

Instructions (shown before students start the test)

Hello and Welcome to the test for Designer Genes for the MI Region 7 January Workshop!

Remember this is a non-competitive workshop and no places will be awarded.

Introduction (shown after students start the test)

This test is a mix of question types and topics and is meant to give you a better understanding of both the online test platform and the subject matter.

This test is based on exams from other invitational tournaments, predominantly the UGA 2020 Invitational.

Questions 1-5 are definition matching (the same 5 terms are provided for each definition provided). Choose the correct term to match the definition.

1. (1.00 pts) _____ the points of contact, or the physical link between two non-sister chromatids belong to homologous chromosomes

- A) DNA Gyrase
- B) Geminin
- C) Karyotype
- D) Chiasmata
- E) Gibson Assembly

2. (1.00 pts) _____ DNA fragments containing homologous overlapping ends are ligated together in one reaction

- A) DNA Gyrase
- B) Chiasmata
- C) Karyotype
- D) Gibson Assembly
- E) Geminin

3. (1.00 pts) _____ an essential bacterial enzymes that catalyzes the ATP-dependent negative super-coiling of double-stranded closed-circular DNA.

- A) Chiasmata
- B) Gibson Assembly
- C) DNA Gyrase
- D) Karyotype
- E) Geminin

4. (1.00 pts) _____ a picture of a complete set of metaphase chromosomes

- A) Geminin
- B) Karyotype
- C) DNA Gyrase
- D) Gibson Assembly
- E) Chiasmata

5. (1.00 pts) _____ a DNA replication inhibitor protein in humans encoded by the GMNN gene

- A) Karyotype
- B) Gibson Assembly
- C) Geminin
- D) Chiasmata
- E) DNA Gyrase

For Questions 6-9, use the information in the table below to answer the questions.

Species	Vertebrae	Four limbs	Amniotic Egg	Hairy
A	Yes	Yes	Yes	No
B	Yes	Yes	No	No
C	Yes	No	No	Yes
D	Yes	Yes	Yes	Yes
E	Yes	Yes	No	Yes

6. (1.00 pts) What is the outgroup for the phylogenetic tree?

- A) A
- B) B
- C) C
- D) D
- E) E

7. (1.00 pts) What is another species in the sister group for species B?

- A) A
- B) B
- C) C
- D) D
- E) E

8. (1.00 pts) What are the ancestral forms of the 4 traits?

- A) Invertebrial, Hairy, Amniotic Egg, 4 limbed
- B) Vertebral, Hairy, No amniotic egg, not 4-limbed
- C) Vertebral, Not Hairy, No amniotic egg, 4-limbed
- D) Vertebral, Not Hairy, No Amniotic Egg, not 4- limbed

9. (1.00 pts) What does CRISPR stand for?

Use the information in paragraph below for questions 10-13:

Alkaptonuria is a metabolic disorder in which affected people produce black urine. Alkaptonuria results from an allele (a) that is recessive to the allele for normal metabolism (A). Tina has normal metabolism, but her brother has alkaptonuria. Tina's father has alkaptonuria and her mother has normal metabolism.

10. (1.00 pts) Provide the genotypes of Tina and her mother.

Tina: _____

Her mother: _____

11. (1.00 pts) Provide the genotypes of Tina's father and her brother.

Tina's father: _____

Her brother: _____

12. (1.00 pts) If Tina's parents have another child, what is the probability that this child will have alkaptonuria?

(Mark ALL correct answers)

- A) 100%
- B) 75%
- C) 50%
- D) 25%
- E) 0%

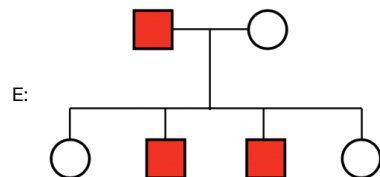
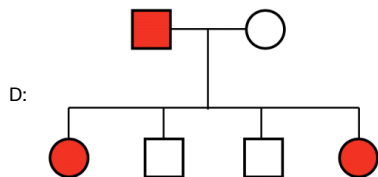
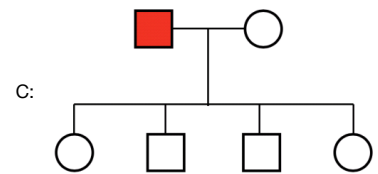
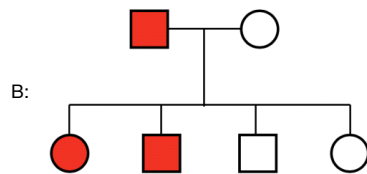
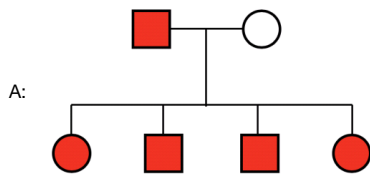
13. (1.00 pts) If Tina marries a man with alkaptonuria, what is the probability that their child will have alkaptonuria?

(Mark ALL correct answers)

- A) 100%
- B) 75%
- C) 50%
- D) 25%
- E) 0%

A man with a specific unusual genetic trait marries an unaffected woman and they have four children. Pedigrees of this family are shown in parts a through e, but the presence or absence of the trait in the children is not indicated. Assume that the trait is rare and fully penetrant. Use the pedigrees below to answer question #14-18.

For each type of inheritance, indicate how many children of each sex are expected to express the trait by selecting the appropriate image from the options below:



14. (1.00 pts) Autosomal Recessive Trait

- A) Image A
- B) Image B
- C) Image C
- D) Image D
- E) Image E

15. (1.00 pts) Autosomal Dominant Trait

- A) Image A
- B) Image B
- C) Image C
- D) Image D
- E) Image E

16. (1.00 pts) X-Linked Recessive Trait

- A) Image A
- B) Image B
- C) Image C
- D) Image D
- E) Image E

17. (1.00 pts) X-linked Dominant Trait

- A) Image A
- B) Image B
- C) Image C
- D) Image D
- E) Image E

18. (1.00 pts) Y-linked Trait

- A) Image A
- B) Image B
- C) Image C
- D) Image D
- E) Image E

19. (1.00 pts) Which of the following is a correct difference between prokaryotic and eukaryotic DNA?

- A) Introns are absent in the coding region of eukaryotic DNA while they do occur in prokaryotic DNA
- B) In transcription, eukaryotic DNA produces mRNA that codes for only one protein, while in prokaryotic DNA it produces mRNA that codes for two or more proteins
- C) The majority of eukaryotic DNA is non-coding, while the majority of prokaryotic DNA is coding

D)

In eukaryotic DNA the Okazaki fragments are comparatively large at about 1000-2000 nucleotides in length, while for prokaryotic DNA they are small at about 100-200 nucleotides in length

20. (1.00 pts) What is the enzyme responsible for initiation of the unwinding of DNA, eliminating supercoiling?

- A) Ligase
- B) Primase
- C) Helicase
- D) Topoisomerase

21. (1.00 pts) How many base pairs are used in VNTR?

- A) 2-10
- B) 100-200
- C) 10-14
- D) 14-100

22. (1.00 pts) What is the Open Reading Frame (ORF)?

- A) Frame of mRNA between the final stop codon and the end of the transcript
- B) Frame of mRNA between the transcriptional start site and the translational start site
- C) Part of gene that codes for protein, starts with ATG start codon and ends with a stop codon
- D) The frame of nucleotides within the promoter where transcription begins

23. (1.00 pts) What is the process that inactivates X chromosomes in female somatic cells?

- A) Chromatic Aberration
- B) Lyonization
- C) Heterochromatization
- D) W-Chromatization

All Done! Good luck on all your events today and remember to join in the virtual meeting for opportunities to talk with some of the event supervisors!