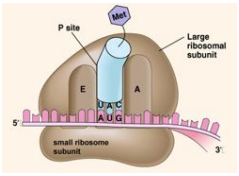
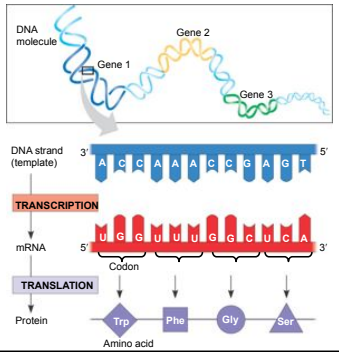
Translation: RNA to Protein

- Finish transcription
- The genetic code
- Translation to protein
  - Initiation
  - Elongation
  - Termination



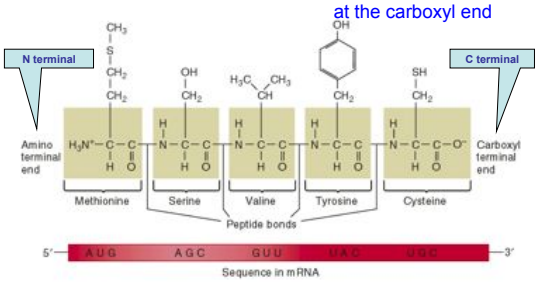
9 Nov 2012

DNA --> RNA --> Protein



Polypeptide has directionality

New amino acids added at the carboxyl end



mRNA is read 5' to 3'

The genetic code

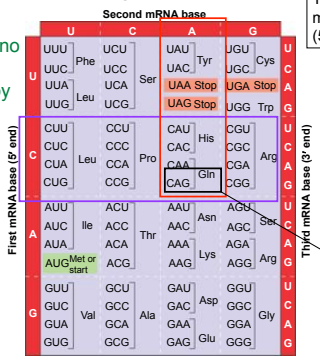
This is in the mRNA sequence (5'-3')

Which amino acid is specified by CAG?

1st base is C

2nd base is A

3rd base is G



Glutamine

The code is a triplet code

- the new boy saw the big cat eat the hot dog
- The first evidence for triplet code came from deletion experiments
  - the new boy saw the big cat eat the hot dog
  - the neb oys awt heb igc ate att heh otd og
- Partial function could be restored by an insertion nearby
  - the new boy saw the big cat eat the hot dog
  - the neb oys aaw the big cat eat the hot dog

The code is a triplet code

- . . . or by two more deletions to get it back into the correct "reading frame"
  - the new boy saw the big cat eat the hot dog
  - the neb oys awt heb igc ate att heh otd og
  - the neb osa wte big cat eat the hot dog

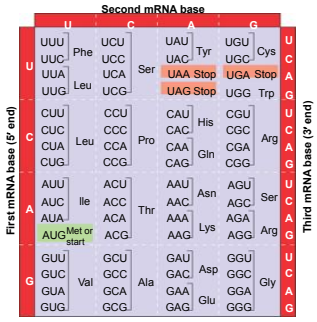
Deciphering the Code

- Your book tells how people used synthetic mRNAs and *in vitro* translation to determine decipher the codons.
- Examples
  - UUUUUUUUUUU -> phenylalanine only
  - UCUCUCUCUCU -> Mixture of leucine and serine

Why is it a mixture?

The code is redundant

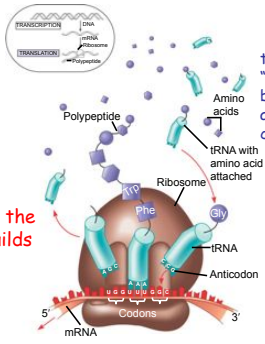
- Several different codons encode the same amino acid



The code is comma free

- No punctuation between words.
  - Therefore deletions cause frameshifts
- It does have start and stop signals, however.
  - Start: AUG
  - Stop: UAG, UAA, UGA

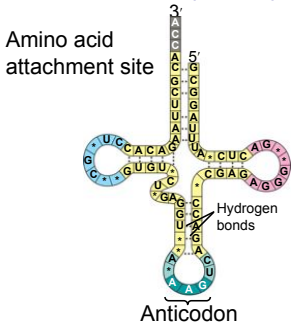
Translation: the basic concept



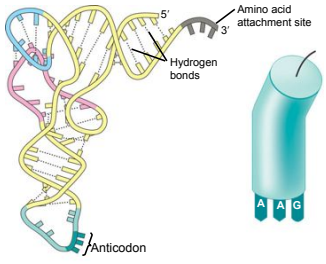
tRNA serves as an "adaptor" that brings the correct amino acid to each codon.

The ribosome is the machine that builds the polypeptide

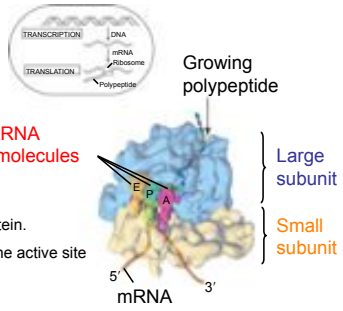
Transfer RNA (tRNA) structure



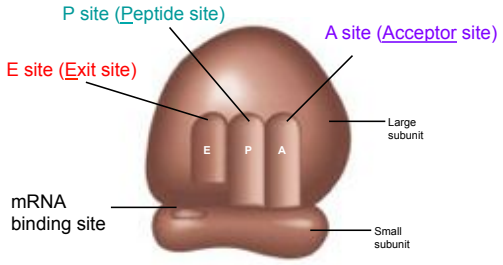
tRNA



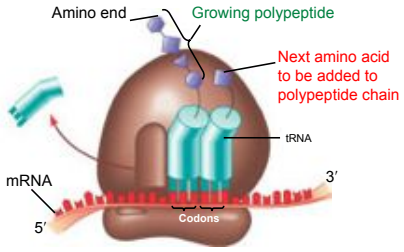
Ribosomes



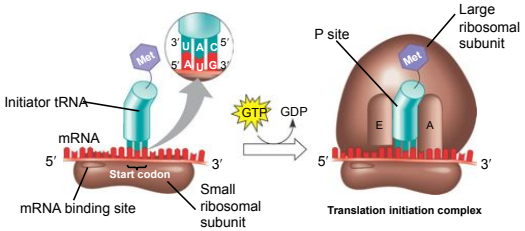
EPA model of a ribosome



New amino acids are added to the carboxyl end of the polypeptide

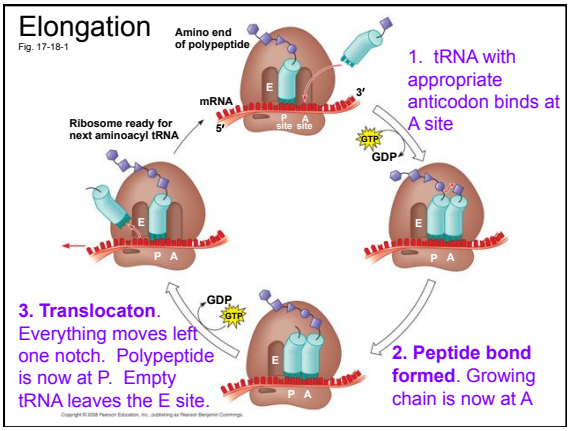


The initiation of translation

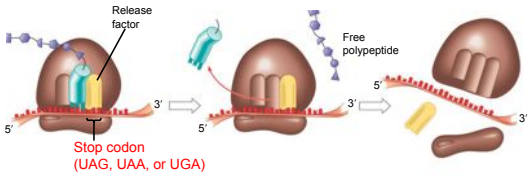


1. Small subunit binds just upstream of start
2. Special initiator methionine binds to the start codon (AUG)
3. The large subunit can now bind to make the active ribosome

Elongation



Termination



1. Stop codon has no matching tRNA
2. Release factor binds and separates the polypeptide from the tRNA
3. The ribosome separates from mRNA