

7 Nucleic acids

7.1 DNA structure and replication

Rosalind Franklin's investigation of DNA structure

- most of X-rays pass through an object, but some are scattered by the material's particles: diffraction; as DNA is arranged orderly enough, a diffraction pattern can be seen
- X-ray detector is placed close to the sample to collect the scattered rays
- Franklin develops a high resolution camera containing X-ray film to obtain very clear images
- from the image there are deductions: helical shape, angle of cross shape shows steepness of helix, distance between horizontal bars is 3.4nm, vertical distance between adjacent base pairs in the helix is 0.34nm

DNA profiling

- variable number tandem repeat (VNTR): short nucleotide sequence that shows variations between individuals in terms of number of repeats
- analysis of VNTR allele combinations can be used in DNA profiling
- paternal lineage is deduced by short tandem repeats on Y-chromosome and maternal lineage by analyzing mitochondrial DNA in single nucleotides at hyper-variable regions

DNA sequencing

- most commonly fluorescence is used to determine bases of genome
- many copies of DNA, deoxyribonucleotides, enzymes and small quantities of fluorescent deoxyribonucleotides are mixed
- fluorescent markers stop replication at the point they are added, fragments are separated by length and computer evaluates sequence based on color and length

7.2 Transcription and gene expression

The function of the promoter

- only some DNA code for production of polypeptides (coding sequences)
- some non-coding sequences have functions production for tRNA and rRNA
- others play role in regulation of gene expression such as enhancers and silencers
- promoter: sequence located near a gene; binding site of RNA polymerase; is not transcribed but plays a role in transcription

7.3 Translation

tRNA-activating enzymes

- each tRNA is recognized by a tRNA-activating enzyme that attaches a specific amino acid to the RNA using ATP
- activation of tRNA molecule involves attachment of an amino acid to the 3' terminal of the tRNA by tRNA-activating enzyme; twenty different tRNA-activating enzymes that are specific to one of 20 amino acids and the correct tRNA molecule
- active site of the activating enzyme is specific to the correct amino acid and correct tRNA
- when ATP and amino acid are attached to active site of enzyme, amino acid is activated by formation of bond between enzyme and adenosine monophosphate (AMP); activated amino acid is attached to tRNA; energy is later used to link amino acid to growing polypeptide chain