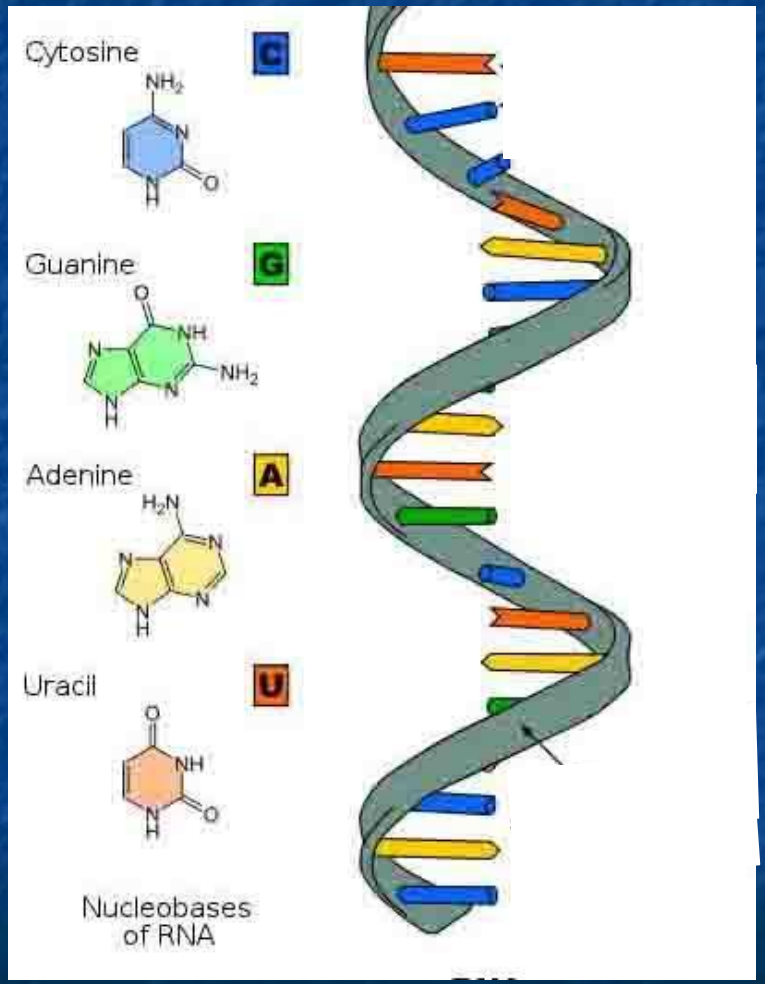
DNA “Quiz Check”

1. draw a nucleotide
2. describe how Adenine bonds to Thymine
3. describe how Guanine bonds to Cytosine
4. list the 3 steps of DNA replication
5. briefly explain each step of replication

RNA Chapter 13

- RNA
- Protein Synthesis
- Pg 360



Central Dogma

- DNA codes for RNA which guides protein synthesis
- DNA → RNA → Proteins
- Protein synthesis occurs in **ALL** living organisms

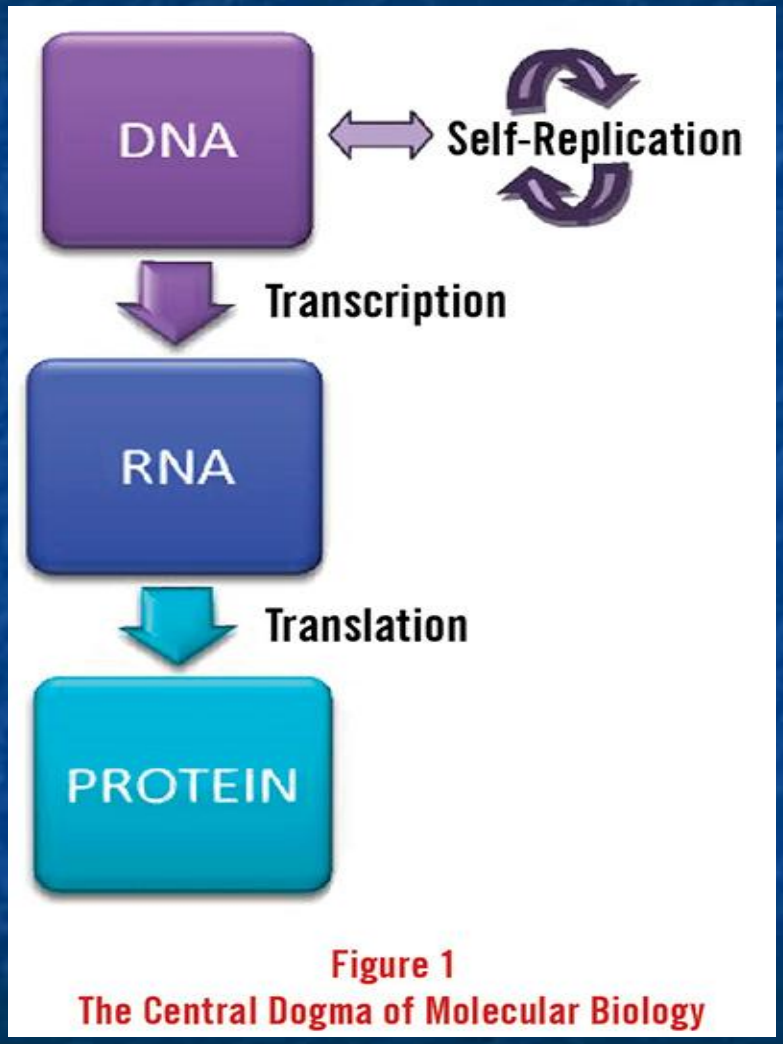
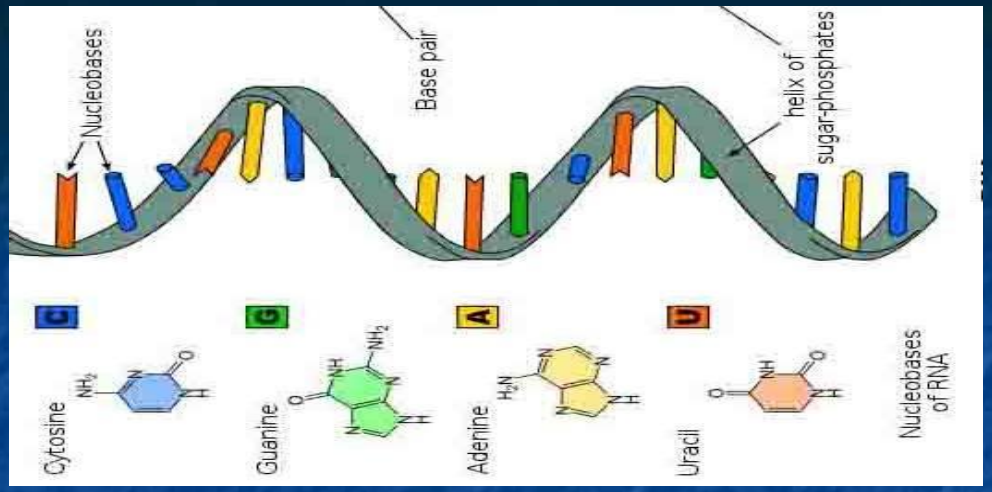


Figure 1
The Central Dogma of Molecular Biology

RNA



- **Full name:**
  - Ribonucleic Acid
- **Shape:**
  - single stranded
- **Base unit** =Nucleotide
  - Ribose sugar
  - Phosphate group
  - Nitrogenous bases

- **4 bases**:
  - Uracil
  - Adenine
  - Guanine
  - Cytosine
- **3 types**:
  - mRNA, tRNA, rRNA

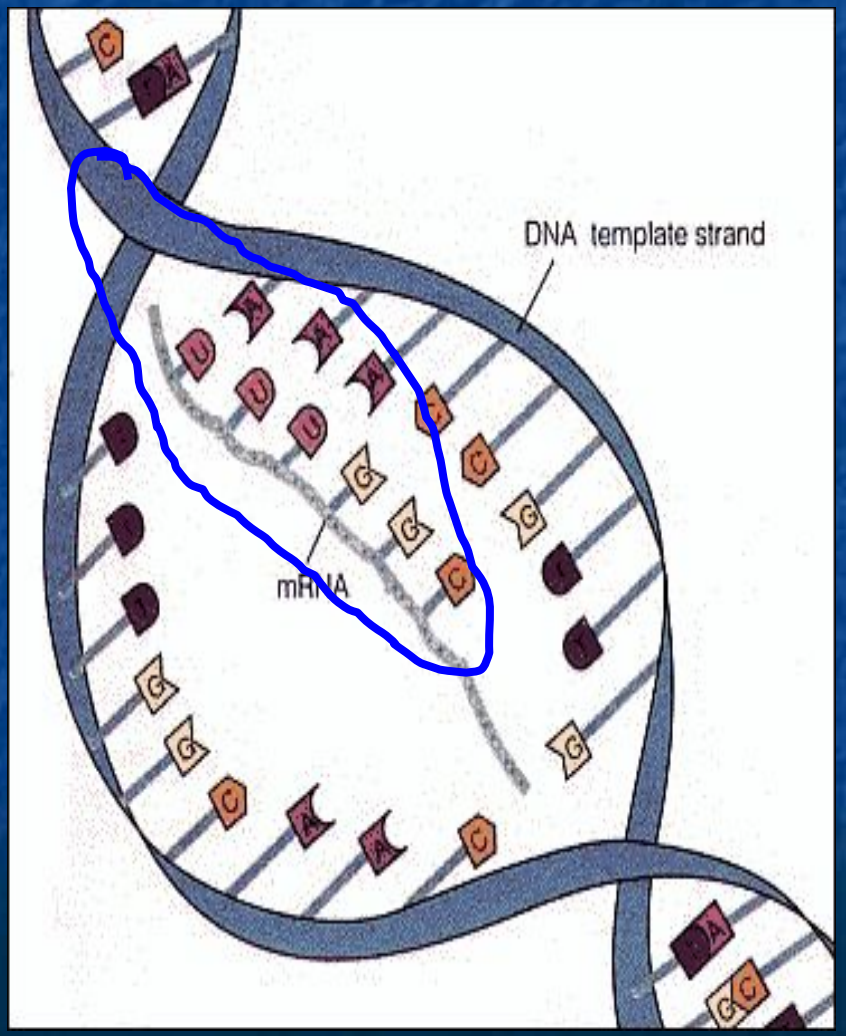
3 differences

- **DNA**
  - **1) Sugar**
    - *Deoxyribose*
  - **2) Bases**
    - *Adenine*
    - ***Thymine***
    - *Guanine*
    - *Cytosine*
  - **3) Structure**
    - *Double helix*
- **RNA**
  - **1) Sugar**
    - *Ribose*
  - **2)Bases**
    - *Adenine*
    - ***URACIL***
    - *Guanine*
    - *Cytosine*
  - **3) Structure**
    - *Single stranded*

1st TYPE of RNA= mRNA

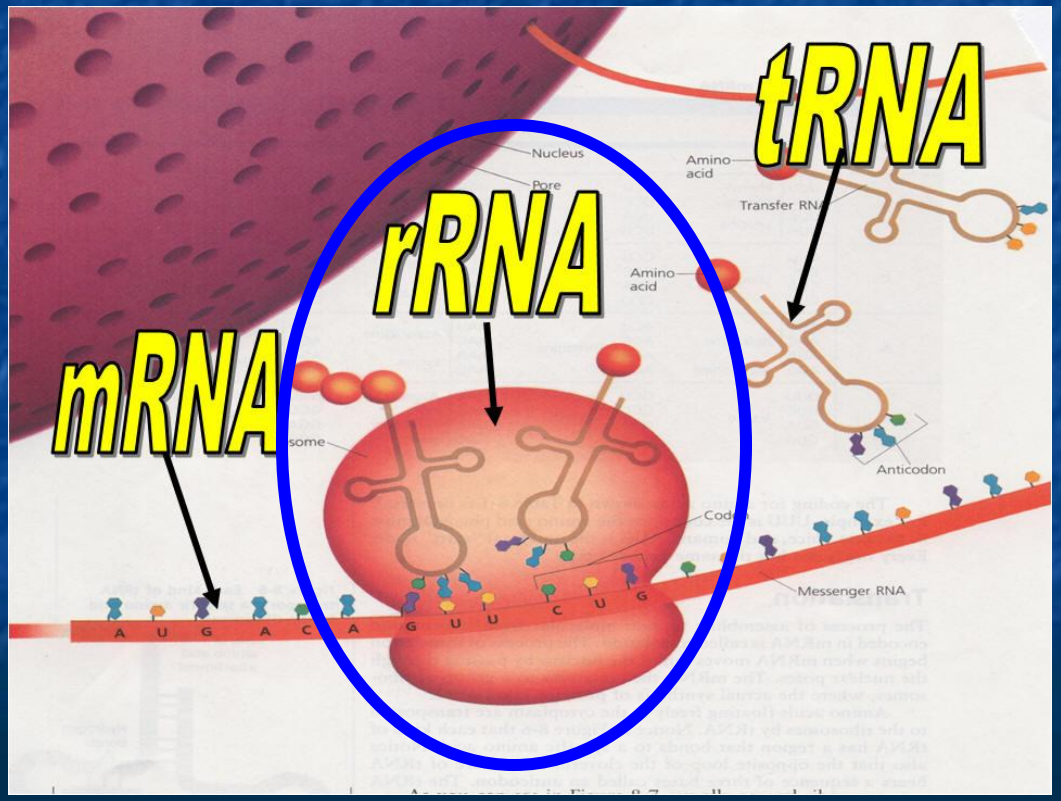
FUNCTION

- Carries instructions from DNA to make proteins
- AKA Messenger RNA



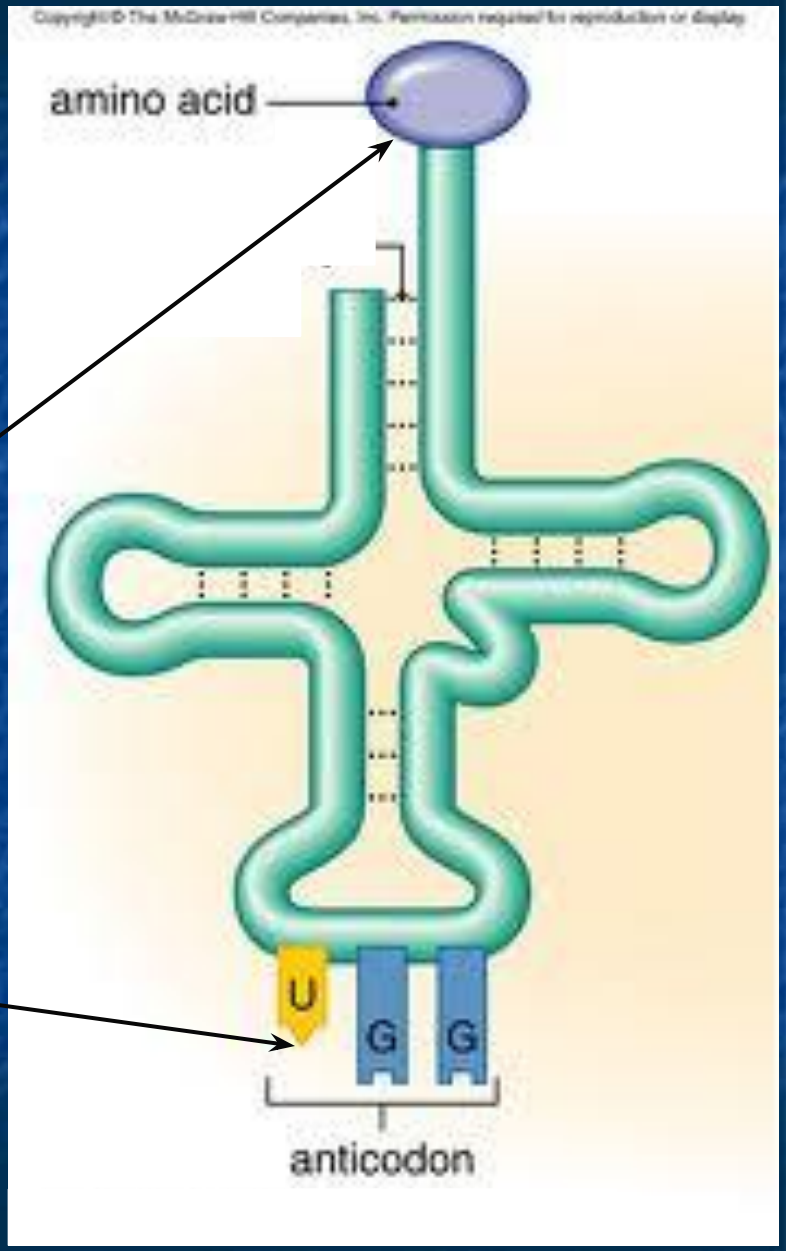
2nd type = rRNA

- Helps to form ribosomes in the cytoplasm
- AKA ribosomal RNA

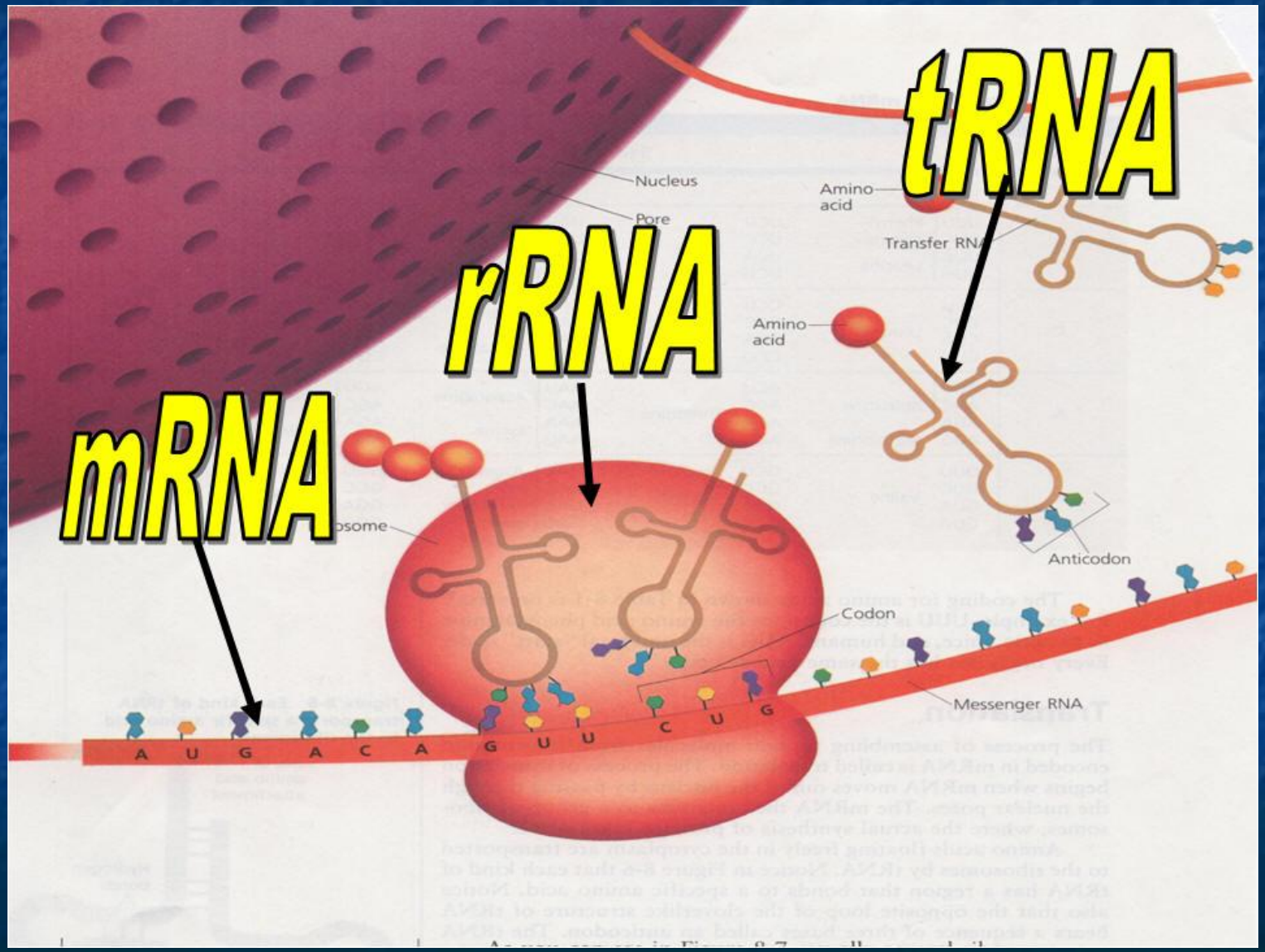


3rd type= tRNA

- Transfers amino acids to the ribosome
- AKA Transfer RNA
- Has 2 parts
  - Amino acid
  - Anticodon

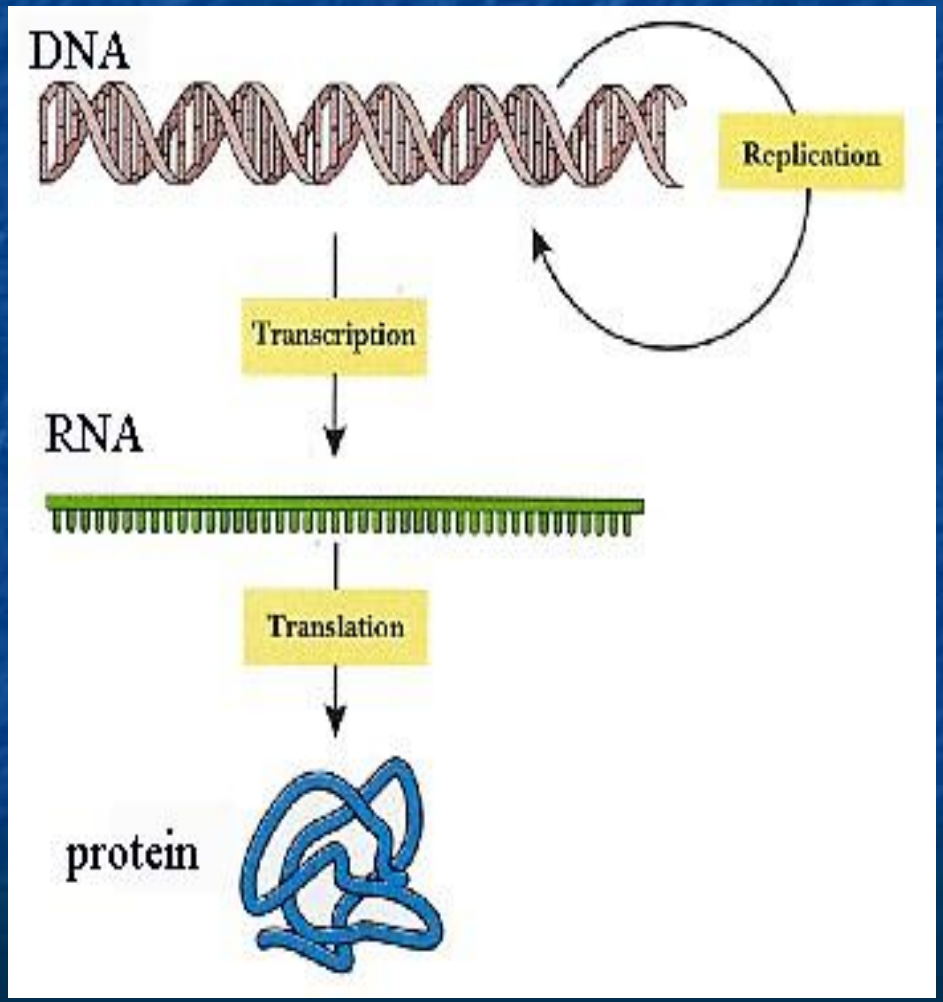


The 3 types of RNA



Protein Synthesis

- Occurs in 2 steps:
  - **Transcription**
  - **Translation**

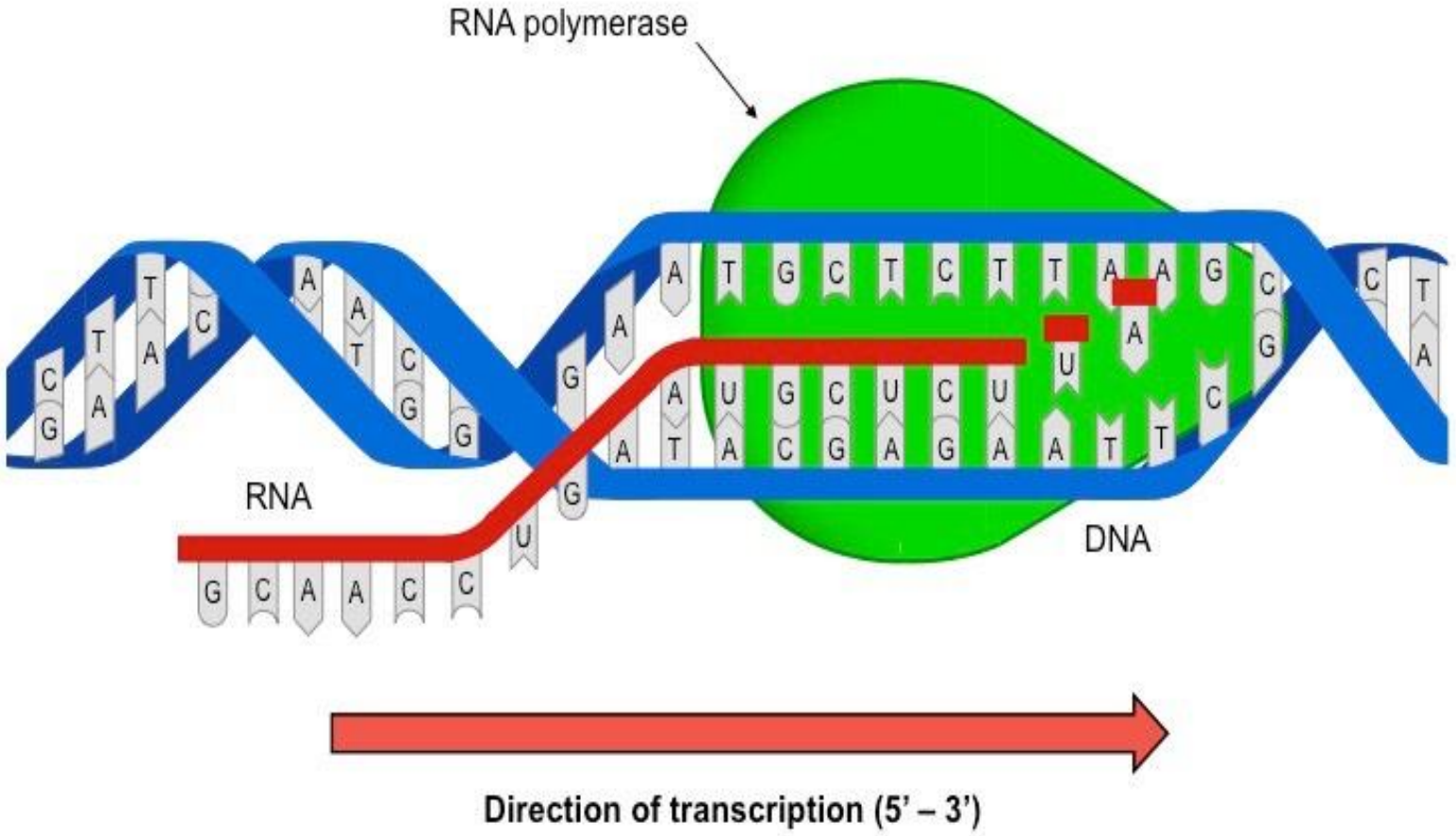


Let’s watch before we begin

TRANSCRIPTION

- Segments of **DNA** serve as **templates** to produce complementary **mRNA molecules**
- DNA template is **complementary** to the RNA
- This occurs in the **cytoplasm** of prokaryotes
- This occurs in the **nucleus** of eukaryotes
- Need the enzyme **RNA polymerase**

Transcription



Transcription

- **RNA polymerase**
  - This **binds** to **DNA**
  - **Unwinds** the DNA
  - Uses **DNA** as a **template** to make **RNA**

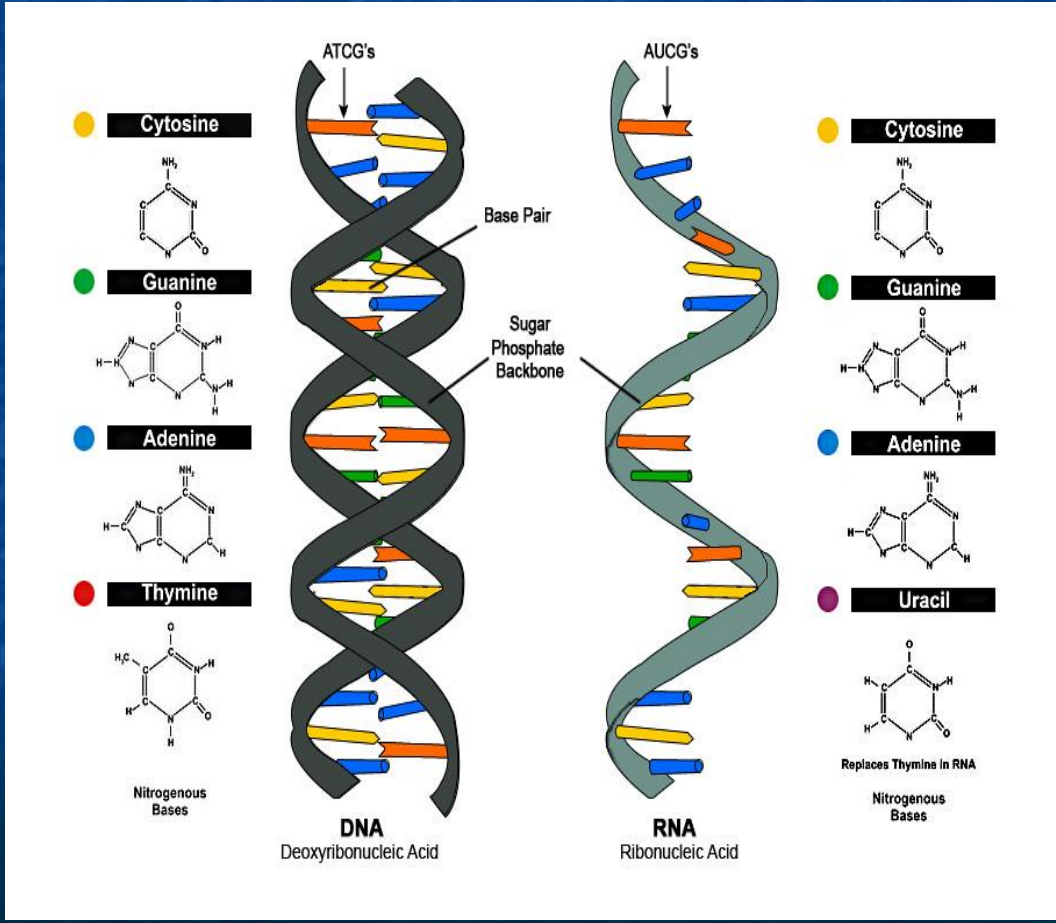
- Example: DNA=TACGGGAGCCCTAACGA

  mRNA=

How do you start & stop?

- The **enzyme RNA polymerase** binds to specific sequences on the DNA called **promoters**
- There are portions of DNA that DO NOT code for anything (non-sense) = INTRONS
- The actual coding sequence is called **EXONS**

Transcription Animation



click on picture

DNA RNA Practice

- If the original DNA strand is:
  - **TAC TTA CCC ATG GAA ATT**
  - What will the strand be at the end of transcription?
  - **AUG AAU GGG UAC CUU UAA**
  - This occurs in the **cytoplasm** of prokaryotes and in the **nucleus** of eukaryotes
  - RNA is bonded by covalent bonds

The Code

- ***We need to figure out the code so that we can make an amino acid sequence***
- So far we had DNA in the languag of **nucleotides** make RNA in the language of **nucleotides** in the process of **transcription** but how do we get from nucleotide language to protein language????

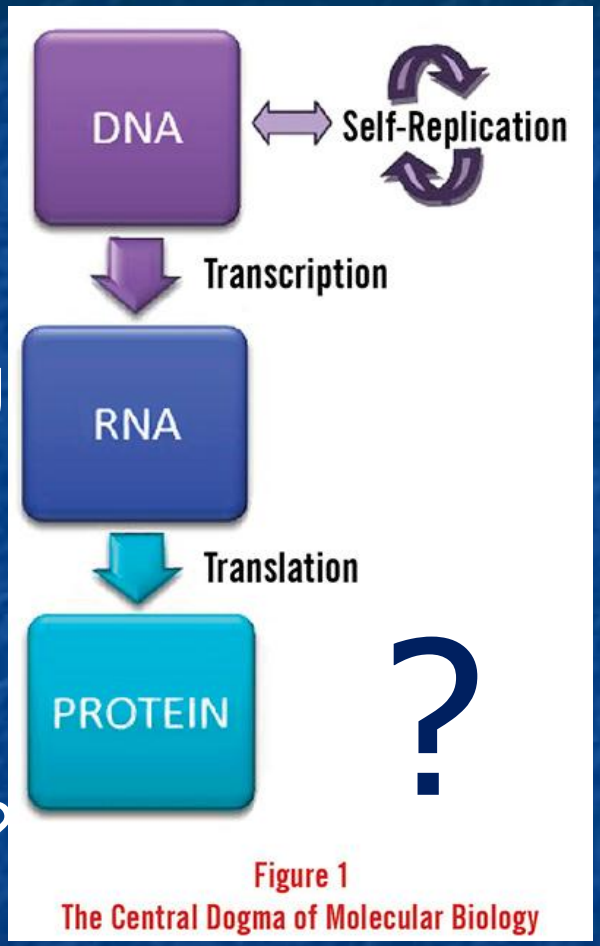


Figure 1
The Central Dogma of Molecular Biology

The Code

- So we need a “dictionary” to find this genetic code
- We need to find the “**Coded Language**” to make proteins
- We read it **3** letters at a time

Coded language

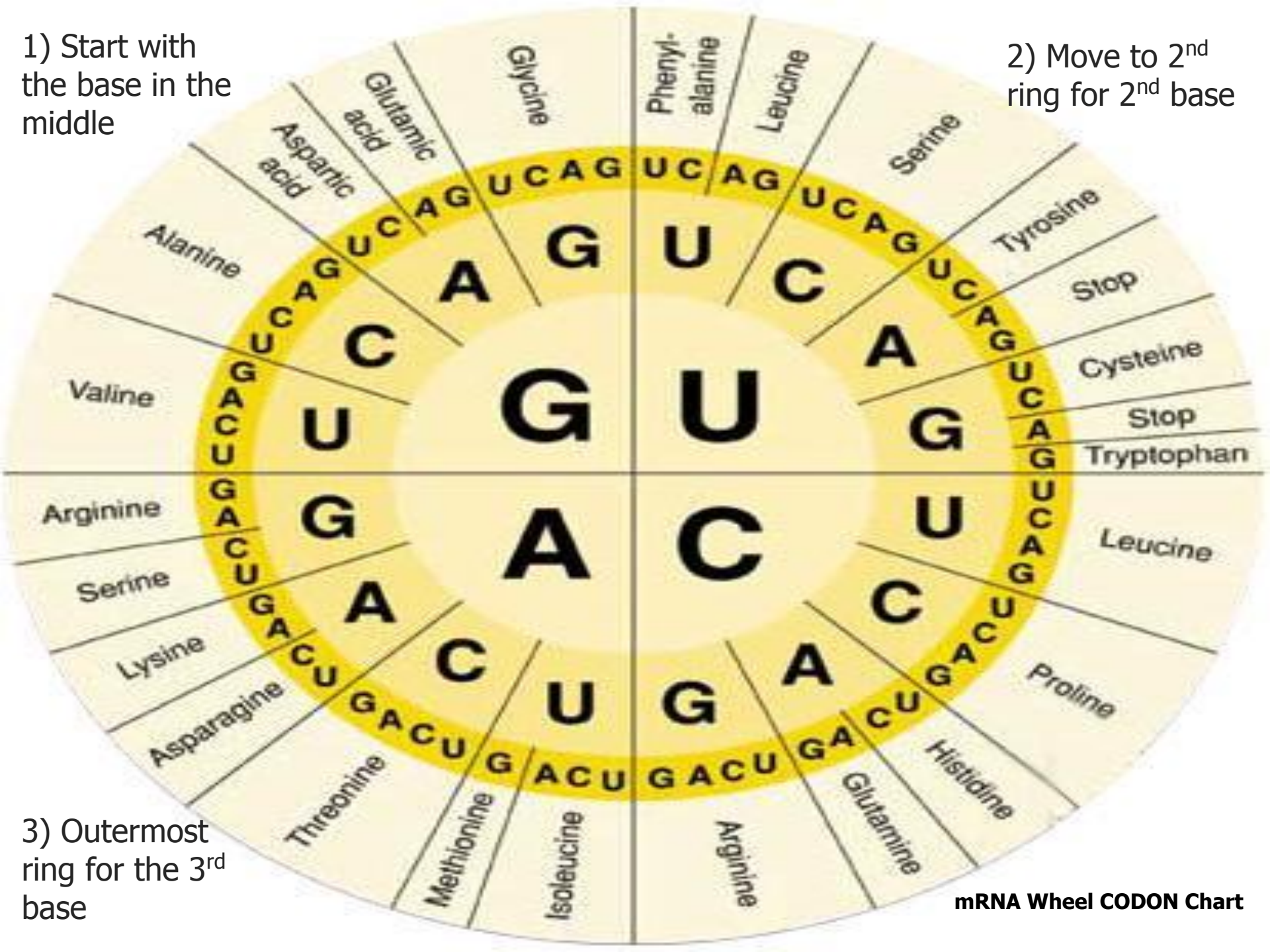
- Each **3** letter word corresponds to a specific **amino acid**
  - This 3 letter word is called a **CODON**
  - Found on **mRNA**
  - Corresponds to a particular **amino acid**

How do Read Codons?

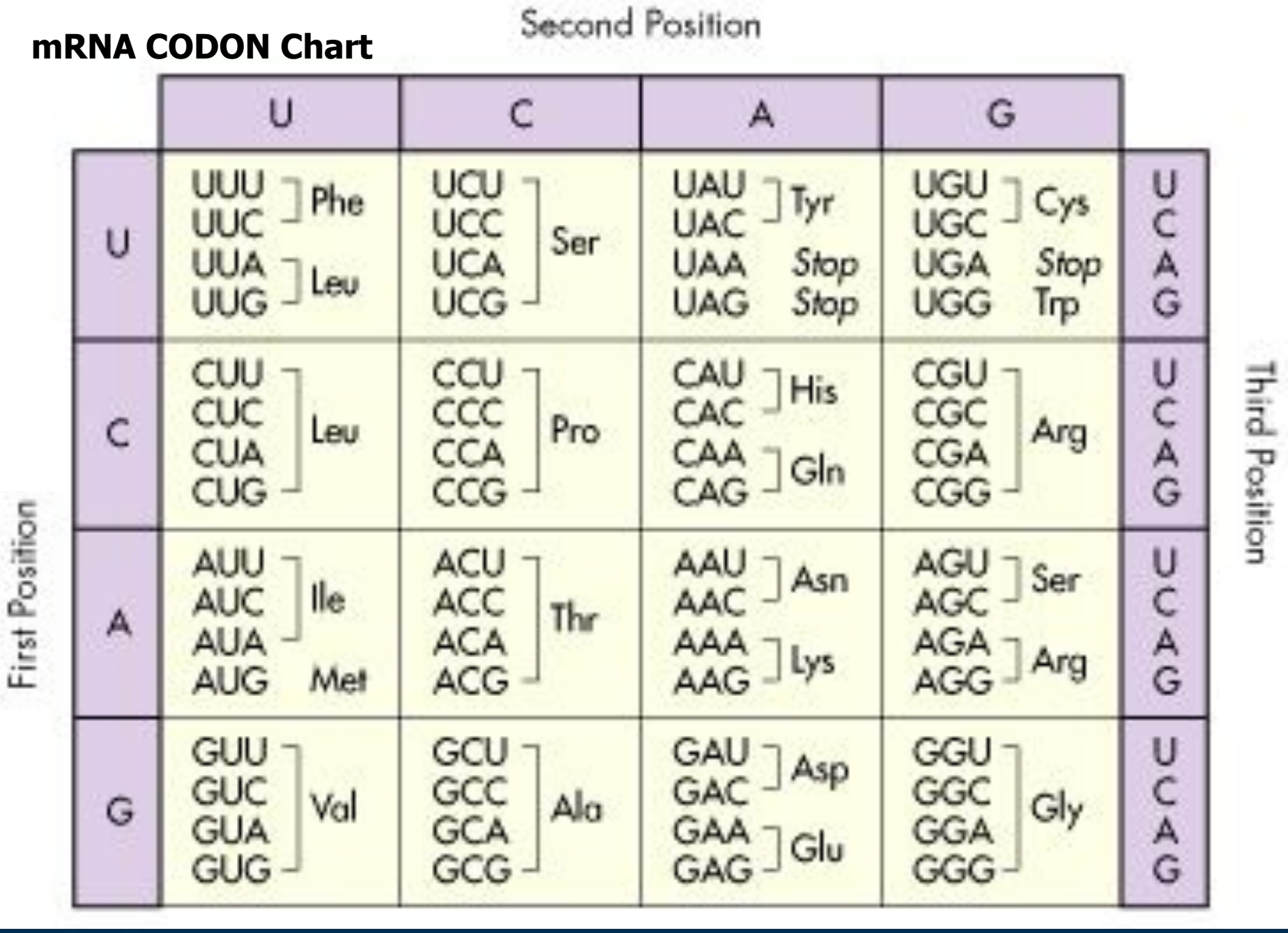
Well….

We need the **Codon Genetic Code Wheel**

There are 2 types that we will go over


1) Start with the base in the middle
2) Move to 2nd ring for 2nd base
3) Outermost ring for the 3rd base
U C A G
Phenyl-alanine
Leucine
Serine
Tyrosine
Stop
Cysteine
Stop
Tryptophan
Leucine
Proline
Histidine
Glutamine
Arginine
Isoleucine
Methionine
Threonine
Asparagine
Lysine
Serine
Arginine
Valine
Alanine
Aspartic acid
Glutamic acid
Glycine
mRNA Wheel CODON Chart

mRNA CODON Chart

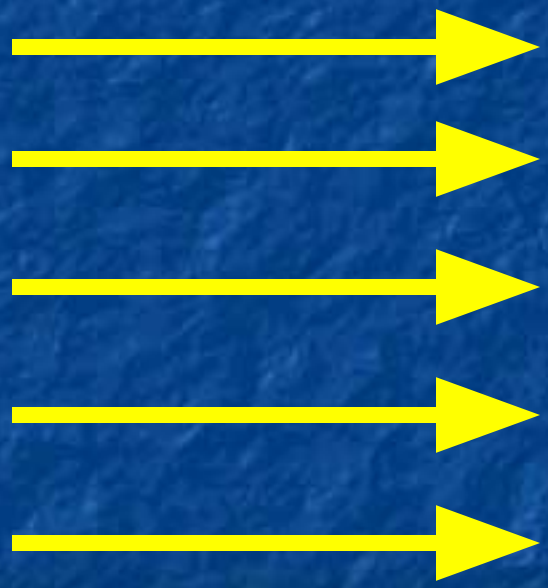


Practice

- Here is the codon
  - UUU
  - UAA
  - AUG
  - AGU
  - CGA
  - CCC
  - UCA
  - AAG
- What is the corresponding amino acid?
  - Phenylalanine
  - Stop
  - Start or methionine
  - Serine
  - Arginine
  - Proline
  - Serine
  - Lysine

Practice

- mRNA's codons
  - AUG
  - AAU
  - GGG
  - UAU
  - UAA



- tRNA's anticodons
  - UAC
  - UUA
  - CCC
  - AUA
  - AUU

Practice

- RNA worksheet due in 2 days

Do you know the RULES ☺

Pg 118

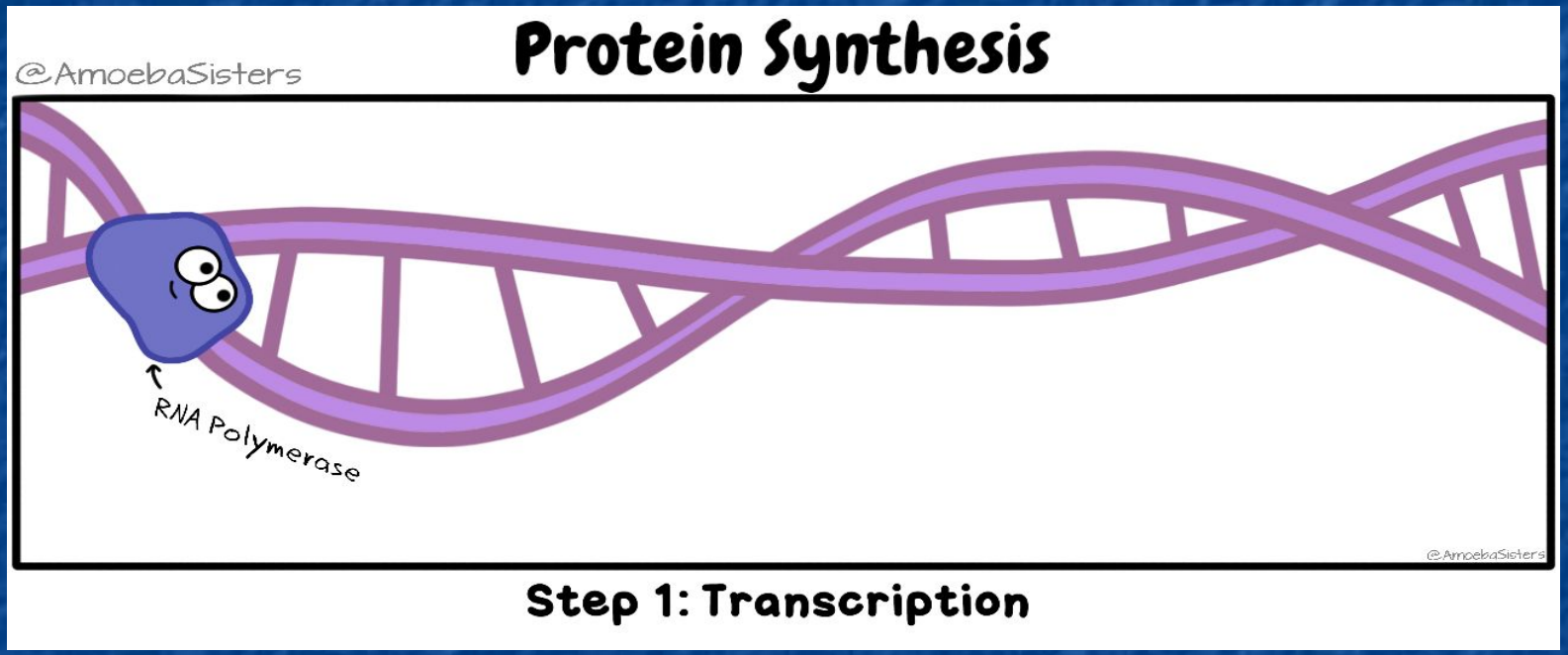
- DNA has the bases _____
- RNA has the bases _____
- Codons and Anticodons are _____
- Codons correspond to _____
- DNA complements are __ to __ & __ to __
- RNA complements are __ to __ & __ to __

Pg 118

FIGURE IT OUT ☺

	GENE 1	GENE 2	GENE 3	GENE 4
DNA			**GAT**	
mRNA codon				**UAU**
Anticodon		**UUC**		
Amino Acid	**Tryptophan**			

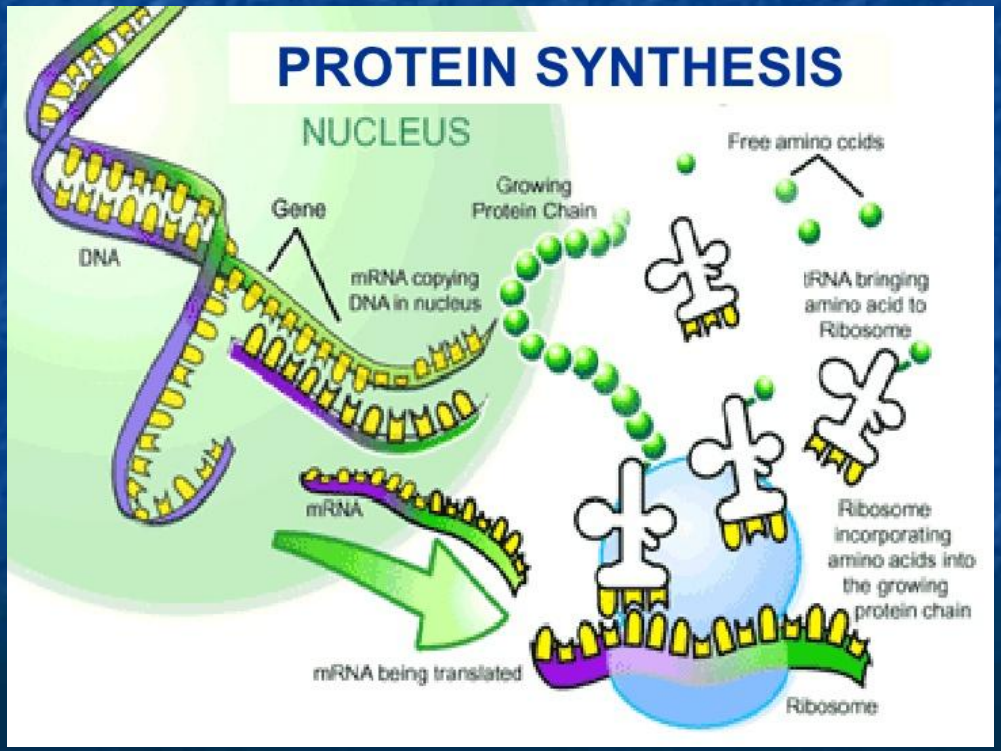
So…. What's next?



Let's complete the second step which is called….????

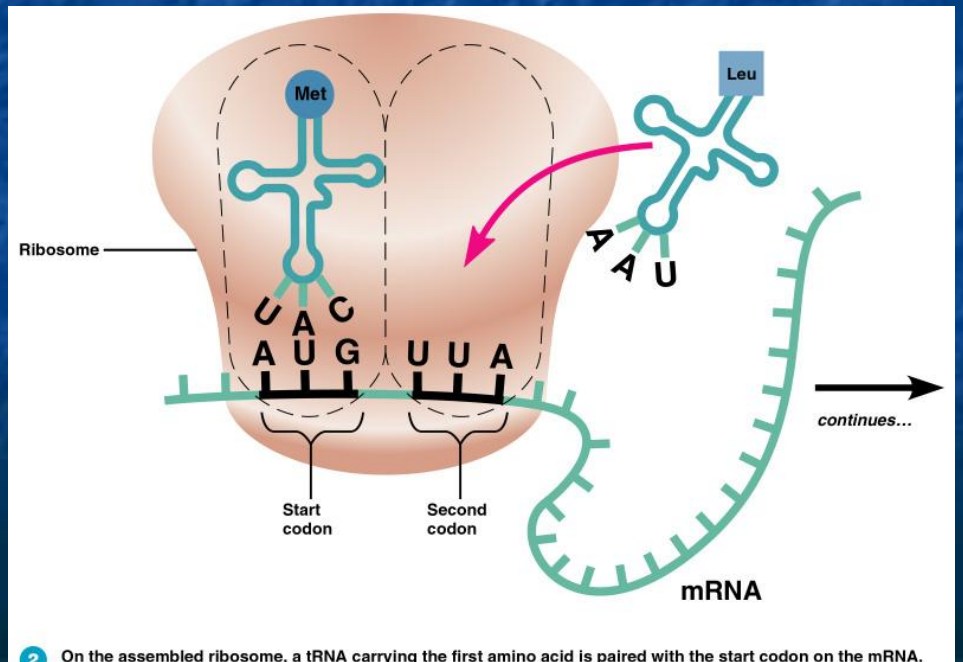
Translation (2nd step)

- The sequence of **nucleotides** bases on a mRNA molecule is a set of **instructions** that give the order for **amino acids** should be joined to produce **polypeptides** (AKA **proteins**)
- Need a ribosome



Translation steps

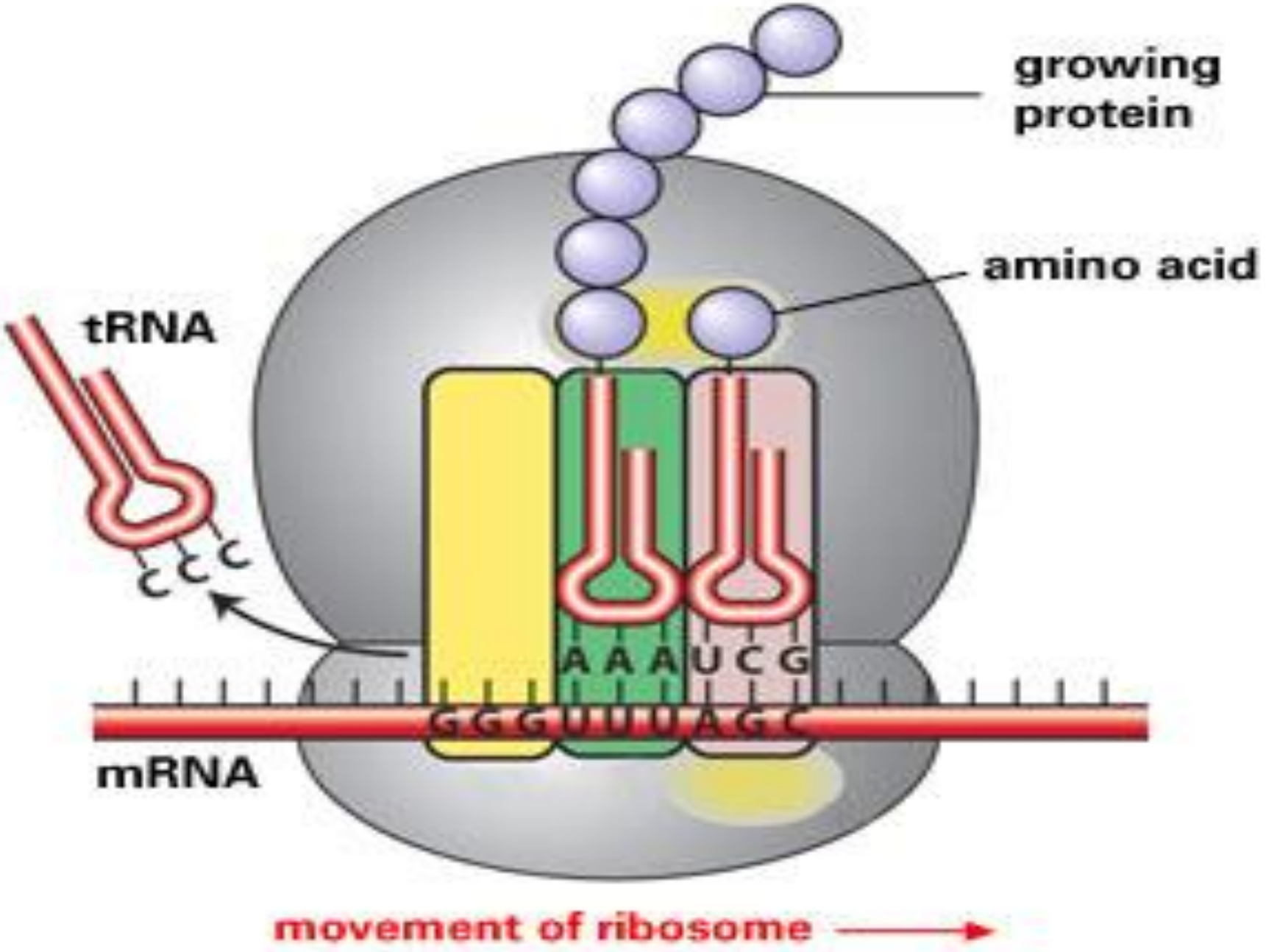
- After transcription, **mRNA** leaves the **nucleus** and enters the **cytoplasm**
- **Ribosomes** attaches to the **mRNA**
- **Codons** pass thru the ribosome as the codon is read



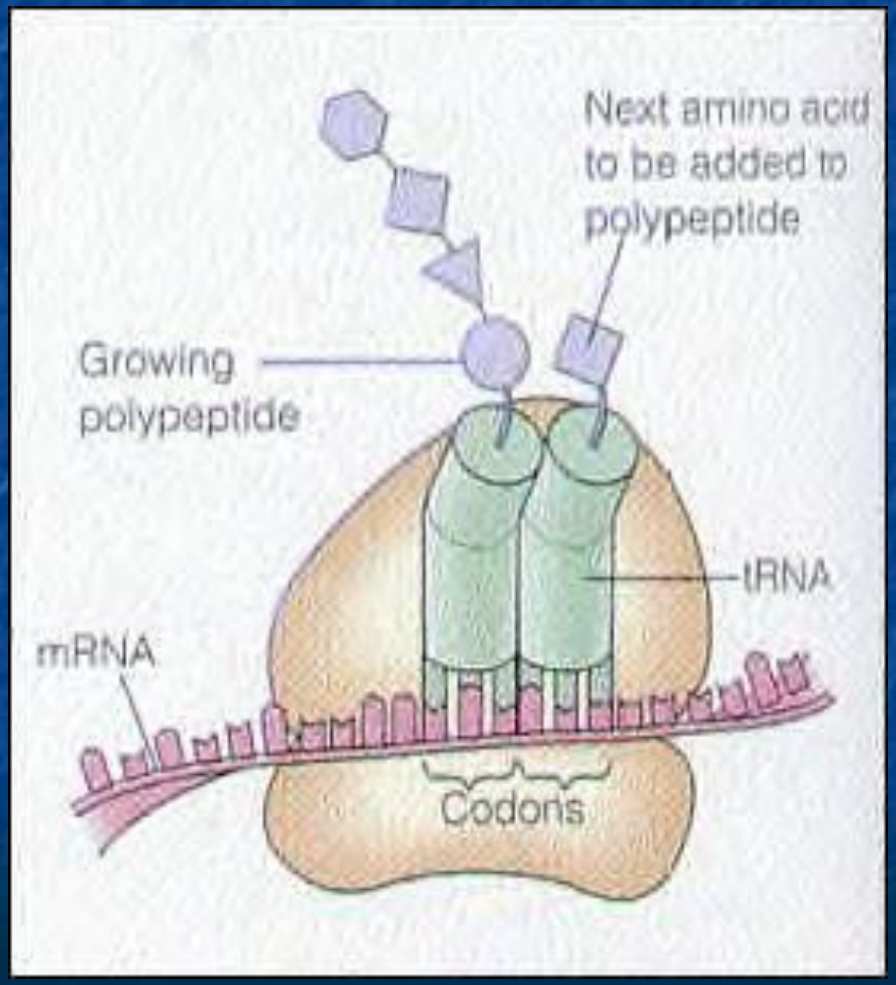
2 On the assembled ribosome, a tRNA carrying the first amino acid is paired with the start codon on the mRNA.

Translation

- **tRNA** will bring in the proper **amino acids** into the ribosome
- The **tRNA** matches its **anticodon** to the codon on the mRNA = they are **complementary**
- **tRNA** brings in corresponding the **amino acid**
- **tRNA** leaves the **amino acid** behind as another **tRNA** enters


growing protein
amino acid
tRNA
A A A U C G
G G G U U U A G C
mRNA
movement of ribosome

Animation of Translation



Translation

- This continues until the entire "**code**" is read
- This creates a **protein**
- Ceases (ends) when a **STOP** codon is reached
- The **protein** goes off and does its job

Central Dogma

- Information is transferred from:

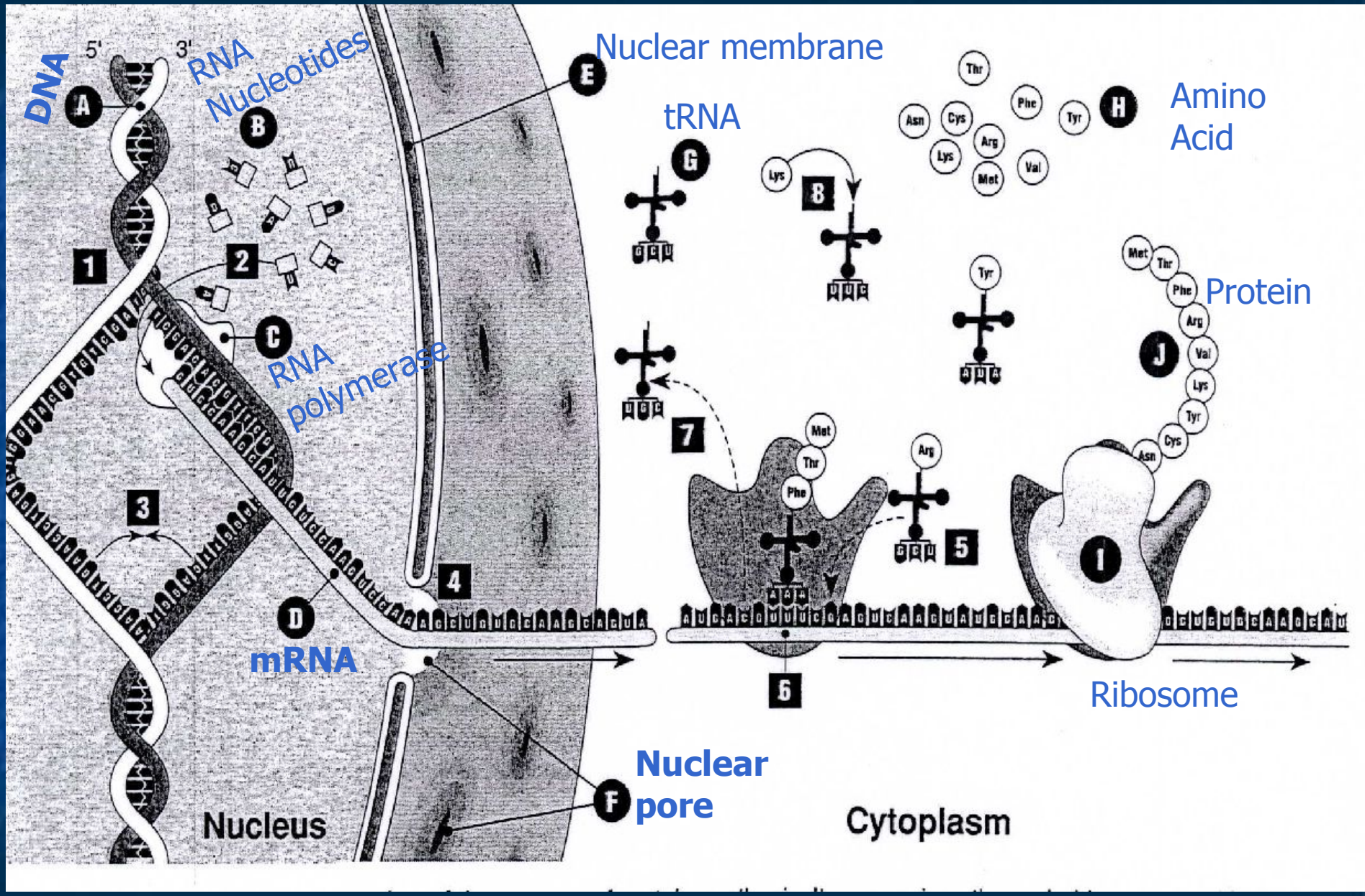
DNA □ RNA □ makes proteins

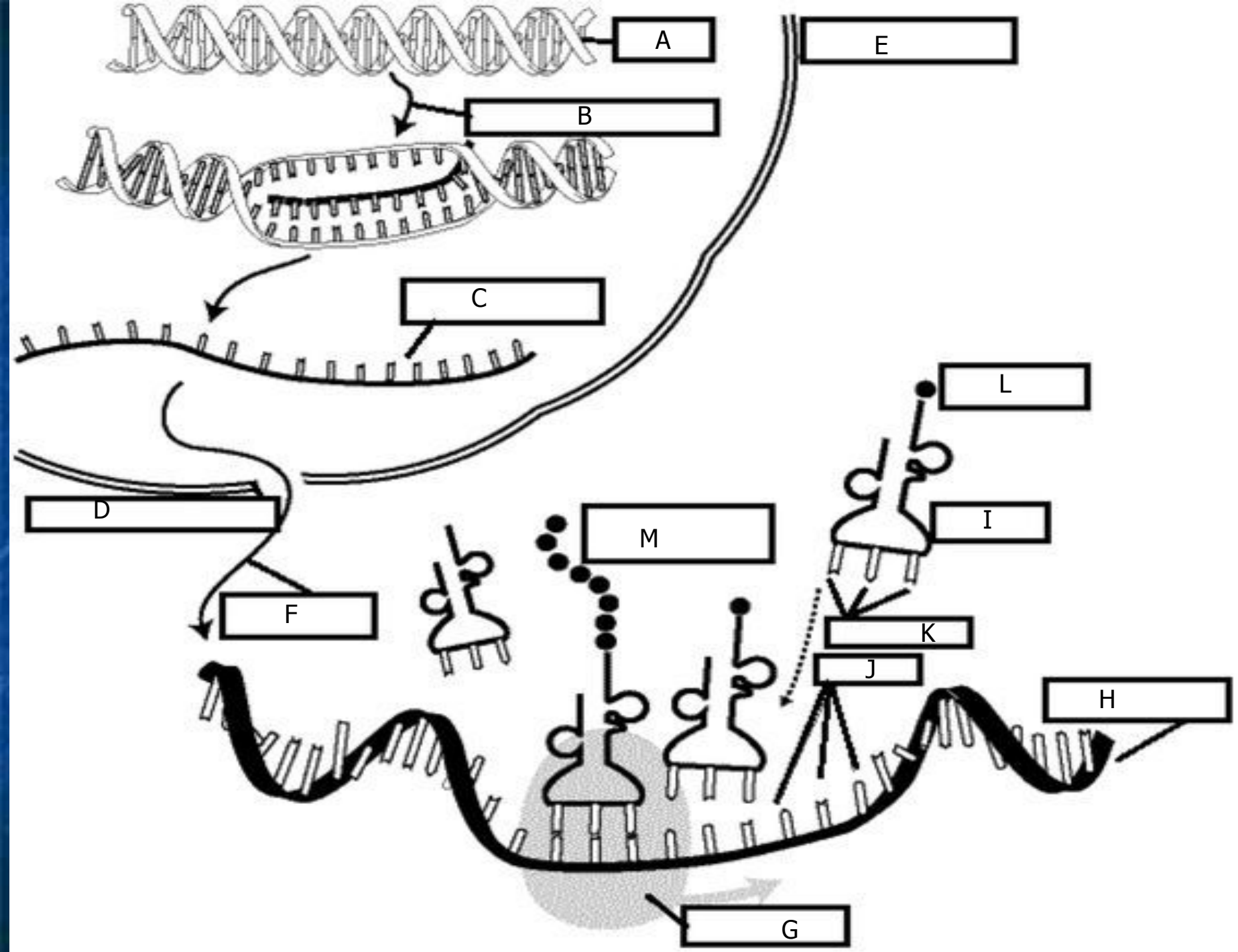
Pg 118

FIGURE IT OUT ☺

	GENE 1	GENE 2	GENE 3	GENE 4
DNA			**GAT**	
mRNA codon				**UAU**
Anticodon		**UUC**		
Amino Acid	**Tryptophan**			

PROTEIN SYNTHESIS Pg 119/120



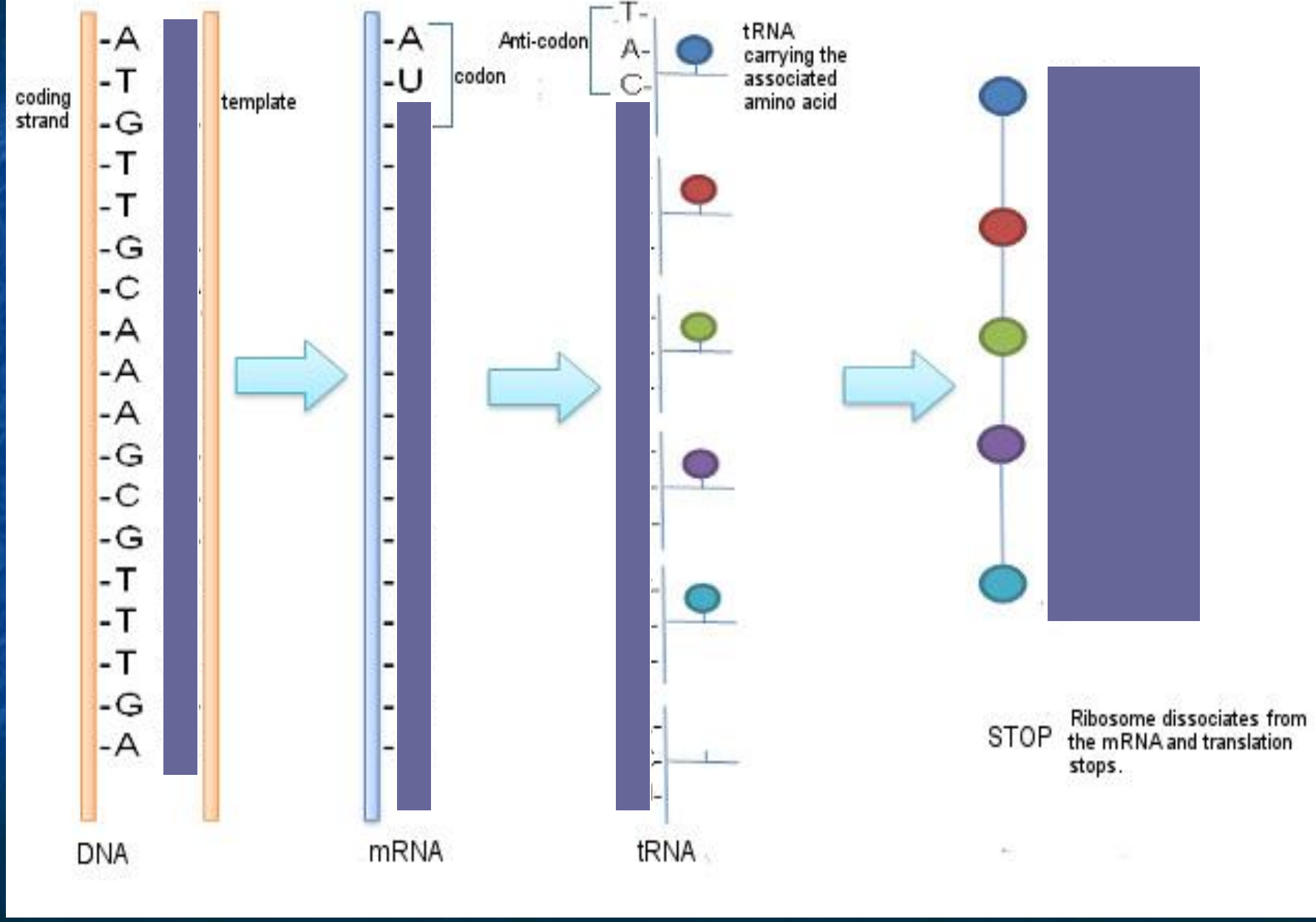

A
B
C
D
E
F
G
H
I
J
K
L
M

Do you know the RULES ☺

Write on your notes under the Translation notes

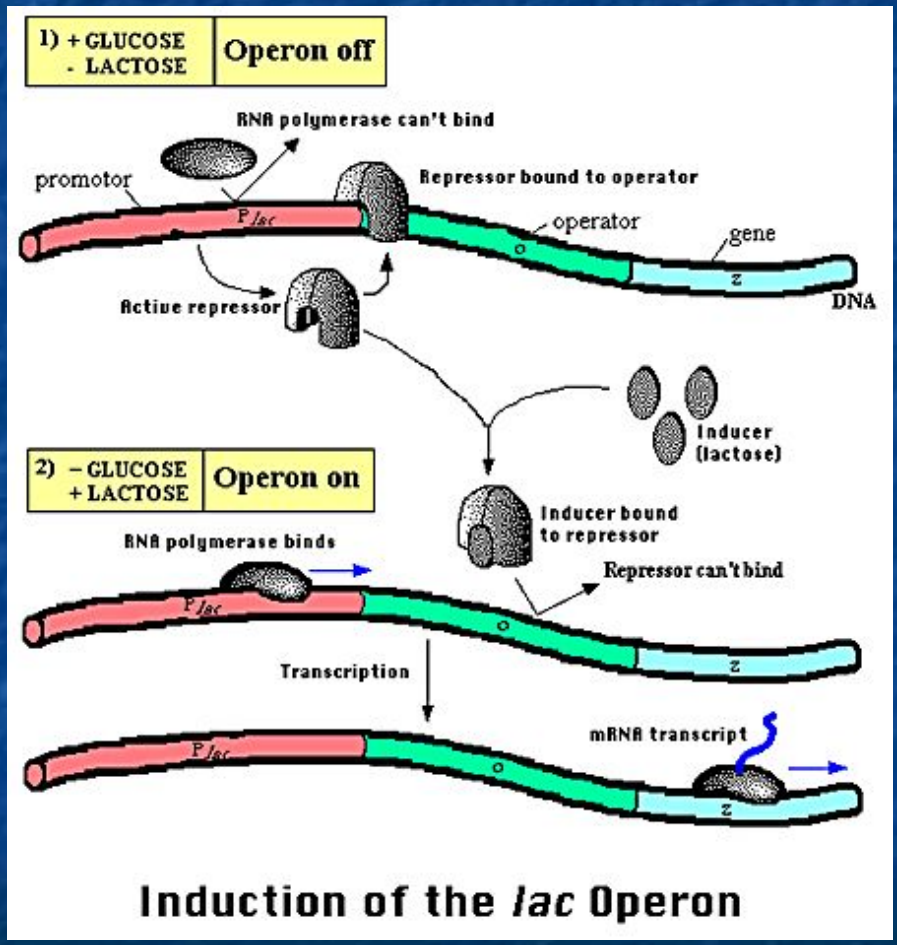
😊

- DNA has the bases __ __ ___ __
- RNA has the base __ __ ___ ___
  Codons and Anticodons are _____
- Codons correspond to _____
- DNA complements are __ to __ & __ to __
- RNA complements are __ to __ & __ to __


coding strand
template
-A
-T
-G
-T
-T
-G
-C
-A
-A
-A
-G
-C
-G
-T
-T
-T
-G
-A
DNA
-A
-U
codon
mRNA
Anti-codon
-T-
A-
C-
tRNA carrying the associated amino acid
tRNA
STOP
Ribosome dissociates from the mRNA and translation stops.

Movie on lac operon

Are we on target!!



Mutations

- Heritable changes in genetic info
- 2 types
  - 1) GENE MUTATIONS
  - 2) CHROMOSOME MUTATIONS

1)Gene Mutation Types

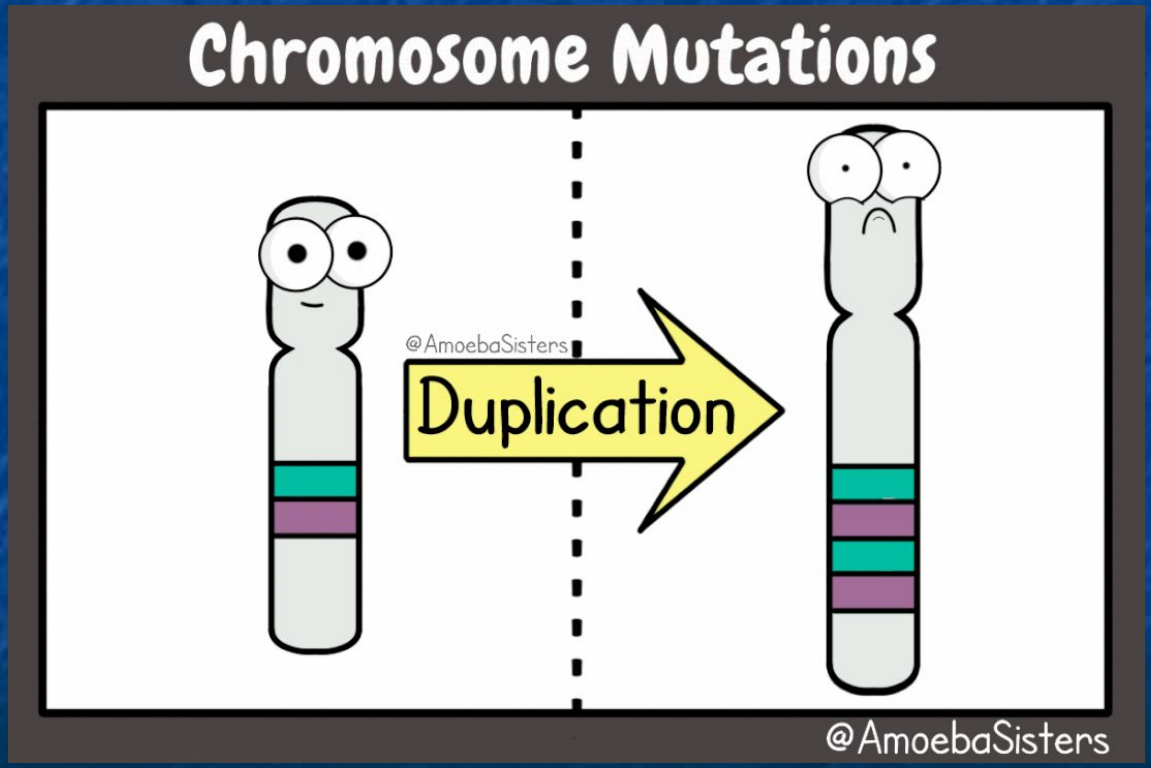
- **Point mutations**
  - Change in 1 or a few nucleotides
  - **SUBSTITUTION**
    - One based changed for another
    - **CCC** → CCA
      - How did this change?
      - *Proline* → *Proline*
    - **CCC** → ACC
      - How did this change
      - *Proline* → *threonine*

Gene Mutation Types

- **Frameshift Mutation**: entire message shifted and all amino acids changed
  - **Deletion** (1 is deleted)
    - AUG CCC UGA
    - AUC CCU GA (the G has been deleted)
  - **Insertion** (1 base inserted)
    - AUG CCC UGA
    - AUG GGC CUG A (inserted a C)

2) Chromosome Mutation

- Change in number or structure of chromosomes
  - Deletion
  - Duplication
  - Inversion
  - Translocation



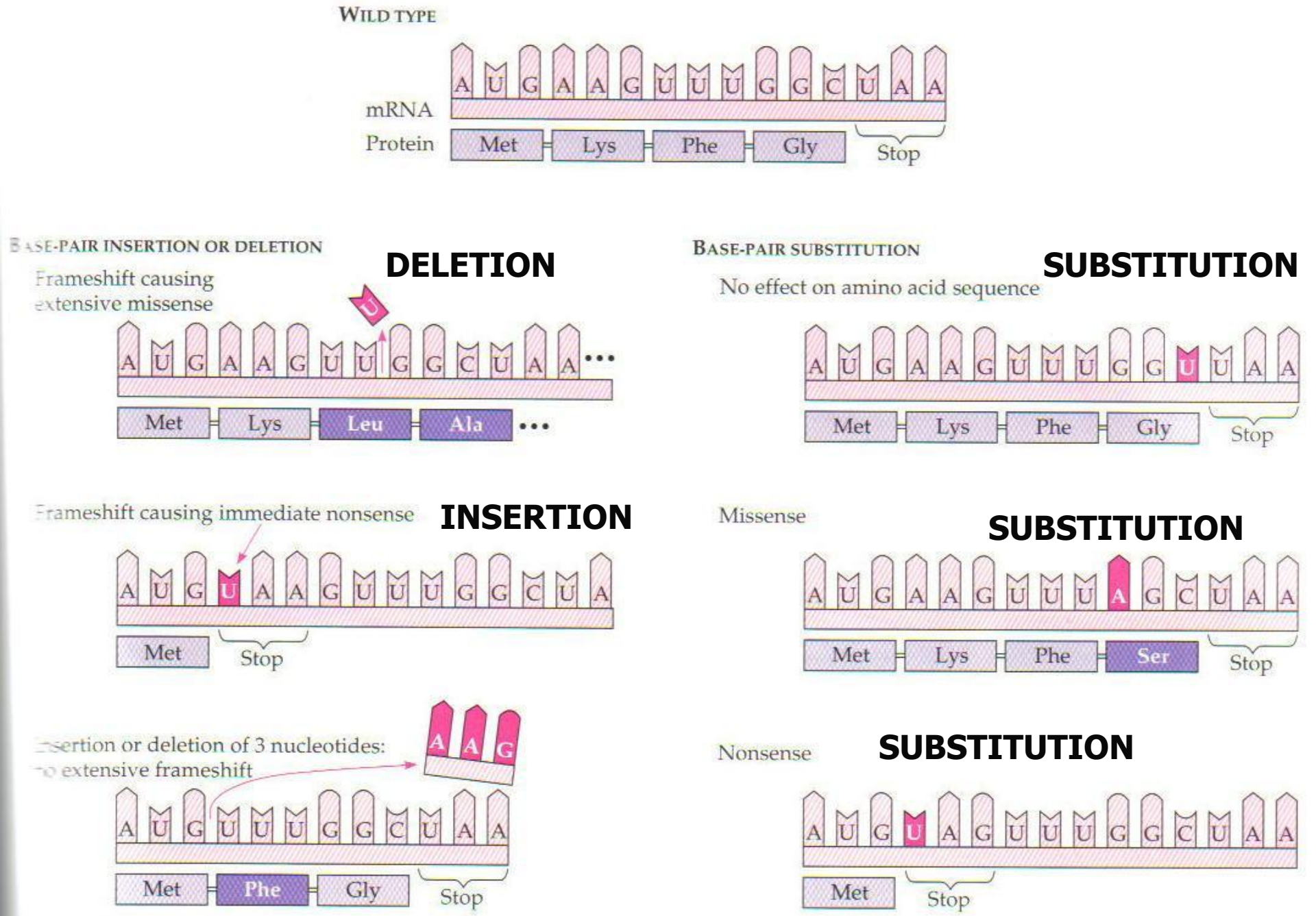
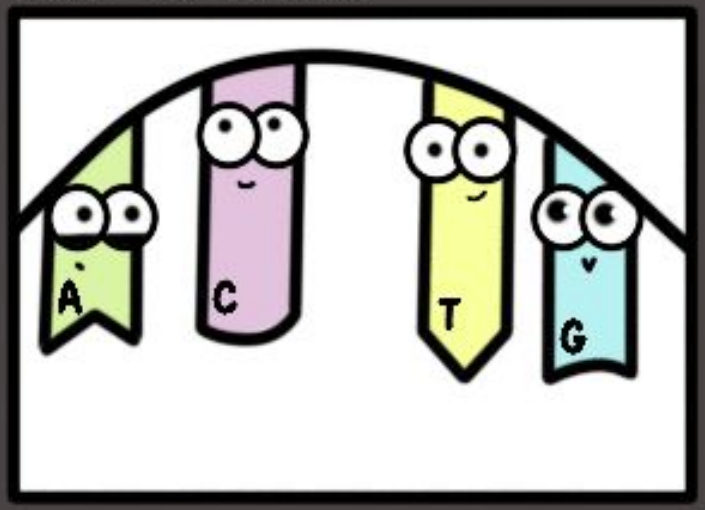


FIGURE 17.22 • **Categories and consequences of point mutations.**

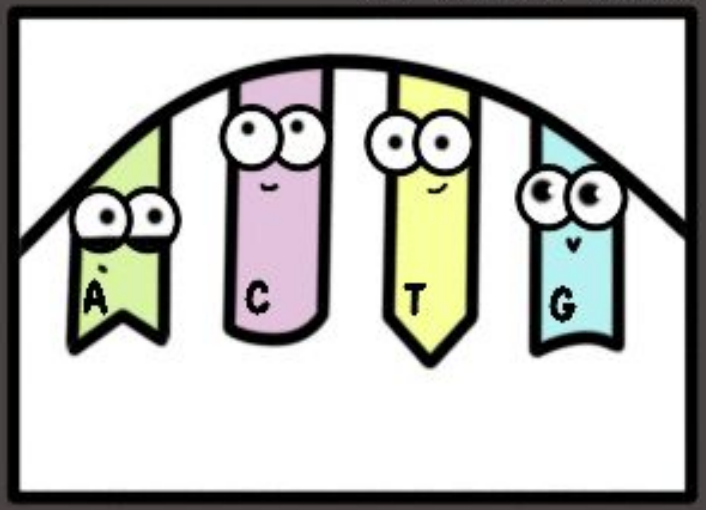
Gene Mutations

@AmoebaSisters

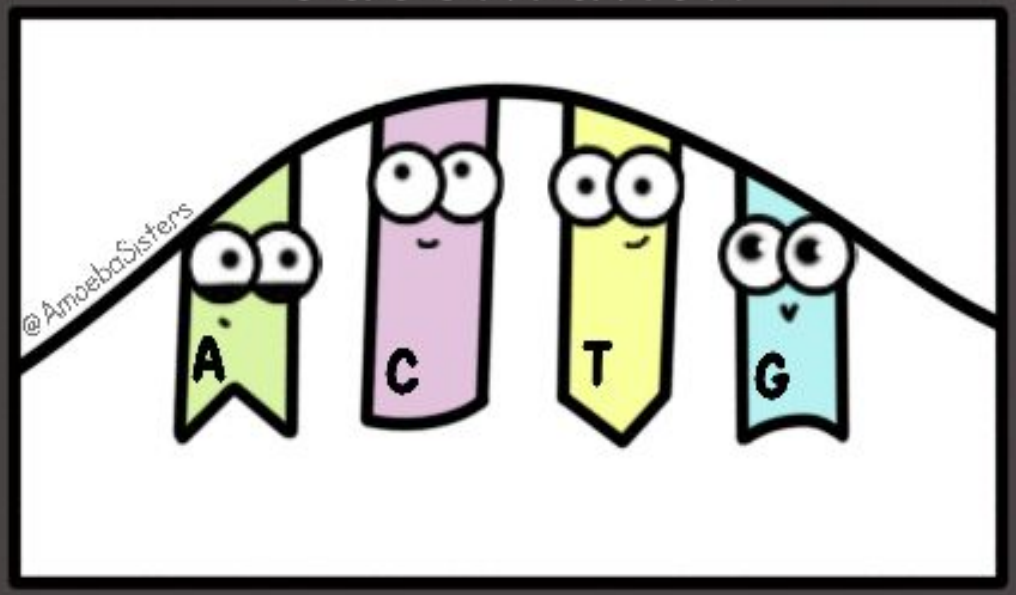
Insertion



Deletion



Substitution



Effects of Mutations

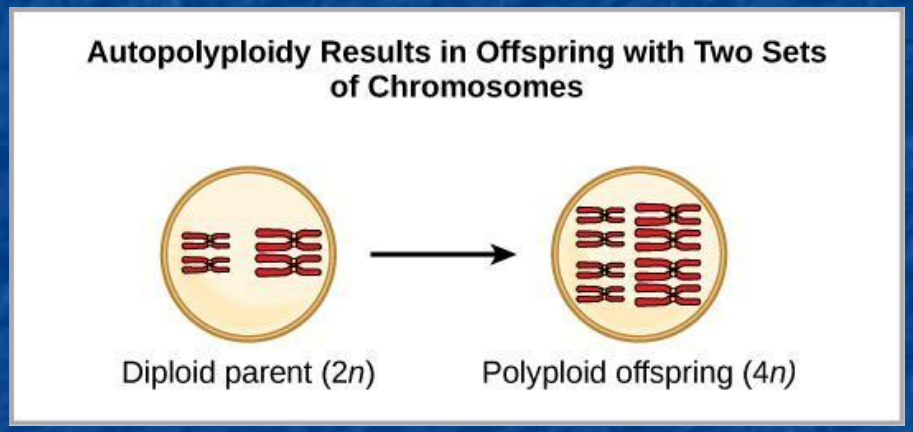
- Errors in DNA replication
  - *1 in 10 million*
- Environmental conditions
- Mutagen
  - *Agent that can cause mutations*

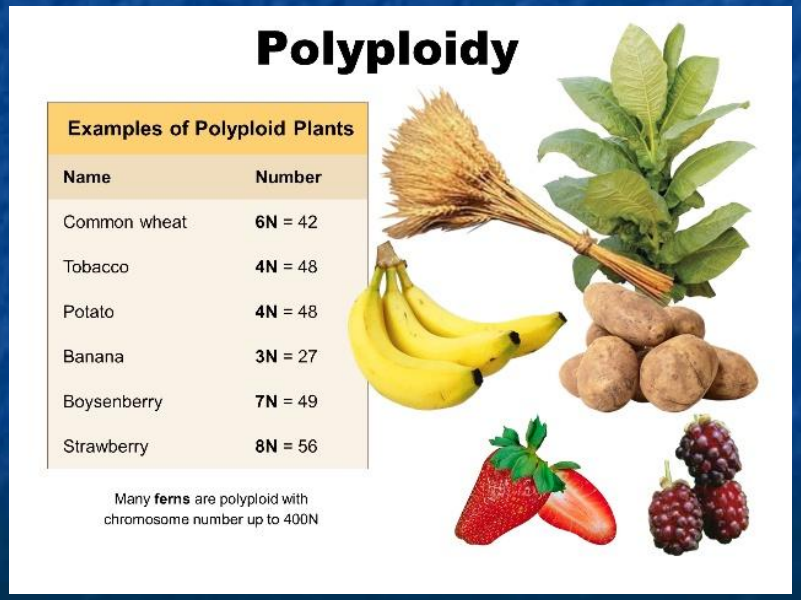
Effects can vary

- No effect
- Beneficial
  - Produce new functions
  - Ability to adapt/evolve
  - Increase resistance
- Harmful
  - Lead to disease/cancer

Polyploidy

- Having extra sets of chromosomes
  - 3 or 4 sets of chromosomes





Body Cell vs. Sex Cell

- Occurs in somatic (body) cells
- Will not be passed on to the next generation

- Chromosome are affect
- Will impact the offspring
- Will be passed on from generation to generation

Sickle cell worksheet

SNORK creation

- You are to create a SNORK from the given mRNA strand.
- Snapple Snork
- Snoopy Snork
- Snicker Snork
- Snuffle Snork

Practice

- UGU – CCG
  - UGC- CGC
  - Cysteine – Proline
  - Cysteine - arginine
- GAA – CGU
  - GAU – CGU
  - Glutamic acid – arginine
  - Aspartic acid - arginine
- GGG – UUA – ACC
  - GGU - UAA
  - Glycine – leucine – threonine
  - Glycine - Stop

Journals

- Mutations & worksheet
- Cookie Journal
- Complete Protein Synthesis labels
- Mutant DNA
- Snorks lab

Protein Synthesis ½ sheet

TAC TAG CCG CGA TTT ACA ATT

ATG ATC GGC GCT AAA TGT TAA

TAC GCC TTA AAG GGC CGA ATC

ATG CGG AAT TTC CCG GCT TAG

What is this process? DNA replication

Protein Synthesis ½ sheet

TAC TAG CCG CGA TTT ACA ATT

AUG AUC GGC GCU AAA UGU UAA

Start, isoleucine, glycine, alanine, lysine, cysteine, Stop

Protein Synthesis ½ sheet

TAC GCC TTA AAG GGC CGA ATC

AUG CGG AAU UUC CCG GCU UAG

Start, arginine, asparagine, phenylalanine, proline, alanine, stop

What is this process? Protein Synthesis (Transcription & Translation

CGT AAG TAC TTG ATC AGA GCT CTT CGA AAA TCG

GCA TTC ATG AAC TAG TCT CGA GAA GCT TTT AGC

CGU AAG UAC UUG AUC AGA GCU CUU CGA AAA UCG

Arginine, lysine, tyrosine, leucine, isoleucine, arginine, alanine, leucine, arginine, lysine, serine