Biology 113 Closed Book Take-Home Exam #1 – Information

There is no time limit on this test, though I have tried to design one that you should be able to complete within 3 hours. Counting this cover page, there are 6 pages in Exam 1 (plus 1 Excel file) including the data gallery. You are not allowed to look at someone else's test, use your notes, old tests, the internet, any books, nor are you allowed to discuss the test with anyone until all exams are turned in no later than **10:30 am on Monday 12 Feb**. Print out your answers embedded with the questions, but you do not have to print the data gallery. Black and white print is fine. If you turn in your hardcopy answers late, you will lose a letter grade for each day you are late. The **answers to the questions must be typed in this Word file** unless you are asked to draw, or you want to use scratch paper to show your work (staple to your exam). If you do not write your answers in the appropriate location, I may not find them. Tell me where to look if you put your answer at the back of your test.

I have provided you with a "Data Gallery" in the form of figures and tables. To choose a figure in support of your answer, simply state Figure #x. Do not assume how many of the data images you will use, or not use. **Simply choosing the data is not sufficient support for your answer. You must explain the significance of the data and how they support your answer.** *I have given you word limits so be concise.*

-3 pts if you do not follow this direction.
Please do not write or type your name on any page other than this cover page.
Merge all your pages (INCLUDING extra pages) together when finished with the exam.

Name (please type):

Read the pledge and sign if you can do so with honor:

_____

On my honor I have neither given nor received unauthorized information regarding this work, I have followed and will continue to observe all regulations regarding it, and I am unaware of any violation of the Honor Code by others.

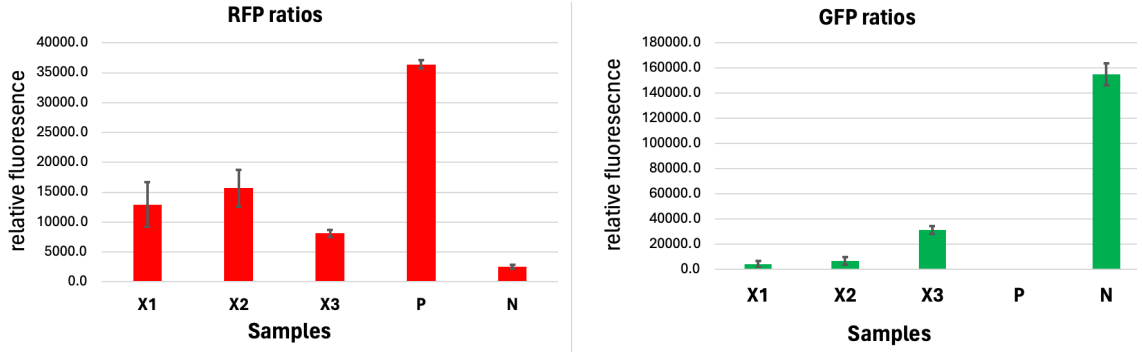
How long did this exam take you to complete? _____

lab blended with textbook questions:

15 pts.

1) Open the file named Exam1_S24.xlsx and generate two graphs, one for the GFP and one for RFP data similar to the way you did in lab. Insert both graphs into the space provided.

a)



b) What was sample X_2's SEM for the RFP data 3100 and the GFP data 3061?

c) Rank the three experimental promoters from strongest first to weakest last based on their RFP results: X1 = X2 > X3 (overlapping error bars)

Textbook questions

40 pts.

2) DNA is the heritable material.

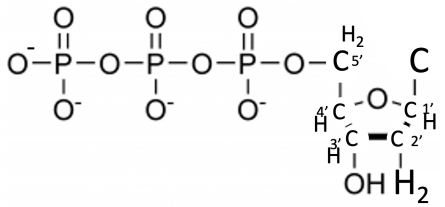
a) Hershey and Chase published a classic experiment. What was their main conclusion? Support your answer with data. (30 words maximum)

Protein not heritable material, Fig 22 or 9 show protein outside cells

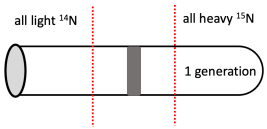
b) What additional data did Hershey and Chase report that further supported their interpretation even though their primary figure did not contain these additional data? (30 words maximum)

progeny phage had ^{32}P, not ^{35}S

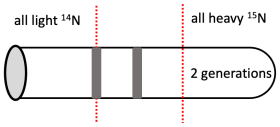
c) Draw dCTP in the space below. Include all atoms except for the C base. Number the carbons in the sugar. You can draw by hand and insert a photo, or draw on PPT and take a screenshot. Make sure the image is big enough for me to see, and your handwriting is legible.



d) For each of the wrong hypotheses about DNA replication, draw one banding pattern that disproved each hypothesis and state which cell generation provided the definitive results. For your drawings, assume the salt gradient was higher density on the right and lower density on the left.



conservative



mosaic

e) What major conclusion was drawn based on the data in Figure 24 from the data gallery? (30 words maximum)
Hypomethylation can activate genes silenced by epigenetic regulation.

25 pts.

3) Central Dogma

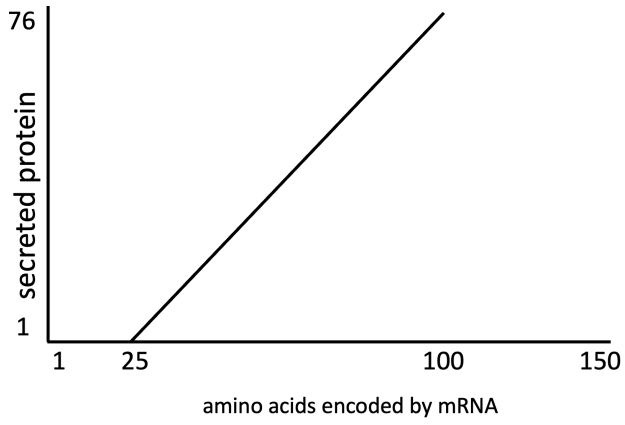
a) List the 3 types of RNAs and describe the primary role for each. You must support each RNA with data from one figure. (30 word maximum for each RNA)

1) rRNA responsible for translation (#8, #13 or #25)
2) tRNA carries amino acids as shown for leucine in #14
3) mRNA tells ribosome what proteins to make as in #13 with viral mRNA bound to ribosome

b) Translate this ORF:

5′ UCGUAUGGCGACGUUAUUUGCGUGUGAGUCCUAGGGGACA 3′
MATLFACES

c) In the space below, draw a dot plot comparing a secreted protein (Y-axis) with the protein as it was encoded by the mRNA (X-axis). The secreted protein has its last 50 amino acids removed and the mRNA contains 150 codons. Be sure to provide a numeric scale on both axes.

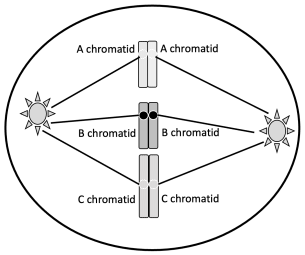


d) Since steroids can penetrate every cell in your body, why don't all cells alter their gene activity in response to steroids? Support your answer with data. (30 words maximum)
Not every cell makes a receptor; those with receptor bind to steroid in cytoplasm and they move to nucleus to function as transcription factor (#17).

20 pts.
4) Patterns of inheritance
a) Make believe genetics problem: hairy palms are encoded by a dominant allele (H) and three ears are encoded by a recessive allele (t). A woman (Shireen) with hairy palms and three ears had a child from her first marriage with smooth palms. Shireen remarries and has a child with her new husband (Reginald) who has smooth palms and 2 ears, though Reginald's first child from his previous marriage had three ears. What is the probability of Shireen and Reginald having a daughter with hairy palms and 2 ears?
____1/8_____ answer in fraction format Show your work for partial credit.

b) Make believe genetics problem: A dominant, sex-linked trait has been discovered that produces backwards elbows (B). A pregnant woman has regular elbows but her husband has backwards elbows. What is the probability of them having a son with regular elbows or a daughter with backwards elbows?
_____1_____ answer in fraction format Show your work for partial credit.

c) Draw a picture of one nucleus from a typical diploid animal cell that contains only 3 different chromosomes (called A, B & C) when this nucleus is metaphase II. Label all chromosomes and chromatids.



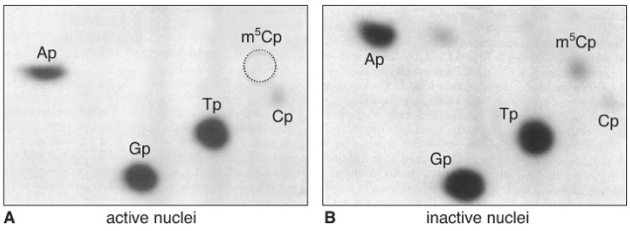
d) Generate a numbered list of processes that generate diversity in gametes. (30 words maximum for each process)

1. Independent assortment of chromosomes

2. Segregation of chromosomes and chromatids
3. Recombination of chromatids during prophase I

Data Gallery

1



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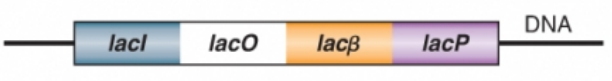
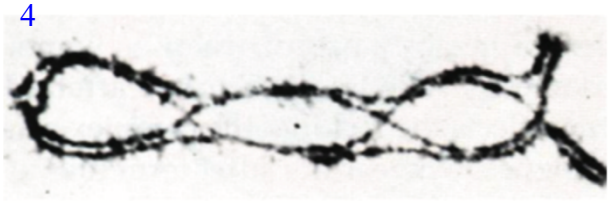


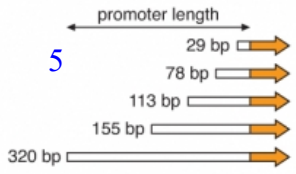
3

plant number	smooth pea	wrinkled pea	plant number	yellow pea	green pea
1	45	12	1	25	11
2	27	8	2	32	7
3	24	7	3	14	5
4	19	10	4	70	27
5	32	11	5	24	13
6	26	6	6	20	6
7	88	24	7	32	13
8	22	10	8	44	9
9	28	6	9	50	14
10	25	7	10	44	18
totals	336	101	totals	355	123

4

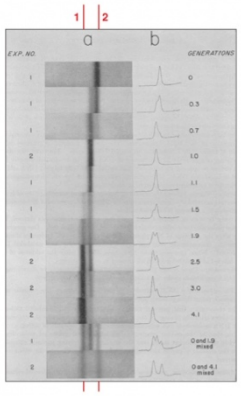


5



doubling time	drug resistant
no growth	none
5 hours	none
5 hours	none
3 hours	yes
3 hours	yes

6



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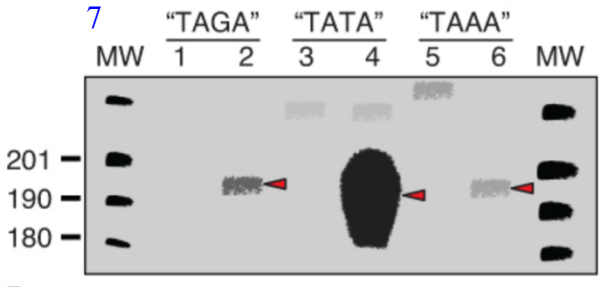
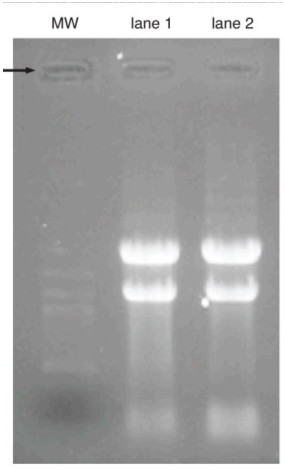


8



9

sample source	extracellular	intracellular
^{35}S-Protein Figure 1.8	~80%	~20%
^{32}P-DNA Figure 1.8	~30%	~70%
^{35}S-Protein refined experiment	~99%	~1%
^{32}P-DNA refined experiment	~30%	~70%

10

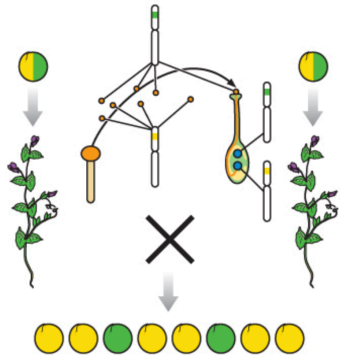
position #	1	2	3	4	5	6	7
A	−6.64	1.84	−6.64	0.84	1.26	−6.64	−0.72
C	−6.64	−6.64	−0.37	−6.64	−6.64	−6.64	−6.64
G	−0.37	−6.64	−6.64	1.18	−0.37	−6.64	1.92
T	1.57	−6.64	1.57	−6.64	−0.72	1.84	−6.64

11

YySs × YySs

pollen genotypes	egg genotypes YS	Ys	yS	ys
YS	YYSS	YYSs	YySS	YySs
Ys	YYSs	YYss	YySs	Yyss
yS	YySS	YySs	yySS	yySs
ys	YySs	Yyss	yySs	yyss
F_2 seeds	315	101	108	32

12



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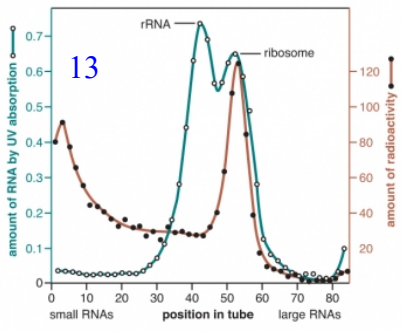
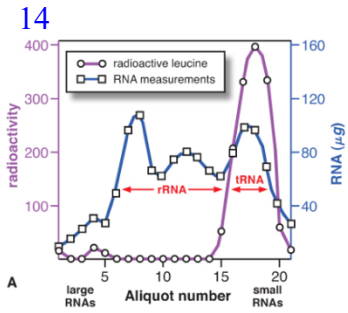


14



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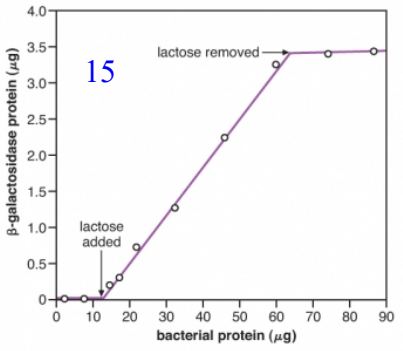
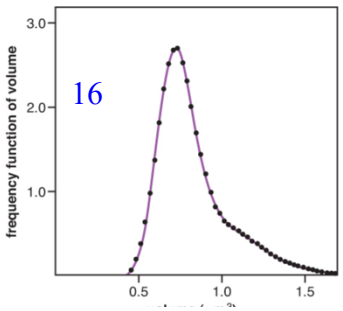


16



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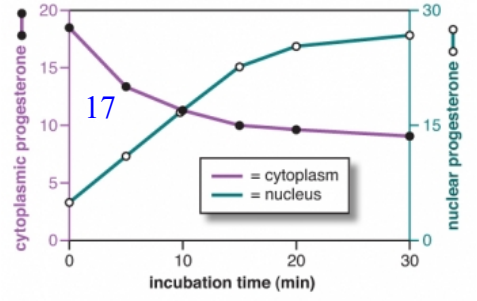
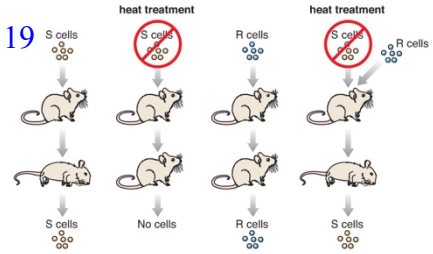


18

second base in codon

first base in codon	U	C	A	G
U	UUU phe F UUC phe F UUA leu L UUG leu L	UCU ser S UCC ser S UCA ser S UCG ser S	UAU tyr Y UAC tyr Y UAA stop UAG stop	UGU cys C UGC cys C UGA stop UGG trp W
C	CUU leu L CUC leu L CUA leu L CUG leu L	CCU pro P CCC pro P CCA pro P CCG pro P	CAU his H CAC his H CAA gln Q CAG gln Q	CGU arg R CGC arg R CGA arg R CGG arg R
A	AUU ile I AUC ile I AUA ile I AUG met M	ACU thr T ACC thr T ACA thr T ACG thr T	AAU asn N AAC asn N AAA lys K AAG lys K	AGU ser S AGC ser S AGA arg R AGG arg R
G	GUU val V GUC val V GUA val V GUG val V	GCU ala A GCC ala A GCA ala A GCG ala A	GAU asp D GAC asp D GAA glu E GAG glu E	GGU gly G GGC gly G GGA gly G GGG gly G

19



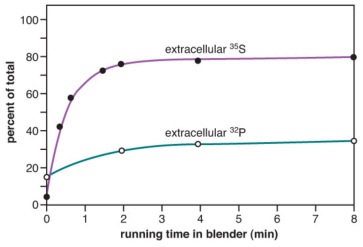
20

```
V-T7     5′...TAAACACGGTACGATGTACCACATGAAACGACAGTGAGTC... 3′
V-fd     5′...GCTTCTGACTATAATAGACAGGGTAAAGACCTGATTTTTG... 3′
V-SV40   5′...ATTGCAGCTTATAATGGTTACAAATAAAGCAATAGCA..... 3′
V-1      5′...ACTGGCGGTGATACTGAGCACATCAGCAGGACGCACTGAC... 3′
B-tRNA   5′...GTCATTTGATATGATGCGCCCCGCTTCCCGATAAGGAGC ... 3′
B-Lac    5′...TCCGGCTCGTATGTTGTGTGGAATTGTGAGCGGATAACAA... 3′
```

21

genotype	– lactose	+ lactose
$I^+ O^+ \beta^+ P^+$	1	100
$I^- O^+ \beta^+ P^+$	100	100
$I^+ O^+ \beta^+ P^+ / I^+ O^+ \beta^+ P^+$	1	240
$I^D O^+ \beta^+ P^+$	1	1
$I^D O^+ \beta^+ P^+ / I^+ O^+ \beta^+ P^+$	1	2
$I^+ O^- \beta^+ P^+$	<1	<1
$I^+ O^- \beta^+ P^+ / I^+ O^+ \beta^+ P^+$	1	100

22



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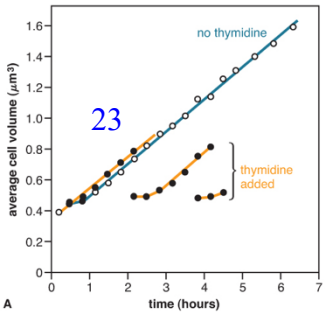

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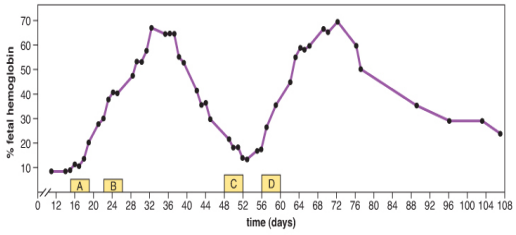
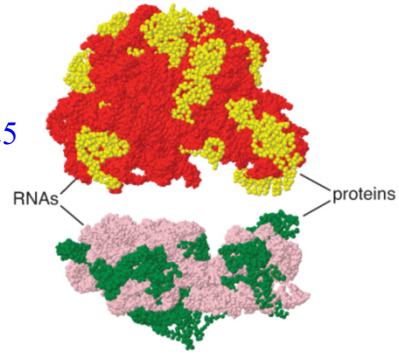


25



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