

Biology 2040 Midterm I

Version B

Oct. 9, 2009 / 8:30 – 9:20 am

- **This exam must be submitted with your scantron sheet to receive a grade.**
- **Your student number and name must be CLEARLY written on this booklet and scantron sheet in order to receive a grade.**
- Your **student number** must be **BUBBLED CORRECTLY** on the scantron to receive a grade
- All questions on this exam are multiple choice – there is **NO** pattern to the answers (*e.g.*, c, a, b, b, a, d), so don't look for one!
- Non-programmable calculators are **PERMITTED**.
- If you complete the exam before the allotted time, raise your hand to identify yourself to the invigilator.
- The invigilators and instructors will immediately **RELOCATE** anyone or **SUSPEND** the examination for any individuals who are suspected of academic dishonesty.

Good Luck!

--

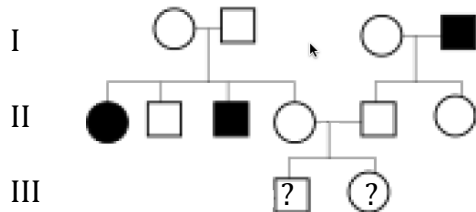
Last name	First Name
Student Number	

Section A: Answer the following by filling in the appropriate response on your scantron.

1. You have midterm version B. Fill in **b** for this question!
2. Height in humans is an example of a _____ trait.
 - A. Continuous
 - B. Polygenic
 - C. Quantitative
 - D. All of the above
3. You are trying to develop true-breeding blue hydrangeas, but the plants in one corner of your garden consistently turn pink regardless of your mating strategy. Which of the following would you suspect played a role in your failed breeding plan?
 - A. Incomplete penetrance
 - B. Variable expressivity
 - C. Multiple genes affecting this trait.
 - D. Environmental effects
4. Which of the following doesn't have to be a characteristic of a good model organism?
 - A. Short generation time that allows multiple generations to be examined within a short time.
 - B. Possess a genome that is closely related to the human genome.
 - C. Produce large numbers of offspring.
 - D. Only a and b are not characteristics of a model organism.
5. What aspect of chromosome behaviour **most clearly** accounts for Mendel's principle of independent assortment?
 - A. Movement of sister chromatids to opposite poles at anaphase II of meiosis.
 - B. Movement of homologous chromosomes to opposite poles at anaphase I of meiosis.
 - C. Crossing over between homologous chromosomes during prophase I of meiosis.
 - D. Independent alignment of different homologous pairs on the metaphase I spindle.
- ~~6. A woman with a mutation in a gene on her X chromosome will pass it on to~~
 - ~~A. All of her daughters.~~
 - ~~B. All of her sons.~~
 - ~~C. Half of her sons, and all of her daughters.~~
 - ~~D. All of her sons, and half of her daughters.~~
 - ~~E. All of her sons and daughters.~~
7. What information cannot be obtained from an individual's karyotype?
 - A. The ploidy of the individual.
 - B. The types of chromosomes present in the individual.
 - C. The number of autosomes in the individual.
 - D. The sequence of bases of a particular gene.

8. Genes *R* & *F* are located on different chromosomes. A woman is heterozygous for both genes. Which of the following processes would generate different combinations of alleles of these 2 genes?
- Recombination
 - Independent assortment
 - Sister chromatid segregation
 - Segregation
9. The somatic cells of males in the species *Dragontis elementis* contain only 1 pair of homologous chromosomes (D1 and D2), and another chromosome without a homolog (chromosome C). Which chromosomal combinations are most likely to be among the 4 meiotic products from a single cell?
- D₁C, D₁C, D₂, D₂
 - D₁C, D₂C, D₁, D₂
 - D₁C, D₁C, D₂C, D₂C
 - D₁D₁, D₂D₂, C, C
10. What is the probability that a gamete from an individual with the genotype $L_1L_2T_1T_1M_1M_2$ will contain all maternally derived homologues?
- 1/6
 - 1/3
 - 1/4
 - 1/8
11. In a group of dragons homozygous for an allele that causes a reduced number of facial bristles (stiff, coarse hairs), you notice that the number of bristles ranges from about half the normal number to only a few bristles. This is an example of which of the following?
- Incomplete dominance
 - Codominance
 - Incomplete penetrance
 - Variable expressivity
 - Both a and c.
12. Which of the following is true about pleiotropy?
- It always involves two or more genes.
 - It only refers to the F₁ generation.
 - It includes genetic phenomena such as epistasis.
 - It refers to the effects of a single gene.
 - Both b and d.
13. Long ears in rabbits are an autosomal dominant trait that exhibits 30% penetrance. You cross a rabbit heterozygous for long ears with one that is homozygous for normal ears. What is the probability that their first offspring will have long ears?
- 0.5
 - 0.3
 - 0.25
 - 0.15

Below is a pedigree for the ability to read minds and applies to the next 2 questions. Darkly shaded symbols represent individuals that exhibit the ability to read minds. Assume that read minds is completely penetrant.



14. For the above pedigree, what is the mode of inheritance of being able to read minds?
 - A. Autosomal recessive
 - B. Autosomal dominant
 - C. X-linked recessive
 - D. X-linked dominant

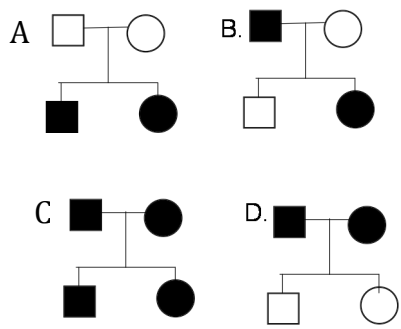
15. What is the probability that the first-born in generation III will be able to read minds?
 - A. 1/2
 - B. 1/3
 - C. 1/4
 - D. 1/6

16. Sasha is a carrier for the X-linked disease muscular dystrophy ($X^D X^d$) and is also a carrier for the autosomal recessive disease albinism (Aa). Sasha produces an egg that has the A allele and the D and d alleles of the muscular dystrophy gene. Assuming no crossing over, what can you conclude?
 - A. The gamete has a normal chromosomal number.
 - B. A nondisjunction event occurred, but you can't determine when it occurred during meiosis.
 - C. A nondisjunction event occurred in Meiosis I.
 - D. A nondisjunction event occurred in Meiosis II.

17. Snoots have a diploid chromosome number of 8. How many different chromosome combinations can normally be found in the gametes of this organism, assuming that no crossing over occurs?
 - A. 2
 - B. 4
 - C. 8
 - D. 16

18. Which of these pedigrees illustrates complementation? Shaded symbols represent affected individuals.

- A. A
- B. B
- C. C
- D. D



19. Mark is a carrier for diastrophic dysplasia (Dd), an autosomal recessive disorder and has achondroplasia, which is an autosomal dominant trait (Aa). Dustina is also a carrier for diastrophic dysplasia and also has achondroplasia. AA human embryos do not survive beyond the first few cell divisions and the allele is considered recessive lethal. Mark and Dustina want to have a child. What is the probability that their child will have only diastrophic dysplasia?
- A. 0
 - B. $1/4$
 - C. $1/6$
 - D. $1/12$
 - E. $1/16$
20. In Snuffalufagi, height is controlled by the H gene; HH and Hh individuals have long legs and hh individuals have short legs. If the growth-promoting allele (G) is absent, there is very limited growth, regardless of which alleles are present at gene H and the Snuffalufagi have short legs. A cross is made between a true-breeding long-legged Snuffalufagi and a short-legged Snuffalufagi that is homozygous recessive for both genes. What proportion of the F_2 progeny will have short legs?
- A. $1/16$
 - B. $3/16$
 - C. $7/16$
 - D. $9/16$
 - E. $1/4$
21. Three mutant strains of white Smurfs have been identified and all are true-breeding. When strain A was crossed with strain C, all F_1 Smurfs were the wild-type blue colour. When strains A and B were mated, all the progeny were white, and when B and C were crossed, all the progeny were blue. What is the best explanation for this observation?
- A. B and C have mutations in the same gene, and A has a mutation in a different gene.
 - B. A and C have mutations in the same gene, and B has a mutation in a different gene.
 - C. A and B have mutations in the same gene, and C has a mutation in a different gene.
 - D. A, B and C are all mutations in the same gene.
 - E. A, B and C are all mutations in different genes.
22. In *Drosophila*, forked bristles is a recessive sex-linked trait, while purple eyes is an autosomal recessive trait. The wild-type for each are straight bristles and red eyes, respectively. A female, heterozygous for both pairs of alleles, is mated with a male with forked bristles and purple eyes. What proportion of the daughters will have forked bristles and purple eyes?
- A. All
 - B. $3/4$
 - C. $1/2$
 - D. $1/4$
 - E. None

23. The genes I^A , I^B and i contribute to the ABO blood antigens in humans. In another trait, Rh^+ is dominant to Rh^- . If a mother with phenotype A Rh^+ has a child with a phenotype of O Rh^+ , which one of the following genotypes is not possible for the father?
- A. $I^A i Rh^- Rh^-$
 - B. $I^B i Rh^+ Rh^-$
 - C. $ii Rh^- Rh^-$
 - D. $ii Rh^+ Rh^-$
 - E. $I^A I^A Rh^+ Rh^+$

Section B: Answer the following by filling in the blank with the appropriate response.

24. Two individuals of genotype $RRSSTYY$ and $rrsstyy$ are mated. The F_1 generation is interbred (self-fertilized) to yield 1500 progeny. What proportion of the F_2 is expected to be $RrSStYy$?

25. The β -globin gene has many alleles. What is the total number of different alleles of the β -globin gene that could be carried by 3 children with the same mom & dad. _____
26. Gerald and Lorna are both carriers of the autosomal recessive condition halitosis. If they have 3 children, what is that probability that two will be affected and one will not, regardless of order? _____
27. A frog somatic cell contains approximately 15 picograms (pg) of DNA in the G_1 phase. How many picograms of DNA are expected in a gamete produced by this individual? _____ pg