

Nucleotide & Nucleic Acid

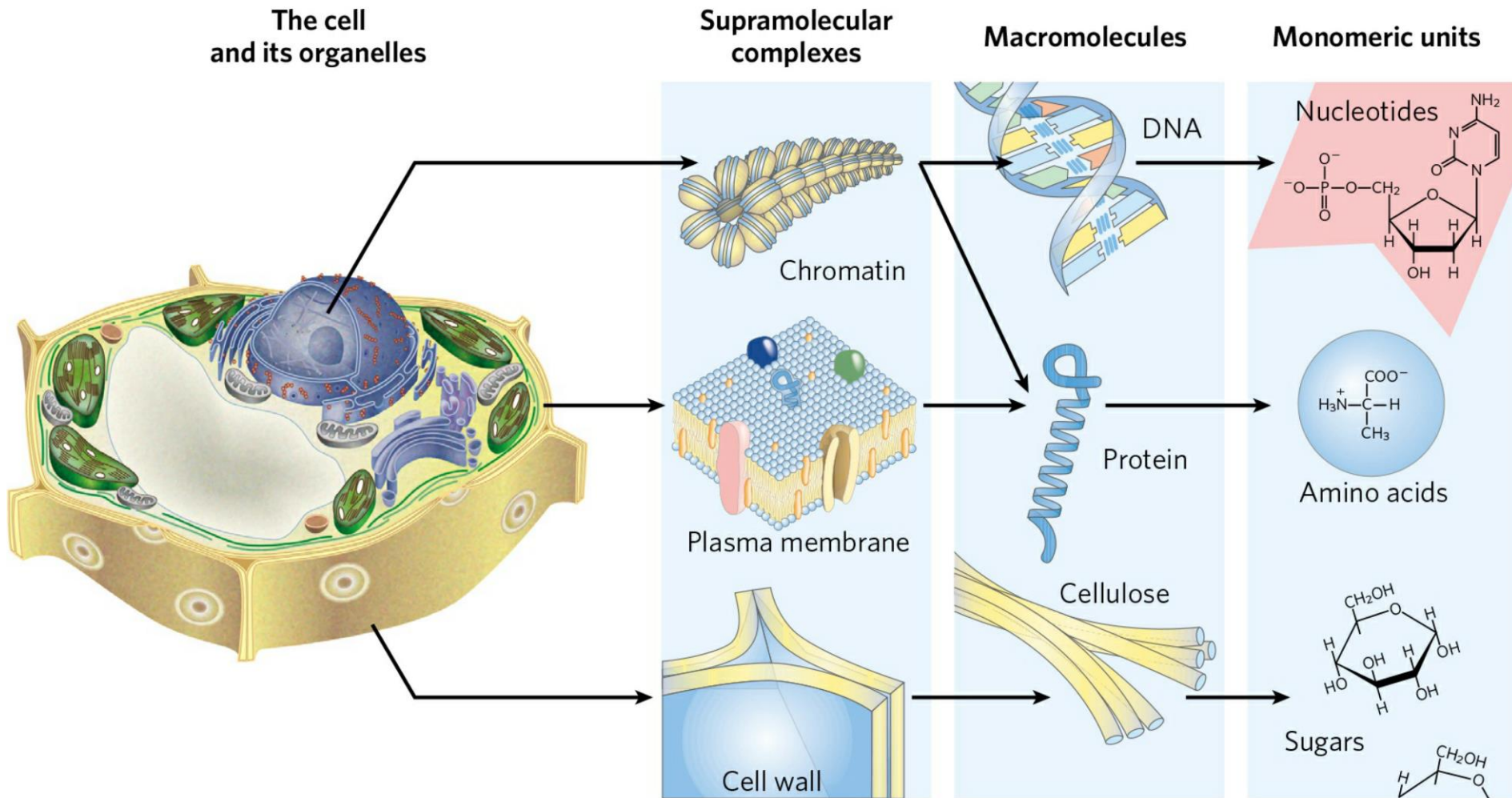


Dr Supanut Pairohakul

Introduction

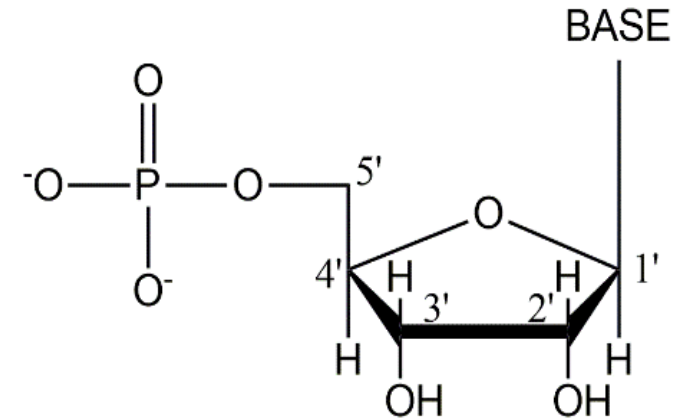
- Nucleotide and Nucleic Acid

Introduction

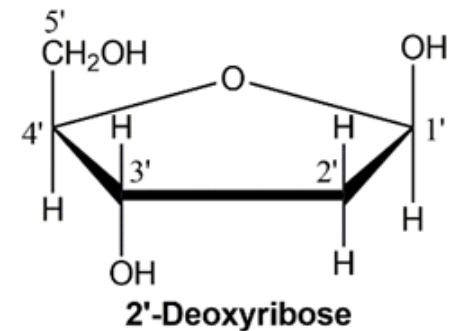
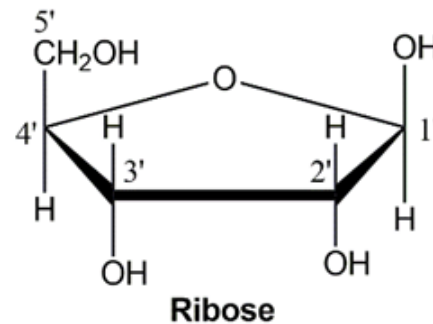


Nucleotide and Polynucleotide

- โครงสร้างทั่วไปของนิวคลีโอไทด์

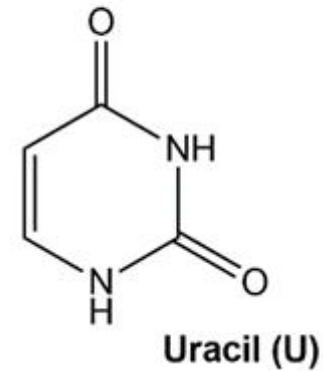
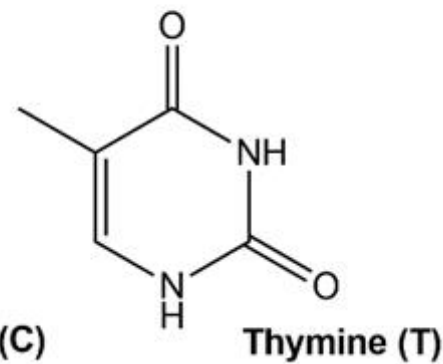
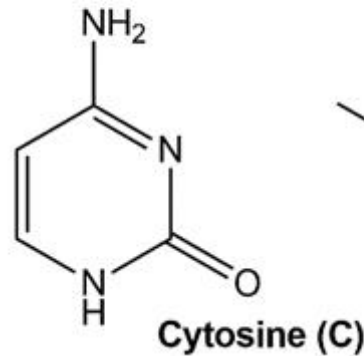
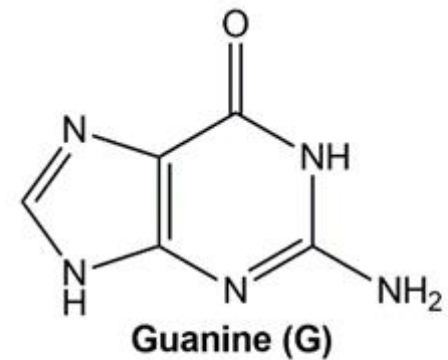
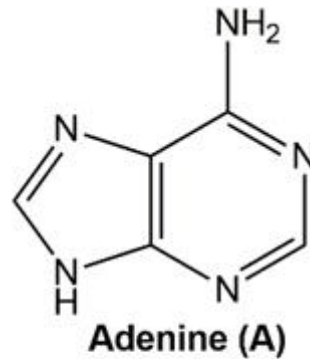


- องค์ประกอบของนิวคลีโอไทด์ (1)



Nucleotide and Polynucleotide

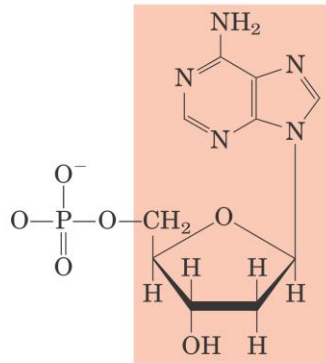
- องค์ประกอบของนิวคลีโอไทด์ (2)



Nucleotide and Polynucleotide

เบสไนโตรเจน	นิวคลีโอไซด์	นิวคลีโอไทด์	กรดนิวคลีอิก
Purines			
อะดีนีน (adenine)	Adenosine	Adenylate	RNA
	Deoxyadenosine	Deoxyadenylate	DNA
กวีนีน (guanine)	Guanosine	Guanylate	RNA
	Deoxyguanosine	Deoxyguanylate	DNA
Pyrimidines			
ไซโทซีน (cytosine)	Cytidine	Cytidylate	RNA
	Deoxycytidine	Deoxycytidylate	DNA
ไทมีน (thymine)	Thymidine (Deoxythymidine)	Thymidilate (deoxythymidinylate)	DNA
ยูราซิล (uracil)	Uridine	Uridylate	RNA

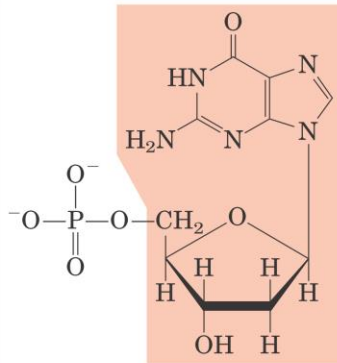
Nucleotide and Polynucleotide



Nucleotide: Deoxyadenylate
(deoxyadenosine 5'-monophosphate)

Symbols: A, dA, dAMP

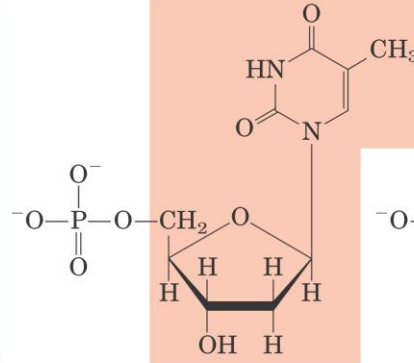
Nucleoside: Deoxyadenosine



Nucleotide: Deoxyguanylate
(deoxyguanosine 5'-monophosphate)

Symbols: G, dG, dGMP

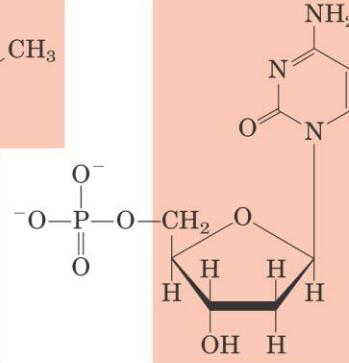
Nucleoside: Deoxyguanosine



Nucleotide: Deoxythymidylate
(deoxythymidine 5'-monophosphate)

Symbols: T, dT, dTMP

Nucleoside: Deoxythymidine

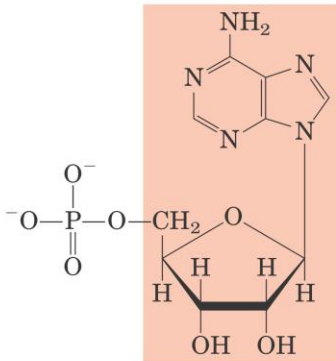


Nucleotide: Deoxycytidylate
(deoxycytidine 5'-monophosphate)

Symbols: C, dC, dCMP

Nucleoside: Deoxycytidine

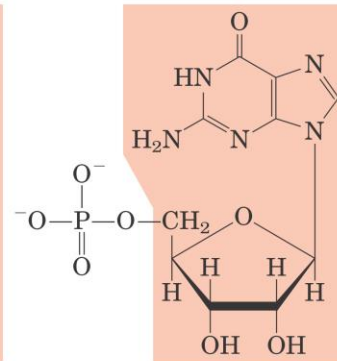
(a) Deoxyribonucleotides



Nucleotide: Adenylate (adenosine 5'-monophosphate)

Symbols: A, AMP

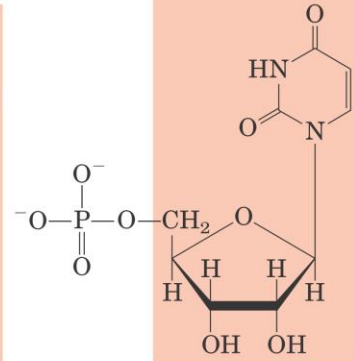
Nucleoside: Adenosine



Nucleotide: Guanylate (guanosine 5'-monophosphate)

Symbols: G, GMP

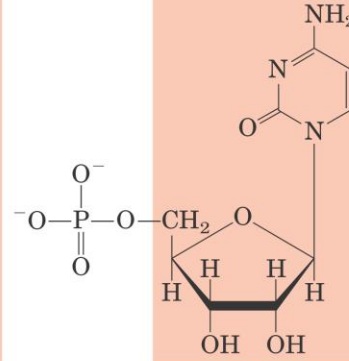
Nucleoside: Guanosine



Nucleotide: Uridylate (uridine 5'-monophosphate)

Symbols: U, UMP

Nucleoside: Uridine



Nucleotide: Cytidylate (cytidine 5'-monophosphate)

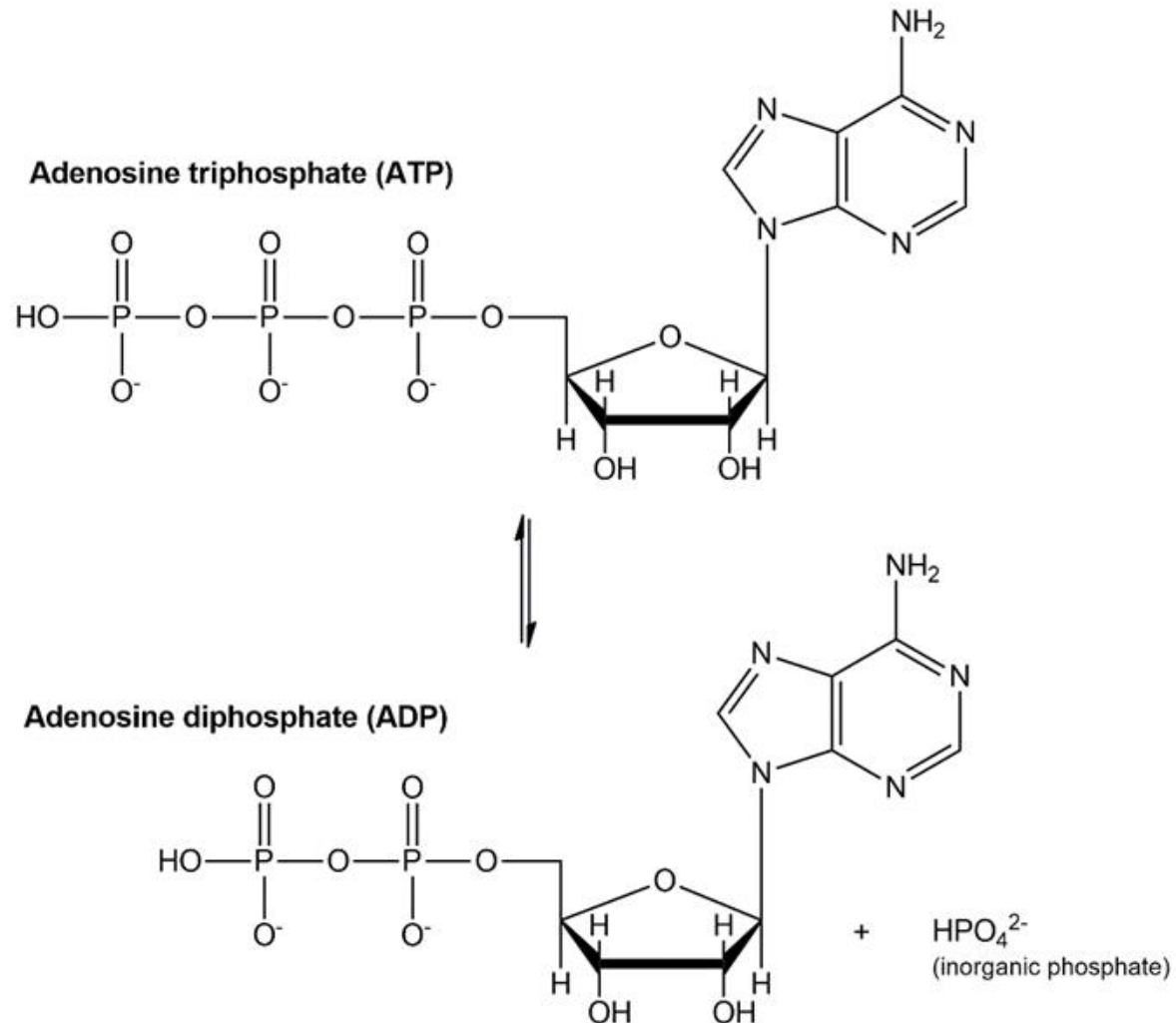
Symbols: C, CMP

Nucleoside: Cytidine

(b) Ribonucleotides

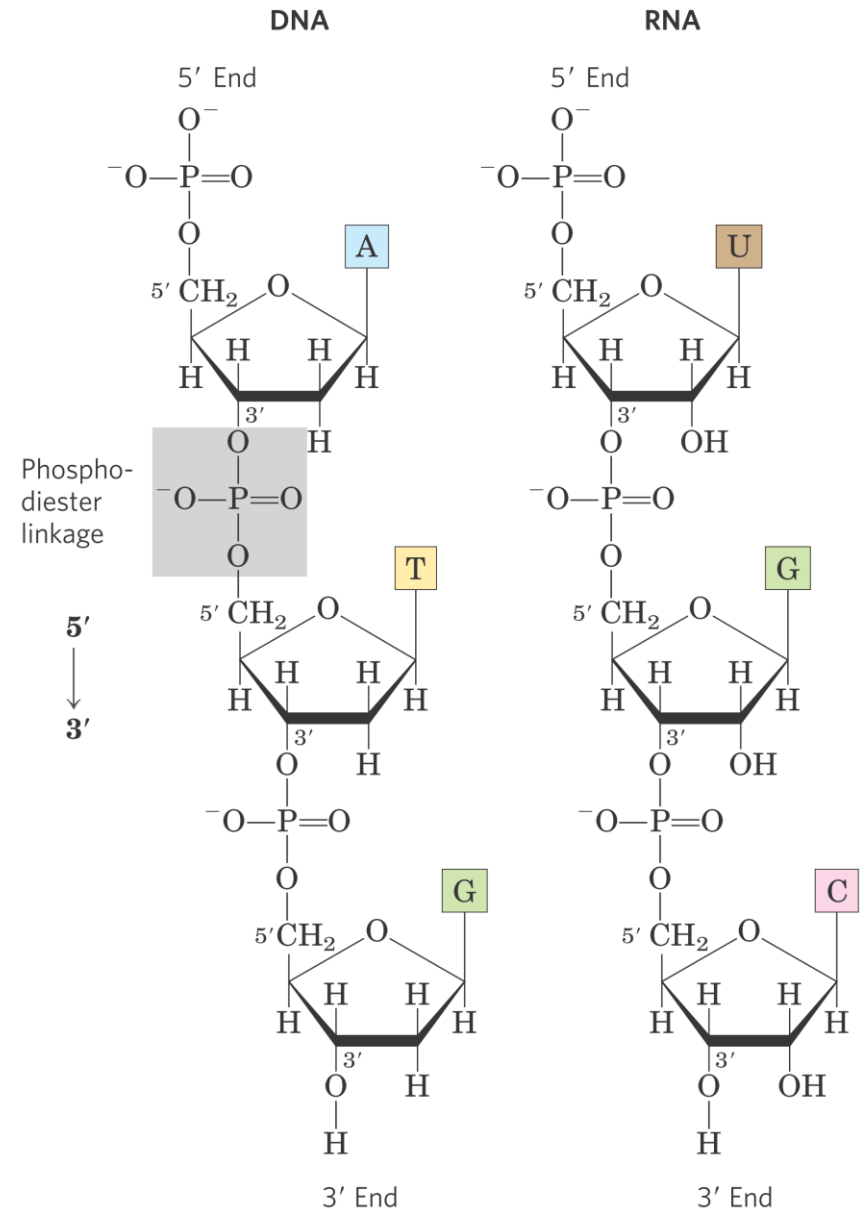
Nucleotide and Polynucleotide

- อณูพันธ์ของนิวคลีโอไทด์ (ATP)



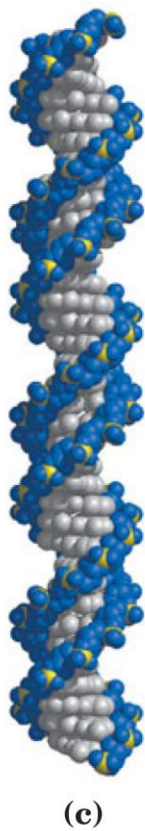
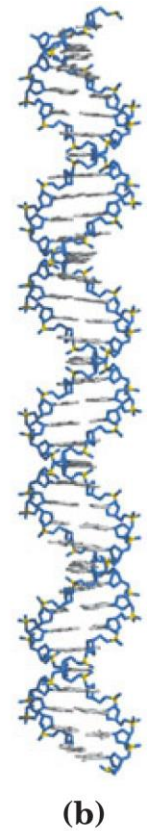
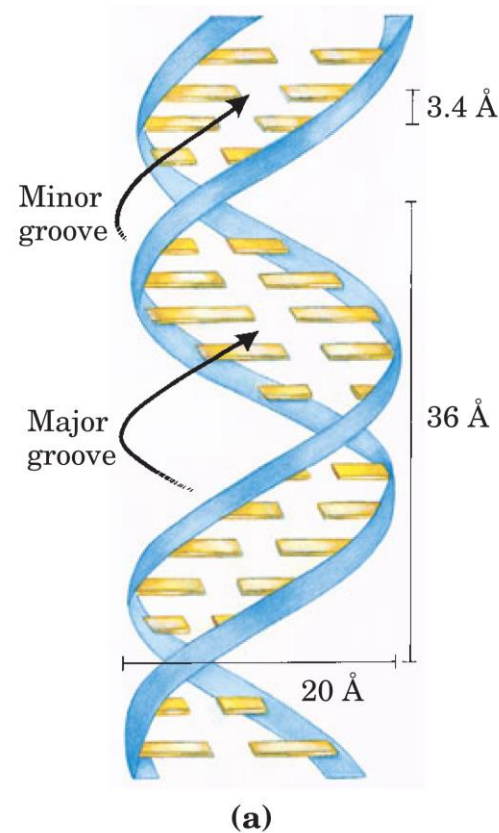
Nucleotide and Polynucleotide

- พอลินิวคลีโอไทด์ (Polynucleotide)



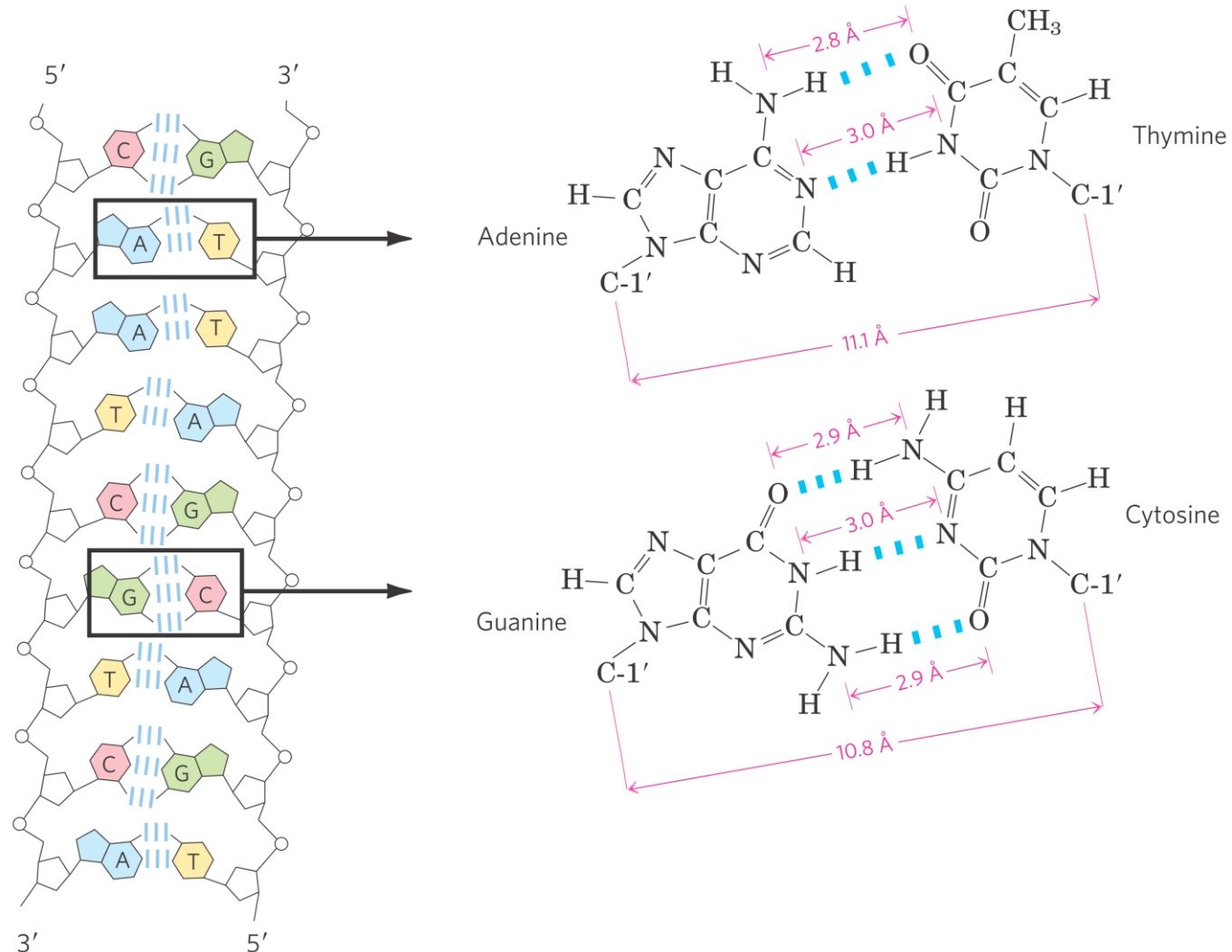
Nucleic Acid

- โครงสร้างของ DNA (Watson and Crick, 1953)



Nucleic Acid

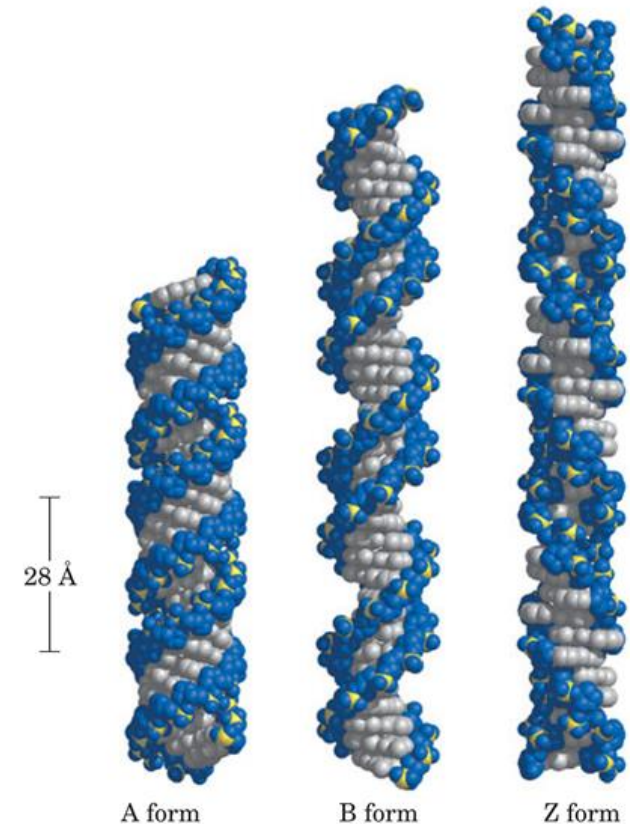
- โครงสร้างของ DNA - complementary base pairing



Nucleic Acid

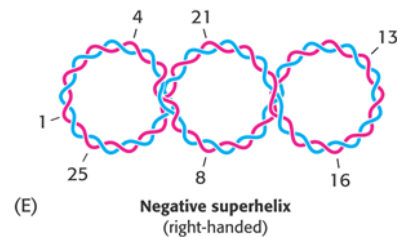
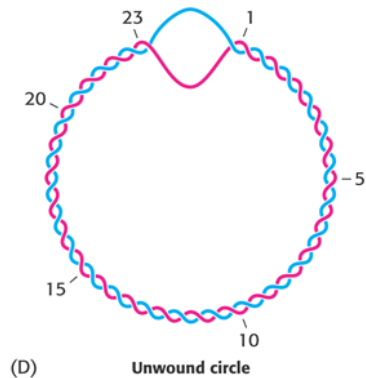
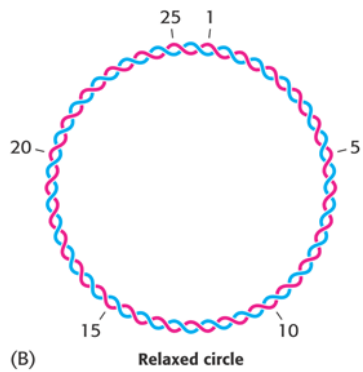
	Helix type		
	A	B	Z
Shape	Broadest	Intermediate	Narrowest
Rise per base pair	2.3 Å	3.4 Å	3.8 Å
Helix diameter	~26 Å	~20 Å	~18 Å
Screw sense	Right-handed	Right-handed	Left-handed
Glycosidic bond*	<i>anti</i>	<i>anti</i>	Alternating <i>anti</i> and <i>syn</i>
Base pairs per turn of helix	11	10.4	12
Pitch per turn of helix	25.3 Å	35.4 Å	45.6 Å
Tilt of base pairs from perpendicular to helix axis	19 degrees	1 degree	9 degrees

**Syn* and *anti* refer to the orientation of the *N*-glycosidic bond between the base and deoxyribose. In the *syn* orientation, the base is above the deoxyribose. Pyrimidines can be in *anti* orientations only, whereas purines can be *anti* or *syn*.



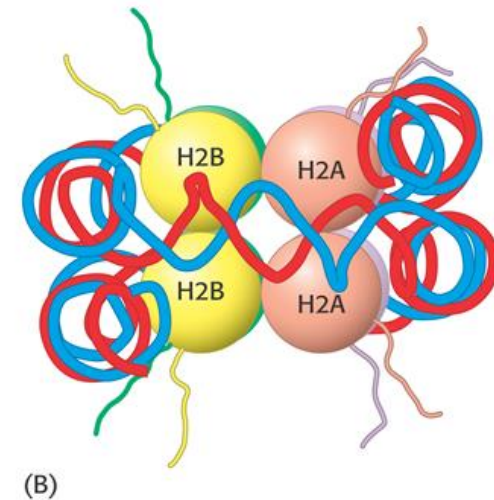
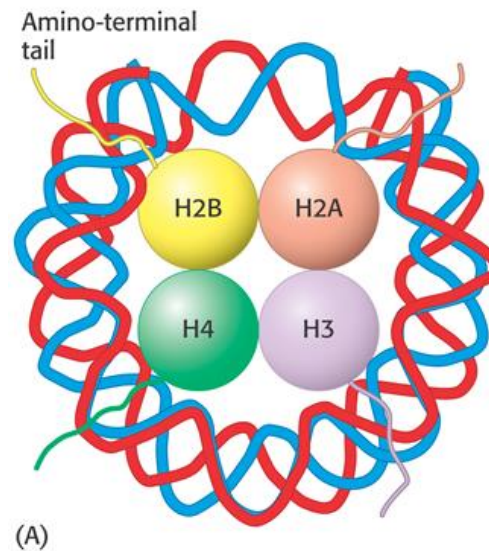
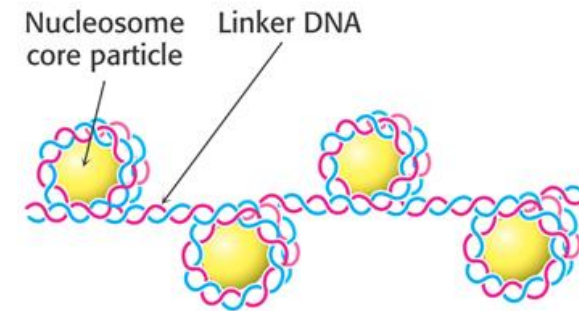
Nucleic Acid

- การเกิด superhelix ของ DNA ใน *E. coli*



Nucleic Acid

- Eukaryotic Genome Organization



Nucleic Acid

1 At the simplest level, chromatin is a double-stranded helical structure of DNA.

DNA double helix

2 nm

2 DNA is complexed with histones to form nucleosomes.

3 Each nucleosome consists of eight histone proteins around which the DNA wraps 1.65 times.

4 A chromatosome consists of a nucleosome plus the H1 histone.

Nucleosome core of eight histone molecules

Histone H1

11 nm

6 ...that forms loops averaging 300 nm in length.

300 nm

Chromatosome

5 The nucleosomes fold up to produce a 30-nm fiber...

30 nm

7 The 300-nm fibers are compressed and folded to produce a 250-nm-wide fiber.

250-nm-wide fiber

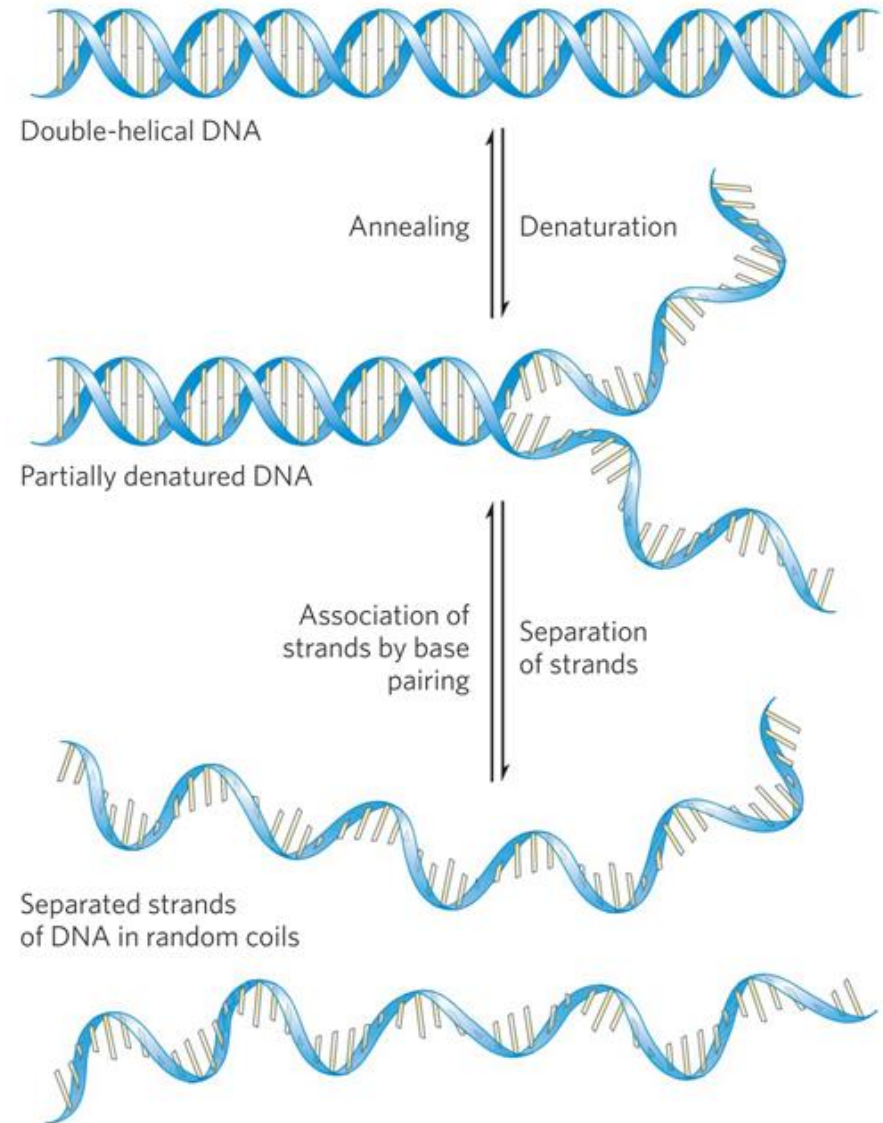
8 Tight coiling of the 250-nm fiber produces the chromatid of a chromosome.

700 nm

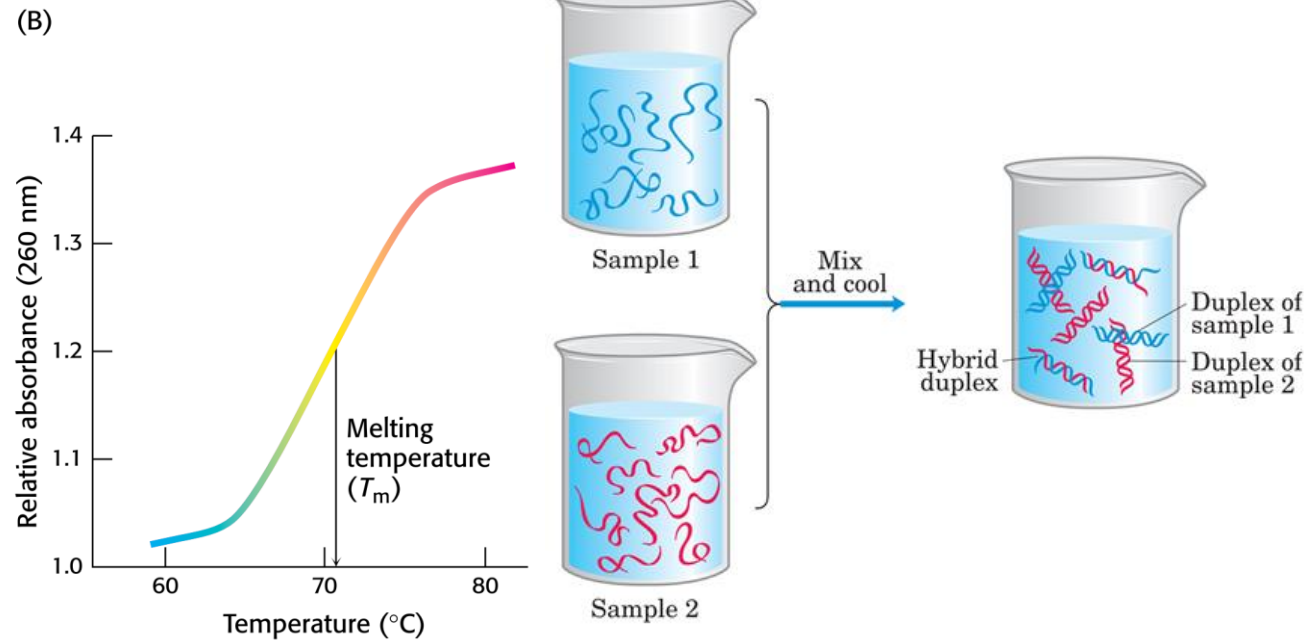
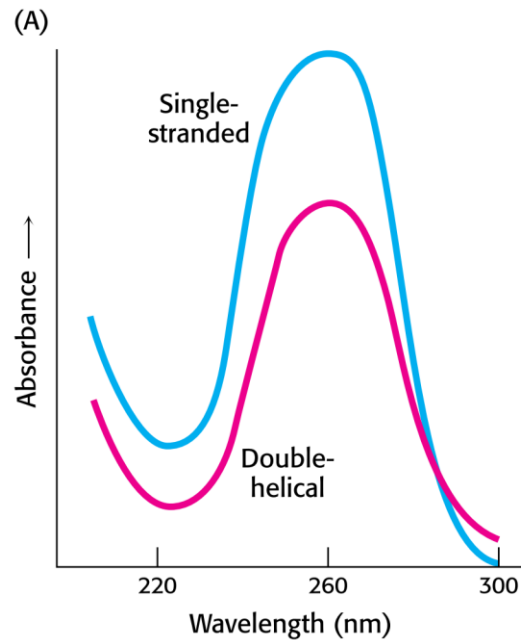
1400 nm

Nucleic Acid

- Chemical properties of DNA

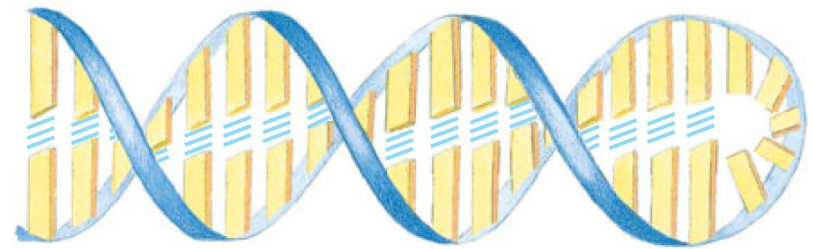
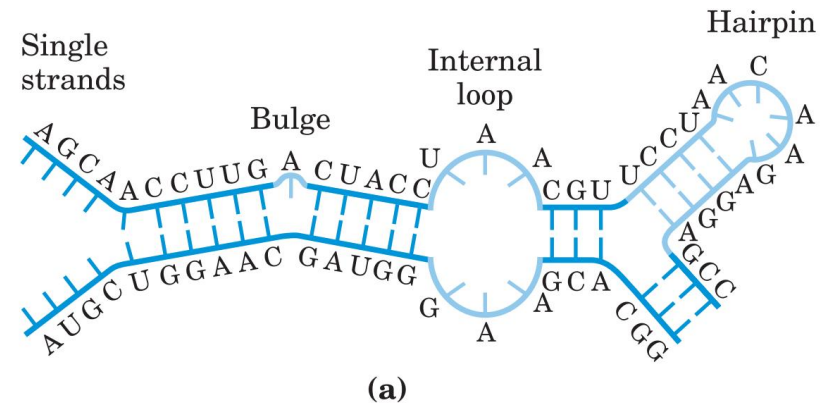


Nucleic Acid



Nucleic Acid

- โครงสร้างของ RNA (RNA Structure)



Hairpin double helix
(b)