

Biology 113 Closed Book Take-Home Exam #3 – Chapters 9 - 11

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. There are 6 pages in this test, including this cover sheet, plus an Excel file. You are not allowed to look at someone else's test, nor 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 by 9:30 am on Wednesday April 15. **EXAMS ARE DUE BY 9:30 AM ON WEDNESDAY APRIL 15.** If you turn in your exam late, you will lose a letter grade which accumulates for each day you are late. The **answers to the questions must be typed within this test** unless you want to draw on a separate page. 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. You do NOT need to move the figure on your test. 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.

Staple all your pages together when finished with the exam. Do not print test pages without answers. I only want to see your answers. You can type your answers right under each question.

Name (please print):

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 Questions:

10 pts.

1) As you know, I have been working in the lab on your behalf. I came up with 4 new promoters that I named Blue, Green, Red and Yellow. I cloned each of these promoters into pClone Red just as you have done previously. I measured each construct in 5 independent replicates (A – E). The attached Excel file contains the experimental RFP outputs and cell densities (absorbance at 600 nm). I would like you to **a)** generate a graph of the data and submit your Excel file for grading; **b)** interpret the results for each experimental promoter. Be sure to label both axes so I can understand your graph. No need for a graph title. You should use these formulas when analyzing the data: =stdev(“Excel cells here”); =“stdev value”/sqrt(n) .

Blue:

Green:

Red:

Yellow:

Lecture Questions:

14 pts.

2) Did someone leave the neuron?

a) Apply figures 10, 13 and 31 to explain how a neurotransmitter is secreted. Focus only on the secretion not how the action potential got there. (maximum of 30 words for each figure)

31:

10:

13:

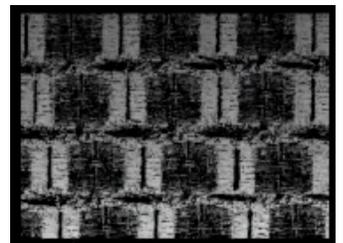
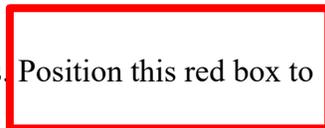
b) To prevent the action potential from moving backwards towards the dendrite, voltage-gated Na⁺ channels have refractory periods but voltage-gated K⁺ channels do not. Apply what you know about an action potential to explain why the two channels differ. You may use a drawing as part of your answer if you want but this is not required. (maximum of 40 words)

c) Explain the concept of a threshold potential. Support your answer with data. (maximum of 40 words)

15 pts.

3) Flex your knowledge.

a) The image to the right shows several sarcomeres. Position this red box to outline exactly one sarcomere.



b) Explain why some parts of the sarcomere appear to change in size (name the parts), whereas other parts (name them) do not. (maximum of 40 words)

c) What allosteric modulation is terminated when my thesis protein (SR calcium pump) influences a muscle contraction? Focus only on the allosteric modulation caused directly by calcium. (maximum of 30 words)

10 pts.

4) Recall what you have learned.

a) Draw the positive feedback loop that is responsible for long term memory.

b) Synthesize the data from figure 28 to explain to your family why they should let you study each day rather than cramming right before a test. (maximum of 40 words)

15 pts.

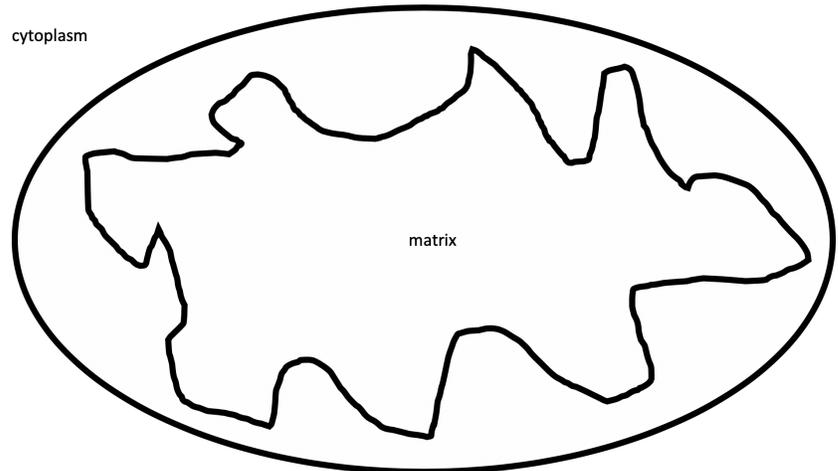
5) Food for thought.

a) List 5 high-energy molecules produced by catabolic reactions prior to the citric acid cycle and state which processes generate them. Support your answer with data. (maximum of 10 words each)

- 1.
- 2.
- 3.
- 4.
- 5.

b) Type the letter (A-E) in the locations each of these processes take place:

- A. glycolysis
- B. beta oxidation
- C. deamination
- D. citric acid cycle
- E. oxidative phosphorylation



14 pts.

6) You are what you eat.

a) Use figure 22 and explain how the pathway is regulated by a negative feedback loop. (maximum of 40 words)

b) Draw **one** picture that connects the reducing agents NADH and FADH₂ to the production of ATP. Incorporate CO into your diagram as well. Neatly label all the key parts of your diagram.

22 pts.

7) You light up my world.

a) Connect the homeostasis of water consumption during the light reaction with the regulation of cyclic vs non-cyclic electron flow. Support your answer with two figures. (maximum of 40 words)

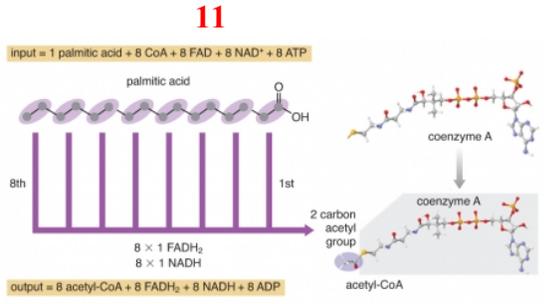
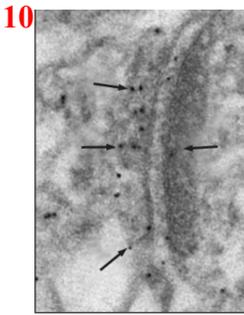
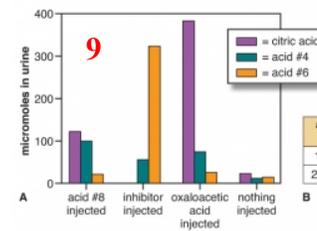
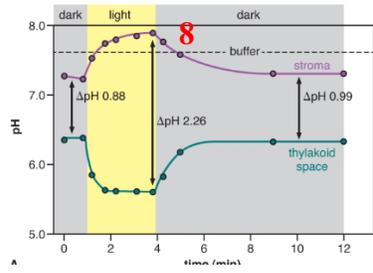
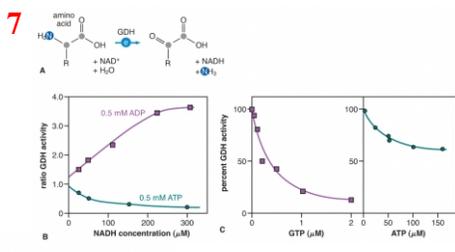
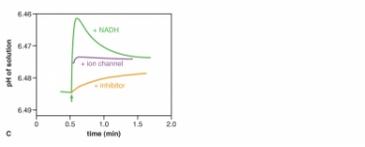
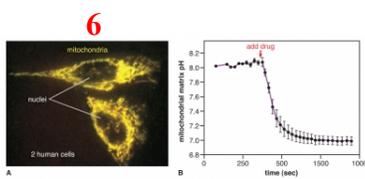
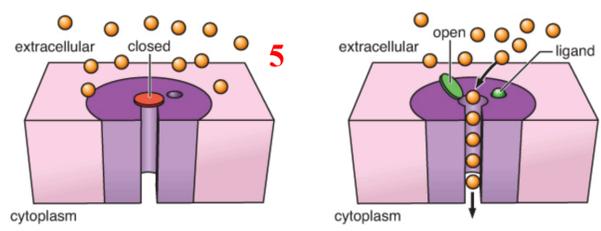
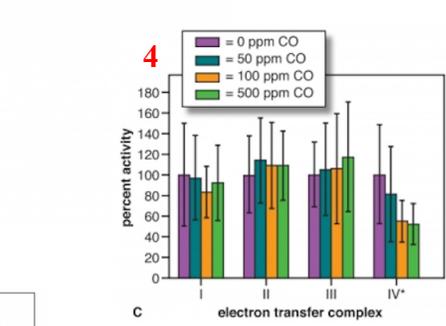
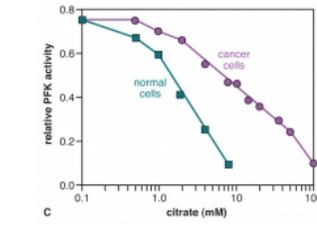
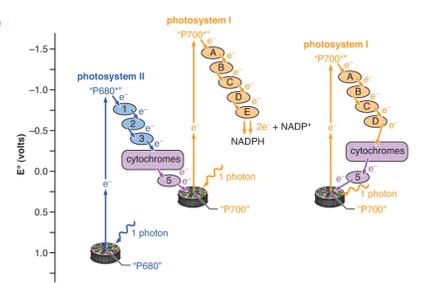
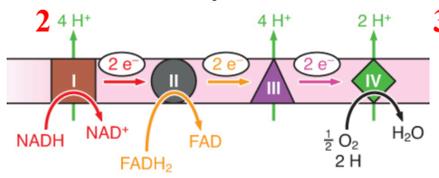
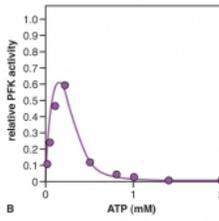
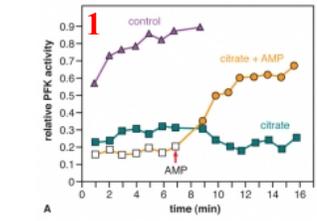
b) Explain where the wood in trees comes from. In other words, what is the raw material for cellulose polymers? Support your answer with two figures. (maximum of 40 words)

c) A common misconception propagated by traditional textbooks is that plants have light and dark reactions of photosynthesis. The mistake comes from the inference that the “dark reaction” happens at night. Use both halves of figure 16 to refute this misconception. (maximum of 40 words)

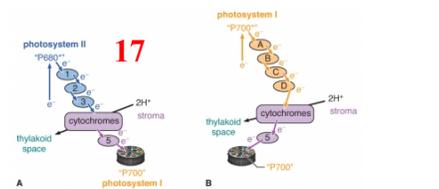
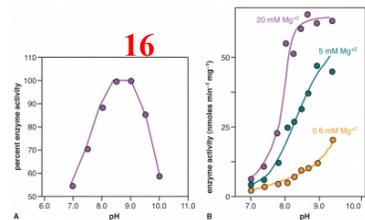
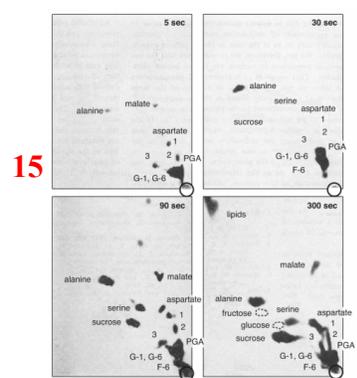
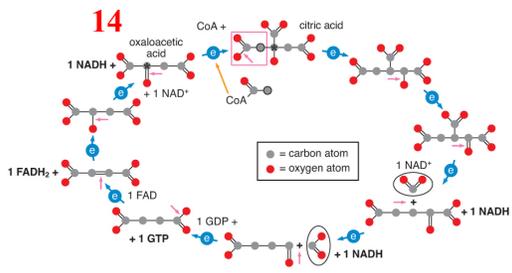
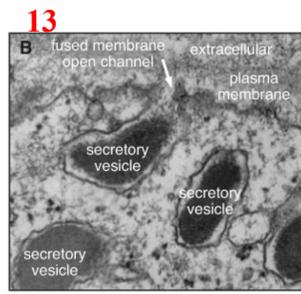
+2 pts

Bonus Question: Integrate what you know about genetics, deamination and memory formation to speculate why a homozygous person with dominant glutamate dehydrogenase (GDH) proteins that cannot be repressed by GTP might not be able to form long-term memories. (maximum of 30 words)

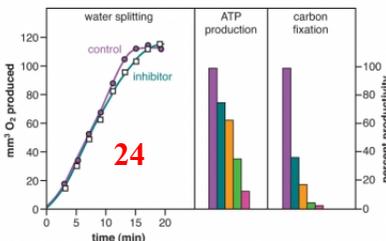
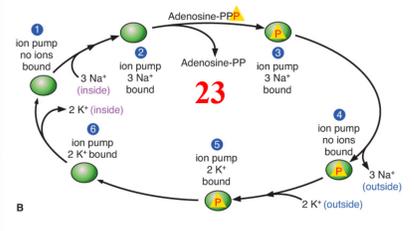
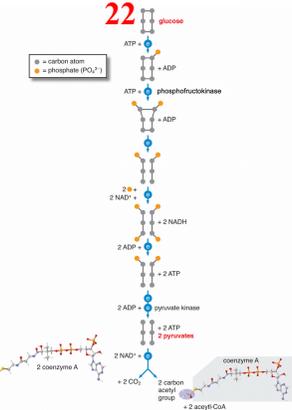
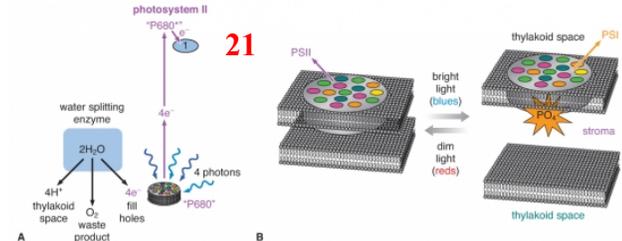
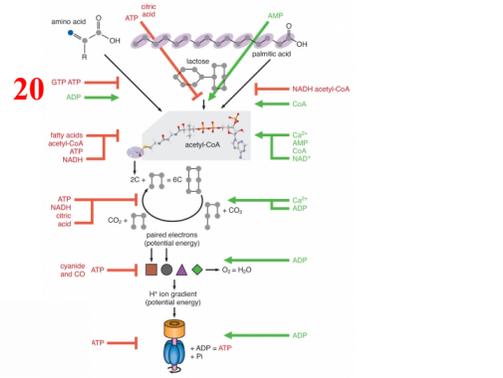
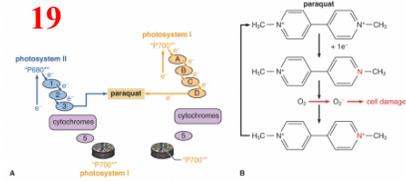
Data Gallery



enzyme identification	enzyme (μM)	substrate (μM)
e1	n.a	s1 near 0
phosphofructokinase	n.a	s2 1,500
e3	810	s3 80
e4	1,400	s4 80
e5	130	s5 50
e6	540	s6 20
pyruvate kinase	170	s6a 65



Dr. Campbell's Bio111 Exam #3 – Spring 2020 or Covid year 1



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ion	intracellular concentration	extracellular concentration
K ⁺	155 mM	4 mM
Na ⁺	12 mM	145 mM
Ca ²⁺	0.0001 mM	1.5 mM
Cl ⁻	4 mM	120 mM

