MARK VERSION NUMBER ON YOUR SCANTRON! ➡ **VERSION 1**

BIOL 2104, Winter 2014, Midterm 1

Check that you have 20 multiple choice questions on 4 pages in this booklet. Answer all multiple choice questions on the Scantron. Be sure to enter the exam version number on your Scantron. Exam duration is 80 minutes. You may use a non-programmable calculator. Keep this question booklet after handing in your completed Scantron.

1) A mutated gene is known to cause blindness in fruit flies. Geneticists identify a similar gene in mice by searching the sequenced genome. They carry out a series of experiments to determine if this gene, when deleted, also causes blindness in mice. This is an example of what type of scientific approach?

a. Forward genetics b. Reverse genetics c. Eugenics
d. DNA barcoding e. Test crossing

2) A long stem, red petal plant was selfed and the following progeny were obtained.

360 long stem, red petal
113 long stem, white petal
119 short stem, red petal
40 short stem, white petal

What proportion of the long stem, white petal plants are expected to be true breeding?

a. 1/16 b. 1/4 c. 1/9 d. 1/3 e. none of previous

3) In *Saccharomyces cerevisiae*, which produces unordered tetrads, the *ura6* mutant requires uracil for growth and the *trp5* mutant requires tryptophan for growth. The wild-type alleles are *URA6* and *TRP5*. The following cross was performed: *URA6 TRP5* x *ura6 trp5*. The following two classes of tetrad were observed in the meiotic products with the associated numbers counted for each:

Tetrad class	Spore Phenotypes				# of Asci
1	*URA6 TRP5*	*URA6 TRP5*	*ura6 trp5*	*ura6 trp5*	112
2	*URA6 TRP5*	*ura6 trp5*	*URA6 trp5*	*ura6 TRP5*	9

What is the map distance between these genes?

a. The genes are not linked b. 3.7 cM c. 7.4 cM d. 8.0 cM
e. Cannot determine map distance from these data.

4) Consider the following cross involving five unlinked genes:

Aa ; *Bb* ; *Cc* ; *Dd* ; *Ee* X *aa* ; *Bb* ; *cc* ; *Dd* ; *ee*

What proportion of the progeny will phenotypically resemble *neither* parent?

a. 55/64 b. 15/16 c. 119/128 d. 7/8 e. 3/4

5) The *B* and *G* loci are 35 m.u. apart. If a plant of genotype *Bg*/*bG* is selfed, what percentage of the progeny will be *bg* in phenotype? (i.e. display both recessive alleles)

a. 12.25% b. 10.56% c. 6.25% d. 3.06% e. none of the previous

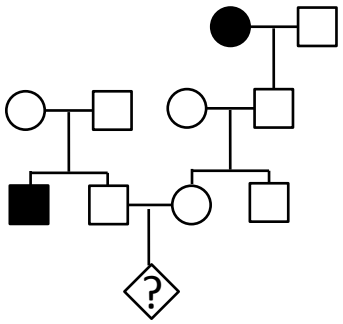
6) In cats, yellow eyes (Y) is dominant to blue eyes (y). A yellow eyed female become pregnant by an unidentified male, and gives birth to 7 kittens: 4 with yellow eyes, and 3 with blue eyes. What is the genotype of the father?

a. YY b. Yy c. yy
d. A, B, and C are all possible e. B and C are both possible

7) In *Drosophila melanogaster*, the *white eye* gene is X-linked. The white-eyed phenotype is recessive to red-eyed phenotype. A white-eyed female fruit fly was mated to a red-eyed male. The vast majority of the female progeny are red-eyed. However, a rare white-eyed female was found in the progeny (1 out of 2234 females). What is the likely karyotype of this white-eyed daughter?

a. XX b. XYY c. XO d. XXX e. XXY

8) Alkaptonuria (AKU) is a rare autosomal disorder that causes defects in metabolism of the amino acids phenylalanine and tyrosine. Based on the pedigree below, what is the chance that individual IV-1 will display this trait?



a. 1/16 b. 1/12

c. 1/24 d. 1/18

e. 1/8

9) Female *Drosophila* heterozygous for three recessive mutations *cn* (cinnabar-eyed), *c* (curved-winged), and *ex* (extra veins) were testcrossed, and the following progeny were obtained:

Phenotype	**Number**
cinnabar-eyed, curved-winged, extra veins	296
cinnabar-eyed, curved-winged	63
cinnabar-eyed	119
cinnabar-eyed, extra veins	10
curved-winged, extra veins	86
curved-winged	15
wild-type	329
extra veins	82

From the data set above, what is the map distance (cM) between *c* and *ex*?

a. 23 b. 40 c. 17 d. 6 e. None of the previous.

10) From the data set of Question 9 above, what is the level of interference across the region?

a. 0.36 b. 0.64 c. 0.74 d. 0.26 e. zero.

11) A and B are independently assorting genes, each affecting a different trait. Among the crosses below, which would produce four phenotypes in a 1:1:1:1 ratio? Assume complete dominance for both genes (A > a; B > b).

a. AABB × aabb b. AaBb × AaBb c. AaBb × aabb
d. AaBB × aaBB e. AAbb × aaBB

12) A rare X-linked recessive mutant, *c*, produces red-green colour blindness in humans. A normal woman whose father was colour blind decides to have children with a colour blind man. What are the chances that the first child from this relationship will be a colour blind daughter?

a. zero b. 1/8 c. 1/1 d. 1/2 e. 1/4

13) The three-point cross *Ndt/nDT* × *ndt/ndt* is carried out and the *N* gene is found to be in the middle. What would be the genotypes of the double crossover gametes in this cross?

a. *Ndt* and *nDT* b. *NdT* and *nDt* c. *ndT* and *NDt*
d. *NDT* and *ndt* e. cannot be determined

14) Two yellow tulips of unknown genotype are crossed. 90 F1 seeds are planted, and 68 have yellow flowers while 22 have white flowers. If one of the white tulips is backcrossed, what would be the expected phenotype ratio in the resulting progeny?

a. 3 yellow : 1 white b. 1 yellow : 1 white c. 3 white : 1 yellow
d. all white e. all yellow

15) In the fungus *Neurospora crassa*, which makes ordered tetrads, a strain that is unable to synthesize proline (mutant allele *p*) was crossed with a strain that is unable to synthesize histidine (mutant allele *h*). In other words, a cross was made between $p\ h^+$ and $p^+\ h$ (or p + X + h). The following results were obtained:

Spore Pairs	**Ascus Type**					
	5	**2**	**3**	**4**	**1**	**6**
1-2	p h	p +	p +	p +	p +	p h
3-4	p h	p h	+ h	+ +	p +	+ +
5-6	+ +	+ +	p +	p h	+ h	p +
7-8	+ +	+ h	+ h	+ h	+ h	+ h
Total	**2**	**114**	**6**	**81**	**390**	**7**

What is the approximate map unit distance between *p* and *h*? (rounded to zero decimal places)

a. 21 b. 26 c. 17 d. 34 e. they are unlinked

16) Using the data set from Question 15 above, what is the approximate map unit distance between *p* and the centromere? (rounded to zero decimal places)

a. 17 b. 8 c. 16 d. 11 e. 21

17) In an organism where 2n = 24. How many chromatids would you expect to be present in the nucleus in Prophase I of meiosis?

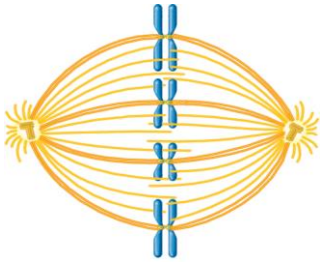
a. 48 b. 24 c. 18 d. 12 e. 6

18) A mouse with the genotype Aa ; Bb ; cD/Cd is test-crossed. What proportion of the F1 progeny will be phenotypically abcd? Note that the C and D genes are 18 cM apart.

a. 0.01125 b. 0.045 c. 0.1025 d. 0.005625 e. none of the previous

19) Consider a cell with a diploid chromosome number of four (2n=4). For the following diagram, this cell is would be in:

a. metaphase of mitosis b. metaphase of meiosis I c. metaphase of meiosis II
d. interphase e. it is impossible to tell



20) Two wild-type fruit flies are crossed, and the following offspring are counted: 572 wild type, 179 fuzzy wings, 184 small eyes, 70 fuzzy wings and small eyes. What can be said about these 2 phenotypes and the likely genotype of the parents? Assume independent assortment of the *fuzzy wings* and *small eyes* genes.

a. Fuzzy wings and small eyes are both dominant. The parents are both dihybrids.
b. Fuzzy wings and small eyes are both recessive. The parents are both dihybrids.
c. Fuzzy wings and small eyes are both dominant. The parents are both pure breeding.
d. Fuzzy wings and small eyes are both recessive. The parents are both pure breeding.
e. Fuzzy wings and small eyes are both recessive. The genotypes of the parents cannot be determined.