Patterns of Base Pairing

- Bases in DNA strands can pair in only one way
  - A always pairs with T; G always pairs with C
- The sequence of bases is the genetic code
- Variation in base sequences gives life diversity

![Diagram of DNA base pairs]

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DNA Replication

Process of duplication of the entire genome prior to cell division

Biological significance

- extreme accuracy of DNA replication is necessary in order to preserve the integrity of the genome in successive generations
- In eukaryotes, replication only occurs during the S phase of the cell cycle.
- Replication rate in eukaryotes is slower resulting in a higher fidelity/accuracy of replication in eukaryotes
DNA replication
Of the 3 possible models, replication is...

Semi-conservative
What happens if a base mismatch occurs?

Where does energy for addition of nucleotide come from?

DNA polymerase has 3’ → 5’ exonuclease activity in order to correct errors.

From cleavage of high energy phosphate of incoming triphosphate.
### Core proteins at the replication fork

<table>
<thead>
<tr>
<th>Protein Type</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topoisomerases</td>
<td>Breaks, swivels and rejoins parental DNA ahead of the replication fork, relieves strain caused by unwinding</td>
</tr>
<tr>
<td>Helicases</td>
<td>- separates 2 strands</td>
</tr>
<tr>
<td>Primase</td>
<td>- RNA primer synthesis</td>
</tr>
<tr>
<td>Single strand binding proteins</td>
<td>- prevent reannealing of single strands</td>
</tr>
<tr>
<td>DNA polymerase</td>
<td>- synthesis of new strand</td>
</tr>
<tr>
<td>Tethering protein</td>
<td>- stabilises polymerase</td>
</tr>
<tr>
<td>DNA ligase</td>
<td>- seals gaps via phosphodiester linkage</td>
</tr>
</tbody>
</table>
DNA Transcription and Translation

http://ingsscience.com/Documents/DNA%20Transcription%20and%20Translation%20GELNCOE.ppt
One Gene – One Enzyme

- The Beadle and Tatum experiment showed that one gene codes for one enzyme.
- One gene codes for one polypeptide.
- **polypeptide** - a chain of covalently bonded amino acids.
  - proteins are made of one or more polypeptide
Transcription

- First step in making proteins
- Process of taking one gene (DNA) and converting into a mRNA strand
- DNA -> RNA
- **Location:**
  - Nucleus of the cell
Translation

- Production of proteins from mRNA
- mRNA goes to the ribosomes in the cytoplasm or the RER and produces proteins
Steps to Translation

4. Amino acids attached to a tRNA molecule and are brought over to the mRNA.

5. This tRNA has an **anticodon** that matches the codon on the mRNA strand

**Anticodon:**

Group of 3 unpaired nucleotides on a tRNA strand. (binds to mRNA codon)