MOLECULAR BASIS OF INHERITANCE - ANSWERS

Part 1. Proof of DNA as the Genetic material

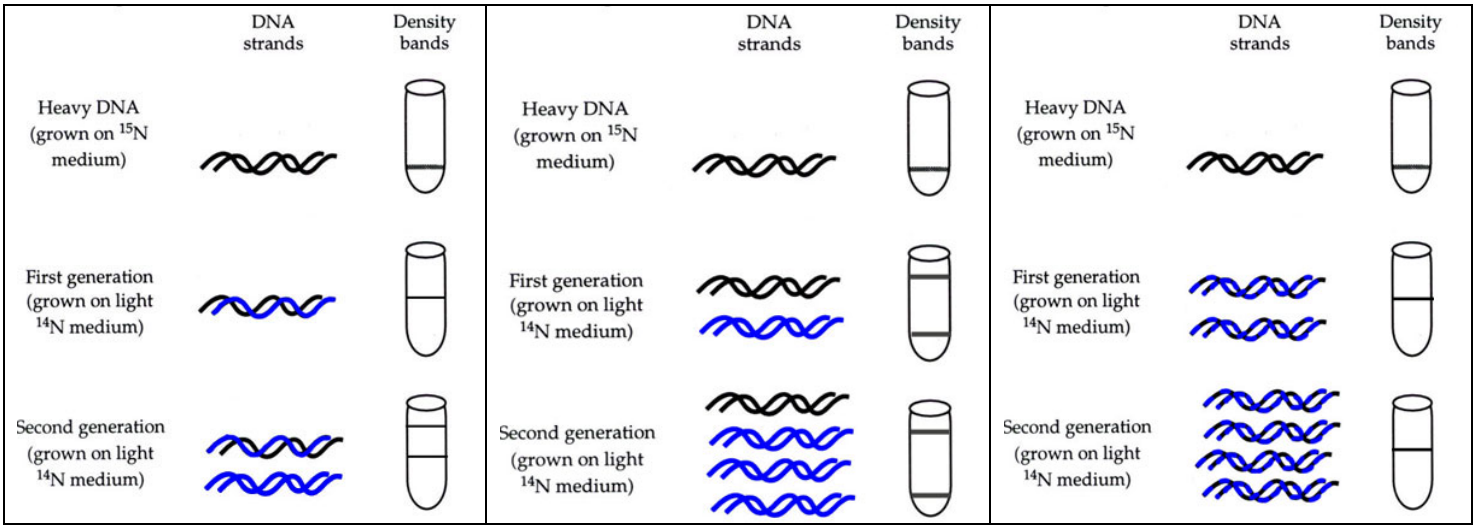
1. Hershey and Chase devised an experiment using radioactive isotopes to determine whether a bacteriophage's DNA or its proteins were transferred during viral replication.
   a) What and/or how did that label the phage protein?
      They grew the T2-bacteriophages in the presence of radioactive sulfur (^{35}S) to tag the cysteine amino acids of the phage proteins.
   b) How did they label the phage DNA?
      They grew the T2-bacteriophages in the presence of radioactive phosphorous (^{32}P) to tag the bases of the individual nucleotides of DNA.
   c) Where was the radioactivity found in the samples with labeled phage protein and why?
      Radioactive ^{35}S was found in the supernatant indicating that the bacteriophage proteins did not enter the E. coli cells.
   d) Where was the radioactivity found in the samples with labeled phage DNA and why?
      In the samples labeled with ^{32}P (DNA) most of the radioactivity was found in the pellet of the centrifuge tube along with the sedimented bacterial cells.
   e) What was Hershey & Chase's conclusion from their experiment?
      They concluded that viral DNA is injected into host bacterial cells during the process of viral replication, and thus DNA serves as the hereditary material for viral replication.

Part 2. Structure of DNA

a. sugar-phosphate backbone
b. complementary base pair
c. adenine
d. pyrimidine bases
e. guanine
f. thymine
g. purine bases
h. hydrogen bonds
i. cytosine
j. nucleotide
k. deoxyribose
l. phosphate
m. 3.4nm
n. 0.34nm
o. 2nm

Part 3. Patterns of DNA Replication

Semi-Conservative **Conservative** **Dispersive**



Part 4. Enzymes of Replication.

a. helicase	b. binding proteins	c. DNA polymerase
d. leading strand	e. lagging strand	f. DNA ligase
g. Okazaki fragment	h. RNA primer	i. primase
j. replication fork	k. 3' end parental strand	l. 5' end parental strand

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? Watson and Crick used model building to recreate the structure of DNA based upon X-ray crystallography data of Rosy Franklin and Maurice Wilkins. This told them the helix was of uniform diameter (2nm wide), with the nitrogenous bases 0.34nm apart, and making a full turn every 3.4nm. Using models of wire they played with various arrangements and finally placed the sugar-phosphate backbone on the outside of the helix with the bases inside. Pairing a purine with a pyrimidine was the only was to get a uniform diameter, i.e., A:T and G:C by hydrogen bond pairing.

b. Each group member should describe in turn, the role of each of the key enzymes and proteins that help direct DNA replication? Replication bubbles form where DNA polymerase recognize specific bases sequences called points of initiation. **Helicase** is an enzyme, which works at a replication fork, untwisting the DNA and separating the two strands. **Topoisomerase** is an enzyme that releases the supercoils formed in DNA by its untwisting by helicase. **Binding proteins** support the separated strands while replication occurs. **Primase** is an enzyme that lays down about 10 RNA bases opposite the DNA template strand. Once a proper base pair joins up on the exposed parental DNA template, **DNA polymerase** joins the nucleotide to the 3' end of the new strand. On the lagging strand, short fragment Okazaki fragments are formed by the DNA polymerase moving in the 5' to 3' direction. **DNA ligase** joins the 3' end of one Okazaki fragment to the 5' end of its neighbor fragment. Proofreading enzymes check for mispaired bases, and excision enzymes, DNA polymerase, and other enzymes repair damage of base pair mismatches.

c. 1. b 2. c 3. a 4. 3' T-A-C 5'

d. Explain why many scientists originally believed that proteins were the carriers of the genetic information?
The proteins were a much more diverse and complex group of molecules which exhibited a lot of molecular heterogeneity and thus were excellent candidates.

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

f. If the DNA on an organism is known to contain 13% adenine, the how much cytosine does it contain?
A:T = 26% G:C = 74%, thus there is 37% C.

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?
Thymine dimmers are excised by a series of repair enzymes found in cells that include excision enzymes that cut out the T-T pairs, primase which add an RNA primer to which DNA nucleotide can be added, DNA polymerase to add complimentary DNA nucleotides to the repaired strand, and DNA ligase to seal the holes left in the repaired DNA.