0.6

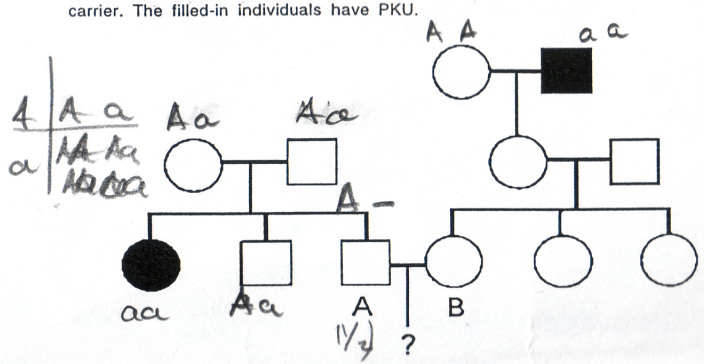
61.214 Introductory Genetics Quiz 1, Name Kristopher Allodin student# 307298

1. In mice a black *(B/b)* female is crossed to a brown (*b/b*) male. What proportion of the baby mice will be brown?

   __ A. None
   __ B. All
   __ C. 1/4
   ✓ D. 1/2
   __ E. 3/4

| | B | b |
|---|---|---|
| b | Bb | bb |
| b | Bb | bb |

2. The following pedigree concerns the autosomal recessive disease phenylketonuria (PKU). The couple marked A and B are contemplating having a baby but are concerned about the baby's having PKU. What is the probability of the first child having PKU? Unless you have evidence to the contrary, assume that a person marrying into the pedigree (i.e. not a descendant of the two parents at the top of the pedigree) is not a carrier. The filled-in individuals have PKU.




   ✓ A. 0
   ✓ B. 1/12
   __ C. 1/4
   __ D. 3/4
   __ E. 9/64

3. A selfed monohybrid characteristically produces progeny phenotypes in the ratio

   __ A. 1:1
   ✓ B. 1:2:1
   ✗ C. 3:1
   __ D. 9:3:3:1
   __ E. 1:1:1:1

| | A | a |
|---|---|---|
| A | AA | Aa |
| a | Aa | aa |

1:2:1

4. A couple are both heterozygous for two autosomal recessive diseases: cystic fibrosis (CF) and phenylketonuria (PKU). What is the probability that their first child will have either CF or PKU?

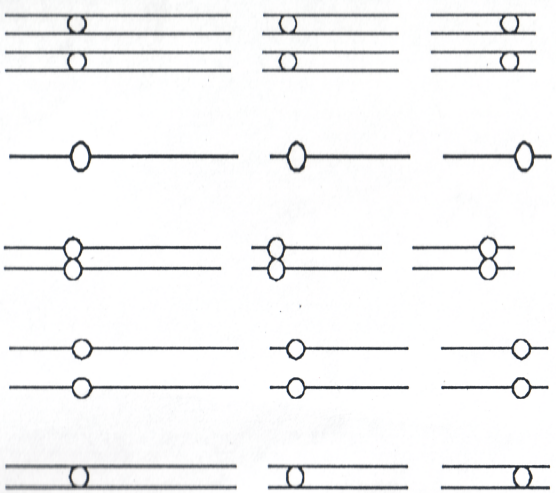
   __ A. 0
   __ B. 1/4
   ✓ C. 1/2
   __ D. 1/16
   __ E. 9/16

| | A | a |
|---|---|---|
| A | | |
| a | | |

1/4 + 1/4 = 2/4

5. In a diploid organism 2n = 6, and there are two long, two intermediate, and two short chromosomes. What is the most accurate representation of a gamete resulting from meiosis in this organism?

   ✓ A.
   ✗ B.
   ✓ C.
   __ D.
   __ E.



61.215 Quiz #2 +R/± total Kristopher Alladin 307298

A cross is performed between two true breeding strains of a diploid organism. The following phenotypic ratios result. Draw a genetic map and give map distances.

| | |
|---|---|
| A + + | 72 |
| + B C | 74 |
| A B C | 28 |
| + + + | 26 |
| | 200 |

D

A trait: $\frac{72}{200} = 0.36$

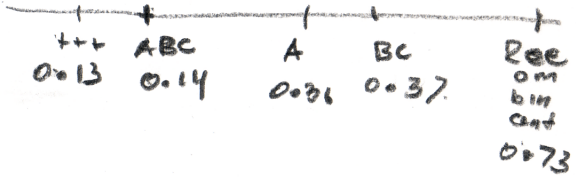
BC trait: $\frac{74}{200} = 0.37$

Map distances

Recombinant: $\frac{72+74}{200} = 0.73$

Parental: $\frac{28}{200} = 0.14$

wild: $\frac{26}{200} = 0.13$



3 1/2 Kristopher Aladin 3007248

March 1 - 61.214* - Intro Genetics - Quiz

1) What is the base sequence of the DNA strand that would be complementary to the following single stranded DNA molecule? Also show 5' and 3' ends.

5' – A G T T A C A T G C A T – 3'

3' - T C A A T G T A C G T A - 5'

2) A double-stranded DNA is 17% cytosine. What is the percentage of adenine in the DNA?

17% C 33% A

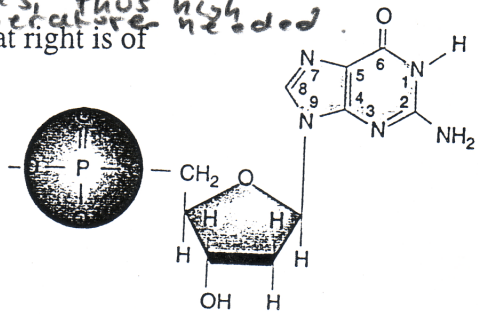
33% A

3) The following are melting temperatures for different double stranded DNAs. Arrange these in order from highest to lowest GC content and briefly explain your ordering. a. 73 °C b. 69 °C c. 78 °C d. 82 °C

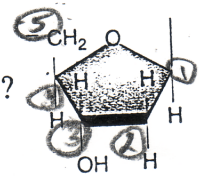
d, c, a, b G≡C => 3 hydrogen bonds, thus high temperature needed

4) Circle the correct answer. The diagram at right is of

a) a pyrimidine nucleoside
b) a pyrimidine nucleotide
c) a purine nucleotide
d) a pyrimidine nucleoside
e) a purine base
f) a pyrimidine base




5) Provide correct number designations for the carbon atoms in the sugar at right. Would this sugar make up part of DNA or RNA (circle one)?




1/2

5

This quiz is questions from Midterm 2 that everyone got wrong

NAME Kristopher Aladin STUDENT# 3072998

**QUIZ 4 TAKE-HOME, DUE WED. 20 MAR, 2002**

1. If phage are labelled with radioactive sulfur and allowed to infect bacterial cells, the phage progeny resulting from lysis are expected … (A) to be non-radioactive. B) to have radioactive DNA. C) to have radioactive proteins. D) to have radioactive DNA and proteins.

2. In a generalized transduction experiment, the T1 phage particles growing on *E. coli* with the genotype *val*$^+$ *ala*$^+$ *trp*$^+$ are collected and allowed to infect *E. coli* cells with the genotype *val*$^-$ *ala*$^-$ *trp*$^-$. The cotransduction frequencies are calculated for the different gene combinations:

*ala - trp* =0.2, *ala - val* =0.8, *val - trp* = 0.6

Which of the following is consistent with the data?

A) The gene order is *ala - val - trp*, *val* is closer to *trp* than it is to *ala*.
B) The gene order is *val - ala - trp*, *ala* is closer to *trp* than it is to *val*.
C) The gene order is *ala - val - trp*, *val* is closer to *ala* than it is to *trp*.
D) The gene order is *ala - trp - val*, *trp* is closer to *ala* than it is to *val*.

3. The following diagram shows a fragment of transcribed DNA (the upper strand is the template strand):

5'-ATTGCC-3'
3'-TAACGG-5'

The transcribed RNA is…

(A) 3'-UAACGG-5' B) 5'-TAACGG-3' C) 3'-AUUGCC-5' D) 5'-UAACGG-3' E) 5'-GGCAAU-3'

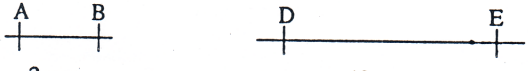
4. A protein sequence has the following sequence:

$NH_2$ - *His-Met-Leu-Ile-Lys-COOH*. The DNA template strand sequence (3' → 5') would be…

A) GUGUACAAUAUUUUU B) GTGTACAATATTTTT C) GTATACAATTATTTT
D) GUAUACAAUUAUUUU (E) CATATGTTAATAAAA

5. The rare enol form of thymine pairs with guanine. If thymine enolization occurs during replication, what would be the mutational event? A) CG to AT (transversion) B) TG to CA (transition)
C) TA to CG (transversion) (D) TA to CG (transition) E) TA to AT (reversal)

6. Given the following genetic map, what proportion of progeny would be phenotypically abde from a testcross of individual ab/AB, de/DE?




2 m.u. 10 m.u.

7. What would be the approximate size of the mature transcript from a gene that has three exons 700, 300 and 1000 base pairs in size, and two introns of 300 and 250 base pairs? Explain briefly (hint: not 2000 bp!)

#6 $2mv + 10mv = 12mv = 12\%$ $\Rightarrow$ of getting anything but parental.

We want parental. Thus its $100 - 12 = 88\%$

These are the possible genotypes:

| | |
|---|---|
| abde | 1/4 |
| ABDE | 1/4 |
| ABde | 1/4 |
| abDE | 1/4 |
| | 4 |

To get abde there is a 1/4 chance

$\Rightarrow (1/4)[88\%] = 22\%$ chance of abde.

(#7) the pre-mRNA length: 2000 bp (exon)
550 bp (intron)
2550 bp (total) => pre-mRNA

To make it mRNA we need to splice out the introns

2550 bp (total)
- 550 bp (intron)
2000 Nucleotides => because RNA is single stranded

This is now mRNA

+ poly A

**Biology 61.214 Introductory Genetics Practice mid-term exam**

1. A phenotypically normal woman is heterozygous for the recessive Mendelian allele causing phenylketonuria, a disease arising from the inability to process phenylalanine in food. What proportion of her eggs will carry the allele that allows normal processing of phenylalanine?
   a. all
   b. 3/4
   c. none
   d. 1/4
   e. 1/2

2. A man and his wife are both heterozygous for the autosomal recessive allele for albinism. If they have two children, what is the probability that both children will be phenotypically identical with regard to skin color?
   a. 3/4
   b. 1/16
   c. 1/4
   d. 9/16
   e. 5/8

3. Drosophila eyes are normally red. Several purple-eyed strains have been isolated as spontaneous variants (mutants) and the purple phenotype has been shown to be inherited as a Mendelian autosomal recessive in each case. To investigate allelism between these different purple mutations, two purple-eyed pure strains were crossed. If the purple mutations are in different genes (that is, they are *not* allelic), the $F_1$ is expected to be
   a. all red.
   b. all purple.
   c. 3/4 red, 1/4 purple.
   d. 1/2 red, 1/2 purple.
   e. 3/4 purple, 1/4 red.

4. *In Drosophila,* the genes for roughoid eyes *(r)* and javelin bristles (*j*) are linked 20 map units apart on one of the autosomes. If a dihybrid male fly r+ *j*/*r j*+ is test-crossed to an *rr ii* female, what proportion of progeny will be *r*+*r j*+*j*?
   a. 0
   b. 0.1
   c. 0.2
   d. 0.4
   e. 0.3

(Note: no crossing over in *Drosophila* males.)

5. In a triploid of genotype *Bbb,* what proportion of gametes will be B?
   a. 1/4
   b. 1/3
   c. 1/2
   d. 1/6
   e. 2/3

6. *In* a tetraploid, x = 5. The ploidy level is
   a. 4.
   b. 5.
   c. 8.
   d. 10.
   e. 20.

7. Fifty cells of an auxotrophic strain of haploid yeast are plated on minimal medium. The number of colonies expected to grow is
   a. 0.
   b. 1.
   c. 25.
   d. 50.
   e. unknown.

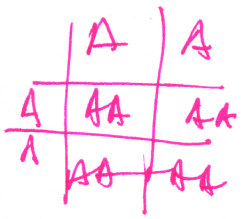
and product of sum

61.214 2002 FIRST MIDTERM NAME Kristopher Alladin
STUDENT# 307298

**ANSWER ALL QUESTIONS WITH PENCIL ON SCANTRON SHEET**

1. A testcrossed monohybrid characteristically produces progeny phenotypes in the ratio

__ A. 1:1
__ B. 1:2:1
__ C. 3:1
✓ D. 9:3:3:1
__ E. 1:1:1:1

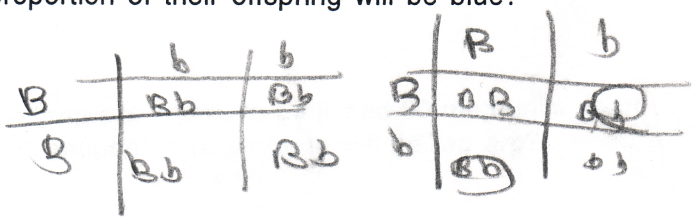


2. If a plant of genotype *A/a;B/b;C/c;D/d* is selfed and the genes assort independently, how many different genotypes will be found among the progeny?

__ A. 4
__ B. 16
__ C. 24
✓ D. 64
__ E. 81

3. In Andalusian fowls *B/B* = black, and *b/b* = white, but the heterozygote is blue. If two heterozygotes are mated, what proportion of their offspring will be blue?

__ A. 3/4
__ B. 2/3
__ C. 1/4
__ D. 1/2
__ E. 9/16



4. Which of the following is the correct order of increasing levels of chromosome packing (smallest to largest)?

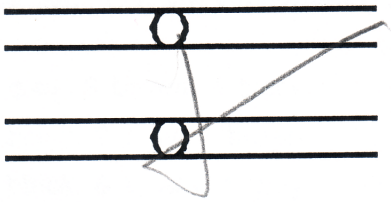
✓ A. Nucleosomes-loops-solenoid-supercoils
__ B. Solenoid-nucleosomes-loops-supercoils
__ C. Solenoid-nucleosomes-supercoils-loops
__ D. Nucleosomes-solenoid-loops-supercoils
__ E. Solenoid-loops-nucleosomes-supercoils

5. In a plant in which $2n = 24$, what is the total number of chromatids present during metaphase I of meiosis?

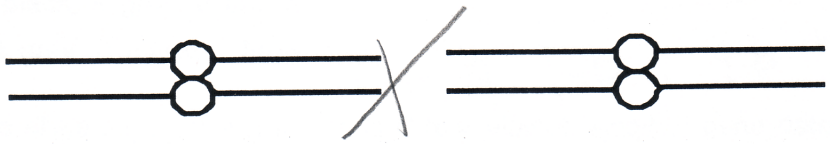
__ A. 6
__ B. 12
✓ C. 24
__ D. 48
__ E. 96

6. Which diagram most accurately shows the arrangement of homologous chromosomes during the first metaphase of mitosis?

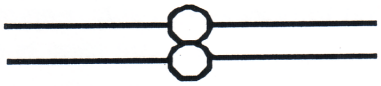
__ A.



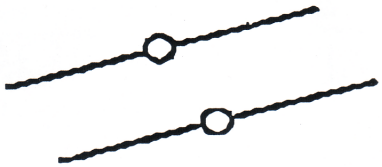
__ B.



__ C.



__ D.



7. In a haploid organism the loci *leu* and *arg* are known to be linked 30 map units apart. In a cross: *leu*$^+$ *arg* X *leu arg*$^+$, what proportion of progeny will be *leu arg*?

__ A. 0
__ B. 0.05
__ C. 0.10
__ D. 0.15
__ E. 0.30

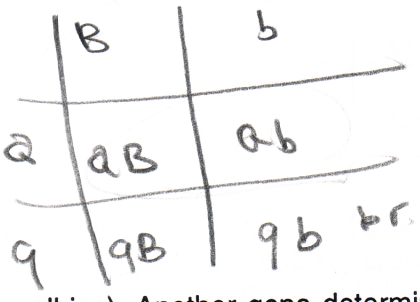
leu+ / arg — leu arg+ — 1/4 — (1/4)(30

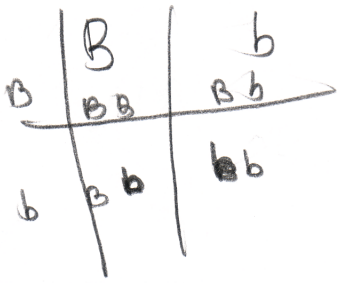
8. In birds the female is the heterogametic sex (ZW) and the male is the homogametic sex (ZZ). It is important for chicken breeders to separate male chicks from female chicks soon after birth, but sexing chickens at this age is extremely difficult. However, a Z-linked dominant allele B (barred feathers) can be used to help in this problem because the barred pattern can be seen immediately after hatching. From which cross would all the chicks of one sex be barred and all those of the other sex nonbarred?

__ A. barred male X nonbarred female
__ B. nonbarred male X barred female
__ C. nonbarred male X nonbarred female
__ D. barred male X barred female
__ E. several of the crosses above would work

9. In a certain breed of dog, the alleles *B* and *b* determine black and brown coats respectively. However, the allele *Q* of a gene on a separate chromosome is epistatic to the *B* and *b* color alleles resulting in a grey coat (*q* has no effect on color). If animals of genotype *B/b* ; *Q/q* are intercrossed, what phenotypic ratio is expected in the progeny?

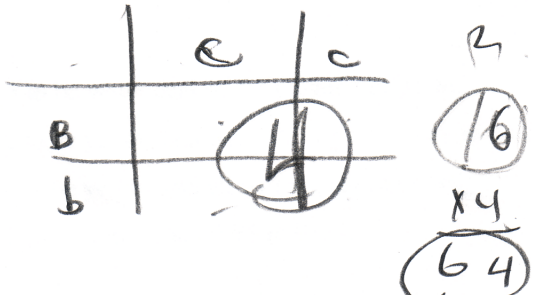
__ A. 9 grey, 3 brown, 4 black
__ B. 1 black, 2 grey, 1 brown
__ C. 9 black, 6 brown, 1 grey
__ D. 9 black, 4 grey, 3 brown
__ E. 12 grey, 3 black, 1 brown

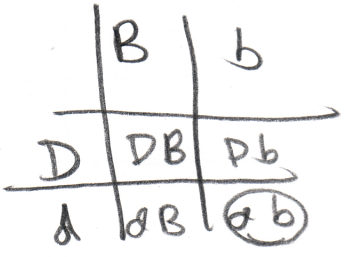



10. In mice the allele for color expression is *C* (*c* = albino). Another gene determines color (*B* = black and *b* = brown). Yet another gene modifies the amount of color so that *D* = normal amount of color and *d* = dilute (milky) color. Two mice that are *C/c* ; *B/b* ; *D/d* are mated. What proportion of progeny will be dilute brown (assume complete dominance at each locus)?

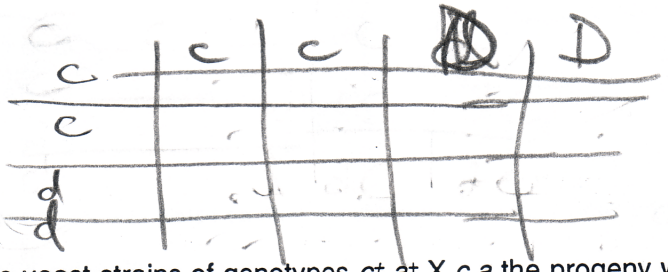
__ A. 9/16
__ B. 3/64
__ C. 9/64
__ D. 1/4
__ E. 3/16




11. A plant of genotype *C/C* ; *d/d* is crossed to *c/c* ; *D/D* and an $F_1$ is testcrossed. If the genes are unlinked, the percentage of *c/c*; *d/d* recombinants will be

__ A. 10
__ B. 20
__ C. 25
__ D. 50
__ E. 75




4/16

1/4

12. In a cross of two yeast strains of genotypes $c^+ a^+$ X *c a* the progeny were

40 $c^+$ $a^+$
36 *c* *a*
11 $c^+$ *a*
13 *c* $a^+$

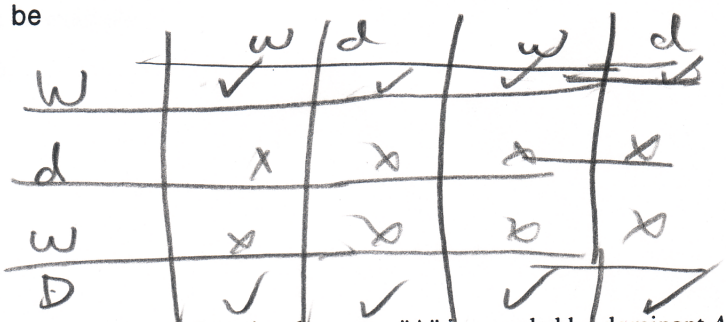
100

The frequency of recombination is

__ A. 76%
__ B. 12%
__ C. 11%
__ D. 13%
__ E. 24%

13. In maize, the genes *W* and *D* are so tightly linked that virtually no crossovers occur between them. A dihybrid *W d/w D* is testcrossed to *w d/w d*. The percent of progeny with *W-/D-* phenotype will be

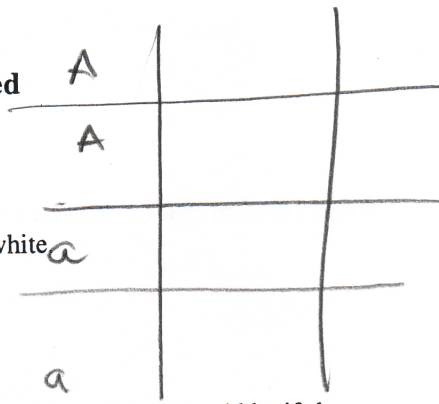
__ A. 0
__ B. 25
__ C. 50
__ D. 75
__ E. 100




8/16

14. Consider the biochemical pathway shown below. Functional enzyme "A" is encoded by dominant *A*, a non-functional enzyme is encoded by allele *a*. Likewise, functional "B" and "C" enzymes are encoded by unlinked genes and *B* and *C* alleles are dominant at the respective loci. In a cross between strain 1 (*AAbbCC*) and strain 2 (*aaBBcc*), you would expect

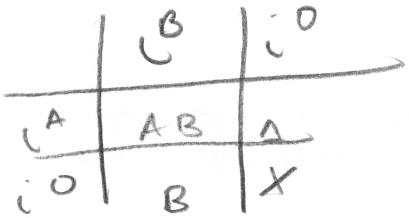
**white** —(enzyme A)→ **yellow** —(enzyme B)→ **orange** —(enzyme C)→ **red**




__ A. strain 1 to be yellow, strain 2 to be white, and all F1 progeny to be white.
__ B. strain 1 to be orange, strain 2 to be yellow and one half of F1 progeny to be white.
__ C. strain 1 to be orange, strain 2 to be yellow and all F1 progeny to be red.
__ D. strain 1 to be yellow, strain 2 to be white and all F1 to be red.

15. A woman with type B blood would naturally like to know what the possible blood types of her children would be if she mated with a type A male. What are they?

__ A. A
__ B. A, AB, O or B
__ C. A, B or AB
__ D. none of above

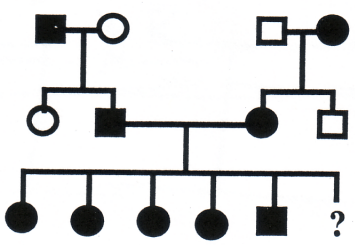



16. A bacterial histidine mutant was plated on minimal medium. A single colony grew. This must have arisen from

__ A. a suppressor mutation.
__ B. an auxotrophic mutation
__ C. a reverse mutation.
__ D. a reverse mutation or a suppressor mutation.

17. The pedigree at right concerns a rare hereditary trait. What is the probability that the sixth child will display this trait?

__ A. 1
__ B. 2/3
__ C. 1/4
__ D. 0
__ E. 3/4



18. In mice the enzyme esterase shows two forms, "fast" and "slow". A mouse from a pure line with only the fast form is crossed to a mouse from a pure line with only the slow form. The F1 all show both forms and the F2 shows 1/4 fast, 1/4 slow, and 1/2 with both. This is an example of

__ A. incomplete dominance.
__ B. complementation.
__ C. epistasis.
O D. codominance.
__ E. none of above.

19. In a human body cell (2n=46), how many DNA molecules are there in the nucleus?

__ A. many thousands
O B. 23
__ C. 46
__ D. 92
__ E. ~1 X $10^{13}$ meters

20. A red and black spotted frog is crossed to a red frog, 38 of the progeny are red and 35 are red and black spotted. This is an example of

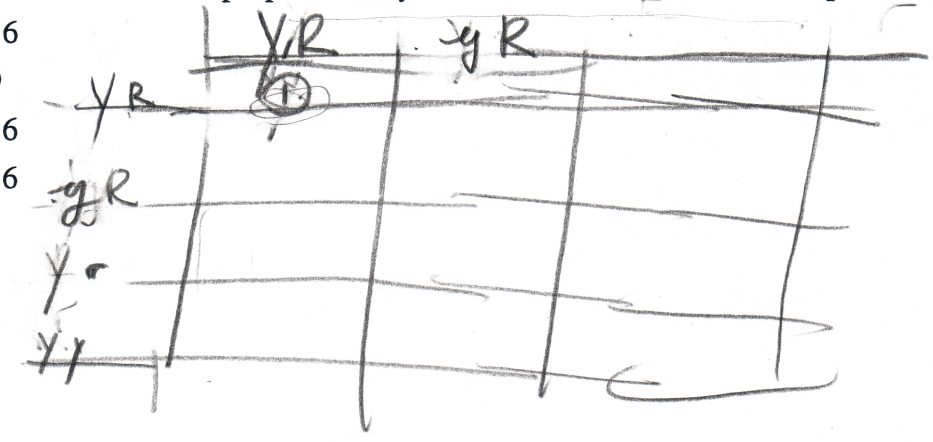
O A. two genes interacting.
__ B. codominance.
__ C. incomplete dominance.
__ D. epistasis.
__ E. a suppressor.

21. A *Neurospora* threonine auxotroph became prototrophic by a suppressor mutation 48 map units away from the original mutation. If this strain is crossed to wild-type, the percent of threonine-requiring progeny will be

__ A. 0.
✓ B. 48.
__ C. 24.
__ D. 12.
__ E. 100.

22. Mendel crossed *YY RR* (yellow wrinkled peas) with *yy rr* (green smooth peas) and selfed the F1 to obtain an F2. In the F2 what proportion of yellow wrinkled individuals were pure-breeding?

__ A. 9/16
__ B. 1/9
✓ C. 1/16
__ D. 3/16




Yy Rr

Name Kristopher Alladin Student# 307298

15

# 61.214 - Intro Genetics Midterm 2

Answer all questions directly on these 5 pages. Good luck!
Papers written in pencil can not be re-marked.

## Part I Multiple Choice Questions

1. A fish that is heterozygous at three markers is test crossed to obtain the following phenotypic ratios. AbD 632, Abd 103, aBd 651, aBD 97.

   9
   3
   3
   1

   ✓ A. The markers are all linked.
   __ B. The markers all unlinked.
   __ C. A and D are linked, B is unlinked.
   __ D. A and B are linked, D is unlinked.
   __ E. The data set is too small to determine linkage relationships.

2. Which of the following is not a mode of gene transfer in bacteria?

   __ A. Transformation
   __ B. Specialized transduction
   __ C. Generalized transduction
   ✓ D. Lysogeny
   __ E. Conjugation

3. From one $F^+$ strain the following three Hfr strains were derived, each shown with the first three markers transferred during an Hfr > $F^-$ cross:

   D A F  E B F  E C D

   Hfr 1 . . . *D A F*
   Hfr 2 . . . *E B F*
   Hfr 3 . . . *E C D*

   The order of the genes on the bacterial chromosomal circle must be which of the following? (A is shown at both ends to represent circularity. Assume that the Hfr picks up all intermediates between any two represented genes.)

   __ A. *A D C E B F A*
   __ B. *A B C D F E A*
   __ C. *A C D F E B A*
   __ D. *A E F B C D A*
   ✓ E. *A F B D E C A*

   D A F  E B F  E C D

   F A D  F B E  D C E

4. Which base composition represents a single-stranded RNA virus?

   __ A. 20% A, 20% T, 0% U, 30% G, 30% C
   __ B. 20% A, 30% T, 0% U, 20% G, 30% C
   ✓ C. 20% A, 0% T, 30% U, 20% G, 30% C
   __ D. 20% A, 0% T, 20% U, 30% G, 30% C
   __ E. 20% A, 20% T, 20% U, 20% G, 20% C

5. *E. coli* cells are put into a medium containing tritiated thymidine for one generation only. The cells are then transferred back to normal medium with nonradioactive thymidine. After one generation in the normal medium, what propotion of the cells will be labeled?

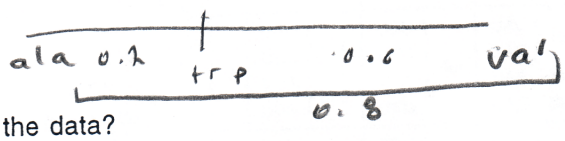
__ A. 1/16
__ B. 1/8
__ C. 1/4
__ D. 1/2
✓ E. All

6. If phage are labelled with radioactive sulfur and allowed to infect bacterial cells, the phage progeny resulting from lysis are expected

__ A. to be non-radioactive.
✓ B. to have radioactive DNA.
__ C. to have radioactive proteins.
__ D. to have radioactive DNA and proteins.
__ E. to have radioactive carbohydrates.

7. In a generalized transduction experiment, the T1 phage particles growing on *E. coli* with the genotype *val* $^+$ *ala* $^+$ *trp* $^+$ are collected and allowed to infect *E. coli* cells with the genotype *val* $^-$ *ala* $^-$ *trp* $^-$. The cotransduction frequencies are calculated for the different gene combinations:

*ala - trp* = 0.2
*ala - val* = 0.8
*val - trp* = 0.6




Which of the following is consistent with the data?

__ A. The gene order is *ala-val-trp; val* is closer to *trp* than it is to *ala*.
__ B. The gene order is *val-ala-trp; ala* is closer to *trp* than it is to *val*.
__ C. The gene order is *ala-val-trp; val* is closer to *ala* than it is to *trp*.
✓ D. The gene order is *ala-trp-val; trp* is closer to *ala* than it is to *val*.

8. The role of snRNA is

__ A. to serve as an intermediate in the decoding of genes.
__ B. to act as transporters bringing amino acids to the site of protein synthesis.
__ C. to serve as general translational components of the ribosome.
✓ D. to facilitate splicing of pre-messenger RNAs.
__ E. function as part of the RNA polymerase.

9. Which of the following acts before the others?

__ A. tRNA alignment with mRNA
__ B. Aminoacyl-tRNA synthetase
✓ C. RNA polymerase
__ D. Ribosome movement to the next codon
__ E. Amino acid chain elongation

10. Which of the following is not a component of the transcriptional system in cells?

__ A. RNA polymerase
__ B. DNA
__ C. Promoter
__ D. Shine-Dalgarno sequence
__ E. Hairpin loop

11. The following diagram shows a fragment of transcribed DNA (the upper strand is the template strand):

5'-ATTGCC-3'
3'-TAACGG-5'

The transcribed RNA is

__ A. 3'-UAACGG-5'
__ B. 5'-TAACGG-3'
__ C. 3'-AUUGCC-5'
__ D. 5'-UAACGG-3'
__ E. 5'-GGCAAU-3'

12. How many nucleotides would be expected for a gene coding for a protein with 300 amino acids?

__ A. 100
__ B. 300
__ C. 600
__ D. 900
__ E. 1200

13. A protein fragment has the following sequence: $NH_2$-*His-Met-Leu-Ile-Lys*-COOH. The DNA template strand sequence (3' → 5') would be

__ A. GUGUACAAUAUUUUU
__ B. GTGTACAATATTTTT
__ C. GTATACAATTATTTT
__ D. GUAUACAAUUAUUUU
__ E. CATATGTTAATAAAA

Second letter

| First letter | U | C | A | G | Third letter |
|---|---|---|---|---|---|
| U | UUU Phe, UUC Phe, UUA Leu, UUG Leu | UCU Ser, UCC Ser, UCA Ser, UCG Ser | UAU Tyr, UAC Tyr, UAA Stop, UAG Stop | UGU Cys, UGC Cys, UGA Stop, UGG Trp | U C A G |
| C | CUU Leu, CUC Leu, CUA Leu, CUG Leu | CCU Pro, CCC Pro, CCA Pro, CCG Pro | CAU His, CAC His, CAA Gln, CAG Gln | CGU Arg, CGC Arg, CGA Arg, CGG Arg | U C A G |
| A | AUU Ile, AUC Ile, AUA Ile, AUG Met | ACU Thr, ACC Thr, ACA Thr, ACG Thr | AAU Asn, AAC Asn, AAA Lys, AAG Lys | AGU Ser, AGC Ser, AGA Arg, AGG Arg | U C A G |
| G | GUU Val, GUC Val, GUA Val, GUG Val | GCU Ala, GCC Ala, GCA Ala, GCG Ala | GAU Asp, GAC Asp, GAA Glu, GAG Glu | GGU Gly, GGC Gly, GGA Gly, GGG Gly | U C A G |

14. A tRNA with the anticodon 3'—ACC—5' would carry the amino acid

__ A. phenylalanine
__ B. tyrosine
__ C. serine
__ D. threonine
__ E. tryptophan

15. For the *lac* operon, a promoter mutation ($P^-$) results in

__ A. No transcription
__ B. Inducible transcription
__ C. Transcription but no translation
__ D. No translation
__ E. Constitutive transcription

16. A partial diploid of genotype $I^- P^+ O^+ Z^+ / I^+ P^+ O^+ Z^-$ will show

__ A. Inducible production of repressor
__ B. Inducible production of 1-galactosidase
__ C. Constitutive production of 1-galactosidase
__ D. No production of 1-galactosidase
__ E. Constitutive production of lactose

17. The rare enol form of thymine pairs with guanine. If a thymine enolization occurs during replication, what would be the mutational event?

__ A. CG to AT (transversion)
__ B. TG to CA (transition)
__ C. TA to CG (transversion)
__ D. TA to CG (transition)
__ E. TA to AT (reversal)

18. A mutation results in an abnormally short protein. The mutation was most likely of a type called

__ A. missense
__ B. nonsense
__ C. antisense
__ D. frameshift
__ E. deletion

19. The spontaneous reversion rate for a chemically induced mutation is $1 \times 10^{-8}$. For nitrous acid the rate is $0.9 \times 10^{-8}$, and for proflavin it is $2 \times 10^{-5}$. What change was involved in the *original* mutation?

__ A. Frameshift
__ B. AT to CG
__ C. AT to GC
__ D. GC to AT
__ E. GC to TA

## PART II Short Answer – make your answers very short!

1/1 20. The sequence of amino acids along a polypeptide is called the primary structure.

0/2 21. How is the old vs the new strand identified during mismatch repair in *E. coli* ?
DNA degradation happens over time.

0/1 22. What is unusual about the DNA molecule shown at right?
Unable to tell the difference between A=T bonds and C≡G bonds.

0/1 23. Given the following genetic map, what proportion of progeny would be phenotypically abde from a testcross of individual ab/AB, de/DE ?

A B D E

2 m.u. 10 m.u.

20%

1/1 24. What would be the approximate size of the mature transcript from a gene that has three exons 700, 300 and 1000 base pairs in size, and two introns of 300 and 250 base pairs? 700 + 300 + 1000 = 2000 bps

0/2 25. You want to know whether a new chemical causes base substitution mutations using an Ames test. What two controls would you do, in addition to placing the filter disk containing the new chemical onto the medium that has been inoculated with your Ames tester strains?
① No air intake (ie controlled air because air contains germs)
each strain has to be clean and unmutated.

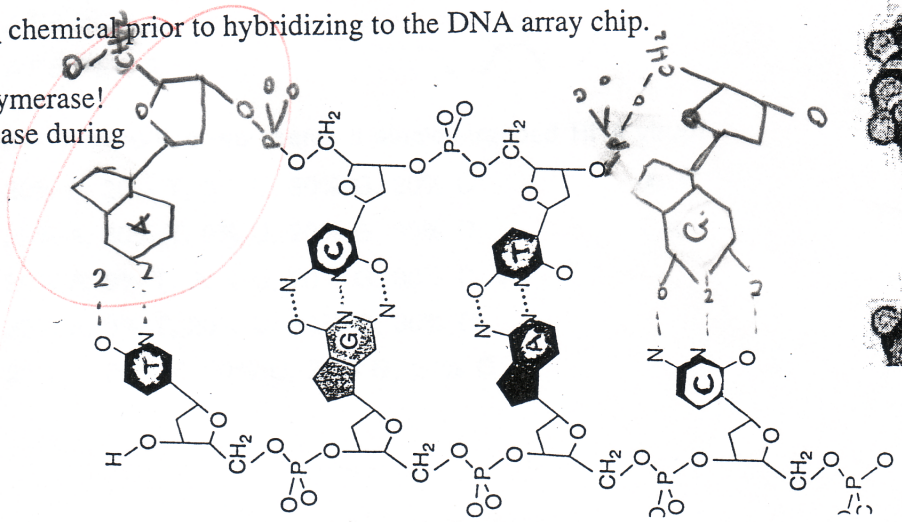
0/1 26. rRNA is a component of proteins.

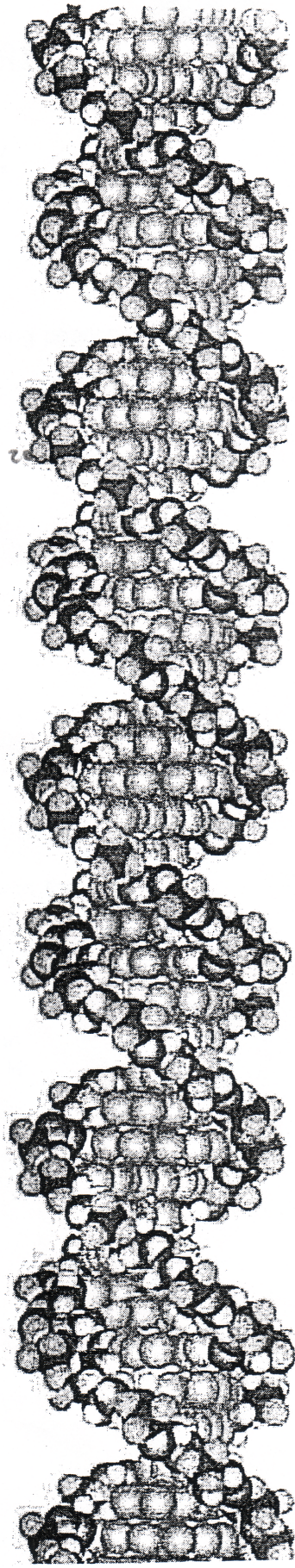
1/1 27. Okazki fragments are small segments of single stranded DNA synthesized as part of the lagging strand.

28. In a microarray experiment the following steps are taken (fill in blanks),

0/3 DNA is extracted, from which RNA is synthesized and then labelled with a radioactive chemical prior to hybridizing to the DNA array chip.

1/2 29. Be a DNA polymerase! Draw in the next base during DNA synthesis.





**61.214 Practise Final, 45 minutes**

**1)** Which of the options shown at right would correctly complete the table shown below?. Note that the left column for each option is "with IPTG" and right column is with "no IPTG".

| | beta galactosidase activity | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | with IPTG | no IPTG | a) | | b) | | c) | | d) | | e) | |
| $i^- p^+ o^+ z^+$ | | | | | ++ | | ++ | | - - | | - - | ++ |
| $i^+ p^+ o^c z$ | | | | | ++ | | ++ | | ++ | | - - | ++ |
| $i^+ p^+ o^c z^- / i^+ p^+ o^+ z^+$ | | | | | ++ | | + - | | ++ | | + - | - + |
| $i^+ p^+ o^+ z^- / i^+ p^+ o^c z^+$ | | | | | + - | | ++ | | - - | | + + | ++ |

**2)** GC → CG mutation is called

a. nonsense b. missense c. frameshift. d. transition. e. transversion.

**3)** The recessive mutations *o* (orange coat colour), *br* (brown eye colour), and *fl* (fluffy eyebrows) identify three autosomal genes in wombats. The following progeny were obtained from a test cross of females heterozygous for all three genes. Draw a genetic map.

| | |
|---|---|
| orange, fluffy | 23 |
| orange, fluffy, brown | 18 |
| orange, brown | 222 |
| orange | 230 |
| fluffy | 235 |
| fluffy, brown | 226 |
| brown | 20 |
| wildtype | 26 |

**4)** In animals and fungi, extranuclear genes are in the

a. endoplasmic reticulum. b. nuclei. c. chloroplasts. d. mitochondria. e. answers c and d.

**5)** From the following plating data on progeny of the cross Hfr++++ x $F^- A^- B^- C^- D^-$ determine the Hfr marker entry sequence (+ means colonies detected).

| | supplements | | | |
|---|---|---|---|---|
| | B C D | A C D | A B C | A B D |
| Time(min) | | | | |
| 2 | - | - | + | - |
| 4 | - | - | + | + |
| 6 | + | - | + | + |
| 8 | + | + | + | + |

The correct marker order of entry is (first at left):

a. B A C D b. A D C B c. D C A B d. B D C A e. C B D A

**6)** In humans 2n = 46. What proportion of human sperm will have centromeres all of which are from the man's father?

a. $(1/2)^{23}$ b. $(1/4)^{46}$ c. $1/2^{46}$ d. 1/2 e. Nearly all

**7)** Assume that a linear DNA molecule has one replication origin exactly in the middle of its length. Draw the DNA at a time when it is half replicated. Include representations of DNA polymerase, leading and lagging strands, and label all 5' and 3' ends.

**8)** The horse, *Equus caballus*, has 32 pairs of chromosomes while the donkey (*Equus asinus*) has 31 pairs of chromosomes. How many chromosomes would be expected in the somatic tissue of mule (a horse x donkey hybrid)?

**9)** Define the following: microsatellite; phylogenetics; Hardy-Weinberg equilibrium; ploidy