Spring 2003 Molecular Biology Exam #3 – Final Exam

There is no time limit on this test, though I have tried to design one that you should be able to complete within 4 hours, except for typing. You are not allowed to use your notes, any books, any electronic sources except those specified in the exam, nor are you allowed to discuss the test with anyone until 1 pm Sunday May 11, 2003. **EXAMS ARE DUE AT 1 PM ON SUNDAY, MAY 11**. You may use a calculator and/or ruler. The answers to the questions must be typed on a separate sheet of paper unless the question specifically says to write the answer in the space provided. If you do not write your answers on the appropriate pages, I may not find them unless you have indicated where the answers are. **You will need internet access and the chime plug-in for this test. You will also need to insert a screen shot into your test file.**

For the figures inserted in this test, I took photographs from journals, so you may detect warps or angles that seem odd. This is due to my need to reduce glare and shoot form about a 45 degree angle. Do not take this odd perspective into consideration for your answers. Ignore the tilted angles of the figures.

When you are ready to take the exam, send me an email with the subject line of **Molecular Test**. This will generate an automated email telling you how to download the exam.

Don't accidentally overlook question 9 at the very end.

-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 (INCLUDING THE TEST PAGES) together when finished with the exam.

Name (please print here):

Write out the full pledge and sign:

How long did this exam take you to complete (excluding typing)?

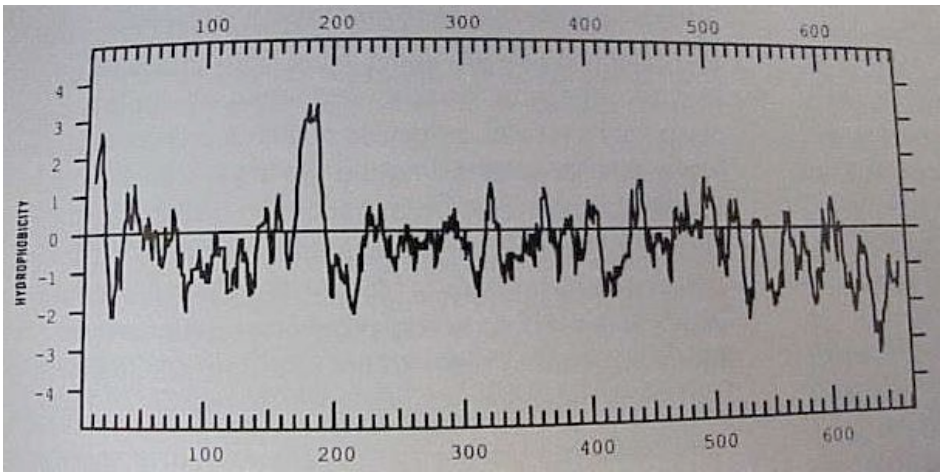
8 pts.

1. The authors of figure 1 claimed that the protein only had one transmembrane domain and they used the Kyte-Doolittle plot to justify their claim.

a) Circle the area which has the transmembrane domain.

b) Explain how they could justify their interpretation.

Figure 1



8 pts.

2. a) On **figure 2** near the end of the test, circle the area or areas that are the sites of protein binding on this fragment of DNA. You will notice that 5 different proteins were used. Lane 1 is bovine serum albumen (BSA). Lanes 2-4 are wt POU of increasing amounts from left to right. Lanes 5-6 are mutant 1 of POU in low (left) and high (right) amounts. Lanes 7-8 are mutant 2 of POU in low and high amounts. Lanes 9-10 are mutant 3 POU in low and high amounts.

b) To get full credit, you must rate the binding sites from 1- *n* with 1 being the best binding site and *n* being the worst.

12 pts.

3. **Figure 3** shows a band shift assay where dsDNA was used as the probe and two different proteins were tested. A wild-type version (WT) and the same protein with a truncated amino terminus (ΔN). Explain each of the four major bands that appear in this gel. By 4 bands, I mean 4 bands of different molecular weight.

12 pts.

4. In **figure 4**, there are results from a CAT assay. Three different transcriptions factors were tested on one promoter. One protein had no activity (Control), wt (CREB), and a mutant (Δ) CREB with 14 amino acids deleted from the middle of the protein. Minus (-) indicates no added protein kinase A while (+) indicates protein kinase A was added to the mixture; each experiment was performed in duplicate. Interpret these data.

15 pts.

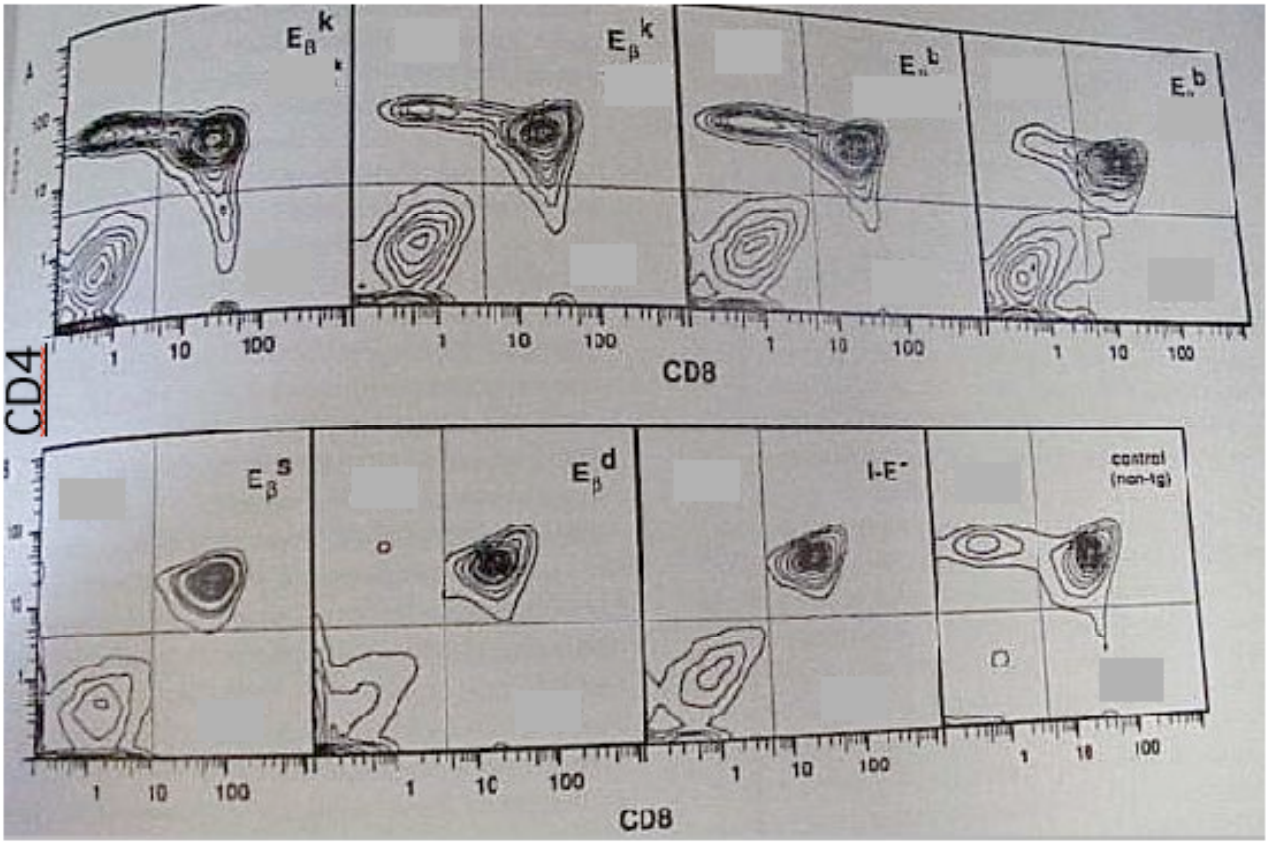
5. **Figure 5** shows the results from a pulse chase experiment. The protein is a repressor of transcription and the investigators measured its half-life using wild-type protein (bottom panel). They then constructed a series of nested deletions. The dotted lines indicated the deleted parts, the light gray bars indicate the portions still present, and the black bars indicate the location of the reporter gene *lacZ*. Data for 4 of these 16 constructs are shown and I have labeled the data A-D (who says Davidson students don't get to do multiple choice questions?)

a) From the 4 with data (A – D), which construct or constructs behave similar to wild-type?

b) **Briefly** interpret the results (A-D) to support your answer to part a above.
c) Circle part or parts on the figure that represent critical parts of this protein (see parts a & b).

8 pts.

6. Using a dark pen, circle the FACS plot (below) that shows the greatest number of cells that contain both CD4 and CD8. The axes are labeled. Draw a square around the FACS plot that shows the fewest cells that lack CD4 and CD8. Do not assume that an equal number of cells was used in each panel.



18 pts.

7. On the next page, you will see two panels. The first panel shows the targeted locus (top), the piece of DNA being used for homologous recombination (middle), and a successfully recombined locus. If the investigators used Bam HI to digest genomic DNA from mice and used the probe as shown in the figure, tell me (in the space below) the genotype of each mouse. (B is a different enzyme cut site.)

1 =

2 =

3 =

4 =

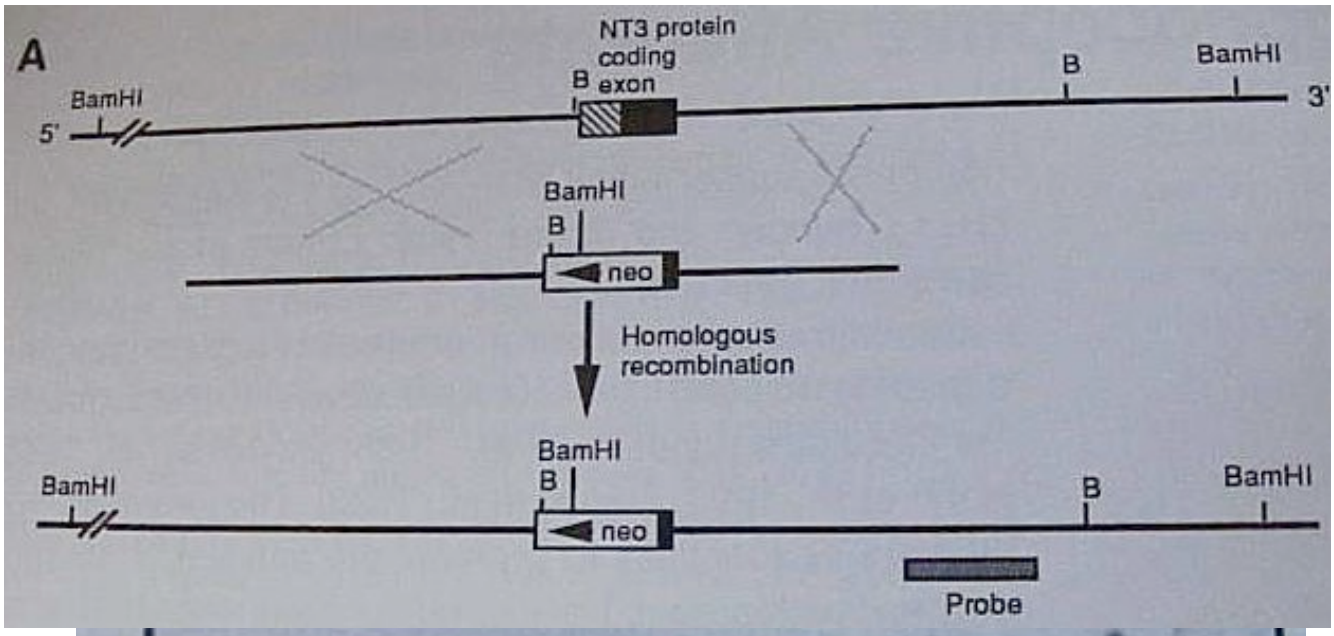
5 =

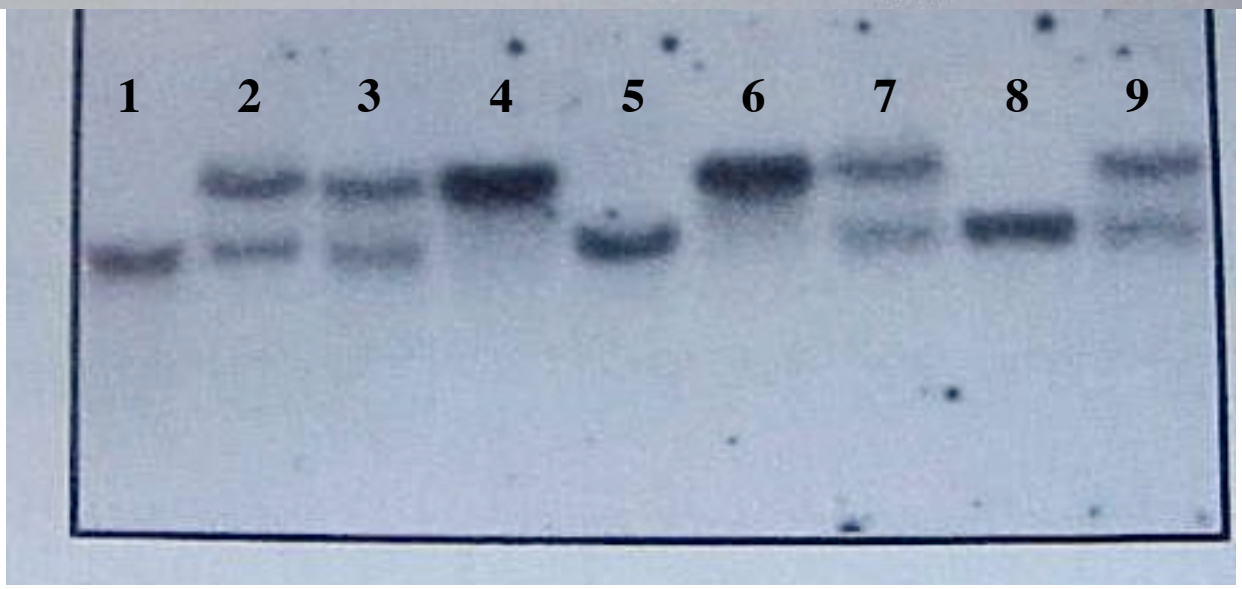
6 =

7 =

8 =

9 =





17 pts.

8. Go to this URL: <www.bio.davidson.edu/courses/Molbio/Exams/2003/examstructure.html> and answer these questions:

a) How many protein chains are present?

b) How many alpha helices?

c) How many beta strands?

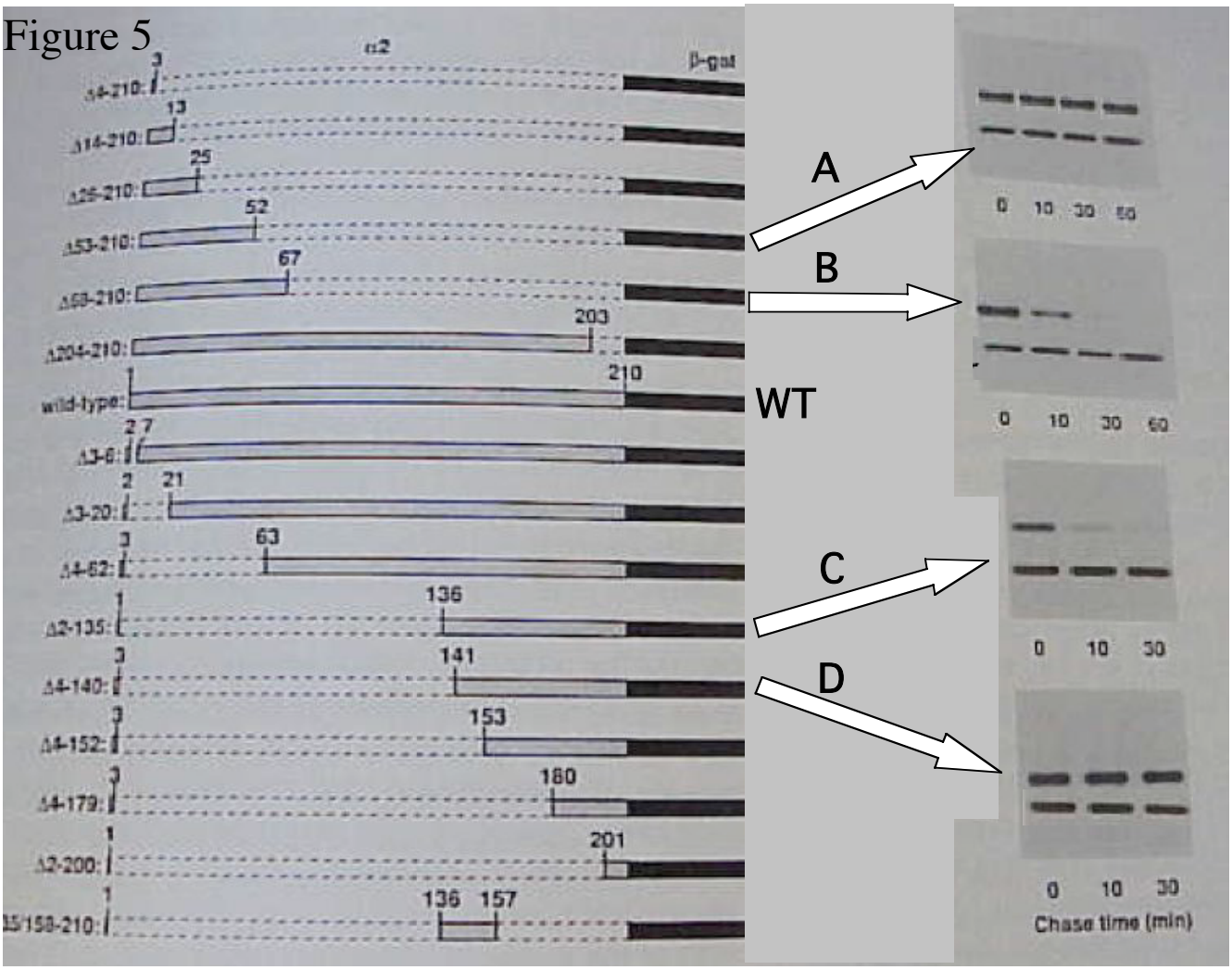
d) The protein is binding to a different type of molecule. What is this molecule?

e) At how many separate sites does the protein bind to the other molecule?

f) Does the protein bind to the same shape multiple times or not? Explain your answer.

g) Finally, generate a screen shot of your structure and insert it in your test file. Show me the best view you can that summarizes what you are looking at. When you print your screen shot, make sure it is readable. It does not have to be in color, but it does need to be big enough for me to see the main parts.

Figure 5



Wild type Protein

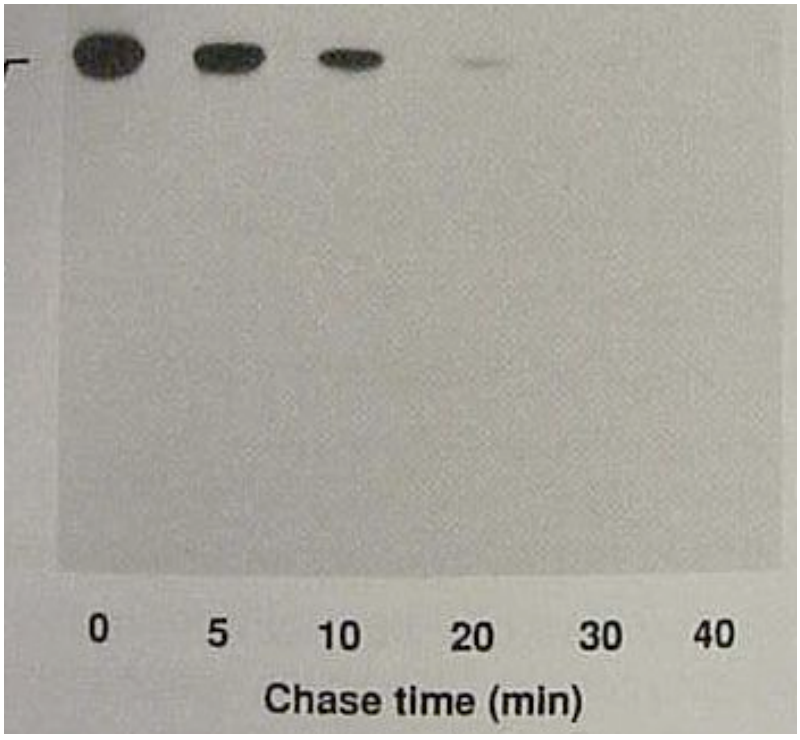


Figure 2

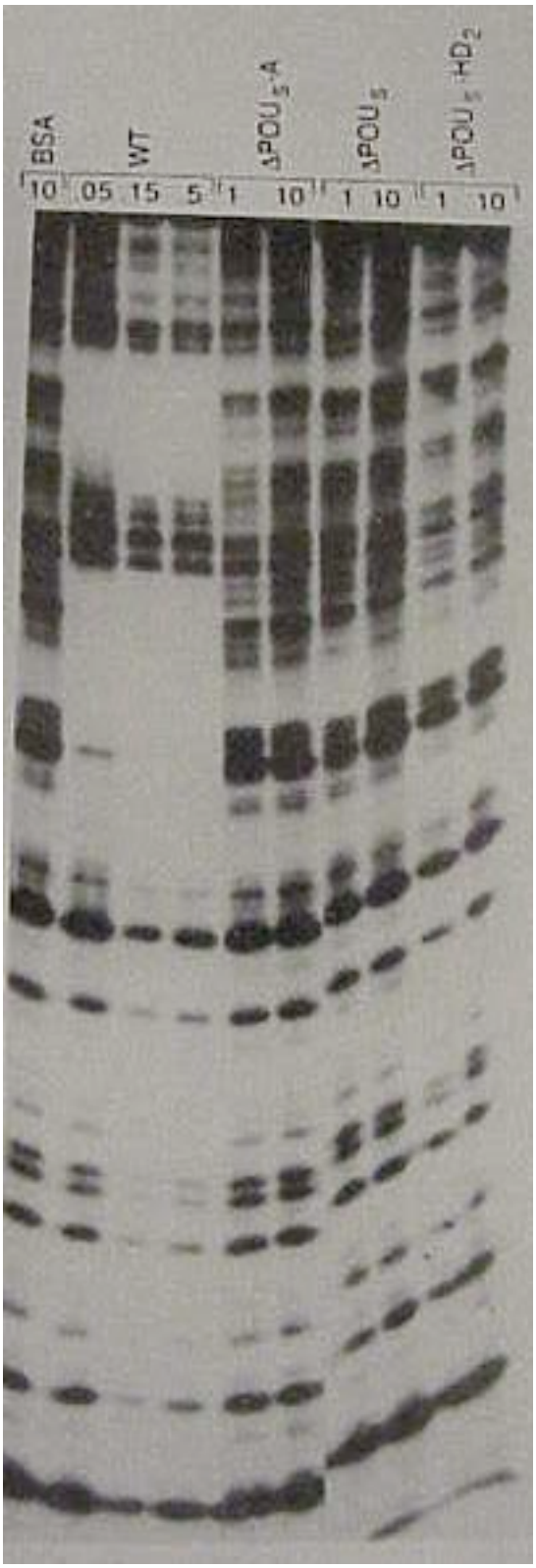


Figure 3

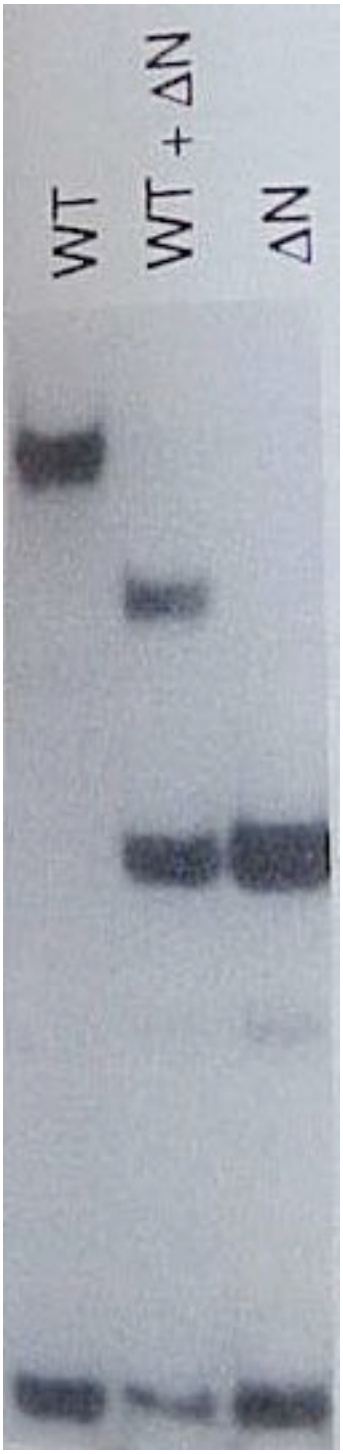
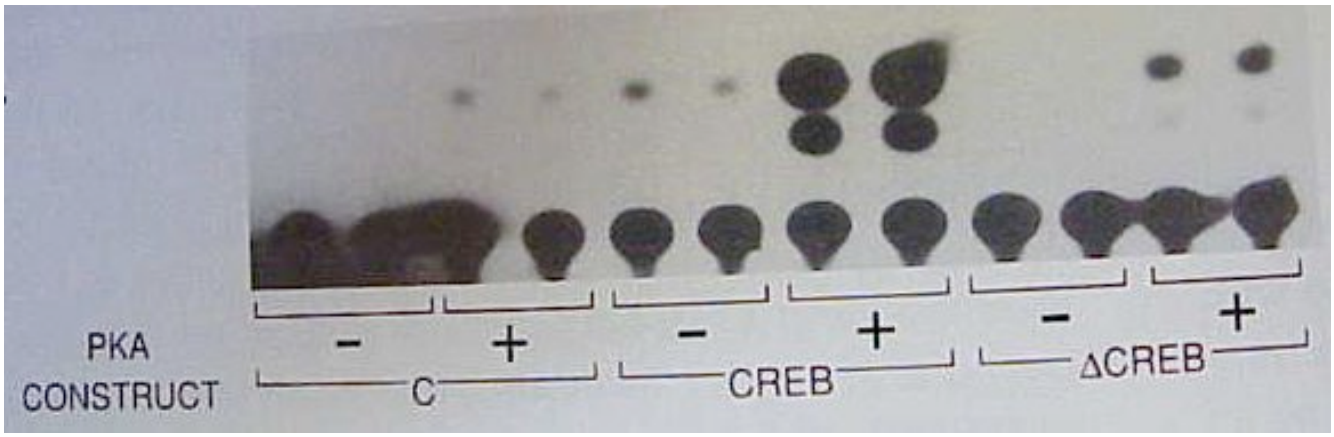


Figure 4



2 pts.

9. When a typical yeast cell divides, what is the volume of the new daughter cell?