(Very) Basic Molecular Biology
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--double-helix DNA molecule
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Gene 1

Chromosomes are divided into 50,000 - 100,000 genes, each of which codes for a particular protein, using an alphabet of 20 amino acids

Gene 2

Protein A
Biotechnological procedures include:

• Exposing organisms to mutation-producing stresses and selecting for desirable variations
• Determining the gene that produces a particular protein
• Recombinant DNA
• Genetic Testing
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Chrysanthemum

- Gamma radiation, producing “peach” chrysanthemum
Peach John Wingfield
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Redundancy

• Nucleotides are “read” in groups of 3 pairs, called codons
  – e.g., AAT, CGA, TGA
• Each codon codes for a particular amino acid
• Because there are 64 codons and only 20 amino acids, many acids can be produced by more than one codon
• Result: you cannot infer the structure of a gene from the sequence of amino acids in the protein it produces
Redundancy

<table>
<thead>
<tr>
<th>Known portion of amino acid sequence</th>
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</thead>
<tbody>
<tr>
<td>H₂N ----</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Possible codons</th>
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<tbody>
<tr>
<td>5'</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>3'</td>
</tr>
</tbody>
</table>

Source: Alberts et al., *Molecular Biology of the Cell*
Using probes to mitigate redundancy

**(Source: Alberts et al., Molecular Biology of the Cell)**

### Known Portion of Amino Acid Sequence

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<thead>
<tr>
<th></th>
<th>H₂N</th>
<th>Gly</th>
<th>Val</th>
<th>Arg</th>
<th>Met</th>
<th>Asp</th>
<th>Trp</th>
<th>Asn</th>
<th>Tyr</th>
<th>Glu</th>
<th>Pro</th>
<th>Leu</th>
<th>Ser</th>
<th>Thr</th>
<th>Trp</th>
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<th>Asn</th>
<th>Gln</th>
<th>Trp</th>
<th>Phe</th>
<th>Val</th>
<th>Arg</th>
<th>Ala</th>
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### Possible Codons

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<th>Position</th>
<th>Codon</th>
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<td>GUA</td>
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<tr>
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</tbody>
</table>

### Regions of Coding Sequence with Least Ambiguity

- **AUGGA₇UGGAA₇UA₇UGA₇GCC** (16 possibilities)
- **UGGGA₇AUGAA₇CA₇UGGUU** (8 possibilities)

### Synthetic Oligonucleotides Used as Probes

It was discovered that probes can be used to enrich for a particular mRNA sequence. The first step is to provide a powerful alternative way of enriching for the cell that expresses the protein of interest. These rare DNA sequences that fail to bind DNA in the hybridisation chamber are likely to represent mRNA sequences present in the cell. The hybridisation chamber works by ensuring that the DNA is bound to mRNA and that the DNA can bind to mRNA successfully. The DNA hybridisation method is a powerful alternative way of enriching for selective mRNA sequences present in the cell.
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Cutting DNA

Source: Alberts et al., *Molecular Biology of the Cell*
“Sticky Ends”

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(a) Better for eating
(b) Susceptible to human diseases – for testing
(c) Factories for hormones useful to people
(d) Perform socially useful functions
(e) (perhaps) generate organs suitable for transplantation
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