Ch 13 - DNA

13.1 – RNA
13.2 - Transcription
Structure of RNA

- Similar structure to DNA
  - Chains of nucleotides
- Three primary differences between DNA and RNA’’

- RNA is usually single-stranded, while DNA is double-stranded

- RNA contains the sugar Ribose, instead of Deoxyribose found in DNA

- RNA contains the nucleotide Uracil, while DNA contains Thymine
  - Uracil replaces thymine in RNA, so Adenine bonds with Uracil (A-U)
Three types of RNA molecules:

- **Messenger RNA (mRNA)** – Serves as messenger to carry DNA’s message out of the nucleus

  - DNA can never leave the nucleus
Transfer RNA (tRNA) – small folded molecule that carries the amino acids that will be used to make proteins during gene expression.
Ribosomal RNA (rRNA) - makes up the ribosomes, where proteins are made.
Gene Expression: Transcription and Translation

- Gene – section of DNA that controls a specific trait

- Gene expression – the process of using the instructions in DNA to produce a protein
- Each gene holds the instructions to build a specific protein – there are millions!

- The proteins then perform specific functions that determine certain traits (hair color, eye color, etc.)
Two steps of gene expression:

- Transcription – copying the DNA sequence into a molecule of RNA (DNA → RNA)
- Translation – the code in the RNA molecule is used as instructions to build a protein (RNA → Protein)

The Central Dogma of biology:
DNA → RNA → Protein
Transcription

- Transcribe means to copy

- A copy of the DNA gene is being made into a molecule of RNA, so that it can leave the nucleus and enter the cytoplasm where the proteins will be made

- The main product after transcription will be an mRNA molecule
Steps in Transcription

1. The enzyme called RNA polymerase bonds to the DNA molecule
   - Bonds at the promoter region, which marks the beginning of the gene, where transcription starts
   - DNA unwinds and the strands separate
2. RNA polymerase moves down one of the DNA strands (not both) and builds a complementary mRNA molecule on top

- RNA nucleotides bond to their complementary DNA nucleotides

<table>
<thead>
<tr>
<th>DNA</th>
<th>T A C</th>
<th>G C A</th>
<th>G A T</th>
<th>T A C</th>
</tr>
</thead>
<tbody>
<tr>
<td>mRNA</td>
<td>A U G</td>
<td>C G U</td>
<td>C U A</td>
<td>A U G</td>
</tr>
</tbody>
</table>
3. RNA polymerase continues building the **mRNA** on the DNA strand until it reaches the **termination signal**, which marks the end of the gene.
4. Transcription will stop and the RNA polymerase releases the DNA and mRNA molecules

- DNA twists up again
- mRNA molecule will leave the nucleus to get ready for translation in the cytoplasm
Transcription video