

# From Gene to Protein

## Chapter 17

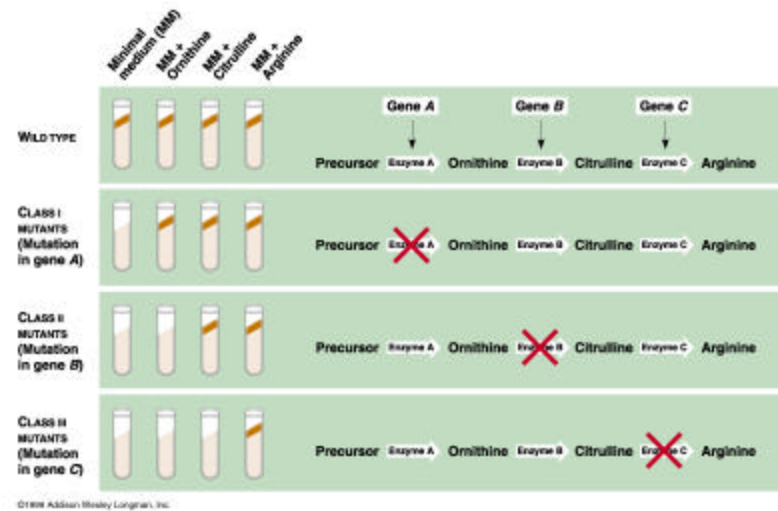
### The Connection Between Genes and Proteins

# Objectives

- Understand the relationship between genes and proteins
- Understand the overall process by which genetic information is converted to polypeptides
- Recognize where and why transcription occurs
- Recognize where and why translation occurs
- Understand relevant vocabulary

# One Gene, One Enzyme

- Work of George Beadle and Edward Tatum
- Bread mold nutrition
- Inability to metabolize a particular AA is the result of an inability to produce necessary enzymes
- Genes dictate the production of a specific enzyme



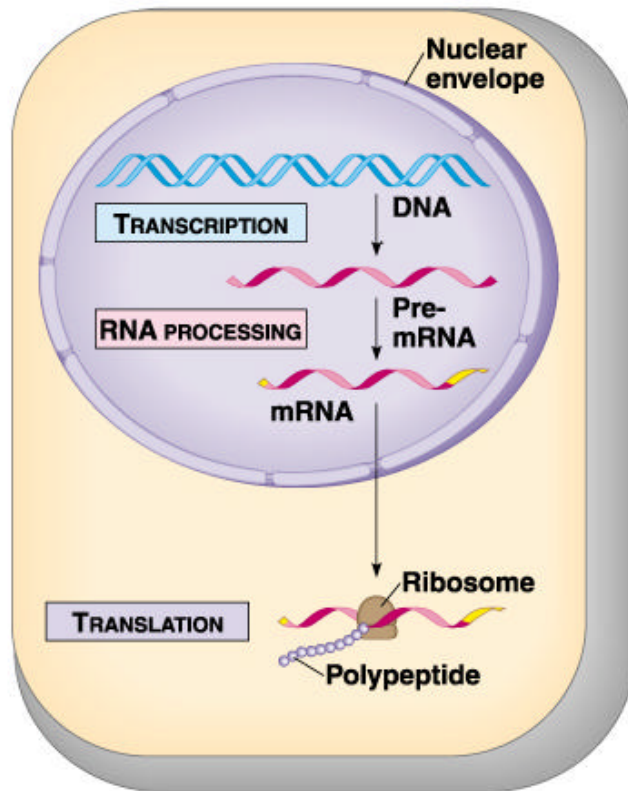
Later modified to reflect the condition that all proteins are not enzymes nor are all made of a single peptide:

**One Gene-One Polypeptide**

# Linking Genetic Information to the Synthesis of Proteins

- If Genes (bits of information on DNA) contain knowledge of how to assemble a polypeptide, then there must be a process by which information on the DNA is conveyed to the protein making machinery of the cell
- **Transcription:** the synthesis of RNA under the direction of DNA
- **Translation:** Synthesis of a polypeptide under the direction of mRNA

# Overview



(b) Eukaryotic cell

- **Transcription**

- players include:

- DNA
- messenger RNA
- RNA Polymerase

- Occurs in the nucleus

- **Translation**

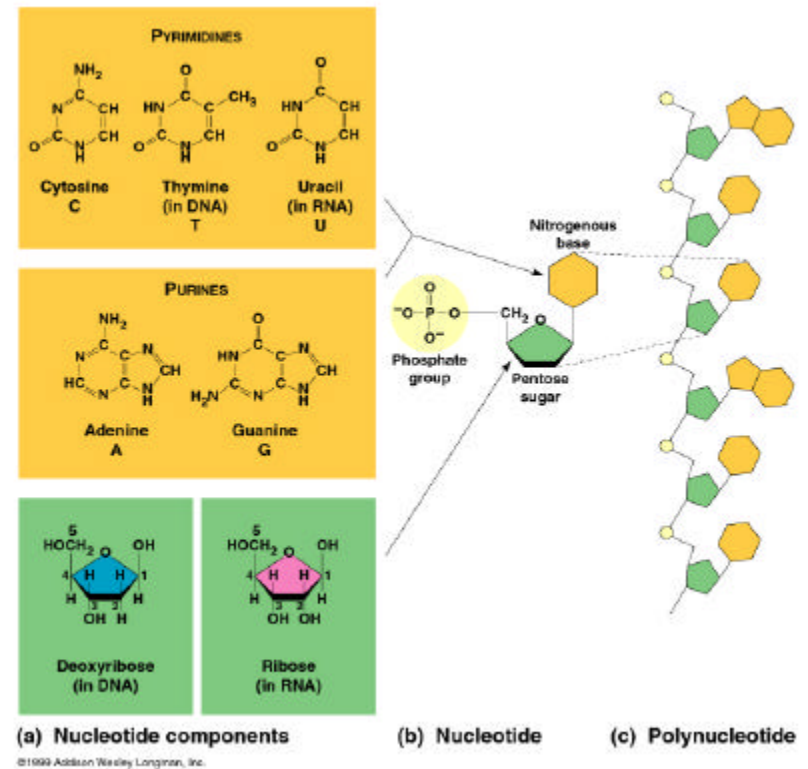
- players include:

- mRNA
- ribosomal RNA
- transfer RNA

- Occurs in the cytosol

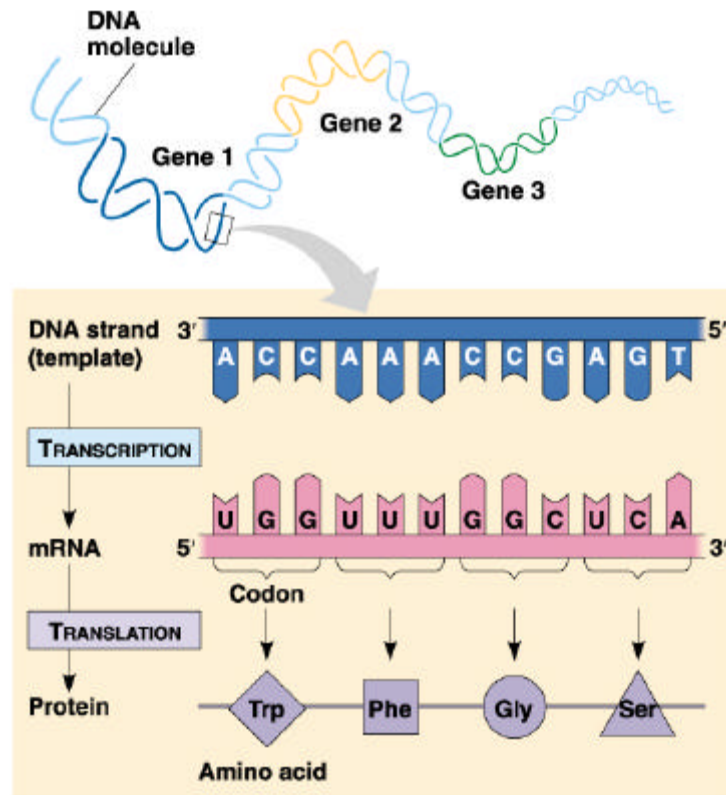
# Review

- Nucleotides each consist of a sugar, Phosphate and Base
- Polymers of nucleotides form either DNA or RNA
- DNA nucleotides have:
  - Deoxyribose as sugar
  - Bases ATGC
  - Double stranded nucleic acid with complimentary bases paired as A-T & G-C
  - Found only in the nucleus
- RNA nucleotides have:
  - Ribose as sugar
  - Bases AUGC
  - Single stranded nucleic acid
  - Found in the nucleus and cytoplasm

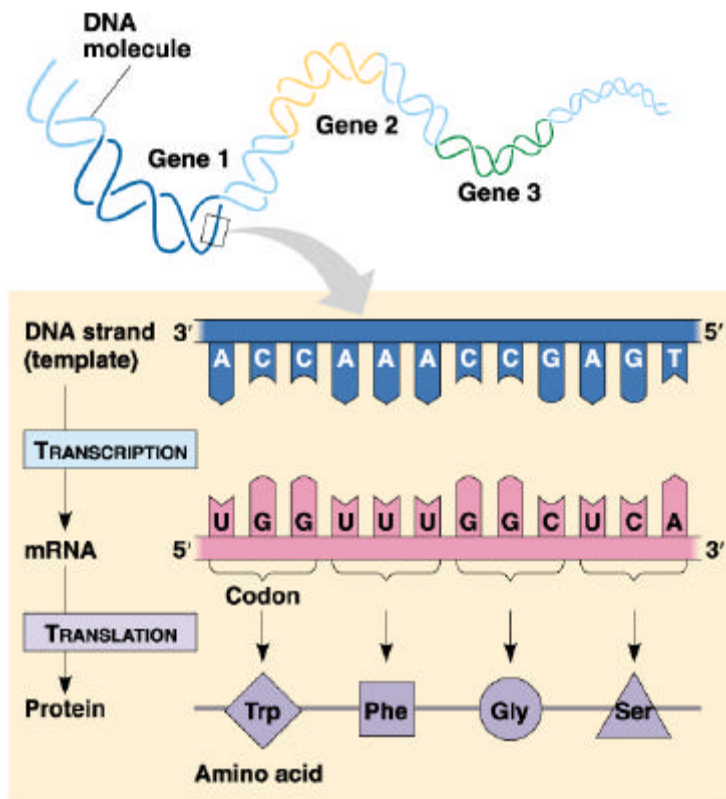


# 3 sequential nucleotides code for 1 AA

- 4 nucleotide bases cannot independently code for 20 different AA
- Pairs of bases would only account for 16 AA
- Triplet bases would give us 64 possible AA that could be coded, exceeding the required amount necessary



# Info Sharing



- Only one strand of the double stranded DNA molecule is involved in transcription (**Template Strand**)
- Complimentary nucleotide triplets of mRNA are called a **Codon** (remember that U is substituted for T as a complimentary pair for A)

# Codons Deciphered

- Marshall Nirenberg (1961) deciphered the meaning of the codon UUU
- All 64 possible codon “words” have been determined
- Redundancy occurs
- **Start and Stop codons** occur
- **Reading frame:** sequence and groupings of the words

		SECOND BASE					
		U	C	A	G		
FIRST BASE (5' end)	U	UUU	UCU	UAU	UGU	U	THIRD BASE (3' end)
		UUC } Phe	UCC } Ser	UAC } Tyr	UGC } Cys	C	
		UUA } Leu	UCA } Ser	UAA } Stop	UGA } Stop	A	
		UUG } Leu	UCG } Ser	UAG } Stop	UGG } Trp	G	
	C	CUU	CCU	CAU	CGU	U	
		CUC } Leu	CCC } Pro	CAC } His	CGC } Arg	C	
		CUA } Leu	CCA } Pro	CAA } Gln	CGA } Arg	A	
		CUG } Leu	CCG } Pro	CAG } Gln	CGG } Arg	G	
	A	AUU	ACU	AAU	AGU	U	
		AUC } Ile	ACC } Thr	AAC } Asn	AGC } Ser	C	
		AUA } Ile	ACA } Thr	AAA } Lys	AGA } Arg	A	
		AUG } Met or start	ACG } Thr	AAG } Lys	AGG } Arg	G	
G	GUU	GCU	GAU	GGU	U		
	GUC } Val	GCC } Ala	GAC } Asp	GGC } Gly	C		
	GUA } Val	GCA } Ala	GAA } Glu	GGA } Gly	A		
	GUG } Val	GCG } Ala	GAG } Glu	GGG } Gly	G		