# DR. H. N. SINHA ARTS AND COMMERCE COLLEGE, PATUR

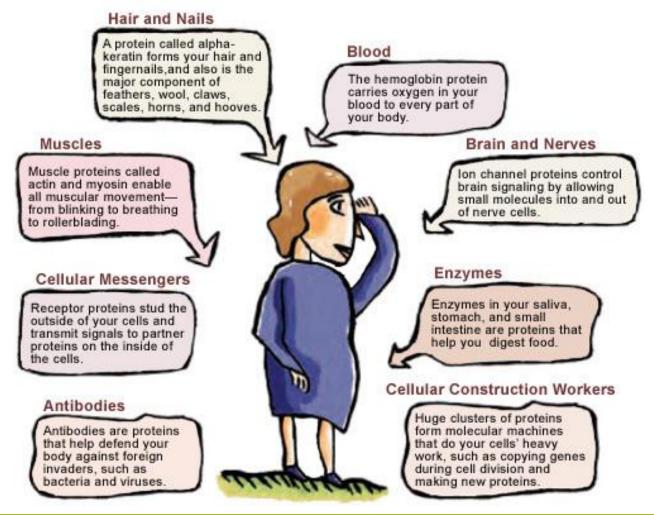
# PROTEIN SYNTHESIS

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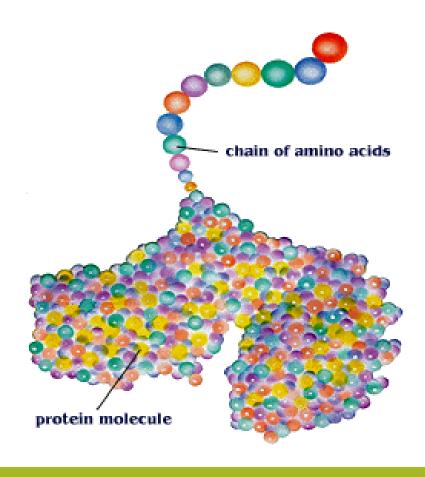
# **Protein Synthesis (Gene Expression) Notes**

# **Proteins** (Review)

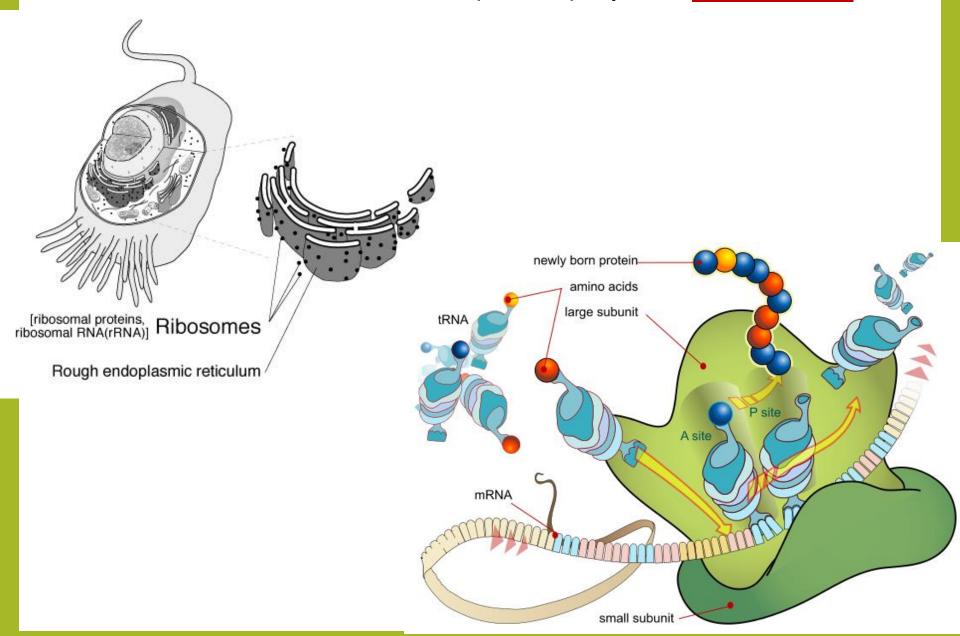
Proteins make up all <u>living</u> materials



- Proteins are composed of <u>amino acids</u> there are <u>20</u>
  different amino acids
- Different <u>proteins</u> are made by <u>combining</u> these 20 amino acids in different combinations

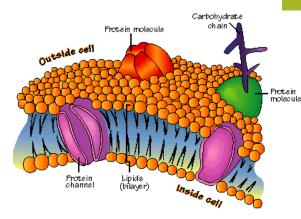


Proteins are manufactured (made) by the <u>ribosomes</u>



- Function of proteins:
  - 1. Help fight disease
  - 2. Build new body <u>tissue</u>
  - Enzymes used for digestion and other chemical reactions are proteins
    (Enzymes <u>speed up</u> the <u>rate</u> of a reaction)
  - 4. Component of all cell membranes





# MAKING PROTEINS

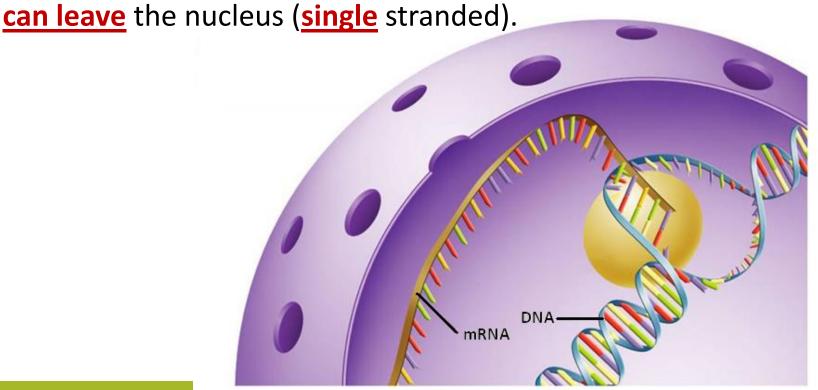
Step 1: Transcription

#### Making a Protein—Transcription

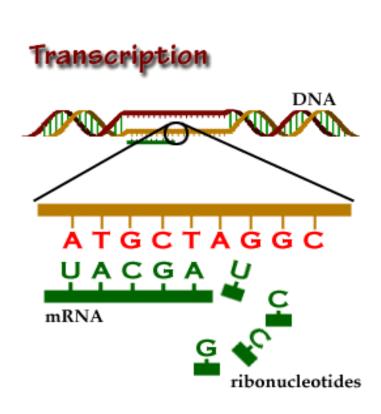
• <u>First Step</u>: <u>Copying</u> of genetic information from <u>DNA</u> to <u>RNA</u> called <u>Transcription</u>

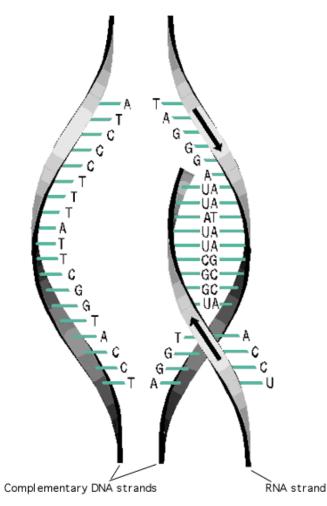
**Why?** DNA has the **genetic code** for the **protein** that needs to be made, but proteins are made by the ribosomes—ribosomes are outside the **nucleus** in the **cytoplasm**.

DNA is too <u>large</u> to leave the nucleus (<u>double</u> stranded), but RNA

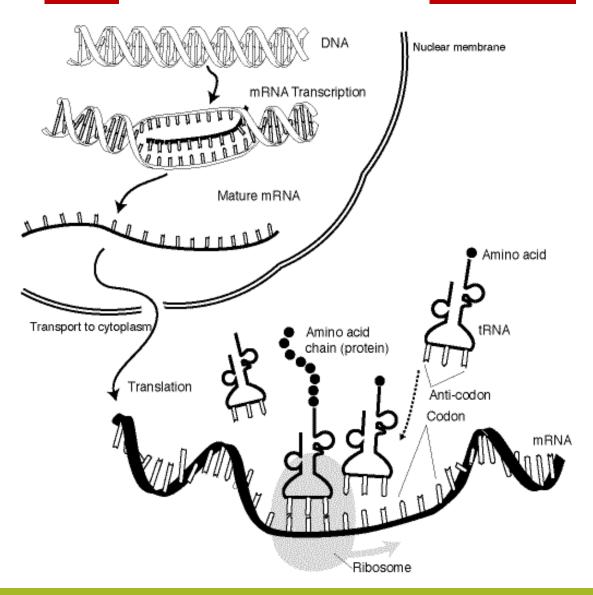


Part of DNA temporarily <u>unzips</u> and is used as a <u>template</u> to assemble <u>complementary</u> nucleotides into <u>messenger RNA</u> (mRNA).





 mRNA then goes through the <u>pores</u> of the nucleus with the DNA <u>code</u> and attaches to the <u>ribosome</u>.

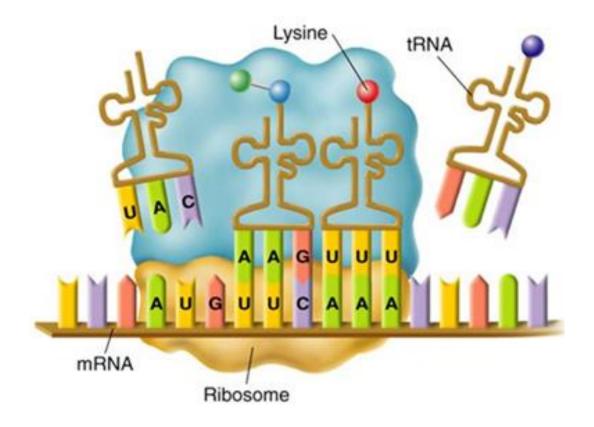


# MAKING PROTEINS

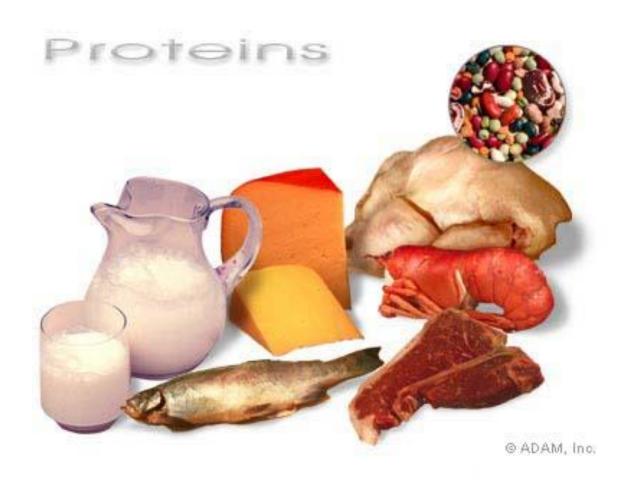
Step 2: Translation

## Making a Protein—Translation

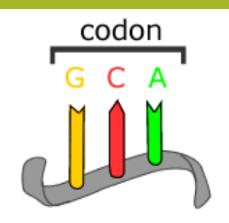
- Second Step: <u>Decoding</u> of mRNA into a <u>protein</u> is called <u>Translation</u>.
- <u>Transfer RNA</u> (tRNA) carries <u>amino acids</u> from the cytoplasm to the <u>ribosome</u>.



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

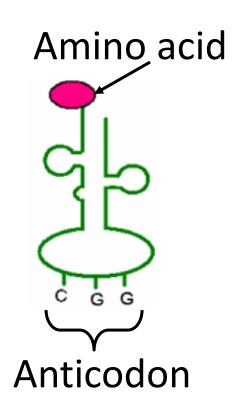


 A series of <u>three</u> adjacent <u>bases</u> in an mRNA molecule codes for a specific amino acid—called a <u>codon</u>.



 Each <u>tRNA</u> has 3 nucleotides that are <u>complementary</u> to the <u>codon</u> in mRNA.

• Each <u>tRNA</u> codes for a <u>different</u> amino acid.

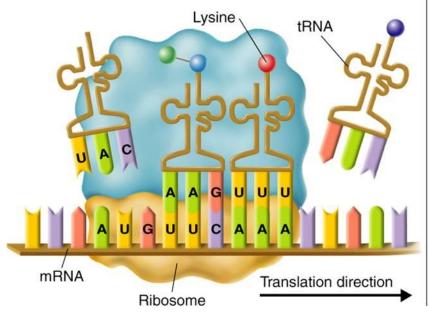


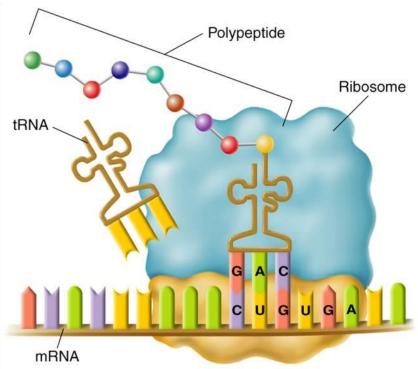
 mRNA carrying the <u>DNA instructions</u> and tRNA carrying amino acids meet in the ribosomes. **Nucleus** A Messenger RNA Messenger RNA is transcribed in the nucleus. mRNA Lysine Phenylalanine tRNA Methionine **B** Transfer RNA The mRNA then enters the cytoplasm and attaches to a ribosome. Translation begins at AUG, the start codon. Each transfer RNA has an anticodon whose bases are complementary to a codon on the mRNA strand. The ribosome positions the start codon to attract its anticodon, which is part of the tRNA that binds methionine. The ribosome also binds the next codon and its Ribosome anticodon. Start codon **mRNA** 

## Amino acids are joined together to make a <u>protein</u>.

#### C The Polypeptide "Assembly Line"

The ribosome joins the two amino acids—methionine and phenylalanine—and breaks the bond between methionine and its tRNA. The tRNA floats away from the ribosome, allowing the ribosome to bind another tRNA. The ribosome moves along the mRNA, binding new tRNA molecules and amino acids.





#### D Completing the Polypeptide

The process continues until the ribosome reaches one of the three stop codons. The result is a complete polypeptide.

Polypeptide = Protein

Use one of the codon charts on the next page to find the amino acid sequence coded for by the following mRNA strands.								
CAC/CCA/UGG/UGA								
AUG/AAC/GAC/UAA								
/	/	/						

# CAC/CCA/UGG/UGA

### 2<sup>nd</sup> Base

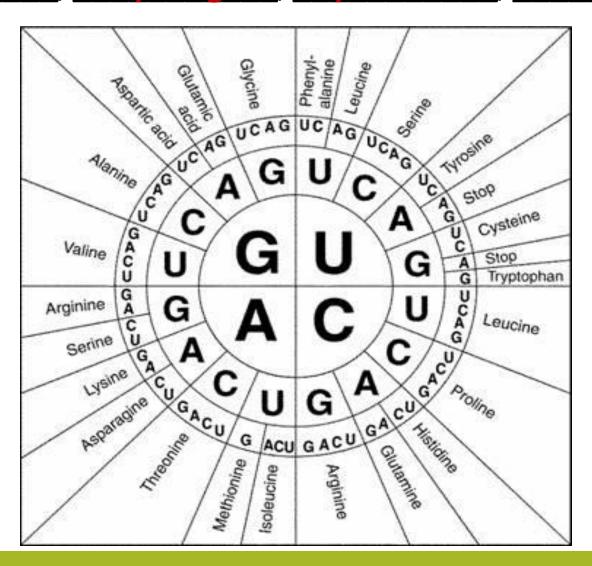
	U		С		Α		G		
U	UUU UUC UUA UUG	Phenylalanine Phenylalanine Leucine Leucine	UCU UCC UCA UCG	Serine Serine Serine Serine	UAU UAC UAA UAG	Tyrosine Tyrosine Stop Stop	UGU UGC UGA UGG	Cysteine Cysteine Stop Tryptophan	U C A G
С	CUU CUC CUA CUG	Leucine Leucine Leucine Leucine	CCU CCC CCA CCG	Proline Proline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

1st Base

3<sup>rd</sup> Base

## AUG/AAC/GAC/UAA

## Methionine / Asparagine / Aspartic Acid/ Stop



# Protein Synthesis















# THANK

YOU