DNA, RNA, and Protein: Transcription & Translation

Chapter 12, section 3

Structure of RNA

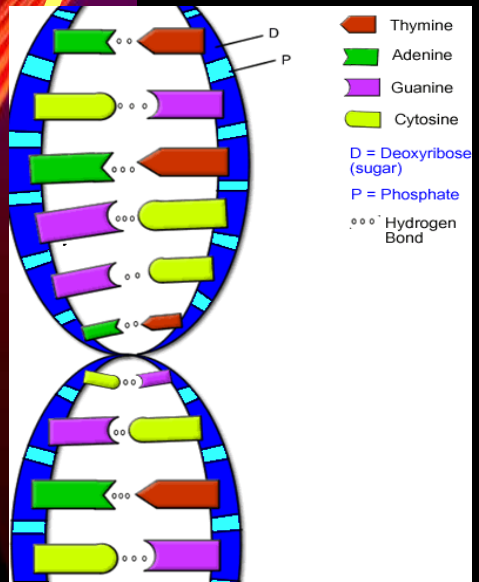
- Single stranded
- Ribose Sugar
- 5 carbon sugar
- Phosphate group
- Adenine, Uracil, Cytosine, Guanine

What is RNA?

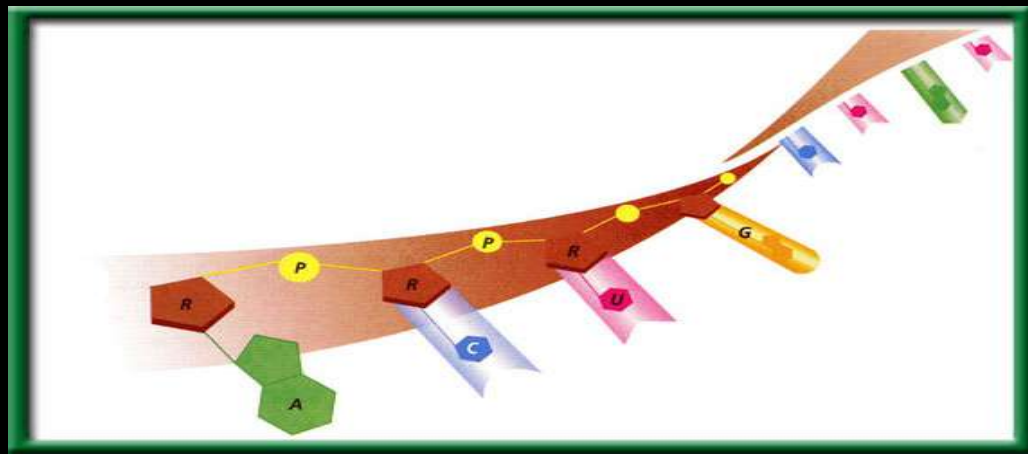
- RNA is like DNA, except instead of ATGC, it has AUGC.
- A matches to T
- U matches to A
- C and G match

DNA vs. RNA

- **DNA**
- Double Helix
- Deoxyribose sugar
- Adenine pairs with Thymine (A-T)
- Stays in nucleus



- **RNA**
- Single strand
- Ribose sugar
- Uracil replaces Thymine!
- Leaves nucleus to do the work



Types of RNA

- Three main types

1. Messenger RNA (mRNA) – transfers DNA code to ribosomes for translation.
2. Transfer RNA (tRNA) – brings amino acids to ribosomes for protein synthesis.
3. Ribosomal RNA (rRNA) – Ribosomes are made of rRNA and protein.

(1961) Watson & Crick proposed…

- **…DNA controlled cell function by serving as a template for PROTEIN structure.**
- **3 Nucleotides = a triplet or CODON (which code for a specific AMINO ACID)**

See p.303

- **AMINO ACIDS are the building blocks of proteins.**

PROTEIN SYNTHESIS: Transcription & Translation

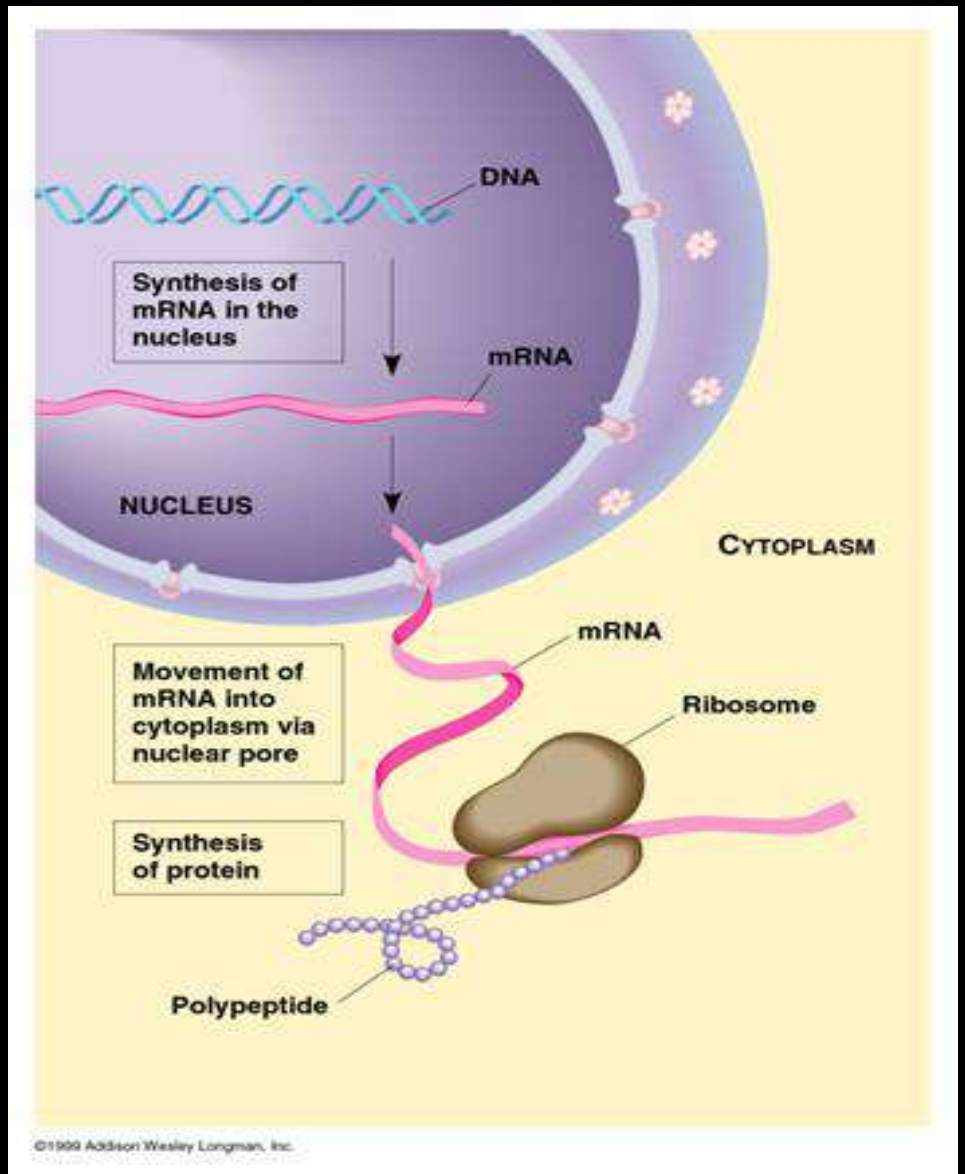
Ch. 12 Section 3

How Does DNA direct the making of proteins?

- DNA can't leave the nucleus, so it uses a "messenger".
- The messenger is called "messenger RNA".
- Messenger RNA matches itself to each section of DNA (to each gene)
- This occurs in 2 steps: **Transcription** & **Translation**

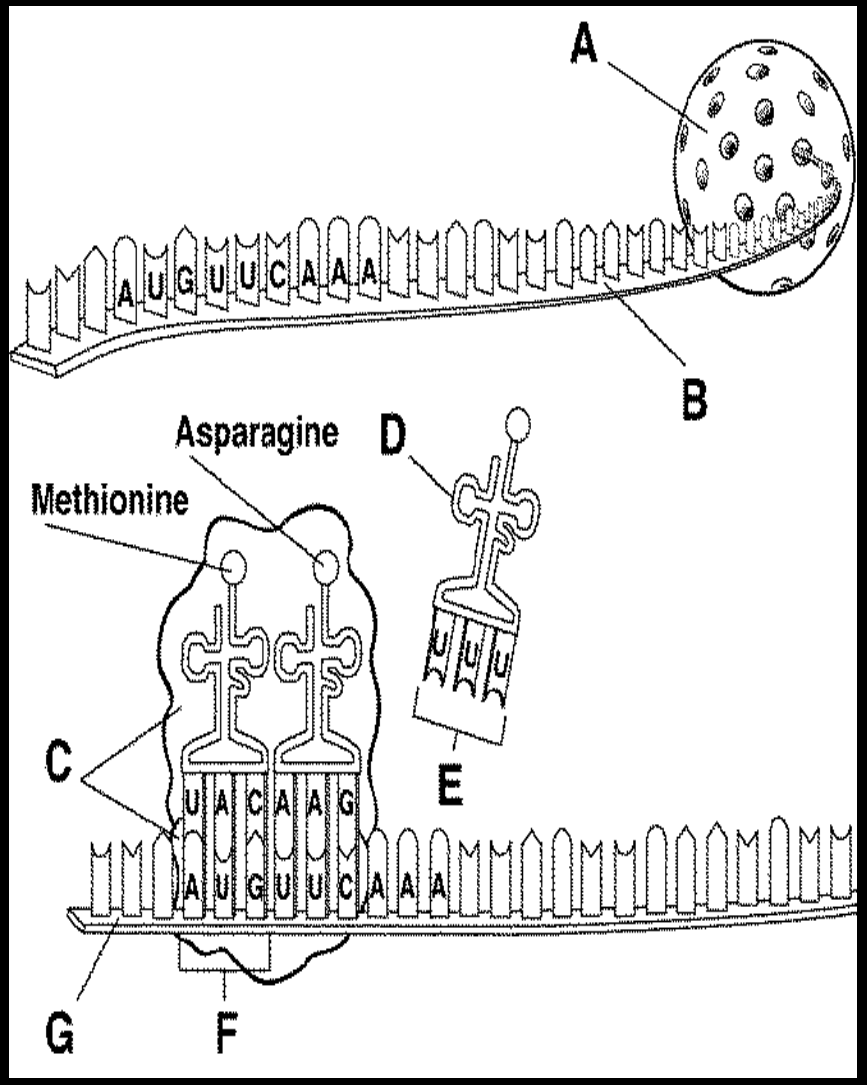
Step 1: DNA Transcription

- DNA can "unzip" itself and RNA nucleotides match up to the DNA strand.
- Both DNA & RNA are formed from NUCLEOTIDES and are called NUCLEIC acids.
- This occurs in the *nucleus*



Step 2: DNA Translation

- The cell uses information from "messenger" RNA to produce proteins while attached to a ribosome (the site of protein synthesis)



So How Does It All Work?

- 1. The messenger RNA sneaks the codon for an amino acid out of the nucleus and takes it to a ribosome (**Transcription**).
- 2. The ribosomes "staple" together the amino acids to make proteins (**Translation**)

Cracking the Code

Chapter 12, Section 3 cont.

How Does the RNA know where a gene begins?

- Some special codes in DNA are called promotors
- Promotors tell the RNA where to start
- There are also special codes that tell it when to stop

What the Heck are Introns and Exons?

- Introns are codes that don't seem to code for anything! (Scientists used to call them "junk DNA" because they thought they were worthless. Now they think that introns may be involved in determining which genes get "turned on" and which stay "off").
- Exons are codes to make proteins

Want to Learn the Secret Code?

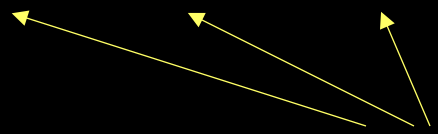
- Every three bases makes an amino acid.
- Each set of three bases is called a codon.
- Codons code for specific amino acids.
- Amino acids are connected by ribosomes to make proteins

Example: UCG makes serine

Codon Activity

- Organize your mRNA into three letter blocks called codons.

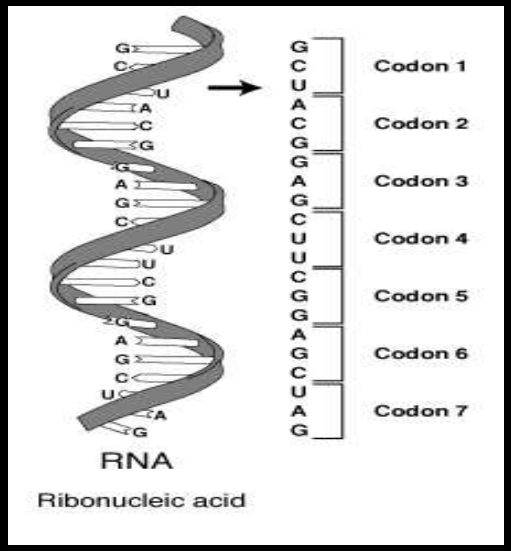
- Example:
- mRNA: AUGUGCUAAG
- AUG UGC UAC

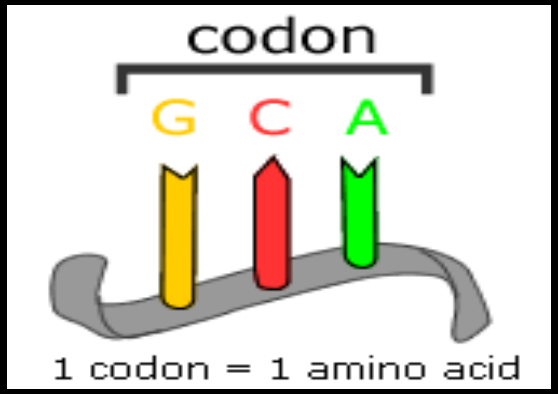


Three letter blocks = codons

Codons

- Each codon codes for a specific amino acid in the protein chain. tRNA (transfer) matches a particular codon to a particular amino acid. Amino acids are joined together in the correct sequence to form a protein chain.





How do I read a Codon chart?

First Letter	Second Letter				Third Letter
	U	C	A	G	
U	phenylalanine	serine	tyrosine	cysteine	U
	phenylalanine	serine	tyrosine	cysteine	C
	leucine	serine	stop	stop	A
	leucine	serine	stop	tryptophan	G
C	leucine	proline	histidine	arginine	U
	leucine	proline	histidine	arginine	C
	leucine	proline	glutamine	arginine	A
	leucine	proline	glutamine	arginine	G
A	isoleucine	threonine	asparagine	serine	U
	isoleucine	threonine	asparagine	serine	C
	isoleucine	threonine	lysine	arginine	A
	(start) methionine	threonine	lysine	arginine	G
G	valine	alanine	aspartate	glycine	U
	valine	alanine	aspartate	glycine	C
	valine	alanine	glutamate	glycine	A
	valine	alanine	glutamate	glycine	G

- "First letter" represents the first letter of a codon. Example: AUG
- "Second letter" represents the second letter of a codon. Example: AUG
- "Third letter" represents the third letter of a codon. Example: AUG
- The amino acid coded for the codon AUG is methionine.

It's your turn to practice using the codon chart! Identify the amino acids represented by the codons on your handout.

Codon Wheel

- With a wheel, you start from the inside and go out. The first letter of the codon is on the inside; the second on the middle rung; and the third is on next.