

Chapter 17 From Gene to Protein

One Gene - One Polypeptide (Fig 17.1)

The function of a gene is to dictate the production of a specific polypeptide

Overview: the roles of transcription and translation in the flow of genetic information (Fig 17.2)

Transcription - the synthesis of RNA under the direction of DNA

Messenger RNA (mRNA) - RNA that carries a genetic message from the DNA to the protein-synthesizing machinery

Transcription unit - the stretch of DNA that is transcribed into an RNA molecule

RNA polymerase - enzyme that synthesizes RNA using DNA as a template

Stages of Transcription

Initiation (Fig 17.7)

Promoter - a region of DNA where RNA polymerase attaches and initiates transcription

Transcription factors - proteins that mediate the binding of RNA polymerase

Transcription initiation complex - the completed assembly of transcription factors and RNA polymerase bound to the promoter

Elongation (Fig 17.6)

Termination

RNA Processing

End alteration (Fig 17.8)

5' cap and poly(A) tail - Protects against degradation and helps the ribosome attach to the mRNA, may also help mRNA export from the nucleus

RNA splicing - the removal of large portions of the RNA molecule that is initially synthesized (Fig 17.9 & 17.10)

Primary transcript - the initial RNA transcript

Introns – non-coding segments between coding regions

Exons - regions that are translated into amino acid sequences

Translation - the synthesis of a polypeptide, which occurs under the direction of mRNA

Triplet code - instruction for a polypeptide chain written in three-nucleotide word (Fig 17.3 & 17.4)

Codons - the mRNA base triplets

Reading frame - the correct sequence and grouping of nucleotides

Transfer RNA (tRNA) (Fig 17.13)

Wobble - relaxation of base pairing rules in the third position of a codon

Aminoacyl-tRNA synthase - set of enzymes responsible for attaching the amino acids to the tRNA (Fig 17.14)

Ribosomes (Fig 17.15)

Ribosomal RNA (rRNA) - RNA found in the ribosome

P site (peptidyl-tRNA) - holds the tRNA carrying the growing polypeptide chain

A site (aminoacyl-tRNA) - holds the tRNA carrying the next amino acid to be added to the chain

E site (exit) - discharged tRNAs leave the ribosome

Stages of Translation (Animation)

Initiation (Fig 17.17)

Elongation (Fig 17.18)

Termination (Fig 17.19)

Polyribosomes - a string of ribosomes that are all attached to the same mRNA (Fig 17.20)

Signal Peptides (Fig 17.21)

Mutations - changes in the genetic material of a cell

Point mutations - chemical changes in just one or a few base pairs in a gene (Fig 17.24)

Substitutions, Insertions and deletions