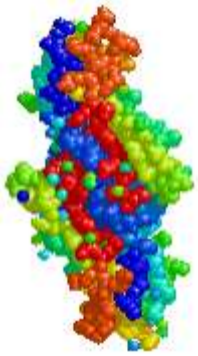
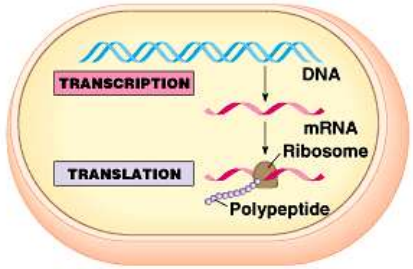


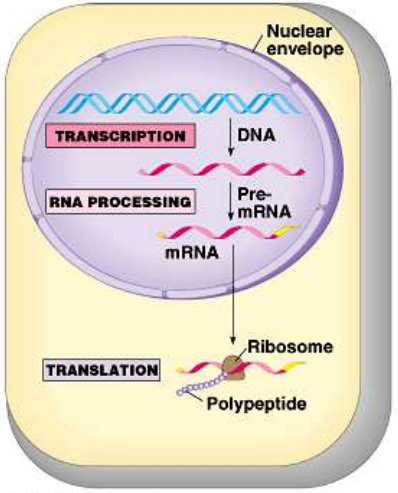
- *Transcription and Translation*
- *From Gene to Protein*

Protein Synthesis: overview

- One gene-one enzyme hypothesis (Beadle and Tatum)
- One gene-one polypeptide (protein) hypothesis
- Transcription: synthesis of RNA under the direction of DNA (mRNA)
- Translation: actual synthesis of a polypeptide under the direction of mRNA



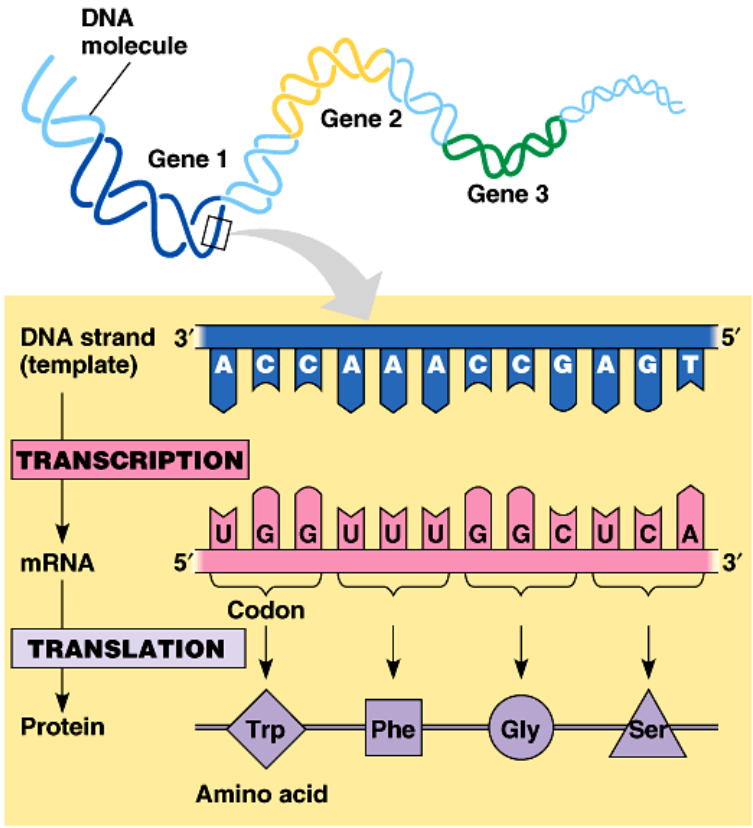
(a) Prokaryotic cell



(b) Eukaryotic cell

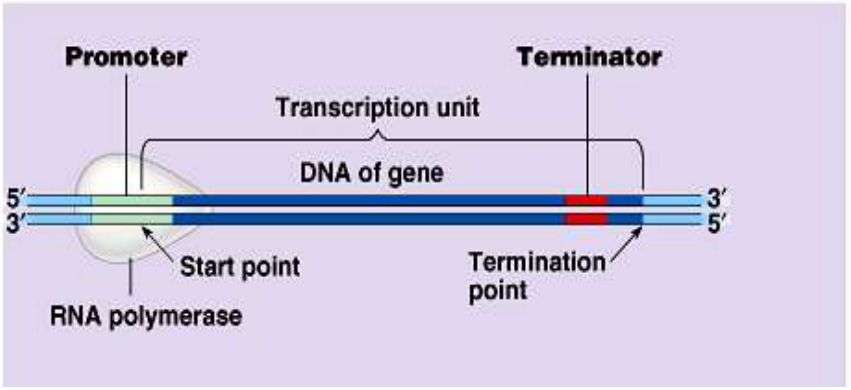
The Triplet Code

- The genetic instructions for a polypeptide chain are ‘written’ in the DNA as a series of 3-nucleotide ‘words’
- Codons
- ‘U’ (uracil) replaces ‘T’ in RNA



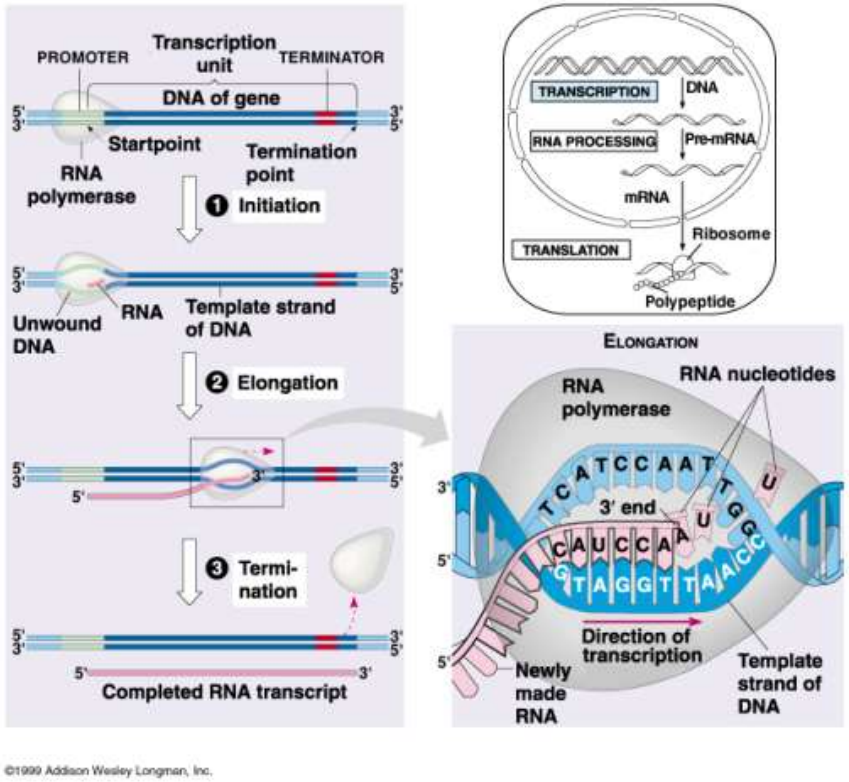
Transcription, I

- RNA polymerase: pries DNA apart and hooks RNA nucleotides together from the DNA code
- Promoter region on DNA: where RNA polymerase attaches and where initiation of RNA begins
- Terminator region: sequence that signals the end of transcription
- Transcription unit: stretch of DNA transcribed into an RNA molecule



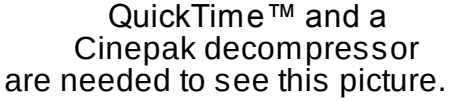
Transcription, II

- Initiation~ transcription factors mediate the binding of RNA polymerase to an initiation sequence (TATA box)
- Elongation~ RNA polymerase continues unwinding DNA and adding nucleotides to the 3' end
- Termination~ RNA polymerase reaches terminator sequence



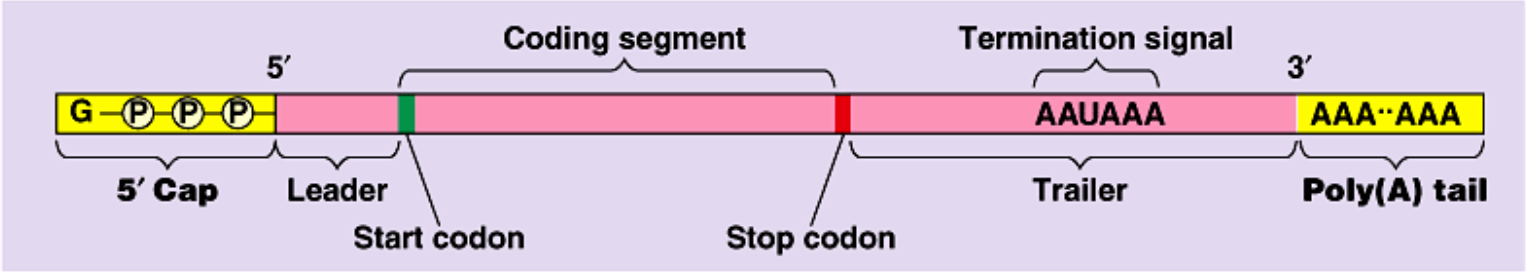
Transcription: overview

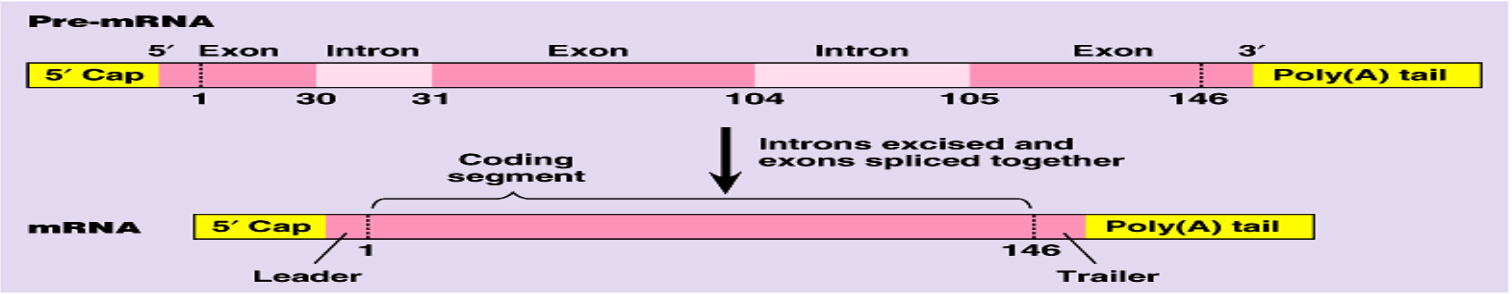
- http://highered.mcgraw-hill.com/sites/9834092339/student_view0/chapter15/transcription.html



mRNA modification

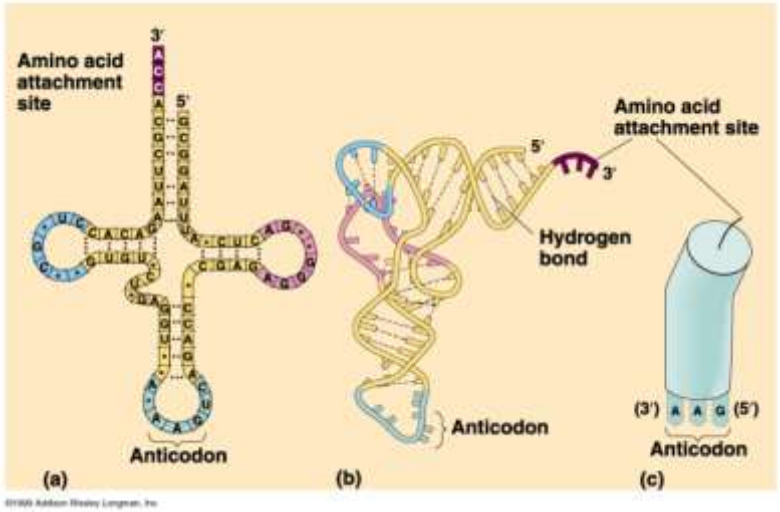
- 1) 5’ cap: modified guanine; protection; recognition site for ribosomes
- 2) 3’ tail: poly(A) tail (adenine); protection; recognition; transport
- 3) RNA splicing: exons (expressed sequences) kept,introns (intervening sequences) spliced out; spliceosome





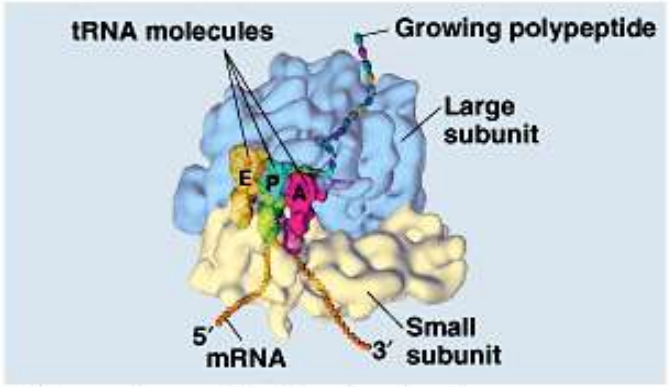
Translation, I

- mRNA from nucleus is ‘read’ along its codons by tRNA’s anticodons at the ribosome
- tRNA anticodon (nucleotide triplet); amino acid

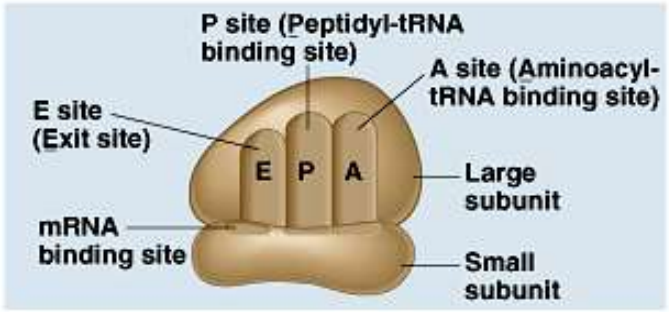


Translation, II

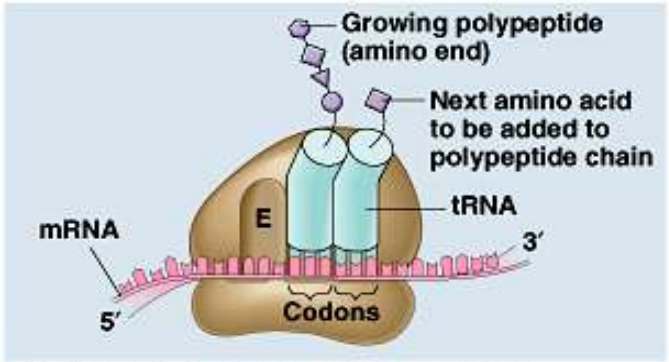
- rRNA site of mRNA codon & tRNA anticodon coupling
- P site holds the tRNA carrying the growing polypeptide chain
- A site holds the tRNA carrying the next amino acid to be added to the chain
- E site discharged tRNA's



(a) Computer model of functioning ribosome



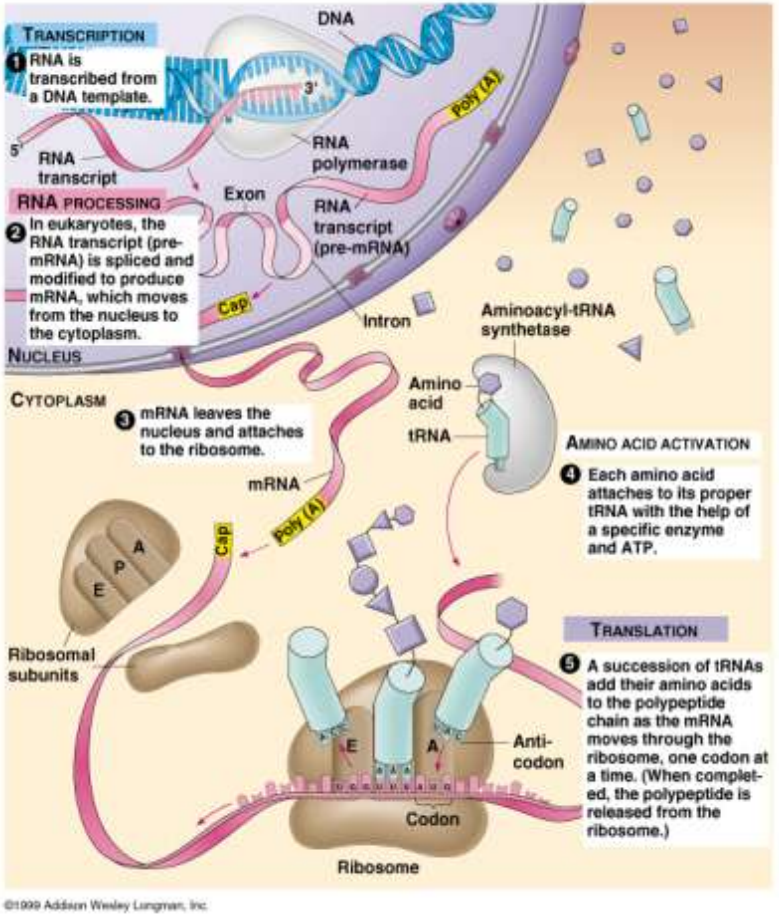
(b) Schematic model showing binding sites



(c) Schematic model with mRNA and tRNA

Translation, III

- Initiation~ union of mRNA, tRNA, small ribosomal subunit; followed by large subunit
- Elongation~ •codon recognition •peptide bond formation •translocation
- Termination~ 'stop' codon reaches 'A' site
- Polyribosomes: translation of mRNA by many ribosomes (many copies of a polypeptide very quickly)

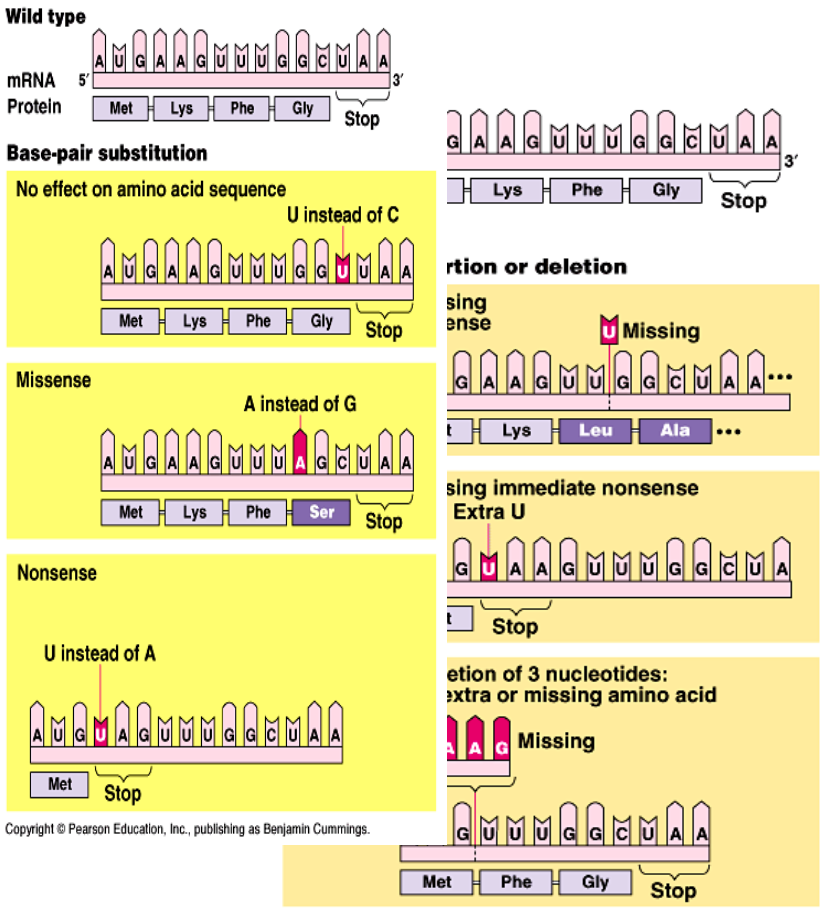


Translation

- http://highered.mcgraw-hill.com/sites/9834092339/student_view0/chapter15/how_translation_works.html

Mutations: genetic material changes in a cell

- Point mutations….
- Changes in 1 or a few base pairs in a single gene
- Base-pair substitutions: •*silent mutations* no effect on protein •*missense* Δ to a different amino acid (different protein) •*nonsense* Δ to a stop codon and a nonfunctional protein
- Base-pair insertions or deletions: _____additions or losses of nucleotide pairs in a gene; alters the 'reading frame' of triplets~*frameshift mutation*
- Mutagens: physical and chemical agents that change DNA



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Mutation by Base Substitution

- http://highered.mcgraw-hill.com/sites/9834092339/student_view0/chapter15/mutation_by_base_substitution.html