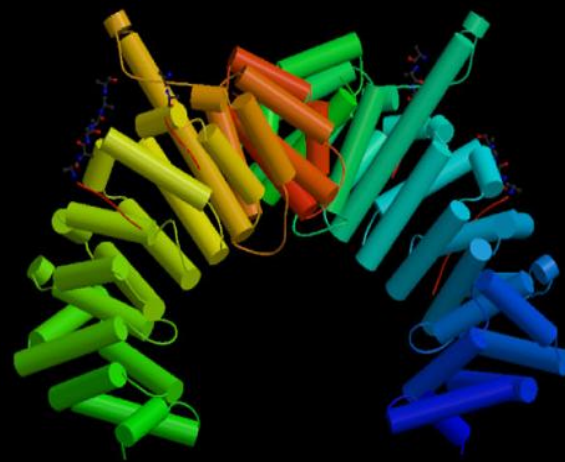
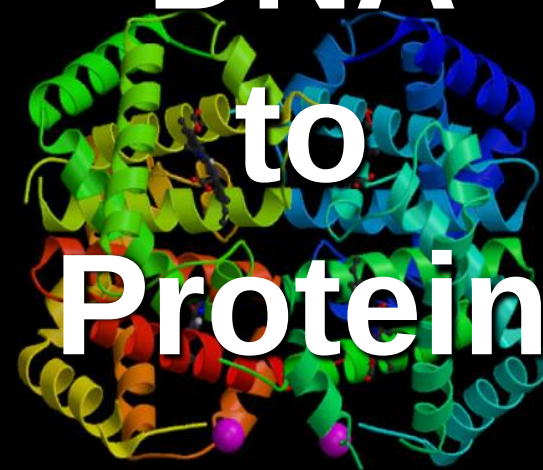
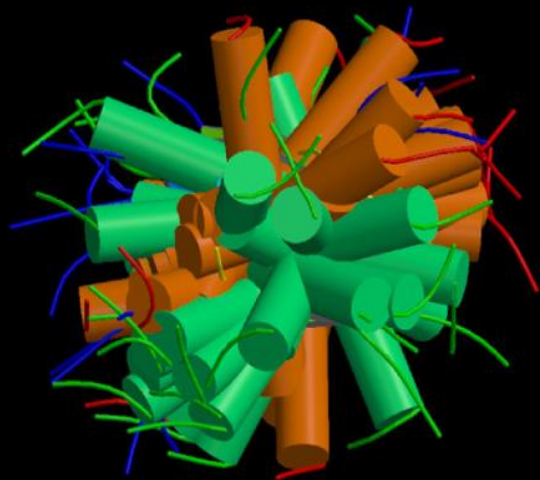
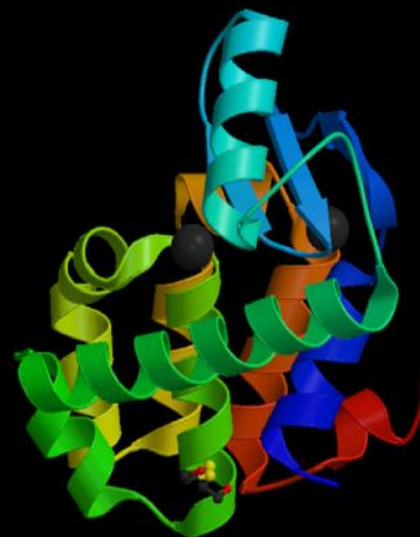
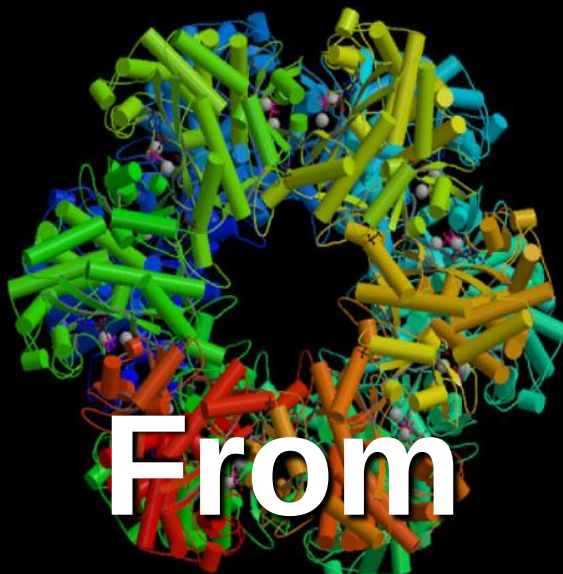
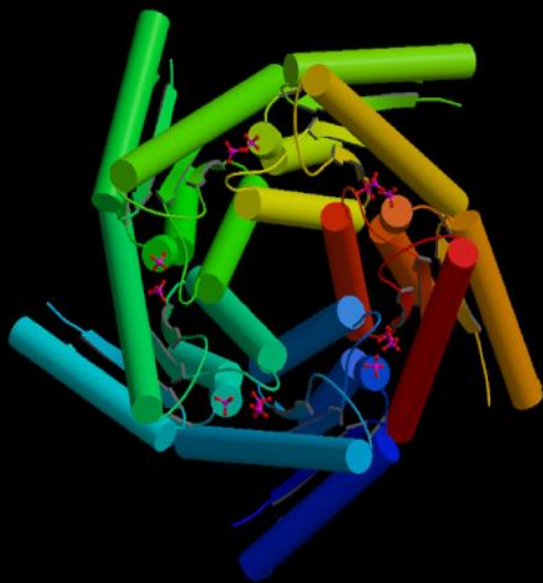
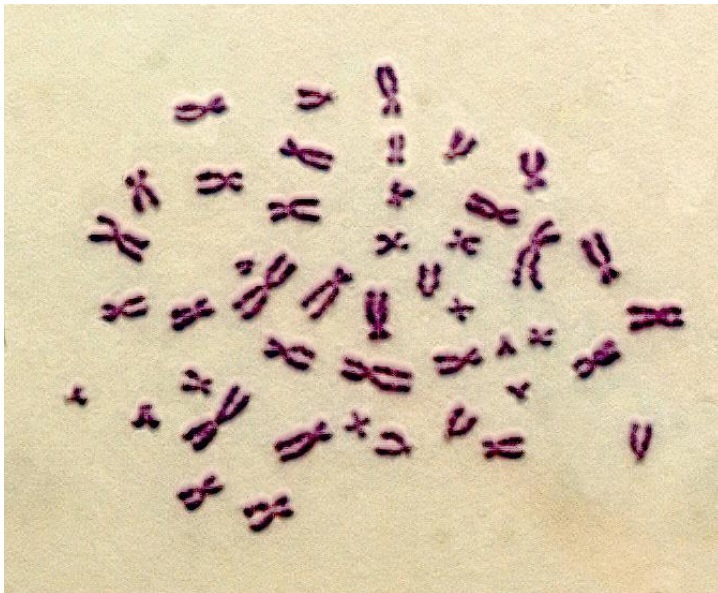


From
DNA
to
Protein

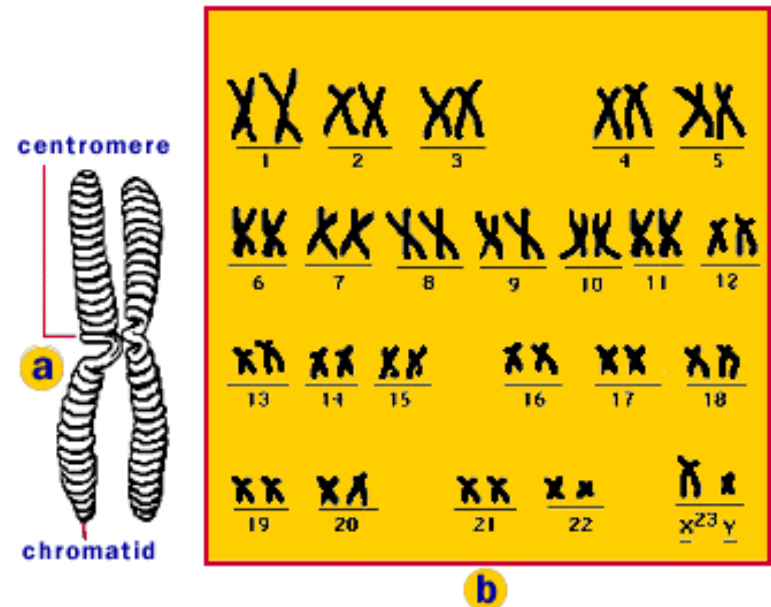


Genes

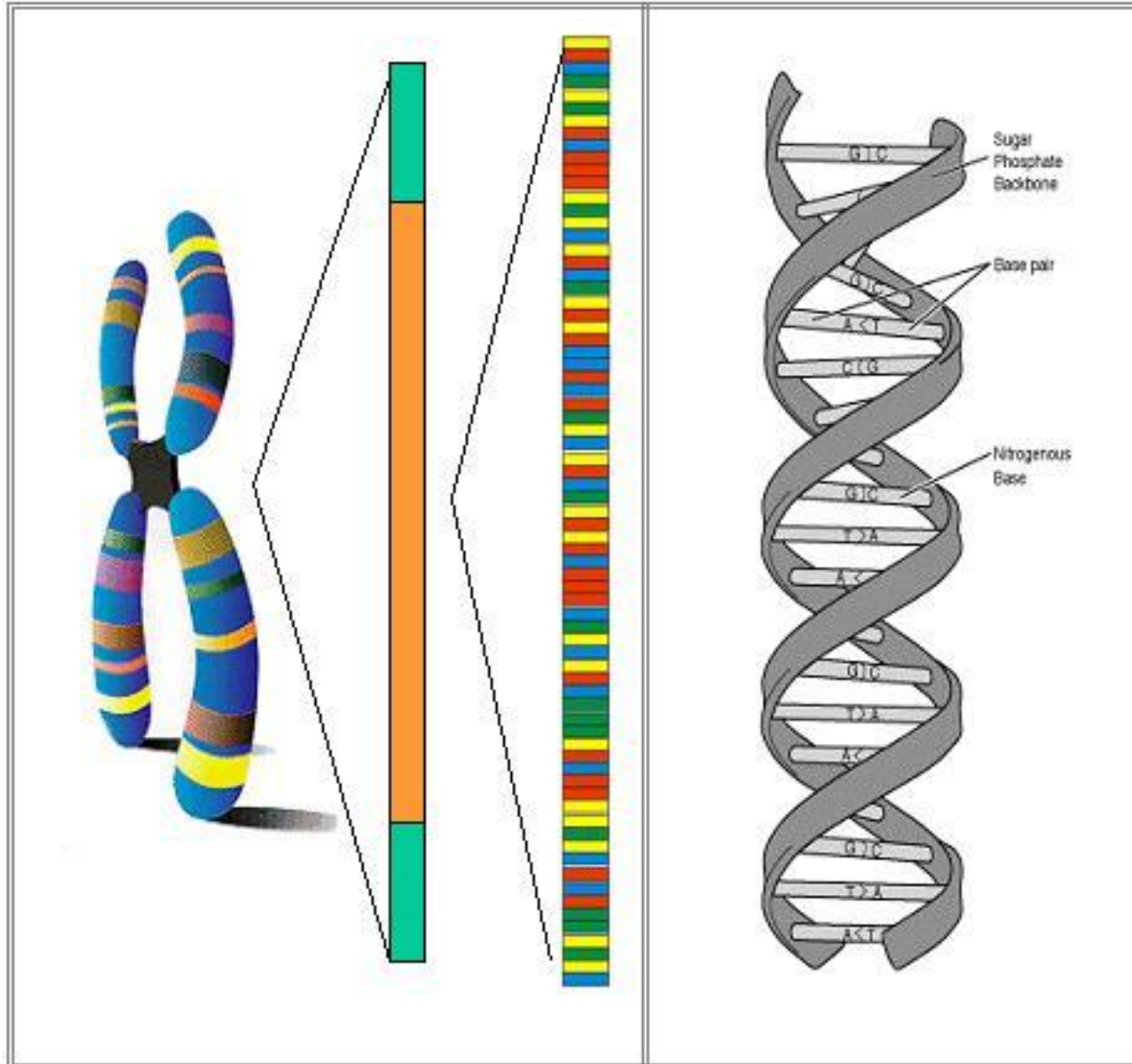
- Segment of **DNA** on a **chromosome**
- Contains the information for **1 protein**.



Human chromosomes!

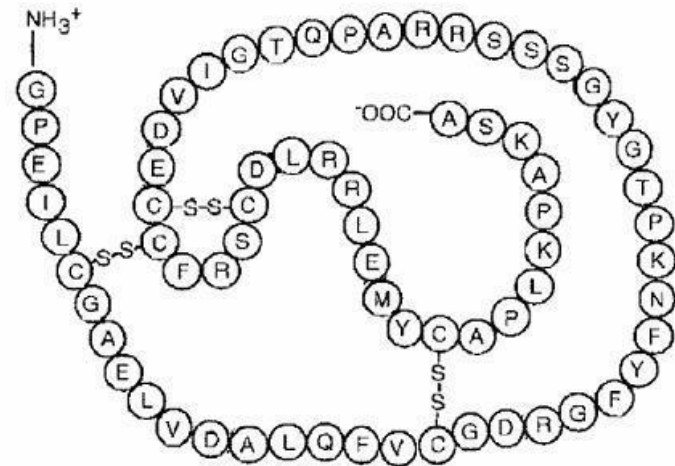
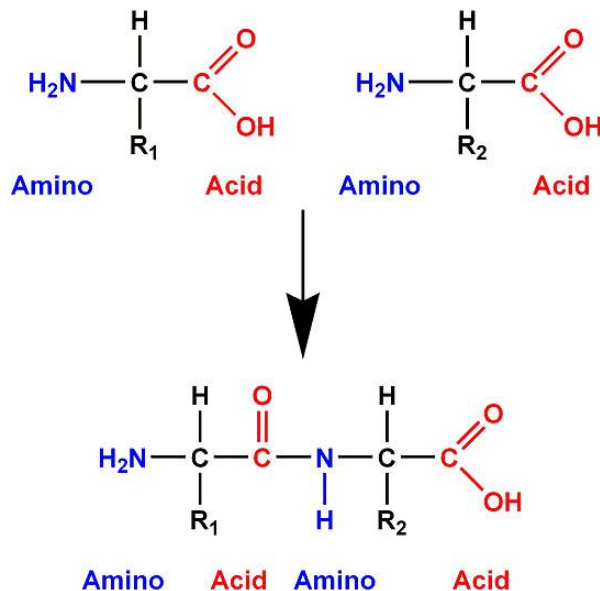


Genes on Chromosomes

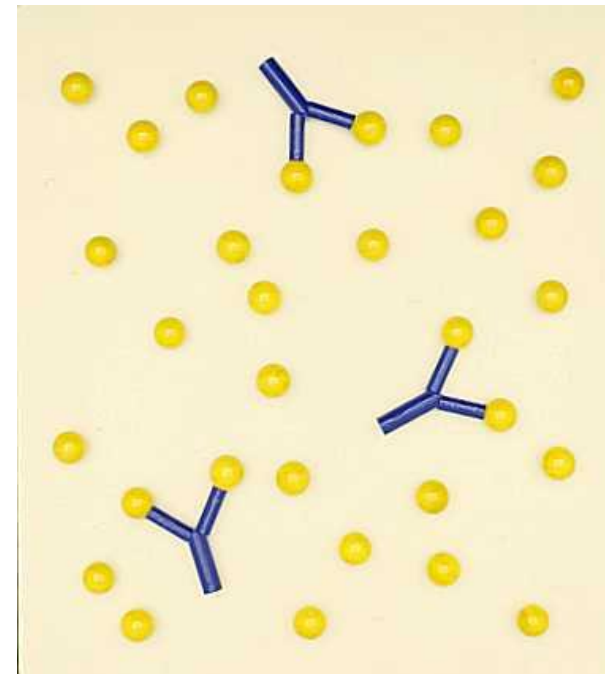
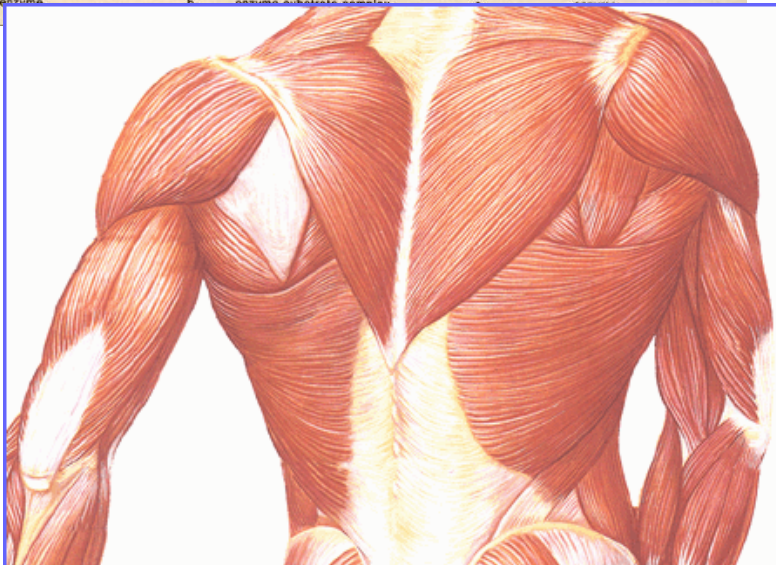
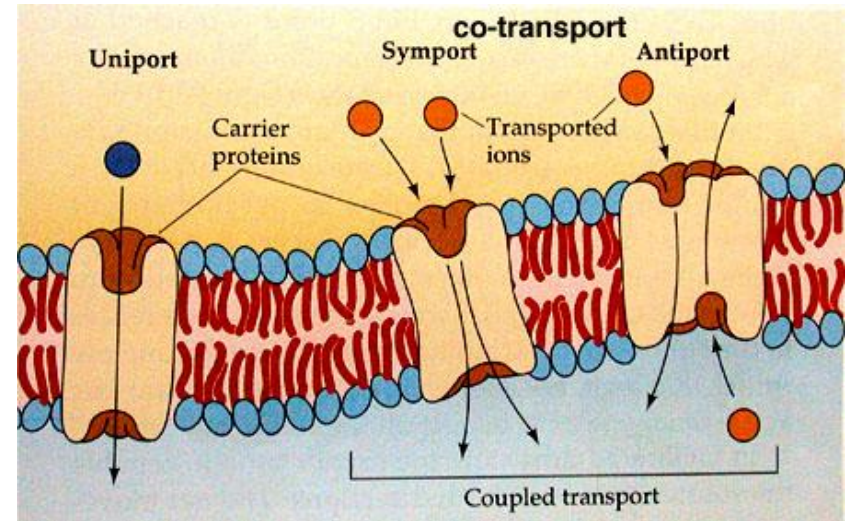
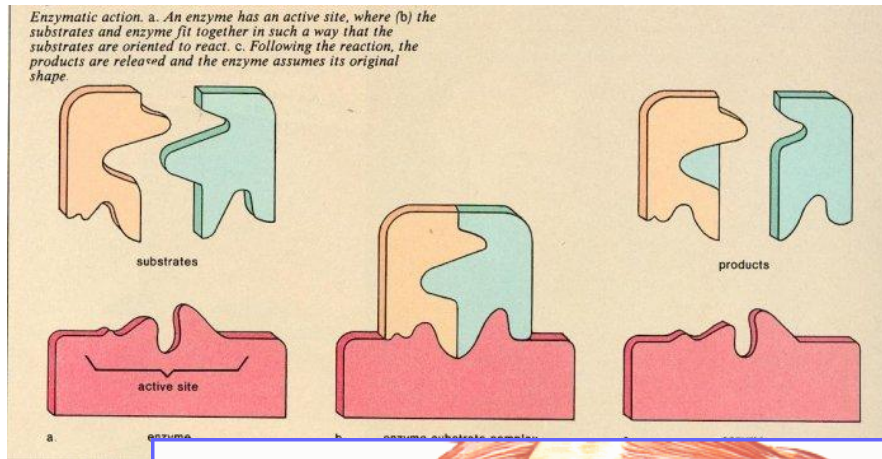


Genes

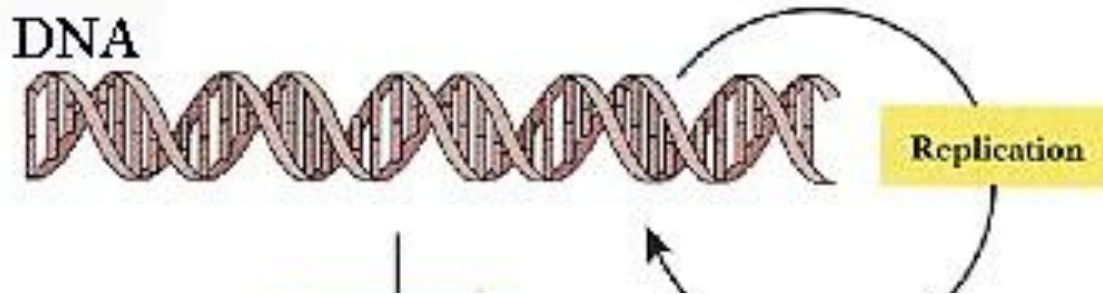
- Each gene has a sequence of DNA nucleotides that leads to a sequence of amino acids in a protein



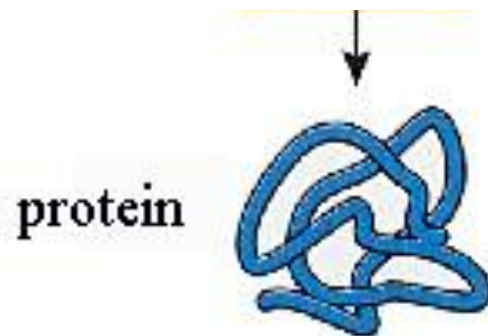
Important Proteins



How do we get from DNA to protein?

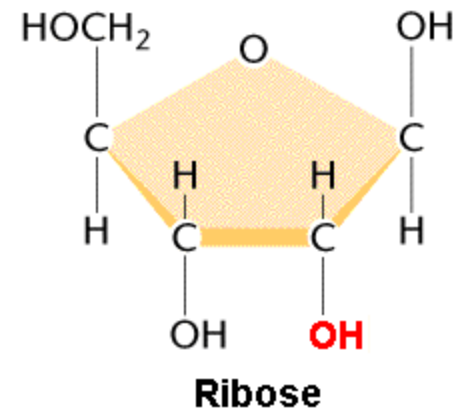
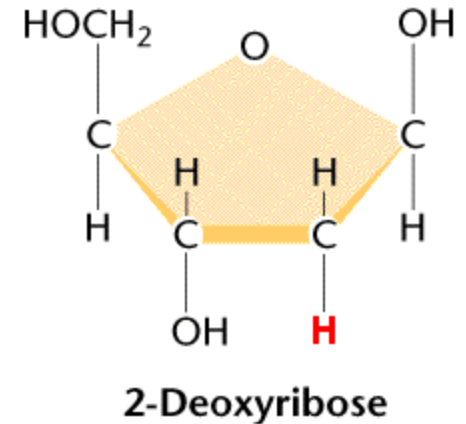


?



RNA

- Needed for protein synthesis
- Ribonnucleic Acid
- Single strand of nucleotides
- Each nucleotide contains
 - Ribose sugar
 - Phosphate
 - 1 of 4 Nitrogen bases



Nitrogen Bases of RNA

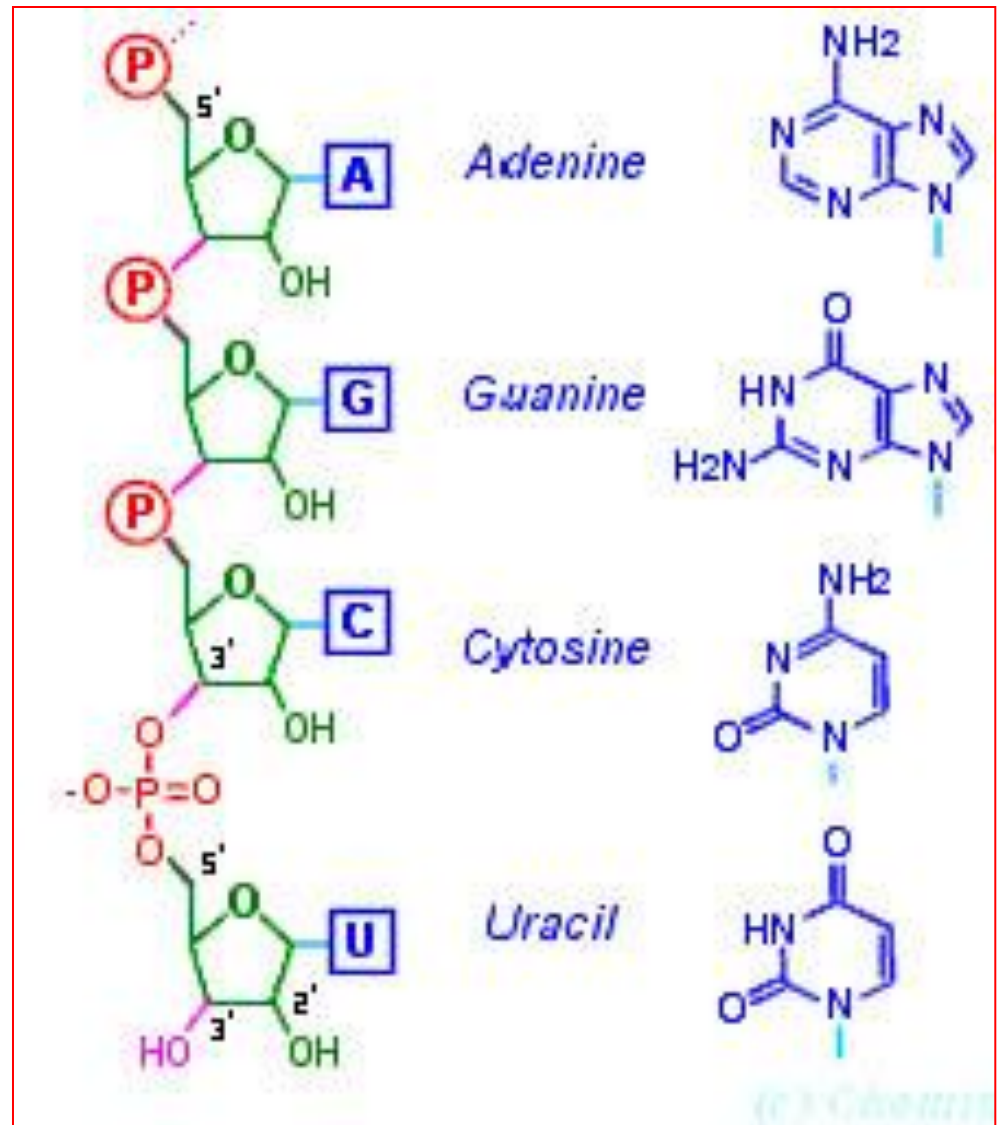
Adenine

Guanine

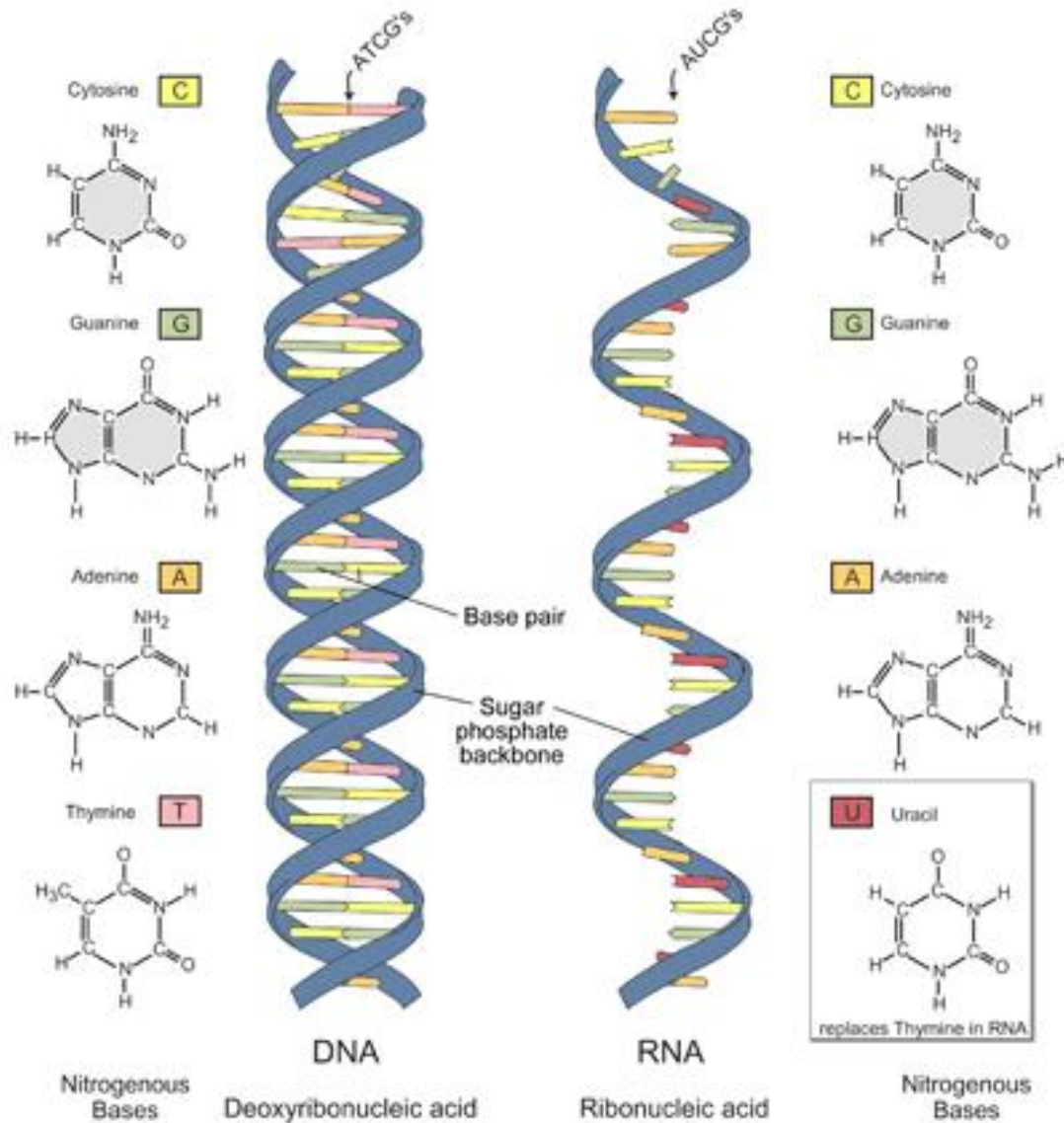
Cytosine

Uracil

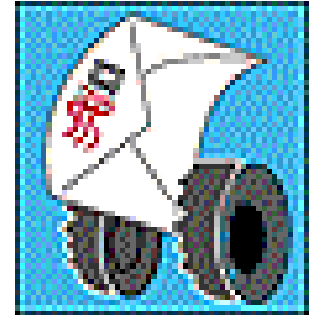
- Replaces
Thymine
- Bonds with
Adenine



DNA vs. RNA

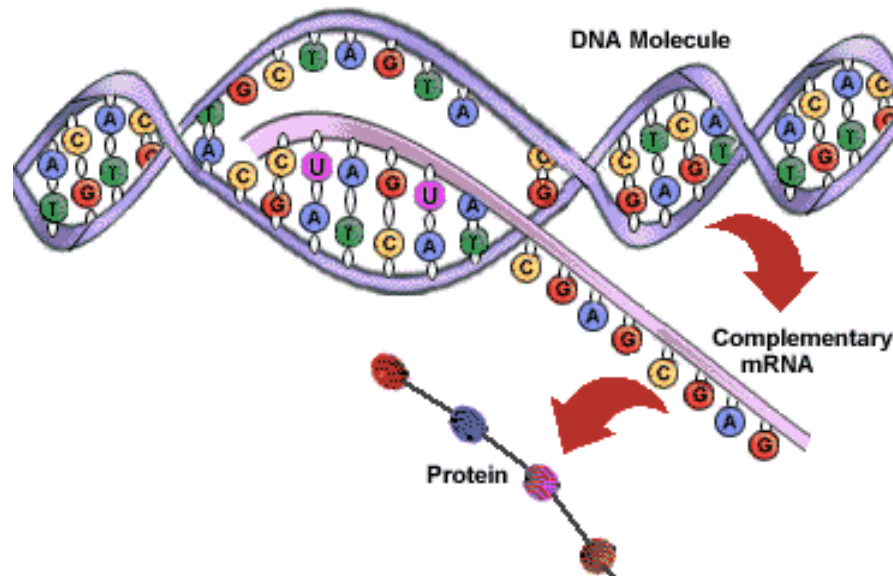


3 Forms of RNA



1. Messenger RNA- mRNA

- Takes **message** from the DNA in the nucleus to the **ribosome**, the site of protein synthesis
- **Complementary** sequence to DNA

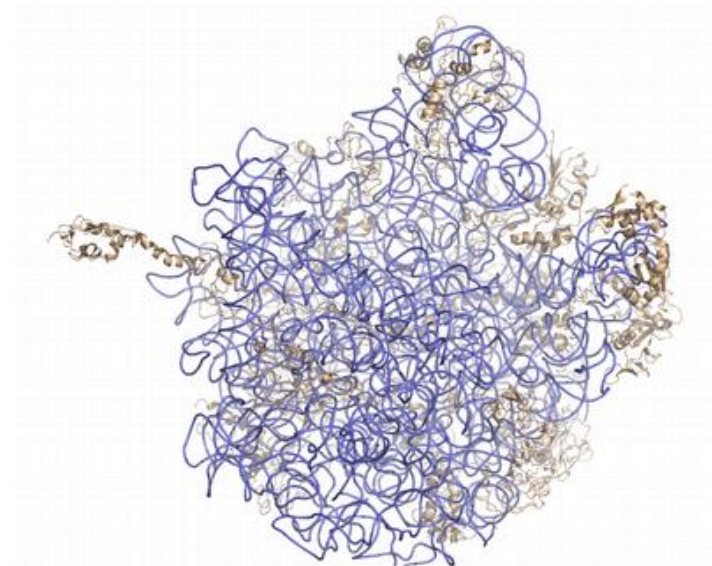
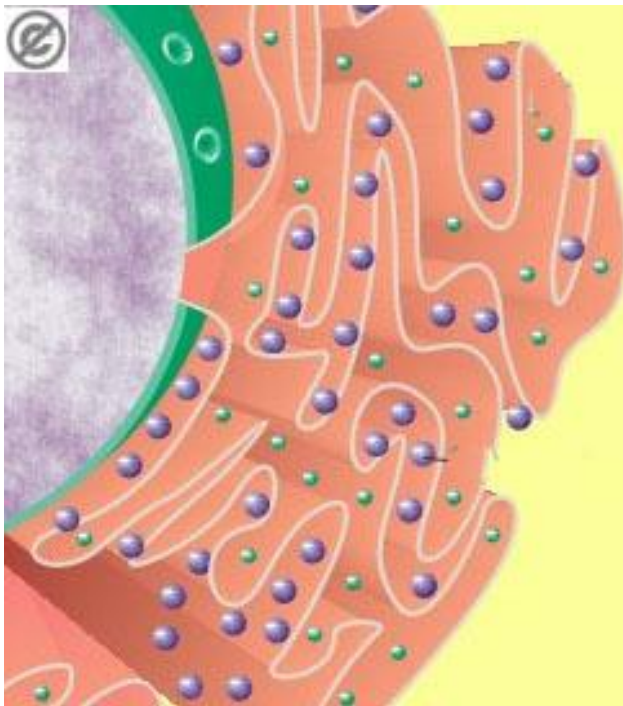


3 Forms of RNA

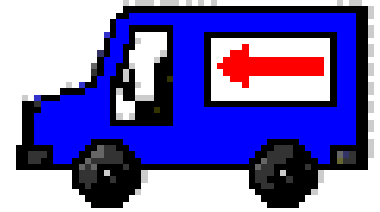


2. Ribosomal RNA- rRNA

- makes up **ribosomes**



3 Forms of RNA



3. Transfer RNA- tRNA

- Delivers specific amino acid to the mRNA and ribosome to be linked with other amino acids to make a protein.

Transfer RNA

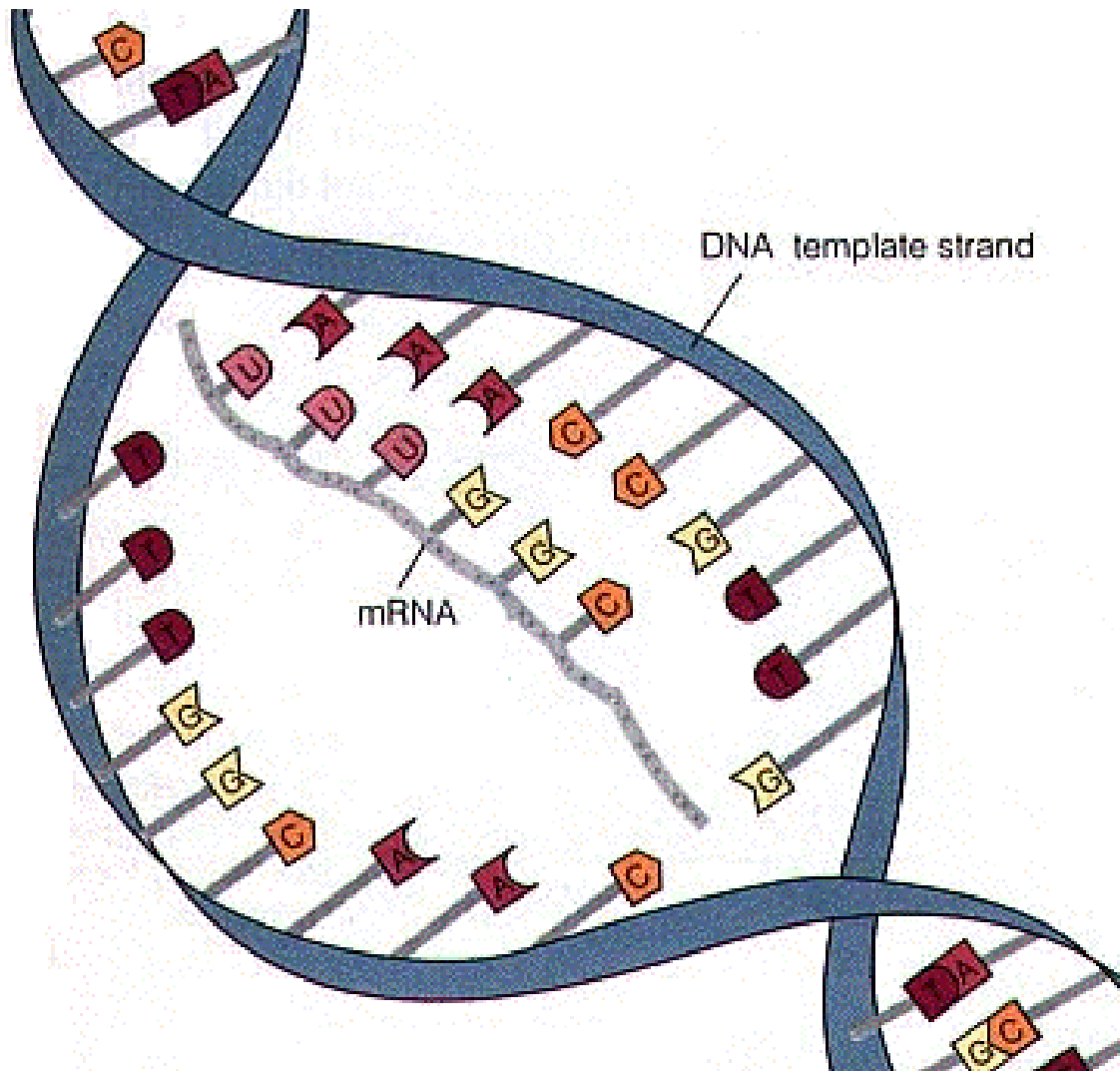


2 Phases of Protein Synthesis

1. Transcription: DNA to mRNA

- DNA unzips
- One DNA strand is “read” to produce mRNA
- mRNA is complementary to the DNA
- mRNA leaves the nucleus goes to ribosome

Transcription



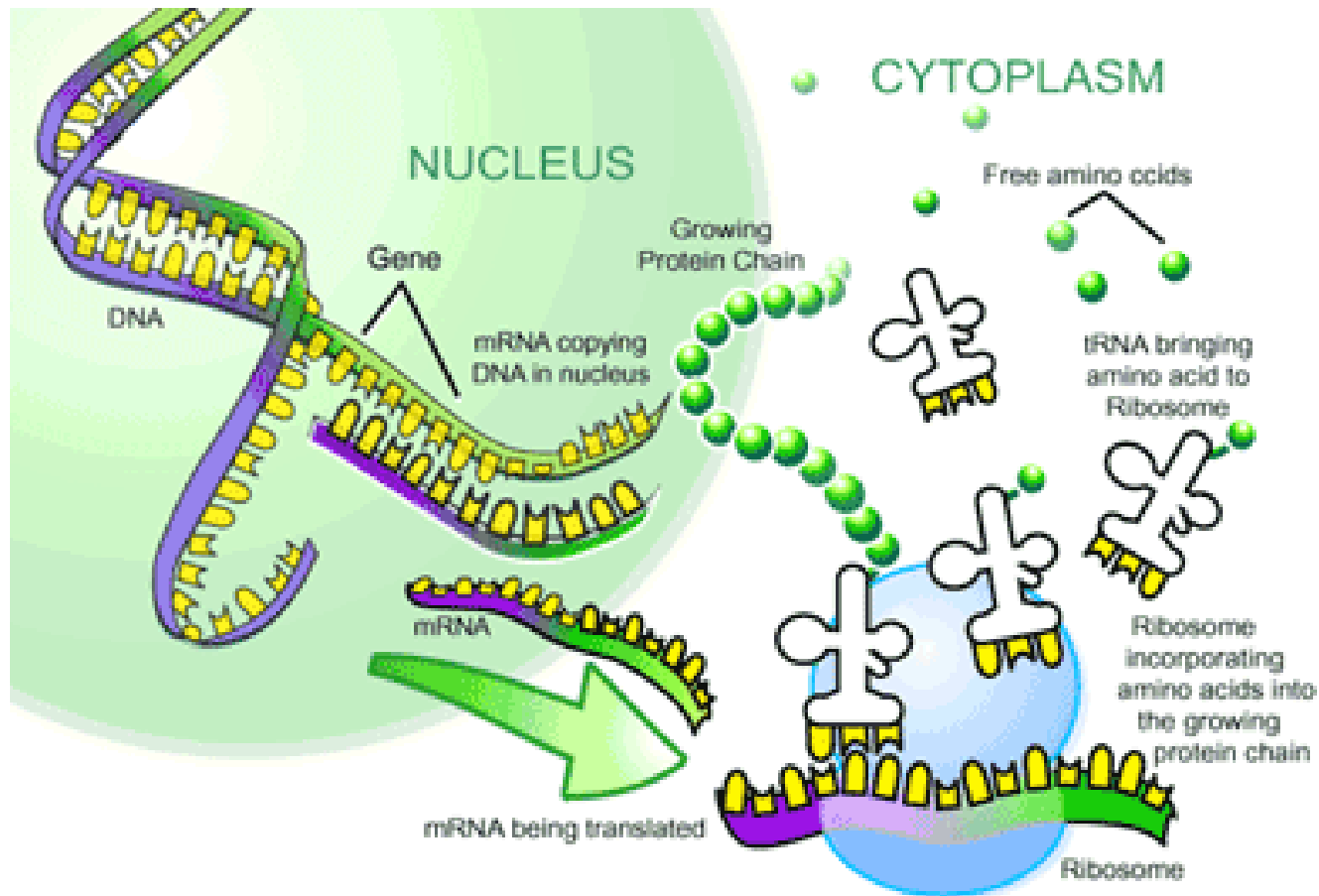
[transcription](#)

2 Phases of Protein Synthesis

2. Translation: mRNA to protein

- mRNA is “read” at the ribosome
 - 3 mRNA bases at a time= Codon
 - Use genetic code chart to determine amino acid sequence
- Continues until stop codon is reached

Translation



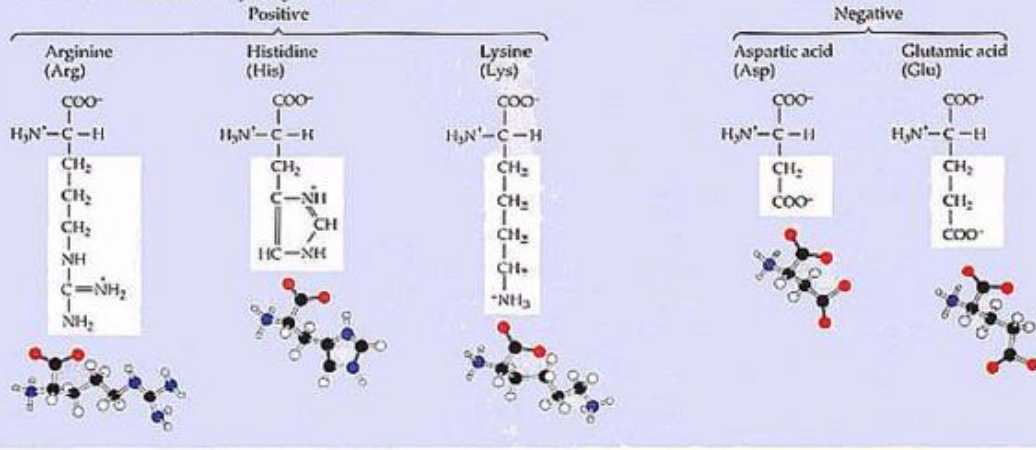
[translation](#)

Genetic Code

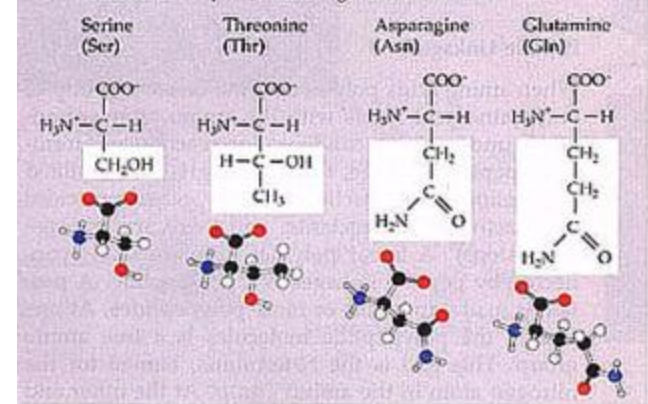
		Second base of codon					
		U	C	A	G		
First base of codon	U	UUU Phenylalanine phe	UCU Serine ser	UAU Tyrosine tyr	UGU Cysteine cys	U	Third base of codon
		UUC	UCC	UAC	UGC	C	
		UUA Leucine leu	UCA	UAA STOP codon	UGA STOP codon	A	
		UUG	UCG	UAG	UGG Tryptophan trp	G	
	C	CUU Leucine leu	CCU Proline pro	CAU Histidine his	CGU Arginine arg	U	
		CUC	CCC	CAC	CGC	C	
		CUA	CCA	CAA Glutamine gin	CGA	A	
		CUG	CCG	CAG	CGG	G	
	A	AUU Isoleucine ile	ACU Threonine thr	AAU Asparagine asn	AGU Serine ser	U	
		AUC	ACC	AAC	AGC	C	
		AUA	ACA	AAA Lysine lys	AGA Arginine arg	A	
		AUG Methionine met (start codon)	ACG	AAG	AGG	G	
	G	GUU Valine val	GCU Alanine ala	GAU Aspartic acid asp	GGU Glycine gly	U	
		GUC	GCC	GAC	GGC	C	
		GUA	GCA	GAA Glutamic acid glu	GGA	A	
		GUG	GCG	GAG	GGG	G	

20 Amino Acids

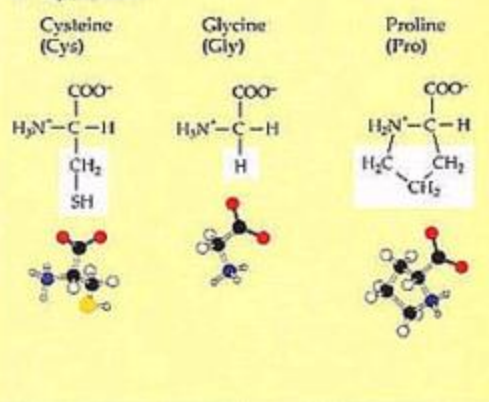
A. Amino acids with electrically charged side chains



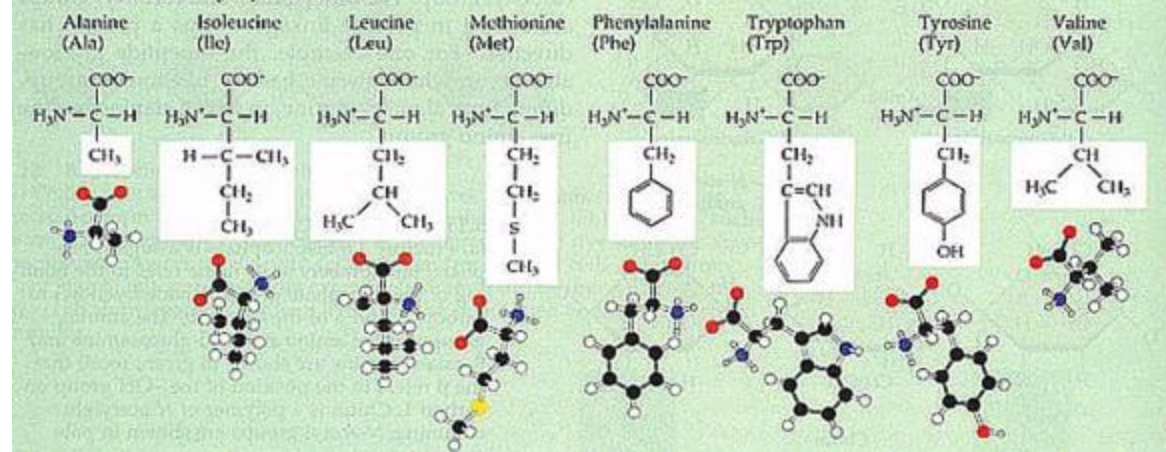
B. Amino acids with polar but uncharged side chains

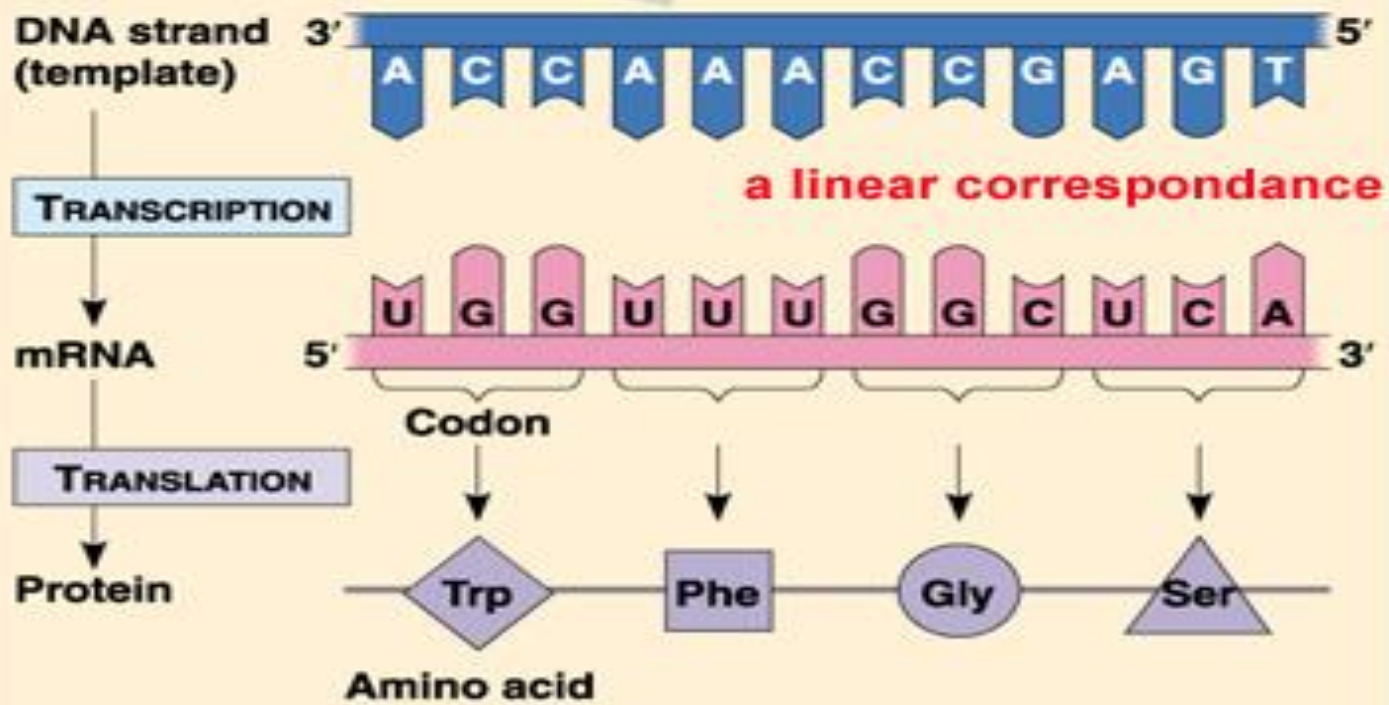
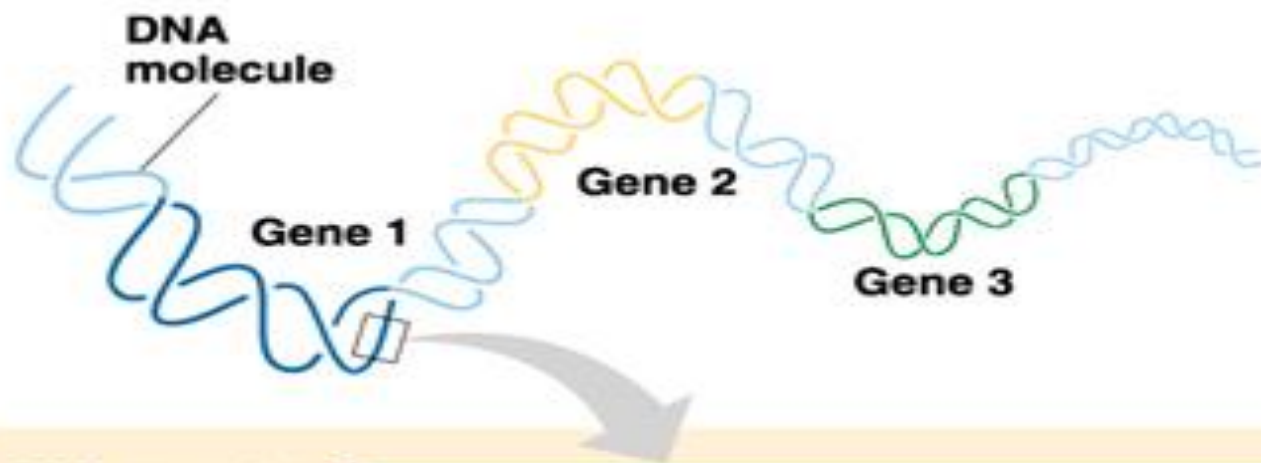


C. Special cases



D. Amino acids with hydrophobic side chains





Practice Protein Synthesis

DNA: A C T G G A T C A G T C

| | | | | | | | | | | |

DNA: T G A C C T A G T C A G

mRNA: A C U G G A U C A G U C

Amino



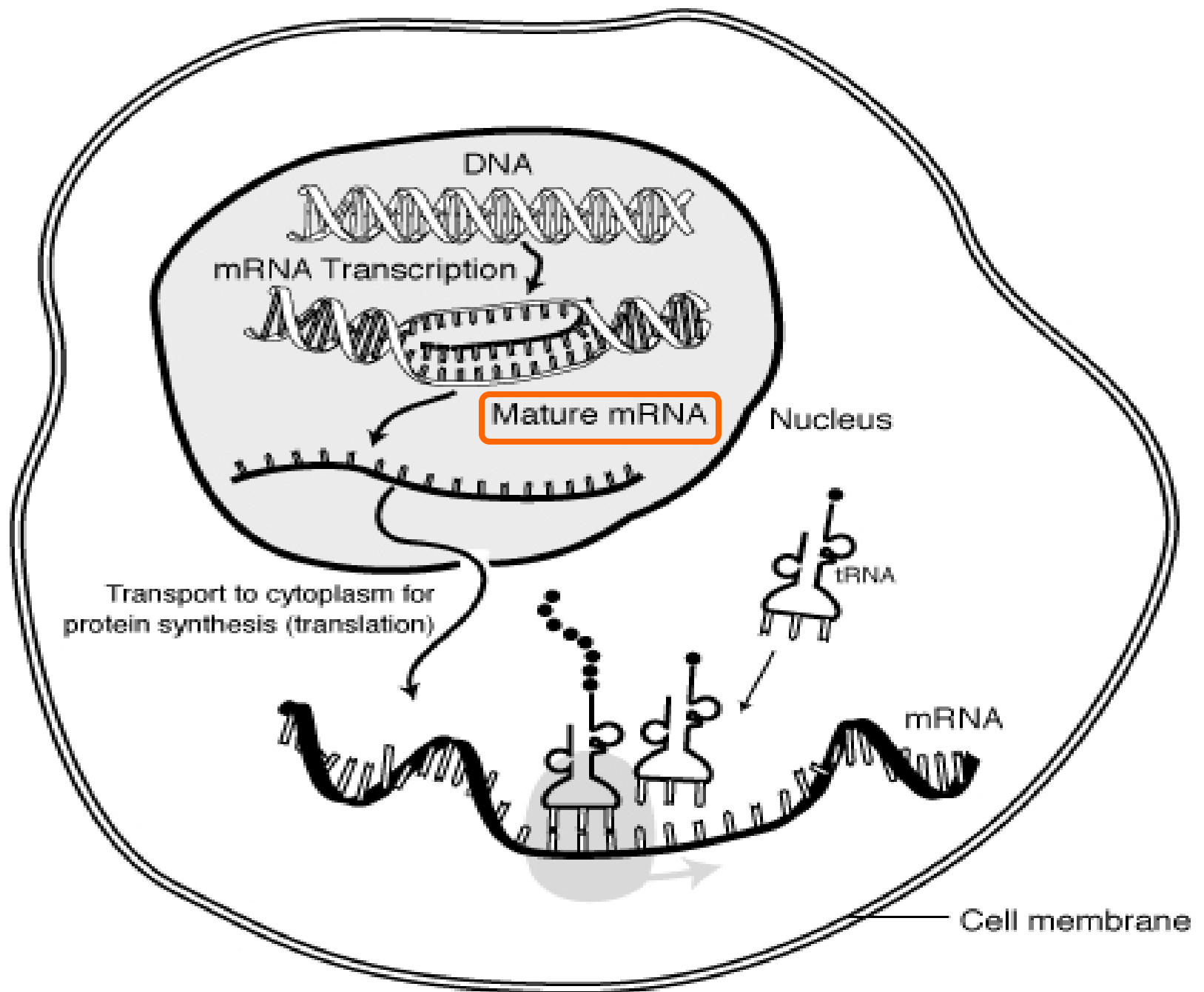
Acid:

Thr

Gly

Ser

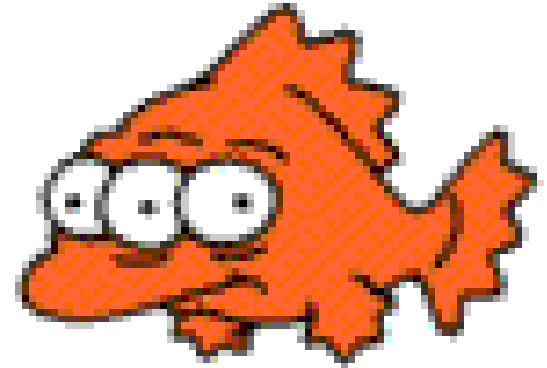
Val



Mutations

Mutation

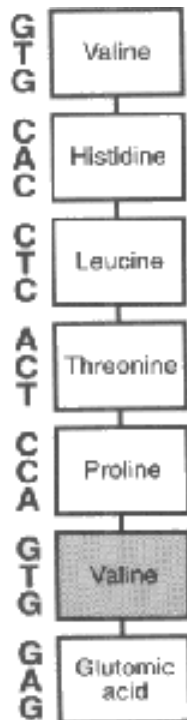
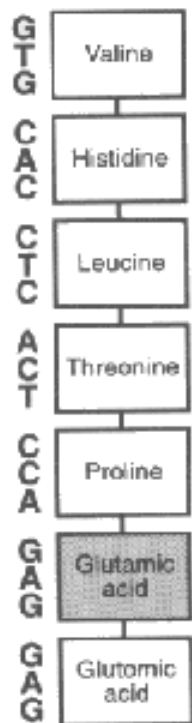
- Any **change** in the DNA sequence
- Changes the **protein** coded for by that gene
- May result in a protein that...
 - Works **normally**
 - Works **less well**
 - Is **beneficial**; evolution
 - Is **fatal**- causing death



Mutations

Sickle Cell Anemia

- Results from the change in 1 base in the gene for hemoglobin



normal red blood cell



sickle cell

Mutations

Mutagen

- Anything that causes a **mutation**
 - **Radiation**- x-rays, UV rays
 - **Chemicals**-cigarettes, asbestos
 - **Heat**- 98.6°



Types of Mutations

Point Mutation

- Change in a single base
- May not change amino acid sequence
- May change 1 amino acid in the sequence
- For example: change A to T
 - GAT TAC AGC → GTT TAC AGC
 - MY DOG SKIP → ME DOG SKIP

Point Mutation

-Review protein synthesis

DNA: A C T G G A T C A G T C

| | | | | | | | | | | |

DNA: T G A C C T A G T C A G

mRNA: A C U G G A U C A G U C

Amino    

Acid: Thr Gly Ser Val

Point Mutation Practice

Determine new sequence after point mutation
A to C

DNA: A C T G G C T C A G T C

| | | | | | | | | | | |

DNA: T G A C C G A G T C A G

mRNA: A C U G G C U C A G U C

Amino    

Acid: Thr Gly Ser Val

Point Mutation Practice

Determine new sequence after point mutation

G to C

DNA: A C T C G A T C A G T C

| | | | | | | | | | |

DNA: T G A G C T A G T C A G

mRNA: A C U C G A U C A G U C

Amino    

Acid: Thr Arg Ser Val

Types of Mutations

Frameshift Mutation

- Insertion or deletion of a base
- Causes a shift in the reading frame
 - Continue to read codons- 3 bases at a time
- All amino acids after the mutation are changed
- Example: remove first A
 - GAT TAC AGC... → G TT ACA GC...
 - MY DOG SKIP → MD OGS KIP

Frameshift Mutation



DNA: A C T G A T C A G T C

| | | | | | | | | |

DNA: T G A C T A G T C A G

mRNA: A C U G A U C A G U C

Amino    

Acid: Thr Asp Glu

Chromosome Mutations

- Involve change in the location of genes on chromosome or chromosome number
 - Ex. Down's Syndrome

