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 7 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 26 Sept**. 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? _____

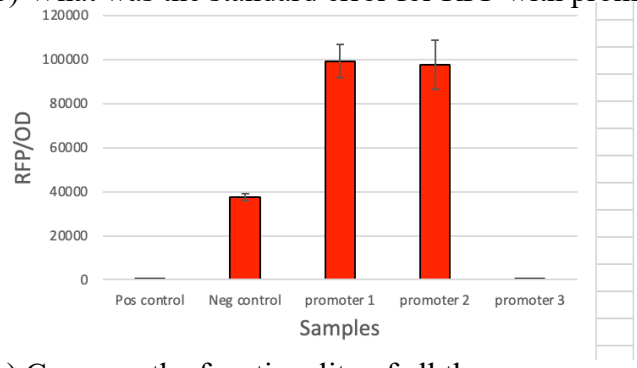
lab blended with textbook questions:

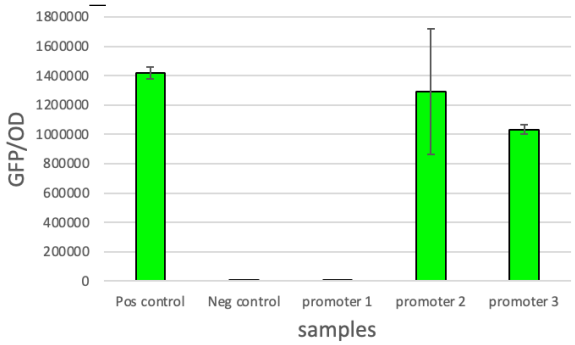
15 pts.

1)

a) Open the Excel file called "Testing3Promoters.xlsx". Process the data and produce two separate graphs of average RFP per cell density and average GFP per cell density. Include standard error bars in your graphs. Be sure to process the Blank data properly. Take a screenshot of your two graphs and **insert image(s) in the space below.**

b) What was the standard error for RFP with promoter #2?_ 11234





c) Compare the functionality of all three new promoters based on your graphs. (25 words maximum per promoter)

promoter 1: points towards RFP, stronger than negative control, equals promoter 2

promoter 2: points towards RFP and GFP (dual), stronger than negative control (RFP), equals promoter 1 (RFP), equals positive control and promoter 3 (GFP)

promoter 3: points towards GFP, weaker than positive control, matches promoter 2 (GFP)

Textbook questions

25 pts.

2)

a) Summarize two best experiments that contributed to the consensus understanding of DNA as the heritable material. Choose a figure first then explain how it contributed to our understanding. (30 words maximum per experiment)

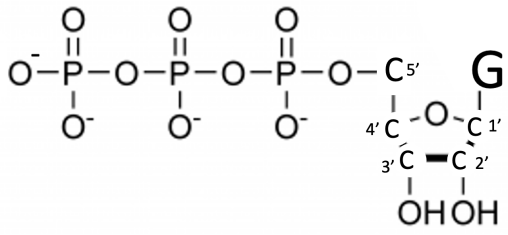
1) #8; Avery's purification of S factor that was chemically similar to DNA

2) #9; Hershey and Chase proving proteins were not the heritable factor

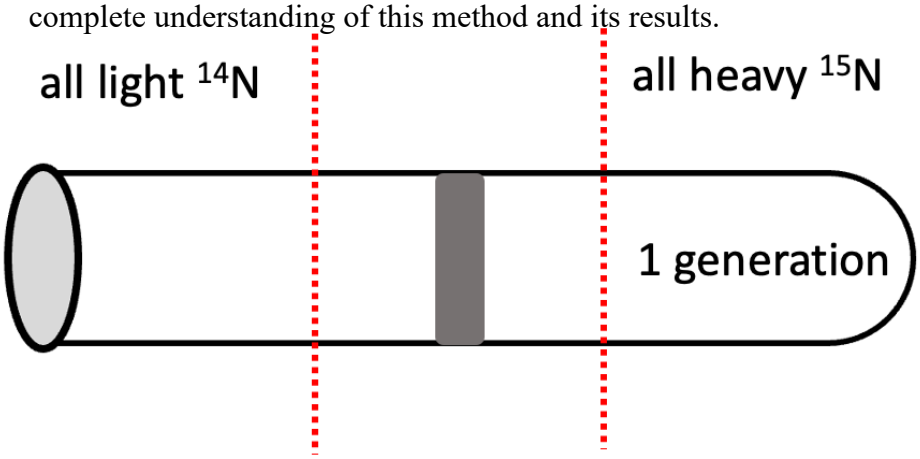
Cannot choose #19 → Griffith thought it was protein

b) Draw GTP in the space below. Include all atoms except for the G 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.

H atoms not included to emphasize 2' and 3' atoms, Hs on Cs required for full credit



c) Draw the banding pattern at only <u>one</u> time point Meselson and Stahl used which disproved the conservative model of DNA replication. You must label your diagram to demonstrate your complete understanding of this method and its results.



time point:__1 generation

24 pts.

3)

a) How does a steroid receptor "know" where to bind on a promoter? (30 word maximum)

With steroid bound, moves to nucleus and binds to specific DNA sequence based on shape.

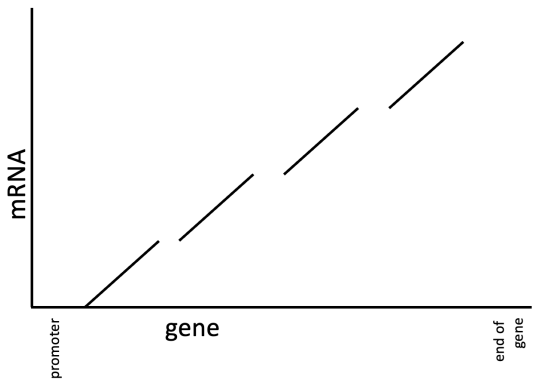
b) Translate this ORF:

5′ UUAACAAUGUAUUCUACCGAACCGCACGAGAAUUAGUGACGACUAAUA 3′

M Y S T E P H E N *

c) In the space below, draw a dot plot comparing a gene containing a promoter with its mRNA when the gene contains 3 introns and the final protein remains in the cell's cytoplasm.

Nothing to draw for staying in cytoplasm

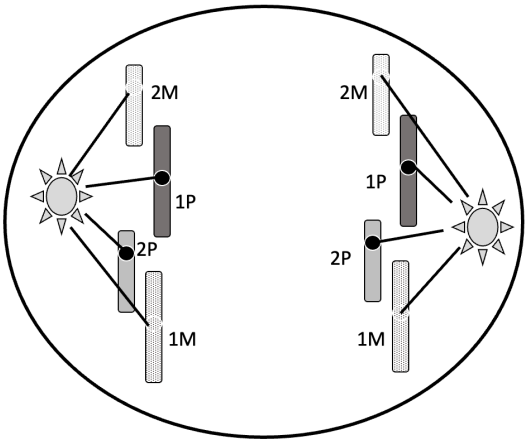


12 pts.

4) Here are some genetics problems to solve.
a) We know that Huntington's disease (HD) is caused by a dominant allele and that it is extremely rare in the overall population. Bob's father had HD and Bob wants to have children but Bob doesn't know if he carries the HD allele. What is the probability of Bob having a daughter with HD? __1/8_____ answer in fraction format Show your work for partial credit.
½ Bob is Hh, * ½ child inherits H, * ½ daughter

b) Having ears on your knees is a rare recessive trait. Having a belly button on your back is extremely rare and only happens if a person is homozygous. Leroy's mother had a belly button on her back and Leroy has ears on his knees. His father-in-law has ears on his knees too and his wife Thu has a belly button on her back. What is the probability Leroy and Thu would have a son with ears on his knees and a belly button on his back or a daughter with normal knees and normal belly button location? __1/4_____ answer in fraction format Show your work for partial credit.
Leroy eeBb x Eebb Thu: (½ boy * ¼ eebb) + (1/2 girl * ¼ EeBb) = ¼ (2/8)

12 pts.
5)
a) Draw a picture of a diploid cell that contains only two different chromosomes (numbered 1 & 2) when this cell is in telophase of mitosis. Number all chromosomes/chromatids.



b) How does prophase I produce diversity in the children of two parents? Use the terms alleles and genes properly in your answer. Support your answer with data. (40 word maximum)
Independent assortment produces gametes with different allele combinations for all genes – figure #3. Crossing over separates alleles for different genes that were on the same chromatid – figure #4.

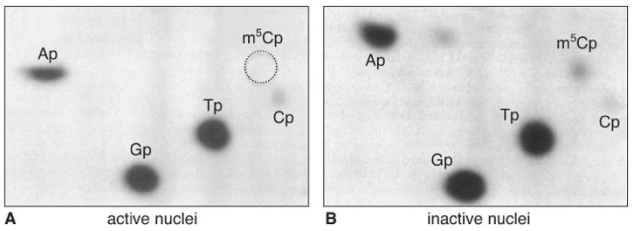
12 pts.
6)
a) Summarize the conclusions drawn from Figure 1 in the gallery below. (25 word maximum)
hypermethylated genes tend to be silenced, hypomethylated genes tend to be active

b) What structure of DNA ensures that the two strands are the same distance apart all the time? (35 word maximum)

adenine and guanine made of two-ringed structures, C & T one-ringed structures. Base pairing (A:T and G:C) assure 3 rings across and strands equally spaced.

Data Gallery

1

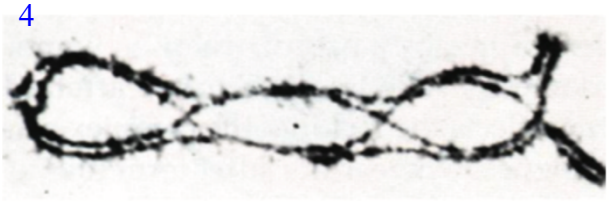


2

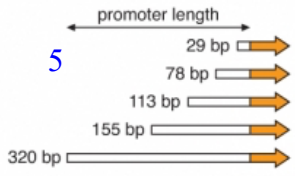
3

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

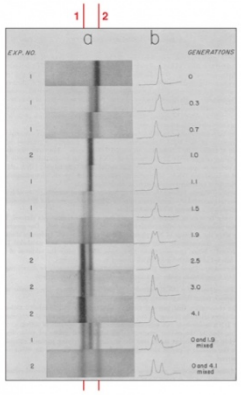


5



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

6



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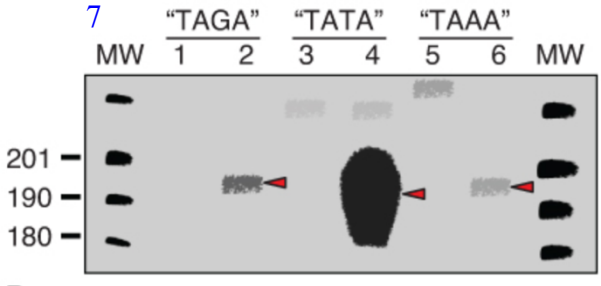

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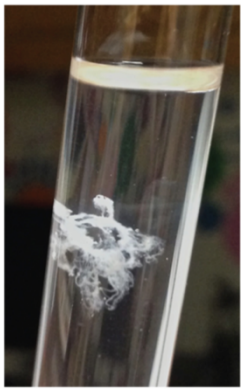


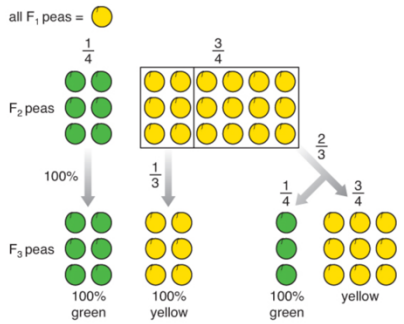
9

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

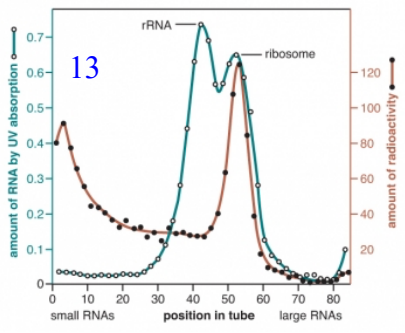
11



12

generation	wrinkled peas	smooth peas
P	5 true-breeding wrinkled plants	5 true-breeding smooth plants
F_1	0 wrinkled peas	281 smooth peas
F_1	0 plants from wrinkled peas	self-cross 253 plants from F_1 smooth peas
F_2	1,850 wrinkled peas	5,474 smooth peas

13



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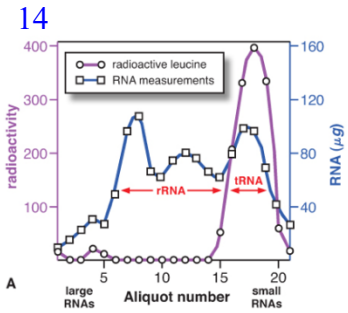

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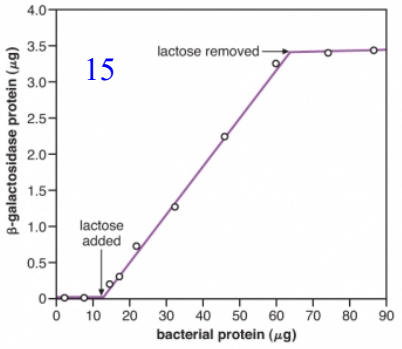

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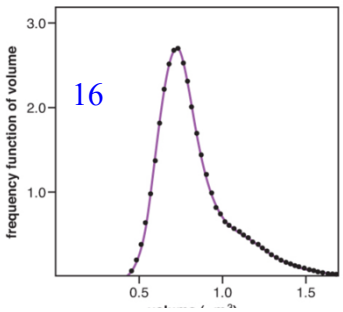
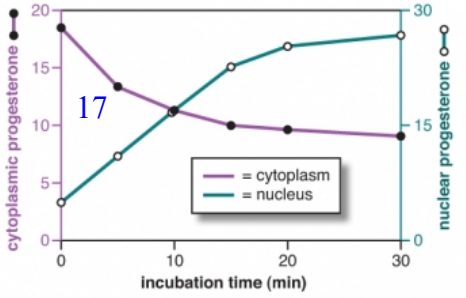


17

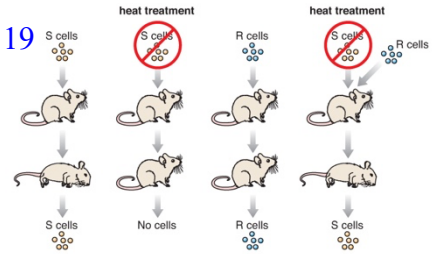


18

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

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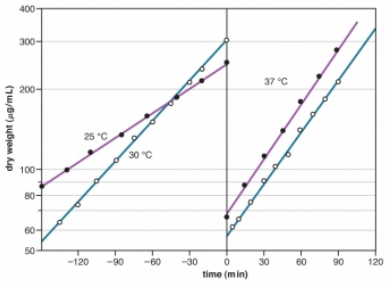
V-T7     5′...TAAACACGGTACGATGTACCACATGAAACGACAGTGAGTC... 3′
V-fd     5′...GCTTCTGACTATAATAGACAGGGTAAAGACCTGATTTTTG... 3′
V-SV40   5′...ATTGCAGCTTATAATGGTTACAAATAAAGCAATAGCA..... 3′
V-1      5′...ACTGGCGGTGATACTGAGCACATCAGCAGGACGCACTGAC... 3′
B-tRNA   5′...GTCATTTGATATGATGCGCCCCGCTTCCCGATAAGGAGC ...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

21

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

22



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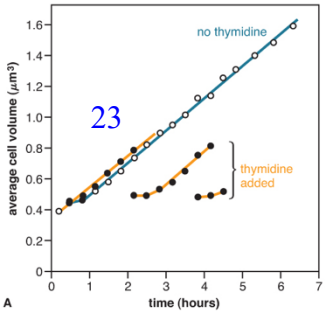
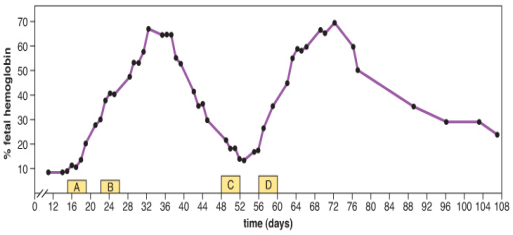


24



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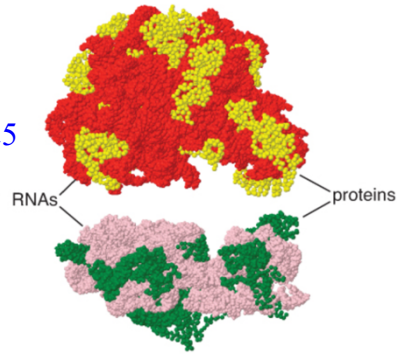

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