

## Composition and structure of DNA

### Composed of Nucleotides:

1. Pentose sugar (deoxyribose)



2. Phosphate Group



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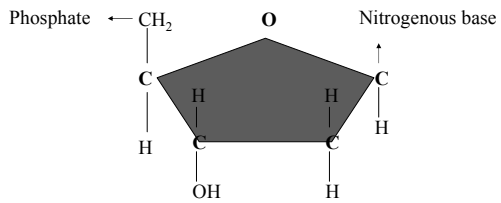
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Deoxyribose

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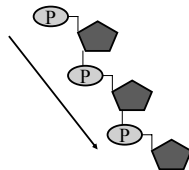
## Composition and structure of DNA

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(1 + 2) = covalent bond "spine" of DNA strand



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## Composition and structure of DNA

### Composed of Nucleotides:

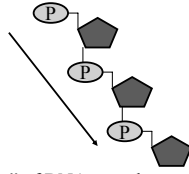
1. Pentose sugar (deoxyribose)

2. Phosphate Group

(1 + 2) = covalent bond "spine" of DNA strand

3. Nitrogenous base

2 pyrimidines (one ring) { **Thymine** ≡ **Cytosine** } 2 purines (two rings) { **Adenine** ≡ **Guanine** }




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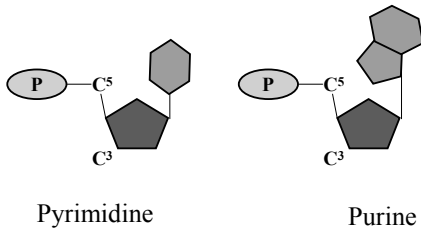
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## Nucleotides: Components of DNA




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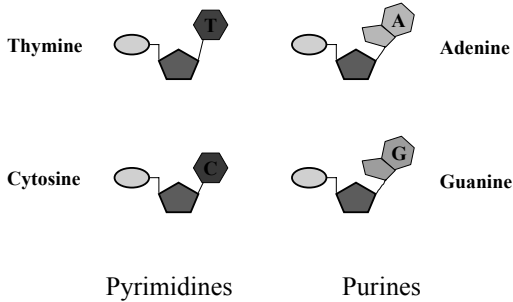
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## Four nucleotide components of DNA




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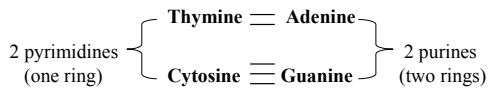
## DNA Structure

1. In 3-dimensional configuration, a **double helix**

3' to 5' spine of one strand matches 5' to 3' spine of other

nitrogenous bases match up at central axis of molecule

hydrogen bonds hold bases on opposite spines together



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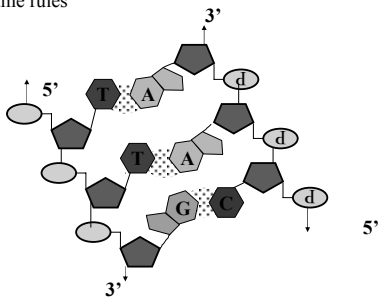
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## DNA Structure

2. In 2-dimensional projection, complementary strings of nucleotides with same rules



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## Chargaff's Ratios

$$A = T \text{ \& \ } G = C$$

Chargaff's ratios allow accurate replication of DNA

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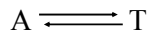
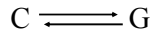
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Chargaff's Ratios were critical to determining  
DNA nucleotide pairing rules



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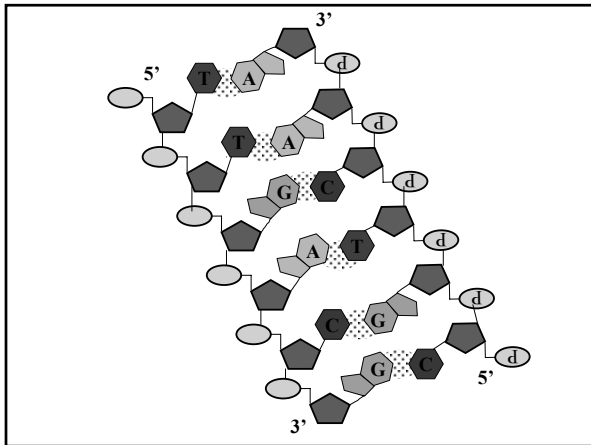
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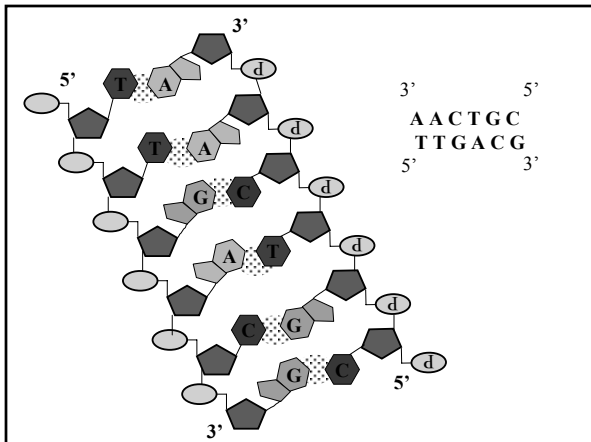
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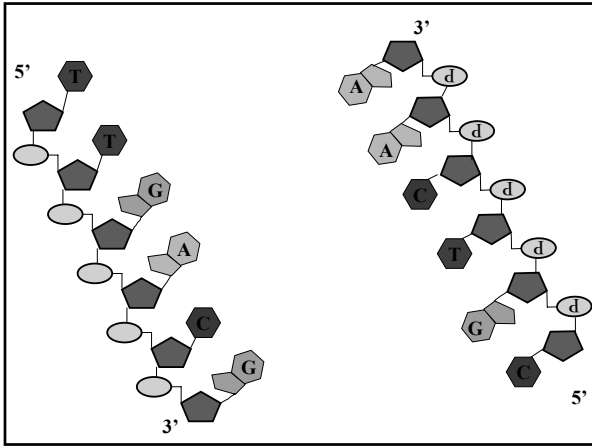
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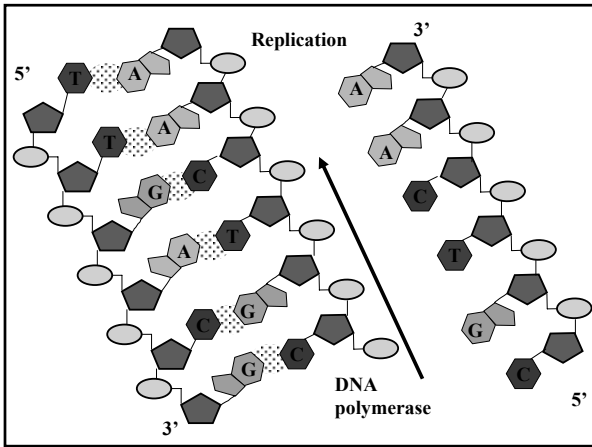
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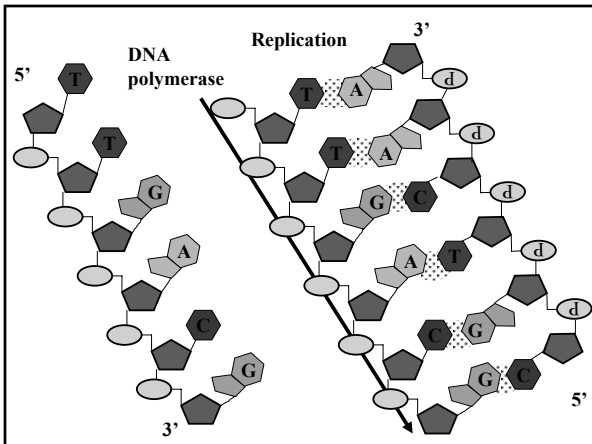
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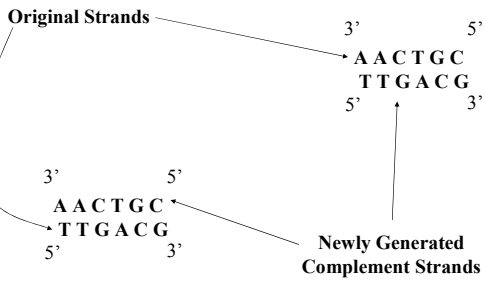


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**Result: Two Identical DNA strands**



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Identical DNA strands or helixes means:

identical copies of genes / alleles

identical copies of chromosomes as a whole

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Read 3' to 5' and Build 5' to 3'



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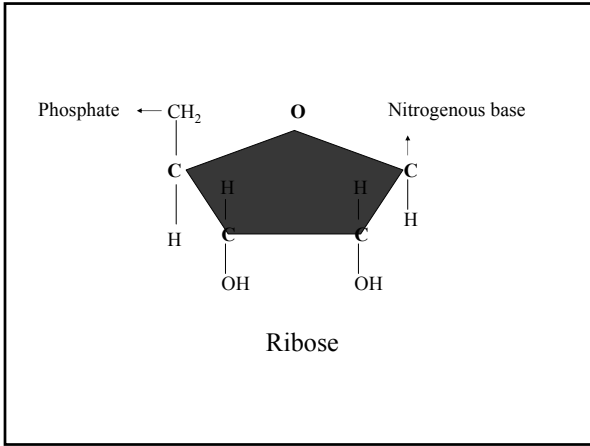
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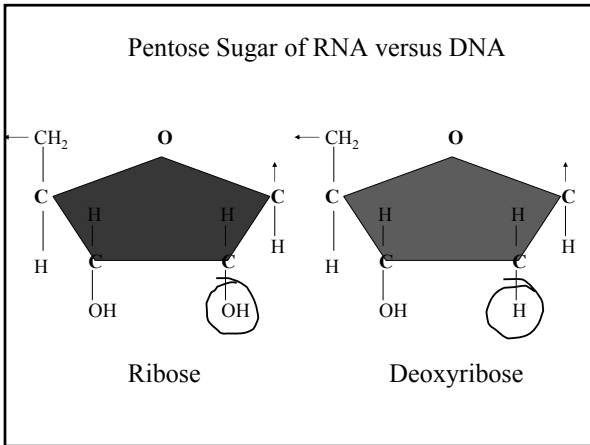
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Composition and structure of RNA

Composed of Nucleotides:

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(1 + 2) = covalent bond "spine" of RNA strand

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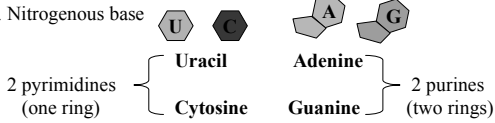
## Composition and structure of RNA

### Composed of Nucleotides:

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(1 + 2) = covalent bond "spine" of RNA strand

### 3. Nitrogenous base




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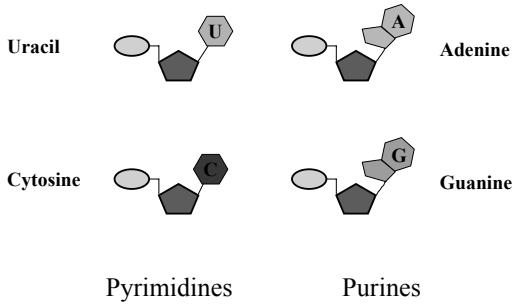
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## Four nucleotide components of RNA




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## Properties of RNA versus DNA

### Similarities:

- Composed of four nucleotides
- Transcribed from DNA template with strict pairing rules
- 3' to 5' covalent bond spine

### Differences:

- Uracil instead of Thymine
- Ribose instead of Deoxyribose
- Single-stranded, not double-stranded

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## Reasons for Single-Strand Structure of RNA

To be read, both DNA and RNA must be "single-stranded"

DNA unzips to be replicated or transcribed

RNA must be read and translated into a protein

By implication, only one strand DNA molecule codes for RNA.

The complement protects and ensures accurate replication.

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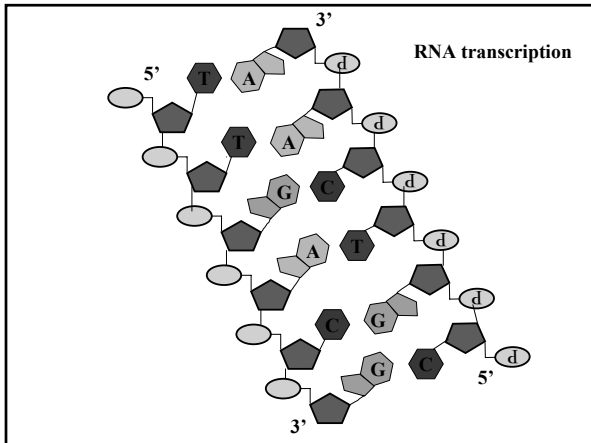
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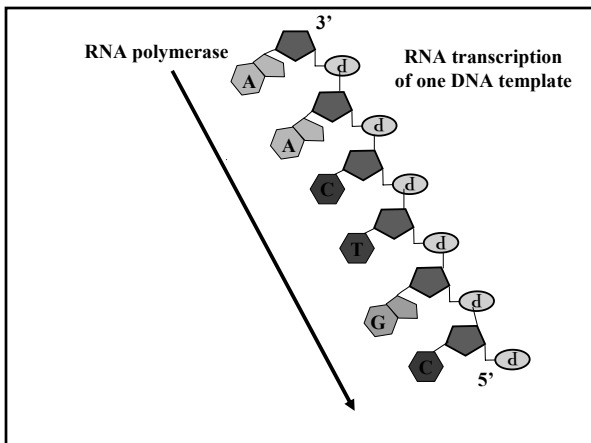
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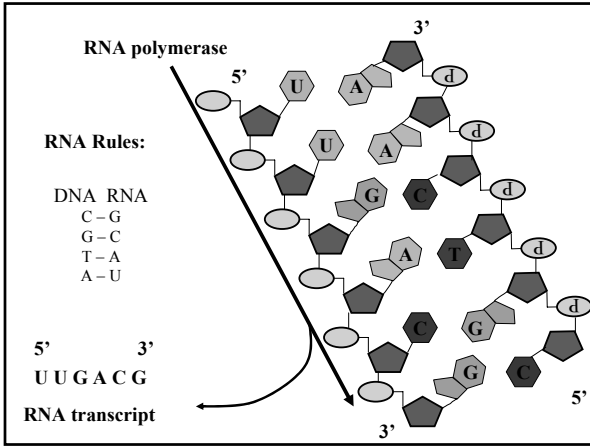
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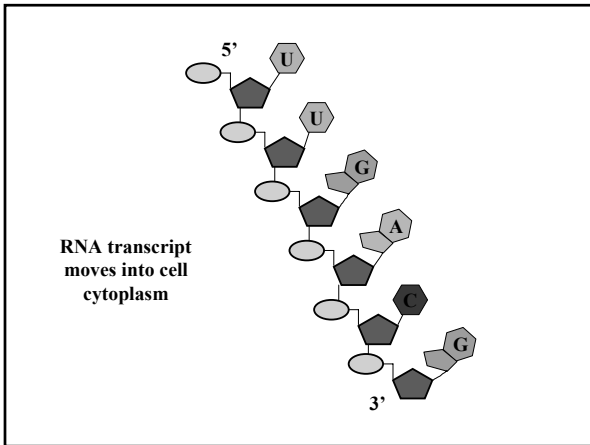
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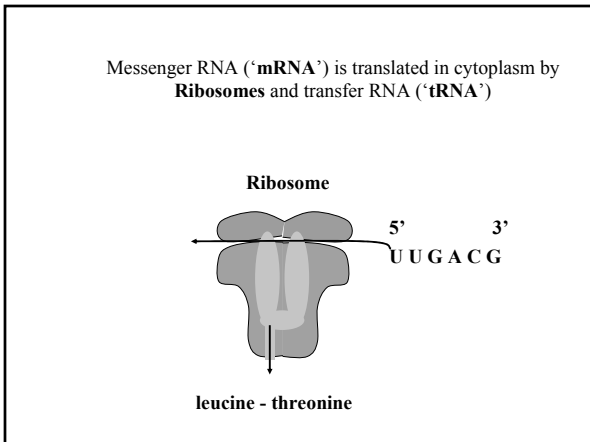
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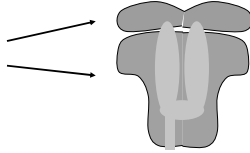
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## Types of RNA

1. The message coded from DNA = messenger RNA = **mRNA**
2. The molecules that build ribosomes where mRNA is translated = ribosomal RNA = **rRNA**

Both components of ribosome are largely RNA molecules



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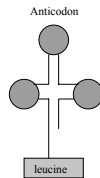
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## Types of RNA

1. The message coded from DNA = messenger RNA = **mRNA**
2. The molecules that build ribosomes where mRNA is translated = ribosomal RNA = **rRNA**
3. The molecules that carry amino acids to the growing protein during translation of mRNA = transfer RNA = **tRNA**



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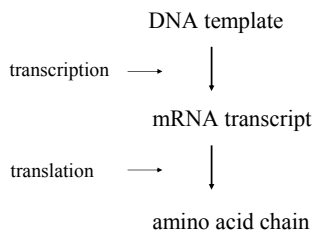
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## Gene Expression – DNA to protein



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**DNA template**      3'    T A C G G A T C T A C T    5'



**mRNA transcript**    5'    A U G C C U A G A U G A    3'

(mRNA is translated from 5' to 3' end)

|         |         |         |         |
|---------|---------|---------|---------|
| Codon 1 | Codon 2 | Codon 3 | Codon 4 |
| A U G   | C C U   | A G A   | U G A   |
| ⏟       | ⏟       | ⏟       | ⏟       |

methionine – proline – arginine – STOP

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Practice Transcription and Translation

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