Answers to Questions for Comprehension

Student Textbook page 587

Q1. Selective breeding is the choosing and breeding of specific plants and animals in order to favour particular physical features or behaviours in their offspring. Examples could include plants bred for climates like Canada's (e.g., Red File Wheat) or animals bred for specific purposes.

Q2. Students will select two from pangenesis (egg and sperm contain particles from all parts of the male and female body that develop into body parts from which they were derived in the offspring), Leeuwenhoek's homunculus (the sperm contains a miniature person), Graaf's egg-containing miniature person, and the notion of blending (offspring are an irreversible blend of characteristics of both parents).

Student Textbook page 588

Q3. A true breeding plant is one that exhibits the same characteristics with each generation. A hybrid plant is the offspring of a cross between two parent organisms that have different inheritable traits. Therefore, the characteristics of the offspring in succeeding generations could be different from those of the parental generation.

Q4. The P generation is the parental generation, the organisms that are originally crossed. The F_1 generation is the first filial generation. It consists of the offspring of the P generation. The F_2 generation is the second filial generation. It consists of the offspring of two organisms from the F_1 generation.

Student Textbook page 589

Q5. A sample response: Individuals have two "factors" for each trait, but their gametes contain only one factor for each trait because the "factors" separate randomly during gamete formation. Students may give the example of a cross between two true breeding pea plants. The F_1 generation will all show the characteristics of the true breeding parent plant carrying the dominant allele. All the F_1 plants have one allele from each parent; the dominant allele is expressed and the recessive one is hidden.

Student Textbook page 590

Q6. The term dominant refers to a characteristic (trait) that is expressed even if the individual is heterozygous for both alleles (dominant and recessive). Recessive refers to a characteristic (trait) that is only expressed if an individual is homozygous for that allele.

Q7. A gene is what determines individual traits, while an allele is one of the different forms of a gene.

Q8. Genotype refers to the combination of alleles for any given trait, while phenotype refers to the outward expression (physical, observable form) of a trait. For example, an individual pea plant with the genotype *RR* would have the phenotype of round seeds.

Q9. Being homozygous for a trait means that an individual has two identical alleles for that trait. Being heterozygous for a trait means that an individual has two different alleles for a trait.

Answers to Questions for Comprehension

Student Textbook page 593

Q10. A Punnett square is a tool (technique) that is used to determine the genotypes of the offspring of a cross between two organisms.

Q11. A test cross is a cross between an organism with an unknown genotype and a homozygous recessive organism in order to determine the unknown genotype.

Q12. A possible response: When the two alleles of one gene segregate, this segregation is not influenced by the alleles of other genes.

Student Textbook page 595

Q13. Incomplete dominance is a condition in which neither of two alleles for the same gene completely conceals the presence of the other.

Q14. Sickle cell anemia and familial hypercholesterolemia are two genetic conditions in humans that exhibit incomplete dominance. In sickle cell anemia, red blood cells are deformed, inhibiting their movement through capillaries. In familial hypercholesterolemia, body tissues are unable to remove low-density lipoproteins from the blood, resulting in higher-than-normal blood cholesterol levels.

Q15. Co-dominance involves both alleles being fully expressed. Incomplete dominance also involves both alleles, but one is expressed without completely hiding the presence of the second.

Q16. In roan colouring, two different colours of horse hair are visible. One allele is expressed in one colour and the other allele is expressed in the second colour.

Student Textbook page 596

Q17. During gamete formation, homologous chromosomes segregate, as do alleles. Also during meiosis, the movement of each pair of homologous chromosomes is independent of all the other pairs; alleles, similarly, assort independently.

Answers to Questions for Comprehension

Student Textbook page 601

Q18. The chromosome theory of inheritance states that genes are located on chromosomes, and chromosomes provide the basis for the segregation and independent assortment of genes. The gene-chromosome theory amends the chromosome theory of inheritance and states that genes exist at specific sites arranged in a linear manner along chromosomes.

Q19. Chromosome mapping is a process in which the concept of crossing over is used to determine the relative positions of genes on a chromosome.

Q20. A map unit is defined as the distance between points on a chromosome where a crossover is likely to occur in one percent of all meiotic events.

Q21. Recombinant types are organisms that have a different combination of linked gene alleles than their parents do. Parental types are organisms that have chromosomes that are identical to those of the P generation (linked gene alleles are the same as those of their parents).

Answers to Questions for Comprehension

Student Textbook page 604

Q22. Traits that are controlled by genes on either the X or Y chromosome are called sex-linked traits.

Q23. In every female somatic cell, one of the X chromosomes is randomly inactivated. The inactive X chromosome is condensed tightly into a structure known as a Barr body. This ensures that only one allele of each gene carried on the X chromosome is expressed in each cell.

Q24. A visible effect of the inactivation of one X chromosome is the tortoiseshell coat colour in cats. The tortoiseshell coat colour is the result of a random distribution of orange and black patches. The gene that codes for coat colour (orange or black) is located on the X chromosome. A tortoiseshell cat is heterozygous for the coat colour allele. That is, one X chromosome carries the allele for black fur, and the other X chromosome carries the allele for orange fur. At an early stage of the cat's embryonic development, one X chromosome in each cell is deactivated. The descendants of these cells have the same inactive X as their parent cells. When the kitten is

born, patches of orange show collections of cells in which the X chromosome that is carrying the black allele is deactivated, and patches of black show collections of cells in which the X chromosome that is carrying the orange allele is deactivated.

Student Textbook page 605

Q25. A gene with more than two alleles is said to have multiple alleles.

Answers to Questions for Comprehension

Student Textbook page 609

Q26. A trait such as human blood type results from a single gene that has more than two alleles. A continuous (polygenetic) trait, on the other hand, such as ear length in corn, is controlled by many genes.

Q27. A continuous trait is a trait for which the phenotypes vary gradually from one extreme to another.

Q28. Students may suggest environmental factors such as diet (i.e., malnourishment) or teratogens. Accept any reasonable answer.

Answer to Question for Comprehension

Student Textbook page 611

Q29. Students could name any cereal, fruit, or vegetable crop, as well as any animal that people raise for meat, milk, or hair.

Answers to Questions for Comprehension

Students Textbook page 612

Q30. Roman numerals are used to indicate different generations. Arabic numerals are used to indicate different individuals within each generation.

Q31. Autosomal inheritance refers to traits—dominant and recessive—that are coded for by genes on autosomes.

Answers to Questions for Comprehension

Students Textbook page 614

Q32. Autosomal recessive traits tend to skip one or more generations in pedigrees. X-linked recessive traits can skip generations, but some of the females in that generation must be carriers if the trait appears in a later generation. X-linked recessive traits can occur in the male children of females who are carriers or have the trait themselves. Female children may be carriers, but will only have the disease if their father has it and their mother is a carrier or also has it, which is a rare

occurrence. Conversely, autosomal recessive traits appear in both sexes with the same frequency.

Q33. Yes, a female can have hemophilia if her father has the disease and her mother is a carrier or has the disease.