



Genetics

Subject : DNA Structure

Lec no : Lec 1

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وَقُلْ رَبِّ زِدْنِي عِلْمًا

تجدون في guidance مادة الباثو على موقع النادي :

كتب المادة

ROBBINS

PATHOMA

شرح المادة

شرح المادة كاملة

يوجد شرح للمادة كاملة من أرشيف نغمة اثر مع العلم ان الوحدة الثالثة كانت تعطل من قبل الدكتور عادة

PATHO ATHAR

شرح لاب الباثو

PATHO LAB

شرح الفريق العلمي

شرح قديم للفريق العلمي

PATHO - SCIENTIFIC TEAM

تقارير

يمكن الاستفادة من تقارير الالفه السابقة

تقارير نفسي اثر و وريد قويات جنا

ATHAR PATHOLOGY NOTES

VEIN PATHO NOTES

QUIZZES

كويزات للدكاترة

للوصول الى guidance الباثو و تقارير
المادة كاملة :



كل اعمال الفريق العلمي تنشر على قناة
التيليجرام



Nucleic acids

→ building blocks of nucleic acids (DNA, RNA)

- Polymer of **nucleotides**.
- Two main types:

DNA

Deoxyribonucleic acid
2 strand

RNA

Ribonucleic acid
1 strand

Effector molecules |

التي تقوم بكل functions داخل الخلية

• All cellular functions depend on **proteins** which consist of chains of amino acids.

Sequence of a.a in protein يحدد sequence of nucleotide in Responsible gene

primary structure of proteins كنا نهتم في number of a.a and sequence of a.a ب

sequence of nucleotides يعتمد على

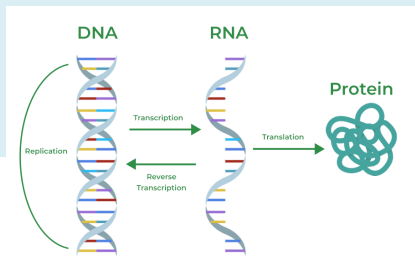
• The precise arrangement of these amino acids necessitates **certain guiding information.**

sequence of nucleotides in DNA

sequence of nucleotides ← sequence of a.a ← protein structure
error فيه error فيه error فيه

• Such information is provided by **DNA** which can convey information through a group of **RNA**.

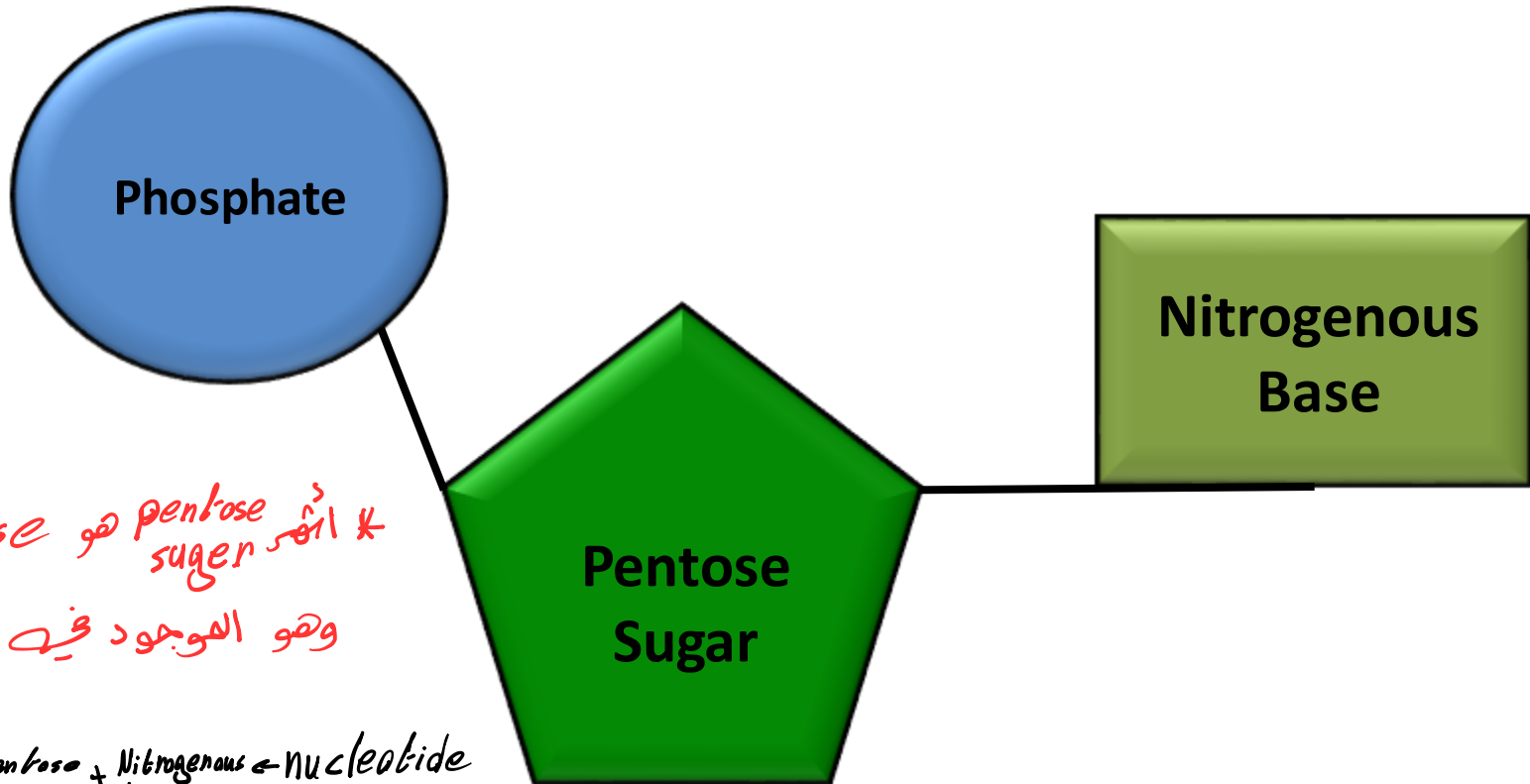
• مش DNA هو وادي يبعطينا protein
RNA هو molecule intermediate
في عملية production of proteins



any change in only one a.a results in abnormal protien functions

wrong sequence of nucleotides= abnormal gene =abnormal sequence of a.a =abnormal protein

Nucleotides



ribose هو pentose sugar *
والسكر هو

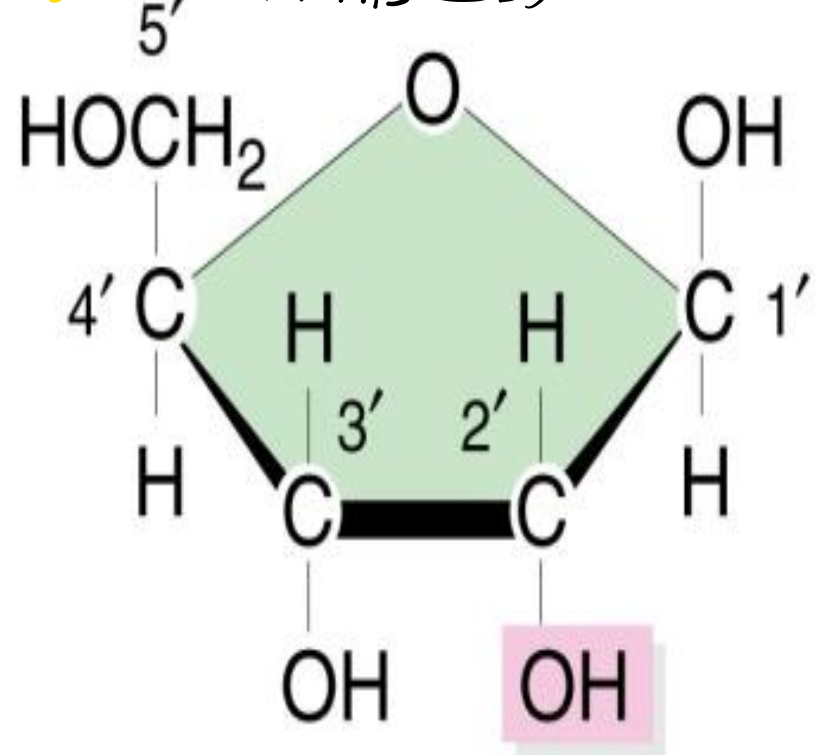
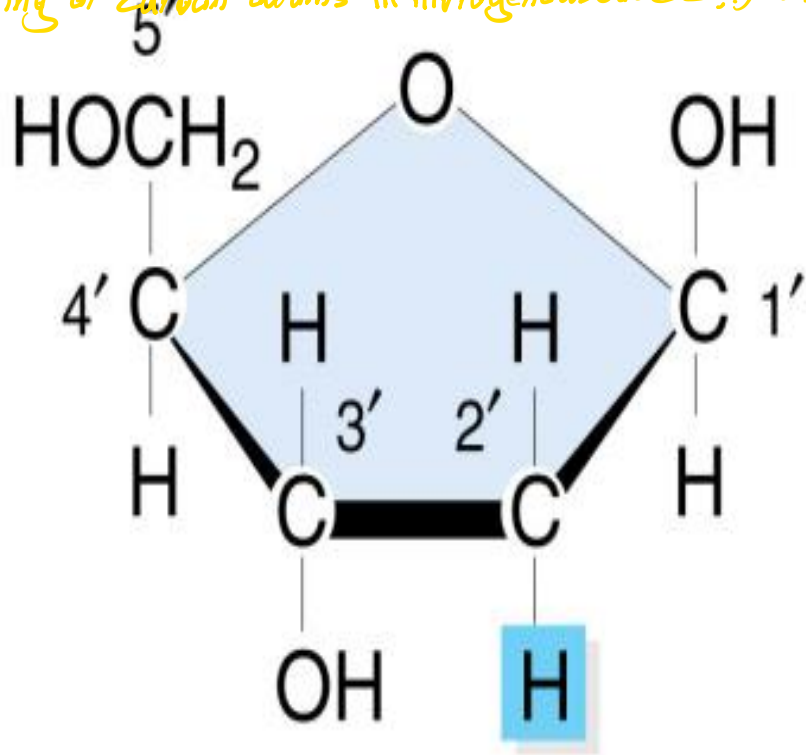
وهو الموجود في DNA, RNA

phosphate + pentose sugar + Nitrogenous Base ← nucleotide

pentose sugar + Nitrogenous Base ← nucleoside

numbering of carbon atoms in ribose by 1', 2', 3', 4', 5'

numbering of carbon atoms in nitrogenous base ليس 1, 2, 3, 4, 5 (مت ايجل التفريق بينها وبين) وليست



DNA → **Deoxyribose**

RNA → **Ribose**

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H atom is on C2

Note that the positions on the sugar are designated with primes to distinguish them from positions on the bases.

* الفرق بين uracil, cytosine

O in C4

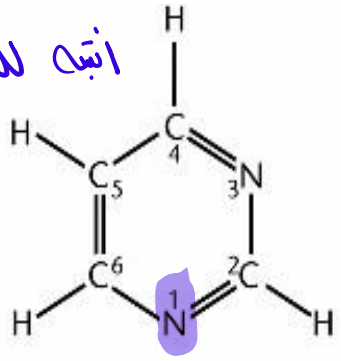
NH₂ in C4

* الفرق بين uracil, thymine

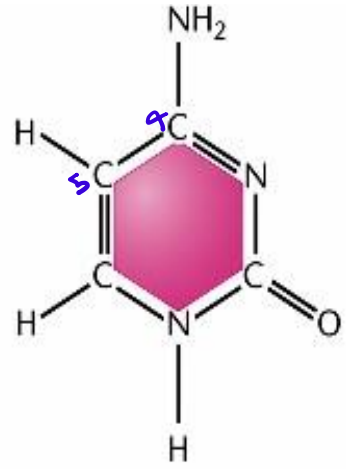
H atom in C5

methyl group (CH₃) in C5

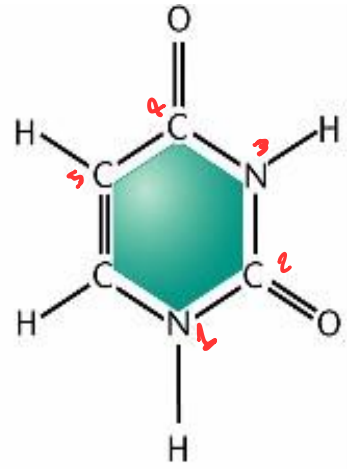
انتبه للنوم فالكر



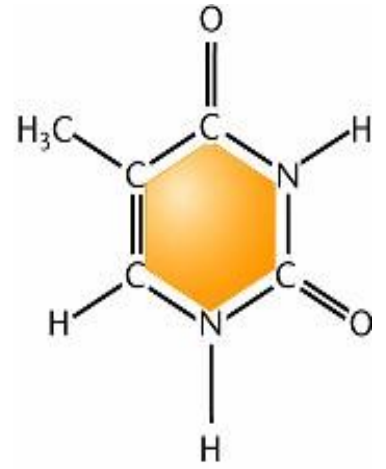
Pyrimidine ring



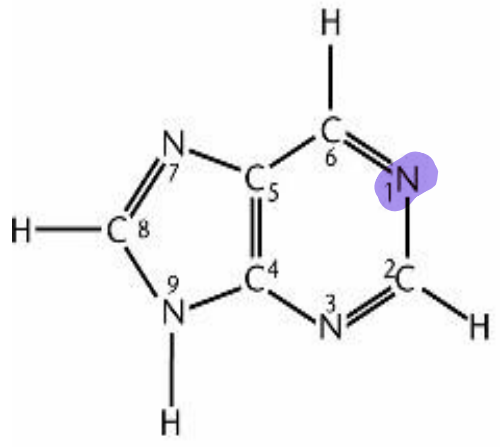
Cytosine



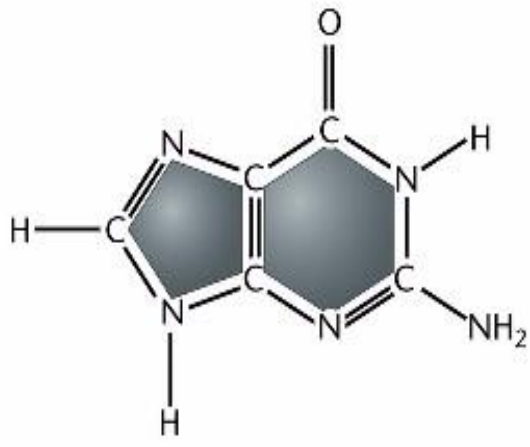
Uracil



Thymine



Purine ring

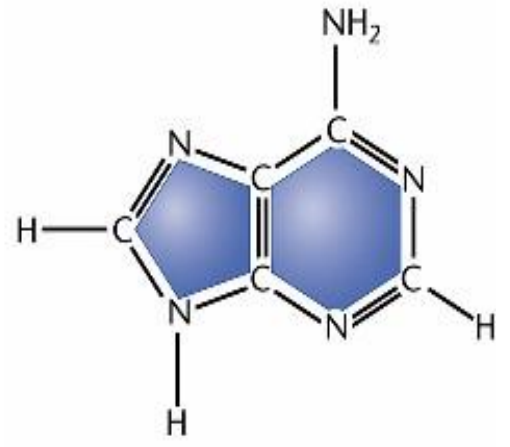


Guanine

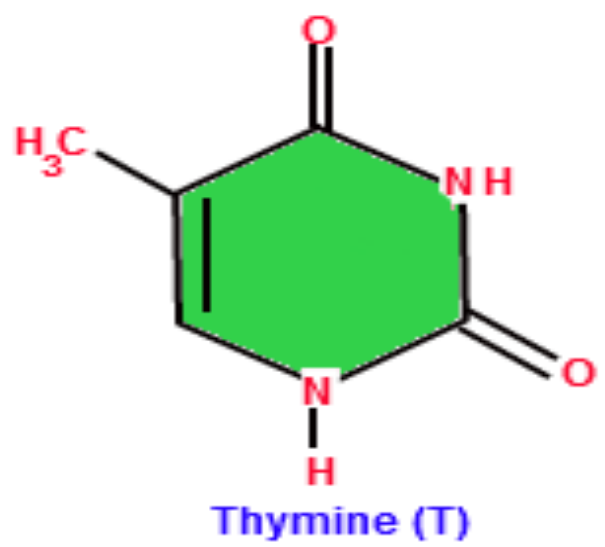
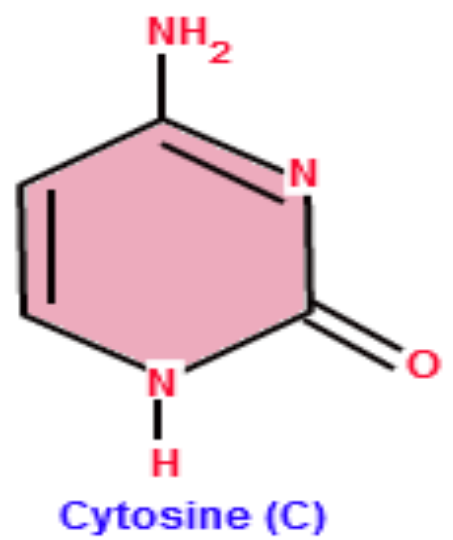
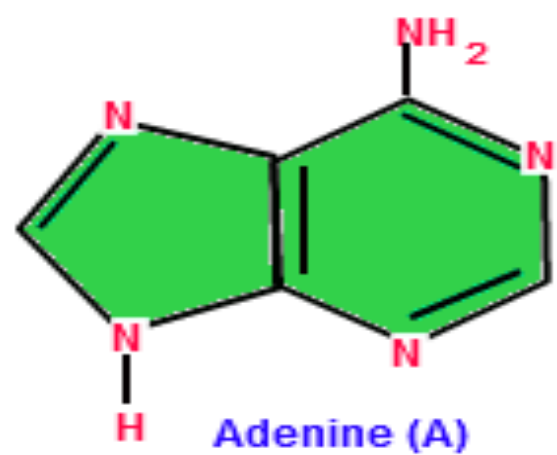
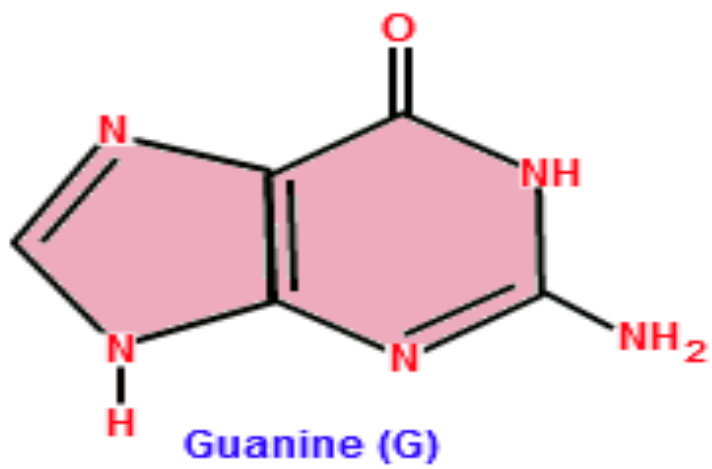
* الفرق بين Guanine, Adenine

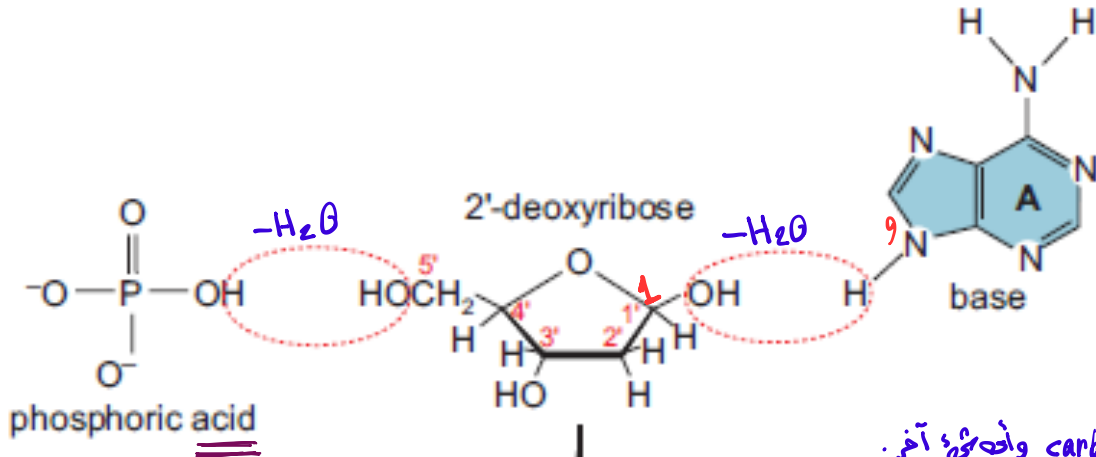
O in C6

NH₂ in C6



Adenine



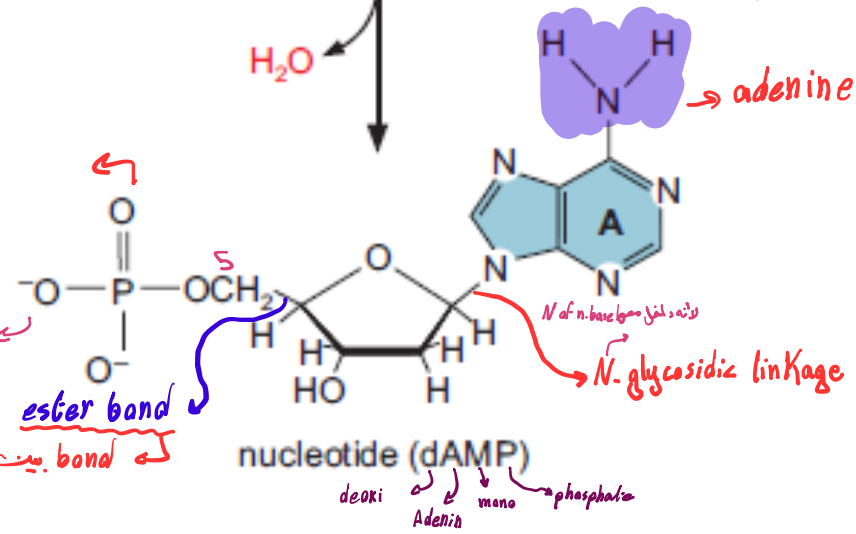


glycosidic bond ← band ترتیب میں آبی carbohydrate molecule وانچے آخر.

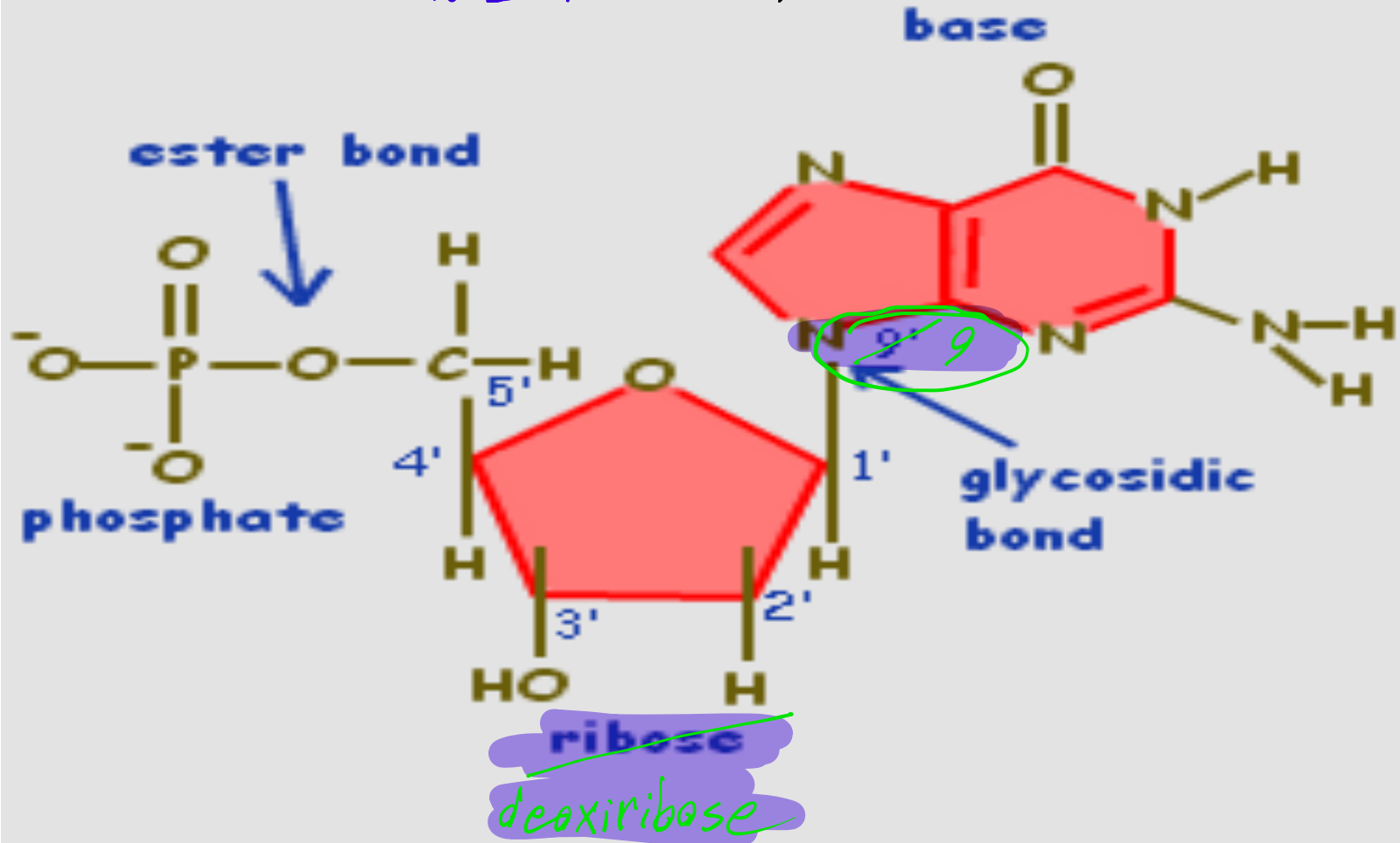
nucleobide of DNA
بسیب 2-Deoxyribose

negative charge of P

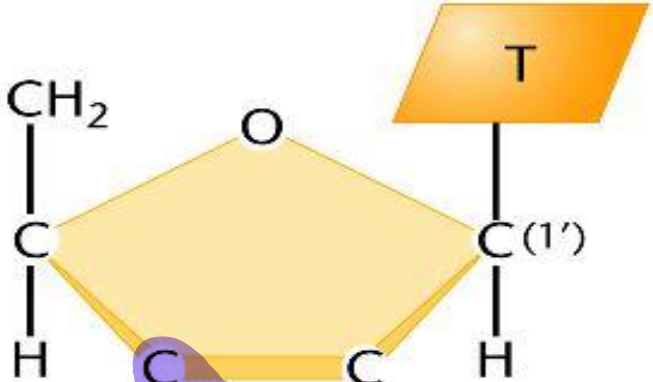
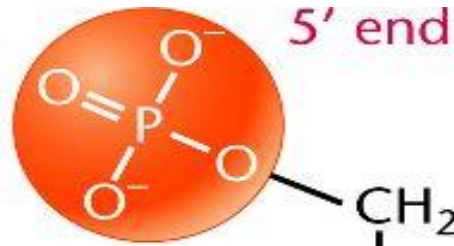
ester bond
acid میں alcohol مع bond



N9 ← بشك 9 ← purine ← nitrogenous bases
N1 ← بشك 1 ← pyrimidine

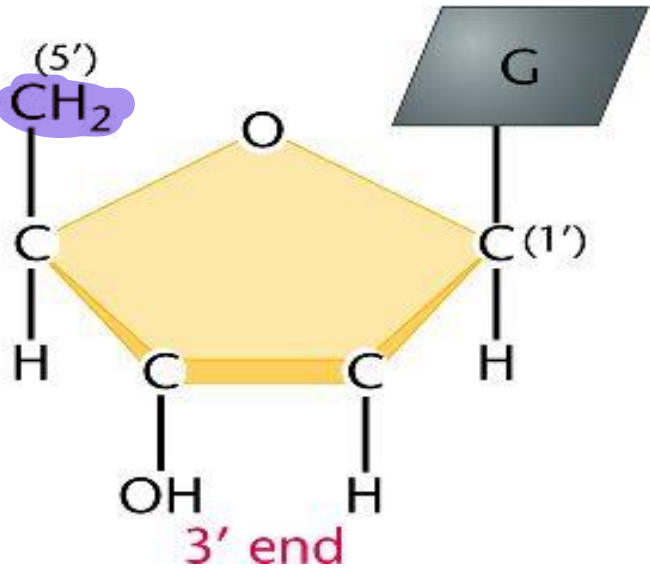
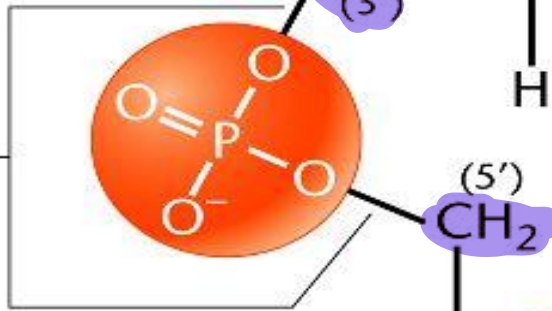


The bases are attached to the deoxyribose by glycosidic linkages at N1 of the pyrimidines or at N9 of the purines.



← amino acids تشبه بعضها عن طريق peptide bond
 ← nucleotides تشبه بعضها عن طريق phosphodiester bond

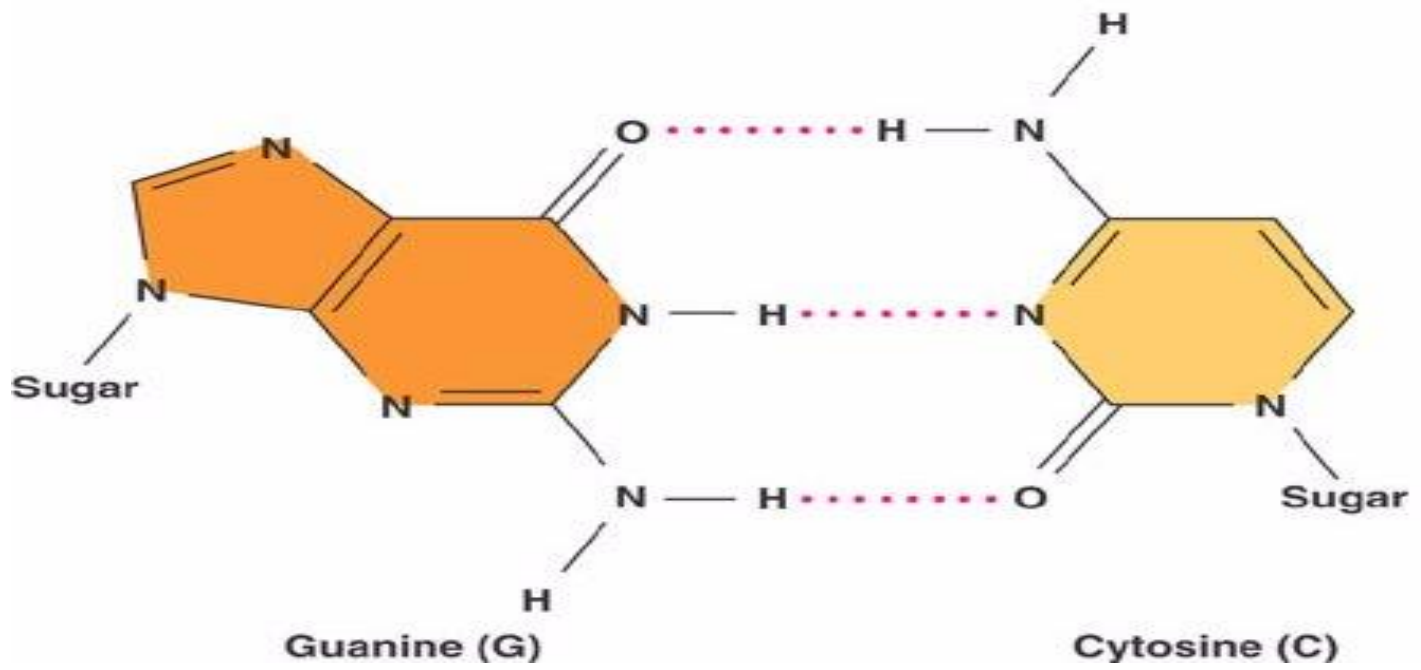
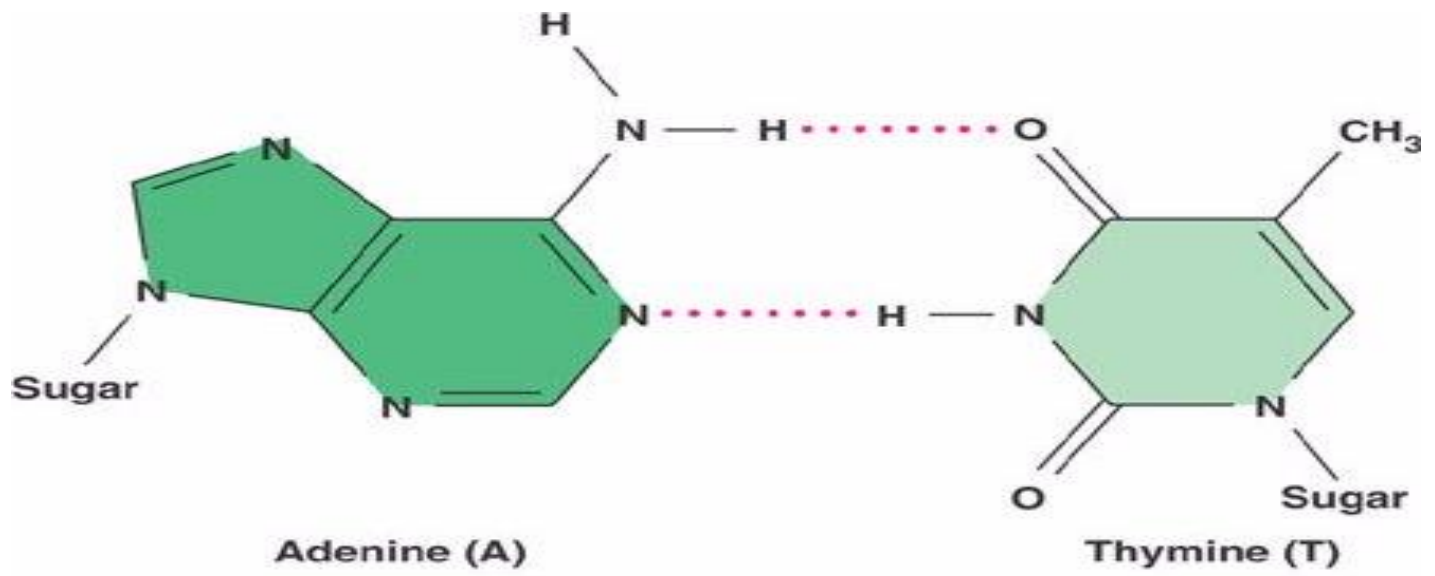
3' to 5' phosphodiester bond



← عشتك نوميل nucleotides مع بعض
 بعمل رابطة (ester bond) بين C3
 في nucleotide و phosphate
 في nucleotide 2


← P تبتغ nucleotide رابطة - deoxy
 عن طريق (ster bond) مع C5

لذلك ابي الرابطة 3 to 5 phosphodiester bond



DNA Structure

- DNA consists of **two strands** of polynucleotides.

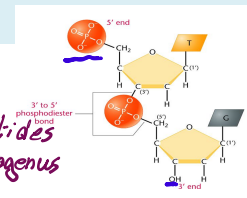
 DNA 1ry structure : *↪ number and sequence of a.a*

- The sequence of nucleotides
- The order of nucleotides in any DNA strand is written in the **5' to 3' direction**

Free phosphate group ↙

↘ Free OH group

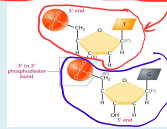
Naming of nucleotides according to nitrogenous base.



TG from 5' to 3' ✓

GT from 3' to 5' ✗

- The nucleotide in each strand covalently linked by phosphodiester bonds between phosphate at 5' of one nucleotide and 3' hydroxyl group of deoxyribose of the next nucleotide.



- Each strand has two ends, 3' end with free hydroxyl group and 5' end with free phosphate group.
- The two DNA strands run antiparallel direction this means that one strands run from 3' to 5' while the other strand run from 5' to 3'.

nucleotide
واحد

OH Group

- The sequence of nucleotide is always read from 5' to 3' direction e.g. 5' pGpApCp... 3' or GAC.

Free phosphate group \leftarrow P *دائفة تسمى*
 P *phosphate groups*

- The sugar phosphate unites form the backbone of DNA strand while nitrogenous bases are projecting to the inside in between the two strands.
- The sequence of bases determines the coding structure of DNA (**genetic information**)

sequence of bases

protein \leftarrow *code* \leftarrow



DNA 2ry structure :

- Watson and crick proposed a structure for DNA in the form of a double helix (**B form**) which is the most common physiological form. It has the following characters:

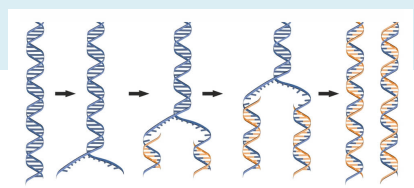
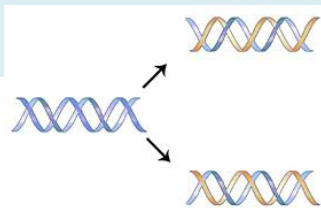
1- Two **antiparallel** strands form a right handed helix: one runs in the 5' to 3' direction and the other in the 3' to 5' direction. The two strands are paired to each other & coil around a common axis to form a right handed helix.

complementary bases ^{مكملة لبعضها} . نيت بعض

- **2-complementary base pairing**: The two strands are held together by hydrogen bonds between the complementary base pairs, adenine forms two hydrogen bonds with thymine and guanine forms three hydrogen bonds with cytosine. Thus the number of adenine equals that of thymine and the number of guanine equals that of cytosine in DNA.
- The sequence of bases in one strand determines the sequence of the other during **DNA replication** ^{النسخ المتماثل} to transfer genetic information in a correct manner as each of the original DNA strand acts as a template for synthesis of a new complementary strand to form two daughter DNA molecules. ^{قالب}

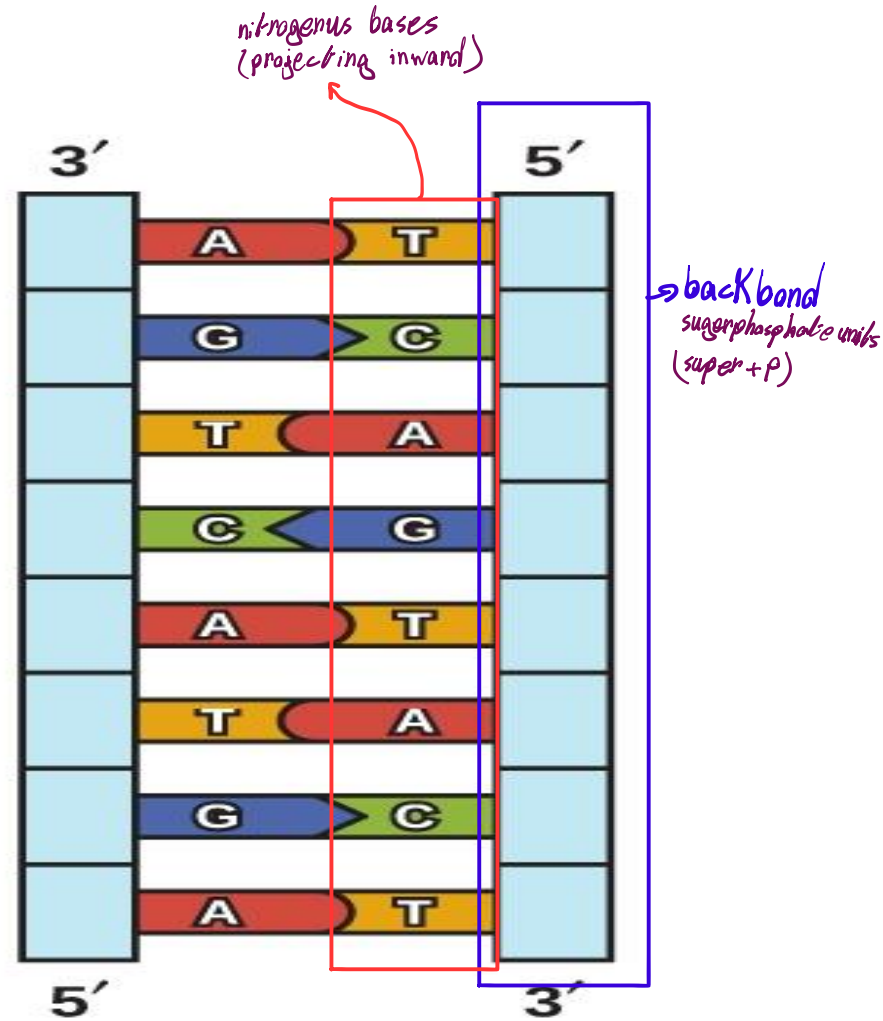
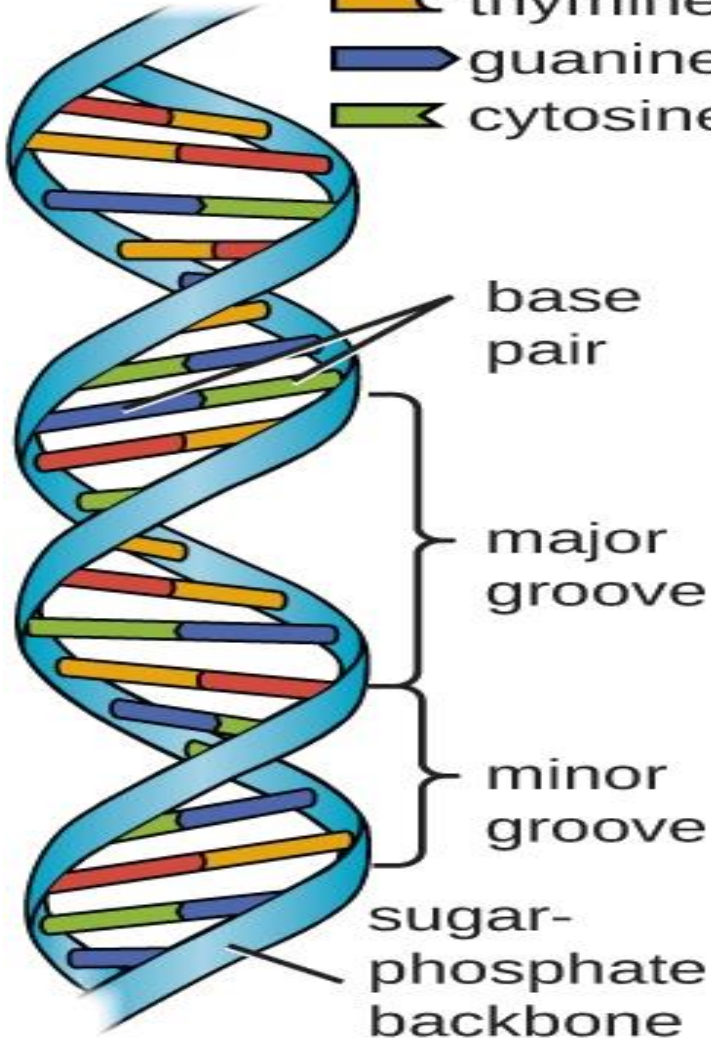
مجموعه خالصة
mitosis
التي خلية تتكون من خلية ائمة
genetic material
معلومات وراثية

DNA ← يكون من strands
لو قطعهم عن بعض رح يكون
strand مقابل كل واحد فيهم
هذا يسمى (replication)
هكذا ينتج 2 copies



nitrogenous bases:

- adenine
- thymine
- guanine
- cytosine



(a) ← متى لانفي antiparallel تبدأ فمادة strand المقابل من (5' to 3')

(b) ← strand المقابل يكون direction تبعه عكس strand الأخرى (3' to 5')

- 3- **Base stacking**: the base pairs are stacked above each other by **van der waals forces** and **hydrophobic interactions** so **stability** of the helix is provided by :

electrostatic interaction

- Van der waals forces
- Hydrophobic interactions
- Hydrogen bonding between complementary base pairs

- **Van der waals forces:** a class of transient electrostatic interaction. The attraction between molecules is greatest at a distance called the Van der waals distance (0.3 to 0.4 nm). If molecules approach each other more closely, a repulsive force develops, by the negative charges of their outer electron shells.

عندها يكون
attractive
بين 2 strands
في أفضل حالاته

إذا قربت 2 strands أكثر من 0.3 يجب أن يحدث repulsion

- **Hydrophobic interactions:** nonpolar molecules cannot form hydrogen bonds with water molecules and tend to cluster together and they are insoluble in water

وأيضا molecules تكون non polar يحدث بينهم تجاذب
non polar ← nitrogenous basis

• 4-Dimensions:

-2 nm wide, each complete turn is 3.4 nm long in which there is 10 base pairs.

يعني مني لازم تفتح helix حتى تكون
exposed bases
لأنها في grooves تكون exposed
من خلال grooves تستطيع many drugs or proteins
contact with nitrogenous bases

-Two grooves are apparent from outside, a major groove (2.2 nm) and a minor groove (1.2 nm), through which many drugs or proteins can make contact with the nitrogenous bases without any need to open the helix as in these grooves the bases are exposed.

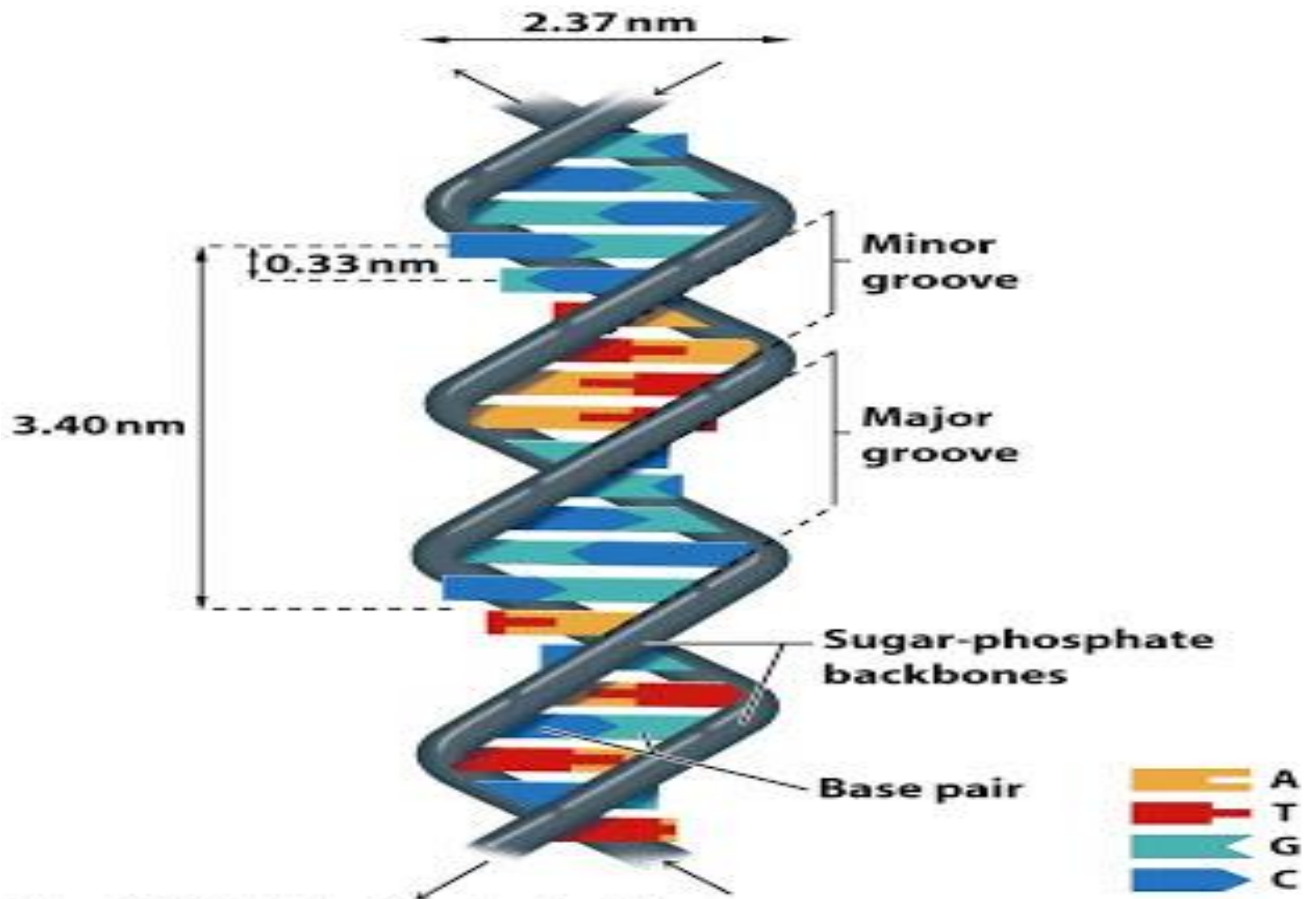
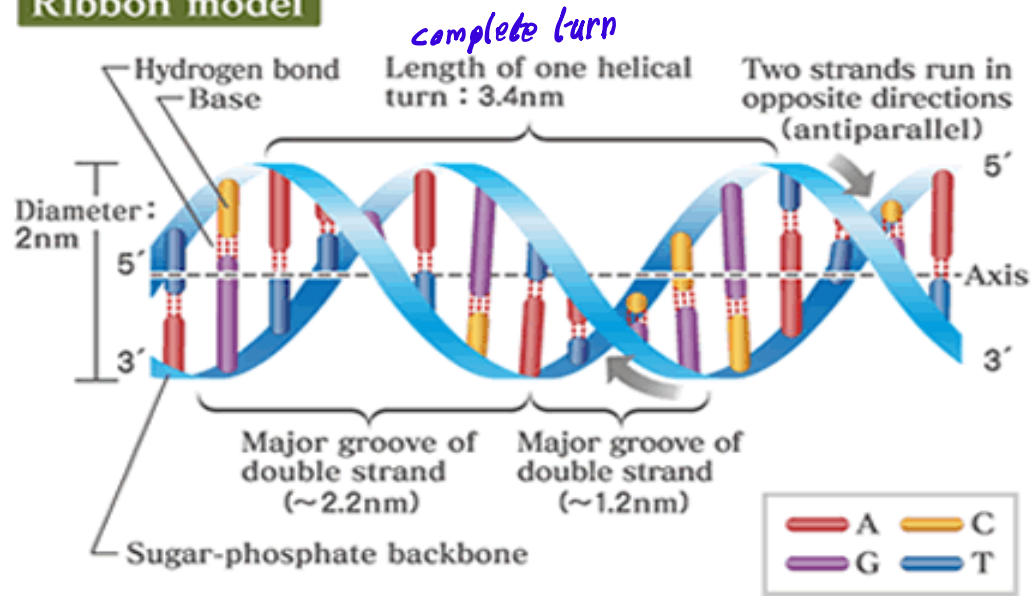


Figure 19-14 Principles of Biochemistry, 4/e
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Ribbon model



Space-filling model

