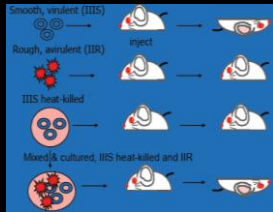






PERUBAHAN BENTUK DINDING SEL *STREPTOCOCCUS PNEUMONIA*



Penelitian Fred Griffith

Dua galur:

Smooth (S) – Virulent (gel coat)
Rough (R) – Kurang Virulen

Tikus disuntik dengan galur R and galur S yang dimatikan melalui pemanasan

Tikus mati dan ditemukan hanya mengandung bakteri galur S

PENELITIAN WATSON DAN CRICK



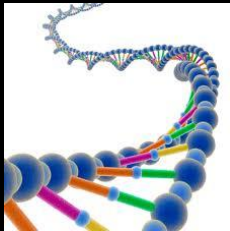
Dengan dukungan data difraksi sinar-X dari Rosalind Franklin dan Maurice Wilkins

Dengan dukungan data analisis kimia basa nitrogen dari Erwin Chargaff

Memformulasikan struktur DNA

Mengelompokkan basa DNA menjadi purin (A,G) dan pirimidin (C,T)

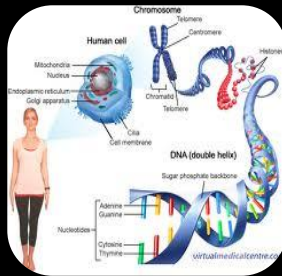
Memformulasikan model replikasi DNA



GENETIC INFORMATION

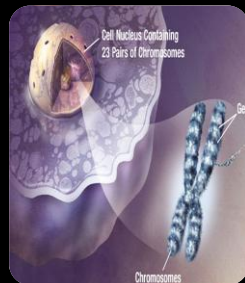
GENETIC INFORMATION

- **Gene** – basic unit of genetic information. Genes determine the inherited characters
- **Chromosomes** – length of DNA containing genes
- **Genome** – sum total of genetic material of an organism (chromosomes + mitochondria /chloroplasts and/or plasmids)
 - genome of cells – **DNA**
 - genome of viruses – **DNA** or **RNA**



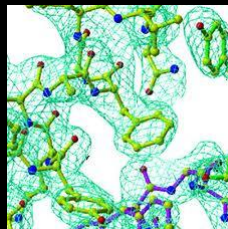
GENOMES VARY IN SIZE

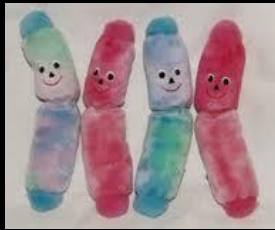
- smallest virus – 4-5 genes
- *E. coli* – single chromosome containing 4,288 genes; 1 mm; 1,000X longer than cell
- Human cell – 46 chromosomes containing 31,000 genes; 6 feet; 180,000X longer than cell



Nucleic acids are made of nucleotides similar to how proteins are made of amino acids each nucleotide consists of 3 parts

- ☑ a 5 carbon sugar (deoxyribose or ribose)
- ☑ a phosphate group
- ☑ a nitrogenous base (adenine, thymine, cytosine, guanine, and uracil)



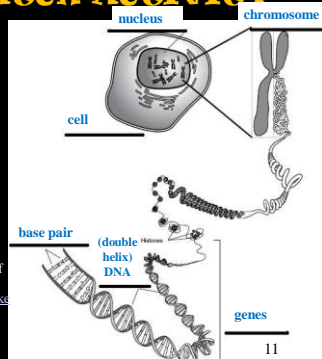


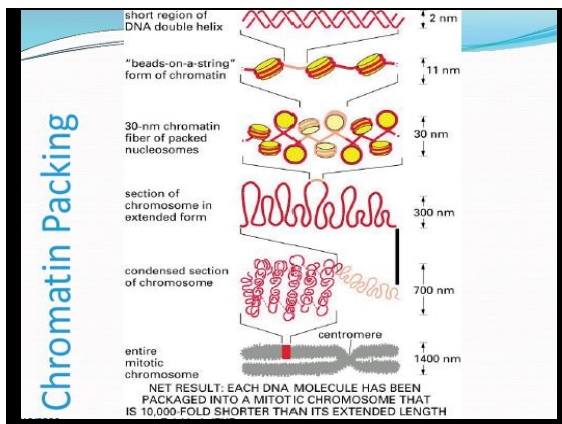
BASIC GENETIC CONCEPTS & TERMS

WORD MATCH ACTIVITY

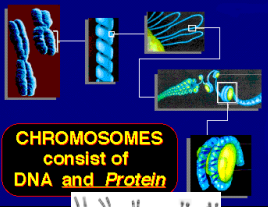
- base pair
- cell
- chromosome
- DNA (Deoxyribonucleic Acid)
- double helix*
- genes
- nucleus

Illustration Source: Talking Glossary of Genetic Terms
<http://www.genome.gov/glossary.cfm?key=chromosome>





Chromosomes vs Genes

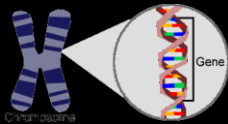


CHROMOSOMES consist of DNA and Protein

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	X	Y
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	X	Y
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	X	Y
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	X	Y

- A **chromosome** constitutes an entire DNA molecule + protein
 - Protein = histones
 - Supercoiled DNA in nucleosomes
 - Humans contain 46 such molecules (23 pairs)
 - 44 somatic chromosomes
 - 2 sex chromosomes (X + Y)

Chromosomes vs Genes



- **Genes** constitute distinct regions on the chromosome
- Each gene codes for a protein product
- DNA → RNA → protein
- Differences in proteins brings about differences between individuals and species

Gene & Protein

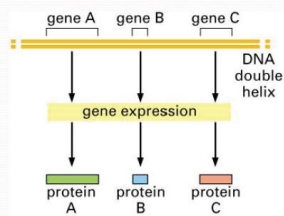
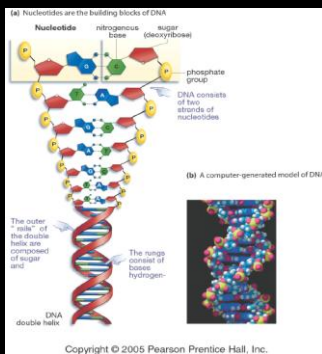


Figure 4-6. Molecular Biology of the Cell, 4th Edition.



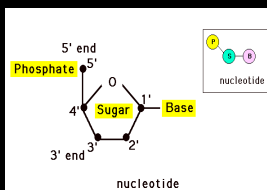
DNA

DNA MOLECULE



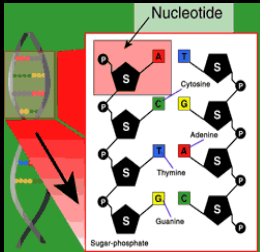
- Composed of 2 polymers of nucleotides
- antiparallel strands 3'to 5' and 5'to 3'
- each strand provides a template for the exact copying of a new strand

Nucleotide structure of DNA



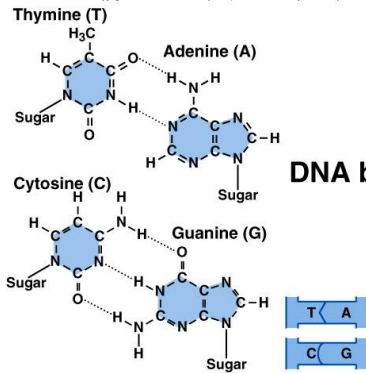
- Each nucleotide of DNA contains:
 - Deoxyribose
 - Phosphate
 - Nitrogen base (either A, G, C, T)

DNA structure

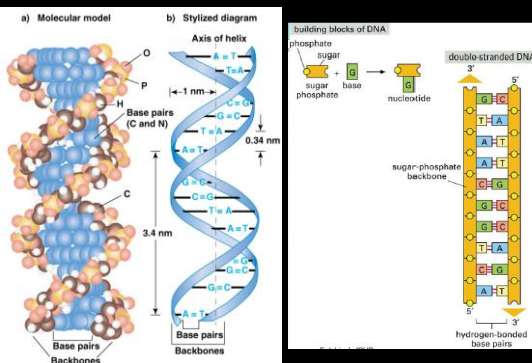


- “Double helix”
proposed by Watson
and Crick (1953)
- Antiparallel backbones
- Complementary base
pairing:
 - Adenine to Thymine
 - Cytosine to Guanine

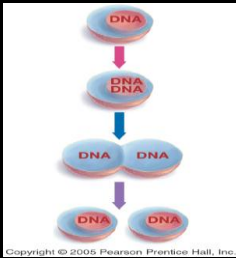
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DNA base pairs

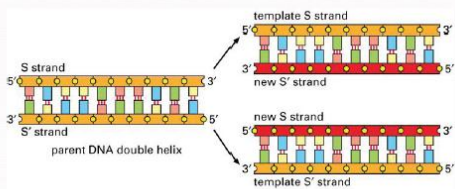


Therefore, prior to dividing, any cell must first replicate DNA

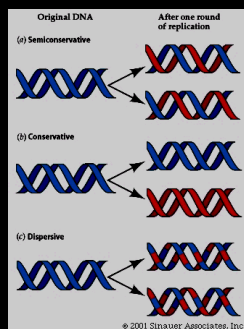


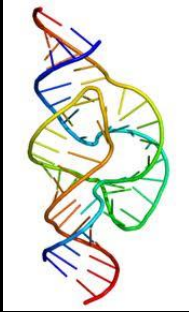
- Each single-stranded (SS) chromosome duplicates to become a double-stranded (DS) chromosome
- Example:
 - A human cell is formed with 46 SS chromosomes
 - Each chromosome replicates to produce 46 DS chromosomes

DNA is a template for its own duplication



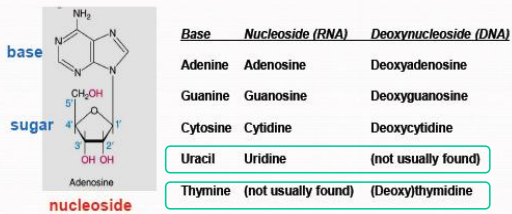
REPLIKASI DNA





RNA

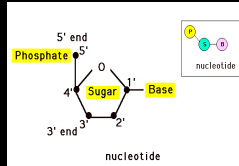
RNA: terminology



RNA (ribonucleic acid)

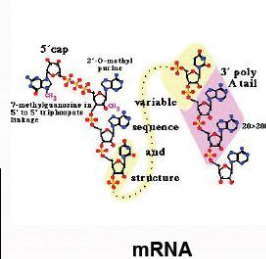
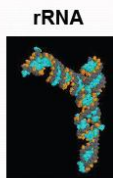
- RNA plays a central role in the life of the cell. We are mostly look at its role in protein synthesis, but RNA also does many other things.
- RNA can both store information (like DNA) and catalyze chemical reactions (like proteins).
- One theory for the origin of life has it starting out as RNA only, then adding DNA and proteins later. This theory is called the "RNA World".

Nucleotide structure of RNA



- Each nucleotide of RNA contains:
 - Ribose
 - Phosphate
 - Nitrogen base (either A, G, C, U*)
- *contains Uracil instead of Thymine

Types of RNA Molecule



11/12/2008

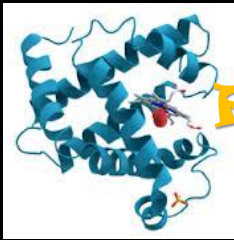
42

RNA Used in Protein Synthesis

- messenger RNA (mRNA). A copy of the gene that is being expressed. mRNA consists of "codons" that code for each individual amino acid in the protein made by that gene.
 - in eukaryotes, the initial RNA copy of the gene is called the "primary transcript", which is modified to form mRNA.
- ribosomal RNA (rRNA). Four different RNA molecules that make up part of the structure of the ribosome. They catalyze the adding of an amino acid to a growing peptide chain.
- transfer RNA (tRNA). Small RNA molecules that act as adaptors between the codons of messenger RNA and the amino acids they code for.

RNA vs. DNA

- RNA contains the sugar ribose; DNA contains deoxyribose.
- RNA contains the base uracil; DNA contains thymine instead.
- RNA is usually single stranded; DNA is usually double stranded.
- RNA is short: one gene long at most; DNA is long, containing many genes.



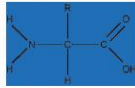
PROTEIN

Proteins

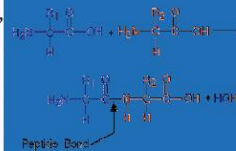
- Proteins are composed of one or more polypeptides, plus (in some cases) additional small molecules (co-factors).
- Polypeptides are linear chains of amino acids. After synthesis, the new polypeptide folds spontaneously into its active configuration and combines with the other necessary subunits to form an active protein. Thus, all the information necessary to produce the protein is contained in the DNA base sequence that codes for the polypeptides.
- The sequence of amino acids in a polypeptide is known as its "primary structure".

Amino Acids and Peptide Bonds

- There are 20 different amino acids coded in DNA.
- They all have an amino group ($-NH_2$) group on one end, and an acid group ($-COOH$) on the other end. Attached to the central carbon is an R group, which differs for each of the different amino acids.
- When polypeptides are synthesized, the acid group of one amino acid is attached to the amino group of the next amino acid, forming a peptide bond.



Peptide Bond Formation



The Genetic Code (3)

- **The degeneracy of the genetic code.** Each amino acid might have up to six codons that specify it.
- Different organisms have different frequencies of codon usage.
- A handful of species vary from the codon association described above, and use different codons for different amino acids.

		Second letter				
		U	C	A	G	
First letter	U	UUU Phenylalanine UUC Phenylalanine UUA Leucine UUG Leucine	UCU Serine UCC Serine UCA Serine UCG Serine	UAU Tyrosine UAC Tyrosine UAA Stop codon UAG Stop codon	UGU Cysteine UGC Cysteine UGA Stop codon UGG Tryptophan	U C A G
	C	CUU Leucine CUC Leucine CUA Leucine CUG Leucine	CCU Proline CCC Proline CCA Proline CCG Proline	CAU Histidine CAC Histidine CAA Glutamine CAG Glutamine	CGU Arginine CGC Arginine CGA Arginine CGG Arginine	U C A G
	A	AUU Isoleucine AUC Isoleucine AUA Isoleucine AUG Methionine; start codon	ACU Threonine ACC Threonine ACA Threonine ACG Threonine	AAU Asparagine AAC Asparagine AAA Lysine AAG Lysine	AGU Serine AGC Serine AGA Arginine AGG Arginine	U C A G
	G	GUU Valine GUC Valine GUA Valine GUG Valine	GCU Alanine GCC Alanine GCA Alanine GCG Alanine	GAU Aspartate GAC Aspartate GAA Glutamate GAG Glutamate	GGU Glycine GGC Glycine GGA Glycine GGG Glycine	U C A G

