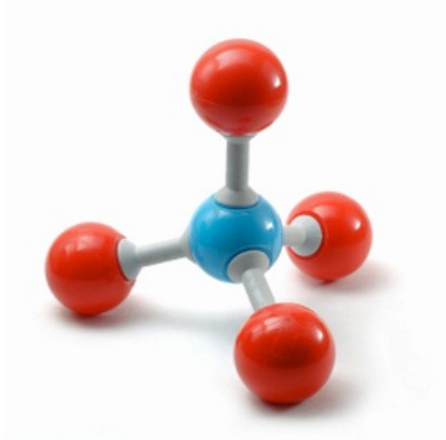
Ch17

Nucleic Acids

Protein blueprints.

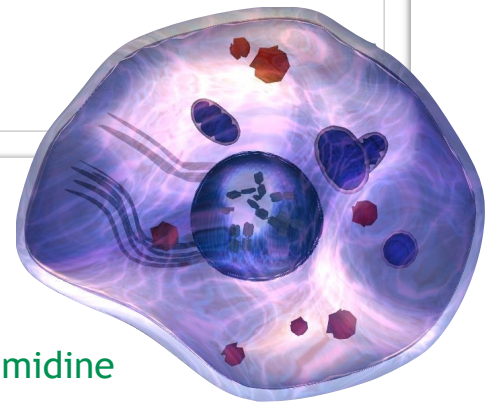
Storing biological design in every cell.



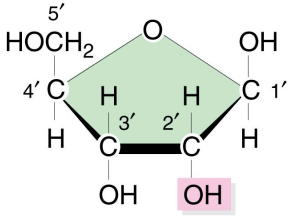
version 1.0

Ch17

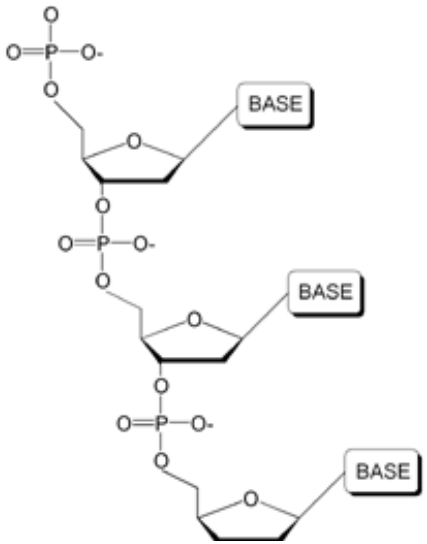
Nucleic Acids



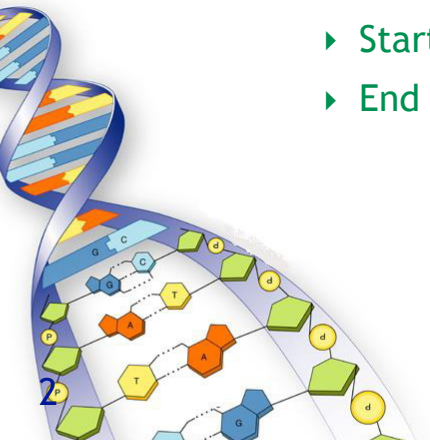
- Nucleic Acids
  - Concept, Function & Size
  - Two flavors, DNA & RNA
- Nucleotides & Nucleosides
  - Structure
  - Composition
    - Sugar
    - Base
  - Naming

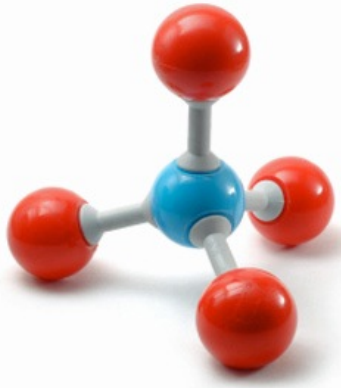


- Nucleic Acid Primary Structure
  - Phosphodiester Bond
  - Sequencing
    - Start w/ 5’ Phosphate
    - End with 3’ Hydroxy

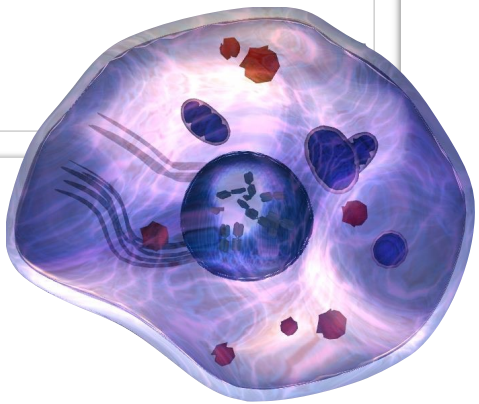


- DNA
  - Ratio of bases
    - # purine = # pyrimidine
  - Complimentary Base pairs
    - AT & GC
      - Hydrogen Bonding
    - Double Helix
    - Complementary Sequence
- DNA Replication
  - Two enzymes:
    - helicase unwinds it
    - polymerase builds it again
  - DNA Fingerprinting

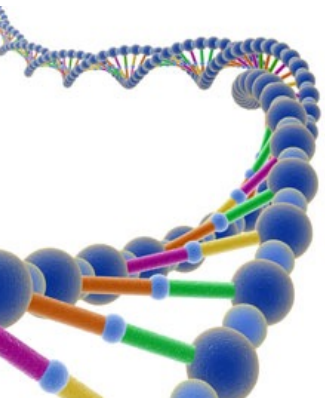


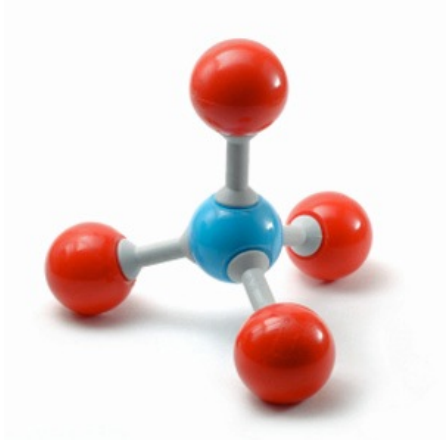


Nucleic Acids

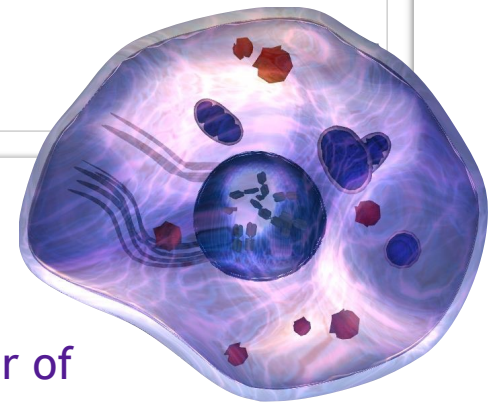


- Nucleic acids, together with proteins, are essential to all forms of known life.
- Nucleic acids are biopolymers, large biomolecules, composed of repeating smaller units called nucleotides.
- Nucleic acids were discovered by Friedrich Miescher in 1869.
- Nucleic acids were named for their initial discovery within the nucleus of cells, and for the presence of phosphoric acid groups in each of their repeating units.
- Although first discovered within the nucleus of eukaryotic cells, nucleic acids are now known to be found in all life forms as well as some nonliving entities, including bacteria, archaea, mitochondria, chloroplasts, viruses and viroids.

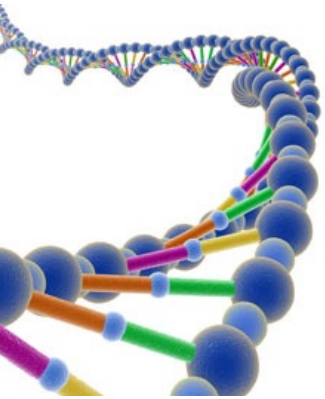


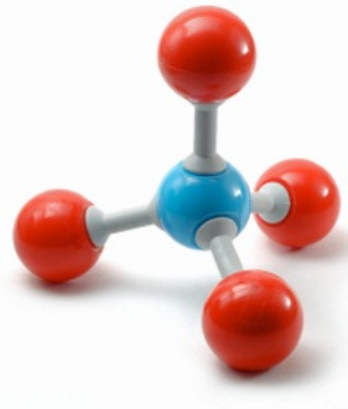


Nucleic Acids

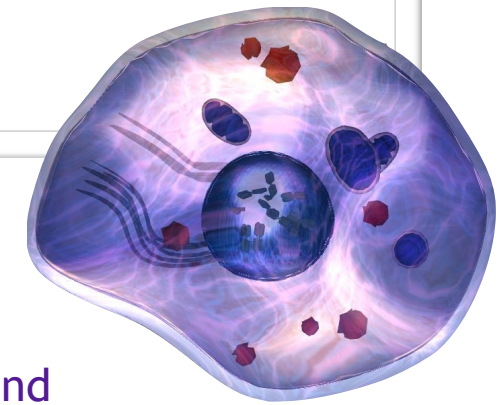


- Nucleic acids function in encoding, transmitting and expressing genetic information.
- The information is written in the nucleic acid sequence, the order of nucleotides within the molecule.
- Strings of nucleotides strung together in a specific sequence are the mechanism for storing and transmitting hereditary, or genetic information via protein synthesis.
- These sequences are the blueprints of every protein in the organism.
- Nucleic acids are very large molecules. The largest known molecules are nucleic acids.
- Well-studied biological nucleic acid molecules range in size from 21 nucleotides to some that contain close to half a billion nucleotides.
  - That's tens of billions of atoms.

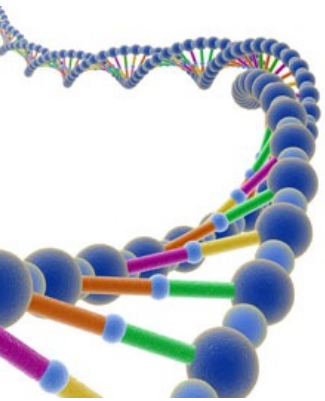


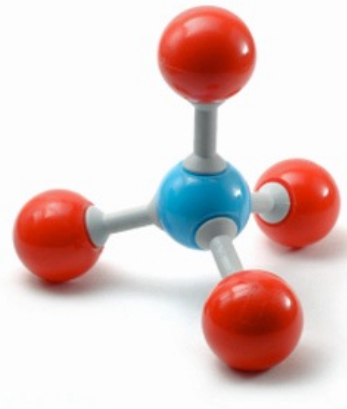


Nucleic Acids



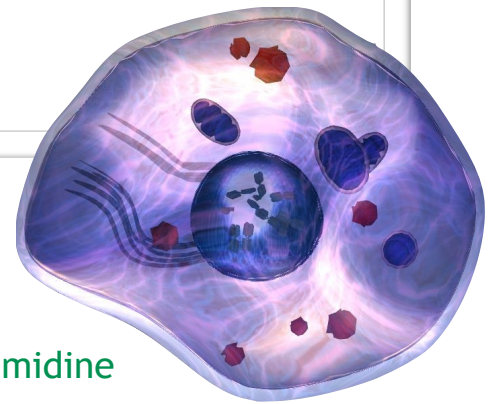
- There are two classes of nucleic acids, DNA & RNA.
- DNA & RNA have different functions.
- Both classes have similar composition and structure, with clear and important differences.
- We'll discuss those similarities and differences shortly.



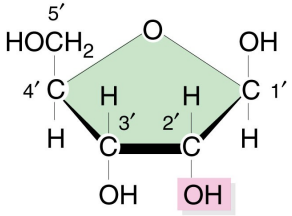


Ch17

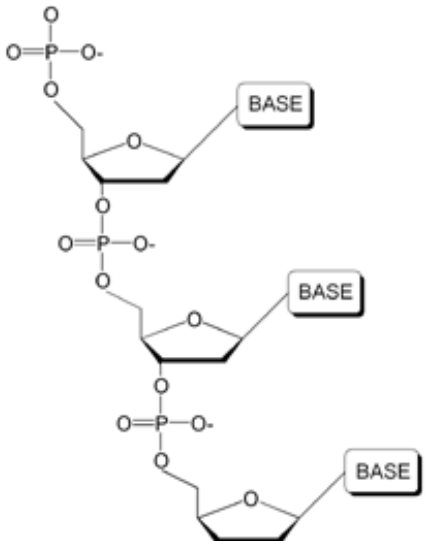
Nucleic Acids



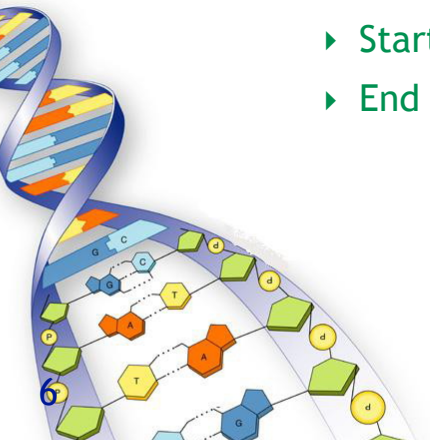
- Nucleic Acids
  - Concept, Function & Size
  - Two flavors, DNA & RNA
- Nucleotides & Nucleosides
  - Structure
  - Composition
    - Sugar
    - Base
  - Naming

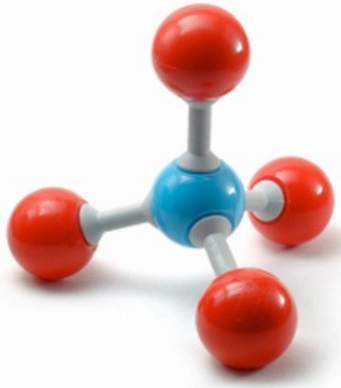


- Nucleic Acid Primary Structure
  - Phosphodiester Bond
  - Sequencing
    - Start w/ 5’ Phosphate
    - End with 3’ Hydroxy



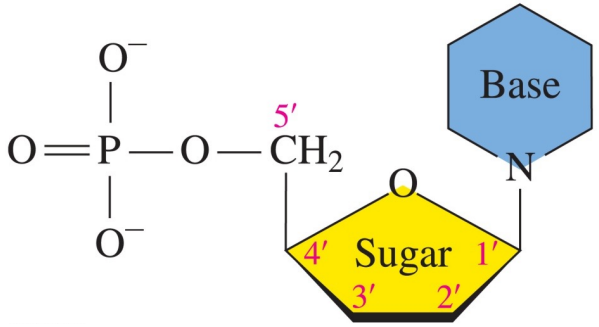
- DNA
  - Ratio of bases
    - # purine = # pyrimidine
  - Complimentary Base pairs
    - AT & GC
      - Hydrogen Bonding
    - Double Helix
    - Complementary Sequence
- DNA Replication
  - Two enzymes:
    - helicase unwinds it
    - polymerase builds it again
  - DNA Fingerprinting



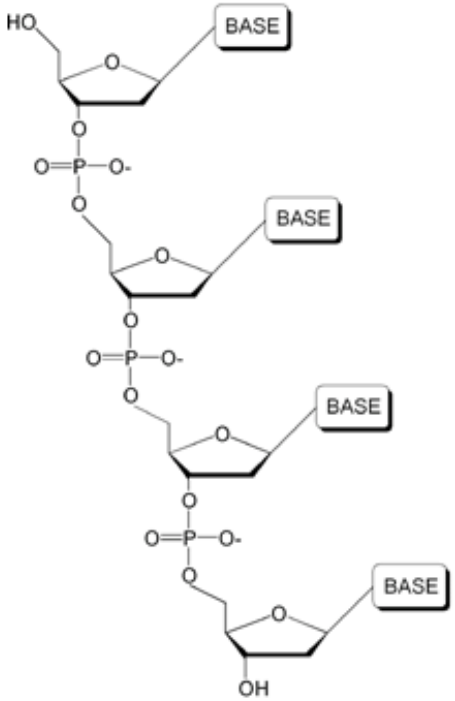


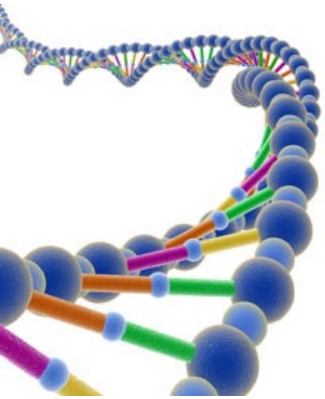
Nucleic Acids

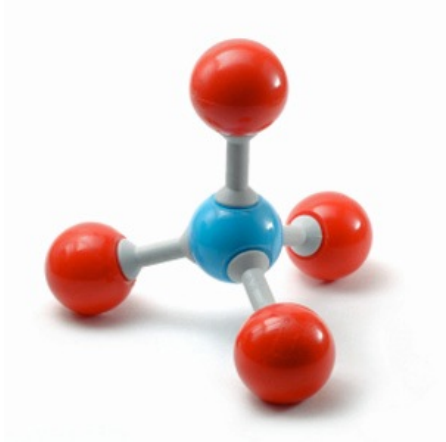
- Nucleic acids are made from monomers known as nucleotides.
- Nucleic acids are also called polynucleotides.
- A nucleotide has three parts:
  - a phosphate group
  - a pentose sugar
  - a heterocyclic amine base



Nucleotide Structure

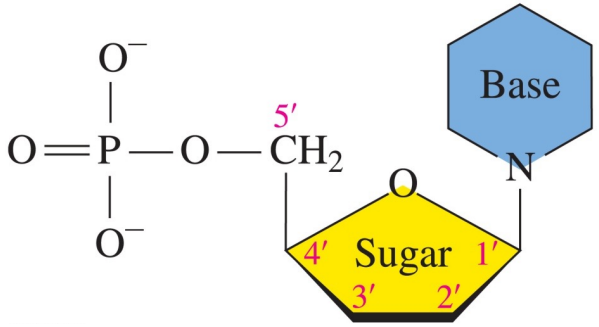




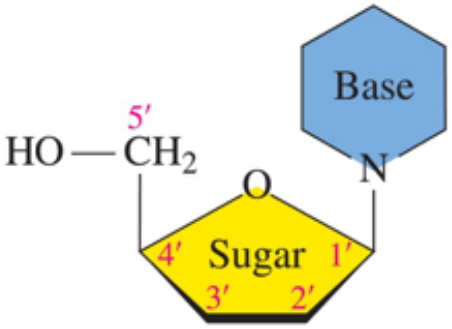


Nucleic Acids

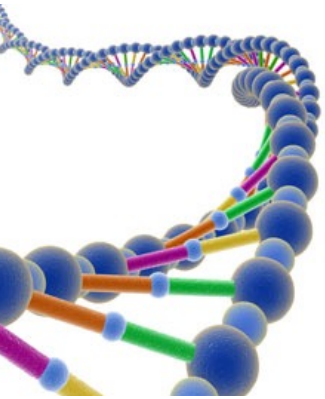
- We use both the terms nucleotide and nucleoside in talking about these repeating units.
- Nucleotides are…
  - a phosphate group
  - a pentose sugar
  - a heterocyclic amine base
- Nucleosides are only the last two parts…
  - a pentose sugar
  - a heterocyclic amine base

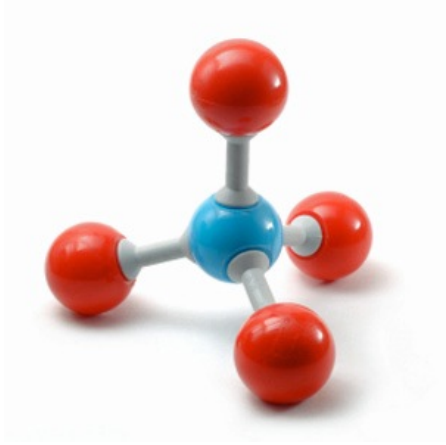


Nucleotide Structure



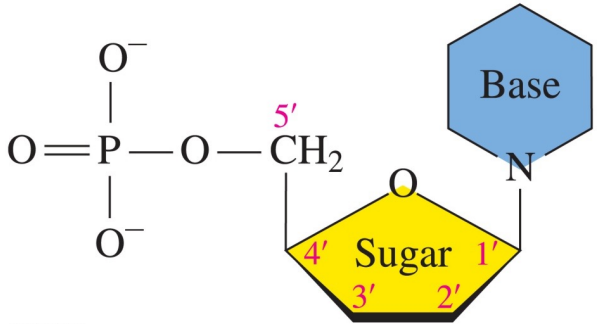
Nucleoside Structure



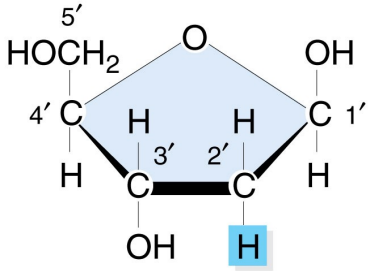


Nucleic Acids

- Nucleic acids are made from monomers known as nucleotides.
- Nucleic acids are also called polynucleotides.
- A nucleotide has three parts:
  - a phosphate group
  - a pentose sugar
  - a heterocyclic amine base
- The sugar is always one of two pentose sugars:
  - Ribose
  - 2’ Deoxyribose



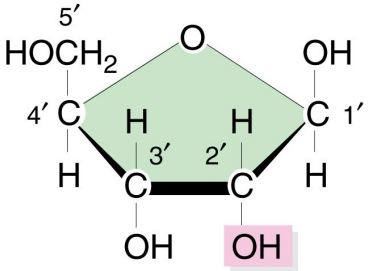
Nucleotide Structure



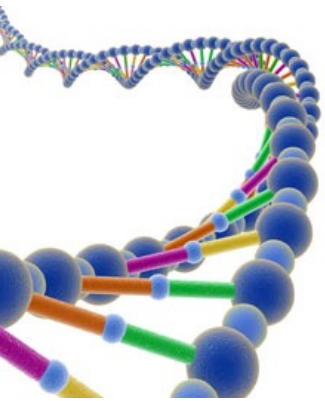
2’ Deoxyribose

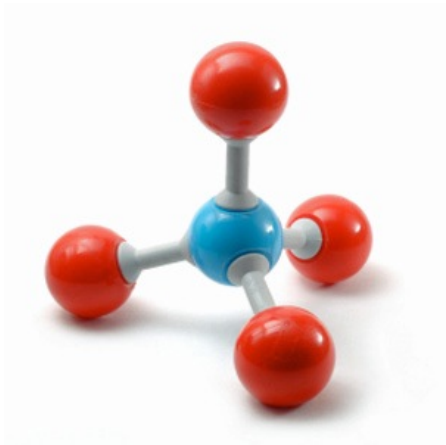
The same as ribose but with one hydroxy group missing.

(deoxy means without oxygen)



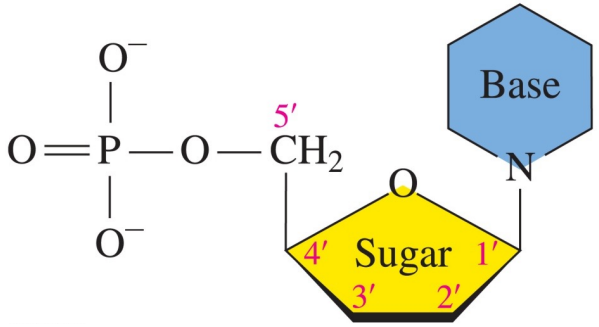
Ribose



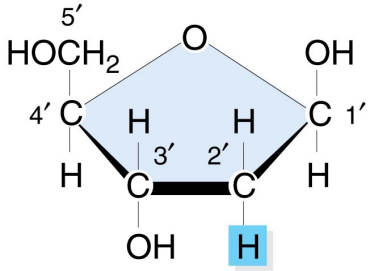


Nucleic Acids

- There are two classes of nucleic acids, DNA & RNA.
- RNA, ribonucleic acids, are nucleic acids where the sugar is ribose.
- DNA, deoxyribonucleic acids, are nucleic acids where the sugar is 2' deoxyribose.



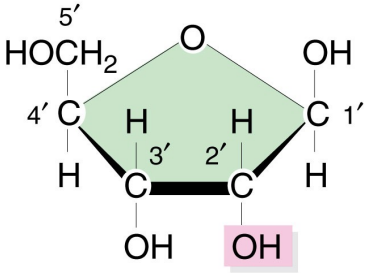
Nucleotide Structure



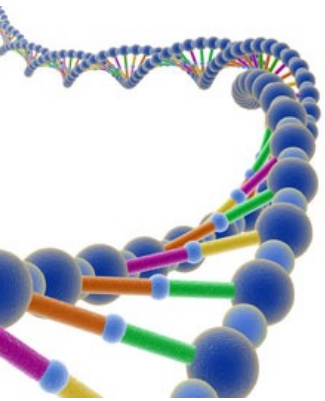
2' Deoxyribose

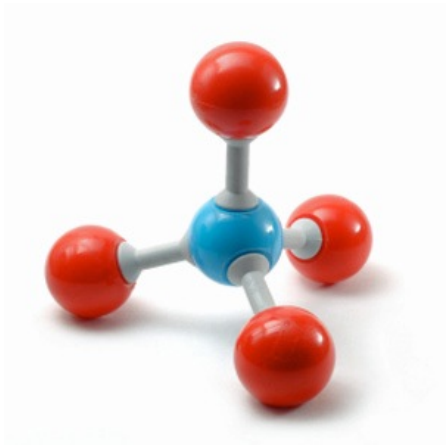
The same as ribose but with one hydroxy group missing.

(deoxy means without oxygen)



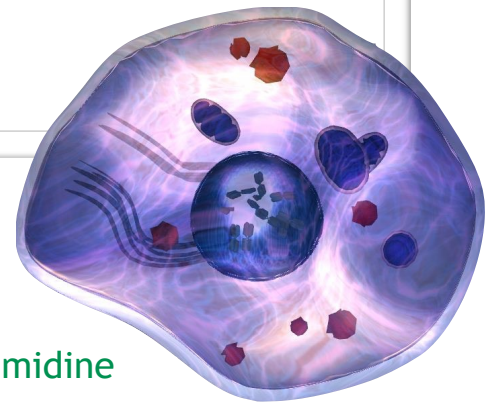
Ribose



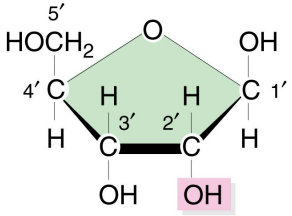


Ch17

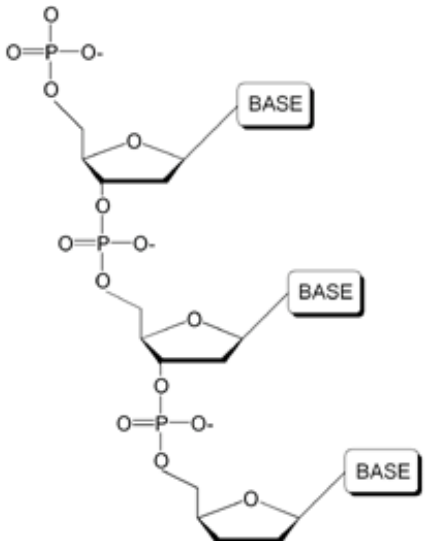
Nucleic Acids



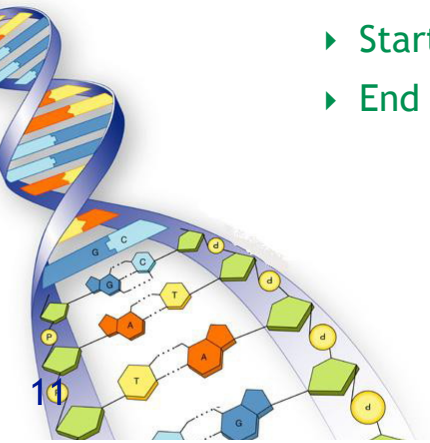
- Nucleic Acids
  - Concept, Function & Size
  - Two flavors, DNA & RNA
- Nucleotides & Nucleosides
  - Structure
  - Composition
    - Sugar
    - Base
  - Naming

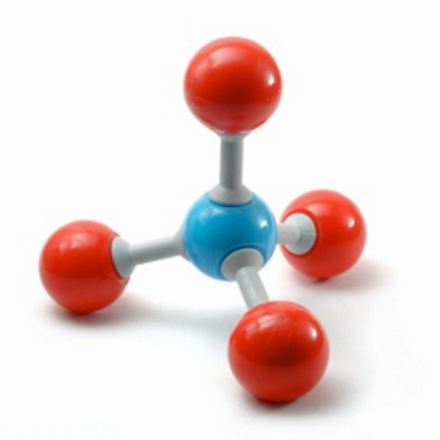


- Nucleic Acid Primary Structure
  - Phosphodiester Bond
  - Sequencing
    - Start w/ 5’ Phosphate
    - End with 3’ Hydroxy



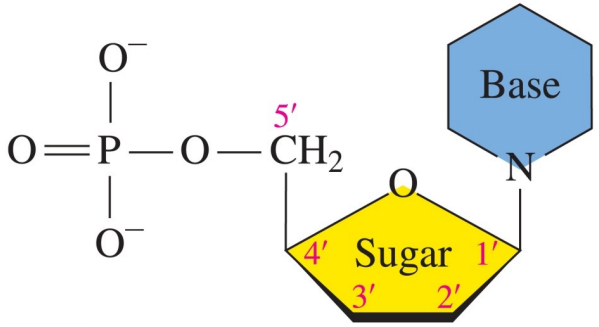
- DNA
  - Ratio of bases
    - # purine = # pyrimidine
  - Complimentary Base pairs
    - AT & GC
      - Hydrogen Bonding
    - Double Helix
    - Complementary Sequence
- DNA Replication
  - Two enzymes:
    - helicase unwinds it
    - polymerase builds it again
  - DNA Fingerprinting



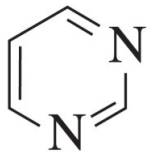


Nucleic Acids

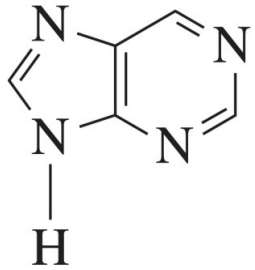
- A base is a substance that absorbs hydrogen ions.
- Only five bases appear in nucleic acids.
- These five bases are all derivative of two substances.
  - Pyrimidine
  - Purine
- Purine is the pyrimidine ring structure with a fused five membered heterocyclic amine.



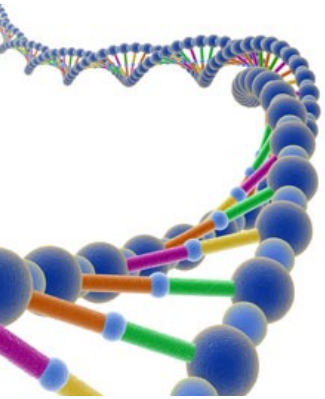
Nucleotide Structure

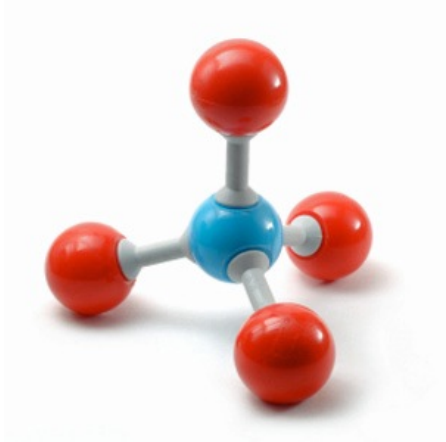


Pyrimidine



Purine



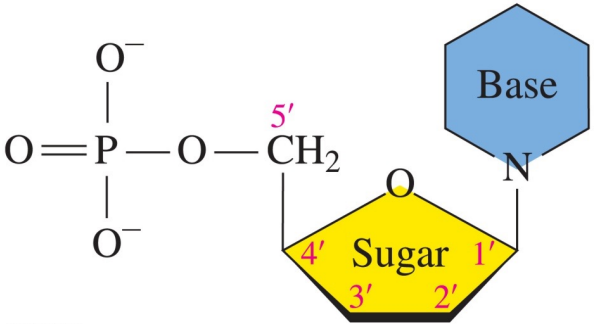


Nucleic Acids

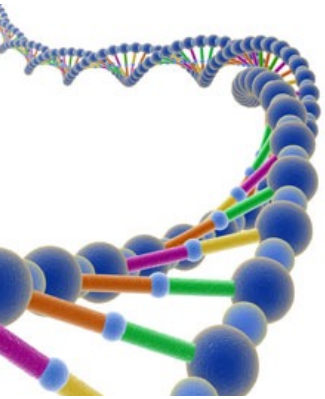
- Two of the bases that appear in nucleic acids are derived from purine.
- Adenine is purine with an amine on carbon #6.
  - Adenine has the one letter symbol A.
- Guanine is purine with an amine on carbon #4 and carbon #6 has been oxidized to make a cyclic amide.
  - Guanine has the one letter symbol G.
- Both of these bases are used in DNA and also RNA.

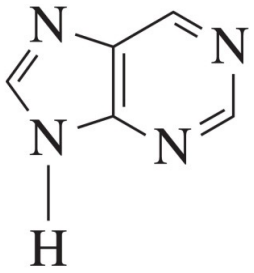
A

G

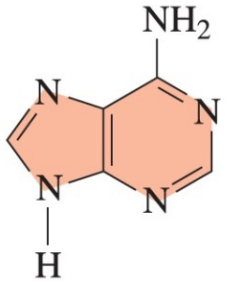


Nucleotide Structure

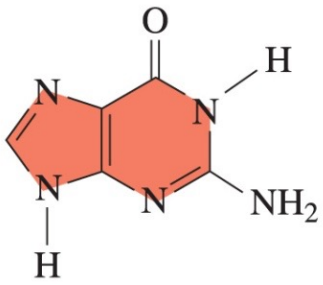




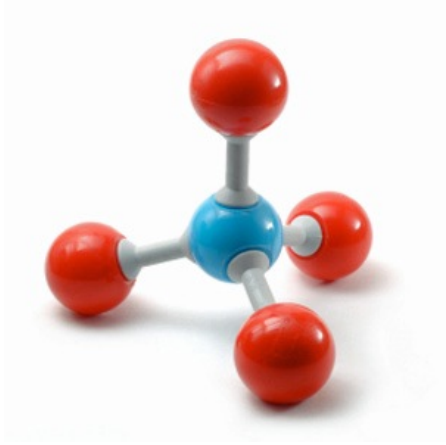
Purine



Adenine (A)
(DNA and RNA)



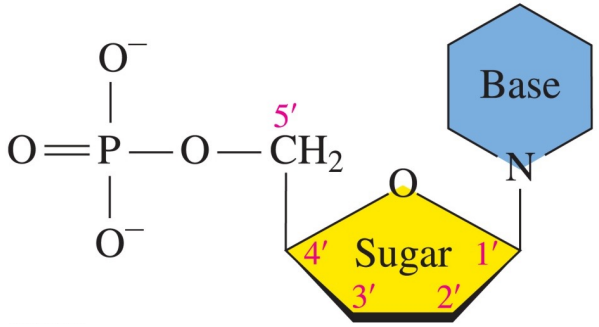
Guanine (G)
(DNA and RNA)



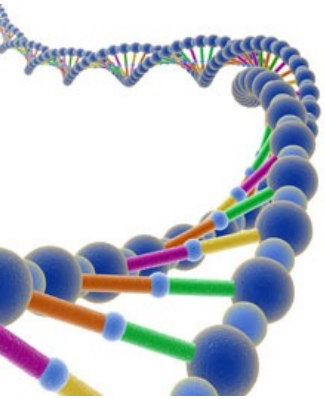
Nucleic Acids

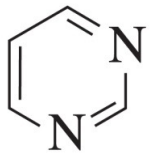
- Cytosine is derived from pyrimidine.
- Cytosine is pyrimidine with an amine on carbon #4 and carbon #2 has been oxidized to make a cyclic amide.
  - Cytosine has the one letter symbol C.
- This base is used in DNA and also RNA.

C

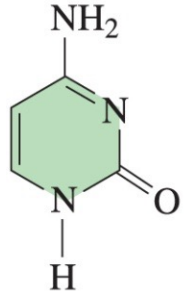


Nucleotide Structure

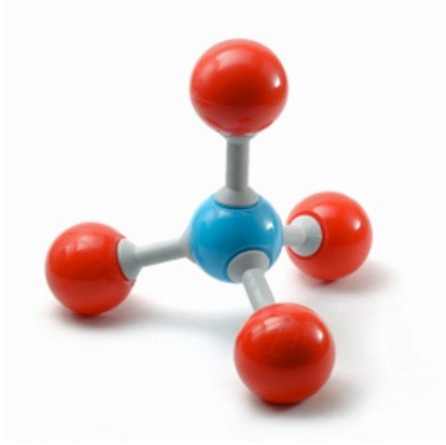




Pyrimidine



Cytosine (C)
(DNA and RNA)

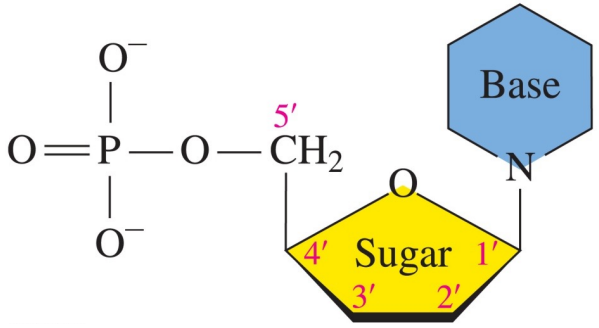


Nucleic Acids

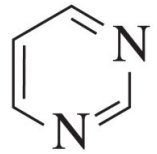
- Thymine & Uracil are both derived from pyrimidine.
- Thymine is pyrimidine where both carbon #2 and #4 have been oxidized to make cyclic amides.
  - And also has a methyl group on carbon #5.
  - Thymine has the symbol T.
  - Thymine is used *only in DNA*.
- Uracil has the same structure as thymine.
  - Except uracil doesn't have the methyl group.
  - Uracil has the symbol U.
  - Uracil is used *only in RNA*.

T

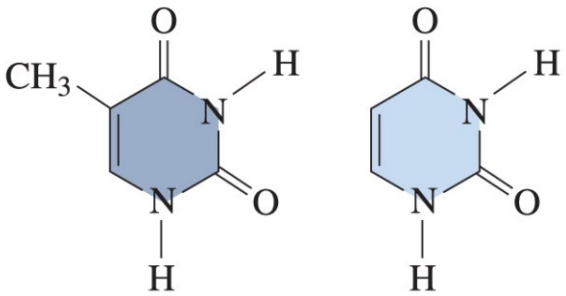
U



Nucleotide Structure

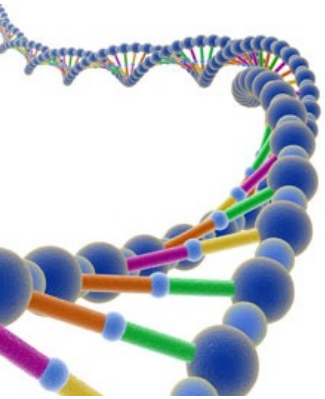


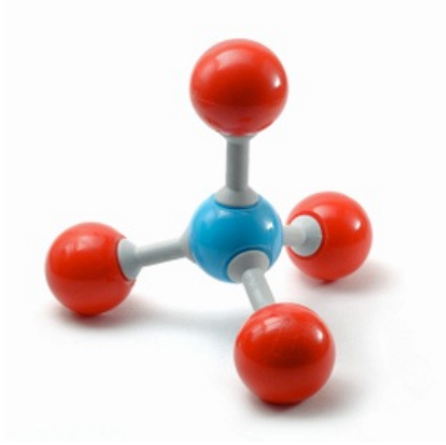
Pyrimidine



Thymine (T)
(DNA only)

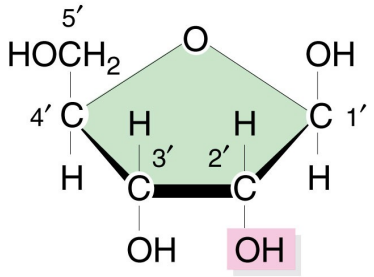
Uracil (U)
(RNA only)





Try it.

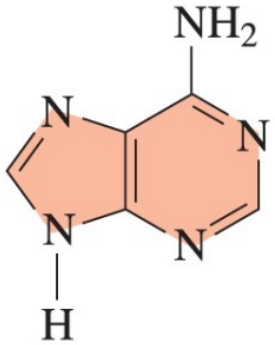
- What is the name of this sugar?
- Does it appear in DNA?



Ribose

Ribose only appears in RNA.

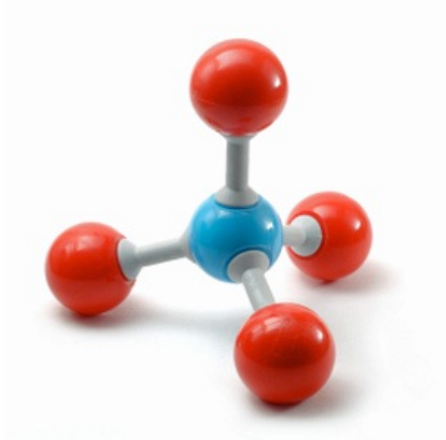
- Is the following base Adenine or Guanine?
- Is it a purine or a pyrimidine?
- Does it appear in DNA?



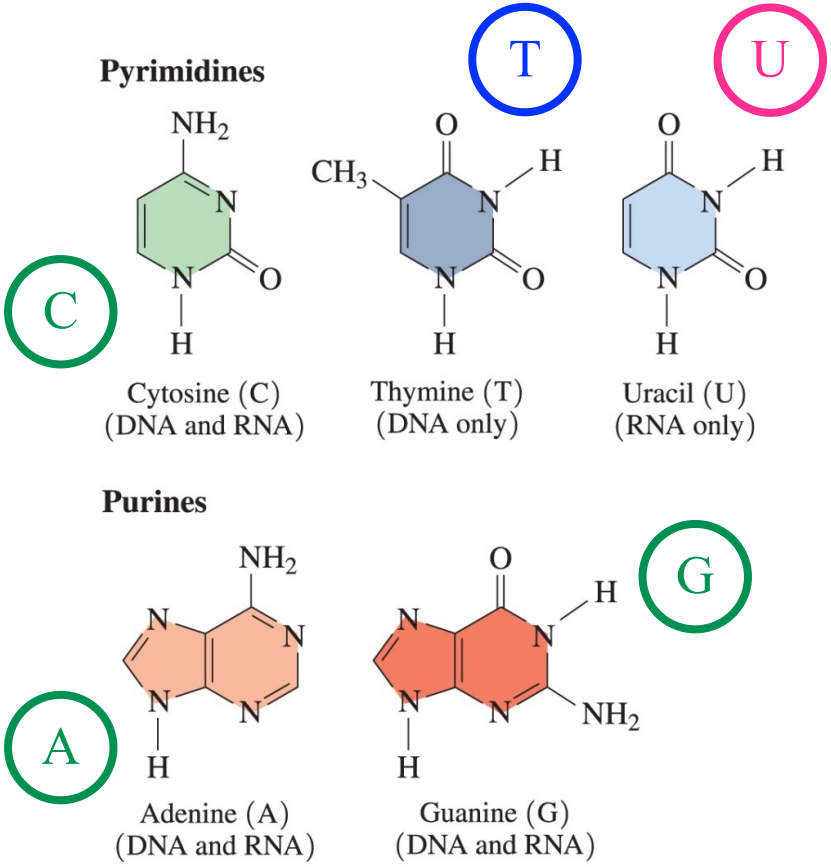
Adenine (A)

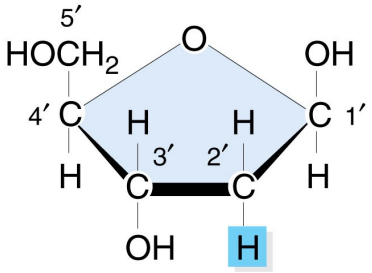
Adenine is a purine.

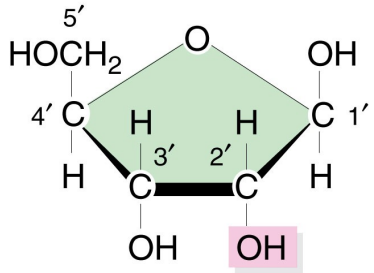
Both pyrimidines appear in RNA and DNA.

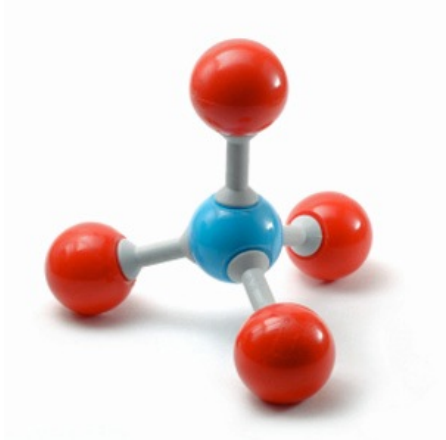


Nucleic Acids



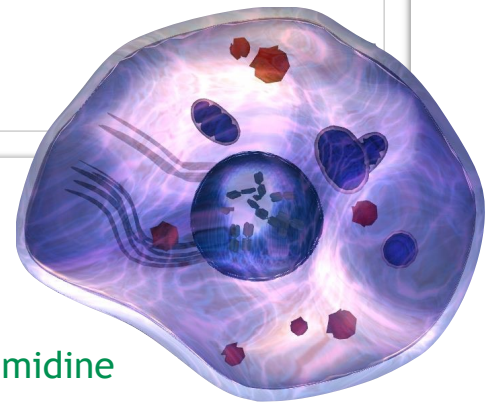




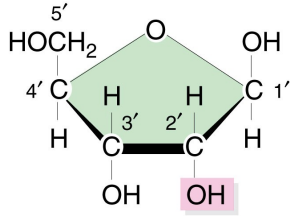


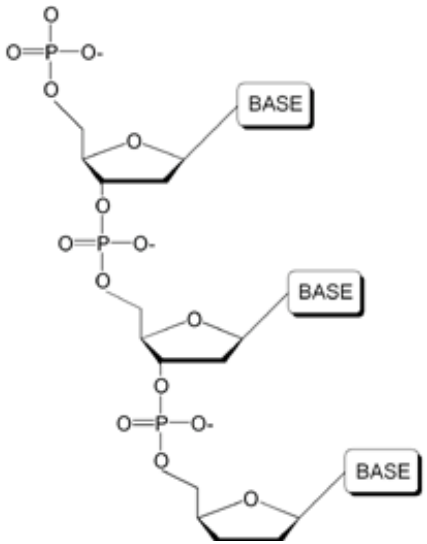
Ch17

Nucleic Acids

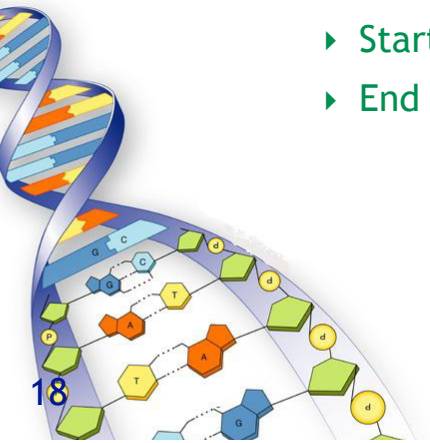


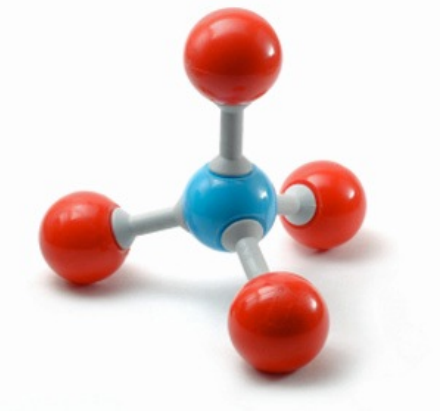
- Nucleic Acids
  - Concept, Function & Size
  - Two flavors, DNA & RNA
- Nucleotides & Nucleosides
  - Structure
  - Composition
    - Sugar
    - Base
  - Naming
- Nucleic Acid Primary Structure
  - Phosphodiester Bond
  - Sequencing
    - Start w/ 5' Phosphate
    - End with 3' Hydroxy



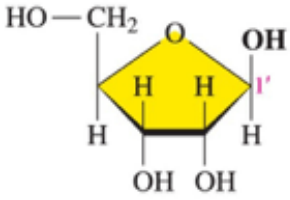


- DNA
  - Ratio of bases
    - # purine = # pyrimidine
  - Complimentary Base pairs
    - AT & GC
      - Hydrogen Bonding
    - Double Helix
    - Complementary Sequence
- DNA Replication
  - Two enzymes:
    - helicase unwinds it
    - polymerase builds it again
  - DNA Fingerprinting

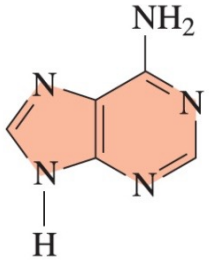




Nucleic Acids



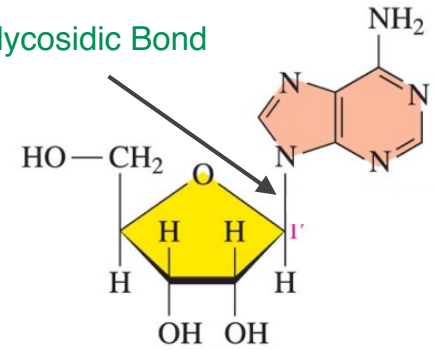
Ribose



Adenine

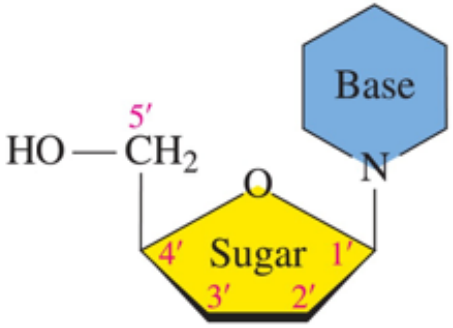
(a purine)

β 1',N Glycosidic Bond



Adenosine

(or Deoxyadenosine)



Nucleoside Structure

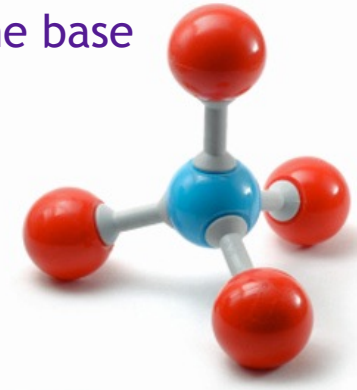
Nucleosides are produced by forming a N-glycosidic bond to from the nitrogen atom of the base to carbon 1 (C1′) of a sugar.

If the sugar is deoxyribose prefix the name with deoxy.

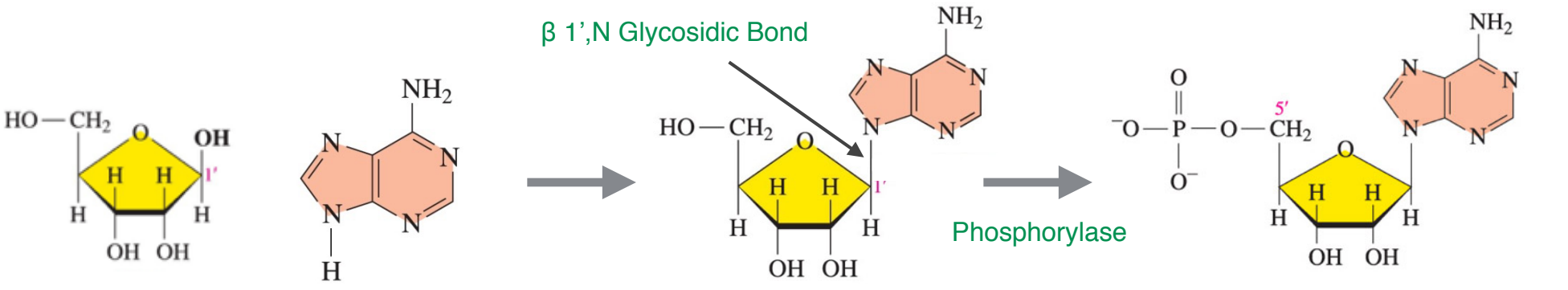
The resulting nucleoside is named by changing the base ending to…

osine for purines

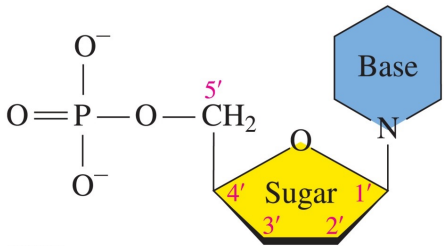
idine for pyrimidines



Nucleic Acids



Ribose | **Adenine** (a purine) | **Adenosine** (or **Deoxyadenosine**) | **Adenosine 5' monophosphate** (or **Deoxyadenosine 5' monophosphate**)

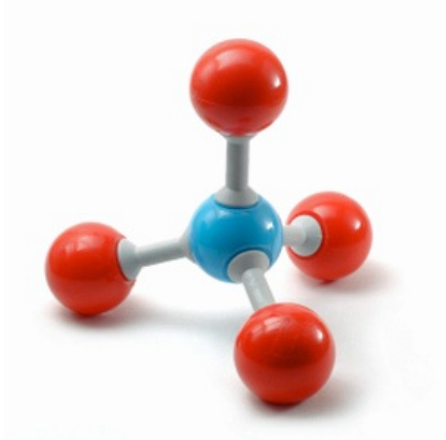


Nucleotide Structure

Nucleotides are produced by forming a ***single phosphoester*** at carbon 5 (C5′) of a nucleoside.

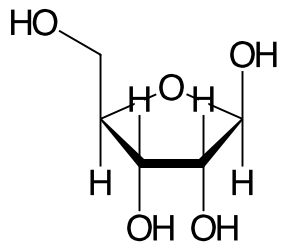
The resulting nucleotide is named by adding to the end of nucleoside name…

5' ***monophosphate***

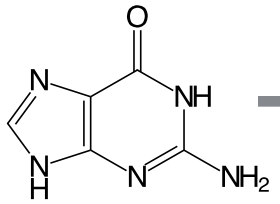


Try it.

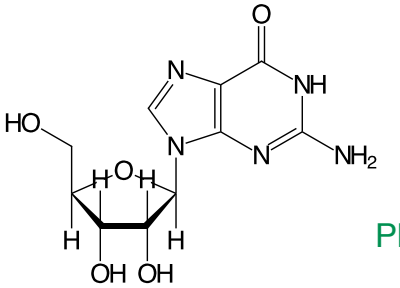
- Name the following substances.



Ribose

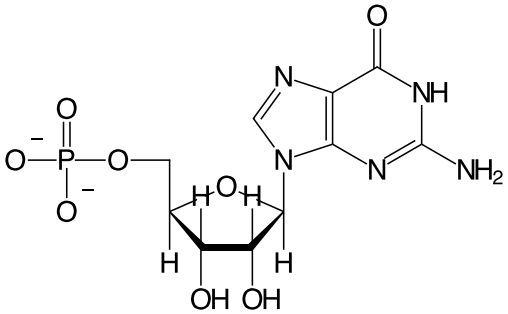


Guanine
(a purine)

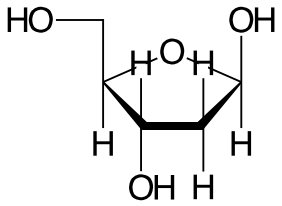


Guanosine

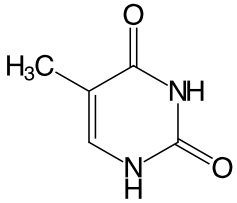
Phosphorylase



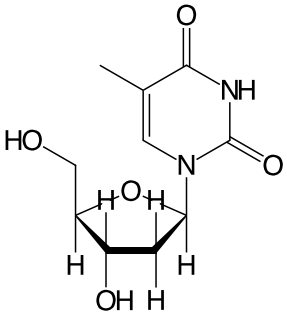
Guanosine 5' monophosphate



Deoxyribose

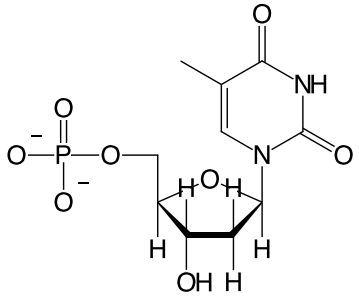


Thymine
(a pyrimidine)

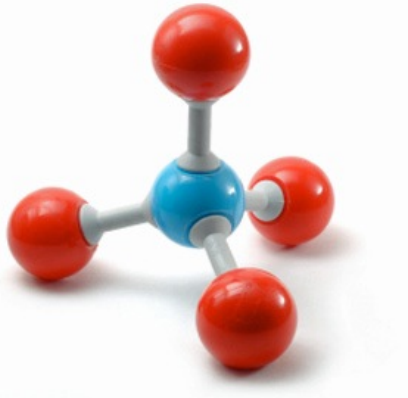


Deoxythymidine

Phosphorylase



Deoxythymidine 5' monophosphate

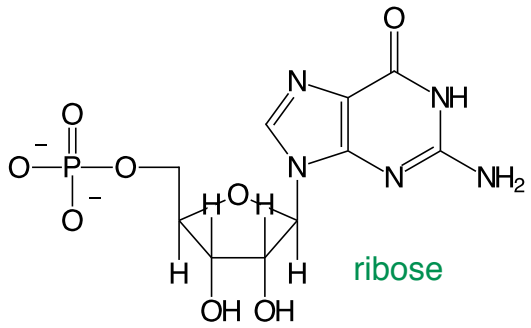


Nucleic Acids

- One letter codes are used to identify nucleosides (it's the same as their base).
- Three letter codes are used to identify nucleotides.
- The nucleotide code is the one letter symbol for it's base.
  - Add to the end of that MP (for monophosphate)
  - Prefix is with a lower case d, only if the sugar is deoxyribose.

- Example:

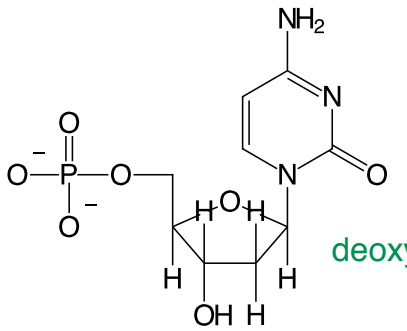
guanine (a purine)



Guanosine 5' monophosphate

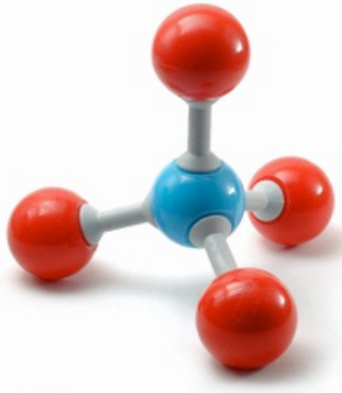
GMP

cytosine (a pyrimidine)



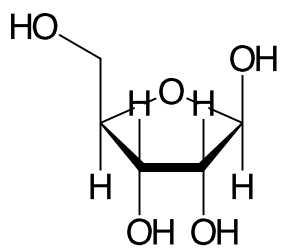
Deoxycytoidine 5' monophosphate

dCMP

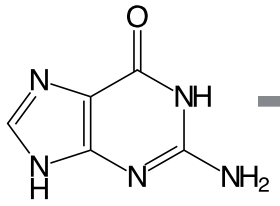


Try it.

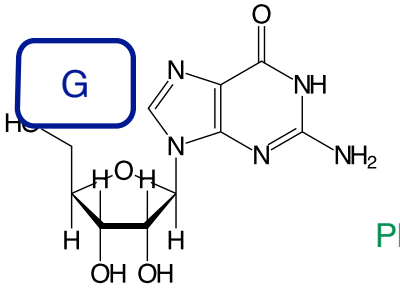
- What is the code (symbol) of each nucleoside and nucleotide?



Ribose

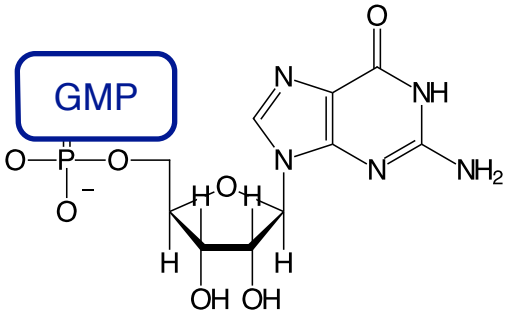


Guanine
(a purine)

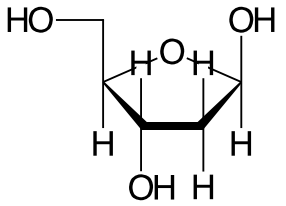


Guanosine

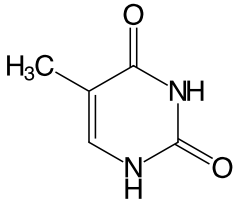
Phosphorylase



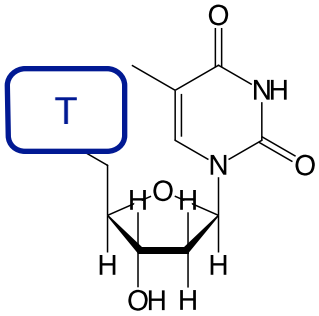
Guanosine 5' monophosphate



Deoxyribose

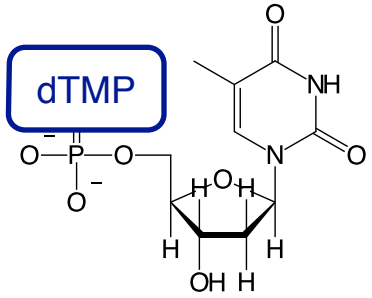


Thymine
(a pyrimidine)

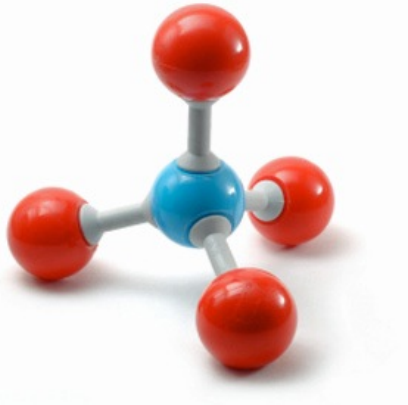


Deoxythymidine

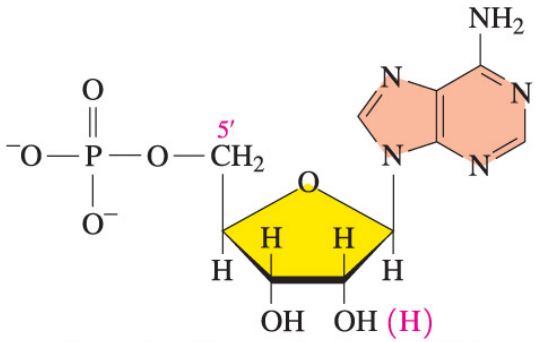
Phosphorylase



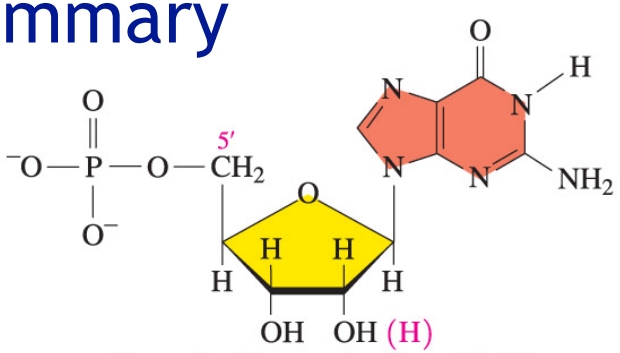
Deoxythymidine 5' monophosphate



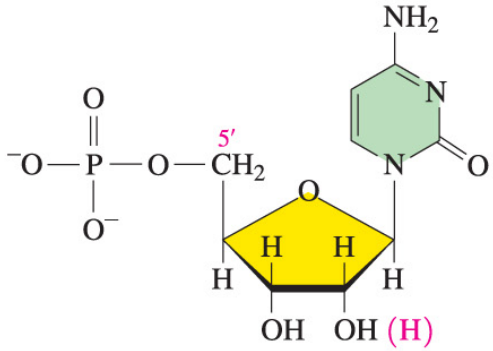
Summary



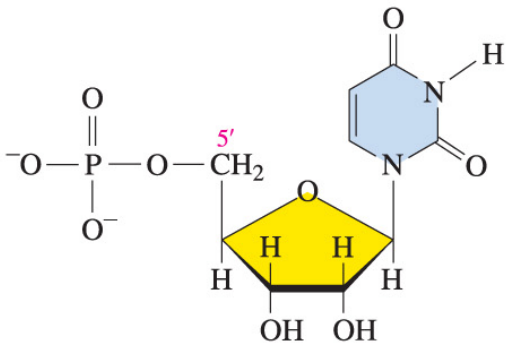
Adenosine-5′-monophosphate (AMP)
Deoxyadenosine-5′-monophosphate (dAMP)



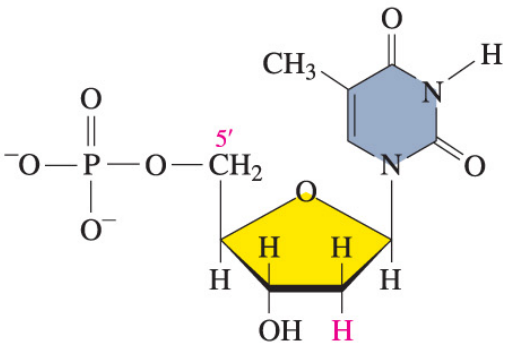
Guanosine-5′-monophosphate (GMP)
Deoxyguanosine-5′-monophosphate (dGMP)



Cytidine-5′-monophosphate (CMP)
Deoxycytidine-5′-monophosphate (dCMP)

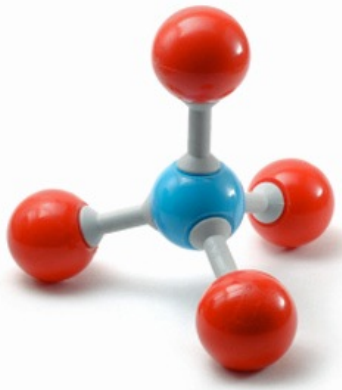


Uridine-5′-monophosphate (UMP)



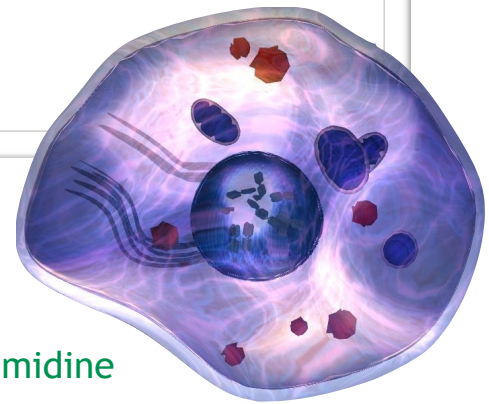
Deoxythymidine-5′-monophosphate (dTMP)

Base	Nucleoside	Nucleotide
DNA		
Adenine (A)	Deoxyadenosine (A)	Deoxyadenosine-5′-monophosphate (dAMP)
Guanine (G)	Deoxyguanosine (G)	Deoxyguanosine-5′-monophosphate (dGMP)
Cytosine (C)	Deoxycytidine (C)	Deoxycytidine-5′-monophosphate (dCMP)
Thymine (T)	Deoxythymidine (T)	Deoxythymidine-5′-monophosphate (dTMP)
RNA		
Adenine (A)	Adenosine (A)	Adenosine-5′-monophosphate (AMP)
Guanine (G)	Guanosine (G)	Guanosine-5′-monophosphate (GMP)
Cytosine (C)	Cytidine (C)	Cytidine-5′-monophosphate (CMP)
Uracil (U)	Uridine (U)	Uridine-5′-monophosphate (UMP)

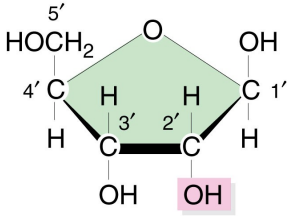


Ch17

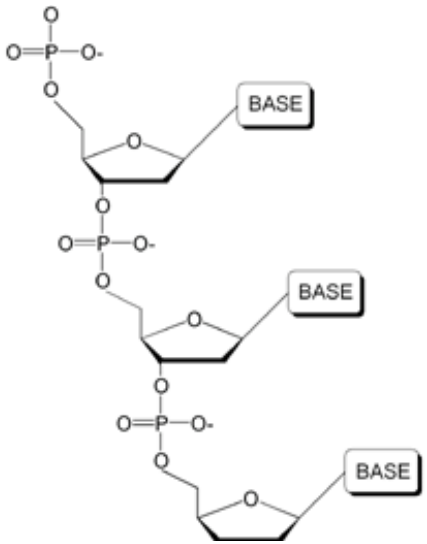
Nucleic Acids



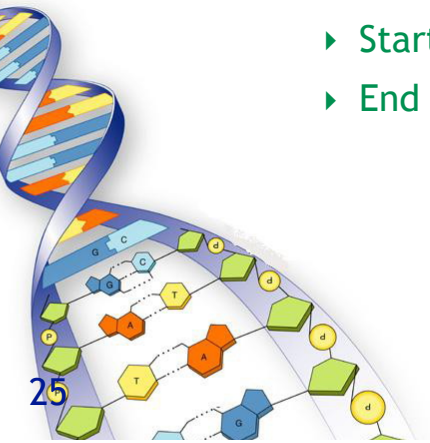
- Nucleic Acids
  - Concept, Function & Size
  - Two flavors, DNA & RNA
- Nucleotides & Nucleosides
  - Structure
  - Composition
    - Sugar
    - Base
  - Naming

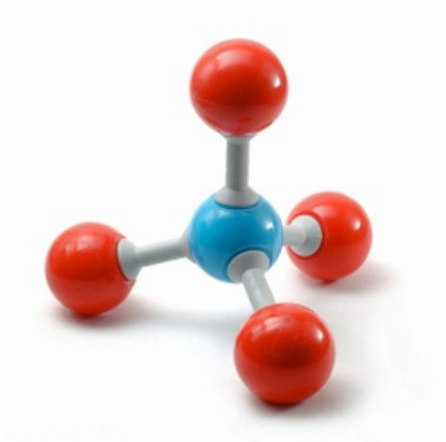


- Nucleic Acid Primary Structure
  - Phosphodiester Bond
  - Sequencing
    - Start w/ 5’ Phosphate
    - End with 3’ Hydroxy



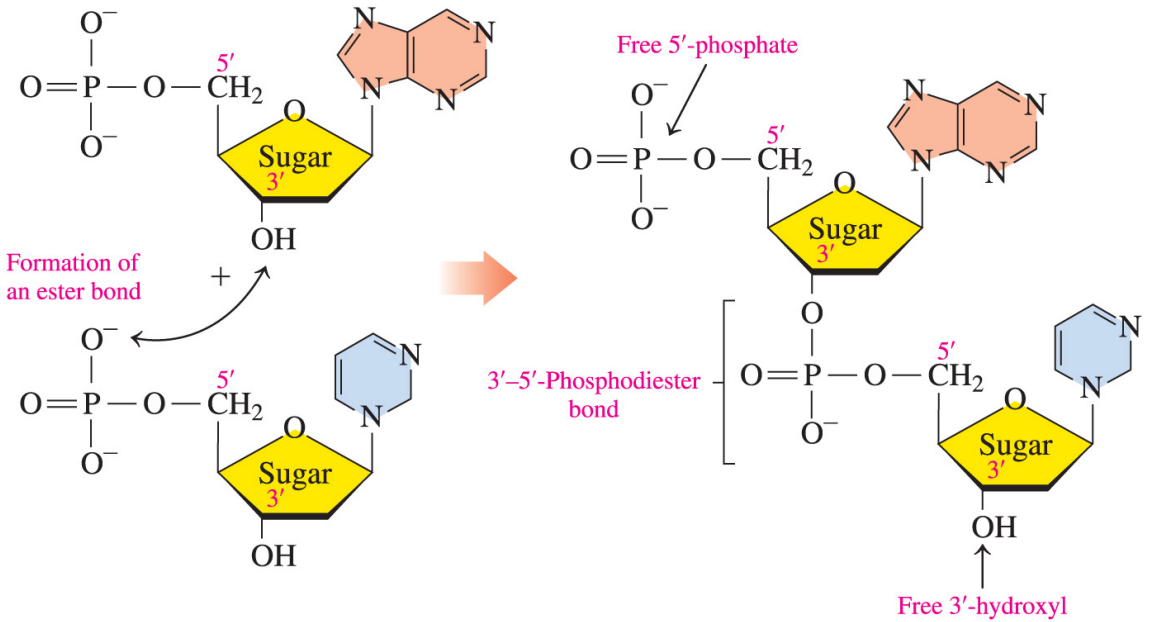
- DNA
  - Ratio of bases
    - # purine = # pyrimidine
  - Complimentary Base pairs
    - AT & GC
      - Hydrogen Bonding
    - Double Helix
    - Complementary Sequence
- DNA Replication
  - Two enzymes:
    - helicase unwinds it
    - polymerase builds it again
  - DNA Fingerprinting

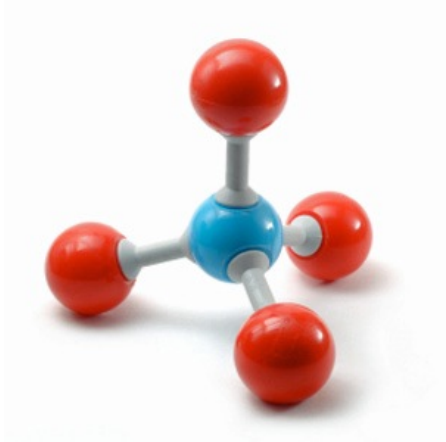




Nucleic Acids

- Nucleic Acids are polymers of many nucleotides.
- The 3′-hydroxyl group of the sugar in one nucleotide bonds to the phosphate group on the 5′-carbon atom in the sugar of the next nucleotide.
- The link between the sugars in adjacent nucleotides is a phosphodiester bond.
- They have one terminal end with an unreacted (free) sugar with a 5′-phosphate and a sugar at the other end with a free 3′-hydroxyl group.

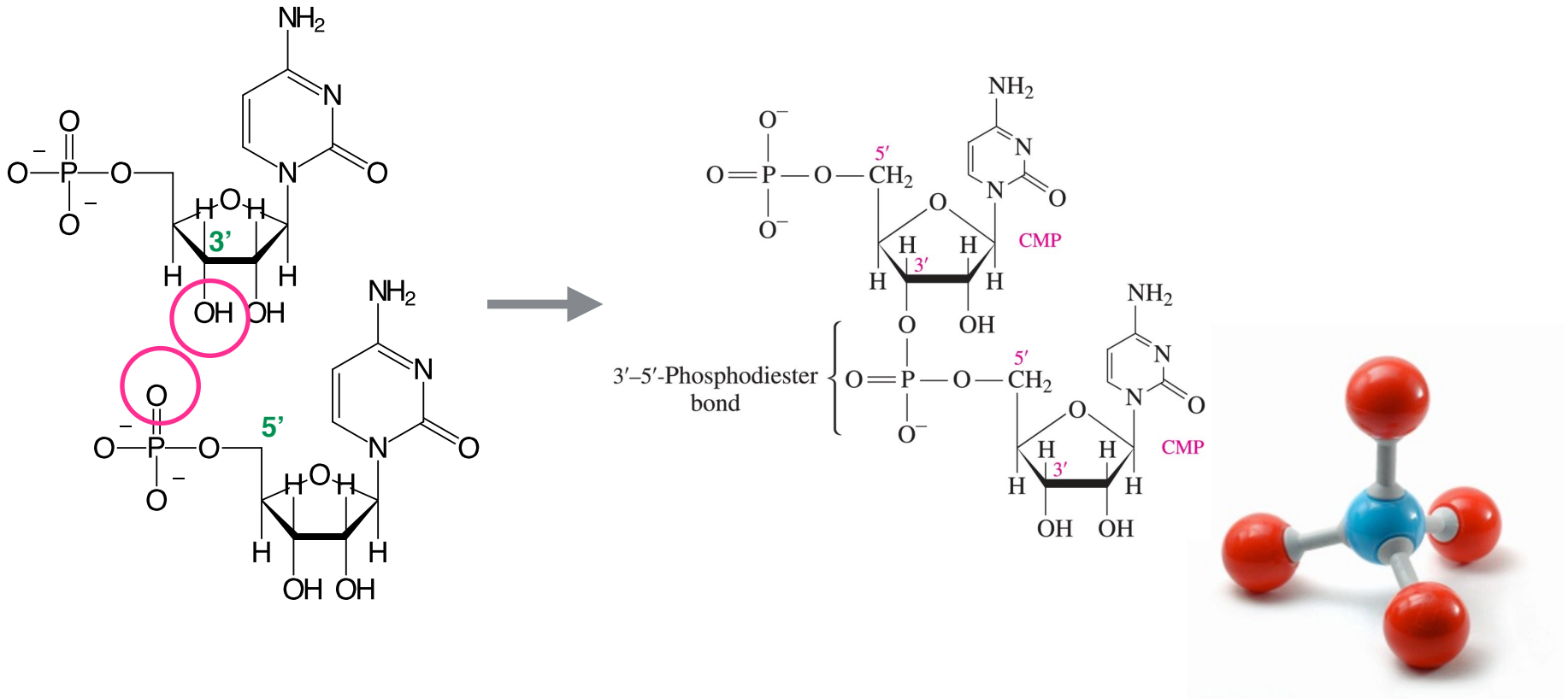




Try it.

Draw the condensed structural formula for the RNA dinucleotide formed by two cytidine-5′-monophosphates.

The dinucleotide is drawn by connecting the **3′-hydroxyl** group on the first cytidine-5′monophosphate with the **5′-phosphate** group on the second.



Nucleic Acids

- The primary structure of a nucleic acid is the sequence of bases in the string.
- The sequence is written using the one letter base codes.
- The sequence
  - STARTS with the free 5’ phosphate
  - ENDS with the 3’ hydroxy.

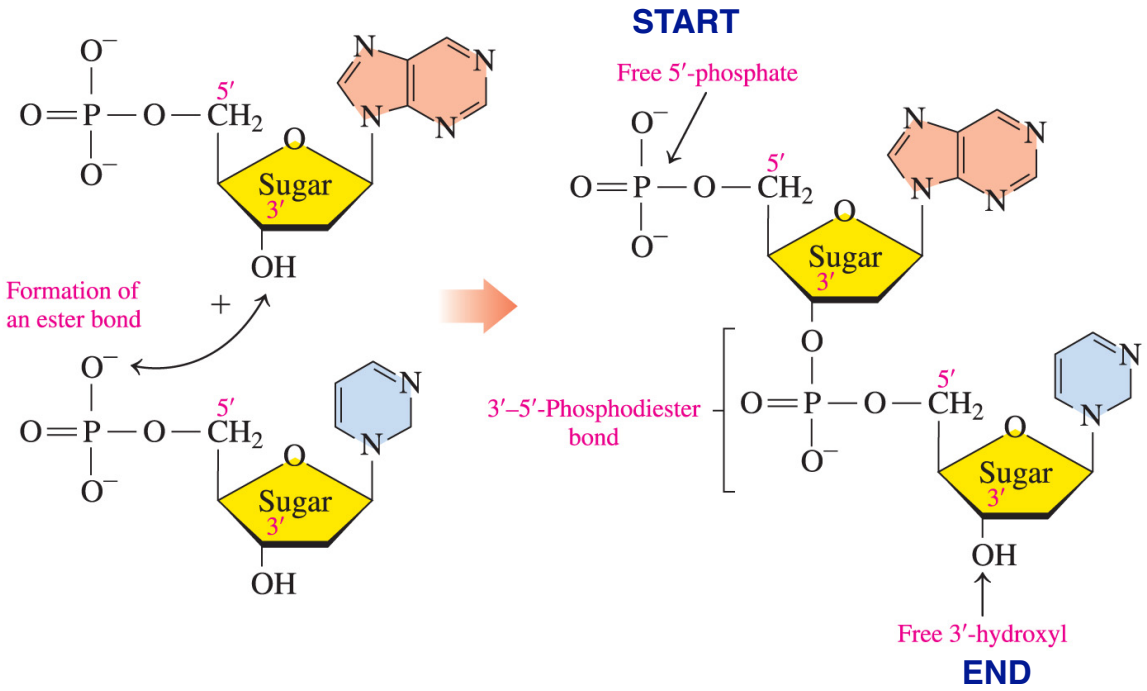
A Adenine

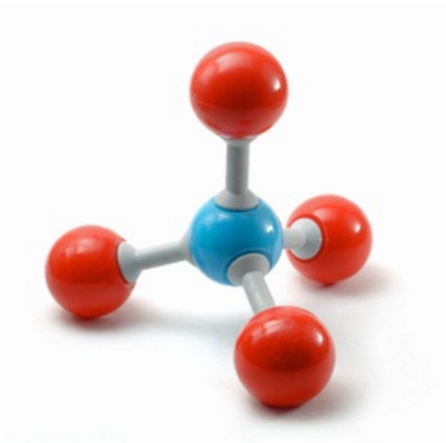
C Cytosine

T Thymine

G Guanine

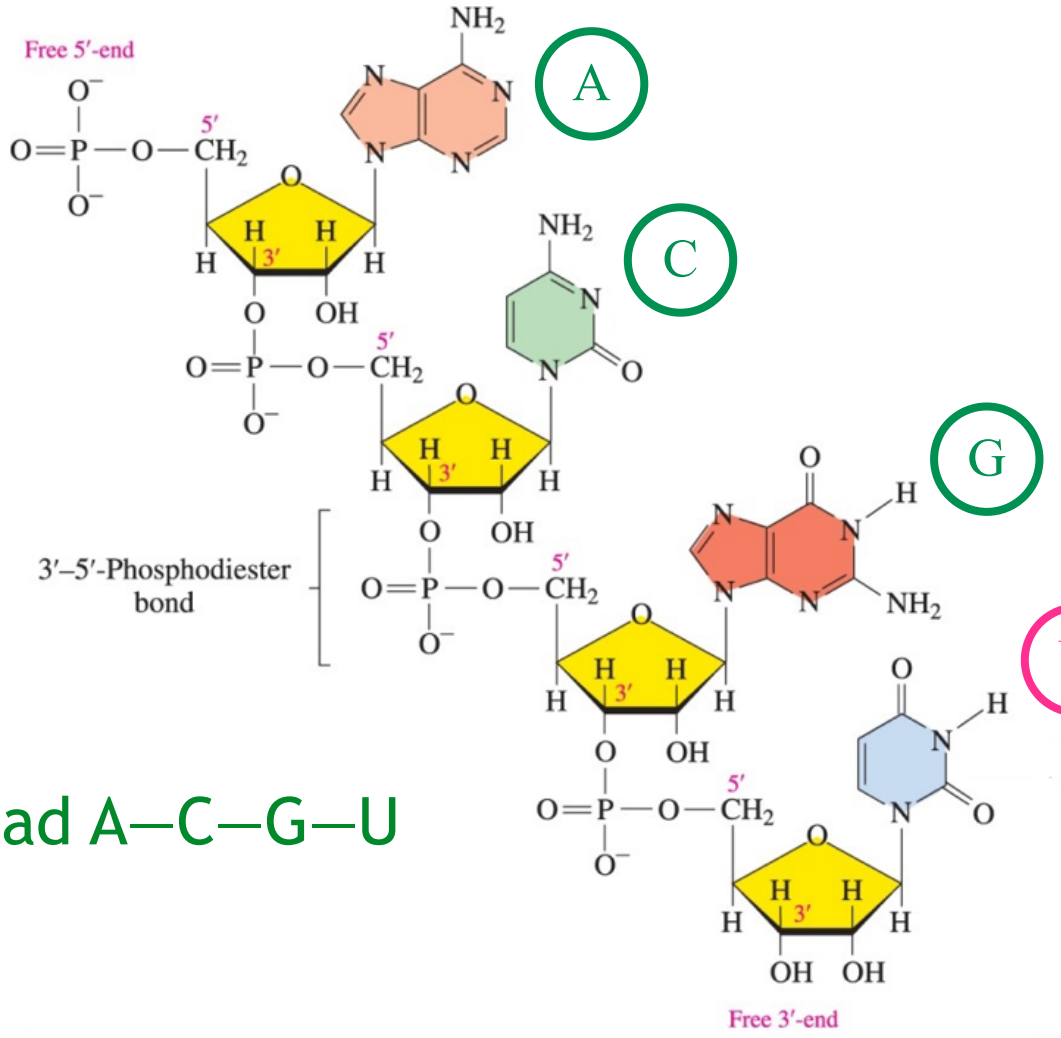
U Uracil



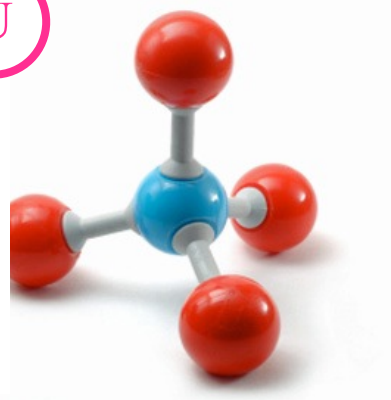


Nucleic Acids

- Each nucleic acid has its own unique sequence of bases that carries the genetic information from one cell to the next.

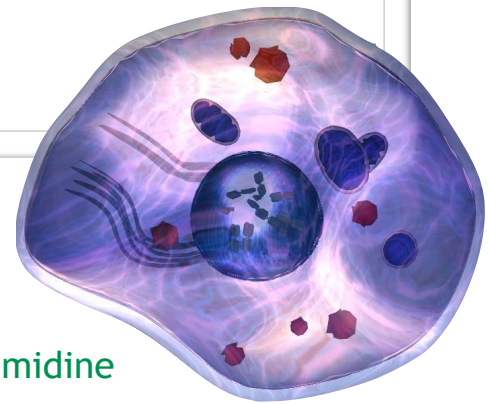


This string is read A—C—G—U

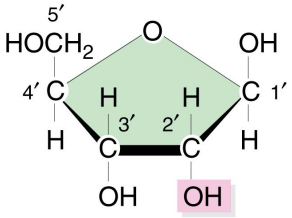


Ch17

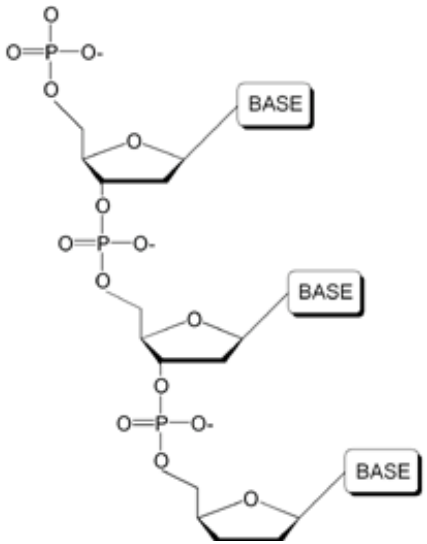
Nucleic Acids



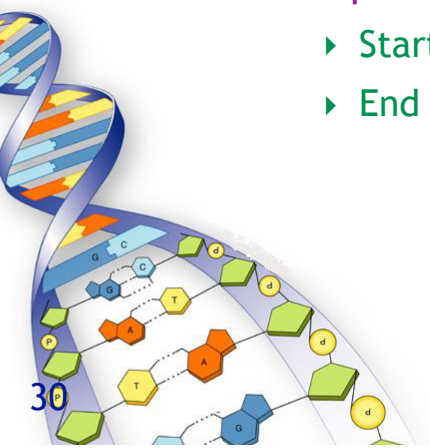
- Nucleic Acids
  - Concept, Function & Size
  - Two flavors, DNA & RNA
- Nucleotides & Nucleosides
  - Structure
  - Composition
    - Sugar
    - Base
  - Naming

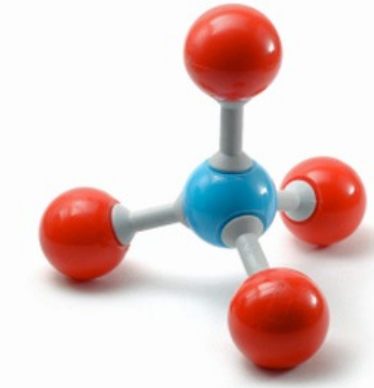


- Nucleic Acid Primary Structure
  - Phosphodiester Bond
  - Sequencing
    - Start w/ 5’ Phosphate
    - End with 3’ Hydroxy



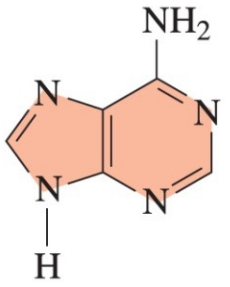
- DNA
  - Ratio of bases
    - # purine = # pyrimidine
  - Complimentary Base pairs
    - AT & GC
      - Hydrogen Bonding
    - Double Helix
    - Complementary Sequence
- DNA Replication
  - Two enzymes:
    - helicase unwinds it
    - polymerase builds it again
  - DNA Fingerprinting



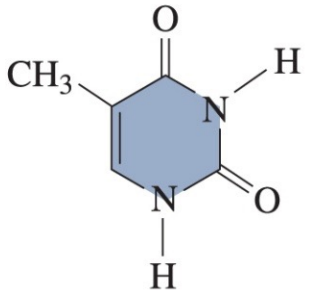


DNA Base Pairs

- During the 1940s, biologists determined that the bases in DNA had a consistent ratio:
  - the amount of adenine (A) was always equal to the amount of thymine (T)

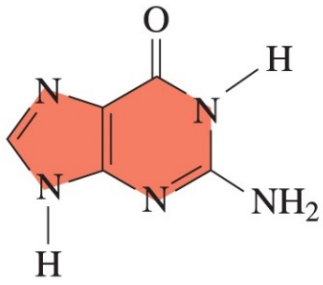


Adenine (A)

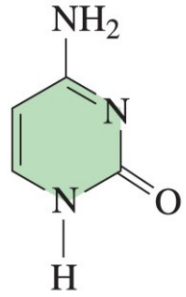


Thymine (T)

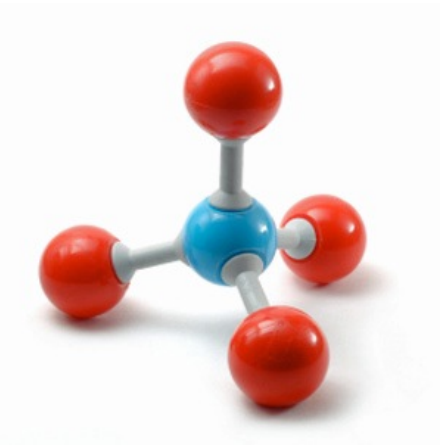
  - the amount of guanine (G) was always equal to the amount of cytosine (C)



Guanine (G)

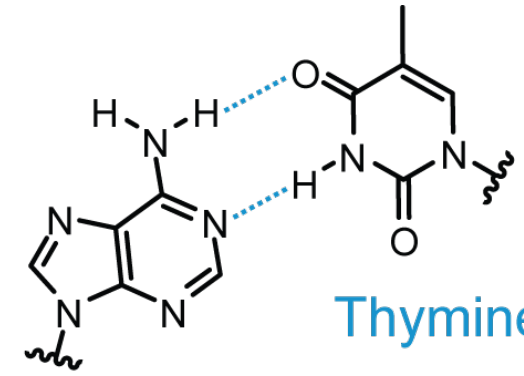


Cytosine (C)

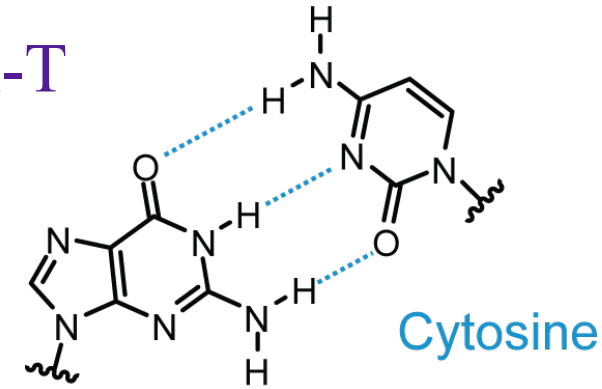


Number of purine bases = Number of pyrimidine bases

DNA Base Pairs

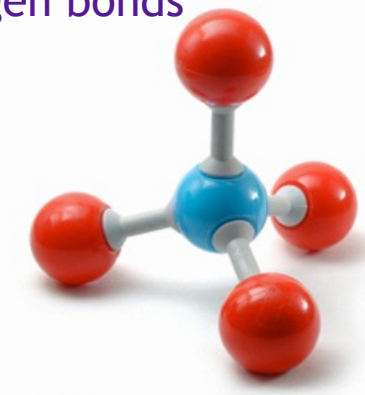


A-T



G-C

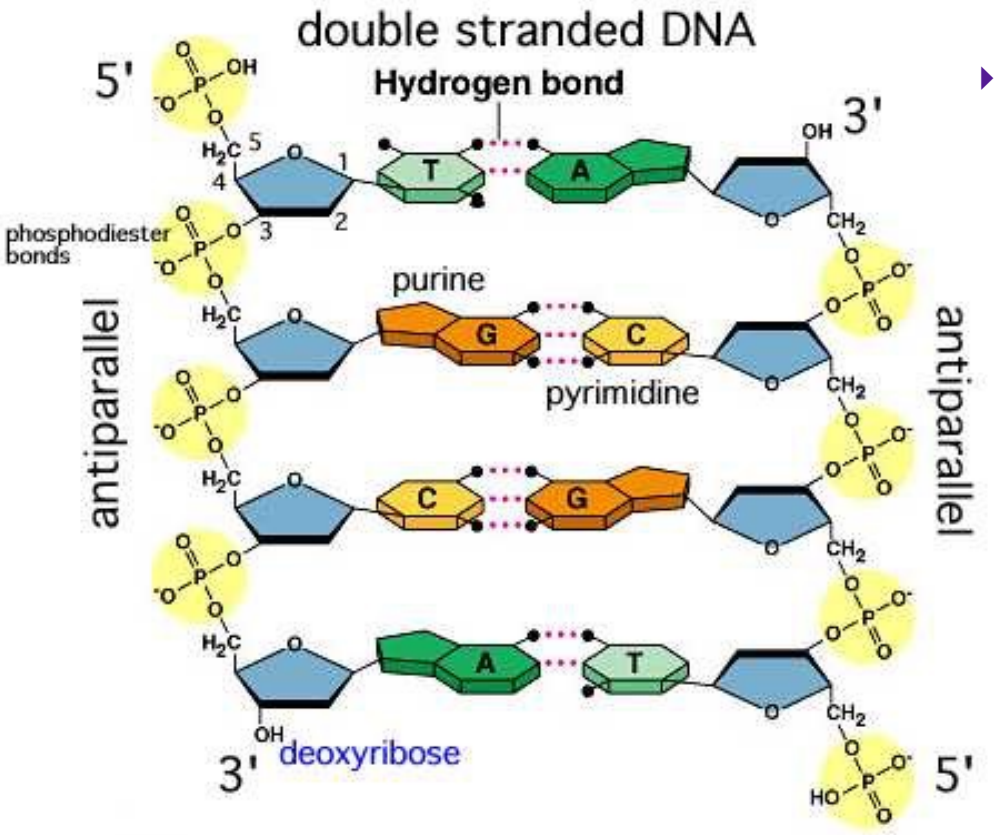
- They hypothesized there was some kind of complimentary interaction between the the two pairs of bases:
  - Adenine with Thymine
  - Guanine with Cytosine
- Looking at the molecular structure of the pairs, a pattern of hydrogen bonding explains the pairing.
- Scientists subsequently confirmed that adenine is always paired with thymine, and guanine is always paired with cytosine.
- DNA is a dimer. Two nucleic acid polymers linked by hydrogen bonds between base pairs.



Number of purine bases = Number of pyrimidine bases

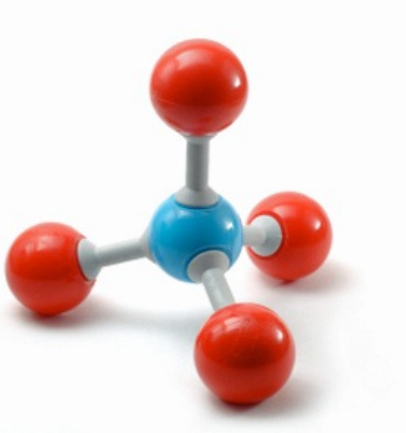
DNA Base Pairs

A-T



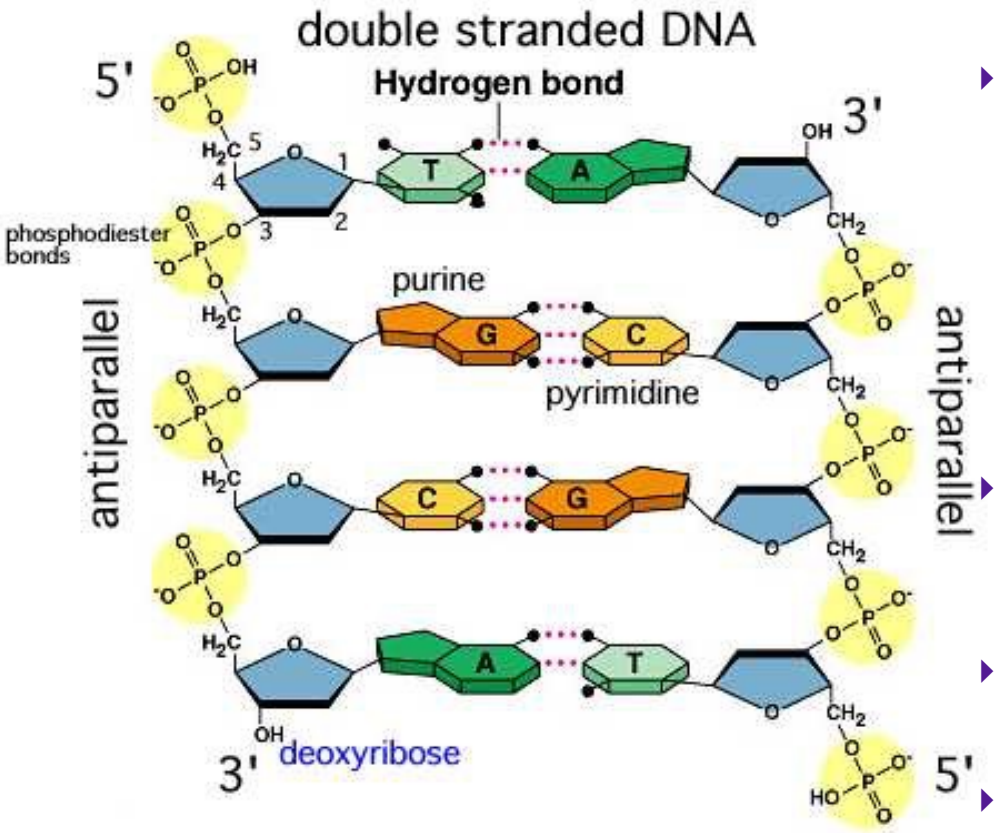
G-C

- DNA is a dimer. Two nucleic acid polymers linked by hydrogen bonds between base pairs.
- DNA contains complementary base pairs, equal amounts of A and T and equal amounts of G and C bases in which
  - Adenine is linked only to Thymine (by two hydrogen bonds)
  - Guanine is linked only to Cytosine (by three hydrogen bonds)



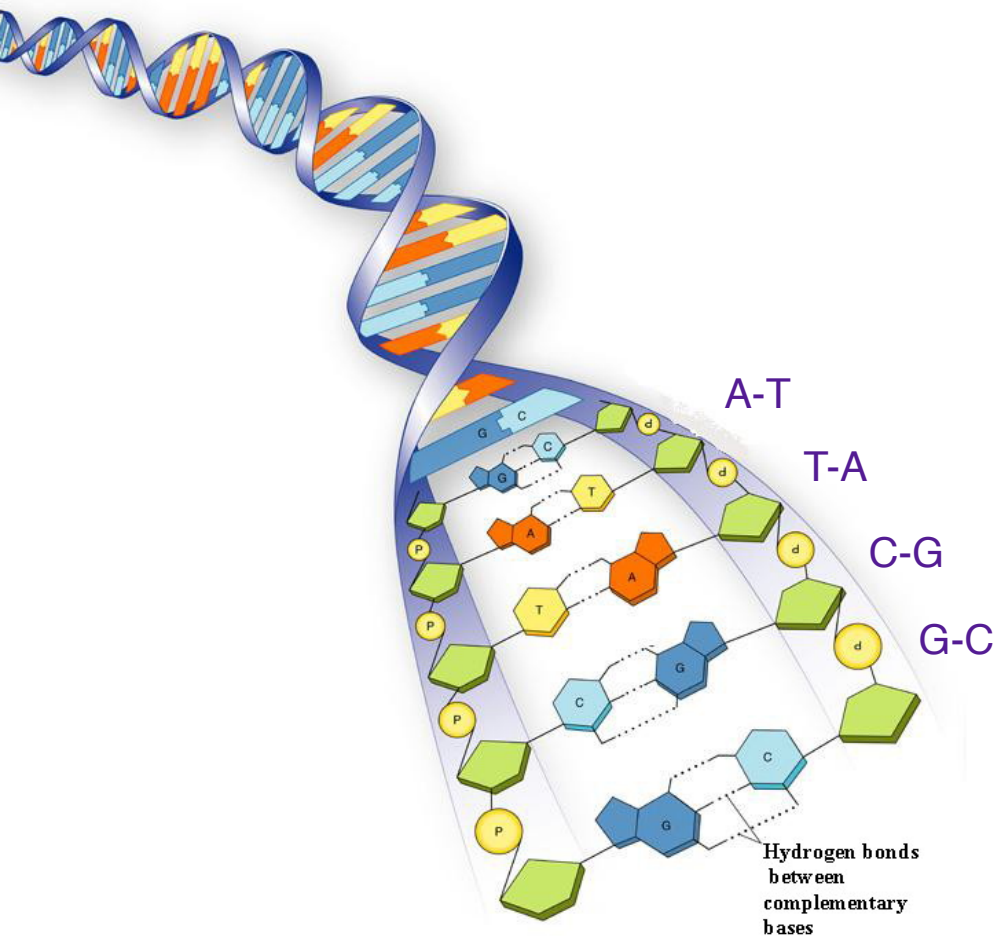
Number of purine bases = Number of pyrimidine bases

DNA Base Pairs



- DNA is a dimer. Two nucleic acid polymers linked by hydrogen bonds between base pairs.
- DNA contains complementary base pairs, equal amounts of A and T and equal amounts of G and C bases in which
  - Adenine is linked only to Thymine (by two hydrogen bonds)
  - Guanine is linked only to Cytosine (by three hydrogen bonds)
- The human genome DNA contains about 3 billion base pairs (about 204 billion atoms).
- Composed into two impossibly long ropes.
- These ropes coil around each other to produce a double helix secondary structure.

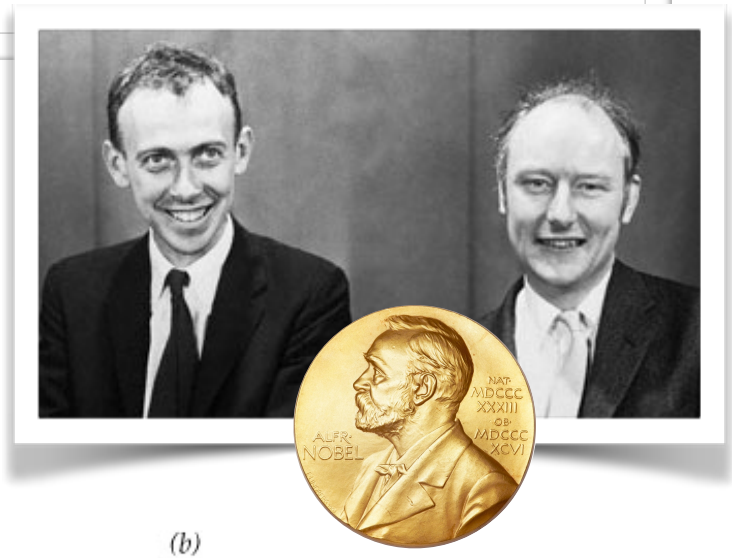
DNA Base Pairs



- DNA is a dimer. Two nucleic acid polymers linked by hydrogen bonds between base pairs.
- DNA contains complementary base pairs, equal amounts of A and T and equal amounts of G and C bases in which
  - Adenine is linked only to Thymine (by two hydrogen bonds)
  - Guanine is linked only to Cytosine (by three hydrogen bonds)
- The human genome DNA contains about 3 billion base pairs (about 204 billion atoms).
- Composed into two impossibly long ropes.
- These ropes coil around each other to produce a double helix secondary structure.

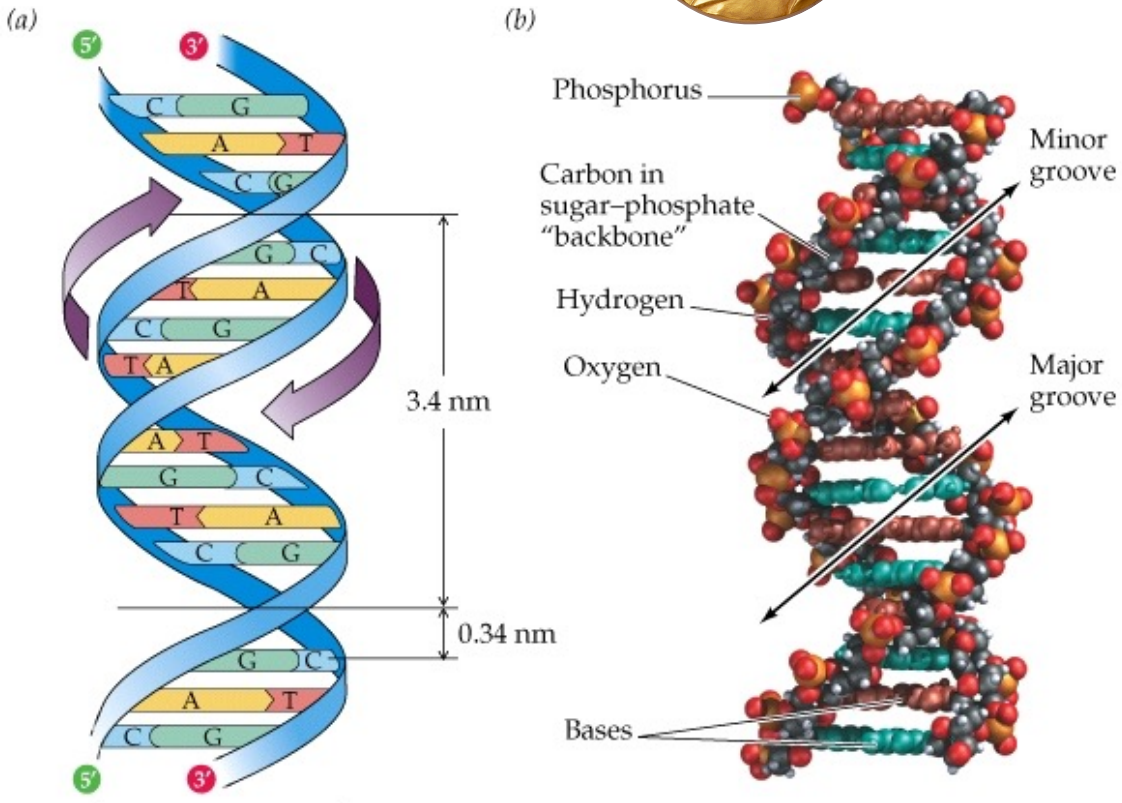
James Watson and Francis Crick

The double helix structure was proposed in 1953 by James Watson and Francis Crick.



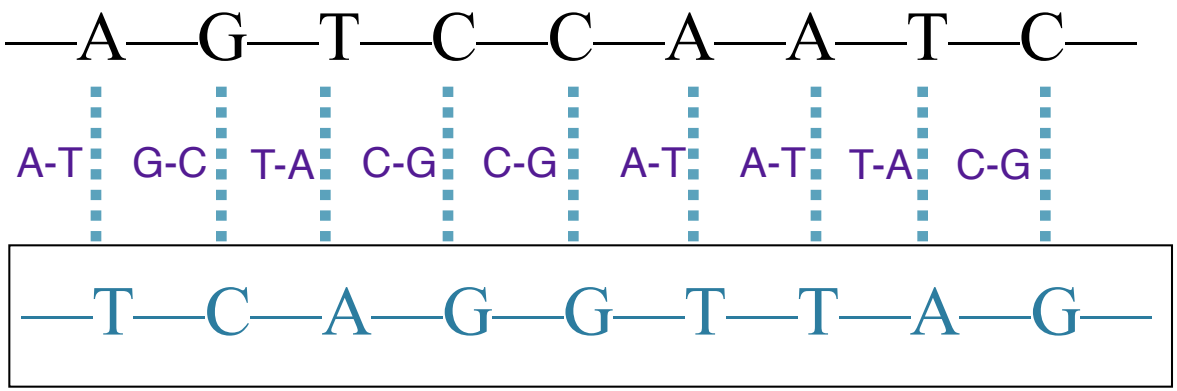
Key points:

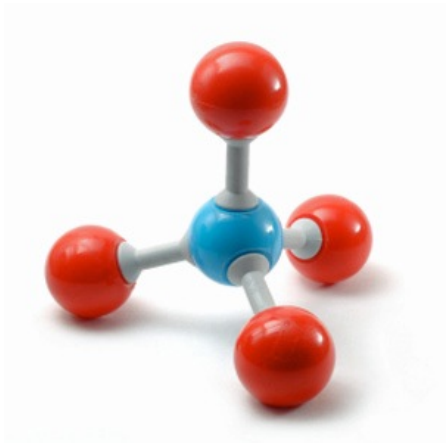
- consists of two polynucleotide strands winding about each other like a spiral staircase
- contains sugar–phosphate backbones analogous to outside stair railings with the bases arranged like steps along the inside
- has one strand that goes from the 5′ to 3′ direction next to a second strand that goes from the 3′ to 5′ direction



Try it.

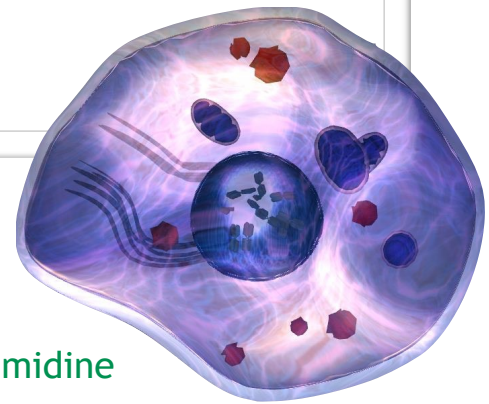
- If you had a single strand of DNA with the following sequence, what would the other half look like? What would be the complimentary sequence?



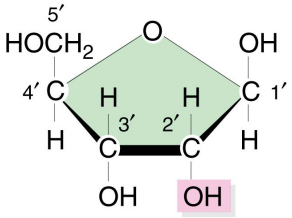


Ch17

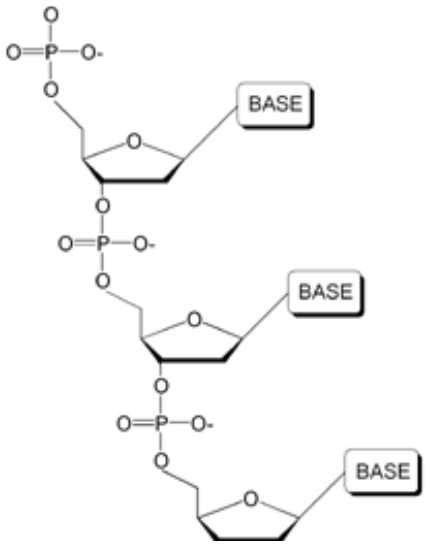
Nucleic Acids



- Nucleic Acids
  - Concept, Function & Size
  - Two flavors, DNA & RNA
- Nucleotides & Nucleosides
  - Structure
  - Composition
    - Sugar
    - Base
  - Naming



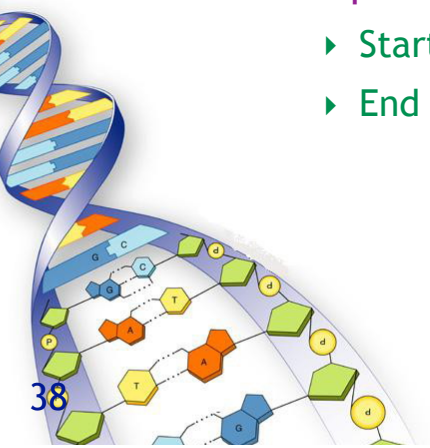
- Nucleic Acid Primary Structure
  - Phosphodiester Bond
  - Sequencing
    - Start w/ 5’ Phosphate
    - End with 3’ Hydroxy

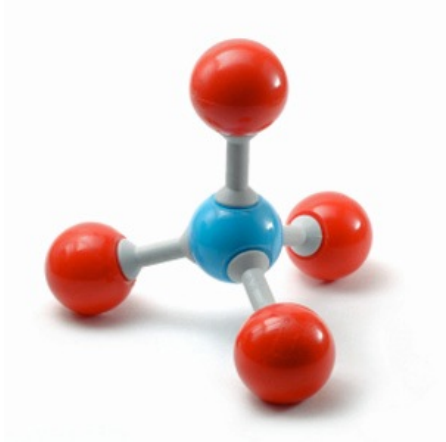


- DNA
  - Ratio of bases
    - # purine = # pyrimidine
  - Complimentary Base pairs
    - AT & GC
      - Hydrogen Bonding
    - Double Helix
    - Complementary Sequence

DNA Replication

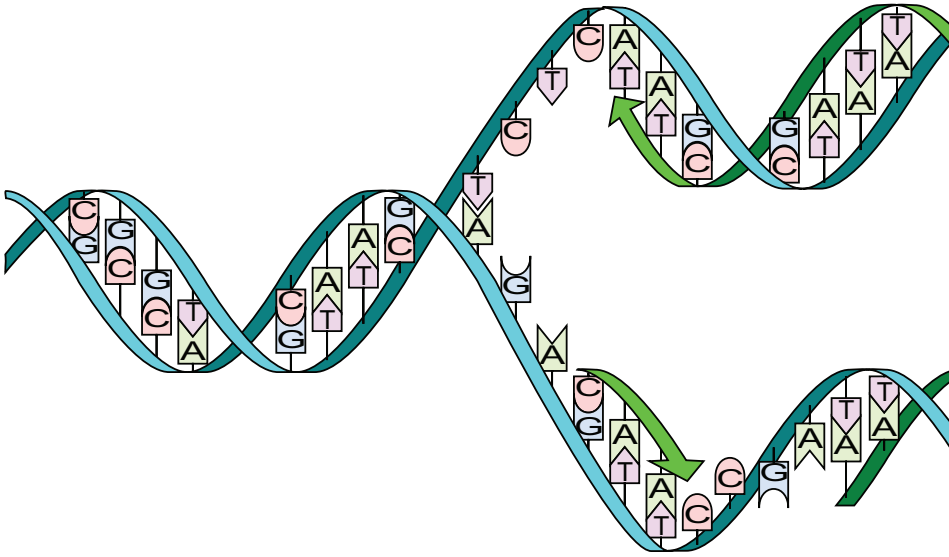
- Two enzymes:
  - helicase unwinds it
  - polymerase builds it again
- DNA Fingerprinting

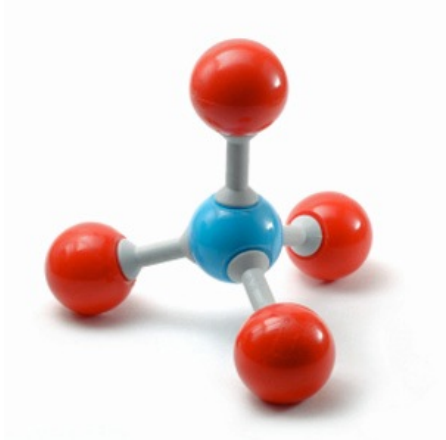




DNA Replication

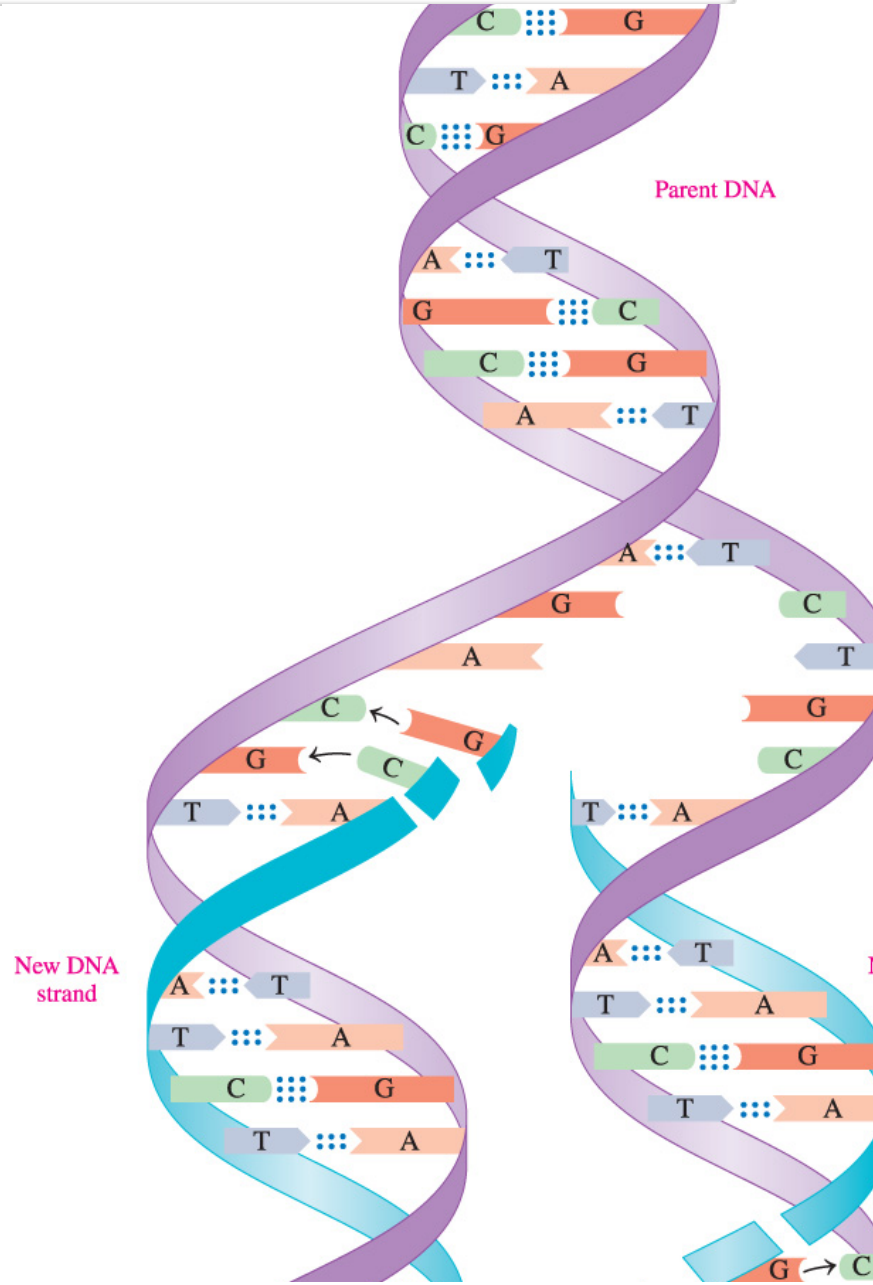
- The job of DNA is to preserve genetic information.
- The blue prints of every protein in your body is saved as AT, GC patterns woven into the DNA strand.
- To keep that information safe, the body makes backups. Lots of backups.
- Every time your cells divide, a copy of your DNA goes with each cell.
- Replication is the process of copying DNA.
- Because each strand of DNA complements the other strand, the information encoded into it exists it both halves.
- DNA replication involves splitting the DNA into separate strands, and using each strand as a template to build an exact copy of the original.





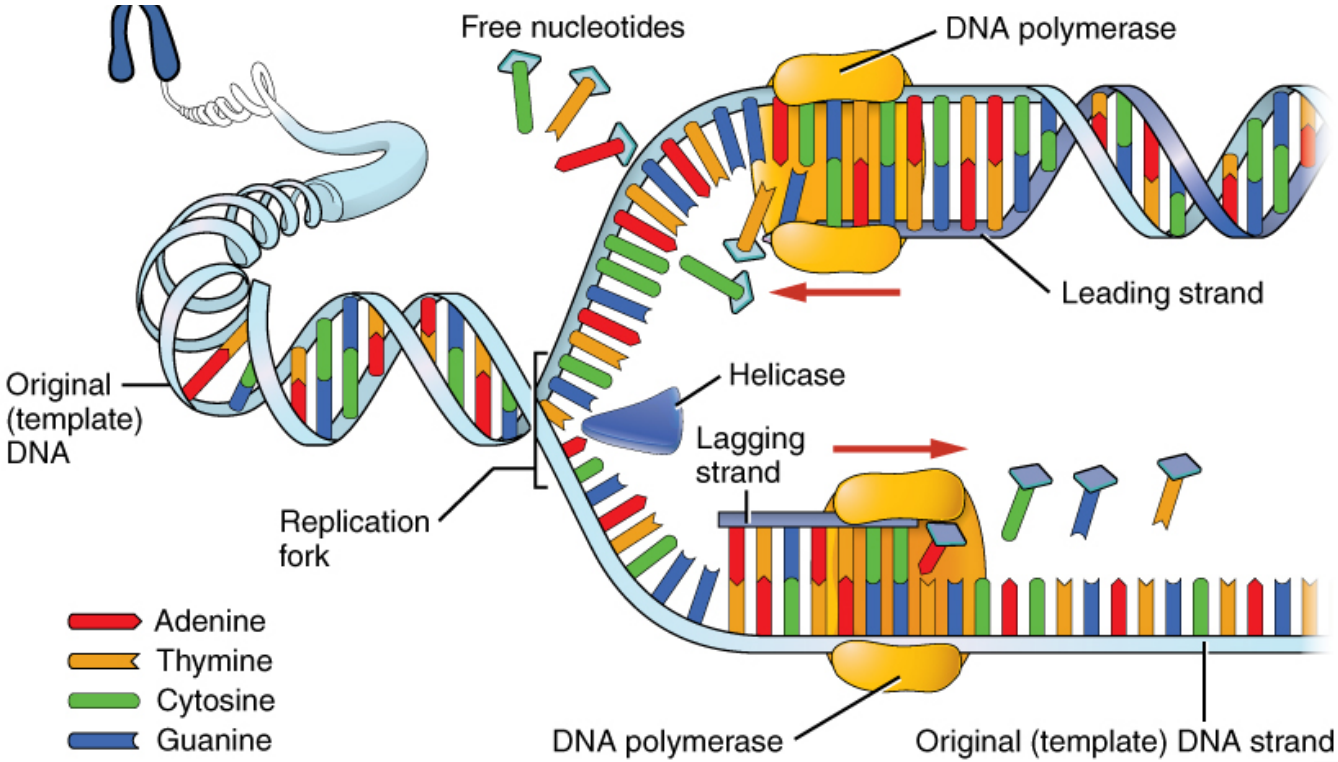
DNA Replication

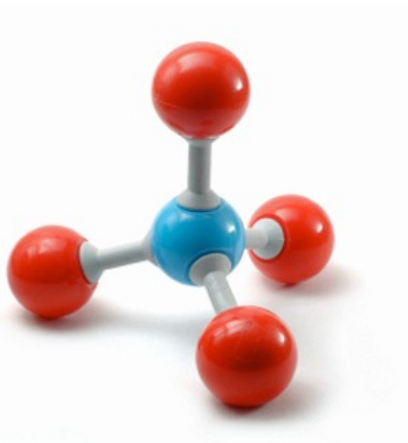
- Because each strand of DNA complements the other strand, the information encoded into it exists it both halves.
- DNA replication involves splitting the DNA into separate strands, and using each strand as a template to build an exact copy of the original.
- The original molecule is described as the parent DNA.
- The new DNA that are created are called daughter DNA.
- Each daughter DNA has half of the parent DNA in it's final structure.



DNA Replication

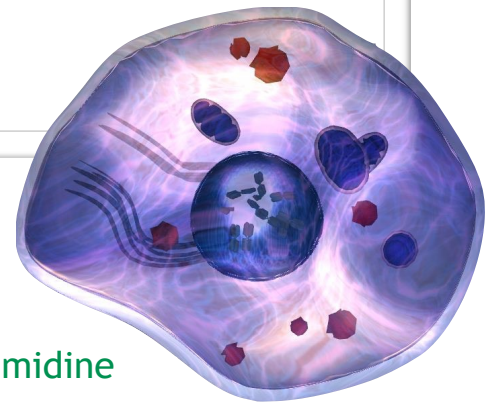
- Helicase is the enzyme that splits DNA into it's component strands.
- Polymerase is the major enzyme involved in building double helix DNA from the separated strands, using free nucleotides.



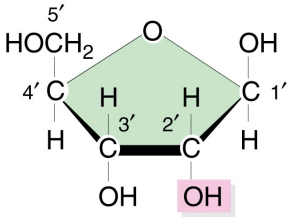


Ch17

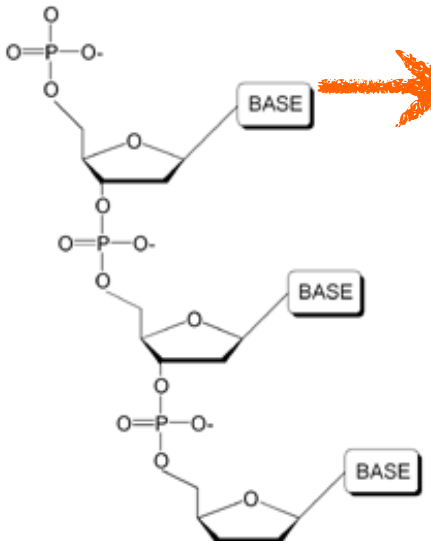
Nucleic Acids



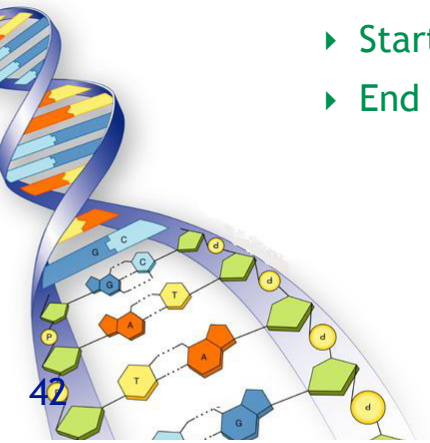
- Nucleic Acids
  - Concept, Function & Size
  - Two flavors, DNA & RNA
- Nucleotides & Nucleosides
  - Structure
  - Composition
    - Sugar
    - Base
  - Naming

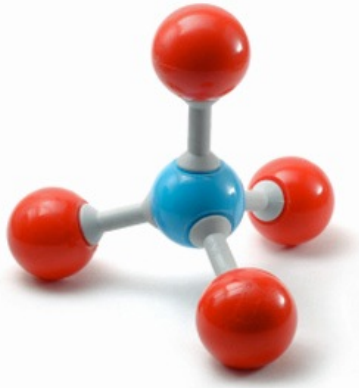


- Nucleic Acid Primary Structure
  - Phosphodiester Bond
  - Sequencing
    - Start w/ 5’ Phosphate
    - End with 3’ Hydroxy



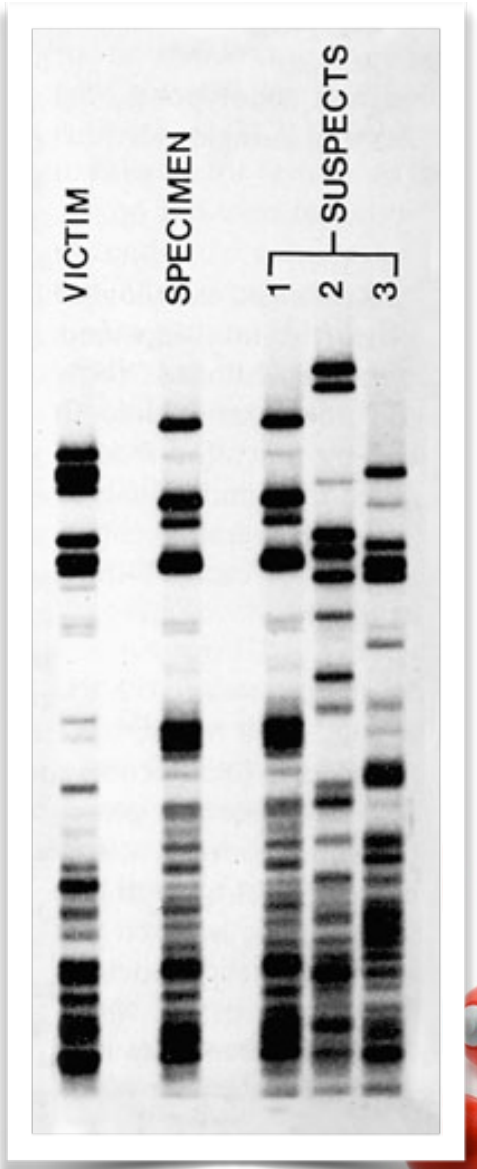
- DNA
  - Ratio of bases
    - # purine = # pyrimidine
  - Complimentary Base pairs
    - AT & GC
      - Hydrogen Bonding
    - Double Helix
    - Complementary Sequence
- DNA Replication
  - Two enzymes:
    - helicase unwinds it
    - polymerase builds it again
- DNA Fingerprinting





DNA Fingerprinting

- With 3 billion base pairs, each of our DNA codes are unique.
- Forensic science makes use of that unique structure to match DNA to individual people. Like fingerprints.
- The DNA fingerprinting works is we take a small sample of DNA and encourage it to replicate, to make a larger sample.
- Then we feed portions of that sample to enzymes that cut the DNA when it matches certain base pair combinations.
  - Example, on enzyme might cut the strand at every incidence of —A-C-G-G-C-A-A-G-T-…—
  - That produces fragments of all different sizes.
  - We then run those fragments down a gell plate, the smaller ones run faster.
  - So they move farther in the same amount of time.
  - We stop it part way, and compare unknown samples to a known one… to see who matches.

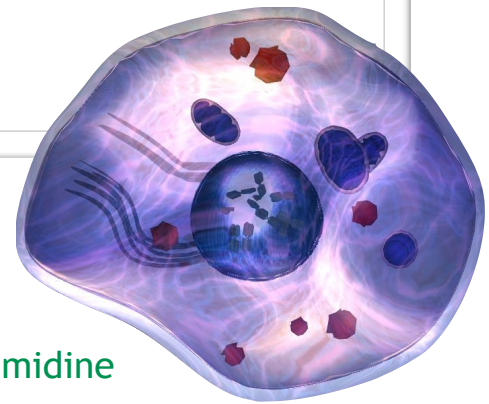


DNA Fingerprinting

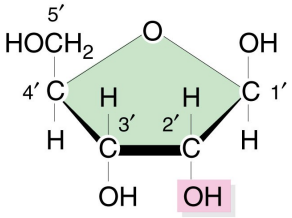
- The odds of two people having the same fingerprint are 1 in 64 million.
  - Which ca be further refined by the fact we have 10 fingers.
- The odds of two people having the same DNA fingerprint are less than 1 in a billion.
  - Which can be refined by the fact we have thousands of enzymes we can use to make cuts.

Ch17

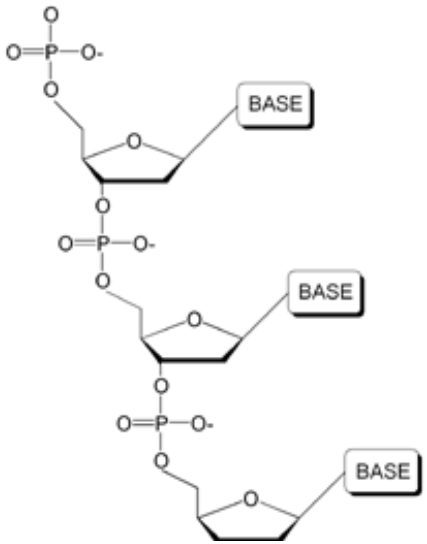
Nucleic Acids



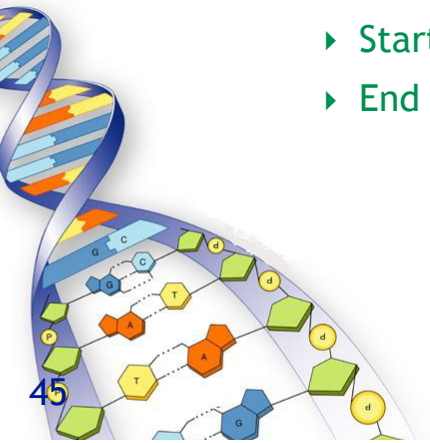
- Nucleic Acids
  - Concept, Function & Size
  - Two flavors, DNA & RNA
- Nucleotides & Nucleosides
  - Structure
  - Composition
    - Sugar
    - Base
  - Naming

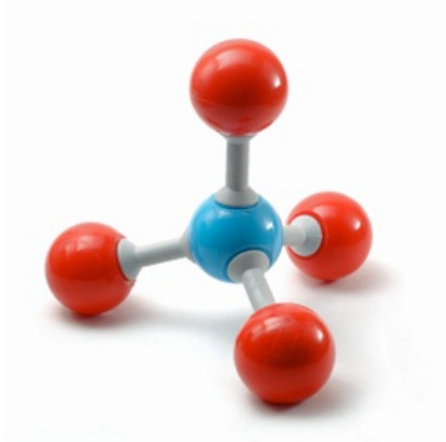


- Nucleic Acid Primary Structure
  - Phosphodiester Bond
  - Sequencing
    - Start w/ 5’ Phosphate
    - End with 3’ Hydroxy



- DNA
  - Ratio of bases
    - # purine = # pyrimidine
  - Complimentary Base pairs
    - AT & GC
      - Hydrogen Bonding
    - Double Helix
    - Complementary Sequence
- DNA Replication
  - Two enzymes:
    - helicase unwinds it
    - polymerase builds it again
  - DNA Fingerprinting





Questions?