

## Chapter 12

How are Genes expressed

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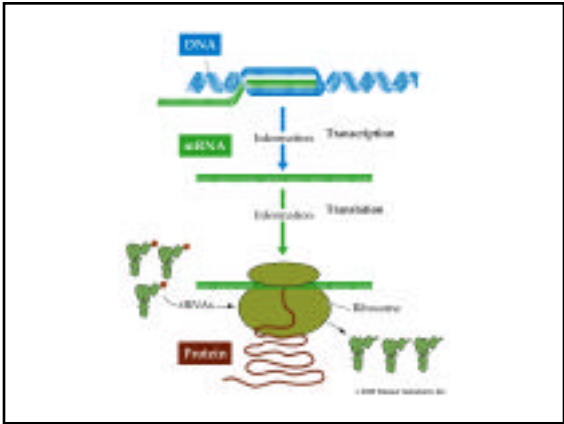
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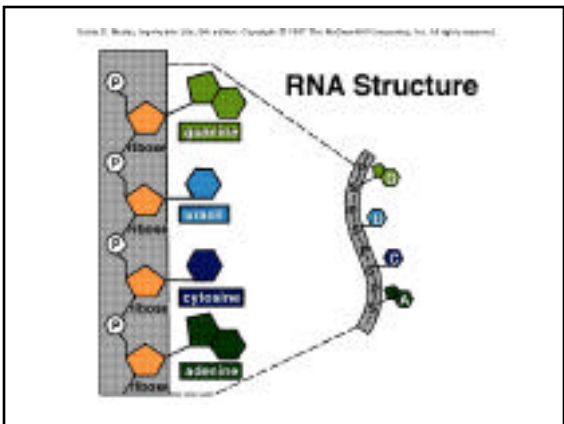
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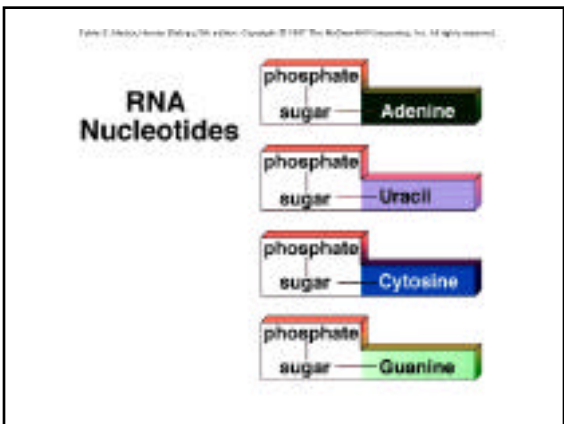
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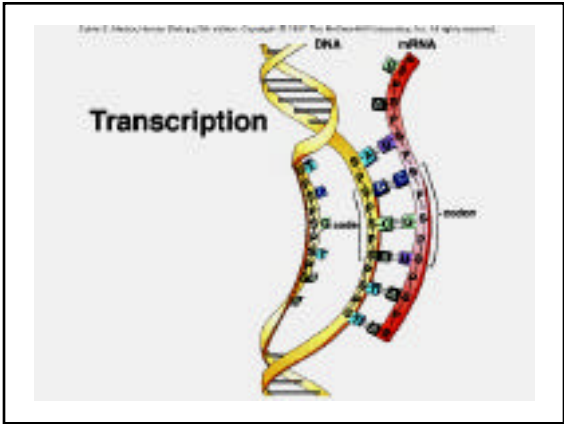
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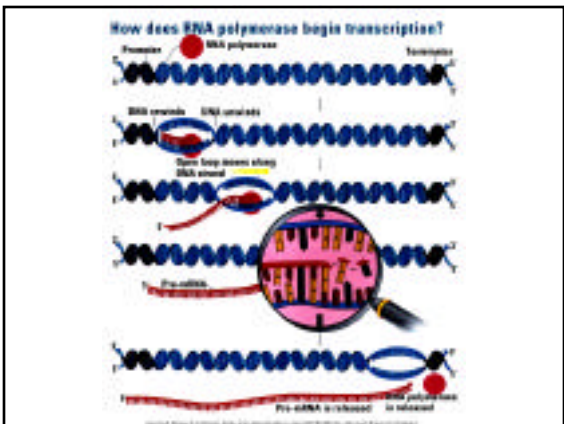
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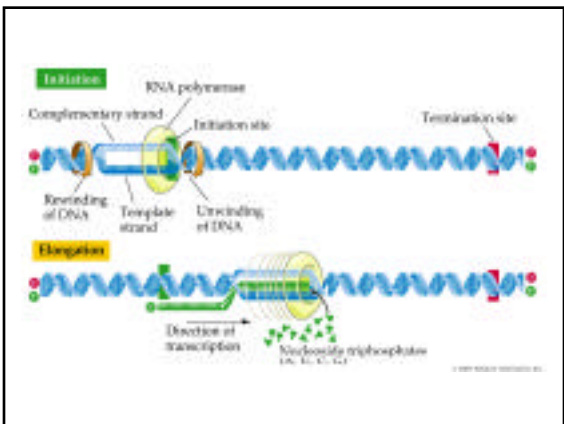
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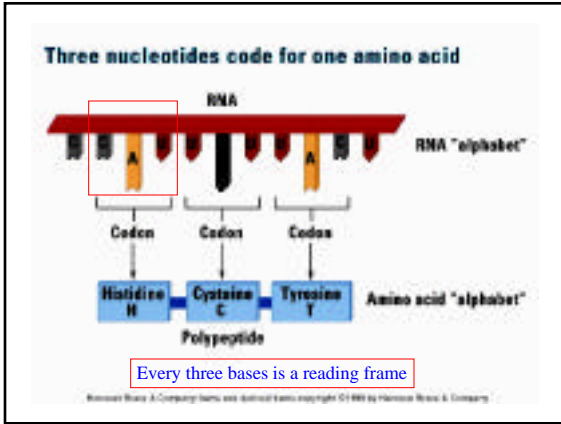
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**Decoding the genetic code**

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

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**12.1 Signals that Start and Stop Transcription and Translation**

	TRANSCRIPTION	TRANSLATION
Initiation	Promoter sequence in mRNA	AUG start codon
Termination	Terminator sequence in DNA	UAA, UAG, or UGA stop codon in mRNA

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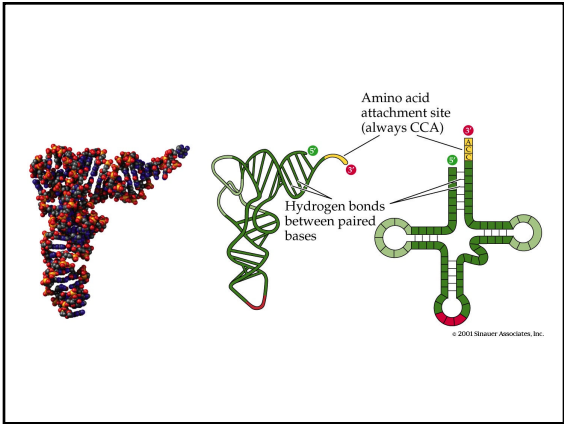
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## Ratio of DNA bases?

- Tetranucleotide hypothesis
  - DNA is a tetramer of ~~of~~ equal quantities of bases - 1:1:1:1 ratio **X**
- Chargaff's rule
  - A 1:1 correspondence exists between the purine and pyrimidine bases

Species	Adenine	Thymine	Guanine	Cytosine
Human being (liver)	30.3%	30.3%	19.5%	19.9%
Mycobacterium tuberculosis	15.1%	14.6%	34.9%	35.4%




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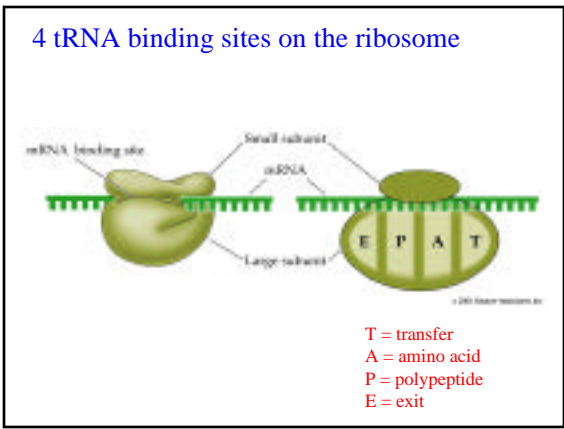
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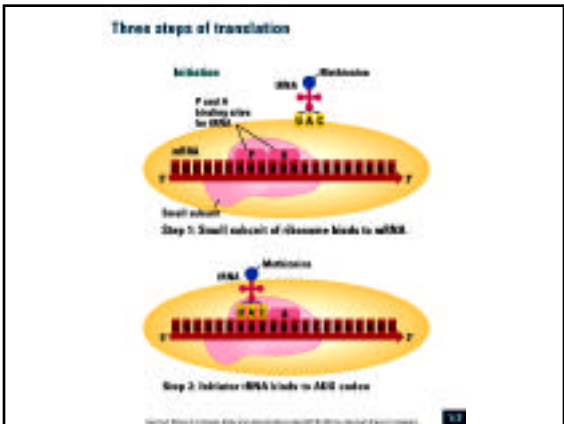
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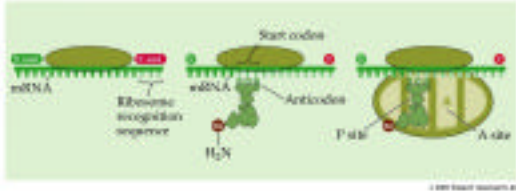
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## Initiation

### Initiation



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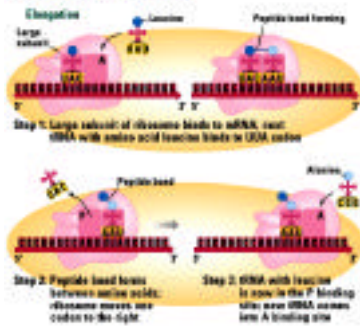
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### Three steps of translation



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## Elongation

### Elongation



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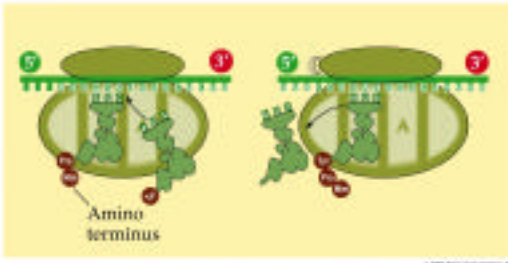
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## Elongation

### Elongation



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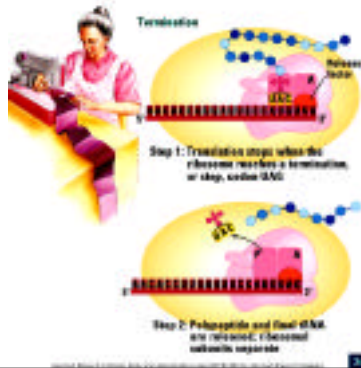
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### Three steps of translation



Release factor binds in the A site, releasing the polypeptide

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## Termination

### Termination



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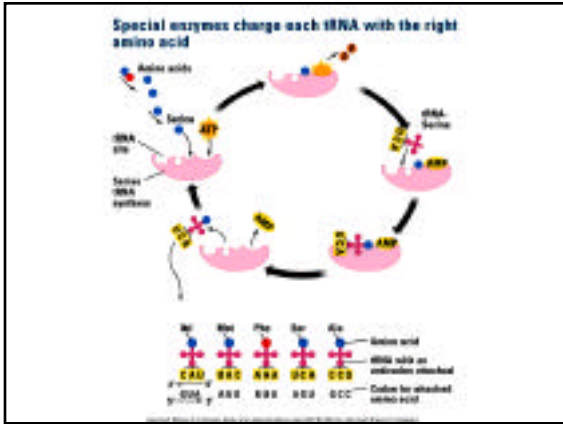
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**12.2 Antibiotics that Inhibit Bacterial Protein Synthesis**

ANTIBIOTIC	STEP INHIBITED
Chlromycetin	Formation of peptide bonds
Erythromycin	Translocation of mRNA along ribosome
Neomycin	Interactions between tRNA and mRNA
Streptomycin	Initiation of translation
Tetracycline	Binding of tRNA to ribosome

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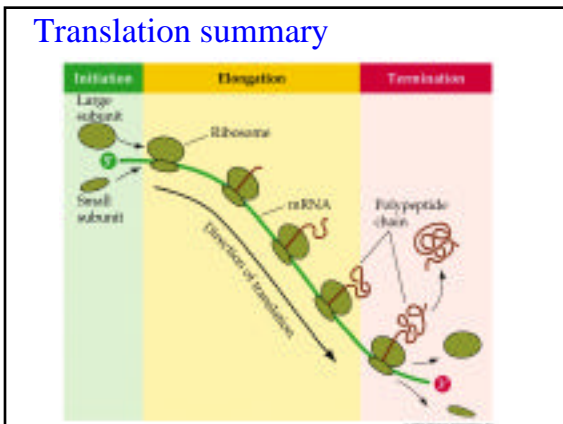
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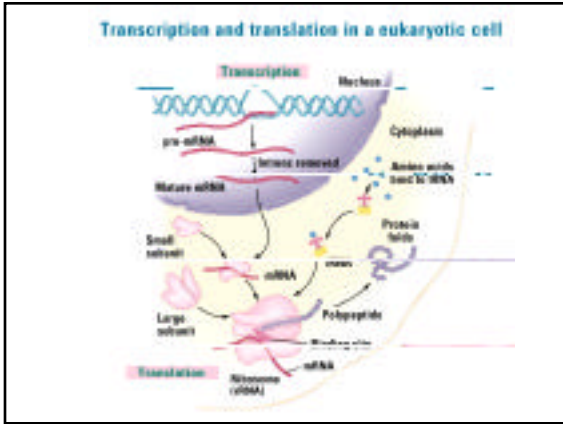
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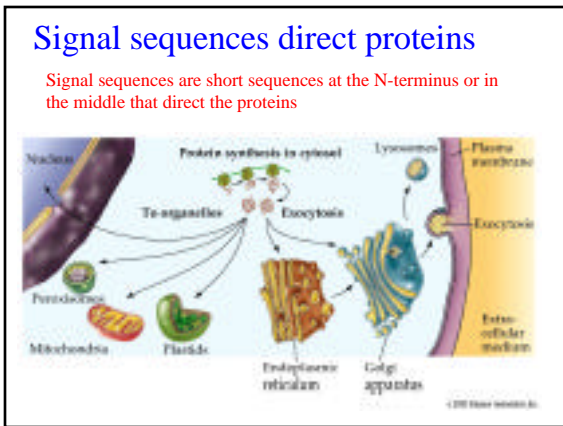
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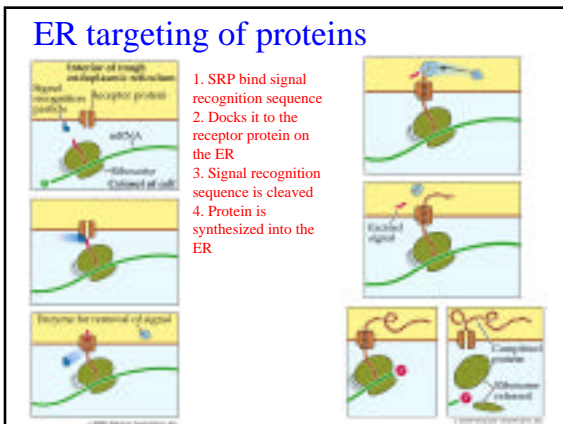
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## Post-translational modifications




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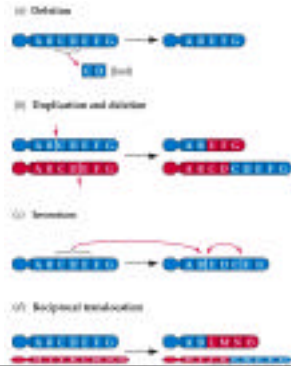
## Mutations

Permanent changes in the DNA sequence

Somatic - non gamete cells  
Germ-line mutations

Point mutations - substitution or deletion/addition of a nucleotide  
 Silent (no change)  
 missense (sickle cell)  
 Nonsense (Stop)  
 Frame shift

Chromosome mutation - loss or change in a DNA segment




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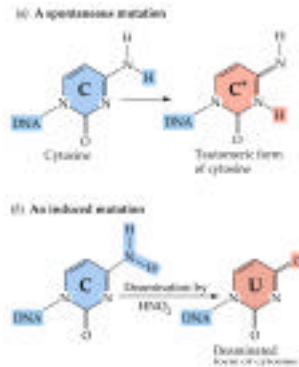
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## Spontaneous and induced mutations

Tautomeric C pairs with A

Base modifications by chemicals or radiation

benzpyrene  
 Nitrates  
 X-rays  
 UV light




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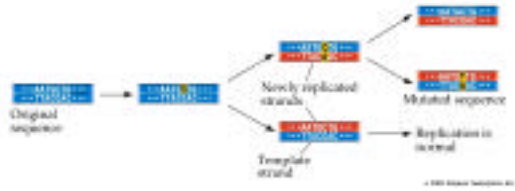
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## Mutation propagation

(c) The consequences of either mutation



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