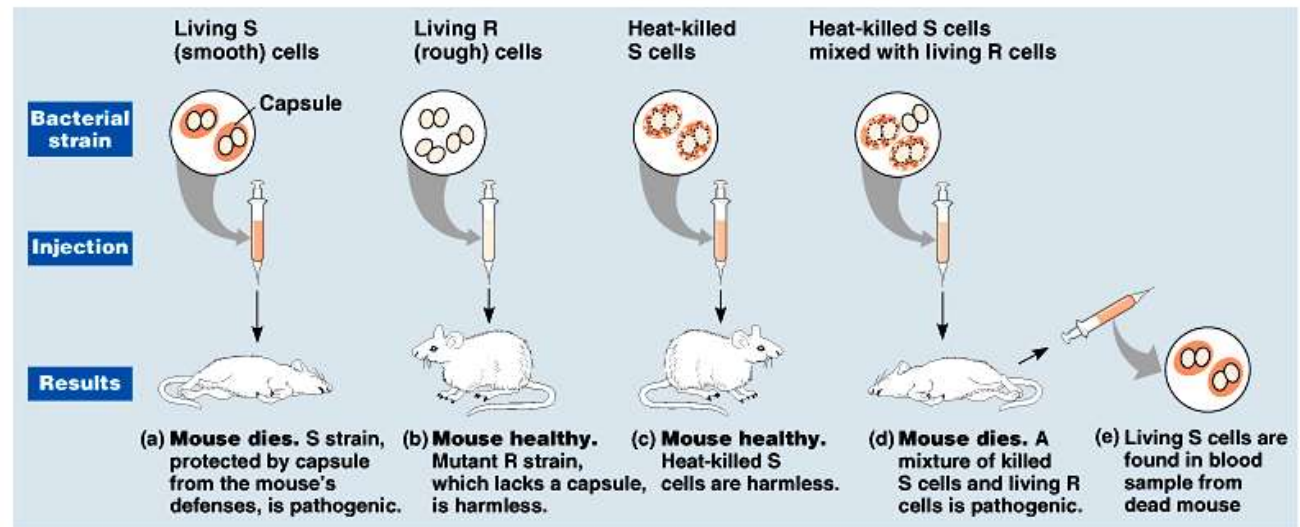


- DNA
- *The Molecular Basis of Inheritance*

Searching for Genetic Material, I

- Mendel: modes of heredity in pea plants
- Morgan: genes located on chromosomes
- Griffith: bacterial work; transformation: change in genotype and phenotype due to assimilation of external substance (DNA) by a cell
- Avery: transformation agent was DNA



Searching for Genetic Material, II

Hershey and Chase

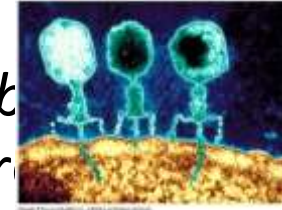
(phages)

hereditary material

is in DNA;

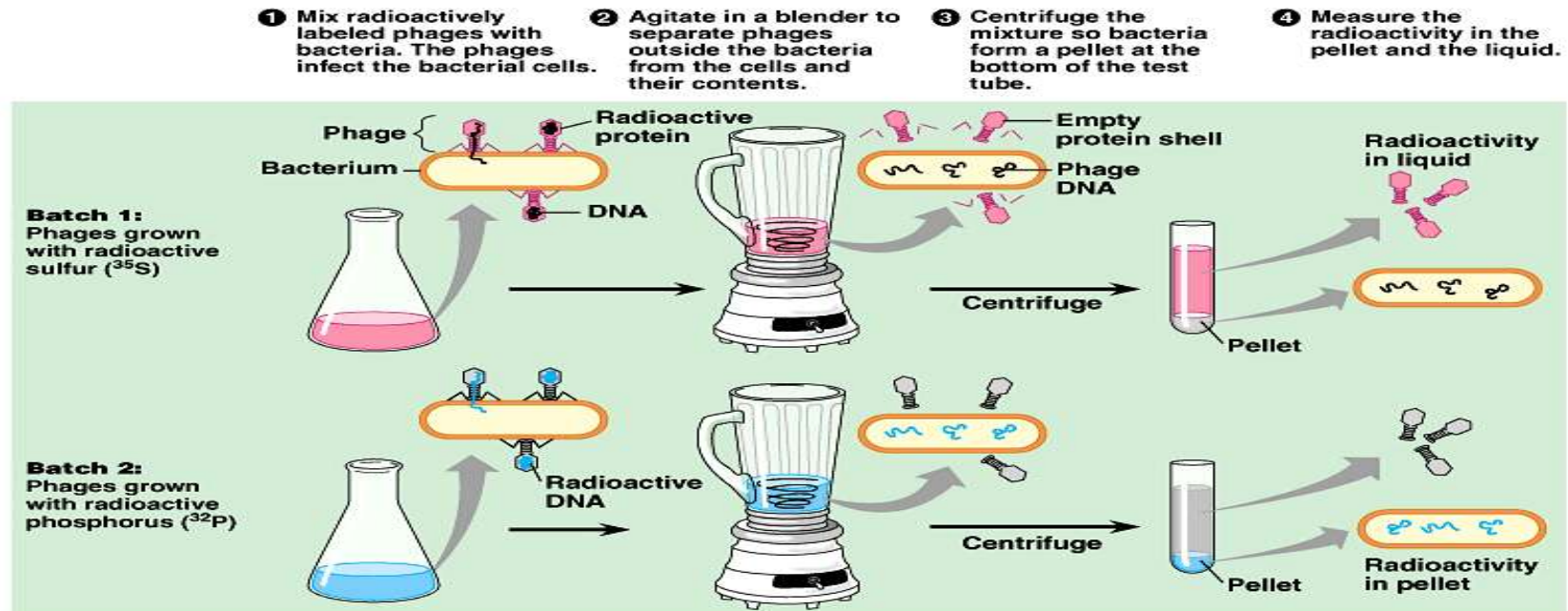
only P was found in host cell

DNA, not protein



bacteriophages

#



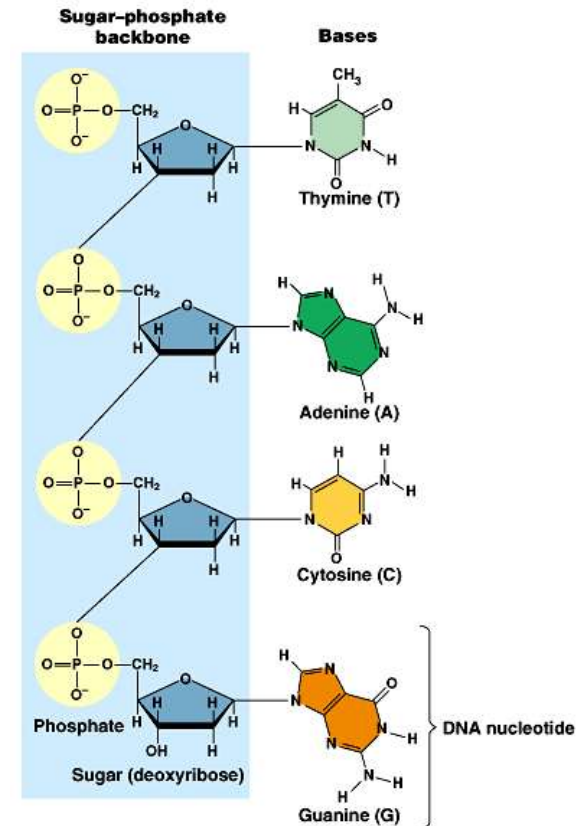
(b) The experiment showed that T2 proteins remain outside the host cell during infection, while T2 DNA enters the cell.

Hershey and Chase animation

- http://glencoe.mcgraw-hill.com/sites/0003292010/student_view0/chapter14/animations_and_videos.html#

DNA Structure

- Chargaff ratio of nucleotide bases (A=T; C=G)
 - Watson & Crick (Wilkins, Franklin)
 - The Double Helix
- nucleotides:** nitrogenous base (thymine, adenine, cytosine, guanine), sugar (deoxyribose); phosphate group



DNA Structure Animation

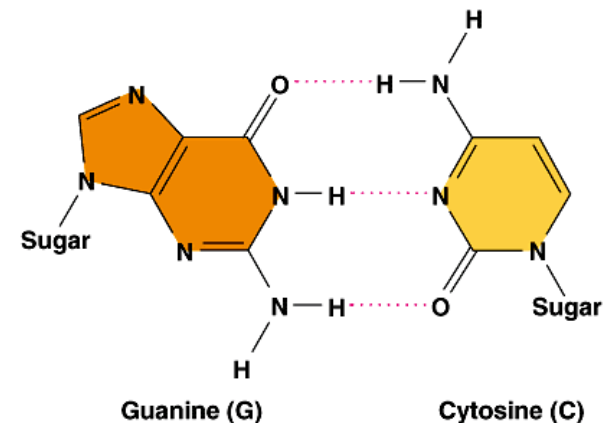
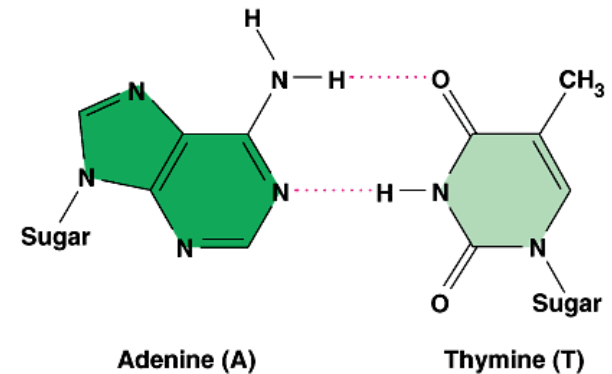
- http://glencoe.mcgraw-hill.com/olcweb/cgi/pluginpop.cgi?it=swf::640::480::/sites/dl/free/0003292010/811325/dna_structure.swf::DNA Structure

- <http://ed.ted.com/lessons/james-watson-on-how-he-discovered-dna>



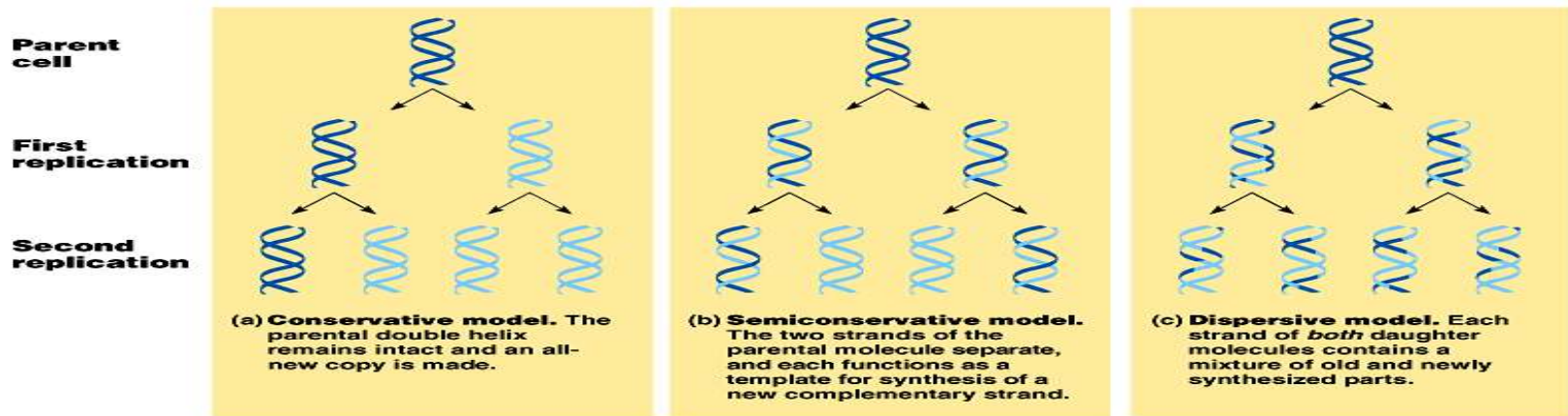
DNA Bonding

- Purines: 'A' & 'G'
- Pyrimidines: 'C' & 'T'
(Chargaff rules)
- 'A' H+ bonds (2) with 'T'
and 'C' H+ bonds (3) with
'G'
- Van der Waals attractions
between the stacked pairs



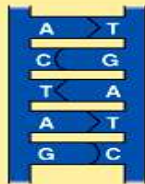
DNA Replication

- Watson & Crick strands are complementary; nucleotides line up on template according to base pair rules (Watson)

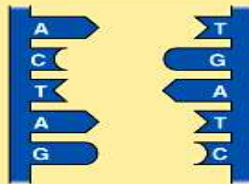


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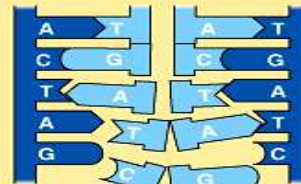
- Meselson & Stahl replication is semiconservative; Expt: varying densities of radioactive nitrogen



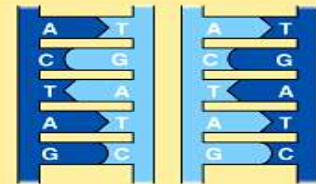
(a) The parent molecule has two complementary strands of DNA. Each base is paired by hydrogen bonding with its specific partner, A with T and G with C.



(b) The first step in replication is separation of the two DNA strands.



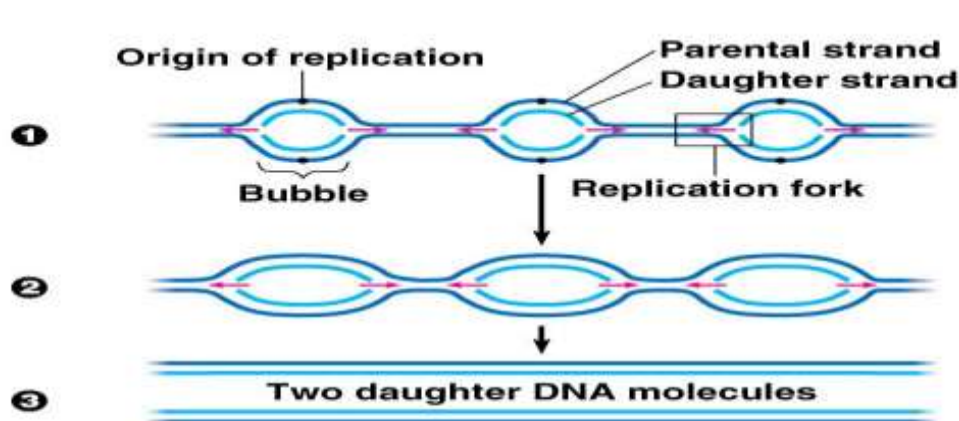
(c) Each parental strand now serves as a template that determines the order of nucleotides along a new complementary strand.



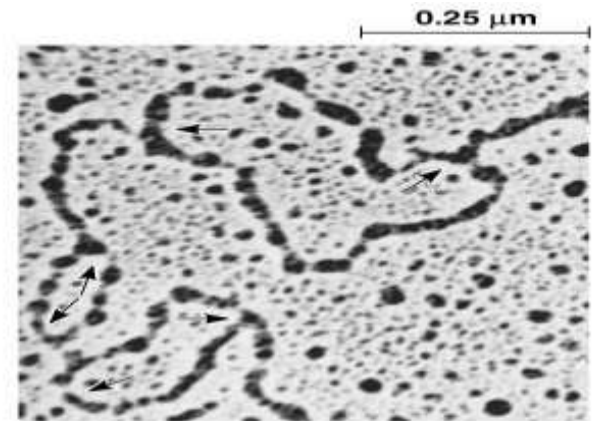
(d) The nucleotides are connected to form the sugar-phosphate backbones of the new strands. Each "daughter" DNA molecule consists of one parental strand and one new strand.

DNA Replication: a closer look

- Origin of replication (“bubbles”): beginning of replication
- Replication fork: ‘Y’-shaped region where new strands of DNA are elongating
- Helicase: catalyzes the untwisting of the DNA at the replication fork
- DNA polymerase: catalyzes the elongation of new DNA



(a) In eukaryotes, DNA replication begins at many sites along the giant DNA molecule of each chromosome.



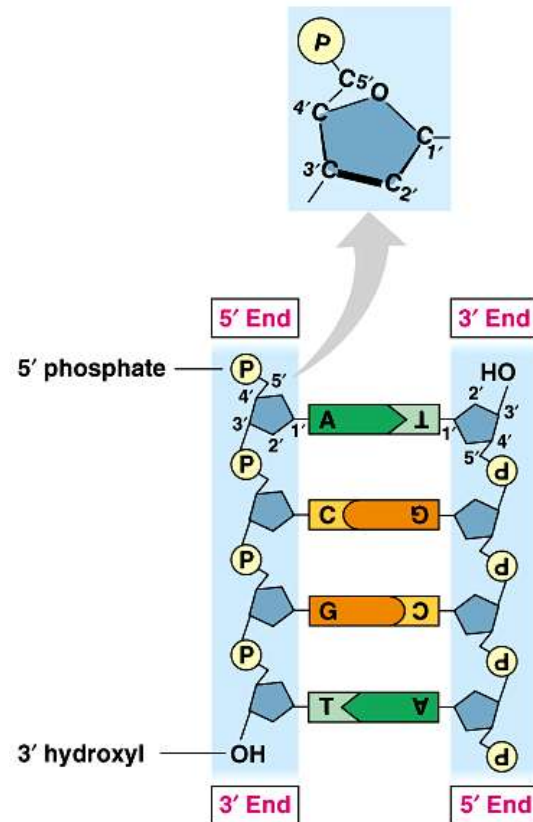
(b) In this micrograph, three replication bubbles are visible along the DNA of cultured Chinese hamster cells. The arrows indicate the direction of DNA replication at the two ends of each bubble (TEM).

DNA Replication

- http://glencoe.mcgraw-hill.com/olcweb/cgi/pluginpop.cgi?it=swf::640::480::/sites/dl/free/0003292010/811325/Structural_Basis_of_DNA_Replication.swf::Structural Basis of DNA Replication

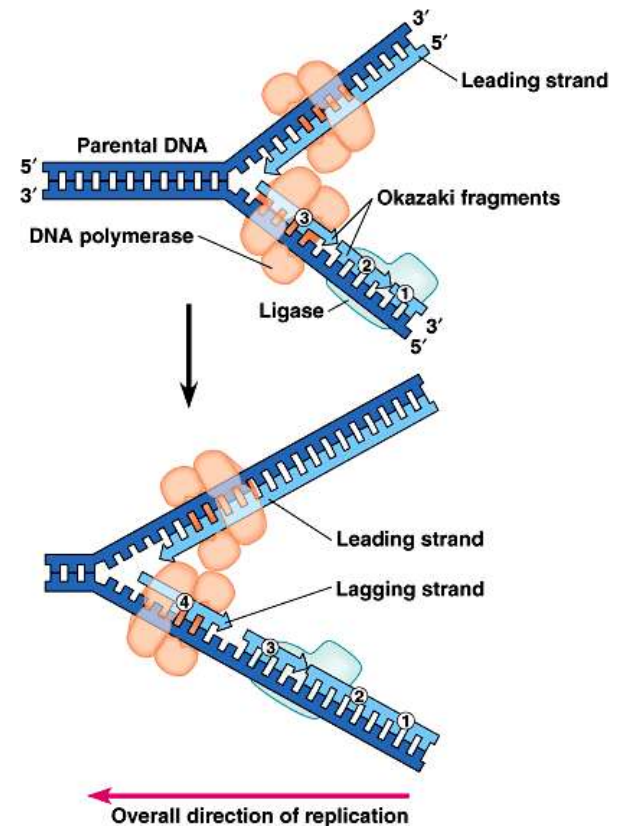
DNA Replication, II

- Antiparallel nature: •
 - sugar/phosphate backbone runs in opposite directions (Crick);
 - one strand runs 5' to 3', while the other runs 3' to 5';
 - DNA polymerase only adds nucleotides at the free 3' end, forming new DNA strands in the 5' to 3' direction only



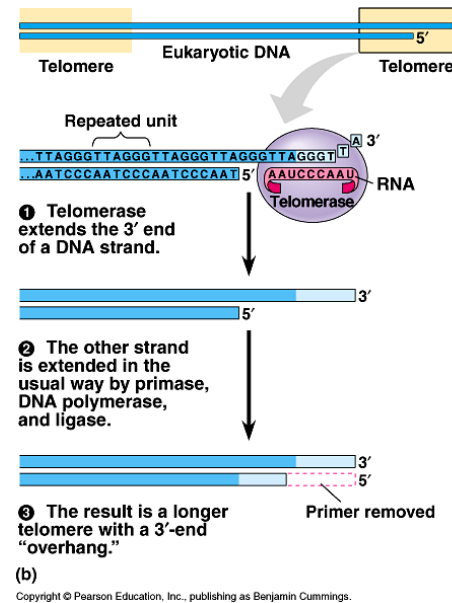
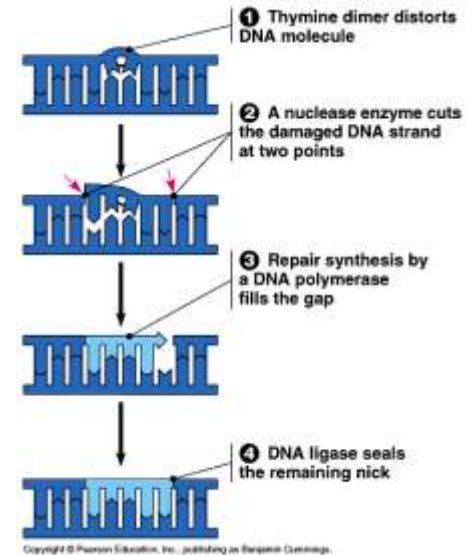
DNA Replication, III

- Leading strand: synthesis toward the replication fork (only in a 5' to 3' direction from the 3' to 5' master strand)
- Lagging strand: synthesis away from the replication fork (Okazaki fragments); joined by DNA ligase (must wait for 3' end to open; again in a 5' to 3' direction)
- Initiation: Primer (short RNA sequence~w/primase enzyme), begins the replication process



DNA Repair

- Mismatch repair: DNA polymerase
- Excision repair: Nuclease
- Telomere ends: telomerase



DNA Repair

- http://glencoe.mcgraw-hill.com/olcweb/cgi/pluginpop.cgi?it=swf::640::480::/sites/dl/free/0003292010/811325/proofreading_function_DNA_Polymerase.swf::Proofreading Function of DNA Polymerase