

CHEM-342 Introduction to Biochemistry
Final Examination - Group Part
Friday, 19 May 2000
9:00 - 10:00 PM
H. B. White - Instructor

Group Members _____

Important - Please read this before you turn the page.

- Each group member must sign his or her name on this page to receive the group grade.
- If you cannot come to consensus, you may submit separate answers for a separate grade that would be substituted for the group grade. In that case do not sign the group exam.
- You may refer to your notes, course reader, handouts, textbook, or graded homework assignments. Reference books in the course library may be consulted briefly and returned..
- Please read the questions carefully and make sure that you have thought them through with everyone's input before converging on a solution.

1. (17 Points) Pauling and coworkers observed that heterozygous individuals for the sickle cell gene produce a 40:60 ratio of HbS to HbA, rather than a 50:50 ratio. The following describes an in vitro (cell-free in a test tube) experiment which gave a similar but much more striking result [Schreier et al., European Journal of Biochemistry, 34, 213 (1973)].

A cell-free protein-synthesizing system, reconstituted with various components (ribosomes, aminoacylated tRNAs, initiation factors, etc.) from mammalian sources, is strongly dependent on exogenous messenger RNA. 9 to 10S RNAs isolated from duck reticulocytes (A) are translated into duck hemoglobin chains by this system. Likewise, 9 to 10S RNAs from rabbit reticulocytes (B) are translated into rabbit hemoglobin chains. When the system is presented simultaneously with duck and rabbit mRNA (A+B) at equal and saturating concentrations, rabbit hemoglobin synthesis occurs almost exclusively even though the maximal rate of hemoglobin synthesis is relatively unaffected whether the mRNAs are employed separately or in combination.

A. Construct a table that displays the results described.

B. Provide a simple pictorial model to explain what appears to be happening on the molecular level.

2. (8 Points) Estimate to within one order of magnitude the number of hemoglobin molecules your body makes every second. Show and explain the basis for your estimate. Up to three points will be awarded for a reasonable set up. Five points will be awarded to answers within one order of magnitude of the accepted answer. One point will be lost for each order of magnitude error in the estimate. For example, you would lose 2 points if you were 1000-fold of above or below the actual answer. No credit for answers a million or more fold off.