Ch 17.4 Notes

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Vocab

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tRNA: Molecules that act as temporary carriers of amino acids

Anticodon: Sequences of nucleotides that are complementary to codons **EX:(Anti = AUG Codon = UAC)**  
Aminoacyl-tRNA Synthetases: An enzyme that attaches the appropriate amino acid onto its corresponding tRNA  
Wobble: The redundancy in the genetic code such that the same amino acid may be encoded by multiple codons  
Ribosomal RNAs (rRNAs): A type of non-coding RNA which is the primary component of ribosomes essential to all cells  
P Site: The second binding site for tRNA in the ribosome  
A Site: A binding site for charged t-RNA molecules during protein synthesis (1st)  
E Site: The third and final binding site for t-RNA in the ribosome during translation, a part of protein synthesis  
Single Peptide: A short chain of amino acids that targets a protein to the ER  
Signal-Recognition Particle (SRP): A particle that escorts the ribosome to a receptor protein built into the ER membrane  
Polyribosomes or Polysomes: Strings of ribosomes that allow cells to rapidly make copies of a polypeptide

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Notes

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tRNA

Bring amino acid to ribosome

* Attached at 3’ end

Anticodon/Codon

3D structure

Translator

* Has nucleotides and AA

Used repeatedly

Transcribed in nucleus

Aminoacyl-tRNA synthetases

Make sure correct amino acid is attached to tRNA

One for each kind of tRNA

Active sites fits only specific tRNA and AA

Uses ATP to attach covalently

Wobble

* Third nucleotide in codon is flexible in terms of complimentary base pairing
* Multiple codons can code for the same AA

Ribosome

Components

* Large subunit & Small subunit
  + Proteins + rRNA
    - RNA most abundant RNA in cells

Eukaryote

* Subunits made in nucleolus
* Exported via pores

Prokaryote vs Eukaryote

* Similar ribosome
* Different subunits

Assemble L/S subunits only around mRNA

Ribosome Structure

Assemble ribosomal complex

* Small ribosomal subunit binds mRNA
* RNA with Methionine bind to AUG start codon on mRNA
* Large ribosomal subunit binds
  + Has three binding sites

Three binding sites for tRNA

* A(ttach): tRNA+amino acid
  + Not ANY tRNA, only the one whose anticodon matches the mRNA codon at that site
* P(olymerize)
  + tRNA in P site transfers amino acid to amino acid-tRNA in A site
    - Peptide bond catalyzed by rRNA
    - New AA added to carboxyl end of poly-P chain
  + Holds tRNA with growing polypeptide chain
  + E(xit)
    - Empty tRNA leaves

Amino acids are linked to become a protein

Ribosomes read mRNA in sets of 3 nucleotides (codons)

tRNAs bring amino acids from cytoplasm to the ribosome to match up with respective codons

* Amino acid Uber
* One side of tRNA holds amino acid
* One side of tRNA has anticodon= matches up with codon
  + Three nucleotides that are complementary to mRNA codon

Small ribosomal subunit holds mRNA, large ribosomal subunit holds growing protein

Initiation= step 1

AUG initiates start

* Both eukaryotes + prokaryotes
* Establishes reading frame

Small subunit binds mRNA + initiator tRNA (met)

* Eukaryotes= initiator tRNA binds to small subunit BEFORE binding to mRNA
  + Binds to mRNA at 5’ cap then scans down to AUG
  + tRNA then H-bonds to AUG
* Prokaryotes= binding order doesn’t matter
  + Binds to mRNA upstream of AUG at specific sequence

Now large ribosomal subunit can bind

Initiation factors bring all these together

Initiator tRNA in P site, A site= empty

Cost= 1GTP to assemble translation initiation complex

Elongation= step 2

Add tRNAs to A site (Cost 1GTP)

Peptide bond formed as polypeptide chain from P site attaches to new amino acid

* Now, P site tRNA is empty and A site tRNA has the polypeptide chain attached

Translocation AKA musical chairs (Cost 1 GTP)

* tRNAs move over one spot
* Empty tRNA from P site moves to E site and exits
* tRNA with polypeptide chain in A site scoots over to P site
* A site now empty and ready for next tRNA

Termination= step 3

Stop codon set in A site

Release factor binds to stop codon

* Shaped like tRNA
* Does NOT carry amino acid
* Adds water to the end of the polypeptide chain
  + Releases polypeptide

Exit tunnel in P site

Disassembly of ribosomal complex (Cost= 2GTP)

Targeting polypeptides to specific locations

Ribosomes are free or attached to ER

ALL protein synthesis starts on free ribosomes

* If signaled by growing polypeptide, ribosome can go to ER and attach
  + Signal peptide targets protein to ER= ~20aa near leading end (N-terminus)
  + Recognized by SRP (signal recognition proteins)
    - Escort to receptors on ER
  + Once bound to ER, synthesis continues, and growing polypeptide chain is threaded into ER lumen
* Some polypeptides finish translating before signal tells them to go to other organelle

Making multiple polypeptides in bacteria and eukaryotes

Multiple ribosomes can translate mRNA at the same time

* Once past start codon enough, a new ribosomal complex can assemble
* Polyribosomes= string of ribosomes translating the same mRNA

Can also transcribe multiple copies of mRNA to make lots of polypeptide