Translation

Gene Expression

transfer of genetic info from DNA to RNA to protein

Codons

mRNA is read in groups of 3 nucleotides. Codes for amino acid

Transfer RNA (tRNA)

single stranded RNA of 80 nucleotides. Bonds to amino acids and mRNA codon

Ribosomes

catalyzes the peptide bonds between amino acids

1) INITIATION

eukaryotes, ribosome small subunit recognizes and binds to the mRNA at the 5' cap. Initiator tRNA attaches at AUG codon

Ribsomal binding sites

1 site where mRNA binds, 3 sites where tRNA binds (**A site** - aminoacyl-tRNA site..... **P site** - peptide-tRNA site..... **E site** exit site, leaves the ribosome)

2) ELONGATION

initiator tRNA binds to ribosome, incoming tRNA binds to A site. H bonds form between mRNA codon and tRNA anticodon. Requires GTP (E)..... Peptide bond formed between A site and P site by ribosomes = longer peptide chain

3) TERMINATION

At stop codon, a protein release factor binds to A site. (Adds H2O instead of amino acid, polypeptide chain is released)

Polysome

single strand of mRNA can be used to make multiple copies of a polypeptide simultaneously

Translation (cont)

Polysome

single strand of mRNA can be used to make multiple copies of a polypeptide simultaneously

History

Friedrich Miescher

discovered DNA. White blood cells from pus- isolated nuclei (high in P)

Frederick Griffith

studied bacteria that caused pneumonia (used Rough and Smooth Strains)- defined it as transformation in cell's function

Avery, LcLeod, and McCarty

purified S strain bacteria, added it to R strain bacteria. No S cells appeared in the tube w/ no DNA, but they did appear in that w/ no proteins and no RNA

Hershey & Chase

used bacteriophage to infect bacteria. Light up DNA and Protein case, only DNA was passed to bacteria.

DNA Replication

Replication Origin

Specific sites where replication begins, then bidirectional. (can be more than one)

Helicase

enzyme that disrupts H bonds, creating replication fork

Single Stranded Binding Proteins

relieve pressure. bind to unwound single stranded DNA to keep strands apart

Topoisomerases

relieve pressure. break bonds in DNA then reform them.

DNA Replication (cont)

RNA Polymerase

adds primer (RNA nucleotides)

Priming

Required as DNAP (DNA Polymerase) can only add nucleotides, but RNAP can start a new chain.

DNA Polymerase III

adds nucleotides to the 3' end of pre-existing nucleotides. (hydrolyzes last two phosphate groups)

Leading Strand

synthesized continuously, moving along replication fork

Lagging Strand

synthesized in short, discontinuous segments of 1000-2000 nucleotides (**Okazaki fragments**)

DNAP I

replaces RNA primer with DNA

DNA Ligase

joins broken pieces of DNA by catalyzing formation of phosphodiester bonds

DNAP III

can correct errors as it moves down the strand

DNAP II

checks for errors and corrects them

Transcription

Archibald Garrod

studied patients w/Alkaptonuria (pee turns black with O2), faulty genes meant they couldn't break down alkapton (no enzyme)

George Beadle & Edward Tatum

bread mould, using x-rays to create mutations- and then the moulds couldn't grow

Transcription (cont)

Central Dogma

TRANSCRIPTION (DNA- mRNA) nucleus **TRANSLATION** (mRNA- protein) ribsomes The Flow Of Info

1) INITIATION

RNAP binds to promoter. Composed of TATA box (less energy to break H bonds) RNAP recognizes the promoter and begins unwinding DNA

2) ELONGATION

RNA polymerase unwinds, exposing 10-20 base pairs. Uses template strand to add complementary RNA nucleotides, from 5' to 3'

3) TERMINATION

Prokaryotes: protein, mRNA binds to itself (hairpin) **Eukaryotes:** many A's = many U's added = weak=proteins bind

Multiple Transcription Machinery

multiple RNAP can transcribe simultaneously on the same gene

Post-Transcriptional Modifications

in prokaryotes mRNA can be used directly, in eukaryotes it needs to be modified (pre-mRNA to mature mRNA) in order to leave the nucleus

mRNA Modifications- capping

poly(A) tail - 50-250 adenine added to 3' end, preventing degredation --------- **5' cap** 7 G's added to prevent degradation, signals for ribosomes to attach

mRNA Modifications- splicing

removal of introns (non-coding regions) & mature mRNA will only contain exons. Occurs in spliceosome (snRNPs bind to splice sites, excises introns, rejoins exons)