BIO-ORGANIC CHEMISTRY
(Organic Chemistry for Biology Students)
(SQBS 1603)

Basic Compounds in Biomolecules: Nucleic Acids

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Nucleic Acids

- Nucleic acid
  - Unbranched polymers composed of repeating monomers called nucleotides.
- Nucleotides
  - Joining a nucleoside with a phosphate
- Nucleoside
  - Joining a monosaccharide and a base
- Two types of nucleic acids
  1. DNA → Deoxyribonucleic acid
  2. RNA → Ribonucleic acid

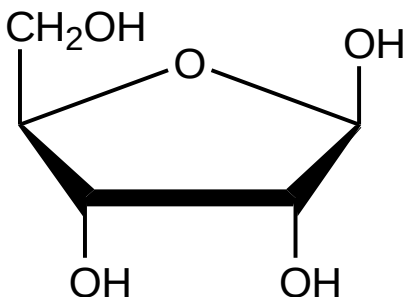
Nucleic Acids

Type of compound	Components
Nucleoside	❖ A **monosaccharide** + a **base (A, G, C, T, U)** ❖ A **ribonucleoside** (monosaccharide ribose) ❖A **deoxyribonucleoside** (monosaccharide 2-deoxyribose)
Nucleotide	❑ A nucleoside + phosphate ❑ A **ribonucleotide** ❑ A **deoxyribonucleotide**
DNA	➢ A polymer of deoxyribonucleotides ➢ The monosaccharide : **2-deoxyribose** ➢ The bases : **A, G, C and T**
RNA	✓ A polymer of ribonucleotides ✓ The monosaccharide : **ribose** ✓ The bases : **A, G, C and U**

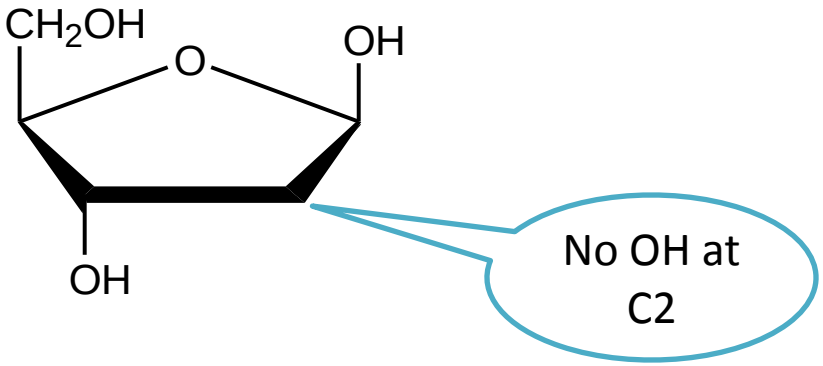
Nucleoside

- A **monosaccharide** + a **base (A, G, C, T, U)**
- A **ribonucleoside** (monosaccharide ribose)
- A **deoxyribonucleoside** (monosaccharide 2-deoxyribose)

monosaccharide



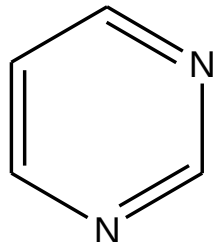
D-ribose



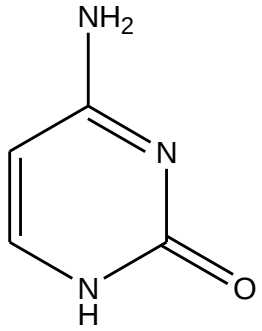
D-2-deoxyribose

Nucleoside

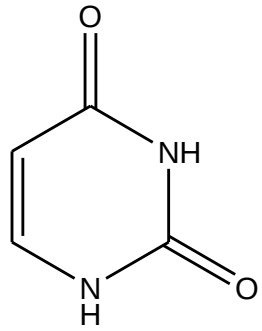
- base (A, G, C, T, U)



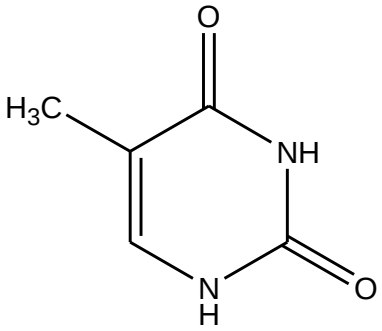
Pyrimidine
(Parent compound)



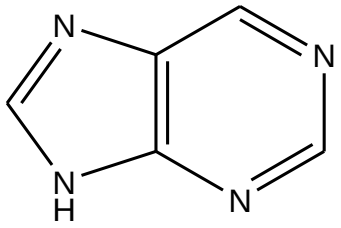
Cytosine (**C**)



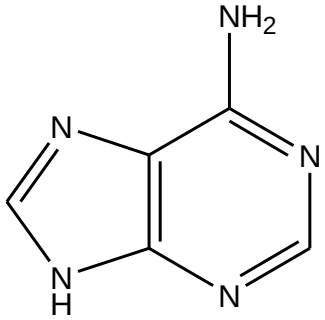
Uracil (**U**)



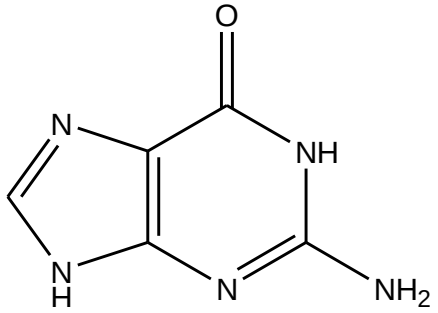
Thymine (**T**)



Purine
(Parent compound)



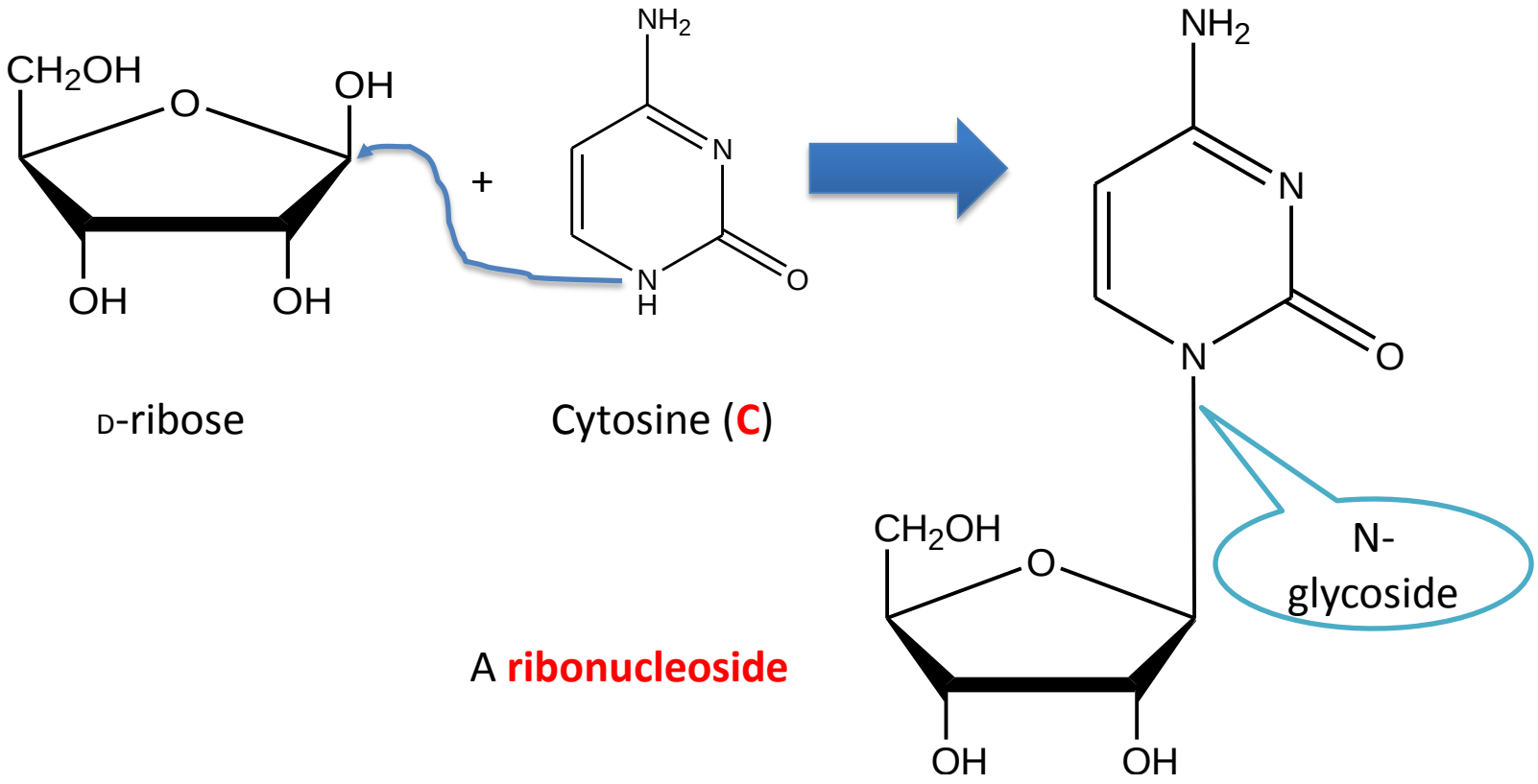
Adenine (**A**)



guanine (**G**)

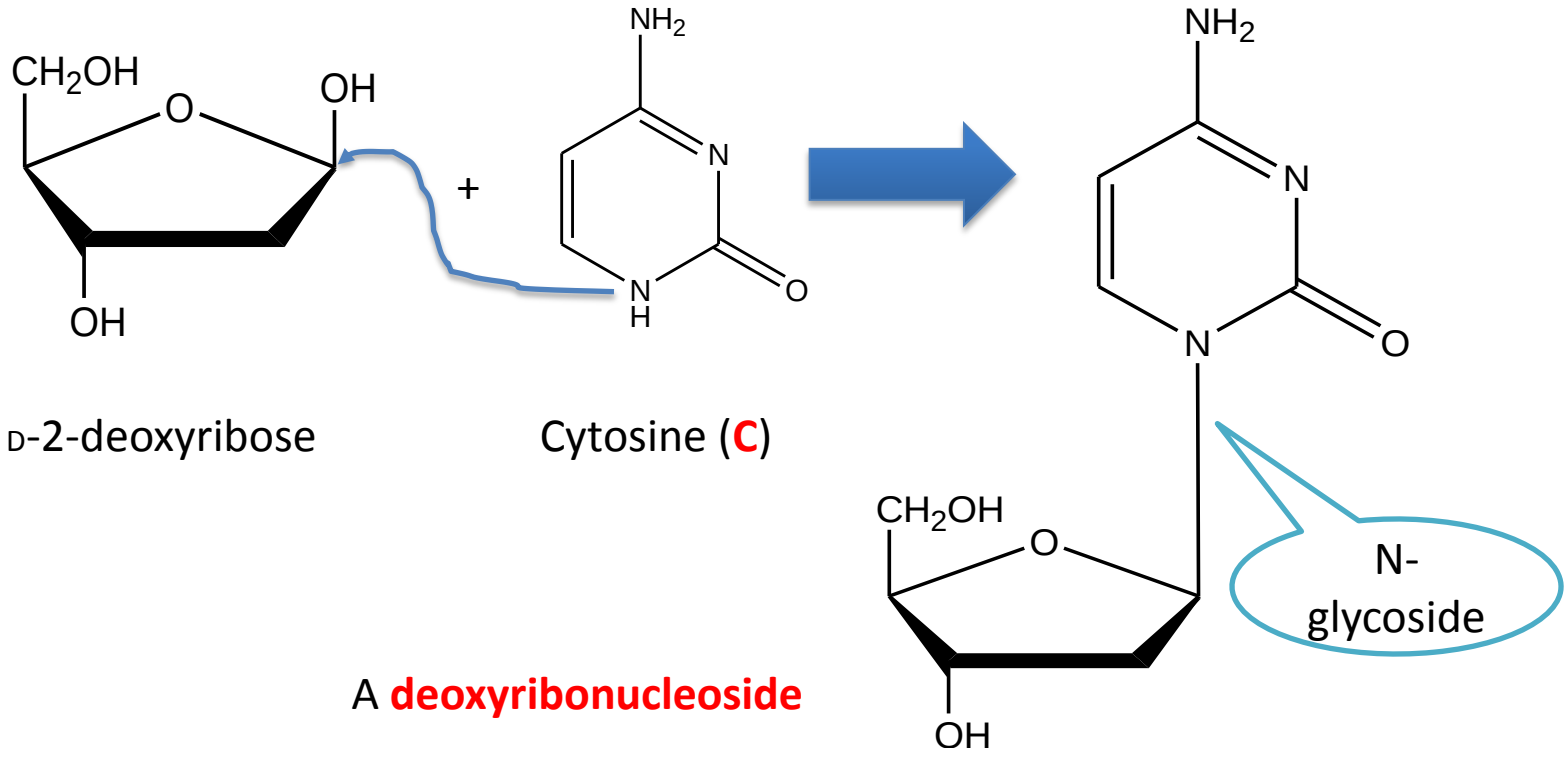
Nucleoside

❖ A **monosaccharide** + a **base (A, G, C, T, U)**



Nucleoside

- A deoxyribonucleoside (monosaccharide 2-deoxyribose)?



D-2-deoxyribose

Cytosine (**C**)

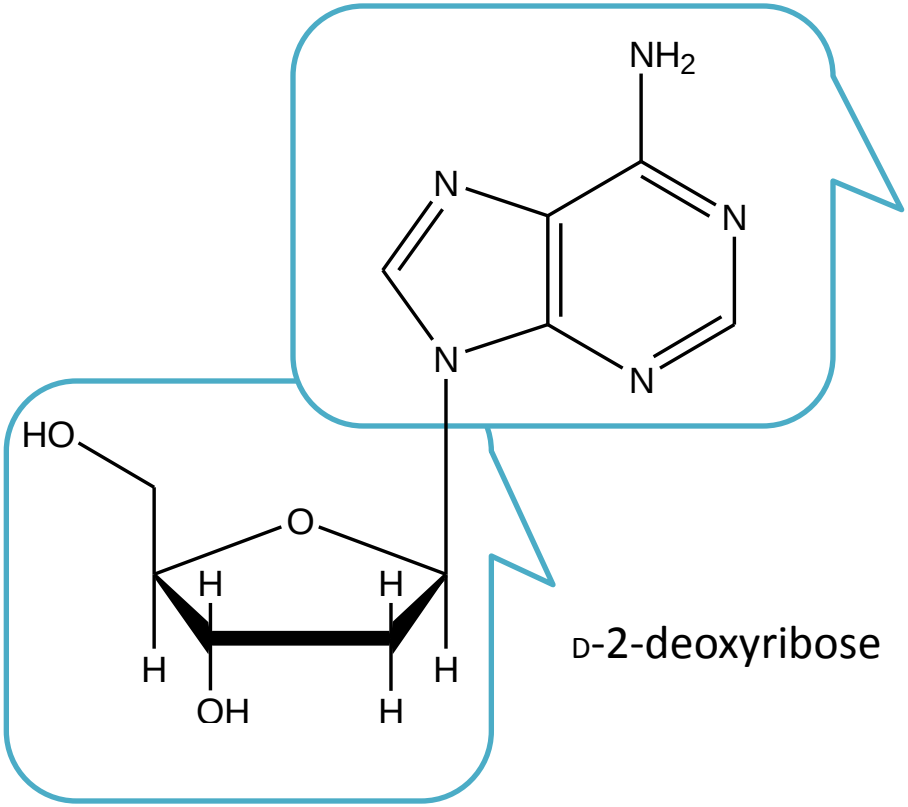
A **deoxyribonucleoside**

Deoxycytidine

Nucleoside

- Naming nucleoside
  - Nucleoside from pyrimidine base
    - Use the suffix -idine
    - E.g: cytosine → cytidine
  - Nucleoside from purine base
    - Use the suffix -osine
    - E.g: adenine → adenosine
  - For deoxyribonucleoside
    - Add the prefix deoxy-
    - E.g: deoxyadenosine

Nucleoside



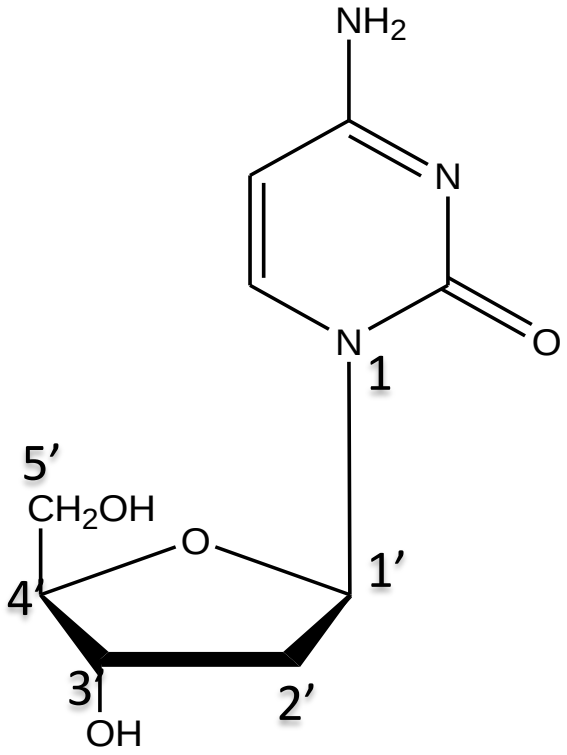
Adenine (**A**)

D-2-deoxyribose

Deoxyadenosine

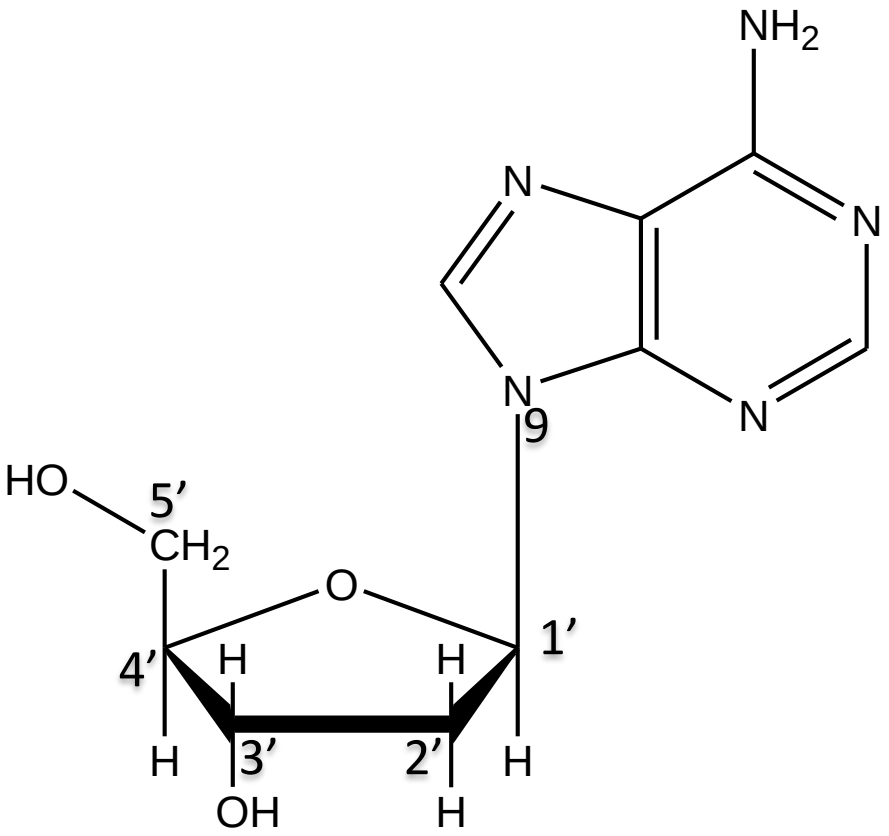
Nucleoside

- Numbering the carbons in nucleoside containing pyrimidine as base.
  - Monosaccharide (C at1') + base (N at1)

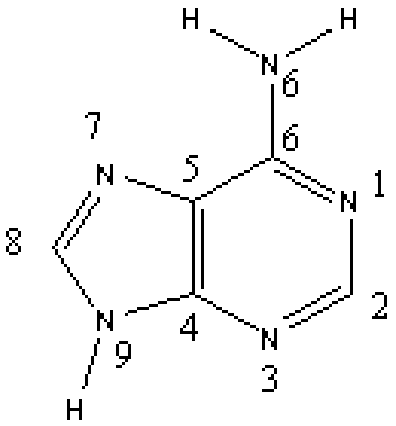


Nucleoside

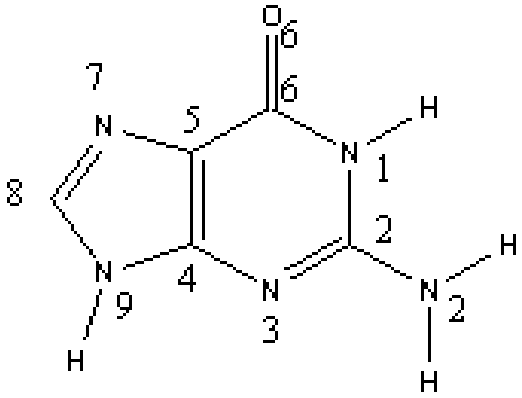
- Numbering the carbons in nucleoside containing purine as base.
  - Monosaccharide (Carbon at1') + base (Nitrogen at 9)



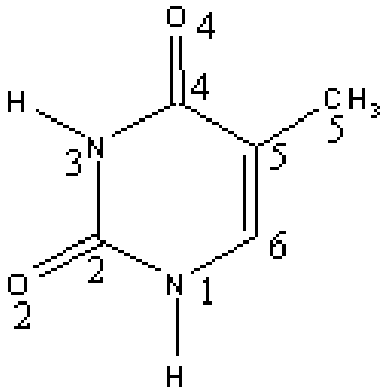
Nucleoside



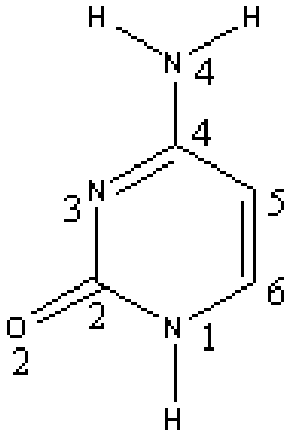
Adenine (Ade)



Guanine (Gua)



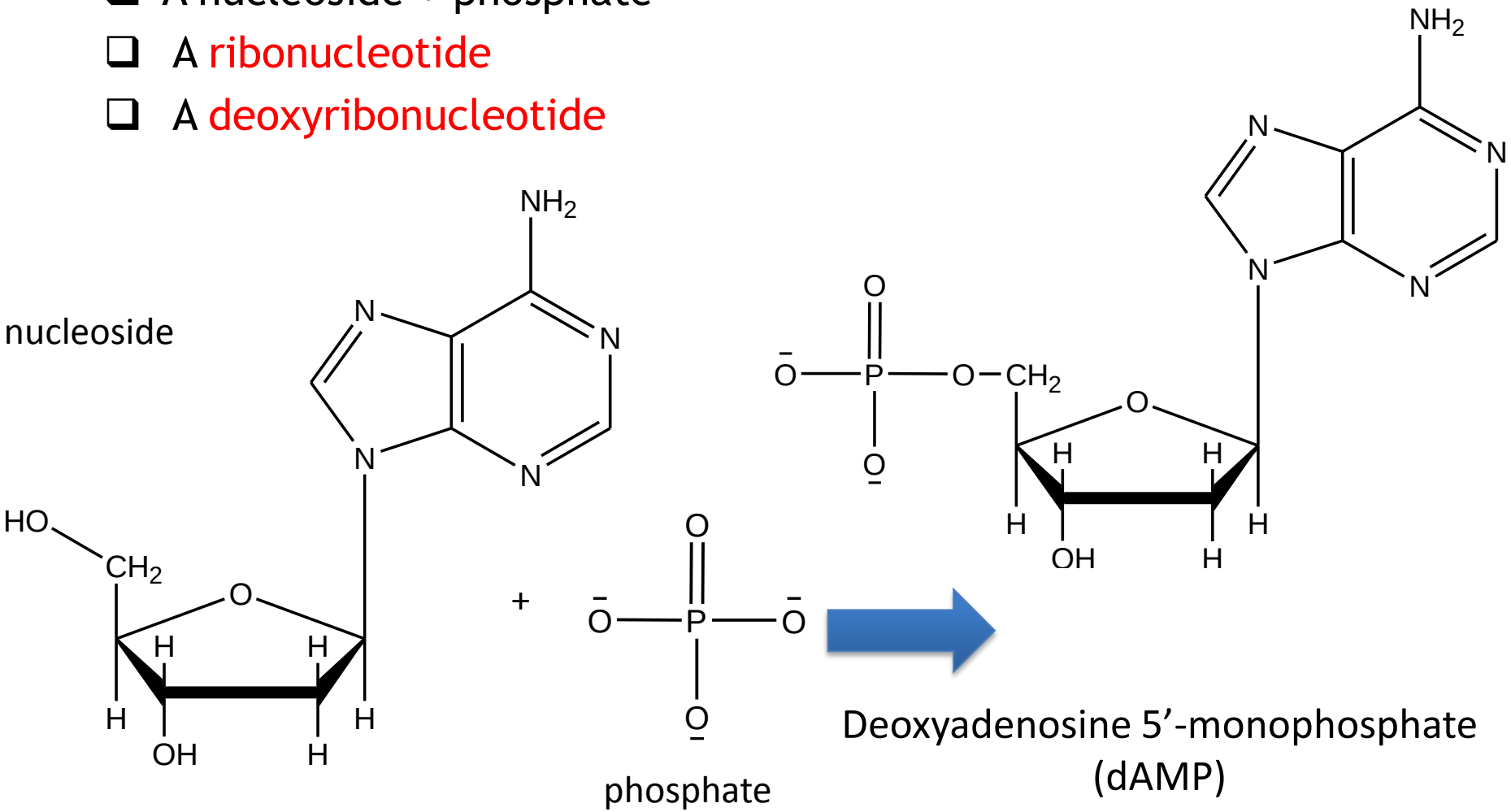
Thymine (Thy)



Cytosine (Cyt)

Nucleotide

- A nucleoside + phosphate
- A ribonucleotide
- A deoxyribonucleotide



Deoxyadenosine 5'-monophosphate (dAMP)

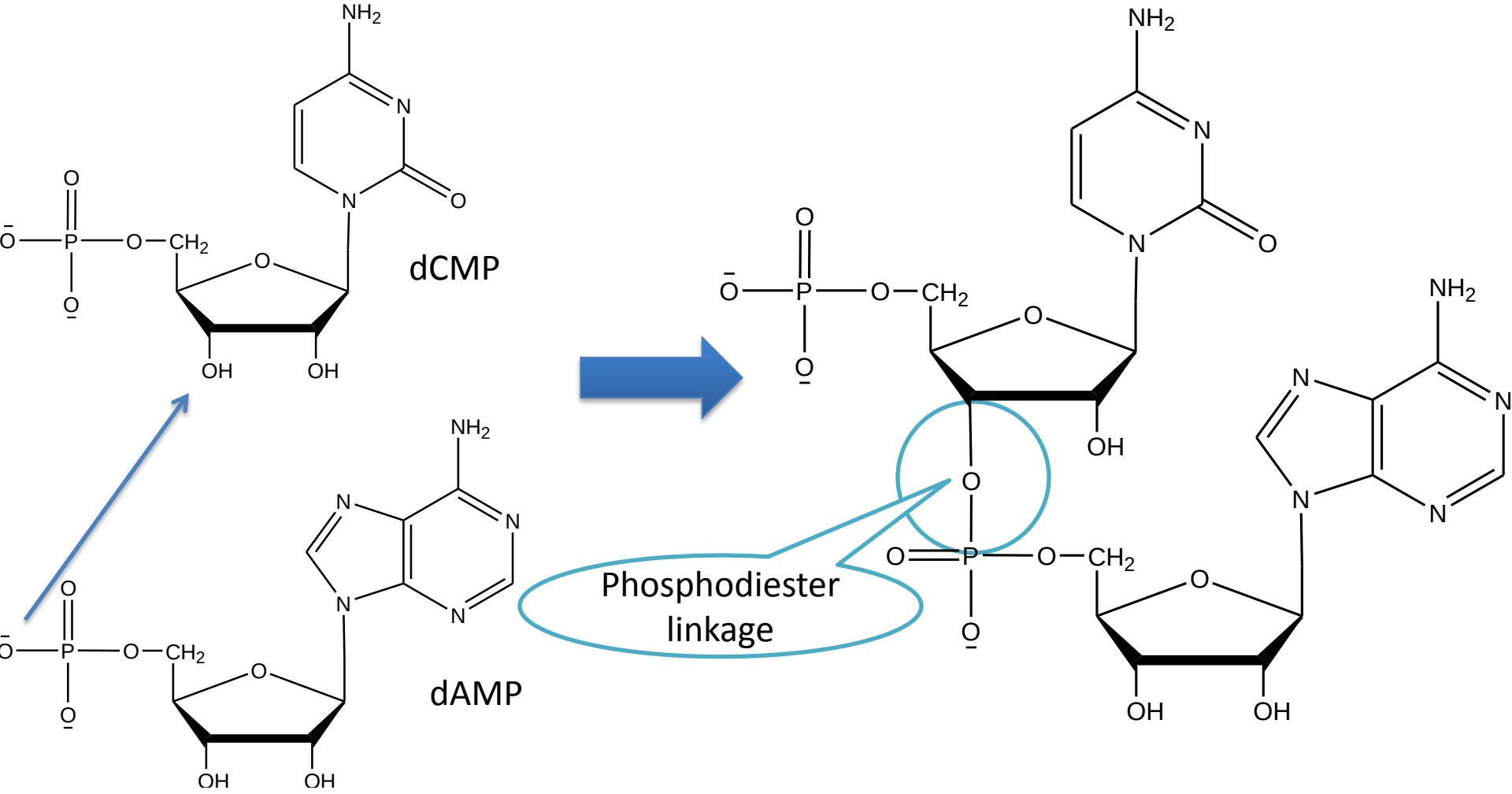
Nucleotide

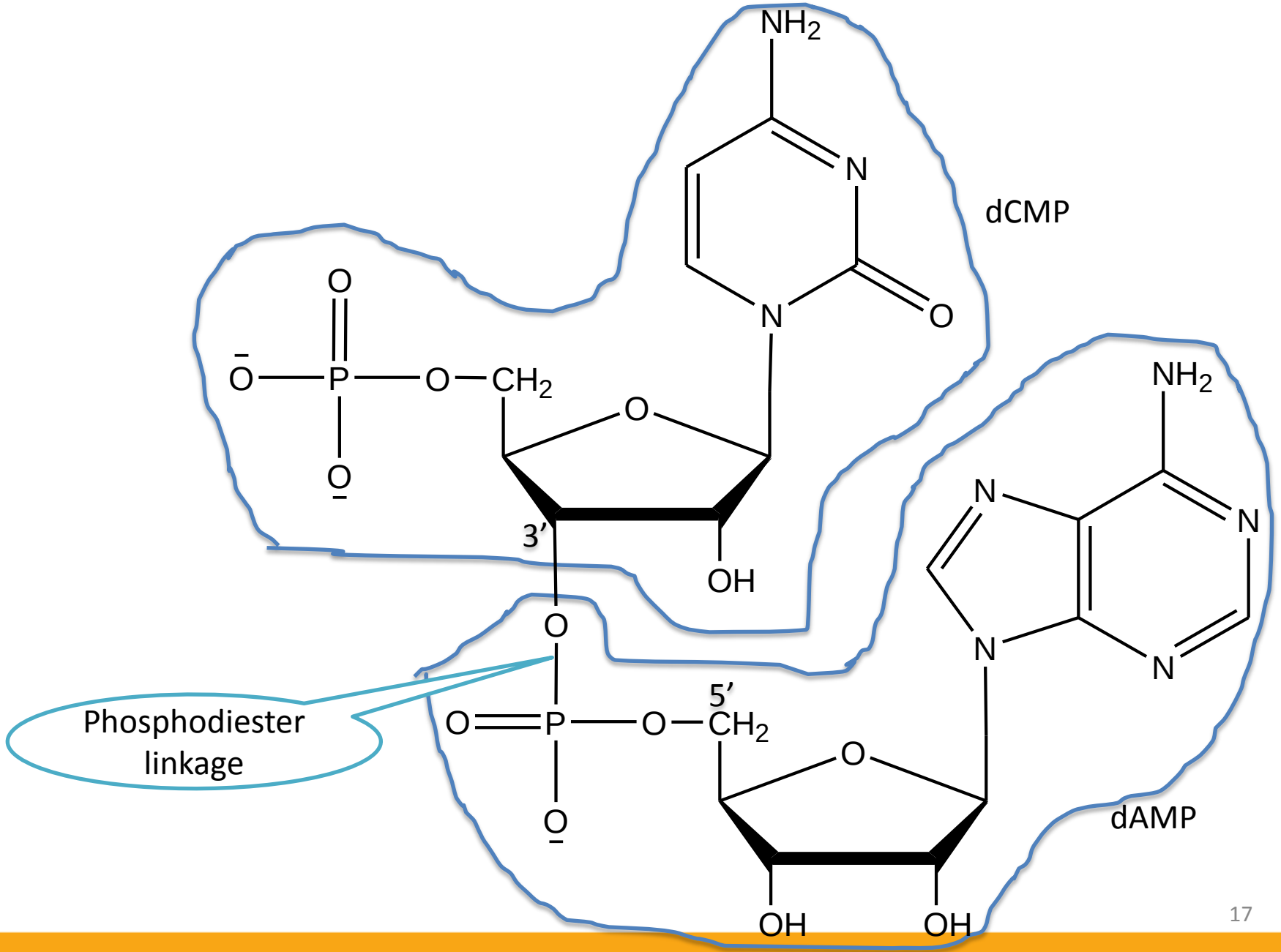
	Base	Abb.	Nucleoside	Nucleotide	Abb.
DNA	Adenine	A	Deoxyadenosine	Deoxyadenosine 5’-monophosphate	dAMP
	Guanine	G	Deoxyguanosine	Deoxyguanosine 5’-monophosphate	dGMP
	Cytosine	C	Deoxycytidine	Deoxycytidine 5’-monophosphate	dCMP
	Thymine	T	Deoxythymidine	Deoxythymidine 5’-monophosphate	dTMP
RNA	Adenine	A	Adenosine	Adenosine 5’-monophosphate	AMP
	Guanine	G	Guanosine	Guanosine 5’-monophosphate	GMP
	Cytosine	C	Cytidine	Cytidine 5’-monophosphate	CMP
	Uracil	U	Uridine	Uridine 5’-monophosphate	UMP

Nucleic acids

- Both DNA and RNA – are polymers of nucleotides, formed by joining 3'-OH group of one nucleotide with the 5'-phosphate of a second nucleotide in a phosphodiester linkage.

Nucleic acids




NH2
N
N
O
dCMP
O
O
O
P
O
CH2
O
3’
OH
NH2
N
N
N
N
5’
Phosphodiester
linkage
O
O
P
O
CH2
O
O
dAMP
OH
OH

REFERENCES

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