

# Transcription and Translation (3.5)

## Outline the process of transcription (3.5.2)

- Transcription is the process of making an RNA copy of a DNA sequence (gene)
- RNA polymerase binds to a promoter sequence and separates the DNA strands
- Complementary ribonucleotides align opposite complementary base pairs
- RNA polymerase joins the ribonucleotides together with covalent bonds
- The transcription process stops when a termination sequence is reached

## Compare DNA and RNA (3.5.1)

Remember: **SBS**

**S**ugar (*deoxyribose versus ribose*)

**B**ase (*thymine versus uracil*)

**S**trand (*double versus single stranded*)

## Types of RNA

**Messenger RNA (mRNA):** Copy of gene for translation

**Transfer RNA (tRNA):** Brings amino acid to ribosome

**Ribosomal RNA (rRNA):** Catalytic part of the ribosome

## Describe the genetic code (3.5.3)

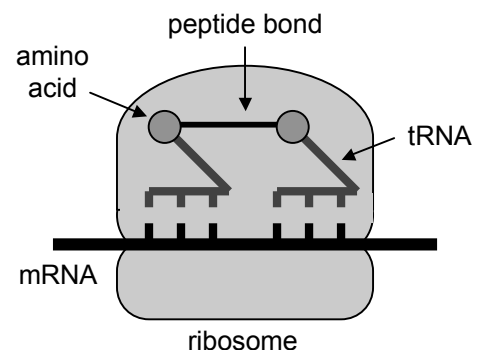
- A set of rules by which information encoded in a gene is converted into a polypeptide sequence
- **Codon:** A triplet of bases which code for amino acids
- The order of the codons determines the amino acid sequence of the protein (1° structure)
- The genetic code has two key qualities:
  - **Universality:** (Almost) every living thing uses the same code
  - **Degeneracy:** Multiple codons may code for one amino acid

|  |                                      |   |   |
|--|--------------------------------------|---|---|
| UUU } Phe<br>UUC }<br>UUA } Leu<br>UUG } | UCU } Ser<br>UCC }<br>UCA }<br>UCG } | UAU } Tyr<br>UAC }<br>UAA } Stop<br>UAG } | UGU } Cys<br>UGC }<br>UGA } Stop<br>UGG } Trp |
| CUU } Leu<br>CUC }<br>CUA }<br>CUG }     | CCU } Pro<br>CCC }<br>CCA }<br>CCG } | CAU } His<br>CAC }<br>CAA } Gln<br>CAG }  | CGU } Arg<br>CGC }<br>CGA }<br>CGG }          |
| AUU } Ile<br>AUC }<br>AUA }<br>AUG } Met | ACU } Thr<br>ACC }<br>ACA }<br>ACG } | AAU } Asn<br>AAC }<br>AAA } Lys<br>AAG }  | AGU } Ser<br>AGC }<br>AGA } Arg<br>AGG }      |
| GUU } Val<br>GUC }<br>GUA }<br>GUG }     | GCU } Ala<br>GCC }<br>GCA }<br>GCG } | GAU } Asp<br>GAC }<br>GAA } Glu<br>GAG }  | GGU } Gly<br>GGC }<br>GGA }<br>GGG }          |

## Explain the process of translation (3.5.4)

Remember: **MR CATAP** (mRNA, ribosome, codon, anticodon, tRNA, amino acid, polypeptide)

- mRNA binds to a ribosome which initiates translation
- The mRNA is read in **codons** (from start codon = AUG)
- **Anticodons** on tRNA align opposite appropriate codons (according to complementary base pairing)
- **tRNA** brings **amino acids** to the ribosome (according to the genetic code)
- Ribosomes join amino acids together with peptide bonds
- When a stop codon is reached translation stops and a **polypeptide** chain is released



## Explain the relationship between one gene & one polypeptide (3.5.5)

- Gene: A sequence of DNA coding for a polypeptide
- Individual proteins may contain multiple polypeptide and be made from multiple genes (e.g. haemoglobin)
- One gene gives rise to one polypeptide

### Exceptions:

1. Gene → Multiple polypeptides (*Exon removal / alternate splicing*)
2. Gene → No polypeptides (*Genes for tRNA & rRNA*)