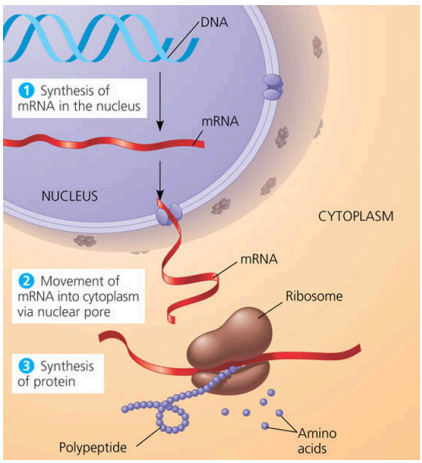
NUCLEOTIDES AND NUCLEIC ACIDS

INFORMATION FLOW IN CELLS = "**Central Dogma** of Molecular Biology"
DNA→ RNA→ PROTEINS

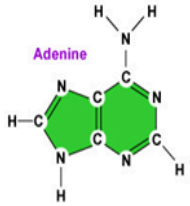
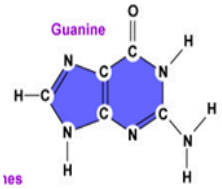
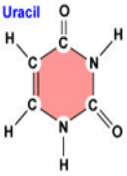


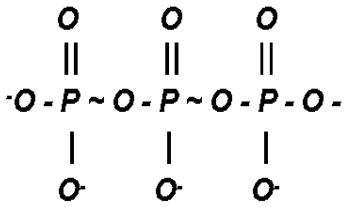
FUNCTION

DNA- genetic code contains info that controls cell activities (some viruses use RNA)
RNA-carries message from DNA to cell; protein synthesis

BASIC STRUCTURE

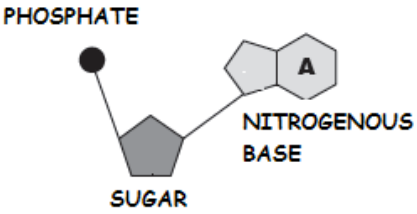
NUCLEOSIDE = nitrogenous base + sugar
NUCLEOTIDE = nitrogenous base + sugar + phosphate group
PURINES = 2 rings; Adenine (A), Guanine (G)
PYRIMIDINES = 1 ring; Cytosine (C), Thymine (T), Uracil (U)

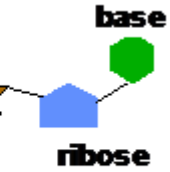
Nitrogen bases **A purine always bonds with a pyrimidine.**		
		



NUCLEOTIDES

Can have one, two, or three phosphate groups
(mono, di, tri-phosphates)
High energy bond between phosphate groups
is important energy transport





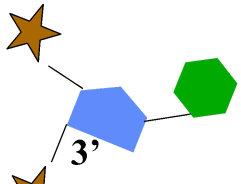
Named for nitrogen base and number of phosphate groups
EX: adenosine triphosphate (ATP)
cytosine diphosphate (CDP)
guanosine monophosphate (GMP)

IMPORTANT NUCLEOTIDES

ADENOSINE TRIPHOSPHATE (ATP) = main energy currency in ALL living things
(GTP & UTP also used)

CYCLIC AMP (cAMP)- "Second messenger"
Important in cell signaling and response to hormones

COENZYMES- Many coenzymes are nucleotides or their derivatives (vitamins)
EX: Flavin adenine dinucleotide (FAD) & nicotinamide adenine dinucleotide (NAD) used in cellular respiration
nicotinamide adenine dinucleotide phosphate (NADP) used in photosynthesis



NUCLEIC ACIDS (DNA & RNA)

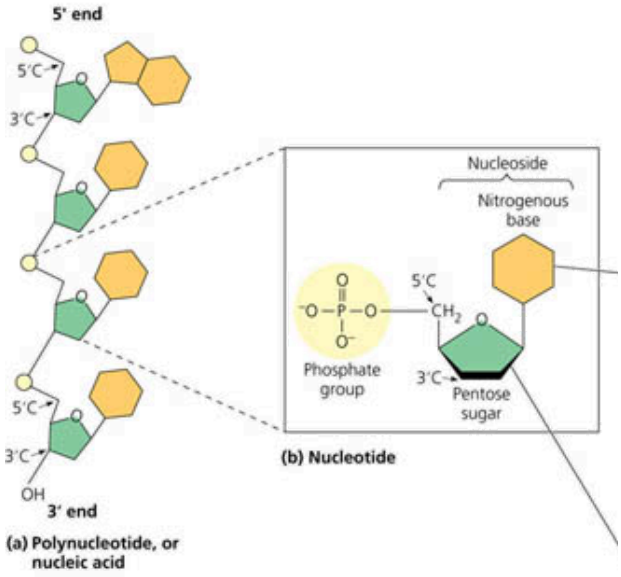
DEHYDRATION SYNTHESIS forms polymers of nucleotide building blocks
PHOSPHATES and **SUGARS** form backbone

To distinguish sugar and nitrogen base carbon atoms when numbered, sugar atoms have a prime (')
Phosphate group attached to 5' carbon on one sugar and the 3' carbon of next sugar

PHOSPHATE LINKAGE between carbon 3' of one sugar and carbon 5' of the next

RIBONUCLEIC ACID (RNA)

- Single stranded
- Sugar = ribose
- Nitrogenous bases = A, U, G, C
- Can fold up in 3D shape



NUCLEOTIDE SUBUNITS

SUGAR = Ribose (RNA)
OR Deoxyribose (DNA)

NITROGEN BASES:

DNA	RNA
Adenine	Adenine
Guanine	Guanine
Cytosine	Cytosine
Thymine	Uracil

DEOXYRIBONUCLEIC ACID (DNA)

- Double stranded
- Sugar = deoxyribose

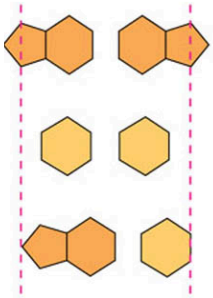
- Nitrogenous bases = A, T, G, C
- Strands run in opposite directions (**ANTIPARALLEL**)

- Backbone = sugars and phosphates
- Rungs of ladder = nitrogenous bases
- Hydrogen bonds between nitrogenous bases

hold sides of ladder together

- Purine always bonds to a Pyrimidine

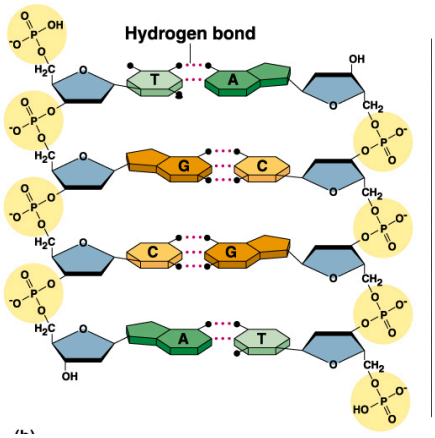
CHARGAFF'S RULE: A = T; G ≡ C



Purine + purine: too wide

Pyrimidine + pyrimidine: too narrow

Purine + pyrimidine: width consistent with X-ray data



The double strand twists around its axis like a spiral staircase, forming a **DOUBLE HELIX**

DNA and protein sequences can be used as tape measures of evolution

- linear sequences of nucleotides in DNA molecules are passed from parents to offspring
- more distantly related species have chains that a less similar