



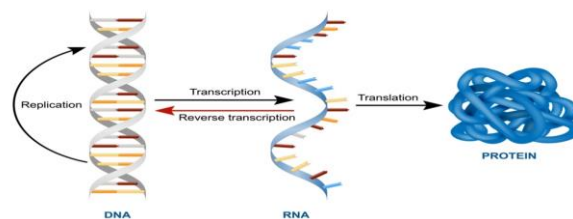
## Molecular Biology

### 2nd stage

### LEC 4

## Transcription, Translation & Protein Synthesis

Transcription and Translation



By

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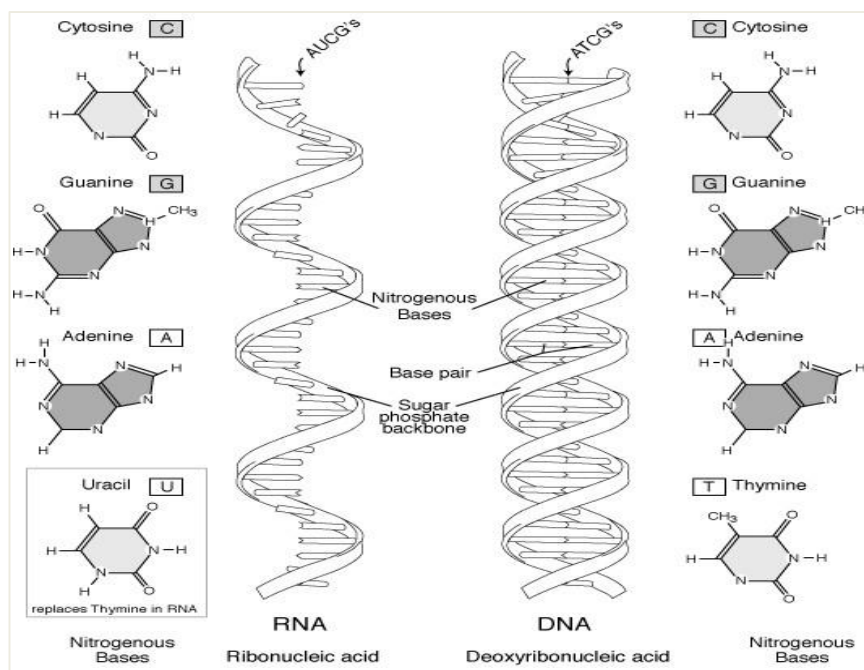
M.SC Nidaa Fadel

## Ribonucleic Acids (RNA)

- The job of **RNA** (ribonucleic acid) is to **carry messages** from the **DNA** (in the nucleus) to the **ribosomes** (in the cytoplasm).
- There are **three types** of RNA:
  - mRNA** – carries a **message** from the **DNA** to the **cytoplasm**
  - tRNA** – **transports amino acids** to the **mRNA** to make a protein
  - rRNA** – make up **ribosomes**, which make protein.

### RNA is almost exactly like DNA, except:

- Contains a **ribose sugar**, instead of a deoxyribose sugar (hence the name...)
- Contains **uracil** instead of **thymine**.
- RNA is single-stranded**, not double-stranded (usually...)



## Protein Synthesis

**Protein synthesis** is the process in which a cell makes protein based on the message contained within its DNA.

However:

- DNA is **only** found in the nucleus

— Proteins are **only** made outside the nucleus – in the cytoplasm.

*Houston, we have a problem*

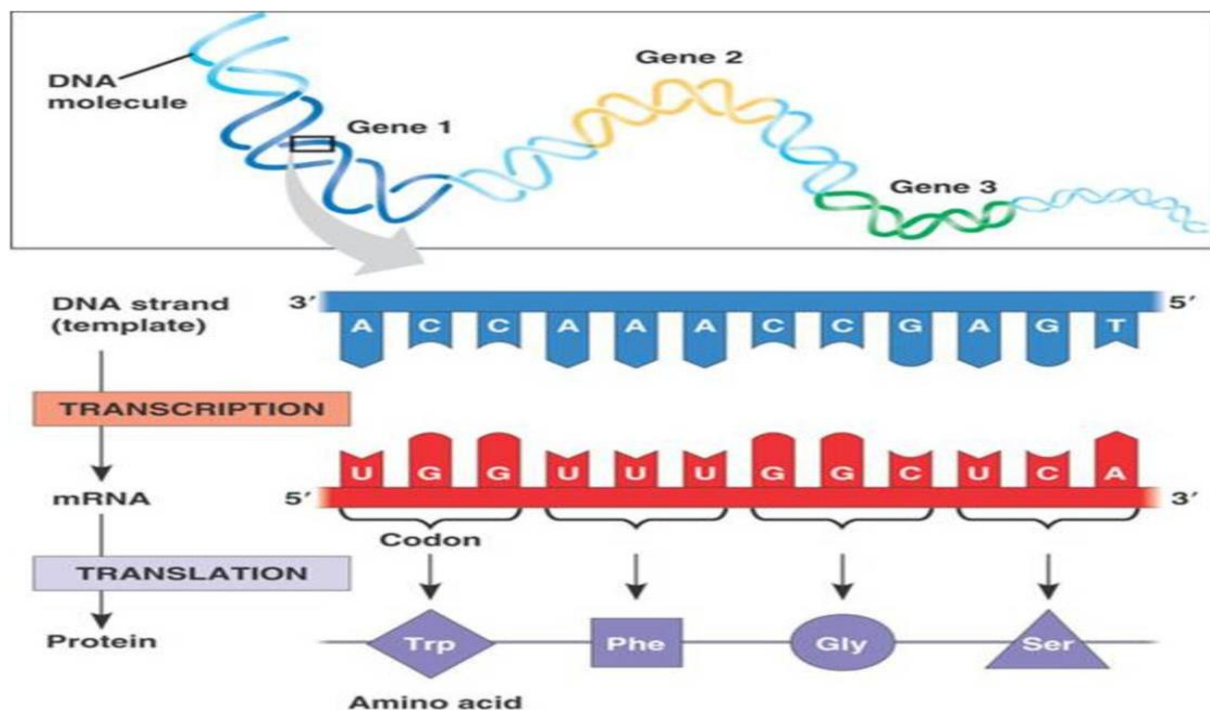
How do the many different messages within the DNA molecule get to the many ribosomes outside the nucleus?

A molecular cousin of DNA – **RNA** – is used to carry these messages.

## Protein Synthesis

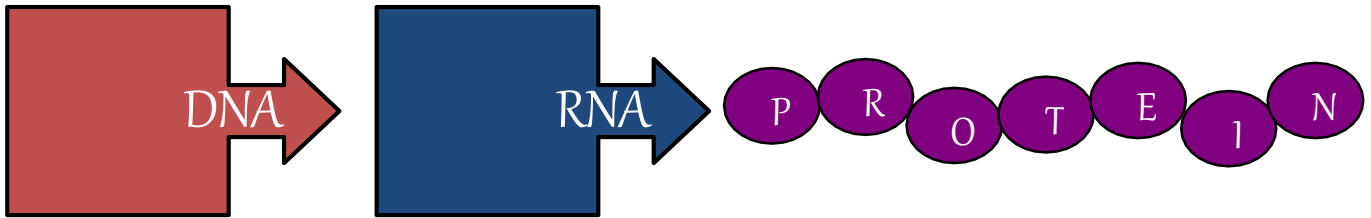
Occurs in **TWO** steps:

- 1. Transcription** – the genetic information from a strand of DNA is copied into a strand of **mRNA**
- 2. Translation** – the **mRNA**, with the help of the **ribosome**, forms a **chain of amino acids** (eventually forming a **protein**) based on the information contained on the mRNA.



## The Central Dogma

This order of events is called **the central dogma** of molecular biology:



### Step One: Transcription

Try it! What **RNA** strand will be made from the following **DNA** sequence?

**TACGCATGACTAGCAAGTCTAACT**  
**AUGCGUACUGAUCGUUCAGAUUGA**

### : RNA Editing

- An mRNA molecule has to be “edited” in order to be useful. There’s a lot of unnecessary information that needs to be removed.
- An mRNA sequence that does NOT code for protein is called an **interon**. A sequence that is useful in making a protein is called an **exon**.

interon

### Step Two: Translation

1. So how do you exactly go about determining what protein your cells are going to make?
2. **FIRST**, Divide the mRNA sequence into **codons**. As you just saw and heard, codons are three-base sections of mRNA:

**AUG|CGU|ACU|GAU|CGU|UCA|GAU|UGA**

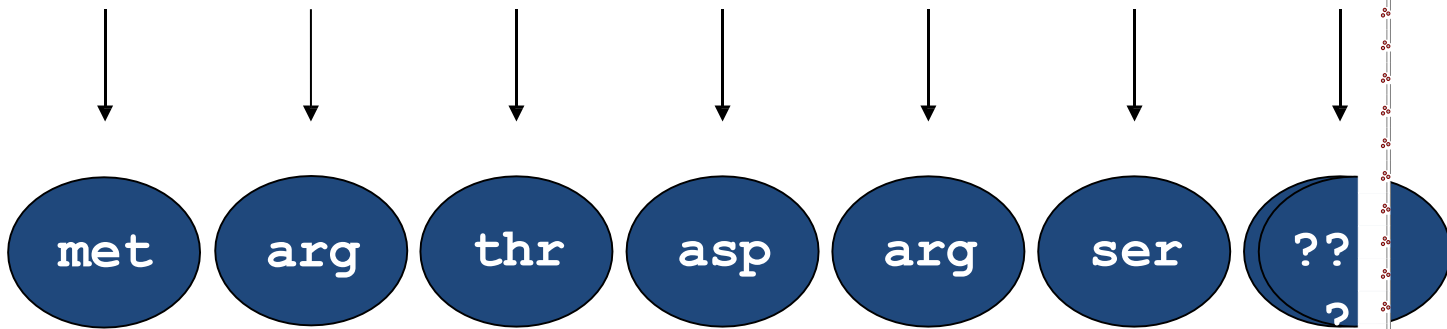
Since each 3-letter combination “codes” for an amino acid, you need to figure out what amino acid matches up with each codon:

**AUG|CGU|ACU|GAU|CGU|UCA|GAU|UGA**

????

- Since each 3-letter combination “codes” for an amino acid, you need to figure out what amino acid matches up with each codon

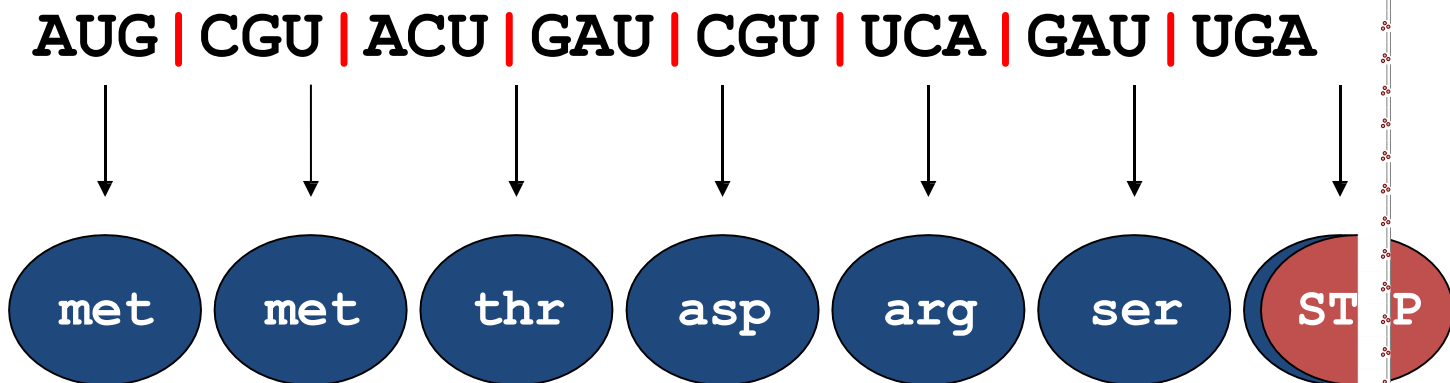
**AUG | CGU | ACU | GAU | CGU | UCA | GAU | UGA**



# The Genetic Code

		Second letter					
		U	C	A	G		
First letter	U	UUU } Phe UUC } UUA } Leu UUG }	UCU } UCC } Ser UCA } UCG }	UAU } Tyr UAC } UAA Stop UAG Stop	UGU } Cys UGC } UGA Stop UGG Trp	U C A G	
	C	CUU } CUC } Leu CUA } CUG }	CCU } CCC } Pro CCA } CCG }	CAU } His CAC } CAA } Gln CAG }	CGU } Arg CGC } CGA } CGG }	U C A G	
	A	AUU } AUC } Ile AUA } AUG Met	ACU } ACC } Thr ACA } ACG }	AAU } Asn AAC } AAA } Lys AAG }	AGU } Ser AGC } AGA } Arg AGG }	U C A G	
	G	GUU } GUC } Val GUA } GUG }	GCU } GCC } Ala GCA } GCG }	GAU } Asp GAC } GAA } Glu GAG }	GGU } GGC } Gly GGA } GGG }	U C A G	
						Third letter	

- Since each 3-letter combination “codes” for an amino acid, you need to figure out what amino acid matches up with each codon:



### RECAP:

1. DNA is transcribed into

mRNA in the nucleus.

2. The mRNA leaves the nucleus and enters the cytoplasm.

3. The protein is translated from the mRNA sequence using tRNA and

amino acids.

