MOLECULAR BASIS OF INHERITANCE

Framework

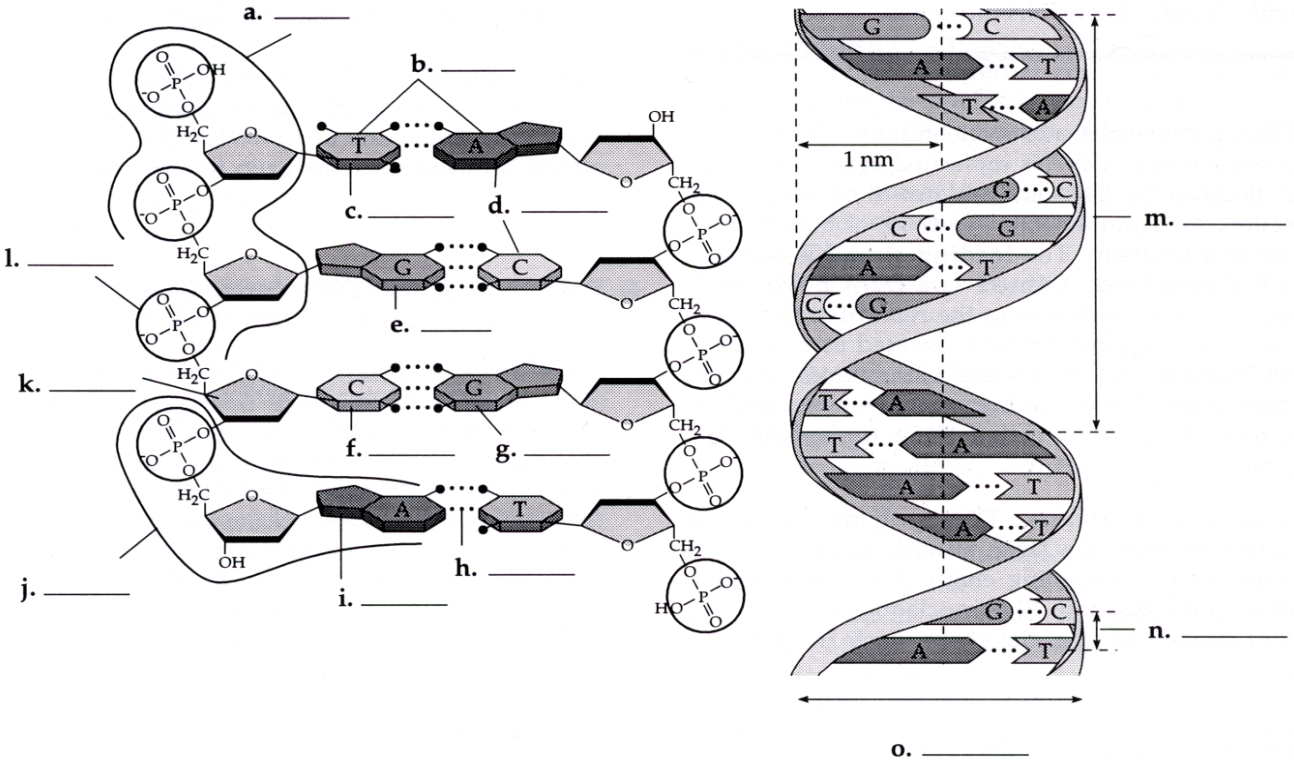
The goal of today's exercise is for you to look at DNA, its structure, and its replication. Deoxyribose-nucleic acid, DNA, is the genetic material, the substance of genes, and the basis of heredity. Nucleic acids unique ability to direct their own replication allows for precise copying and transmission of DNA into all the cells of the body from one generation to the next. DNA encodes the blueprints that direct and control all the biochemical, anatomical, physiological, and behavioral traits of living organisms. Have one member, in turn, of your Learning Community answer one part of each of the questions or problems, then let the next member go on to the next part...

Part 1. Proof of DNA as the Genetic material

1. Hershey and Chase devised an experiment using radioactive isotopes to determine whether a bacteriophage's DAN or its proteins were transferred during viral replication.
   a) What and/or how did that label the phage protein?
   b) How did they label the phage DNA?
      Separate experimental samples of E. coli were infected with the differently (protein & DNA) labeled T2 virus particles, then blended to stop infection, and then centrifuged to isolate the bacterial cells from the virus particles.
   c) Where was the radioactivity found in the samples with labeled phage protein and why?
   d) Where was the radioactivity found in the samples with labeled phage DNA and why?
   e) What were Hershey & Chase's conclusions from their experiment?

Part 2. Structure of DNA

2. Review the Structure of DNA by having each member of your Learning Community, in turn, label the following diagram (note the important dimensions 2nm, 0.34 nm, 3.4nm and 10 np's.



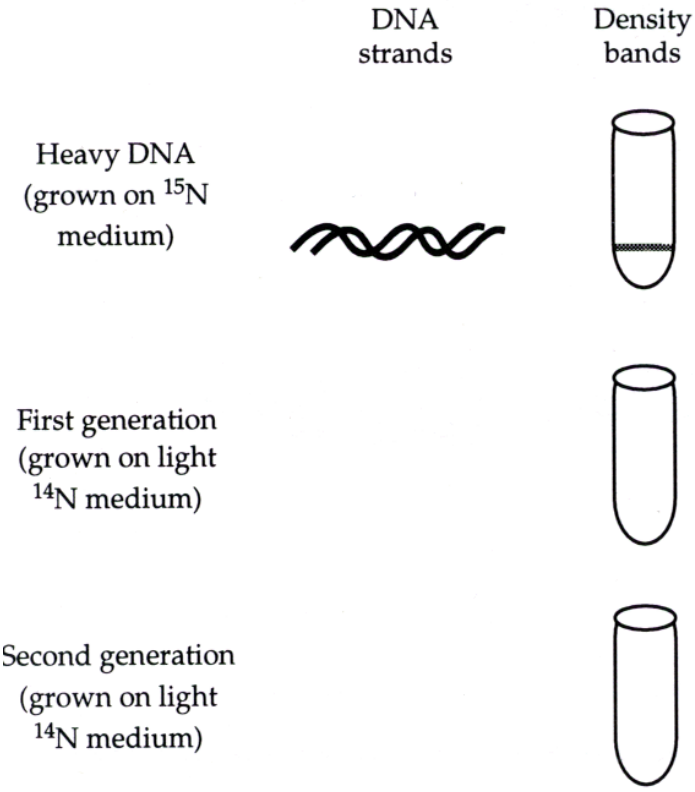
Part 3. Patterns of DNA Replication

A. Have a member of your group use a large piece of paper or go to a backboard and using different colors or different patterns for the light and heavy strands of DNA in a Mesleson/Stahl-like experiment, sketch the results of the semi-conservative replication cycles of heavy DNA when the E. coli cells are moved to an ^{14}N medium for two successive generations.

Show the resulting light, hybrid, heavy density bands in the centrifuge tubes.

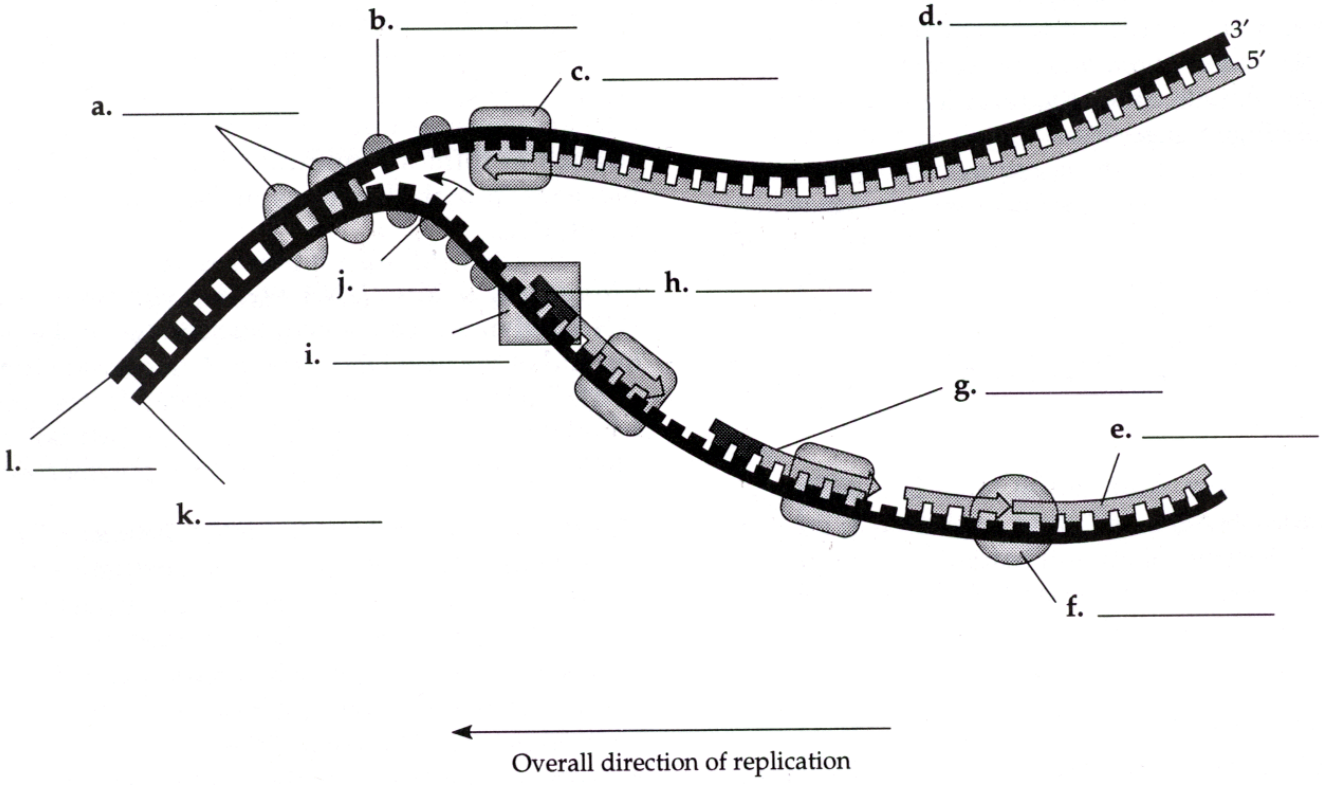
B. Now do the same for a conservative pattern of replication

C. and the same for a dispersive pattern of DNA replication



Part 4. Enzymatic Replication of DNA

In the diagram below each should in turn identify the label for the following items: leading strand, lagging strand, Okazaki fragment, DNA polymerase, DNA ligase, helicase, primase (RNA polymerase), binding proteins, RNA primer molecule, replication fork, and the 5' and 3' ends of the parental DNA, and newly made DNA.

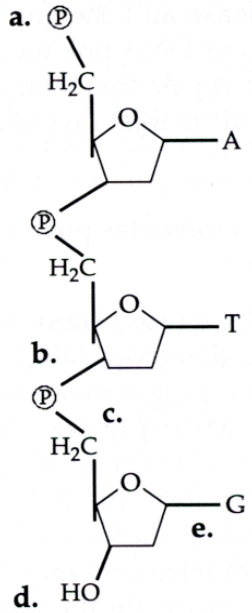


Part 5. Some thought questions?

a. Summarize the evidence and techniques of procedures that Watson and Crick used to deduce the double helix structure of DNA?

b. Each group member should describe in turn, the role of each of the key enzymes and proteins that help direct DNA replication?

c. Use the diagram to the right to answer the following questions?



1. Which letter indicates the 5'-end of this ssDNA chain?
2. At which letter would the next nucleotide be added by DNA polymerase
3. Which letter represents the phosphodiester bond from by DNA polymerase
4. The base sequences of the DNA strand that is made from this ssDNA template (top to bottom) is?

d. Explain why many scientist originally believed that proteins were the carriers of the genetic information?

e. The uptake of exogenous/external DNA material, most often by bacterial cells is?

f. If the DNA on an organism is known to contain 13% adenine, the how much cytosine does it contain? _____

g. Thymine dimers, covalent bond links between adjacent thymine bases in DNA, are often induced in response to UV light. When they occur they are repaired naturally by?