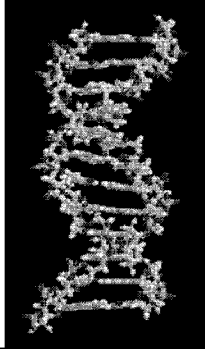


Thursday, October 14  
Heredity, DNA, & Mutations



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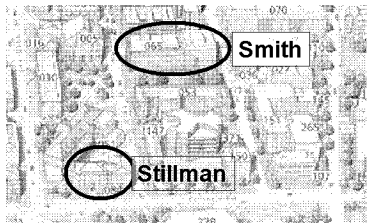
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Planetarium Show & Star Party



Planetarium Show: **Tonight**, at 7:30 pm  
(telescope viewing after, if clear).

Star Party: **Friday** night, 7:30 – 10:30 pm  
Smith Lab, fifth floor (north end of building)

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Heredity  
Key Concepts

- 1) DNA stores and transmits the instructions for synthesis of proteins and other molecules.
- 2) RNA plays a key role in protein synthesis.
- 3) Mutations (changes in the DNA's structure) are the molecular basis of evolution.

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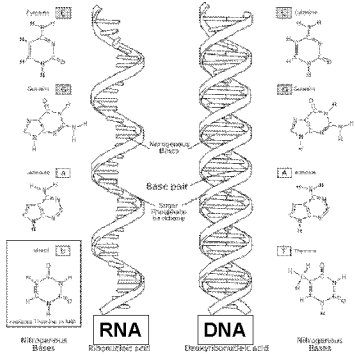
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Nucleic acids store and transmit hereditary information in **all** cells on Earth.




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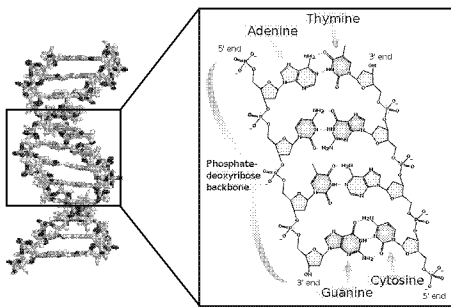
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### DNA: The Double Helix

Two helical sugar-phosphate backbones, connected by four "DNA bases" that come in pairs.




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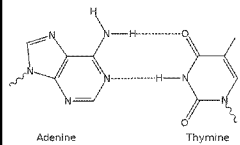
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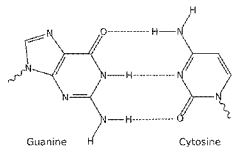
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The "message" of DNA is written in the sequence of base pairs that runs along the helix.



Adenine pairs with Thymine.

Thymine pairs with Adenine.



Guanine pairs with Cytosine.

Cytosine pairs with Guanine.

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Each 3-base "word" codes for a different amino acid.

first base		second base				third base	
		T	C	A	G		
T	TTT	TCT } Phenylalanine	TAT	Tyrosine	TGT	TGC } Cysteine	
	TTC		TAC	stop	TGA		stop
	TTA	TCA } Serine	TAA	stop	TGG	Tryptophan	
C	TTG	TCG } Leucine	TAG	stop			
	CTT	CCT } Leucine	CAT	Histidine	CGT	CGC } Arginine	
	CTC	CCC } Proline	CAC		CGA		
CTA	CCA } Glutamine	CAA		CGG			
G	CTG	CCG } Leucine	CAG				
	ATT	ACT } Isoleucine	AAT	Asparagine	AGT	AGC } Serine	
	ATC	ACC } Threonine	AAC		AGA		AGG } Arginine
ATA	ACA } Met or start	AAA	Lysine				
ATG	ACG } Met or start	AAG					
A	GTT	GCT } Valine	GAT	Aspartic acid	GGT	GGC } Glycine	
	GTC	GCC } Alanine	GAC		GGA		
	GTA	GCA } Alanine	GAA	Glutamic acid	GGA		
	GTG	GCG } Alanine	GAG		GGG		

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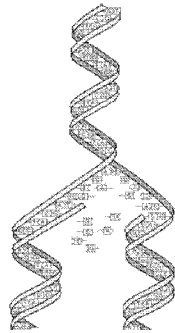
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The double helix structure allows for simple replication of DNA.

The helix "unzips", splitting the base pairs.

Each single strand's matching bases are added by an enzyme.

The result is a (usually) perfect copy of the DNA.




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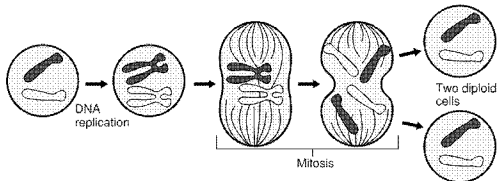
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The replication of DNA inside a cell is the first step of cell division.



Each "daughter" cell inherits a copy of the DNA instruction manual.

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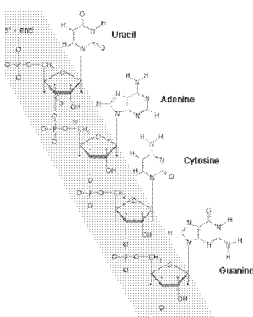
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**RNA is a single-stranded helix with a different backbone than DNA, and with Uracil instead of Thymine.**

RNA plays three roles:

- It copies instructions for protein synthesis from DNA.
- It transports amino acids to the synthesis site.
- It catalyzes protein synthesis.




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**Copying errors during DNA replication permanently change base sequences.**

Original: The big dog bit the red fox

Base Replacement: The big dog qit the red fox

Base Insertion: The big dro gbi tth ere dfo x

Base Deletion: The big dgb itt her edf ox

Word Insertion: The big dog bit xyz the red fox  
The big dog bxy zit the red fox

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**A change in the base sequences is called a **mutation**.**

Some mutations have no effect.

Some make subtle changes in the organism (such as eye or hair color).

Some can make bigger changes, most of which are harmful.




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Mutations are the source of the genetic variations that are crucial for evolution by natural selection.

Occasionally, a mutation confers an adaptive advantage.

These advantageous mutations tend to spread throughout the species in later generations.



Mutation is the molecular basis of evolution.

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Tomorrow's Lecture:

Extreme Life

This Week's Reading:

Chapter 5

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