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Constituents of Nucleoproteins (Nucleotides or PolyNucleotides containing Proteins or touching Proteins)

http://aris.gusc.lv/06Daugavpils/Research/NucleoProteinsAS.pdf **A** Task for student practical studies using Interactive Molecule viewers: Chemscape RasWin FireFox 3.5.5.v

B. Lunch Massachusetts's professor **Marz** prepared **DNA structure**

http://aris.gusc.lv/ChemFiles/DnaMarzHTM/INDEX.HTM

the molecule and investigate at Display | the **CPK Corey**, **Pauling**, **Koltun** publication of scientists in **Nature** & **USA Patent 1965** for atomic modeling

at Display conditions: **Stick** (on Menu Stripe) **Ball & Stick** **Spacefill**

Atom Name	Symbol	Color	Valence Number
Carbon	**C**	**Gray** lightly or **Black**	**4**
Hydrogen	ℍ	White	**1**
Oxygen	**O**	**Red**	**2** (donor acceptor ligand up to 4)
Nitrogen	**N**	**Bluish**	**3** + 1 (donor acceptor ligand up to 4)
Sulfur	**S**	**Yellow**	**-2** , +**6**
Phosphor	**P**	**Yellow** Intensive dark	**5** (& 3)
Sodium ion	Na^+	**Blue**	**+1** (coordination up to 6)
Magnesium ion	Mg^{2+}	**Green**	**+2** (coordination up to 6)
Calcium ion	Ca^{2+}	**Gray** Dark	**+2** (coordination up to 6)
Iron ion	Fe^{2+}	**Yellow** Gray	**+2** (coordination up to 6)
Iron ion	Fe^{3+}	**Yellow** Gray	**+3** (coordination up to 6)

Pentose Phosphate **backbone**

-PO₄-⌂-PO₄-⌂-PO₄-⌂- is ribose ⌂ phosphate covalent ester bonds like bridges of oxygen.

DNA and RNA bases

G-Guanine-Green

C-Cytosine-Carmine

A-Adenine-Azure

T-Tymine-Tweety bird

U-Uracil-PUrple

1. How many **base pairs** do constitute given **DNA** fragment ? .....17 base pairs.....

2. Which one two molecular components compose **DNA** of one strand **backbone** ?

.....**phosphate** esters with **deoxy-ribose** **–O-PO_2^-–O-**⌂**-–O-PO_2^-–O-**⌂**- backbone**.....

3. What net charge of one strand and complete double strand fragment of **DNA**?.....**-17,-34**.....

4. Which two 2 kind bonds-interaction forces (underline those) support stabile structure of **DNA** in cellular water $ℍ_2O$ medium ? Are known five **5** bonds-interaction forces in Biochemistry!

1.**Hydrogen**,2.**Hydrophobic,**3.**Salt bridge,**4.**sulfur** -**S-S**- **disulfide bridge**,5.**coordinative** donor-acceptor **bond**

5. Draw structural molecular units of two chosen intermolecular bonds for **DNA** stability:

1.... >C=**O**.....**H**—**N**< **2**..... **$(H_2O)_4$**→◊◊←**$(H_2O)_4$** .....

6. Draw on protocol paper the structural planar laying of colored atoms on computer screen to symbolic type of atoms for two 2 type **base pairs** : with two hydrogen bonds **A**=**T** and **G**≡**C** with three hydrogen bonds adding hydrogens ℍ in screen picture using the button**!**

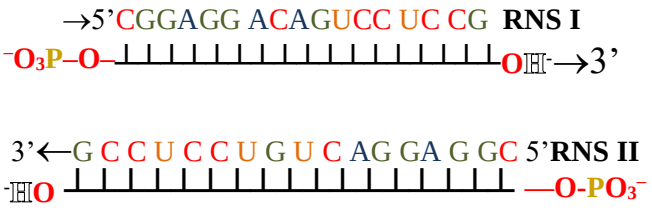
7. Show the planar picture **replication** of given fragment **DNA** using **A T G C** symbols of bases!

8. Show the forward direction **5'→3'** markers position on ends of **DNA** strand **fragment**; and **3'←5'** anti parallel direction of **DNA** markers!

9. Show the difference in **replication** using **base** symbols **A T G C** and **transcription** of given **DNA** fragment in to **RNA** sequences **I** and **II** using **bases A U G C** symbols!

10. What base in pairs is replaced from **DNA** fragment in to **RNA** sequences **I** and **II**?

T base replaced **U**.....



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Lunch the "**tRNA-Tour.html**". You will lunch **Yeast tRNA^{Phe} Tour of the Structure** : http://aris.gusc.lv/ChemFiles/CarnegieMellonUChem/Programs/Courses/BiochemMols/tRNA_Tour/tRNA_Tour.html prepared in Carnage Melon University USA: To investigate the **Phe** transport RNA molecule

1. Find the **5**-terminal and **3**-terminal nucleotides and call them!.....**G1**.....**A76**.....

2. Determine nucleotide account on one stranded **tRNA^{Phe}**? .....76 nucleotides.....

3. Determine net charge of one stranded **tRNA^{Phe}** molecule?.....**-76**.....

4. What size has **tRNA^{Phe}** molecule in overall dimensions units **Å**?

71.07__**Å**
↑
|
|←20.69**Å**→|
|
↓

5. Which six molecular components compose **tRNA** strand and backbone 1°, 2°, 3° structure, call them on report paper and four usual nucleotides, show those missing Uracil and D-Ribose structure on report paper?

6. What structure type refers **tRNS^{Phe}**, if known 1°, 2°, 3°, 4°?.....3°.....

7. Call and explain the five (5) loops secondary 2° structures for **tRNA^{Phe}**
.....**AA Stem**, amino acid acceptor stem;
.....**D Arm**, dihydrouridine hairpin;.....**AC Arm**, anticodon hairpin;
.....**V Loop**, variable loop;.....**T Arm**, the TΨC hairpin.....

8. Show **anti**codon loop like **U** four nucleotides and 3 nucleotides sequence for **tRNA^{Phe} !**
U loop → 5'U33–O2'MG34–A35–A36.....**3'→**
3 nucleotides → **5' O2'MG34 – A35–A36**..... **3'→**
mRNA codon← **3' C3 – U2 – U1**..... **5'←**

9. Mark on table of **genetic codes** investigated **tRNA^{Phe}** molecule?....→5' **U1U2C3** 3'→.....

Table 1. The genetic code. For messenger RNA molecule **mRNA Genetic Code**

1st position (5' end) ↓	**2**nd position U	C	A	G	**3**rd position (3' end) ↓
U	Phe	Ser	Tyr	Cys	U
	Phe	Ser	Tyr	Cys	C
	Leu	Ser	**STOP**	**S-SelCys**	A
	Leu	Ser	**STOP**	Trp	G
C	Leu	Pro	His	Arg	U
	Leu	Pro	His	Arg	C
	Leu	Pro	Gln	Arg	A
	Leu	Pro	Gln	Arg	G
A	Ile	Thr	Asn	Ser	U
	Ile	Thr	Asn	Ser	C
	Ile	Thr	Lys	Arg	A
	Met init	Thr	Lys	Arg	G
G	Val	Ala	Asp	Gly	U
	Val	Ala	Asp	Gly	C
	Val	Ala	Glu	Gly	A
	Val	Ala	Glu	Gly	G

Note: that those messenger **mRNA code** begin with **U1**,**C1**,**A1**,**G1** but second element with **U2** as well **C1**,**G1** with second **C2** nucleotide tend to specify for translation seven amino acids on protein chain most hydrophobic.

10. Which three nucleotides set on codon sequences to specify seven amino acids having hydrophobic properties!
First **four** nucleotides.....
U1 U2, **C1 U2**, **A1 U2**, **G1 U2**.....
second nucleotide is **C2**,**G2**.....
to **C1 C2** and.....
to **G1**, **C2**.....

11. Call & depict in short cut symbols twelve 12 tertiary 3° unusual structures for **tRNA^{Phe}**
……..…**G4-U69** wobble base pair. ……..……**T54-A58** reversed Hoogsteen base pair.
……..…**G18-PSU55** base interaction.....**G26-A44** base pair.……
.....**G15-C48** reversed Watson-Crick base pair.....**G19-C56** Bent Watson-Crick base pair.....
.....**G10-C25 base pair & G45**.....**U12-A23** base pair & **A9**.....
.....**C13-G22 base pair & G46**.....**A9** intercalates between **G45** and**G46**.....
.....**G18** intercalates between **G57 and A58**.....**G57** intercalates between **G18** and **G19**.....

12. How many **Mg^{2+}** ions **4**....and What coordination number **N=6**...? **13.**Draw coordinative bond structural molecular unit of donor acceptor bonding! =**O:** →□**Mg**□$^{+}$←**:O**=.....

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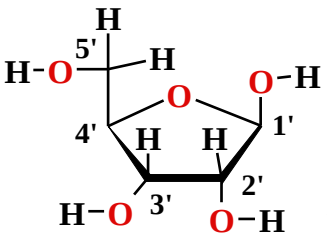
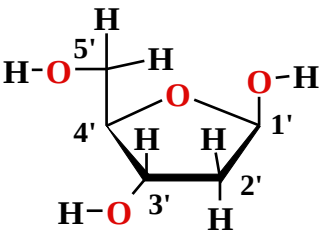
11. Draw Cloverleaf diagram for **tRNA^{Phe}** on Your lab report for 76 **bases** showing its **base pair** regions and five **5** loop- or hairpin- secondary 2° structure regions !

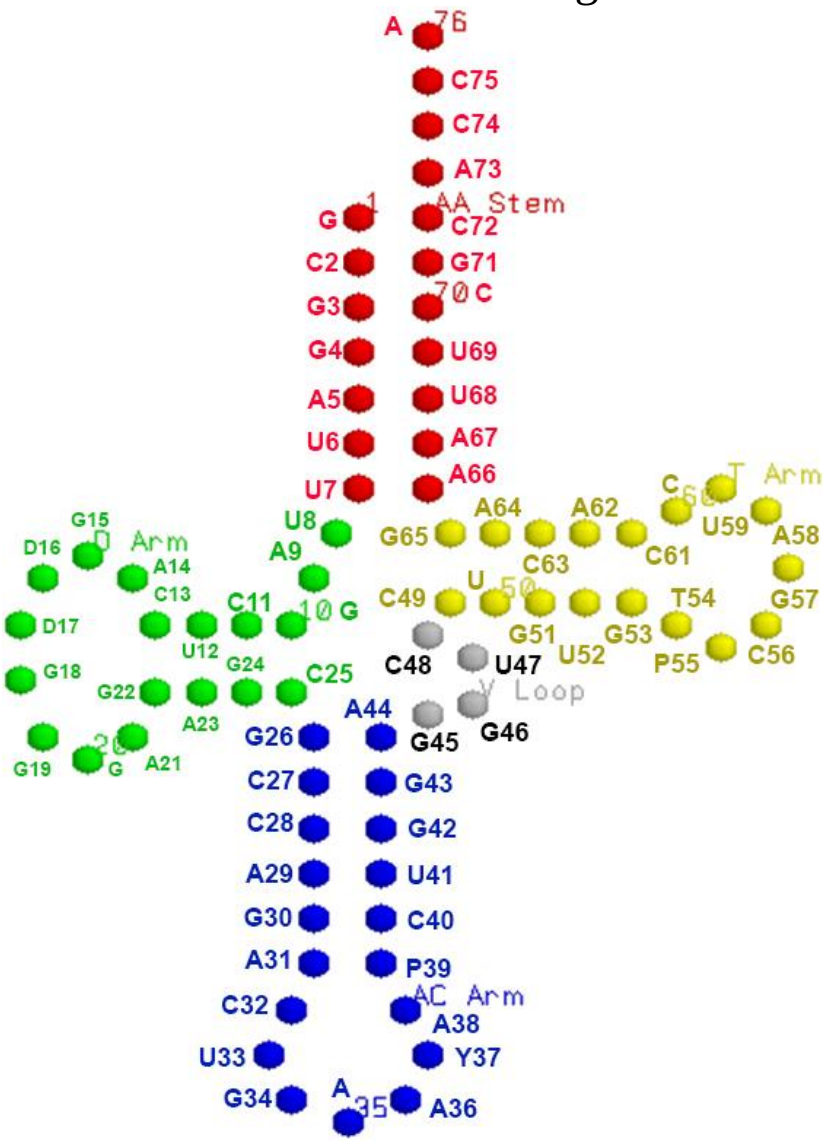
Protocol

Sugar Structures **Ribose**

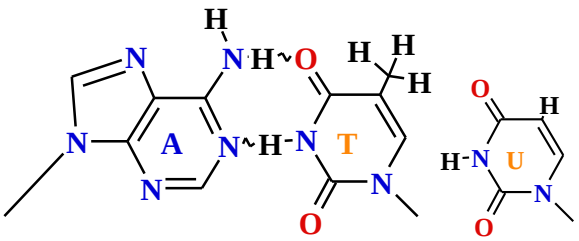


DeoxyRibose

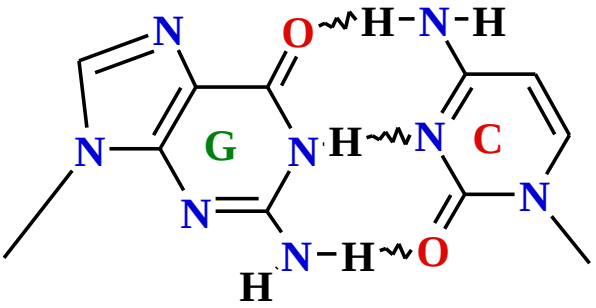




A=T **U**



G≡C



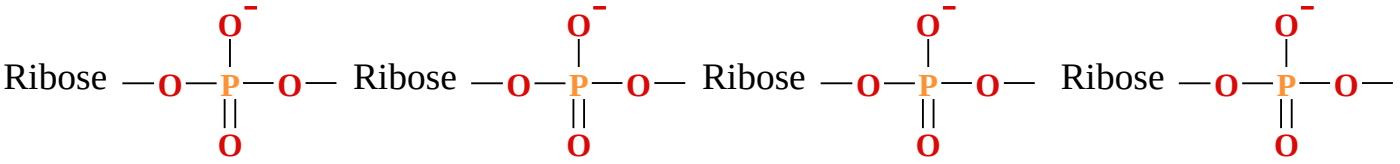


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Table 1. The genetic code. For messenger RNA molecule **mRNA Genetic Code**

Sets of three **3 nucleotides** (**codons**) in an **mRNA** molecule are translated into amino acids **AA** in the course of protein synthesis according to the rules shown. The codons **G U G** and **GAG**, for example, are translated into **valine** and **glutamic acid**, respectively.

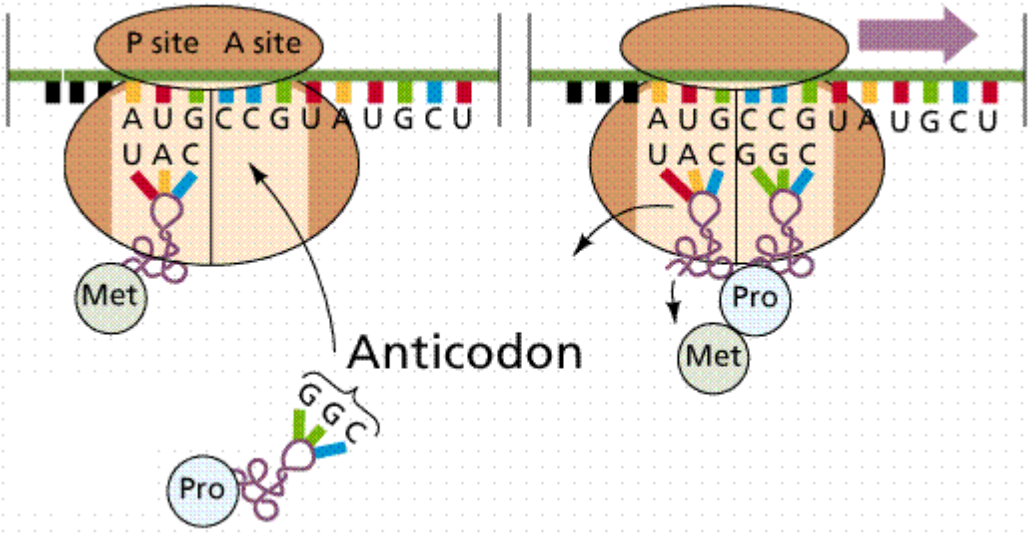
Note: that those messenger **mRNA code** begin with **U1**,**C1**,**A1**,**G1** but second element with **U2** as well **C1**,**G1** with second **C2** nucleotide tend to specify for translation on protein chain seven amino acids most hydrophobic.

1st position (5' end)↓	2nd position U	C	A	G	**3**rd position (3' end)↓
U	Phe	Ser	Tyr	Cys	**U**
	Phe	Ser	Tyr	Cys	**C**
	Leu	Ser	**STOP**	**SelCys**	**A**
	Leu	Ser	**STOP**	Trp	**G**
C	Leu	Pro	His	Arg	**U**
	Leu	Pro	His	Arg	**C**
	Leu	Pro	Gln	Arg	**A**
	Leu	Pro	Gln	Arg	**G**
A	Ile	Thr	Asn	Ser	**U**
	Ile	Thr	Asn	Ser	**C**
	Ile	Thr	Lys	Arg	**A**
	Met init	Thr	Lys	Arg	**G**
G	Val	Ala	Asp	Gly	**U**
	Val	Ala	Asp	Gly	**C**
	Val	Ala	Glu	Gly	**A**
	Val	Ala	Glu	Gly	**G**

Translation in ribosome start with methionine: **Met init**, Pro, Tyr, Ala

Four amino acids 1, 2, 3, 4,

How do we go from mRNA to Protein?



8. encodes transfer **tRNA^{Phe}** ribonucleic acid for phenylalanine **Phe** amino acid transport.

4 nucleotides **U** loop**:** → **5'U33–O2'MG34 – A35 – A36 3' → anticodon loop**

3 nucleotides **Phe anticodon:** → **5' O2'MG34 – A35 – A36 3'→ anticodon** sequence

3 nucleotides **codon** on **mRNA:** ← **3' C3 – U2 – U1 5' ← codon** sequence **ant parallel**

Incoming AA Pro tRNA with←3'GGC5' anticodon complementar to mRNA →5'CCG3' codon

Initiation of the Translation begins by AminoAacid Met init tRNA ←3' UAC 5' anticodon complementar to mRNA →5' AUG 3' codon