based on the data and statistical analysis, draw conclusions about the effect of the fertilizer on plant growth.
- Report whether your hypothesis was supported or refuted.

9. Replication and Peer Review: To ensure the reliability of your results, others should be able to replicate your experiment. Share your methodology and results for peer review.

10. Ethical Considerations: Ensure the ethical treatment of plants and follow any relevant guidelines or regulations for experimentation with living organisms A well-designed experiment should minimize bias, control variables, and provide reliable results to answer your research question about the effect of the fertilizer on plant growth.