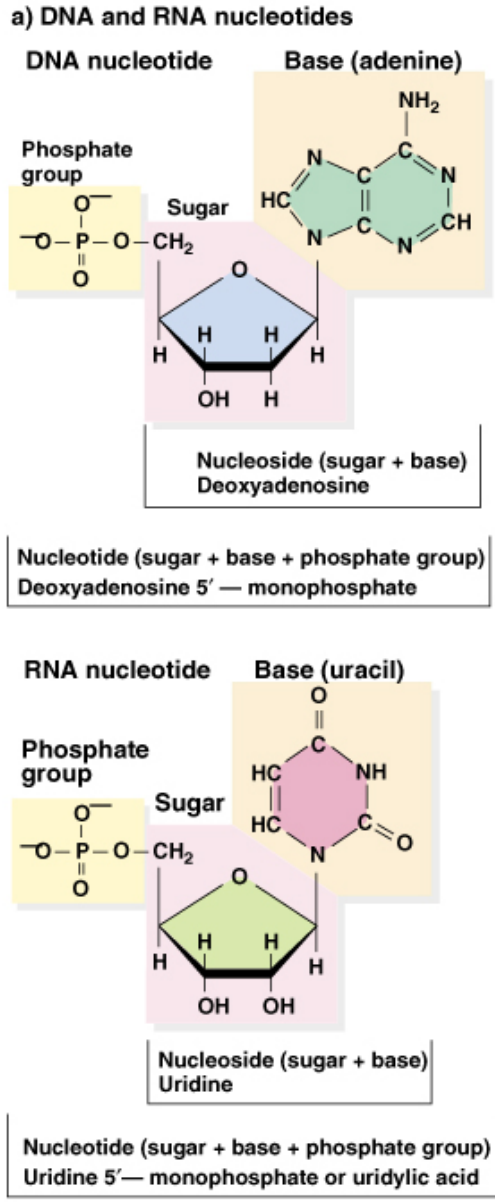
# DNA and RNA

**Week 1**

# DNA and RNA

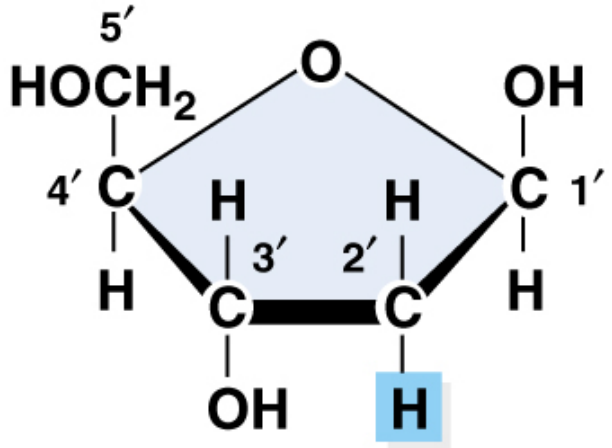
- Polymers
- Nucleic acids
- They are made of the same basic components: pentose (5 carbon) sugar, nitrogenous base, phosphate group.
- Nitrogenous bases are always covalently bonded to the sugar C1 carbon, and the phosphate group is bound to the sugar's C5 carbon.
- Nucleoside = sugar + base
- Nucleotide = sugar + base + phosphate

# Şekil 7. DNA ve RNA'nın kimyasal yapıları

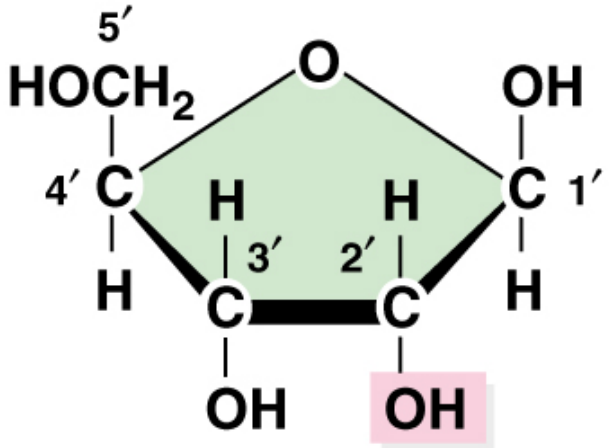


# DNA and RNA

- They are composed of different sugar molecules



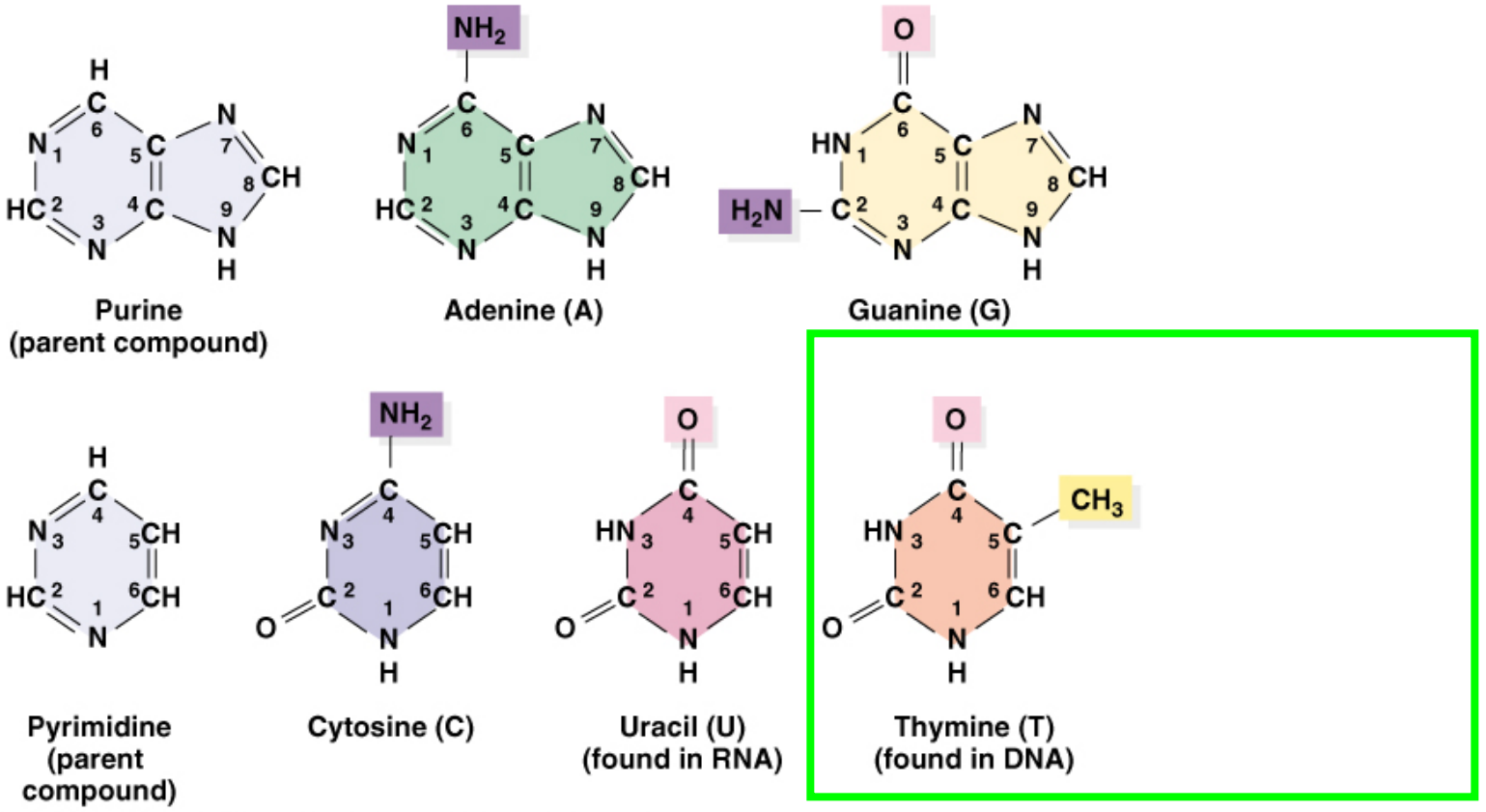

Deoxyribose




Ribose

# DNA and RNA

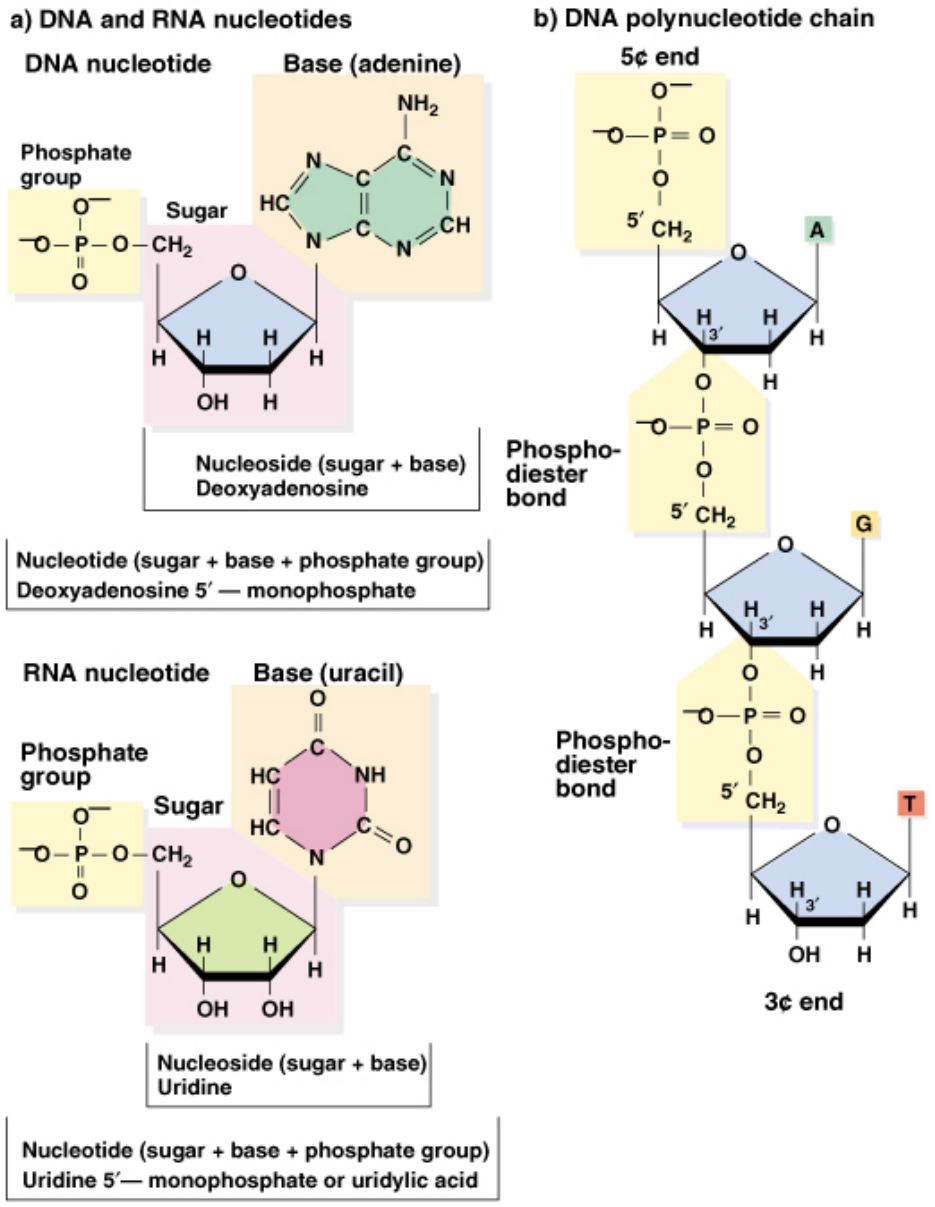
- There are differences in nitrogenous bases



# DNA and RNA

- Nucleotides in a DNA or RNA strand are covalently linked to each other by phosphodiester bonds.
- Phosphodiester bonds are formed by condensation or dehydration synthesis (water is released)
- It breaks down by hydrolysis (needs water)
- The phosphodiester bond is formed between the phosphate at C5 and the OH group at C3 of the next nucleotide.
- It forms the sugar-phosphate backbone
- The ends of the chain are different and have polarity

# Şekil 8. DNA ve RNA'nın Kimyasal Yapıları



# Discovery of DNA structure

- 1953—James D. Watson and Francis H. C. Crick
  - They knew that DNA is made up of nucleotides.
  - They used data generated by others to interpret the structure of DNA.
  - Base composition studies
  - X-ray diffraction studies

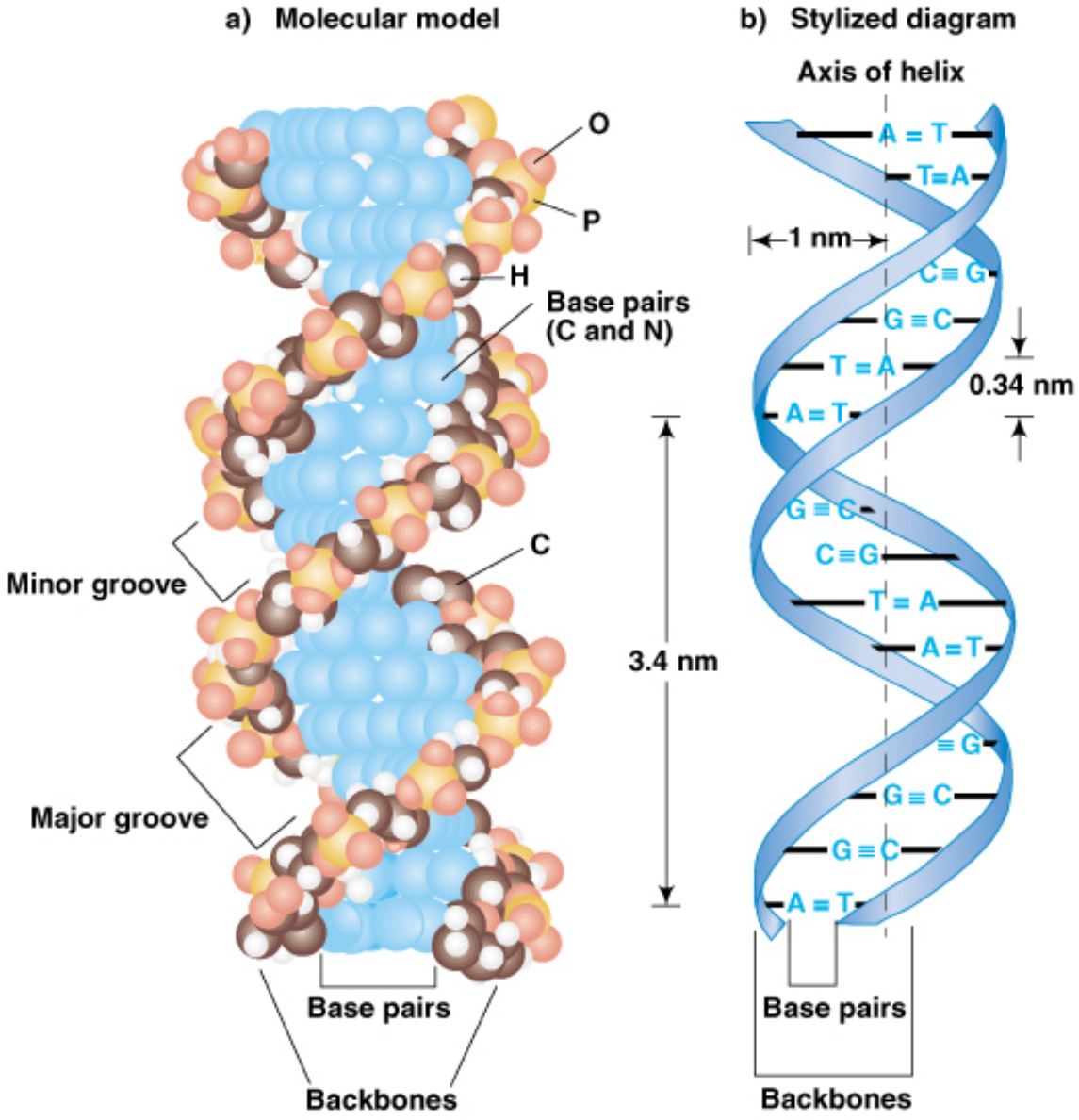
# Discovery of DNA structure

- Base composition studies
- Erwin chargaff
- Determination of purine and pyrimidine numbers in DNA belonging to different species
- Proving that the ratio of purines to primidines is 1: 1
- According to Chargaff's Rule, the amount of A and T, A = T and C and G in a DNA sequence is equal to C = G.
- A: T ratio is 1: 1 and C: G ratio is 1: 1 in all organisms, BUT (A + T) / (C + G) varies between organisms (this difference is called% GC content)

# Discovery of DNA structure

- X-ray diffraction studies
- Rosaline Franklin and Maurice H. F. Wilkins
- They examined the diffraction pattern of DNA (formed by atomic weight and spatial arrangement of molecules)
- DNA is helical
- The helix needs a length of 3.4 nm (34 angstroms) to make a full turn.
- The helix is 2 nm (20 angstroms) in diameter
- 0.34 nm (3.4 angstroms) is the distance between adjacent nucleotides
- One turn of the helix takes 10 nt

# Şekil 9. DNA'nın moleküler yapısı.



# Watson and Crick Model

- Double stranded, right-handed helix structure
- Antiparallel strand
- Sugar phosphate backbone outside the helix with bases facing in
- The bases of the opposite strands are linked to each other by hydrogen bonds.
- There are 2 bonds between

# Watson and Crick Model

- The bases are 0.34 nm (3.4 angstroms) apart in one strand and the length of one turn of the helix is 3.4 nm (34 angstroms, 10 nt per turn).
- The helix is 2 nm (20 angstroms) in diameter
- Since the number of hydrogen bonds between bases is different, there is one big and one small gap in DNA.