PROTEIN SYNTHESIS

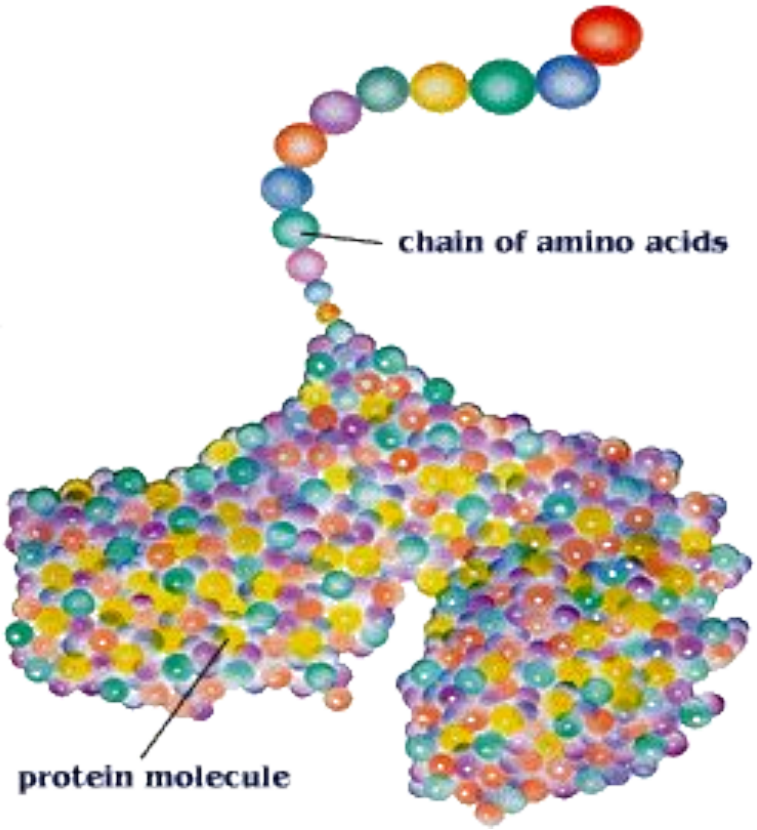
The Protein-making Process

Protein Synthesis (Gene Expression) Notes

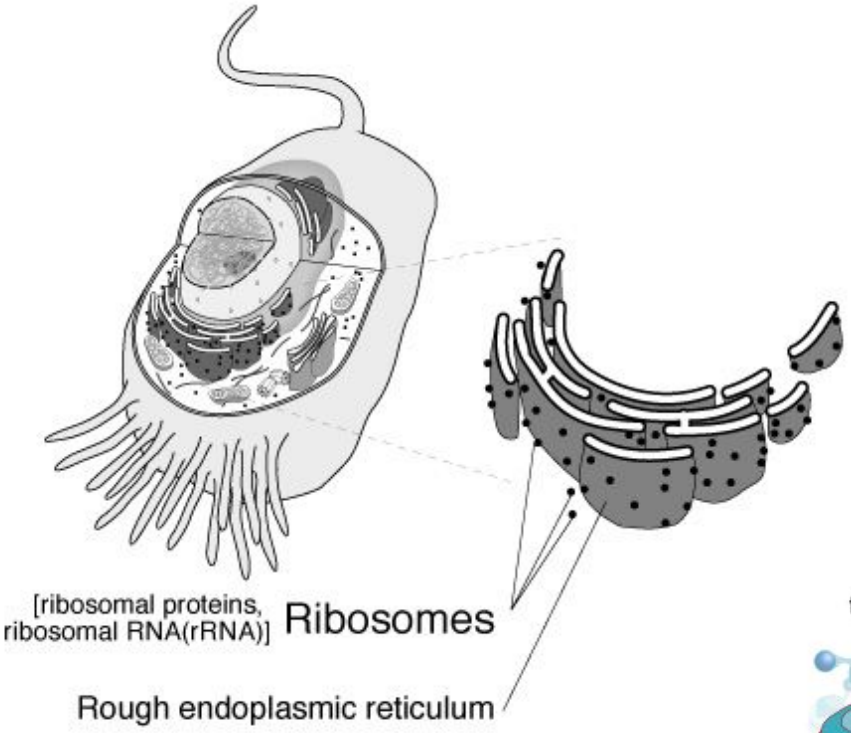
Proteins (Review)

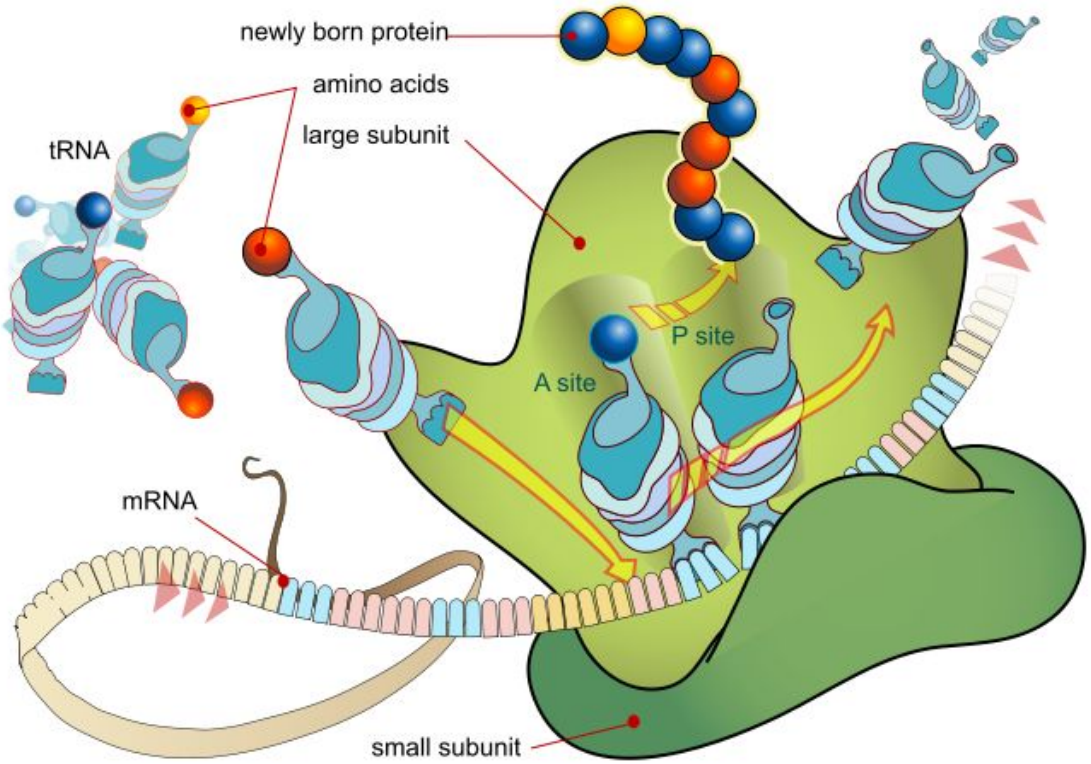
- Proteins make up all **living** materials

- Proteins are composed of **amino acids** – there are **20** different amino acids
- Different **proteins** are made by **combining** these 20 amino acids in different combinations



- Proteins are manufactured (made) by the **ribosomes**

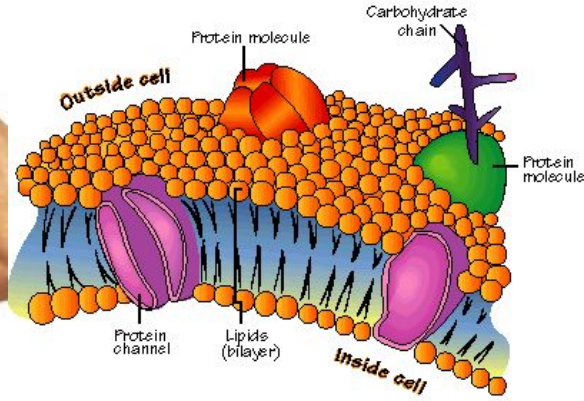




- Function of proteins:

1. Help fight **disease**
2. Build new body **tissue**
3. **Enzymes** used for digestion and other chemical reactions are proteins

   (Enzymes **speed up** the **rate** of a reaction)
4. Component of all **cell membranes**



MAKING PROTEINS

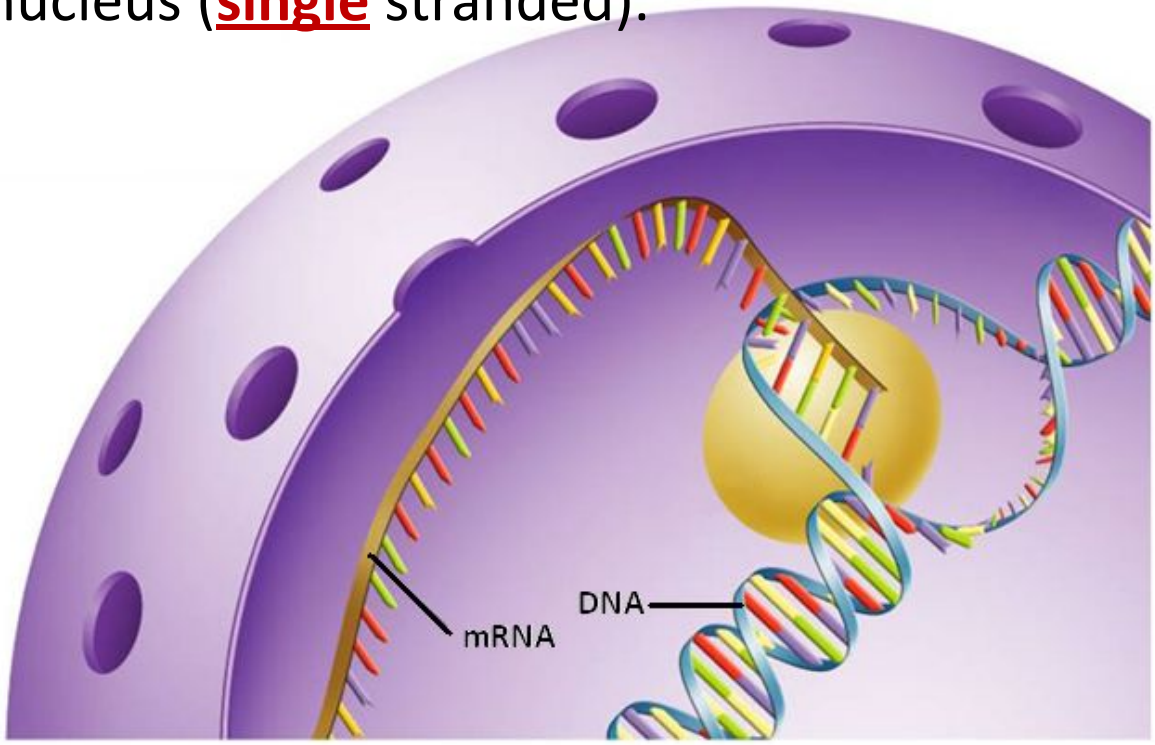
Step 1: Transcription

Making a Protein—Transcription

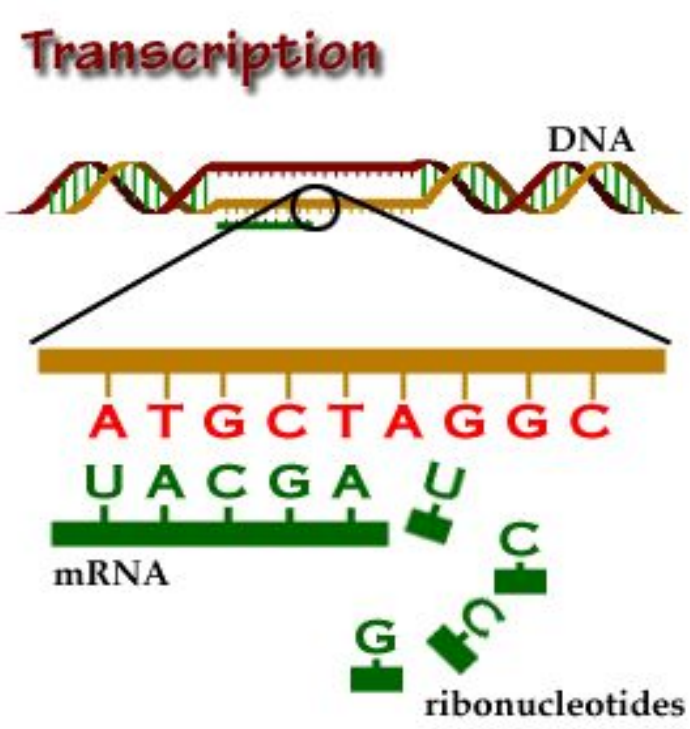
- **First Step**: **Copying** of genetic information from **DNA** to **RNA** called **Transcription**

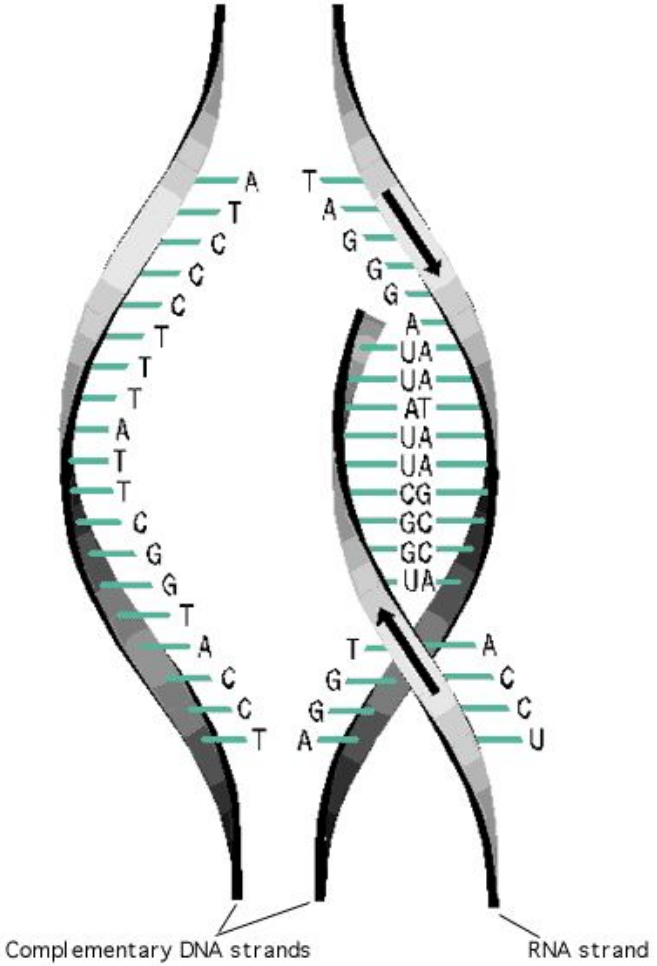
Why? DNA has the **genetic code** for the **protein** that needs to be made, but proteins are made by the ribosomes—ribosomes are outside the **nucleus** in the **cytoplasm**.

DNA is too **large** to leave the nucleus (**double** stranded), but RNA **can leave** the nucleus (**single** stranded).

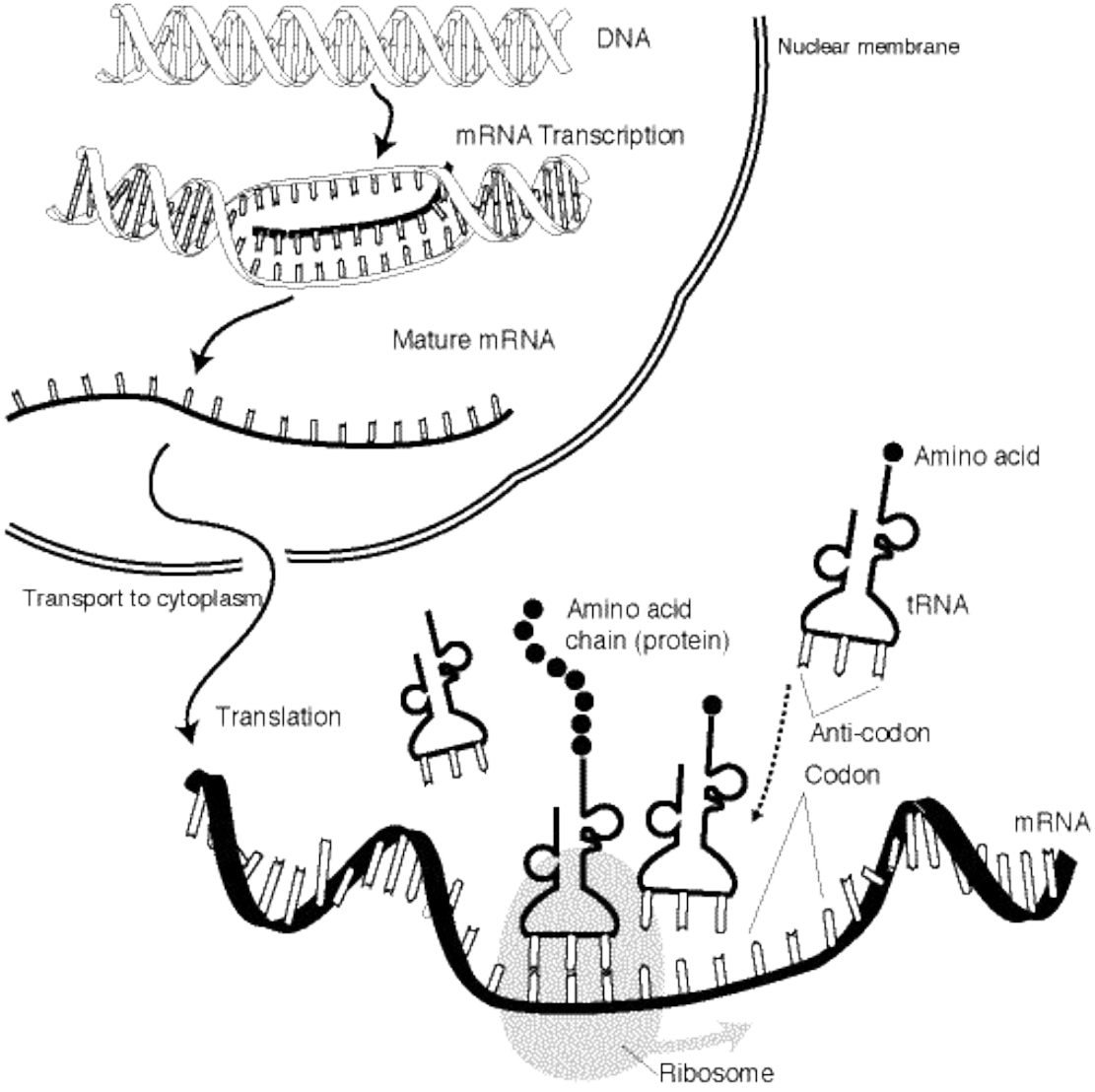


- Part of DNA temporarily **unzips** and is used as a **template** to assemble **complementary** nucleotides into **messenger RNA** (mRNA).





- mRNA then goes through the **pores** of the nucleus with the DNA **code** and attaches to the **ribosome**.

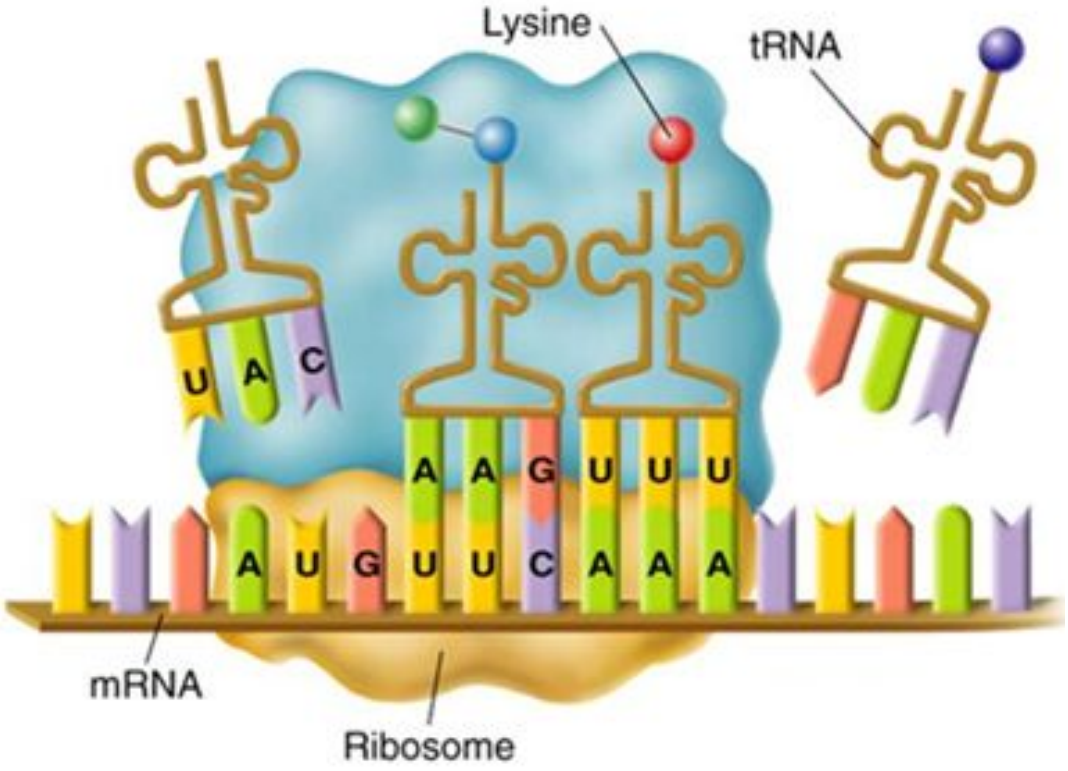


MAKING PROTEINS

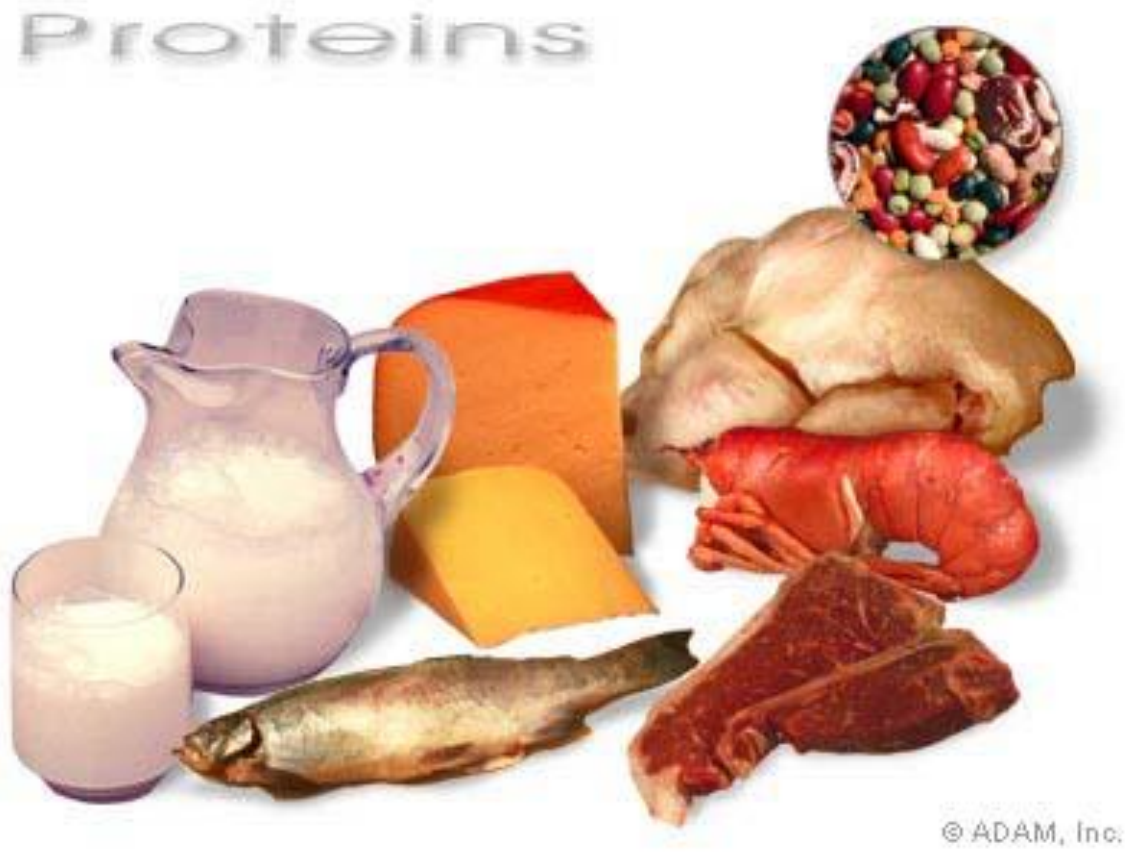
Step 2: Translation

Making a Protein—Translation

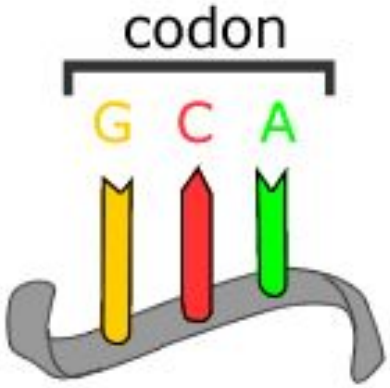
- **Second Step**: **Decoding** of mRNA into a **protein** is called **Translation**.
- **Transfer RNA** (tRNA) carries **amino acids** from the cytoplasm to the **ribosome**.



These amino acids come from the **food we eat**. Proteins we eat are broken down into individual **amino acids** and then simply **rearranged** into new **proteins** according to the needs and directions of our **DNA**.

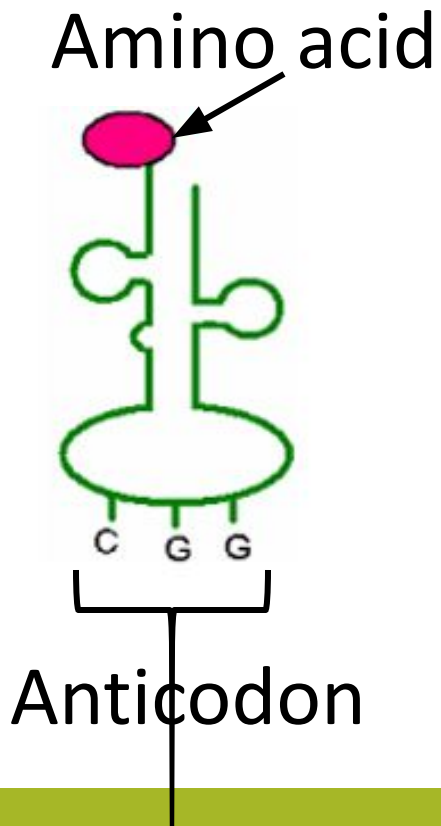


- A series of **three** adjacent **bases** in an mRNA molecule codes for a specific amino acid—called a **codon**.

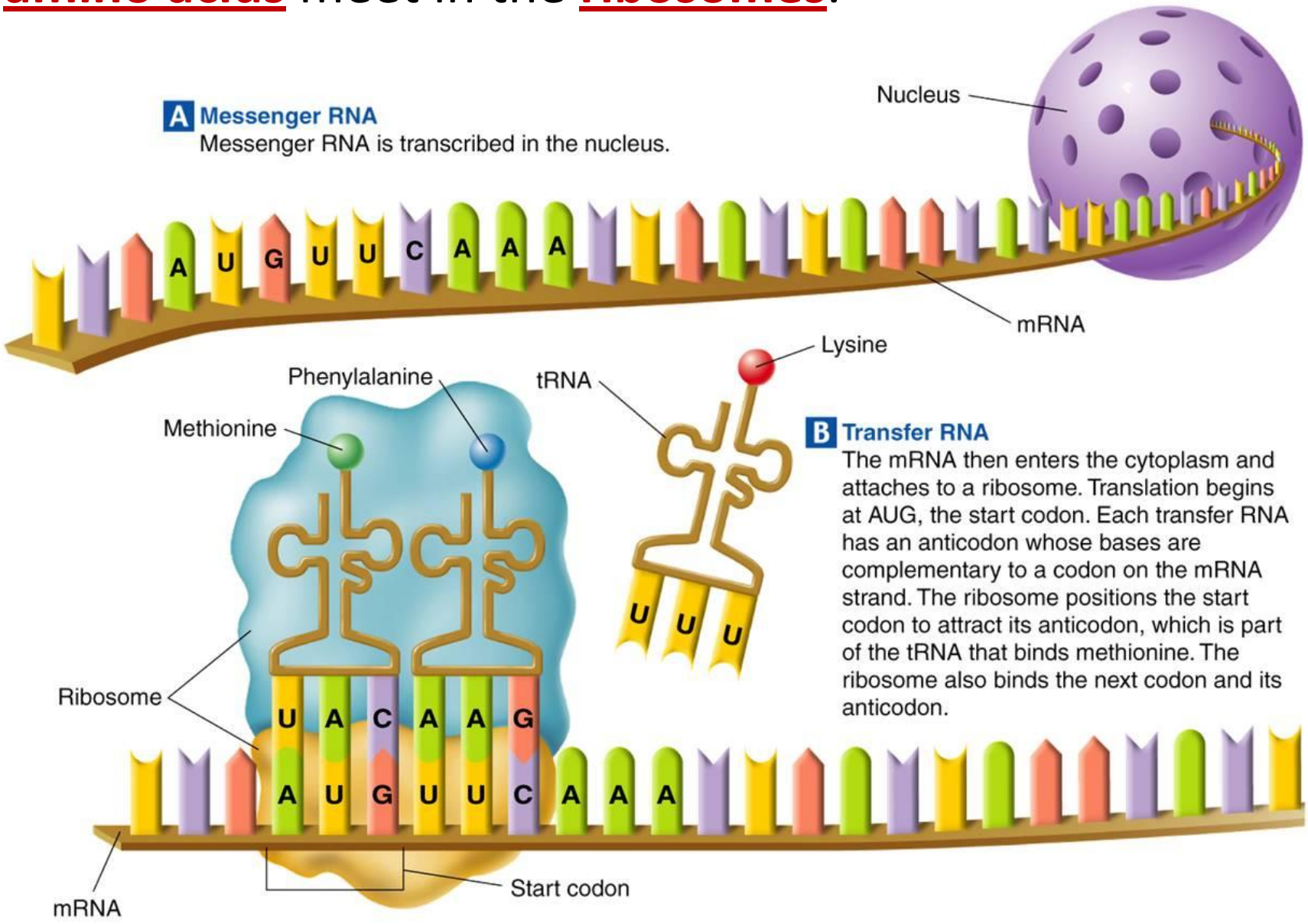


- Each **tRNA** has 3 nucleotides that are **complementary** to the **codon** in mRNA.

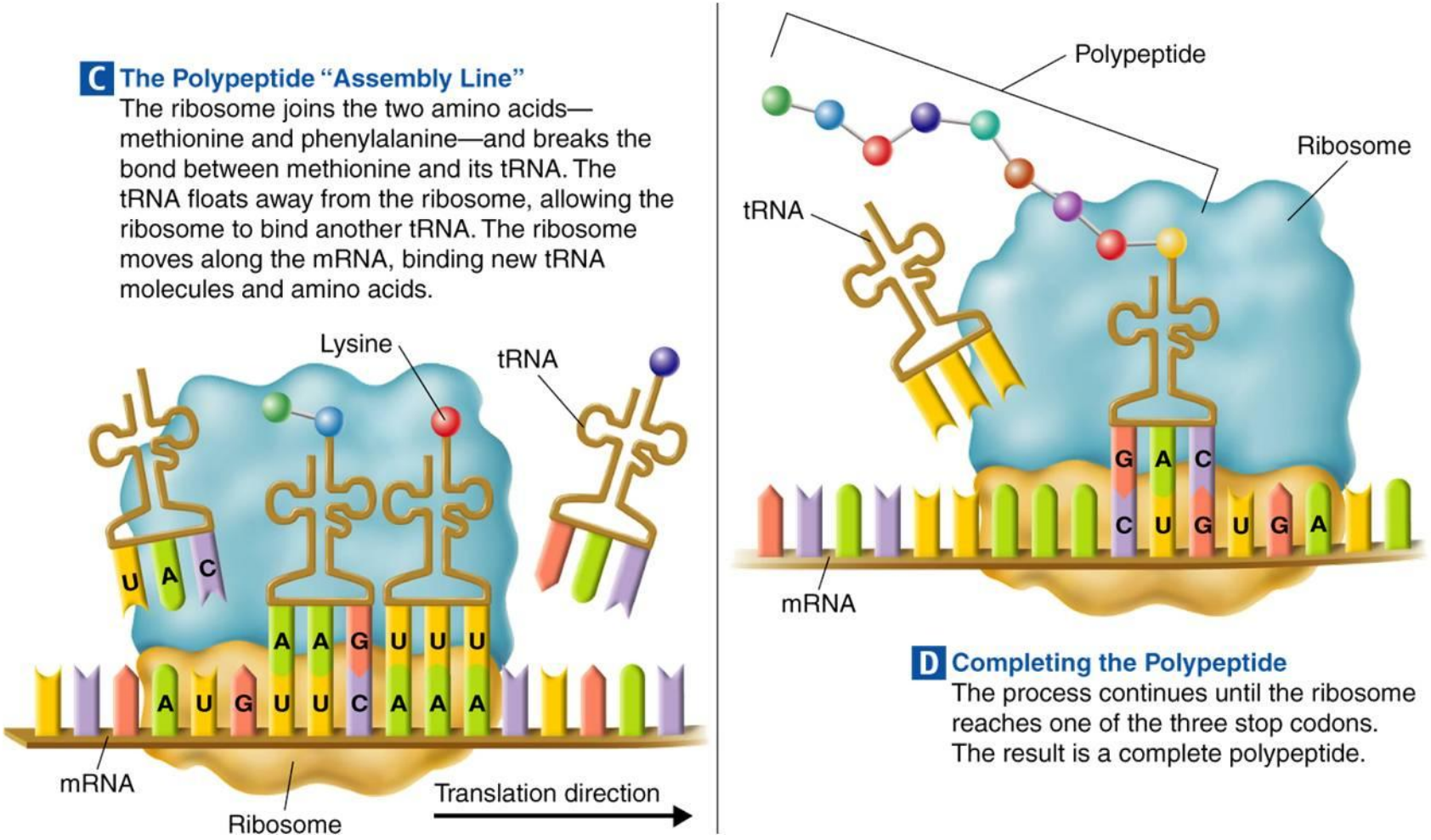
- Each **tRNA** codes for a **different** amino acid.



- mRNA carrying the **DNA instructions** and tRNA carrying **amino acids** meet in the **ribosomes**.



- Amino acids are joined together to make a **protein**.



Polypeptide = **Protein**

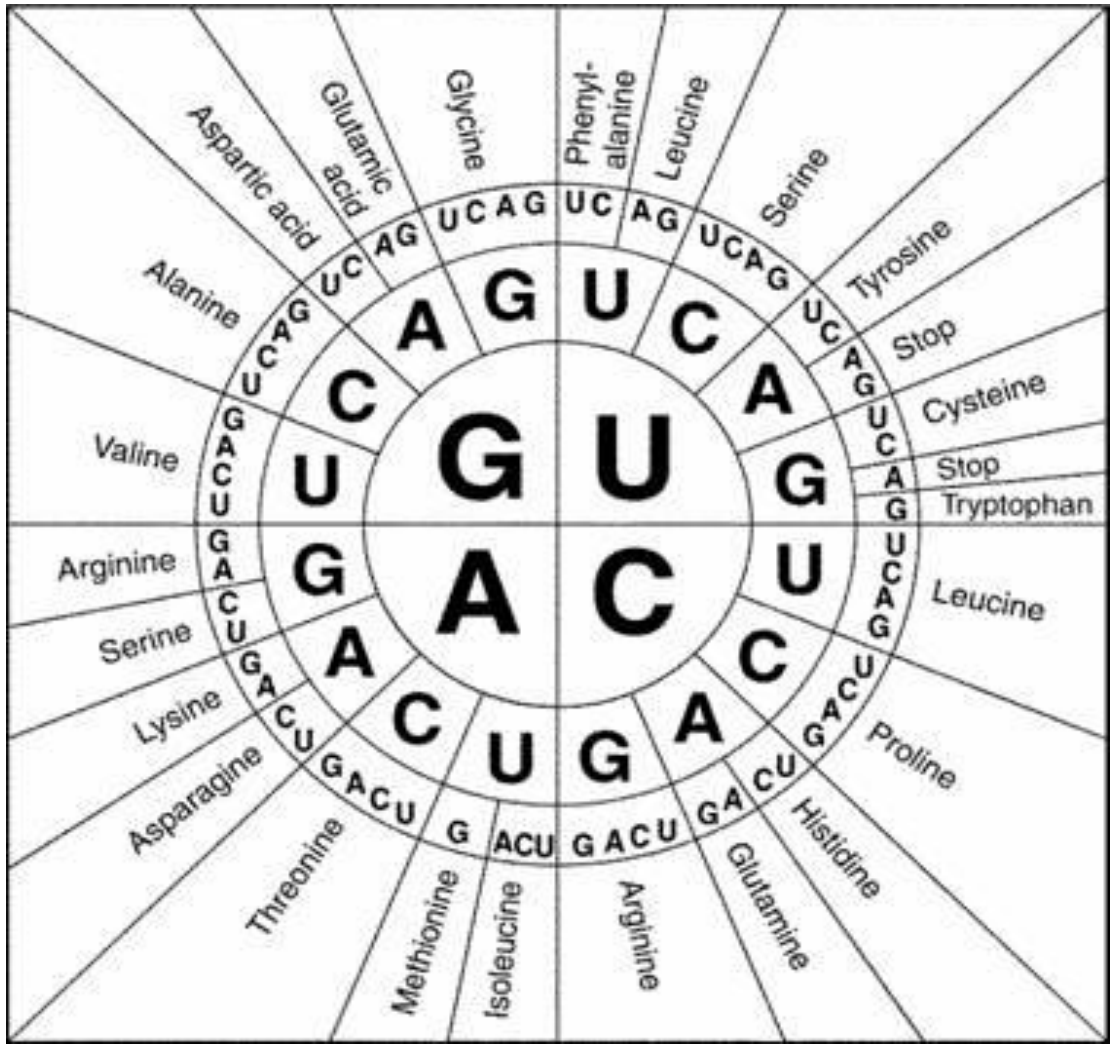
Genetic code has codons, which codes amino acids. 3 base = 1 codon = amino acid

2nd Base

1st Base	U		C		A		G		3rd Base
U	UUU	Phenylalanine	UCU	Serine	UAU	Tyrosine	UGU	Cysteine	U
	UUC	Phenylalanine	UCC	Serine	UAC	Tyrosine	UGC	Cysteine	C
	UUA	Leucine	UCA	Serine	UAA	Stop	UGA	Stop	A
	UUG	Leucine	UCG	Serine	UAG	Stop	UGG	Tryptophan	G
C	CUU	Leucine	CCU	Proline	CAU	Histidine	CGU	Arginine	U
	CUC	Leucine	CCC	Proline	CAC	Histidine	CGC	Arginine	C
	CUA	Leucine	CCA	Proline	CAA	Glutamine	CGA	Arginine	A
	CUG	Leucine	CCG	Proline	CAG	Glutamine	CGG	Arginine	G
A	AUU	Isoleucine	ACU	Threonine	AAU	Asparagine	AGU	Serine	U
	AUC	Isoleucine	ACC	Threonine	AAC	Asparagine	AGC	Serine	C
	AUA	Isoleucine	ACA	Threonine	AAA	Lysine	AGA	Arginine	A
	AUG	Methionine (Start)	ACG	Threonine	AAG	Lysine	AGG	Arginine	G
G	GUU	Valine	GCU	Alanine	GAU	Aspartic Acid	GGU	Glycine	U
	GUC	Valine	GCC	Alanine	GAC	Aspartic Acid	GGC	Glycine	C
	GUA	Valine	GCA	Alanine	GAA	Glutamic Acid	GGA	Glycine	A
	GUG	Valine	GCG	Alanine	GAG	Glutamic Acid	GGG	Glycine	G

AUG/AAC/GAC/UAA

Methionine / Asparagine / Aspartic Acid / Stop



Protein synthesis