

(Very) Basic Molecular Biology

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Each human cell has 46 chromosomes
--double-helix DNA molecule

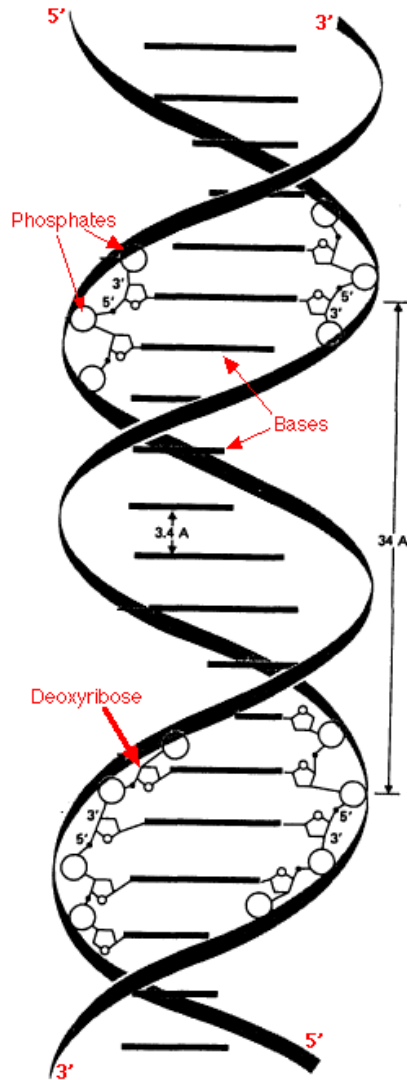
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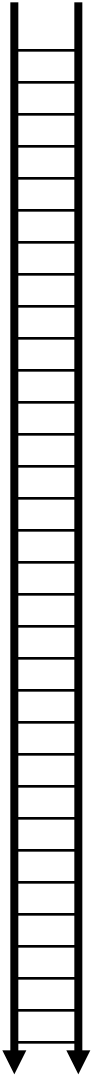
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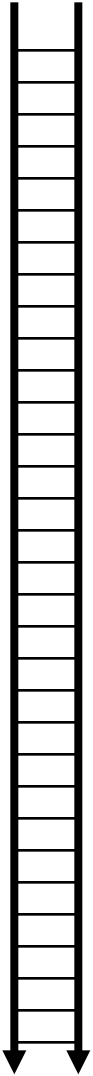


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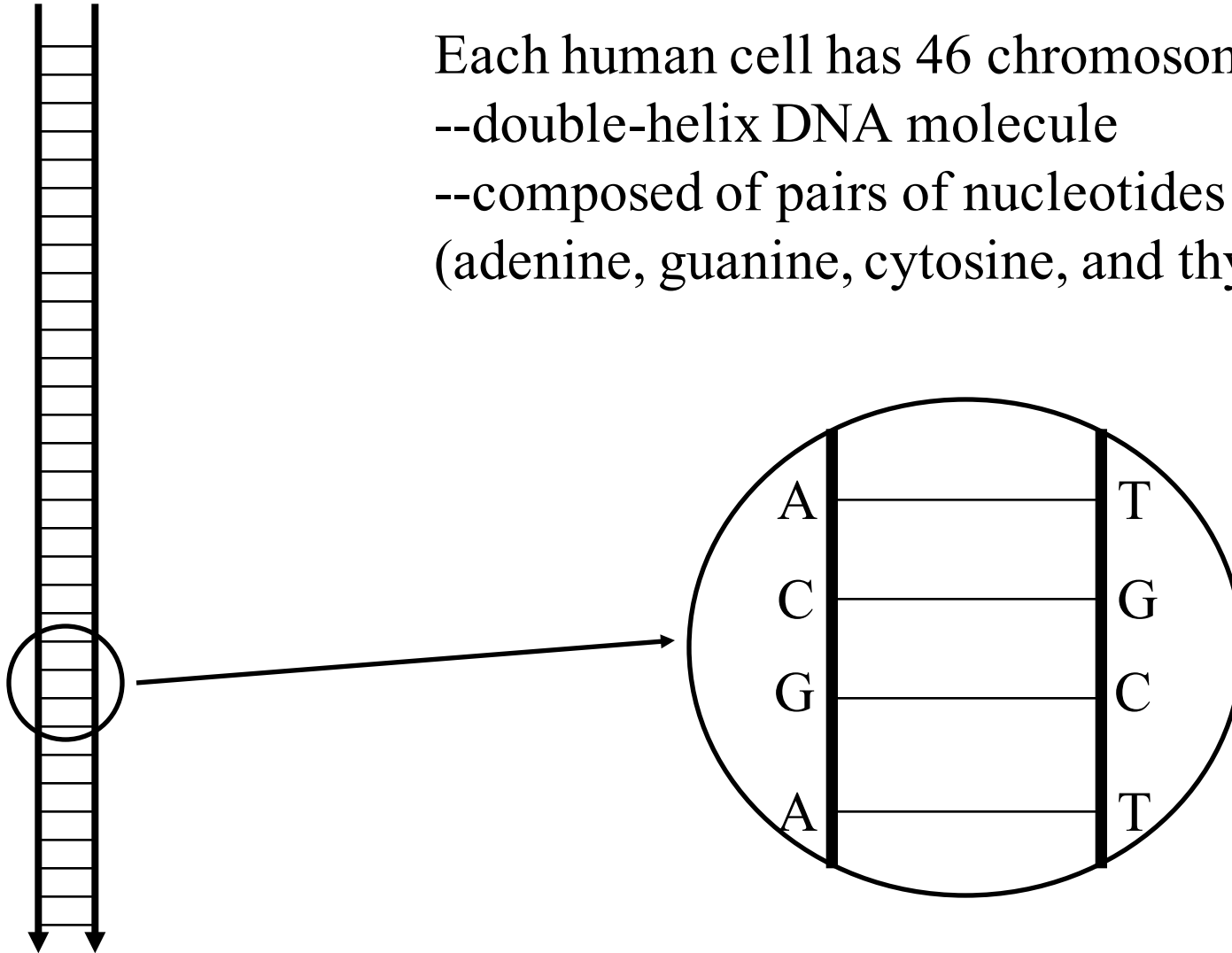
--double-helix DNA molecule

--composed of pairs of nucleotides

(adenine, guanine, cytosine, and thymine)

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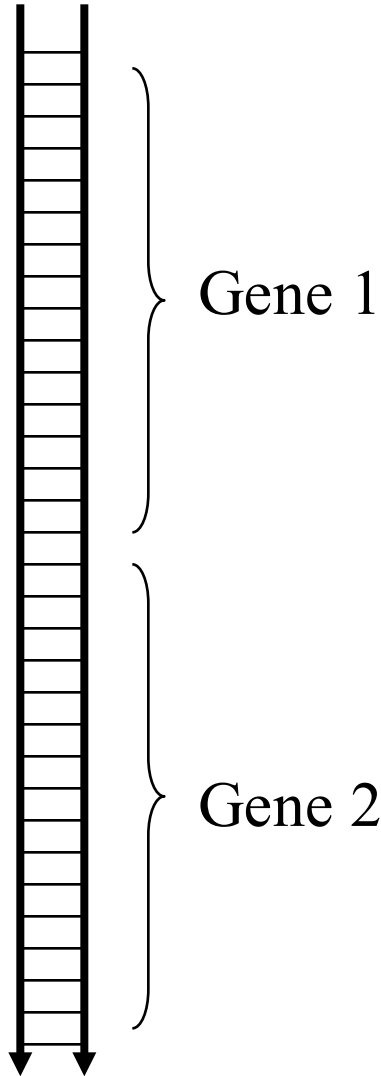


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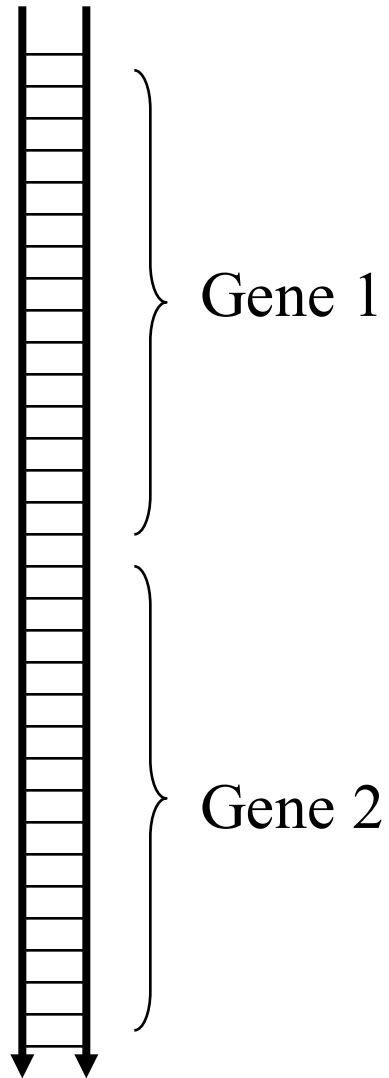
Chromosomes are divided into
50,000 - 100,000 genes

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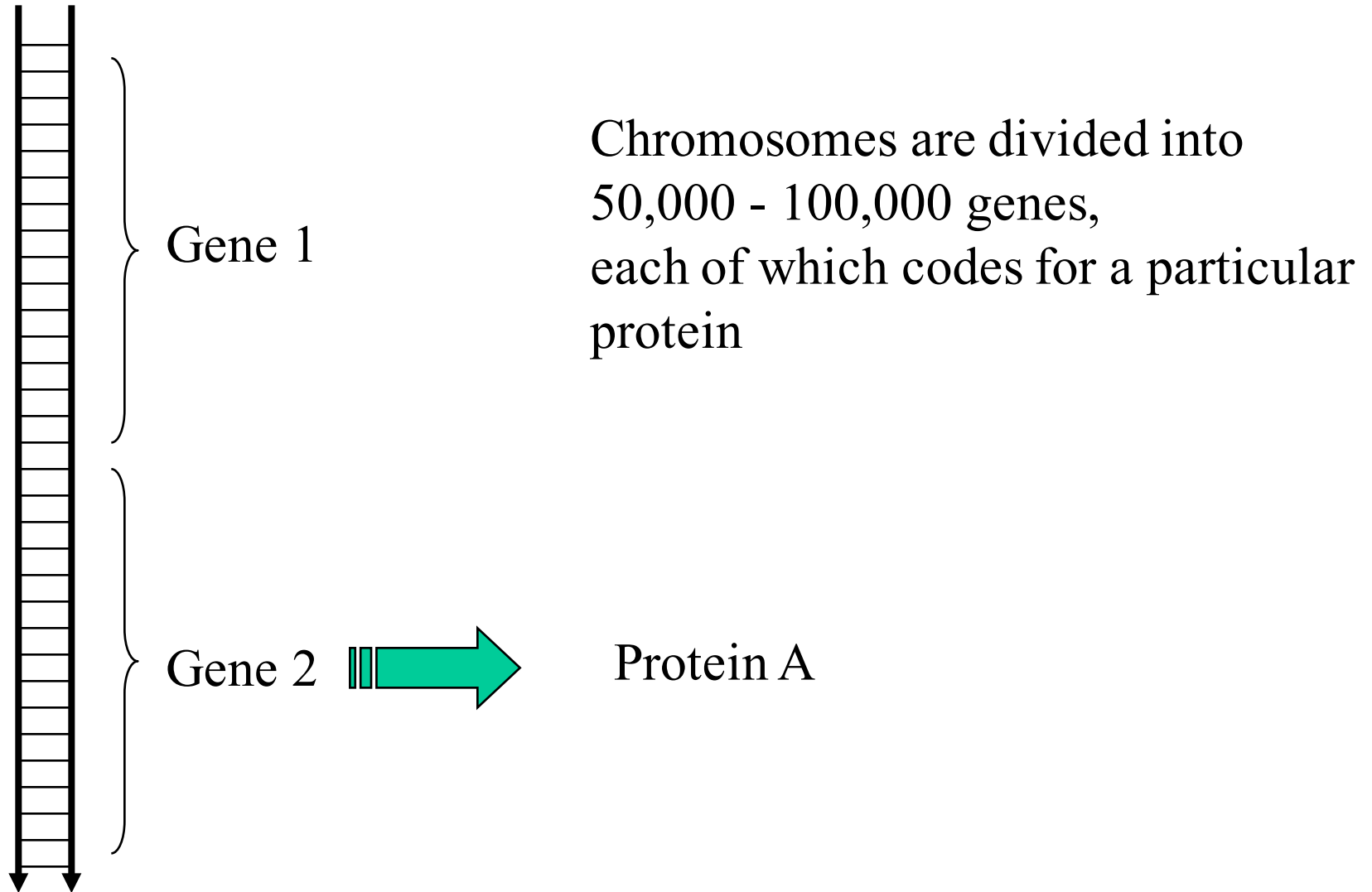
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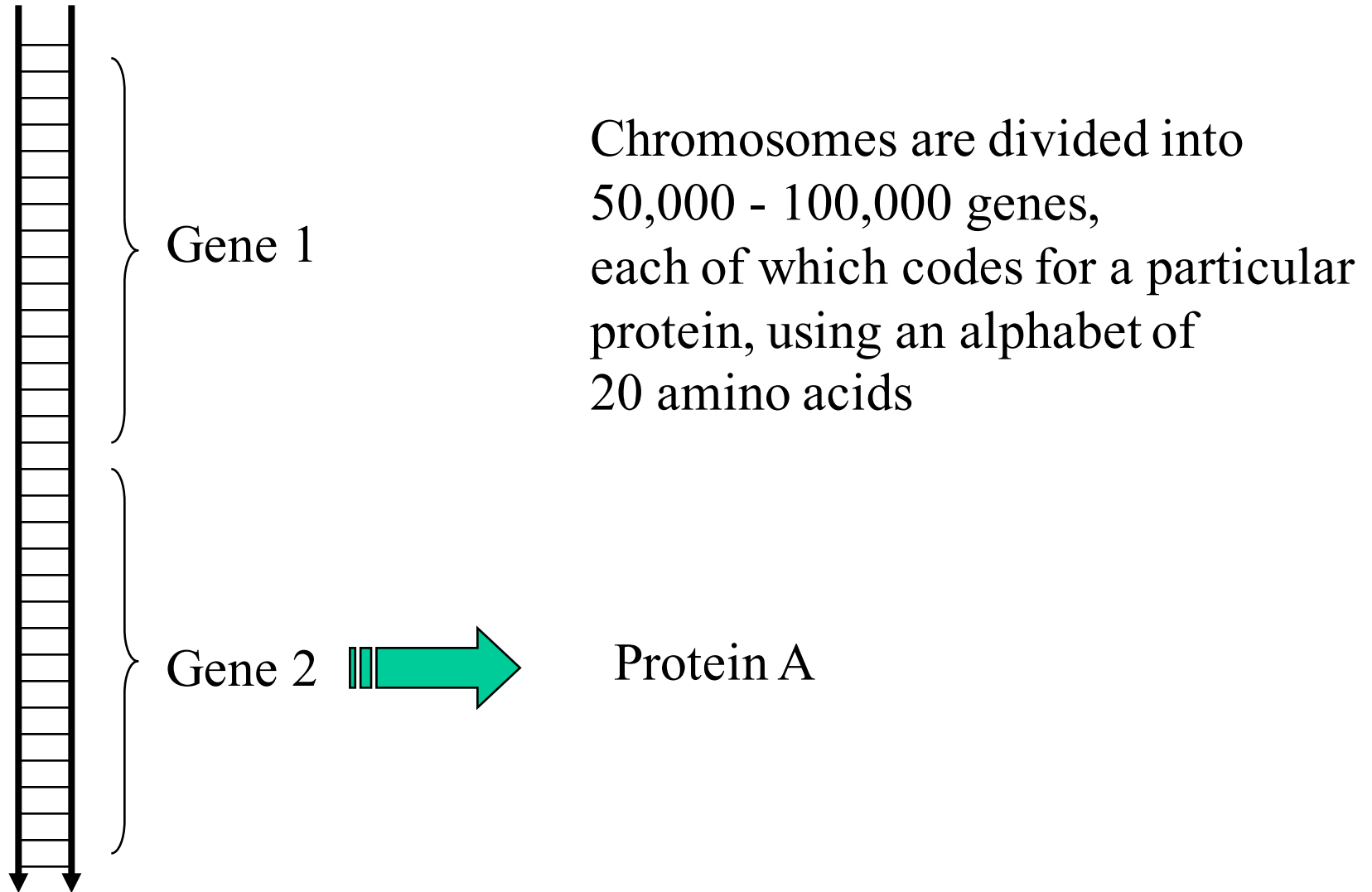


Chromosomes are divided into
50,000 - 100,000 genes,
each of which codes for a particular
protein

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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

known portion of amino acid sequence

H₂N --- Gly Val Arg Met Asp Trp Asn Tyr Glu Pro Leu Ser Thr Trp Glu Met Asn Gln Trp Phe Val Arg Ala --- COOH

possible codons

5'	GGA	GUA	AGA	AUG	GAC	UGG	AAC	UAC	GAA	CCA	UUA	AGC	ACA	UGG	GAA	AUG	AAC	CAA	UGG	UUC	GUA	AGA	GCA	3'
	GGC	GUC	AGG		GAU		AAU	UAU	GAG	CCC	UUG	AGU	ACC		GAG		AAU	CAG		UUU	GUC	AGG	GCC	
	GGG	GUG	CGA							CCG	CUA	UCA	ACG								GUG	CGA	GCG	
	GGU	GUU	CGC							CCU	CUC	UCC	ACU								GUU	CGC	GCU	
			CGG								CUG	UCG									CGG			
			CGU								CUU	UCU									CGU			

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

Using probes to mitigate redundancy

known portion of amino acid sequence

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possible codons

5'	GGA	GUA	AGA	AUG	GAC	UGG	AAC	UAC	GAA	CCA	UUA	AGC	ACA	UGG	GAA	AUG	AAC	CAA	UGG	UUC	GUA	AGA	GCA	3'
	GGC	GUC	AGG		GAU		AAU	UAU	GAG	CCC	UUG	AGU	ACC		GAG		AAU	CAG		UUU	GUC	AGG	GCC	
	GGG	GUG	CGA							CCG	CUA	UCA	ACG								GUG	CGA	GCG	
	GGU	GUU	CGC							CCU	CUC	UCC	ACU								GUU	CGC	GCU	
			CGG								CUG	UCG										CGG		
			CGU								CUU	UCU										CGU		

regions of coding
sequence with
least ambiguity

synthetic
oligonucleotides
used as probes

AUGGA^CUGGAA^CUUA^CGAG^ACC

(16 possibilities)

UGGGA^AGUGAA^CUCA^AGUGGUU

(8 possibilities)

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

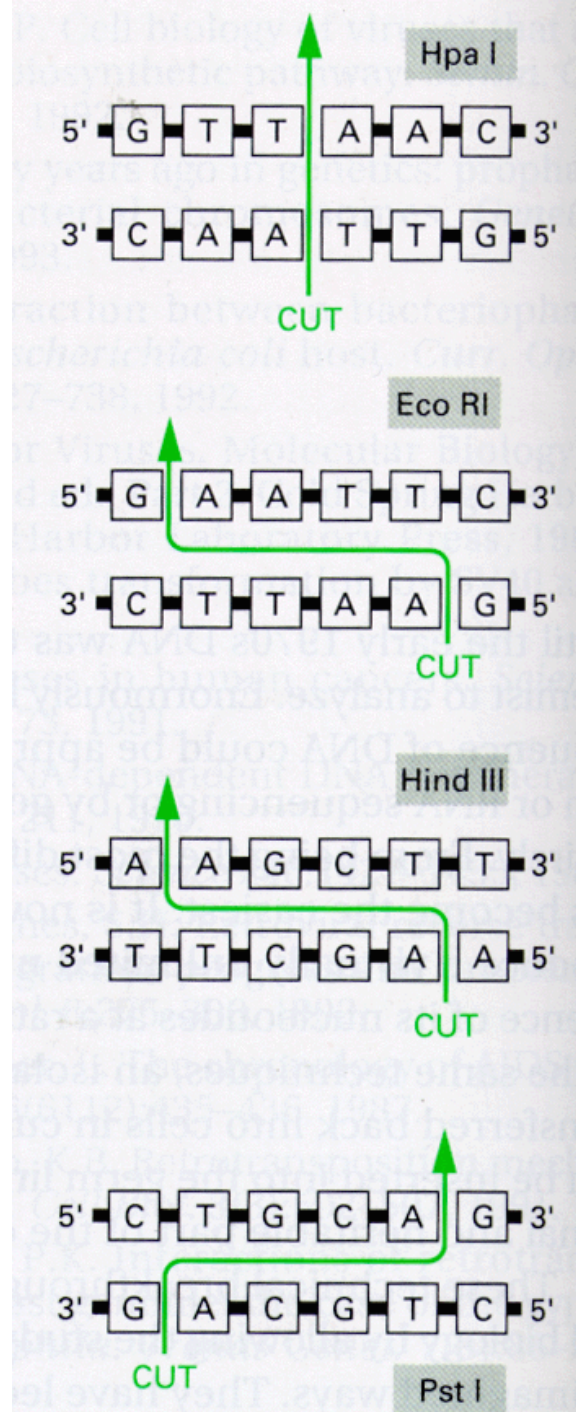
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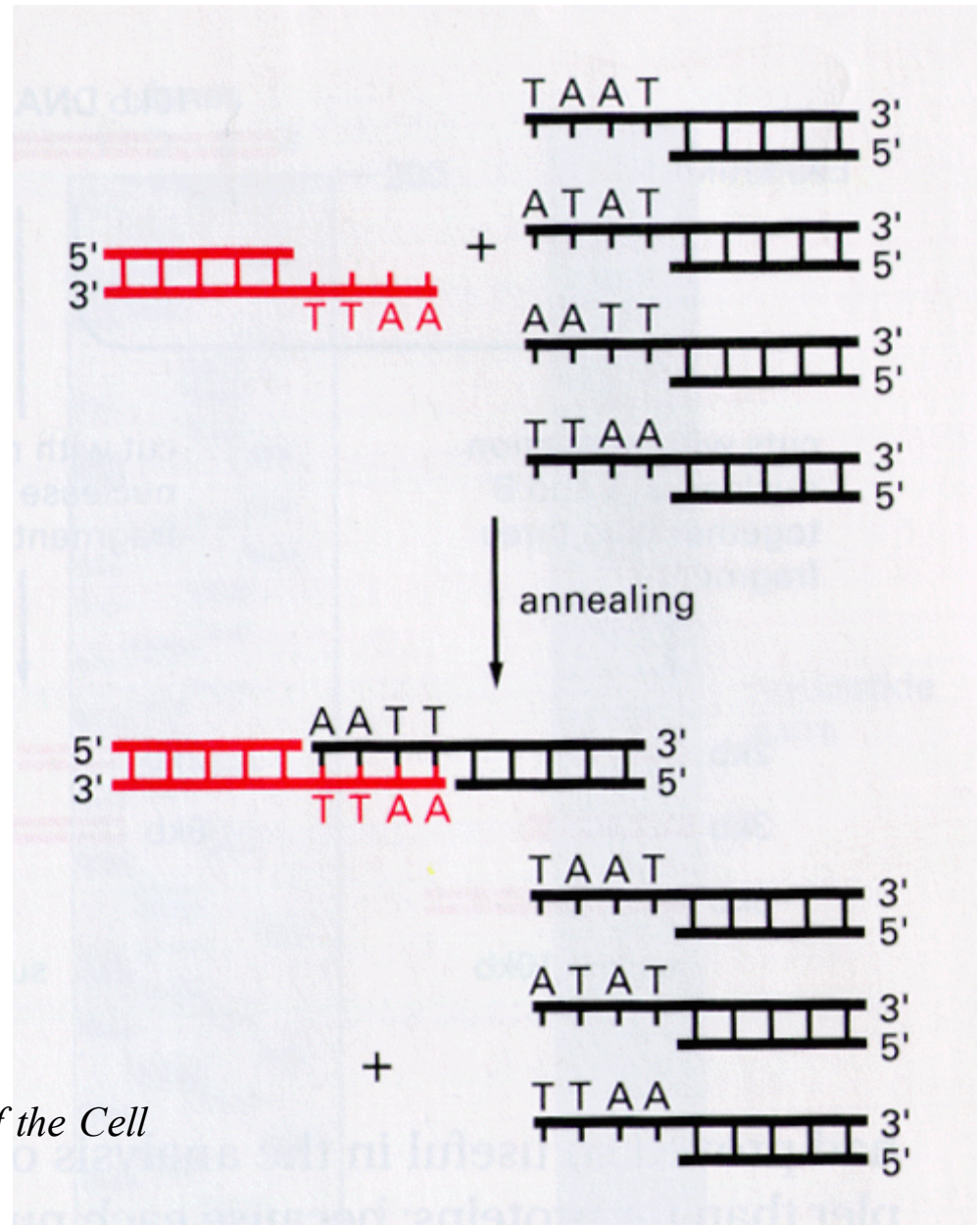
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Cutting DNA



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

“Sticky Ends”



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

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

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