

Matching 2pts each: Indicate which term/concept on this page best fills in the **BLANK** in the statement on the facing page by placing the **LETTER** representing each term/concept in the blank in the sentence on the facing page. Note: there is one best term/concept for each **BLANK**, however, there are more terms/concepts on this page than needed.

A	Alfred Hershey
B	alkaptonuria
C	Archibald Garrod
D	codon
E	colonies
F	complementary
G	duplex DNA
H	genes
I	genetic code
J	genome
K	homogentisic acid
L	inborn errors of metabolism
M	Martha Chase
N	metabolic pathway
O	metabolite
P	mutant
Q	mutation ✓
R	phage T2
S	phenylalanine hydroxylase
T	phenylketonuria
U	pleiotropy
V	polarity (of DNA or RNA)
W	polypeptide chain
X	protein folding
Y	proteome
Z	reading frame
AA	replication
BB	ribosomal RNA
CC	ribosome
DD	<i>Streptococcus pneumoniae</i>
EE	template
FF	trait
GG	transcript
HH	transcription
II	transformation
JJ	tRNA

KEY

Matching 2pts each: Indicate which term/concept on this page best fills in the BLANK in the statement on the facing page by placing the LETTER representing each term/concept in the blank in the sentence on the facing page. Note: there is one best term/concept for each BLANK, however; there are more terms/concepts on this page than needed.

A	Alfred Hershey
B	alkaptonuria
C	Archibald Garrod
D	codon
E	colonies
F	complementary
G	duplex DNA
H	genes
I	genetic code
J	genome
K	homogentisic acid
L	inborn errors of metabolism
M	Martha Chase
N	metabolic pathway
O	metabolite
P	mutant
Q	mutation ✓
R	phage T2
S	phenylalanine hydroxylase
T	phenylketonuria
U	pleiotropy
V	polarity (of DNA or RNA)
W	polypeptide chain
X	protein folding
Y	proteome
Z	reading frame
AA	replication
BB	ribosomal RNA
CC	ribosome
DD	<i>Streptococcus pneumoniae</i>
EE	template
FF	trait
GG	transcrip
HH	transcription
II	transformation
JJ	tRNA

KEY

1. A Q in the third position of a codon is often silent.
2. Homogentisic acid is the metabolite that turns black in the urine of individuals with β.
3. The two strands of duplex DNA have opposite V.
4. Using Garrod's terminology, PKU and alkaptonuria are examples inherited diseases called L.
5. The structure of R can be described as a hypodermic needle, which injects its genetic material into its bacterial host.
6. The mutation in phenylalanine hydroxylase is said to show U because it can affect pigmentation in addition to cognitive development.
- 7 and 8. A and M conducted their famous "waring blender" experiment to demonstrate that DNA was the genetic material of bacteriophage, T2.
9. tRNAs and ribosomal RNAs are the products of H that do not encode proteins. HH
10. The Y of an organism includes all proteins expressed in by that organism.
11. One FF can be affected by one gene, multiple genes, or by genes and the environment.
12. If the percentage of Adenine plus Guanine equals the percentage of Cytosine plus Thymine in the genome of a bacteriophage, it's structure is most likely G.
13. Although the J of humans is ten times larger than that of fruit flies, it appears to contain only 3 times as many genes.
14. A ribosome is composed of BB and protein.
15. A W composed entirely of phenylalanine would be synthesized by in vitro translation of an RNA that contained only uracil.
- 16 and 17. HH of DNA produces RNA whereas AA of DNA produces DNA.
18. R and S refer to the trait of *S. pneumoniae* E observed on the surface of a Petri plate. c*
19. In a RNA that folds back on itself to form a hairpin (also called a "stem-loop structure), sequences in the stem of the hairpin are F to each other.
20. An individual with PKU carries two copies of a P form of the *PAH* gene.

21. (10 Points) What percentage of your final grade is determined by:

a) weekly homework? 20%

b) weekly tests? 60%

2 PTS EACH

c) midterm exam? 0

d) cumulative final exam? 20%

e) term paper? 0

22. (10 Points) How many points will you receive for your homework if you turn in notes that receive a passing grade on:

a) The Thursday of the lecture on the assigned reading, before lecture begins? 11

b) Before 4 PM on the Friday following the lecture on the assigned reading? 10

2 POINTS

c) Before 4 PM on the Monday following the lecture on the assigned reading? 8.5

EACH

d) The Tuesday of the test on the assigned reading before the test begins? 7.5

e) Anytime after the test on the assigned reading but before the final exam? 5.0

23. How will you determine what the correct answers are to a test and what should you do if you disagree with the score you received for a test and you want to have the test re-evaluated?

Look at the answer key posted on the course website,
If a regrade is requested, write out your argument
and turn the test in ^{for a regrade,} ~~to me.~~

10 POINTS CORRECT

5 POINTS CLOSE

0 POINTS OTHERWISE

24. (10 Points) A nucleic acid is made that has a random sequence of 30 % Guanine, 30 % Cytosine and 40% Thymine.

a) What is the structure of this nucleic acid?

most likely ss DNA

b) If this nucleic acid was used as a template for the synthesis of RNA, what would be the percentage of A, G, C, and U bases in the RNA produced?

30% C, 30% G, 40% A

If you used the RNA from (b) in an *in vitro translation* reaction to synthesize polypeptides, what is the expected frequency of the following amino acids in those polypeptides?

c) threonine?

A

2 POINTS EACH

d) asparagine?

0.5 POINTS FOR EFFORT

e) arginine?

on c, d, + e

c) ACA

$$\left(\frac{4}{10}\right)\left(\frac{3}{10}\right)\left(\frac{4}{10}\right)$$

ACC

$$\left(\frac{4}{10}\right)\left(\frac{3}{10}\right)\left(\frac{3}{10}\right)$$

ACG

$$\left(\frac{4}{10}\right)\left(\frac{1}{10}\right)\left(\frac{3}{10}\right) \leftarrow$$

$$\frac{48}{1000} + \frac{36}{1000} + \frac{36}{1000} = \frac{120}{1000} = 0.12$$

d) AAC

$$\left(\frac{4}{10}\right)\left(\frac{4}{10}\right)\left(\frac{3}{10}\right) = \frac{48}{1000} = 0.048$$

e) CGC

$$\left(\frac{3}{10}\right)^3 = \frac{27}{1000}$$

~~CGA~~

CGG

$$\left(\frac{2}{10}\right)^3 + \left(\frac{3}{10}\right)^3 = \frac{27}{1000} + \frac{27}{1000} = \frac{54}{1000} = 0.054$$

AGA $\frac{4 \cdot 3 \cdot 4}{1000} = \frac{48}{1000}$

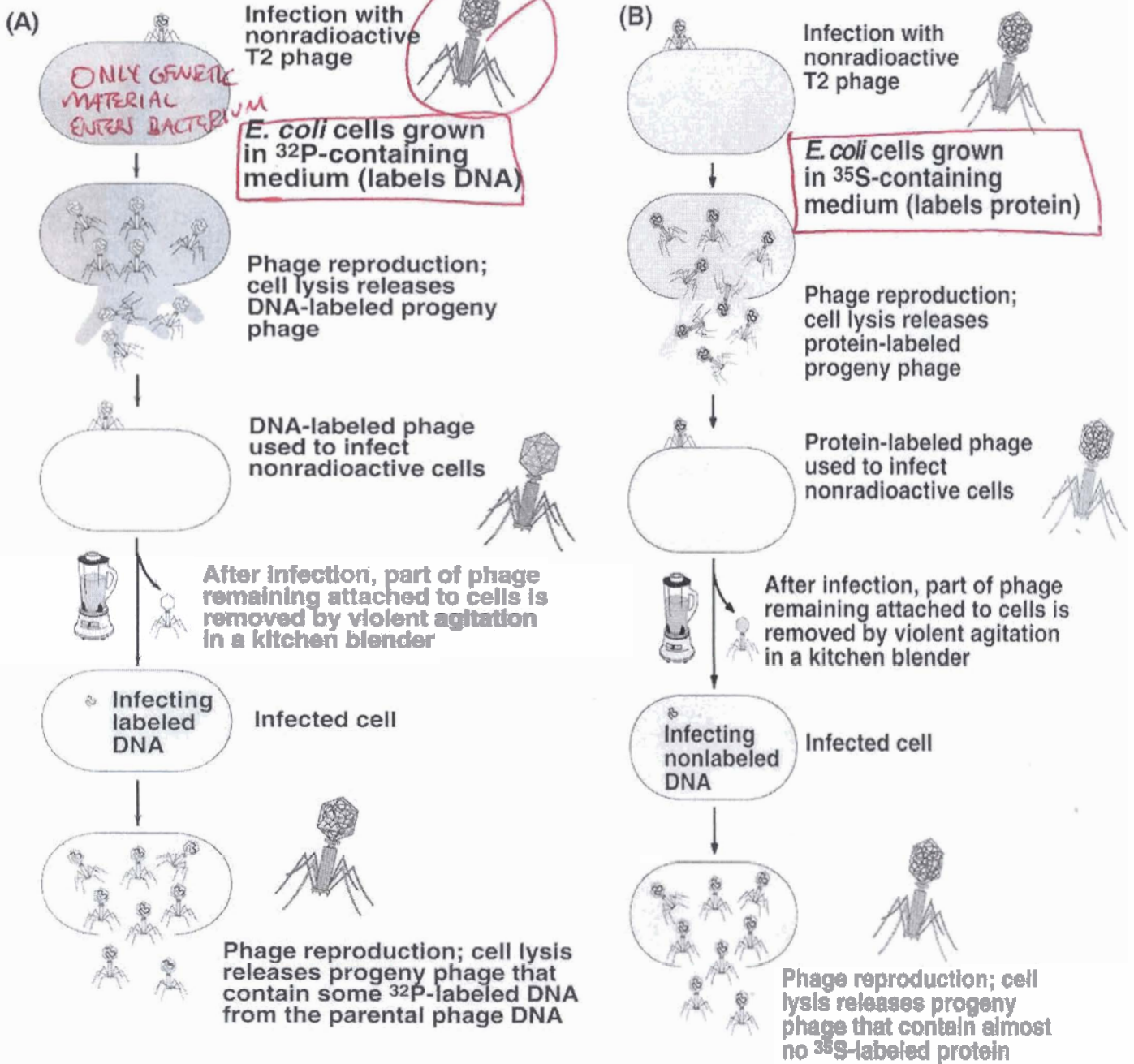
AGG $\frac{4 \cdot 3 \cdot 3}{1000} = \frac{36}{1000}$

$\frac{48}{1000} + \frac{36}{1000} = \frac{84}{1000} = 0.084$

$$\frac{81}{1000} = 0.081$$

25. (10 Points) Describe the structure of bacteriophage T2 and the process by which the genetic material of the bacteriophage enters the bacterium. Which radioactive elements did Hershey and Chase use to follow bacteriophage T2's DNA and protein. Indicate which label was specific for which phage component.

*head mostly DNA
remainder mostly protein*



10 POINTS - CORRECT
 8 POINTS - CLOSE
 6 POINTS - NOT SO CLOSE
 4 POINTS - SOME EFFORT
 1

26. (10 Points) The coding sequence in the mRNA for amino acids 1 through 10 of human beta globin (part of hemoglobin, the oxygen carrying protein in red blood cells) is shown below.

5' AUG GUG CAC CUG ACU CCU GAG GAG AAG UCU 3'

a) Write the dsDNA sequence that corresponds to this RNA sequence.

5' ATGGTGCACCTGACTCCTGAGGAG AAGTCT 3'
 3' TACCA CGTGGACTGA GGA CTC CTC TTCAGA 5'

b) Write the sequence of the first 10 amino acids in the beta globin polypeptide.

M-V-~~R~~-L-T-P-E-E-K-S
 H

c) A mutant form of beta globin is discovered in which the underlined C has been changed to a G. Write the sequence of the first 10 amino acids in the beta globin polypeptide encoded by this mutant mRNA.

M-V-Q-L-T-P-E-E-K-S

d) Another mutant form of beta globin is discovered in which underlined C has been deleted. What is the consequence of this mutation with respect to the sequence of the beta globin polypeptide?

Frameshift mutation - mutant polypeptide produced is:

M-V-H-STOP

e) Another mutant form of beta globin is discovered. The first ten amino acids of the mutant polypeptide is shown below. The mutation is due to the insertion of a single nucleotide into the sequence of the beta globin mRNA shown in (a). Write the sequence of the first 31 nucleotides in the mRNA of this mutant.

M-V-H-L-T-P-G-G-E-V
 AUG - GUG - CAC - CUG - ACU - CCU - GGA - GGA -
 -GAA - GUC - U 3'
 Insertion

5' AUG - GUG CAC CUG ACU CCU GGA GGA GAA GUC U 3'
 INSERTION OF 1 G