核 酸

- **分子構造：** N1

  核苷酸　核酸　雙螺旋　三級構造　Palindrome

  質體　RNA　基因表現　N2

- **功能性質：** N3

  參加重要生理功能　Central Dogma　變性與復性

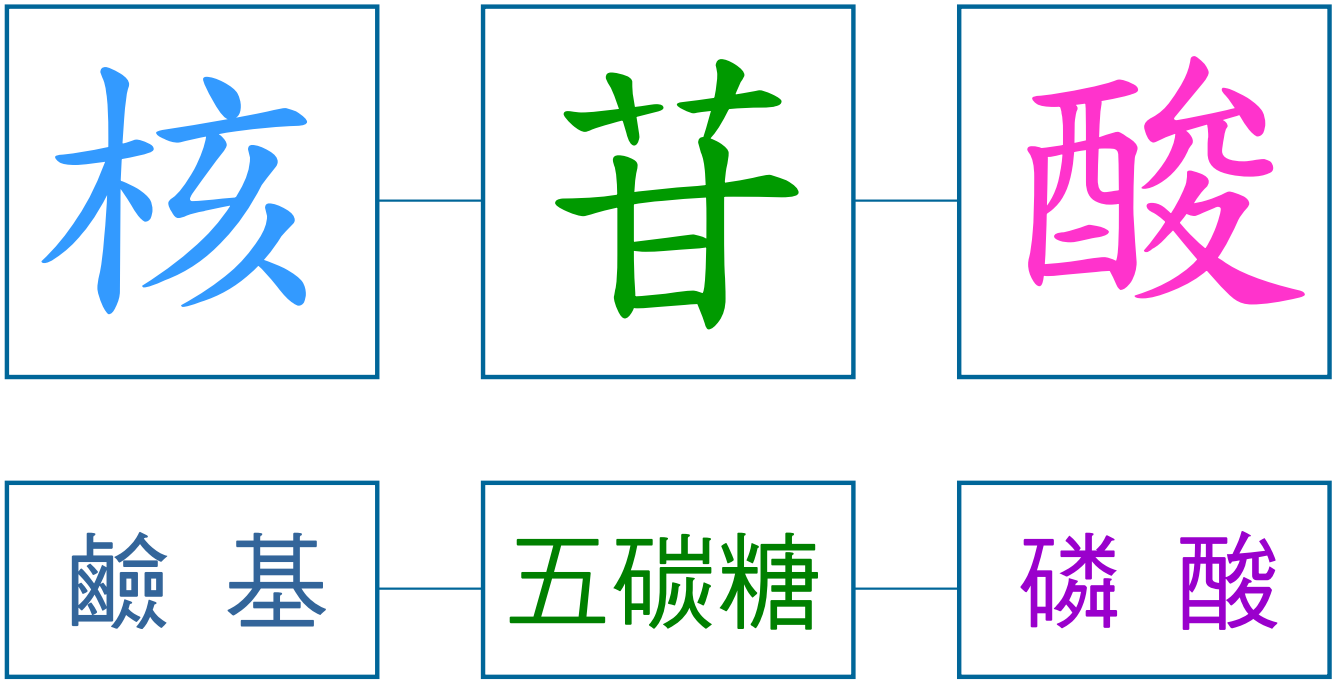
  鹼基組成的影響　雜合反應　Intron 與 exon

- **研究技術：** N4

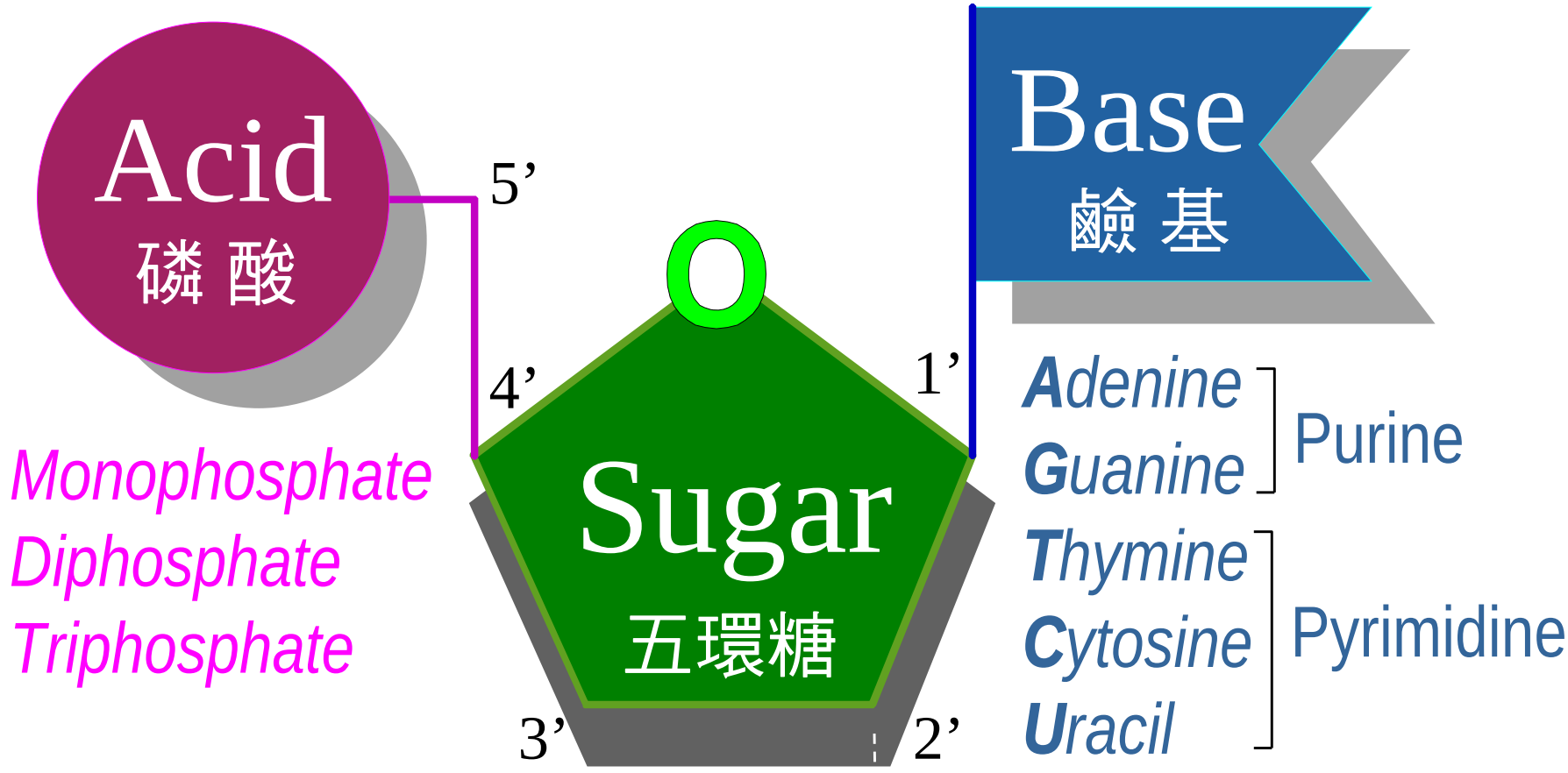
  核酸之純化　限制脢　核酸轉印法　基因操作

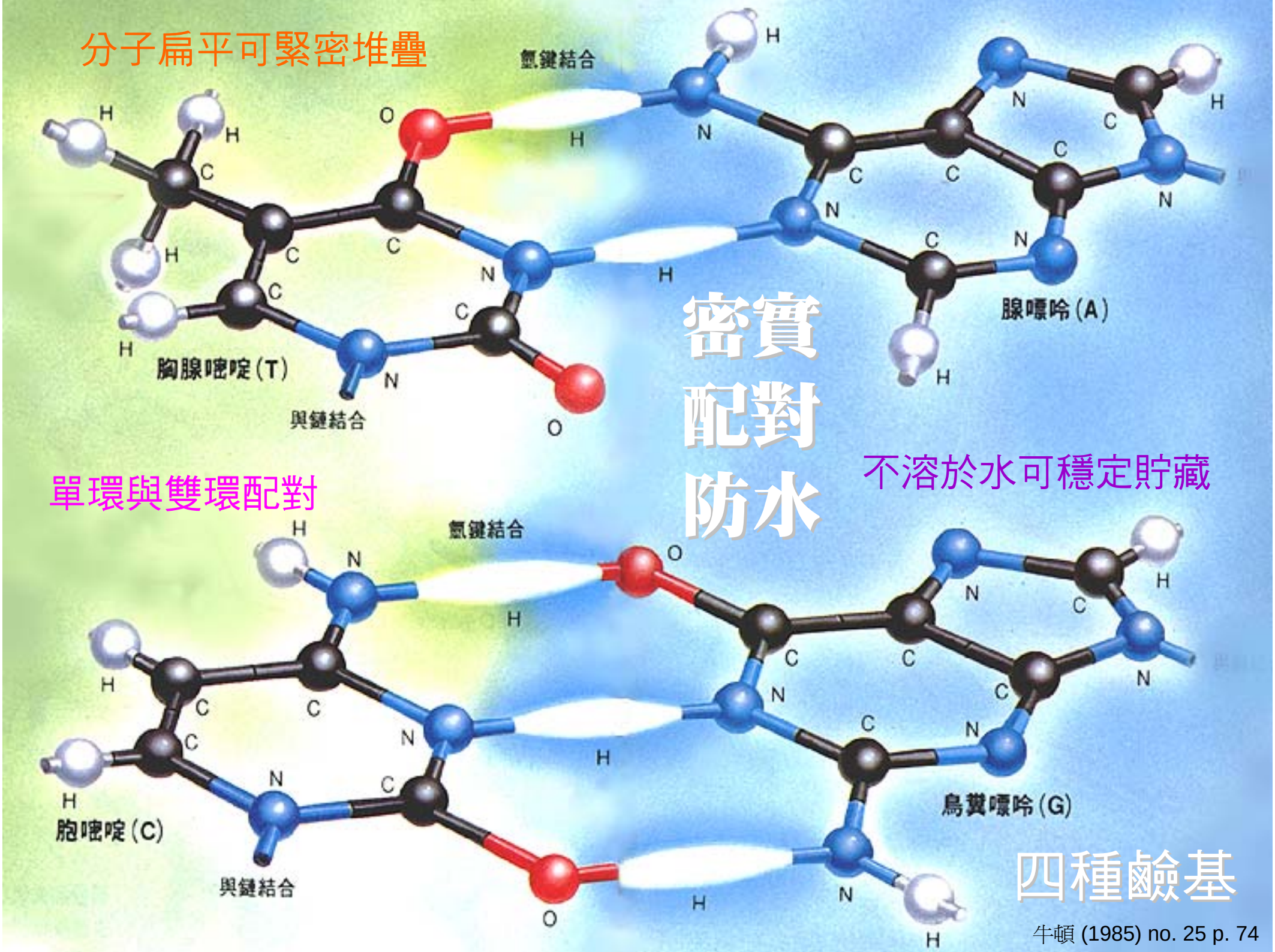
  基因庫建構　PCR　DNA 定序　定點突變　RFLP

象形文字



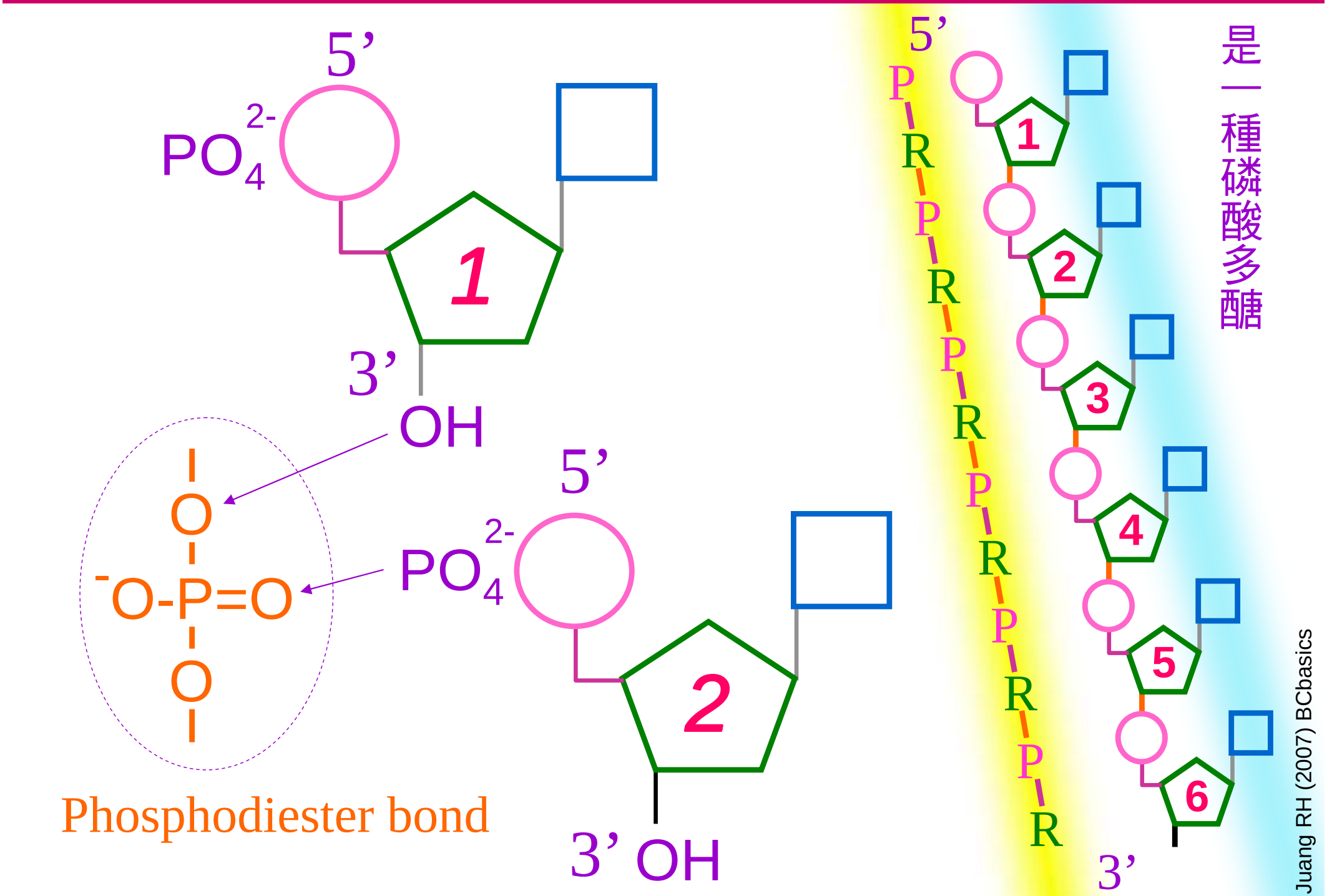
核苷酸 的基本構造



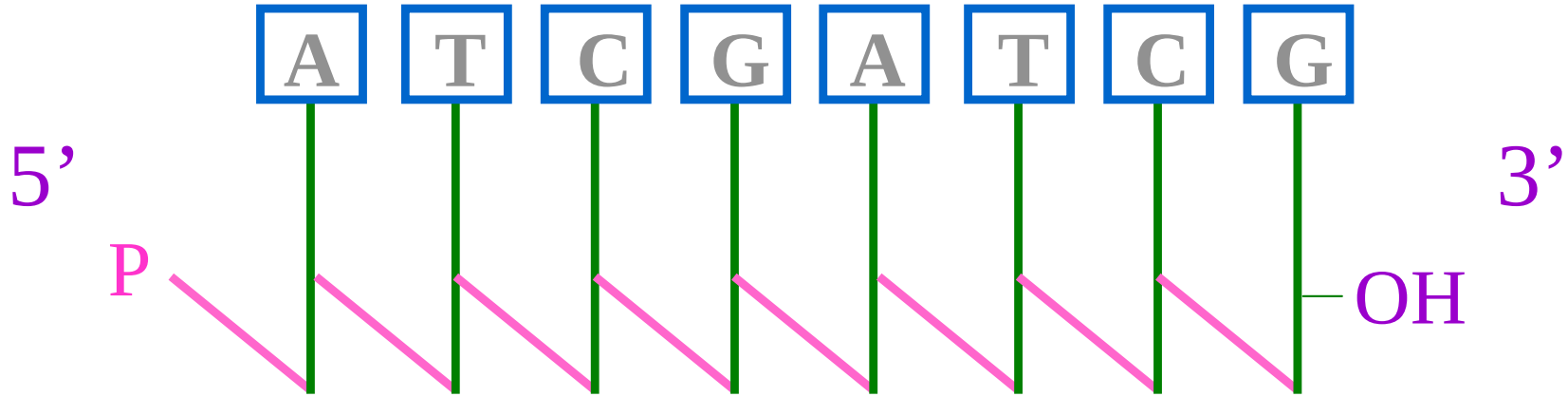


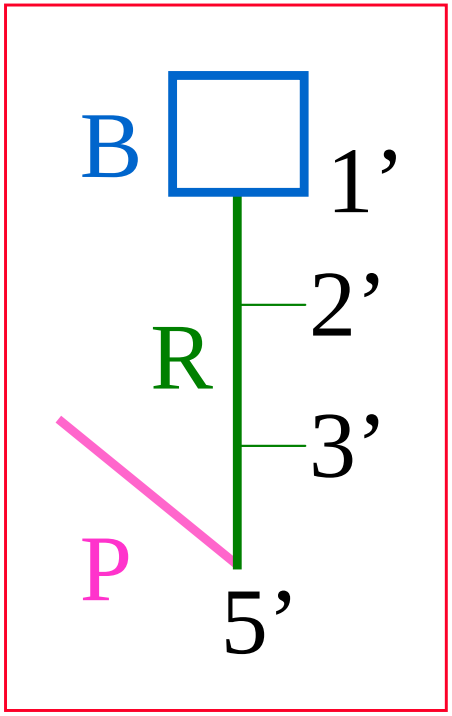
牛頓 (1985) no. 25 p. 74

核苷酸 以磷酯鍵連結成長鏈核酸



核酸長鏈紀錄方式之演進





5’ pApTpCpGpApTpCpG-OH 3’

5’ pATCGATCG-OH 3’

ATCGATCG

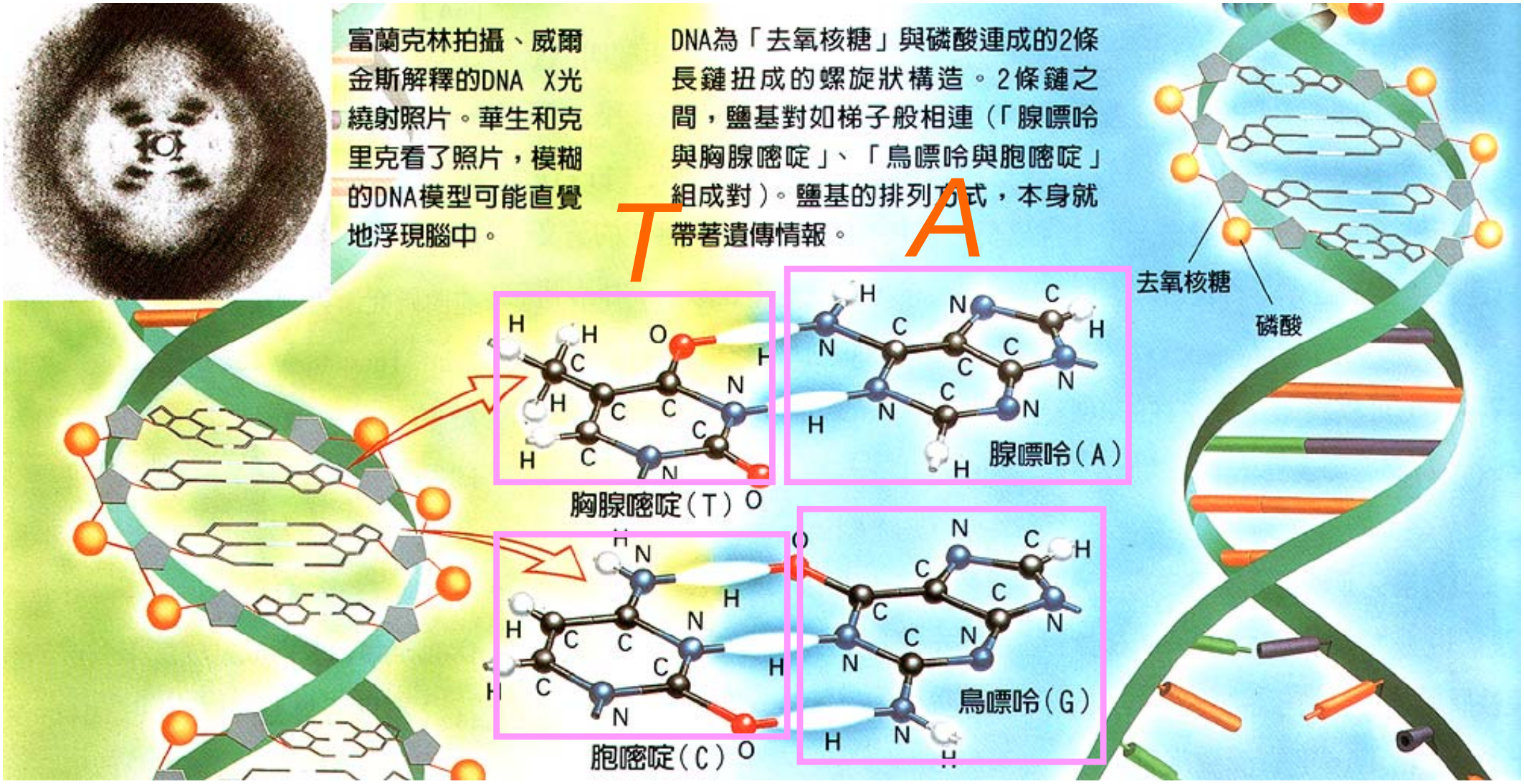
兩股核酸的方向相反

5’ pApTpCpGpApTpCpG-OH 3’

3’ HO-TdAdGdCdTdAdGdC 5’

DNA 以 核苷酸 小單位連結成長條巨分子

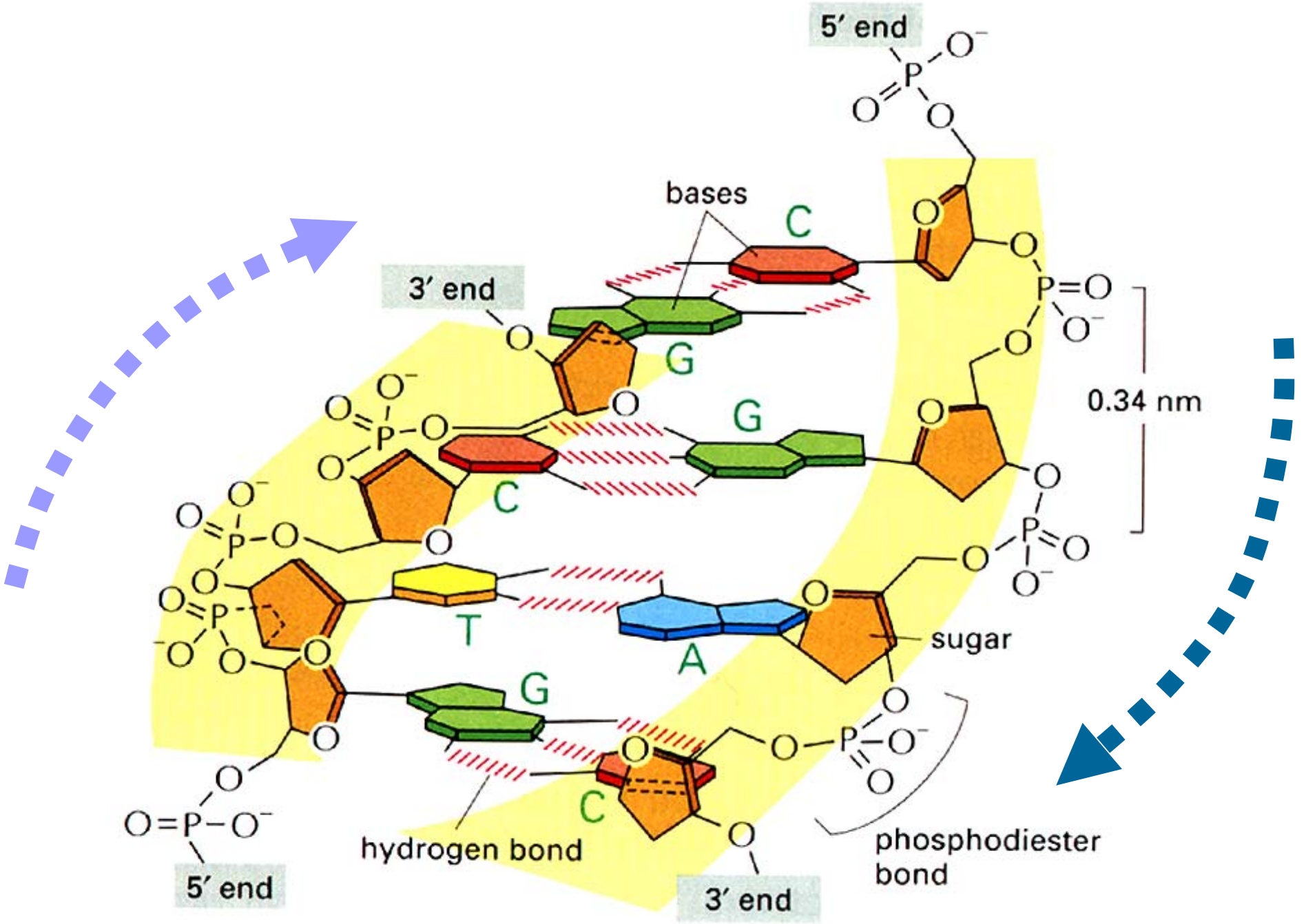
(1) Purine = Pyrimidine (2) Helical structure (3) Hydrogen bonding



兩股 DNA 間的密碼互補

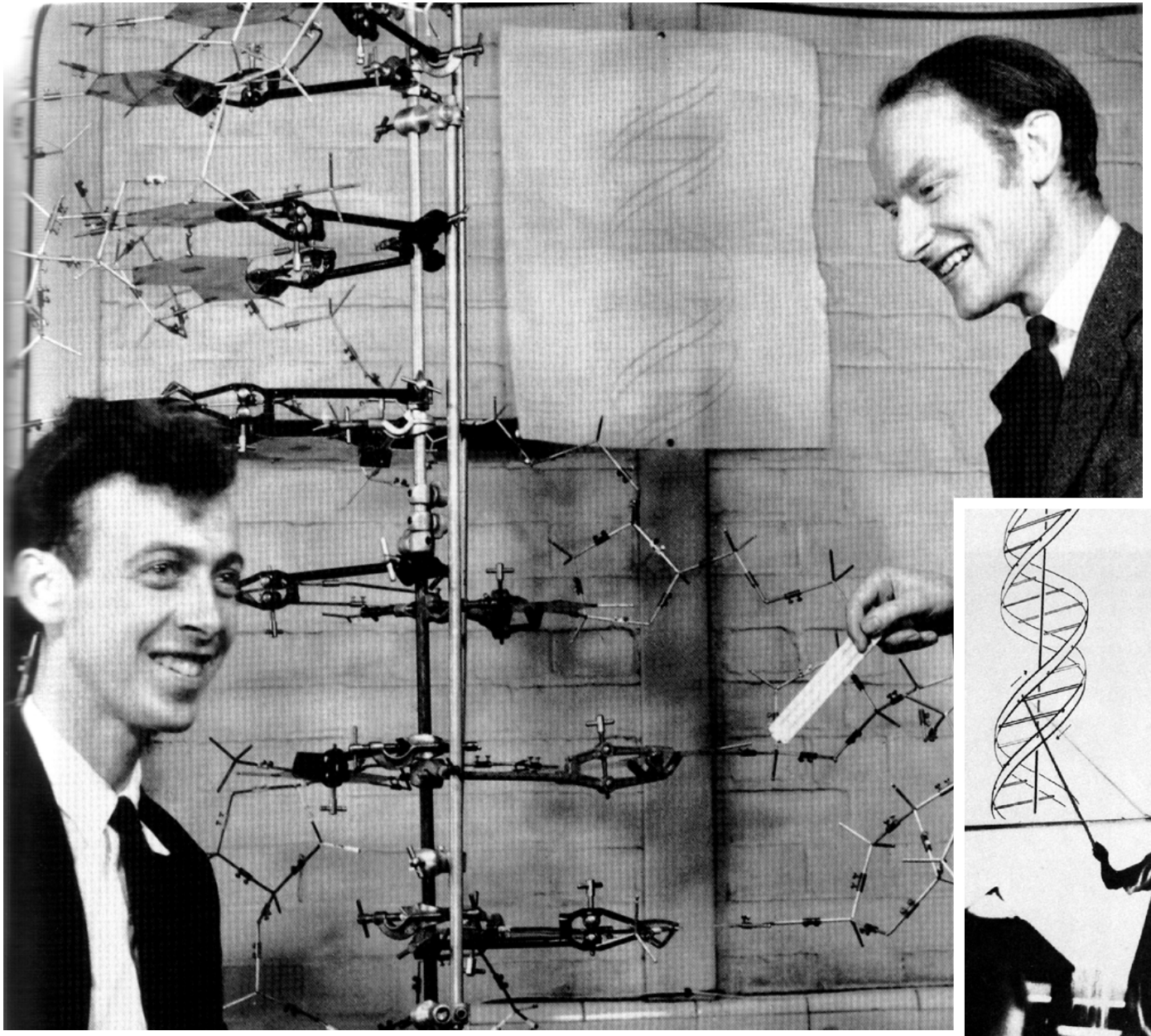
牛頓 (2000) no. 201 p. 36

每一鹼基配對有如階梯的一層



Alberts et al (2002) Molecular Biology of the Cell (4e) p.195

解出 DNA 構造的二人組

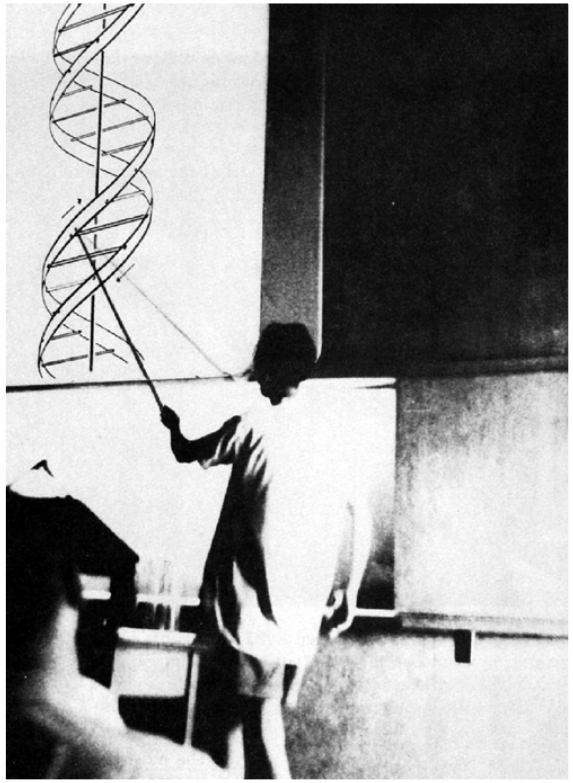


JD Watson

1953 Cambridge

1962

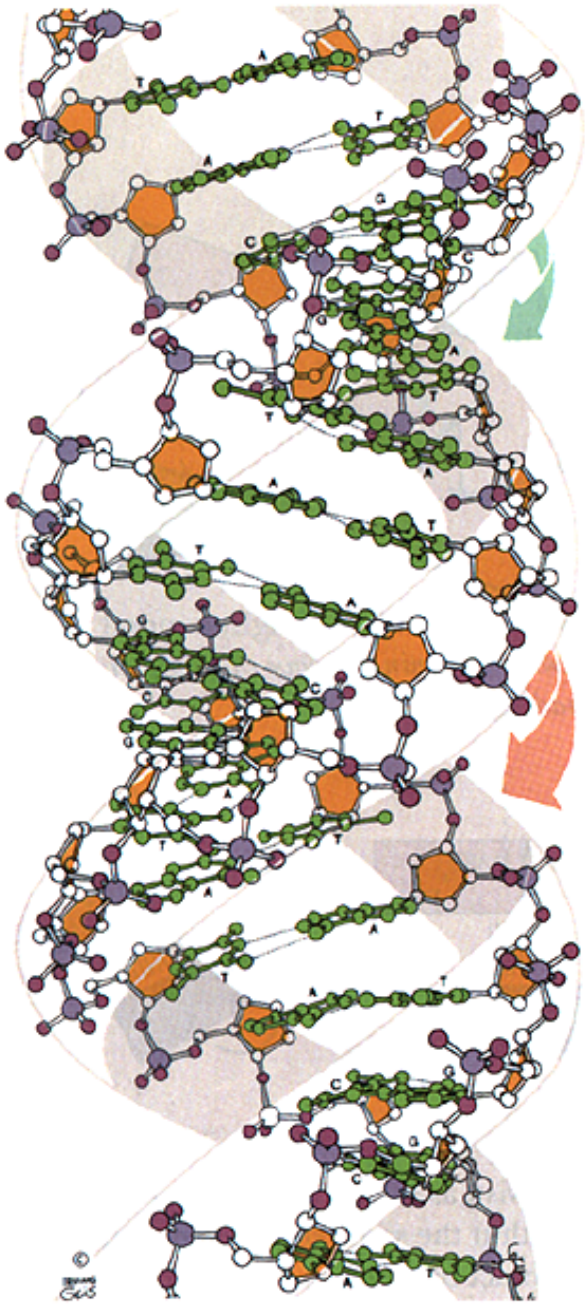
F Crick



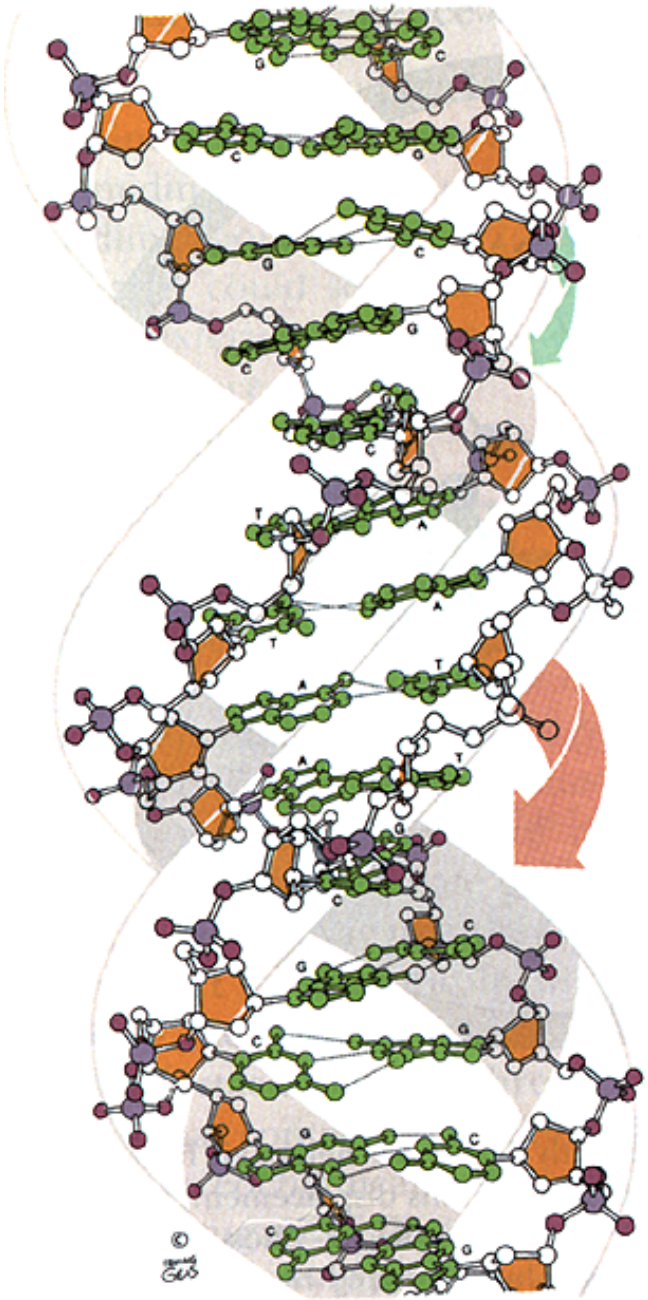
Judson (1996) The Eighth Day of Creation

Darnell et al (1990) Molecular Cell Biology (2e) p.11

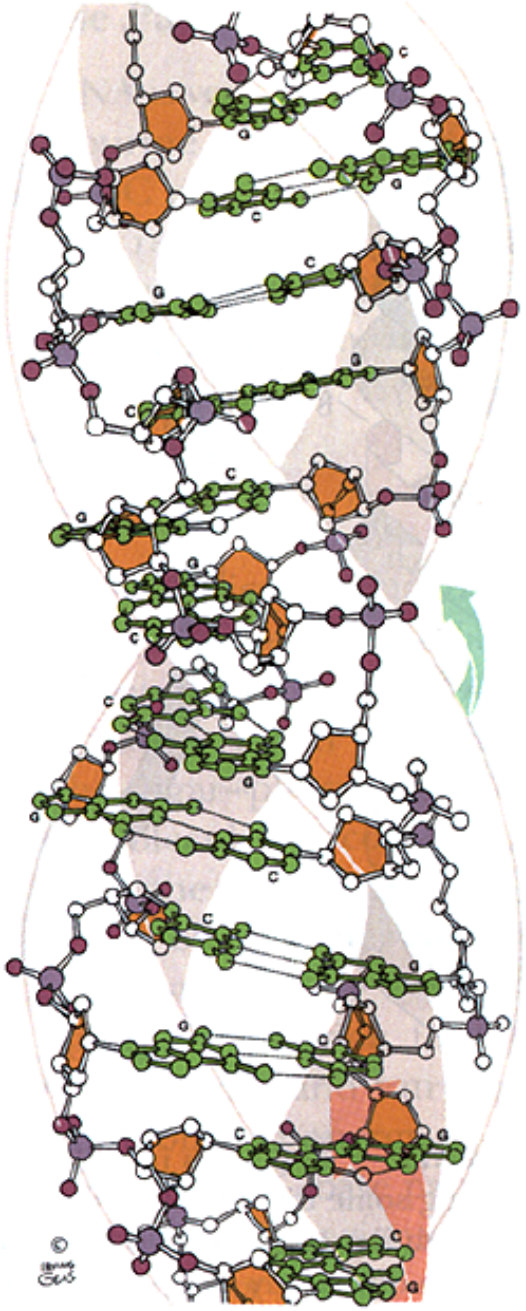
雙螺旋有 A, B, Z 三種形式



A DNA



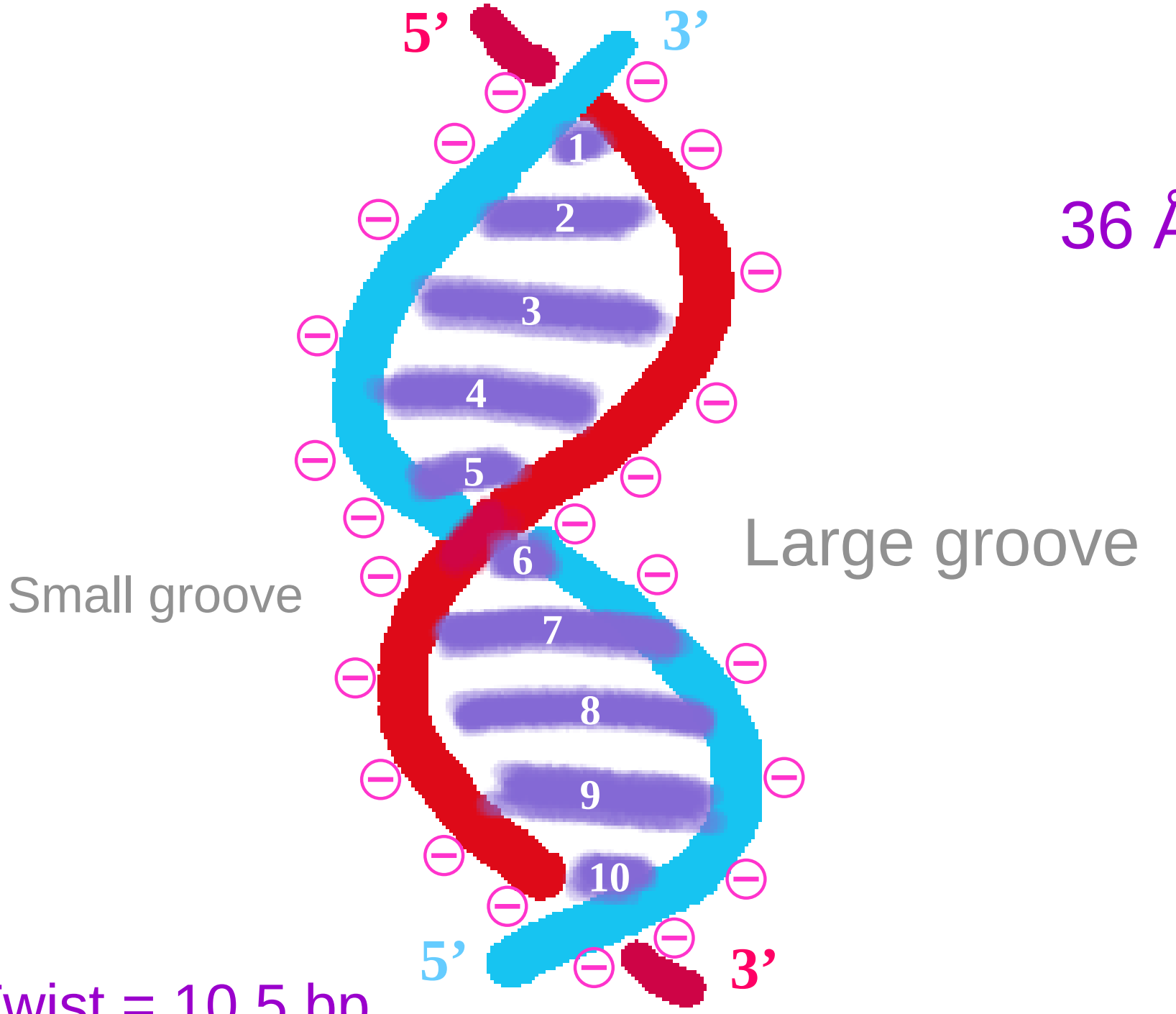
B DNA



Z DNA

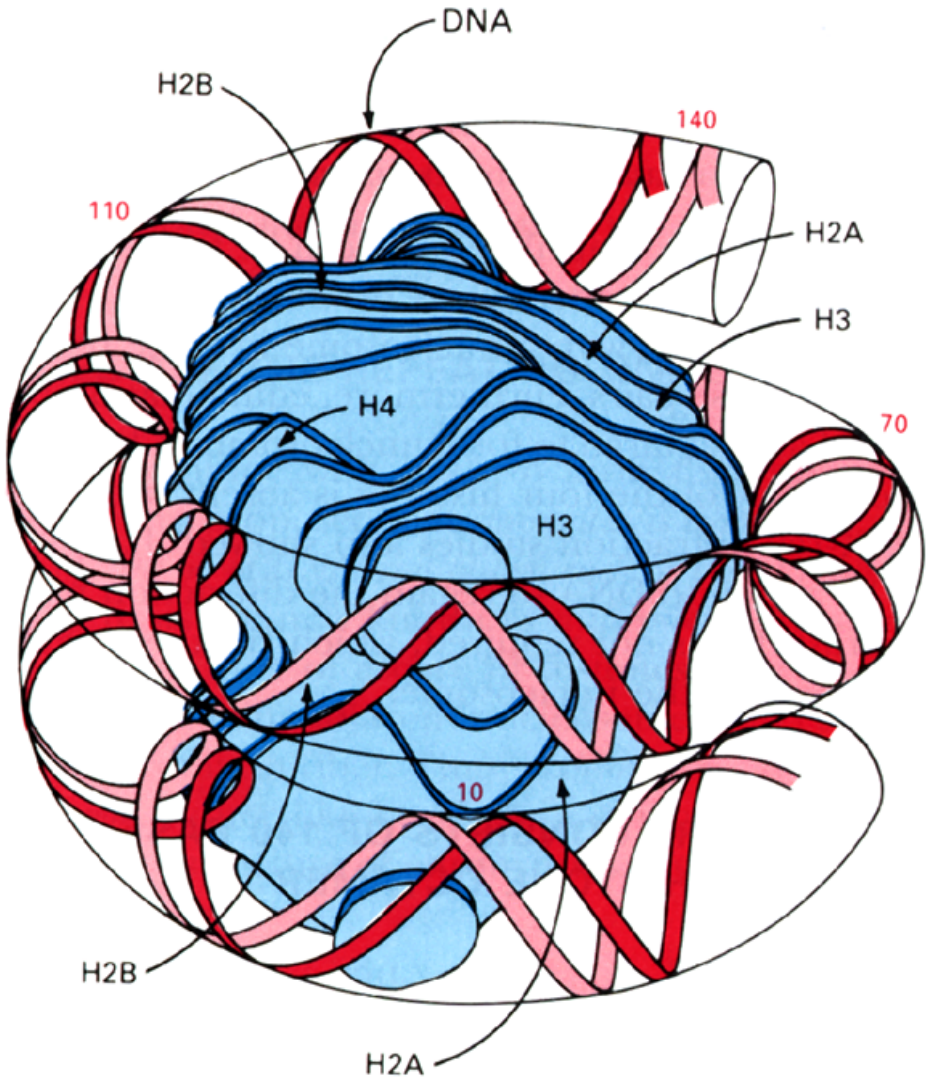
Garrett & Grisham (1999) Biochemistry (2e) p.366

核酸二級構造的特徵



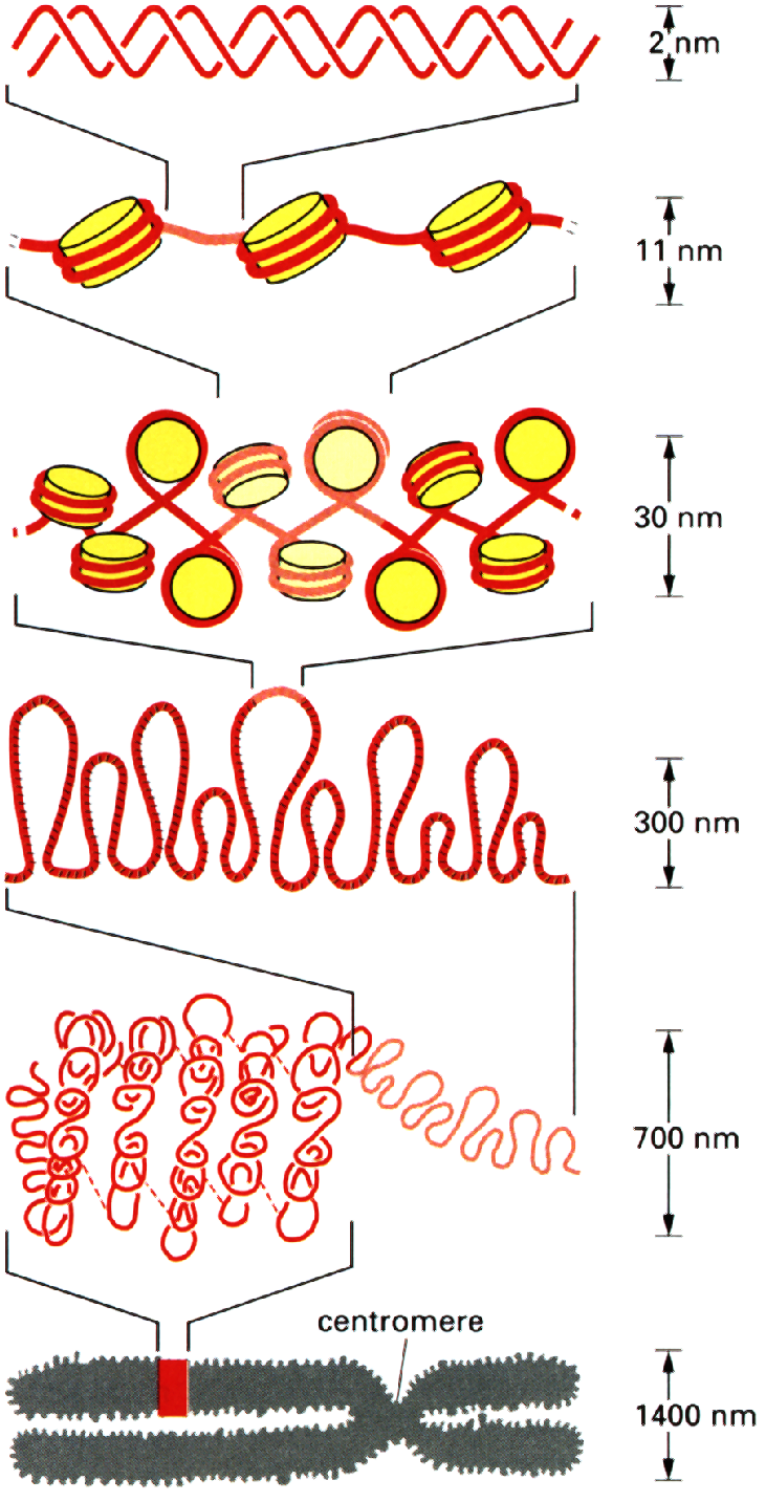
Juang RH (2007) BCbasics

染色體緊密包裹核酸



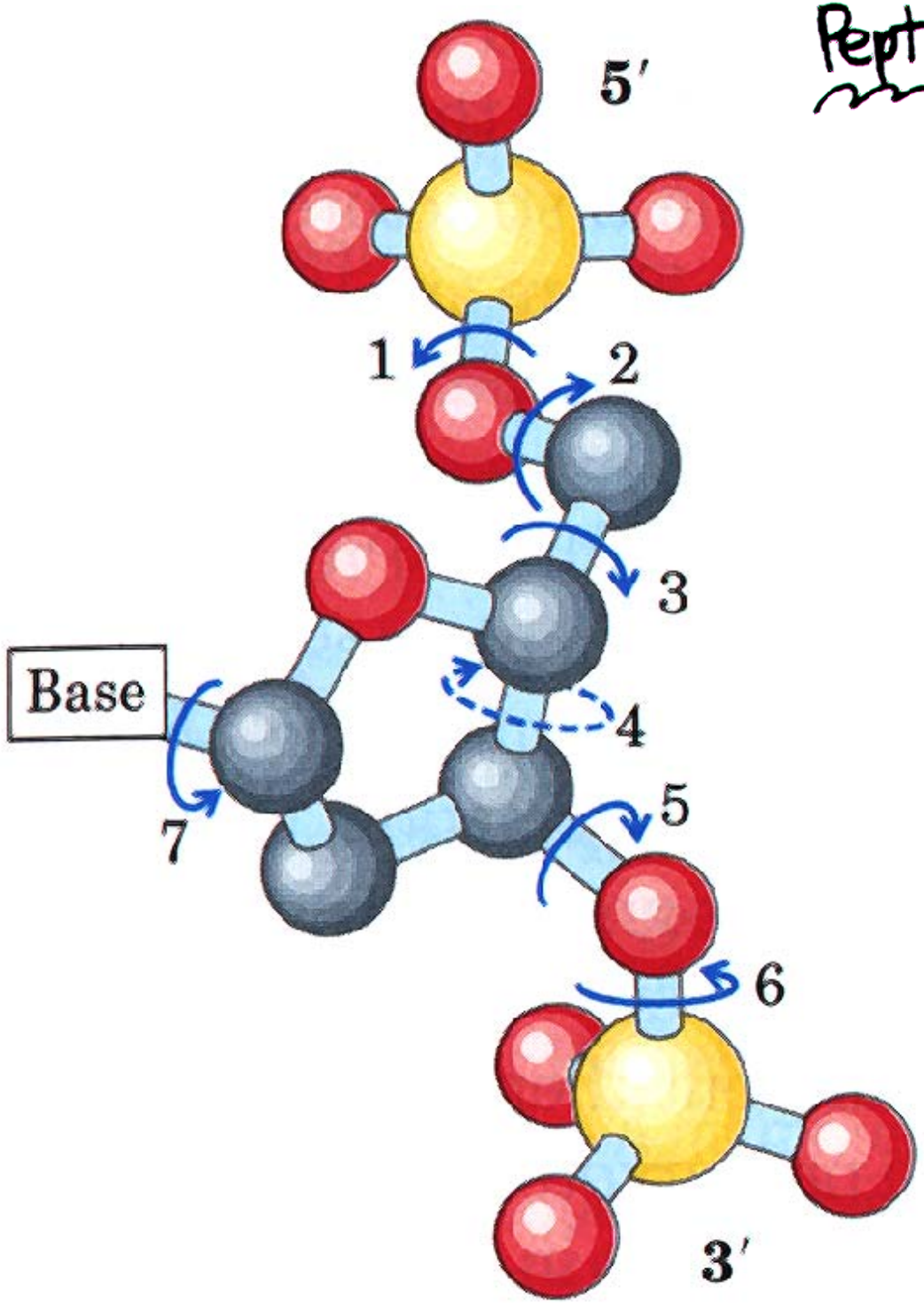
核酸緊密纏繞在 histone 上面

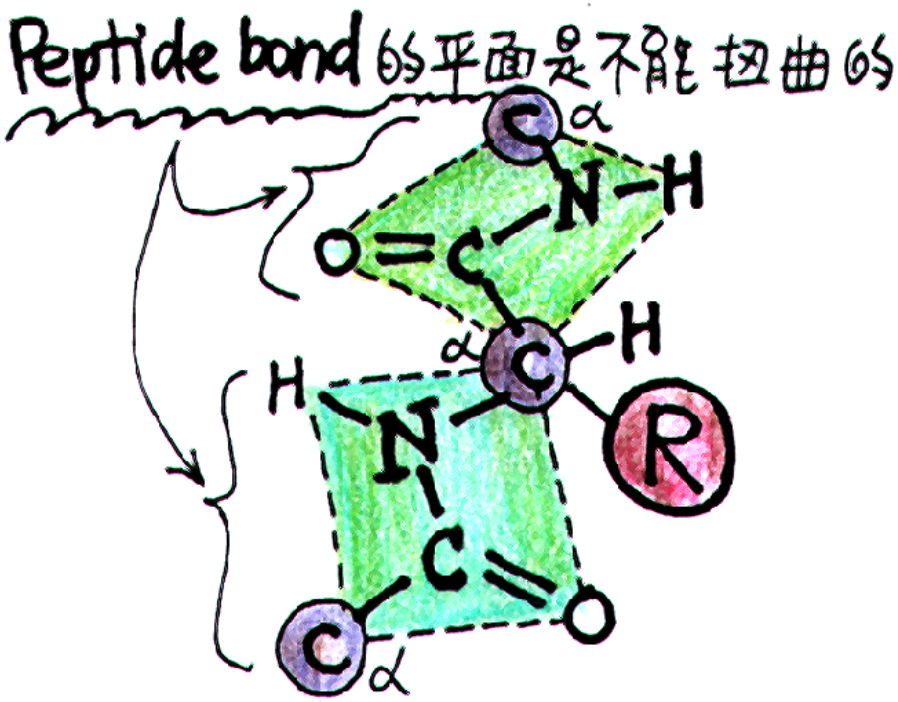
Stryer (1995) Biochemistry (4e) p.980



Alberts et al (2002) Molecular Biology of the Cell (4e) p.230

核酸骨架的自由度比蛋白質高

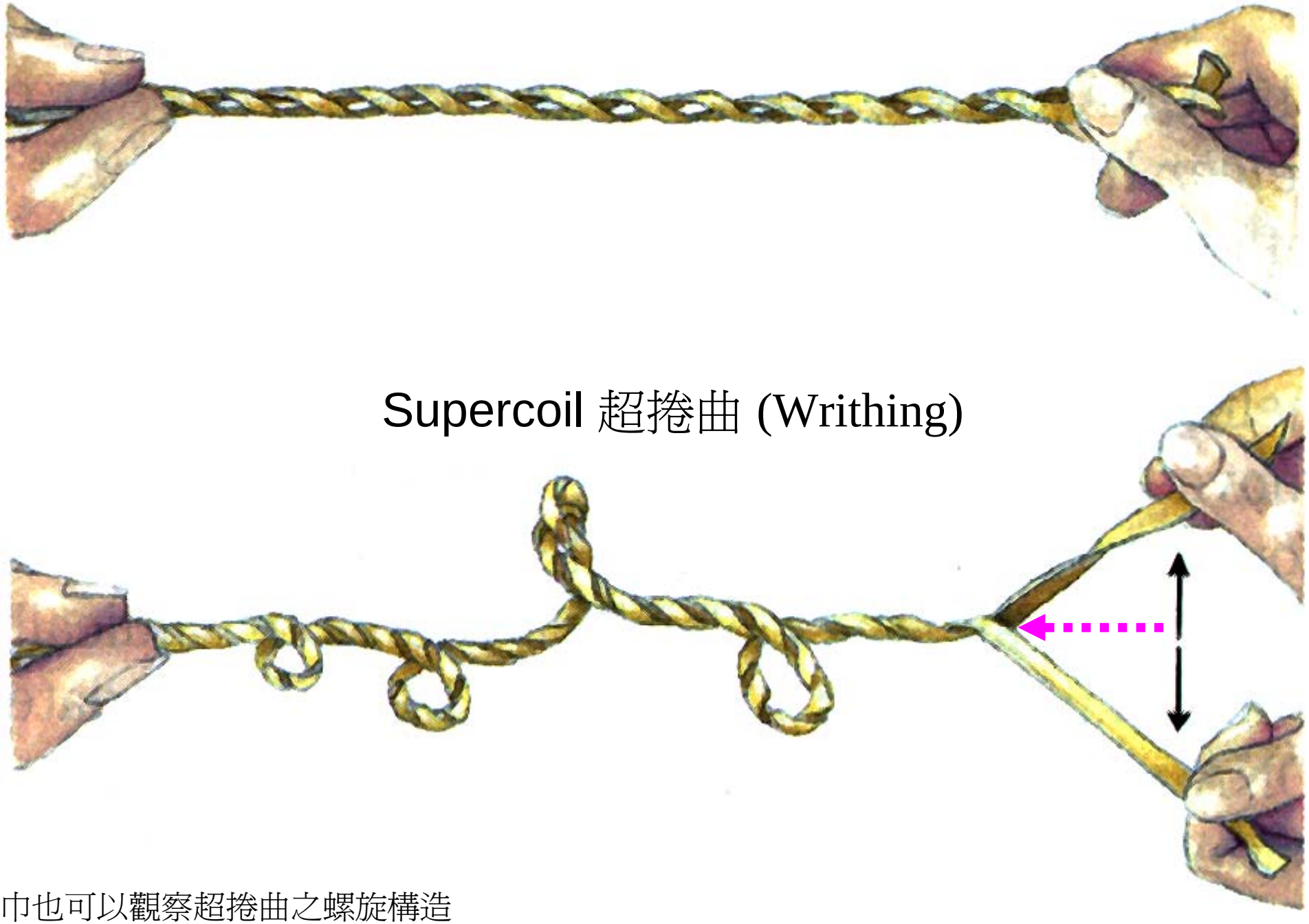




但是 DNA 有雙股

Nelson & Cox (2000) Lehninger Principles of Biochemistry (3e) p.337

兩股核酸捲繞仍有立體限制

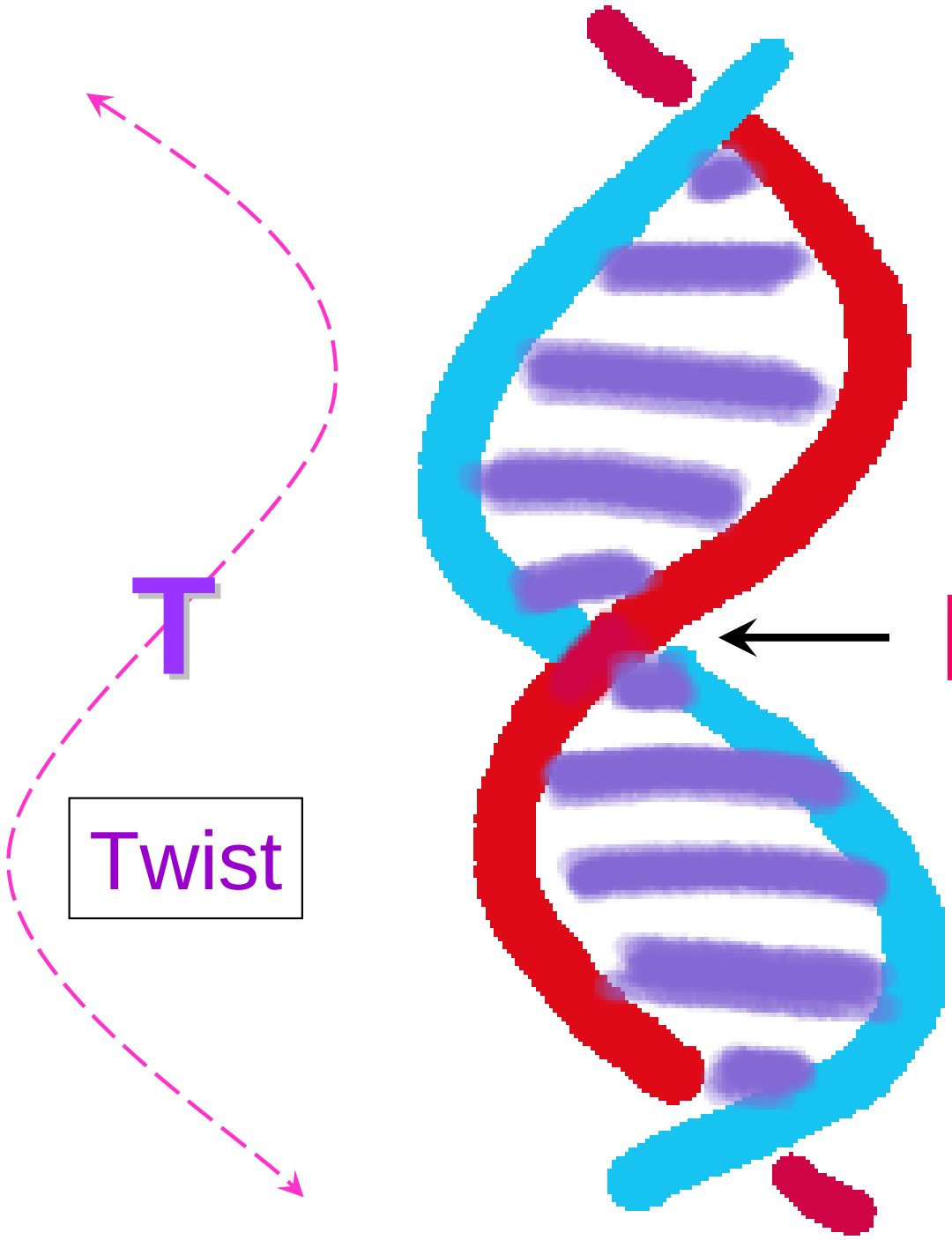


Supercoil 超捲曲 (Writing)

用毛巾也可以觀察超捲曲之螺旋構造

Nelson & Cox (2000) Lehninger Principles of Biochemistry (3e) p.917

控制核酸二級構造的基本元素



$$L = T + W$$

Writhing

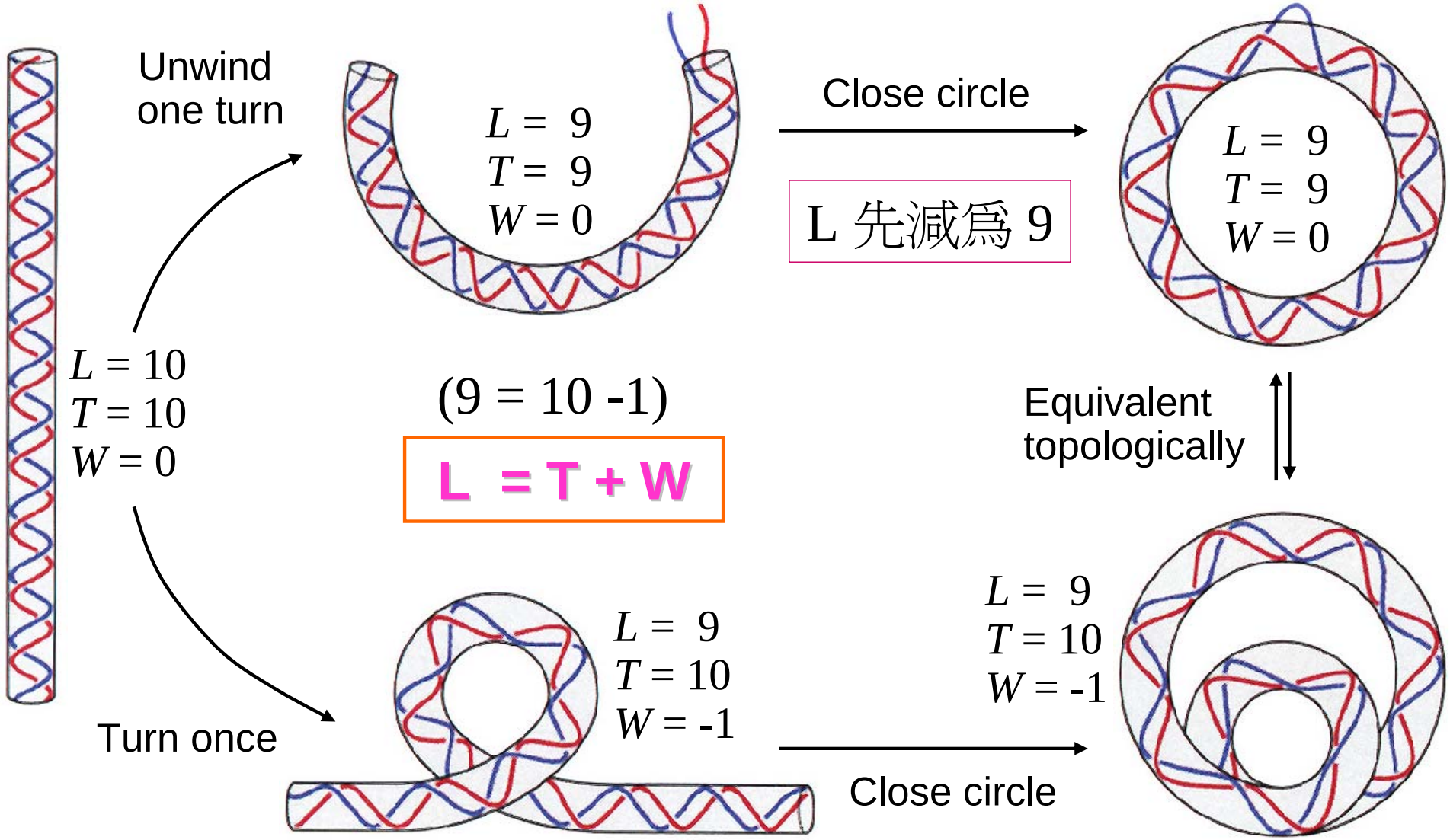
1 Twist = 10.5 bp

DNA 之超捲曲構造可用數學描述

核酸的三級構造說明實例

105 bp = 10 Twists (T = 10)

11.6 bp = 1 Twist



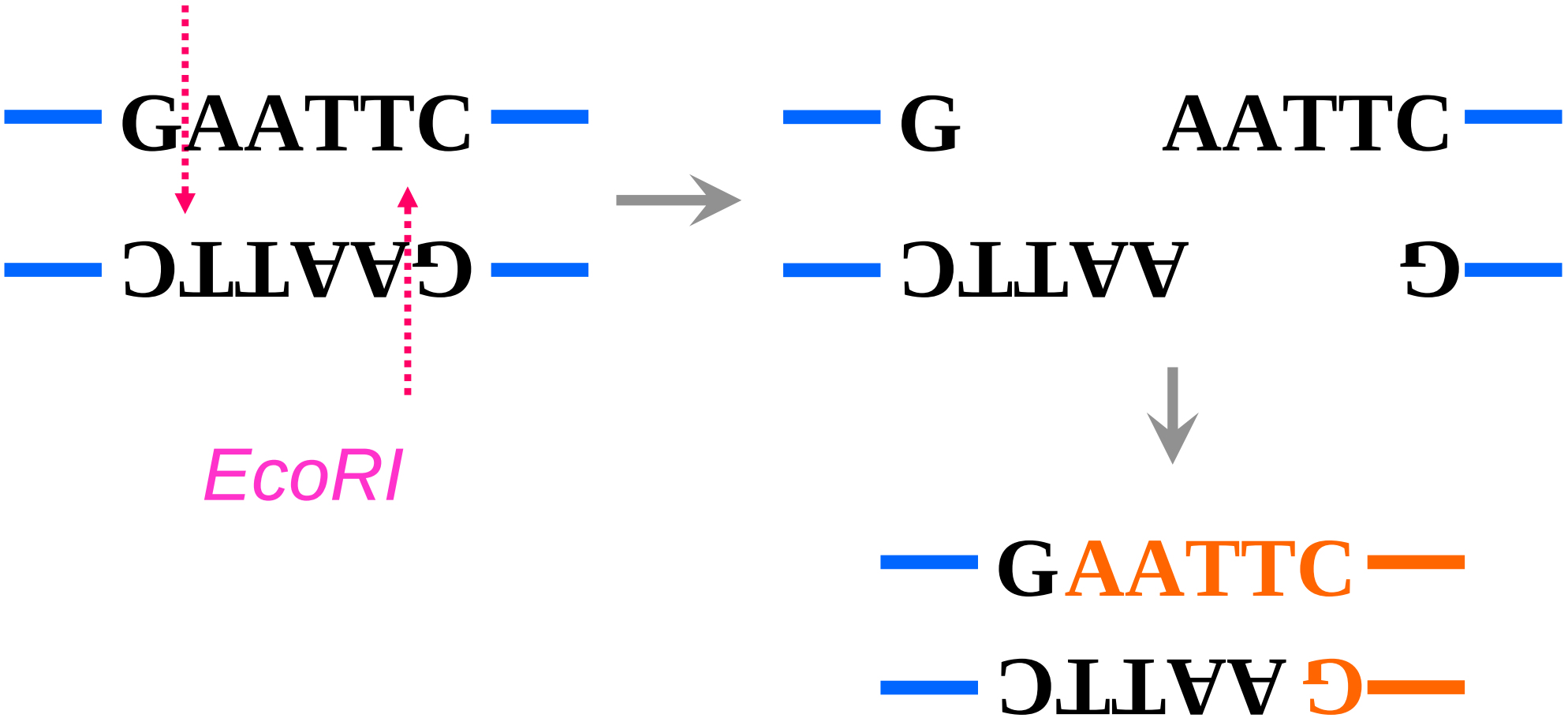
Voet et al (1999) Fundamental of Biochemistry p.733

Palindrome, Restriction Enzyme, Sticky Ends

Arber, Nathans, Smith (1978)

CIVIC, Madam

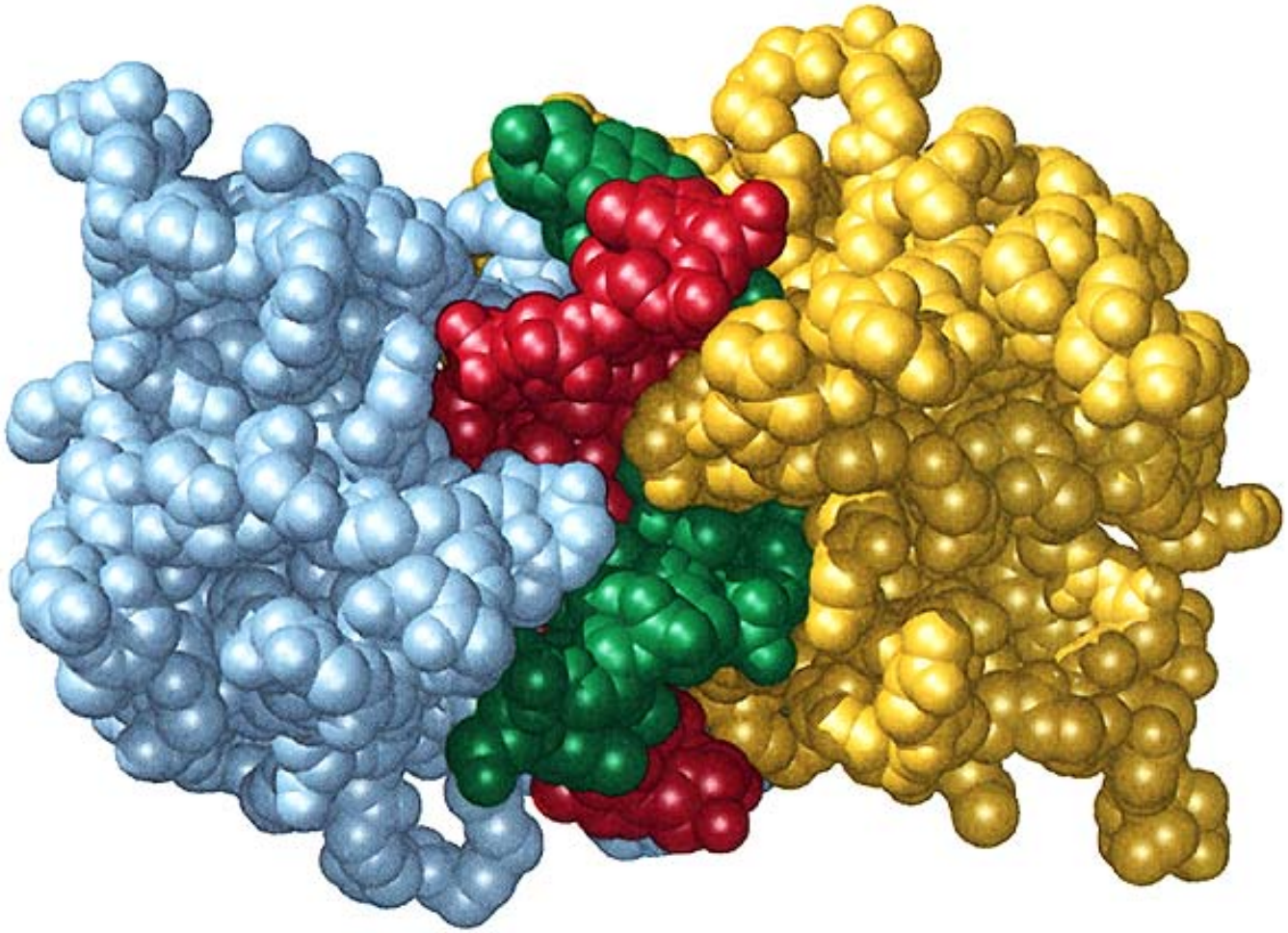
Sticky Ends
(Cohesive Ends)



Get **A**n **A**pple **T**o **T**he **C**lass

Juang RH (2007) BCbasics

*Eco*RV 可產生鈍端 Blunt ends



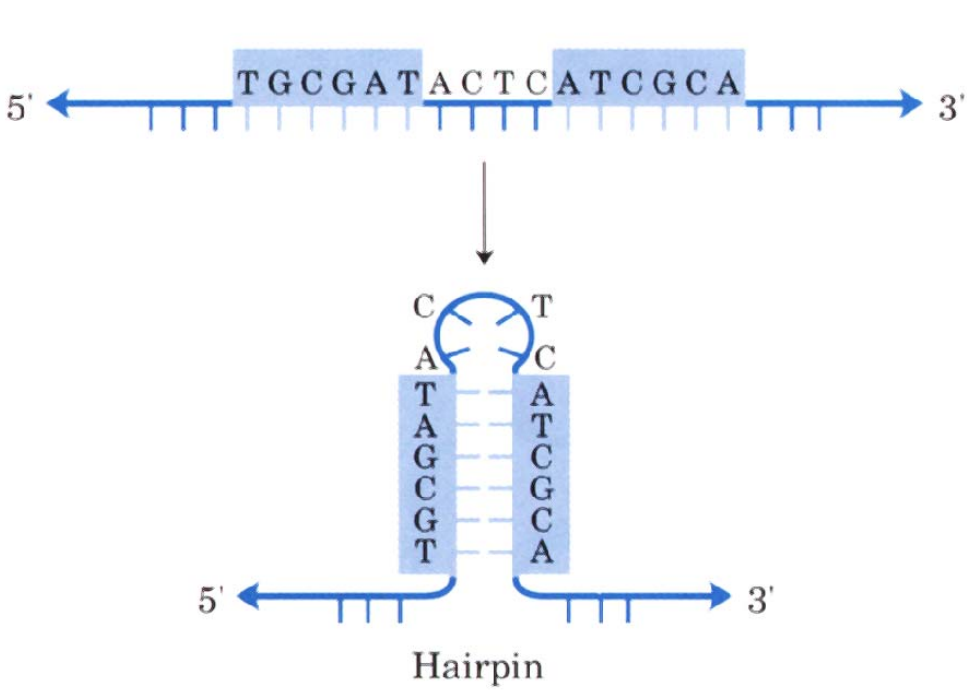
*Eco*RV

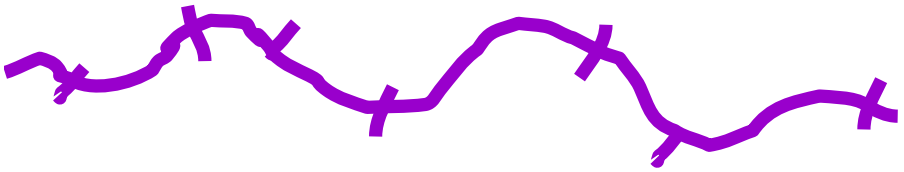
GATATC

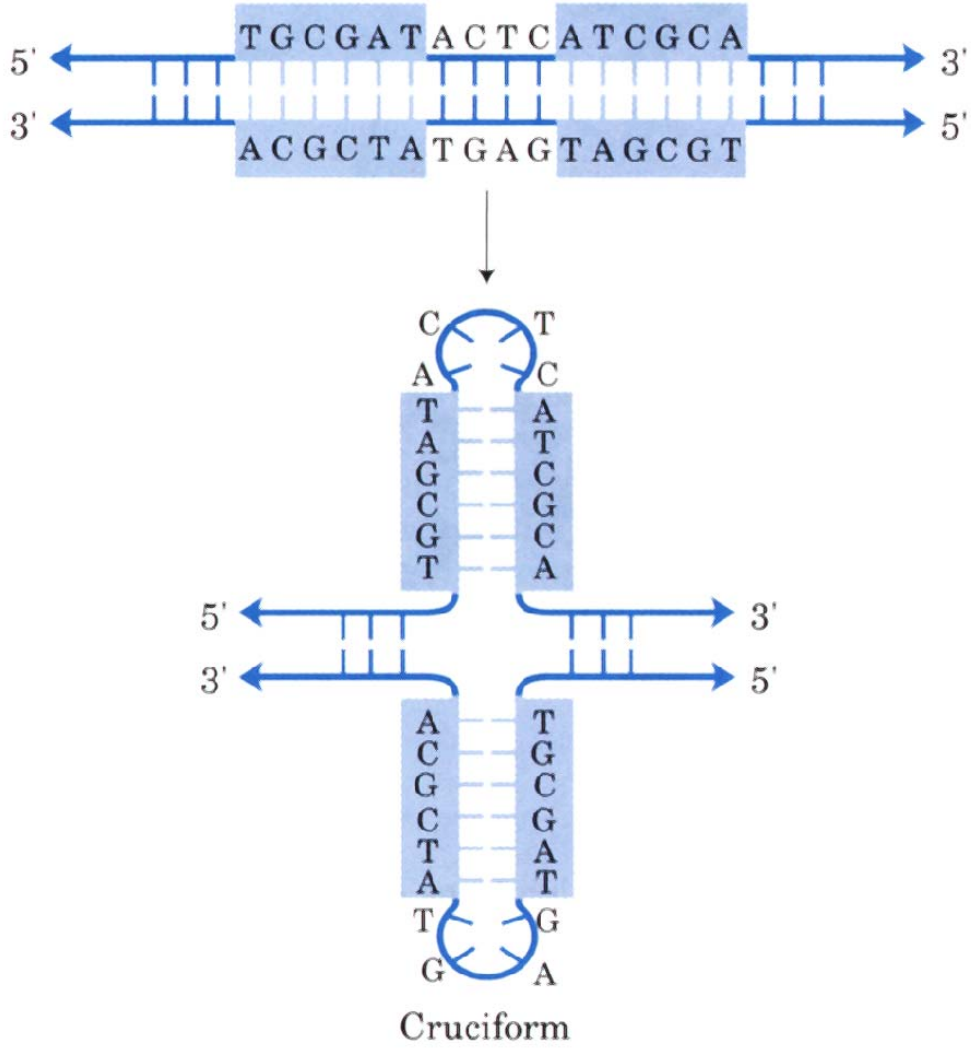
CTATAG

Stryer (1995) Biochemistry (4e) p.792

核酸的 Hairpin 或 Cruciform 構造

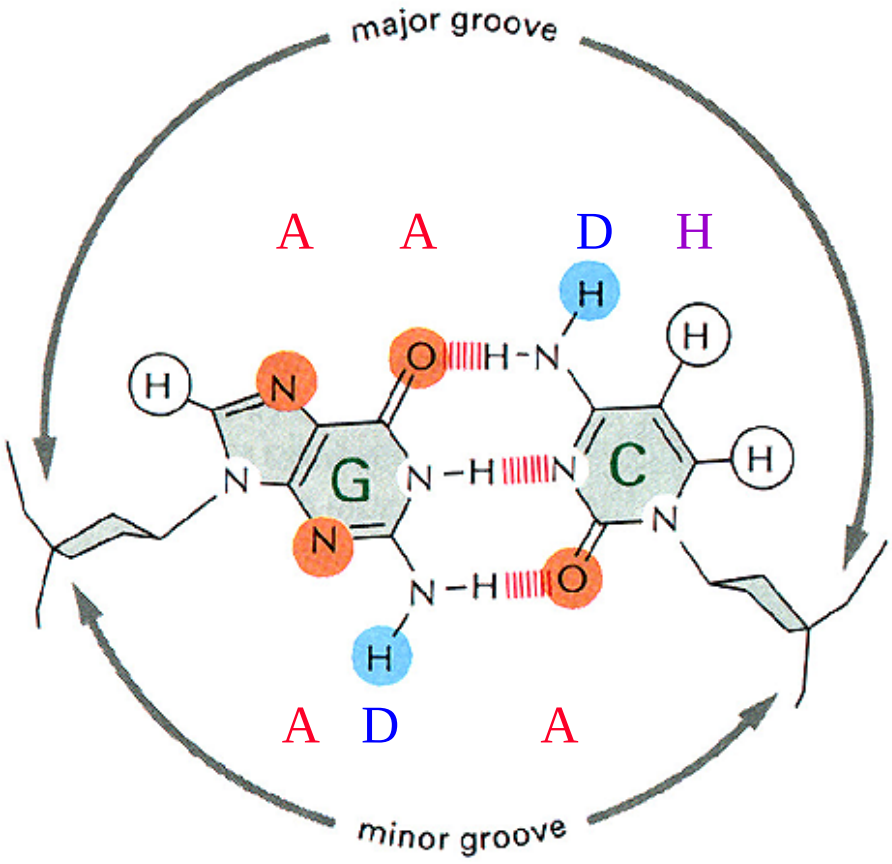


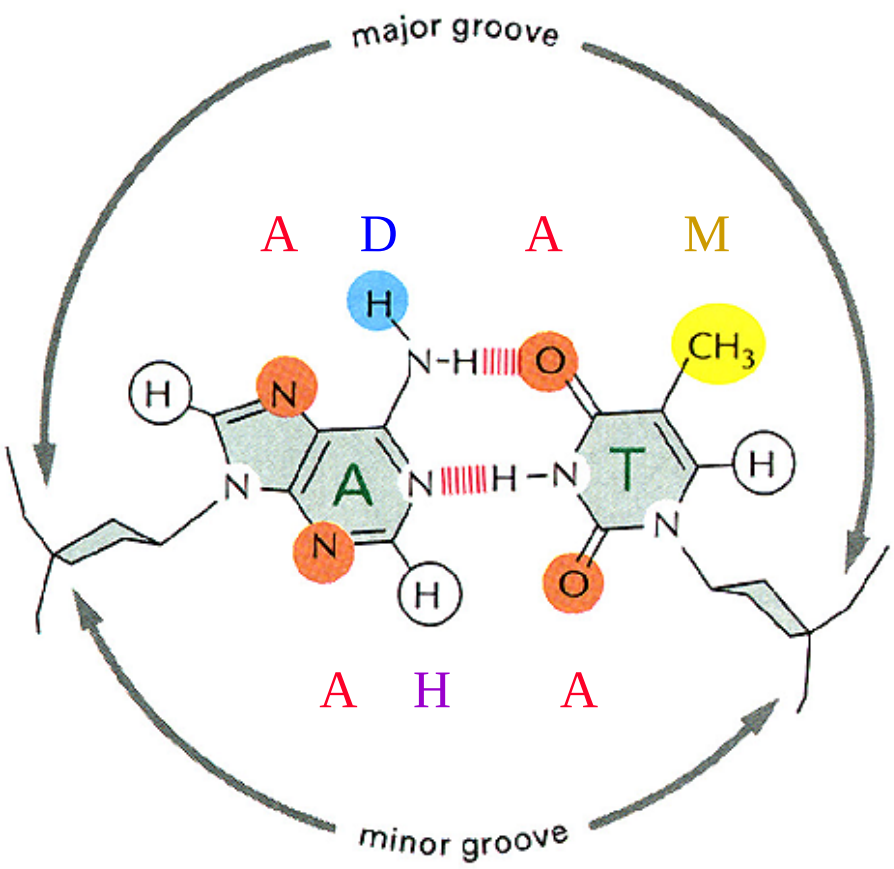


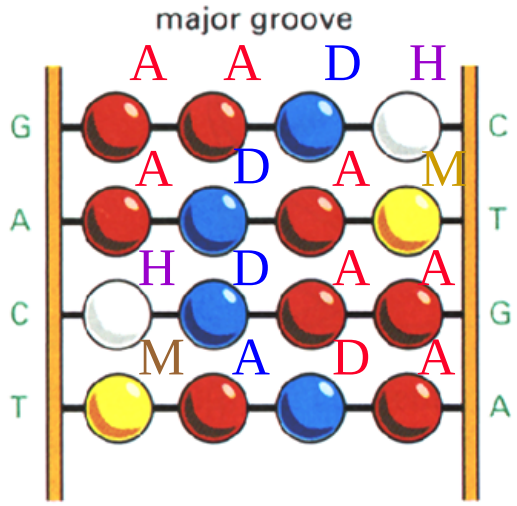


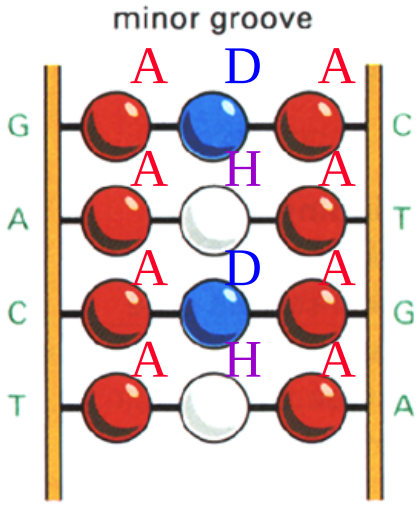
Nelson & Cox (2000) Lehninger Principles of Biochemistry (3e) p.339

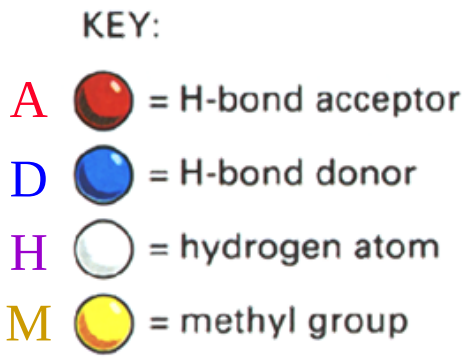
DNA 的外圍可以被蛋白質辨識





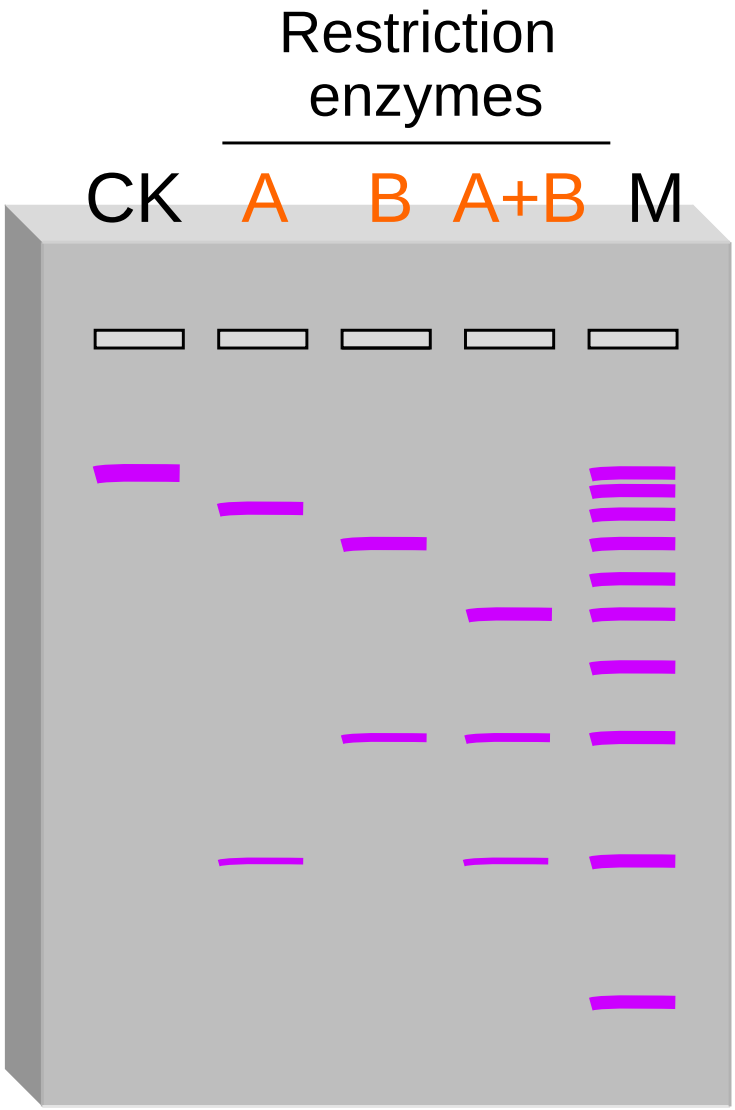


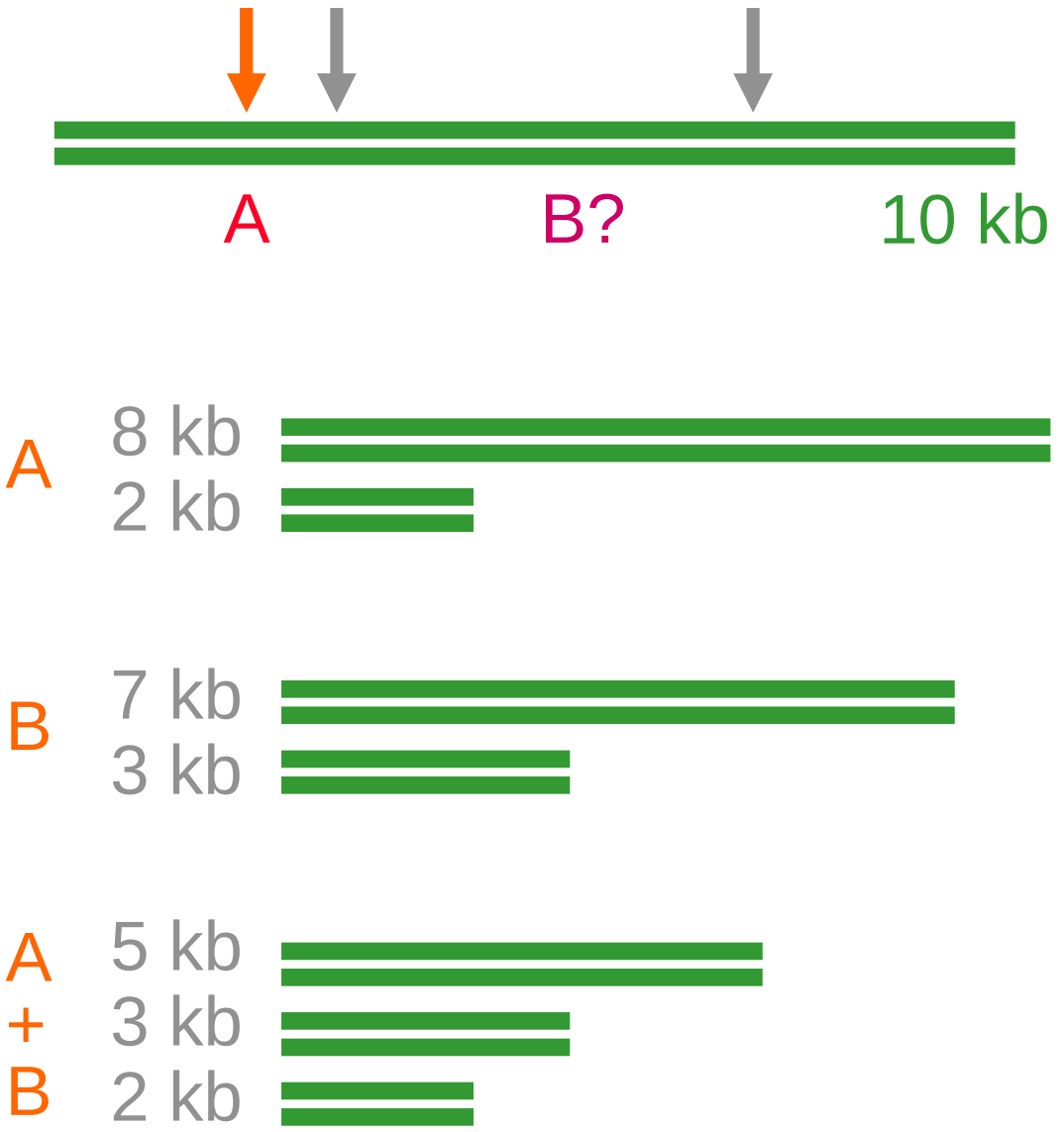




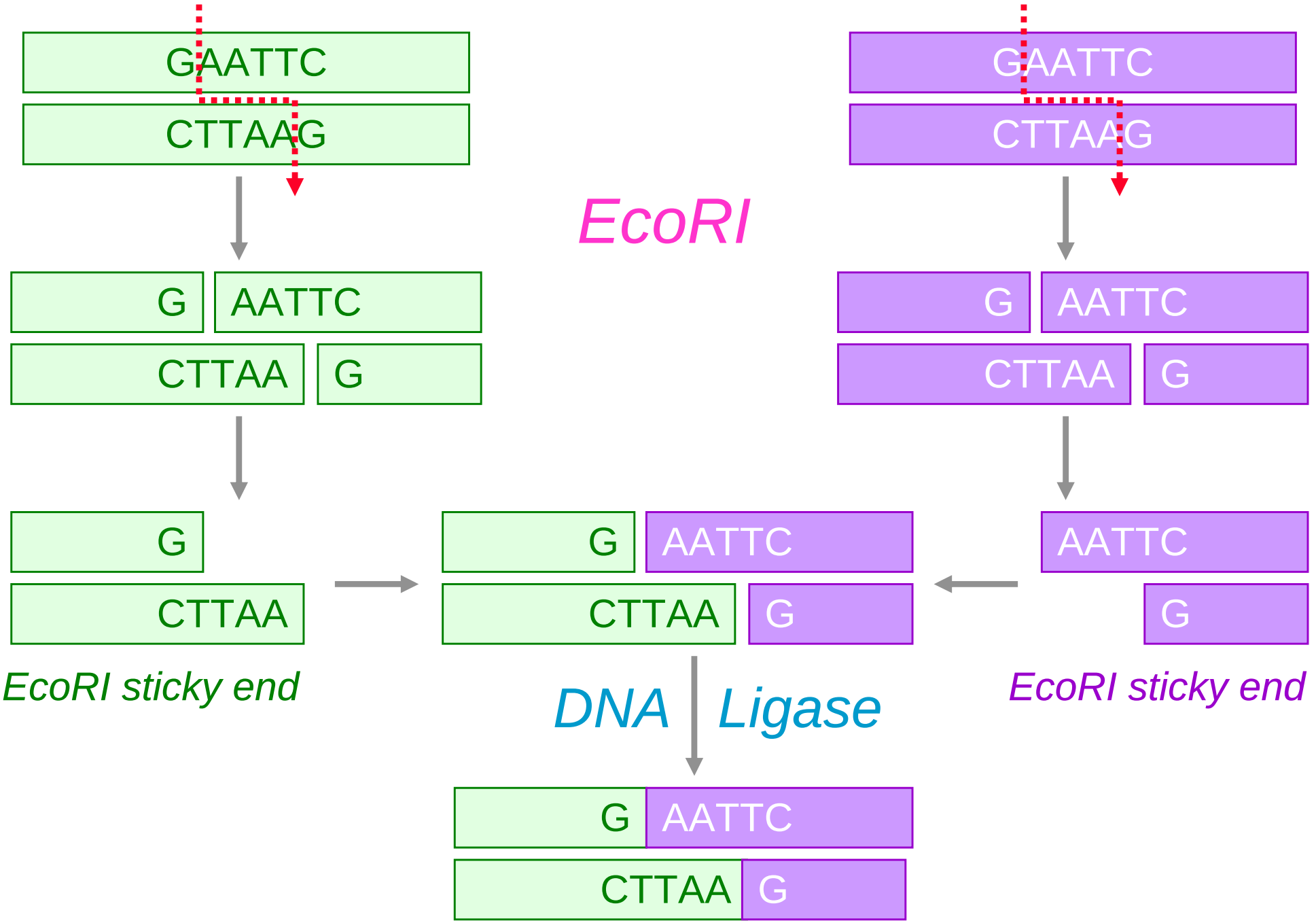
Alberts et al (2002) Molecular Biology of the Cell (4e) p.381

DNA 的限制胰圖譜檢定



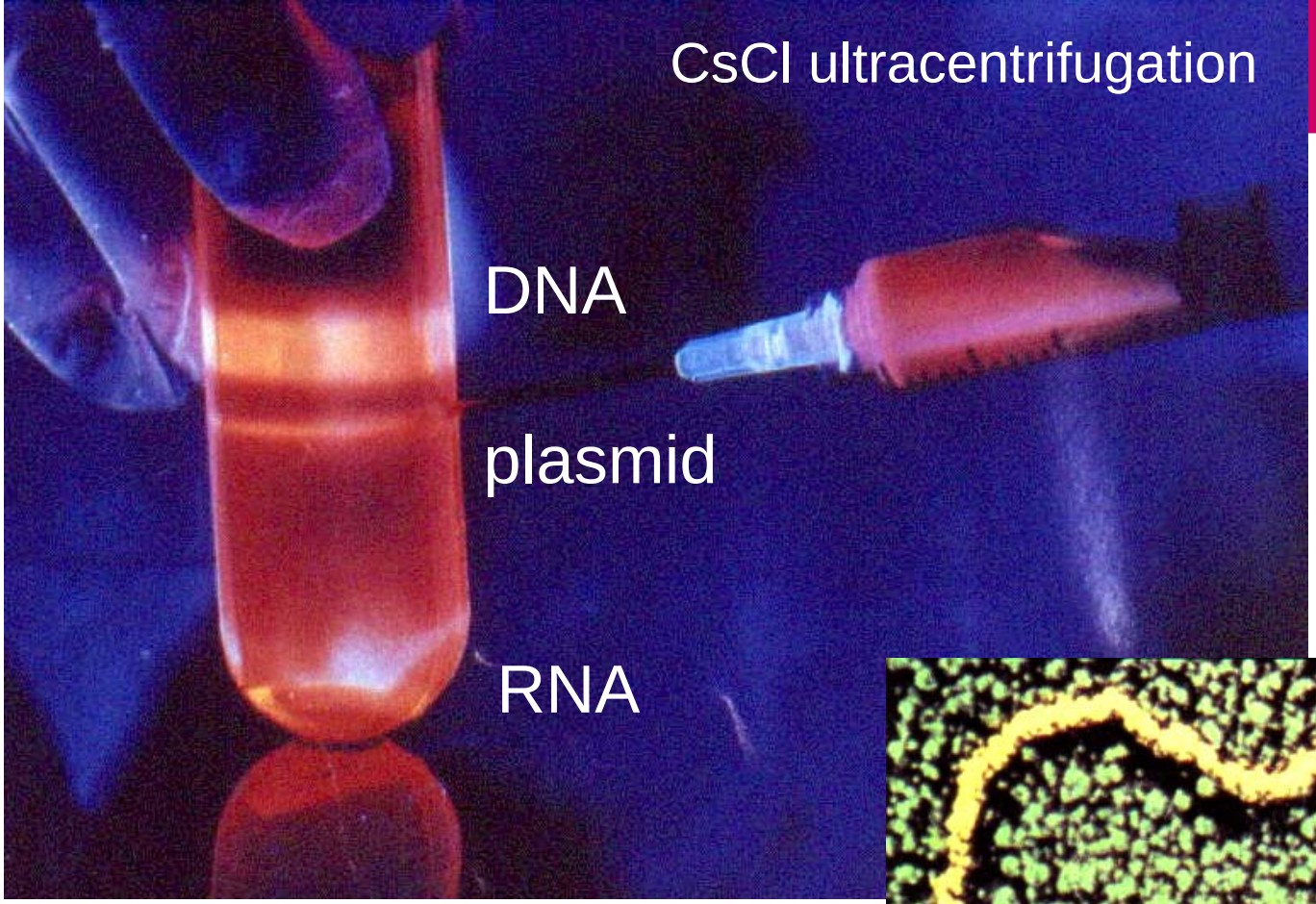


以限制酶及連結酶進行核酸剪接



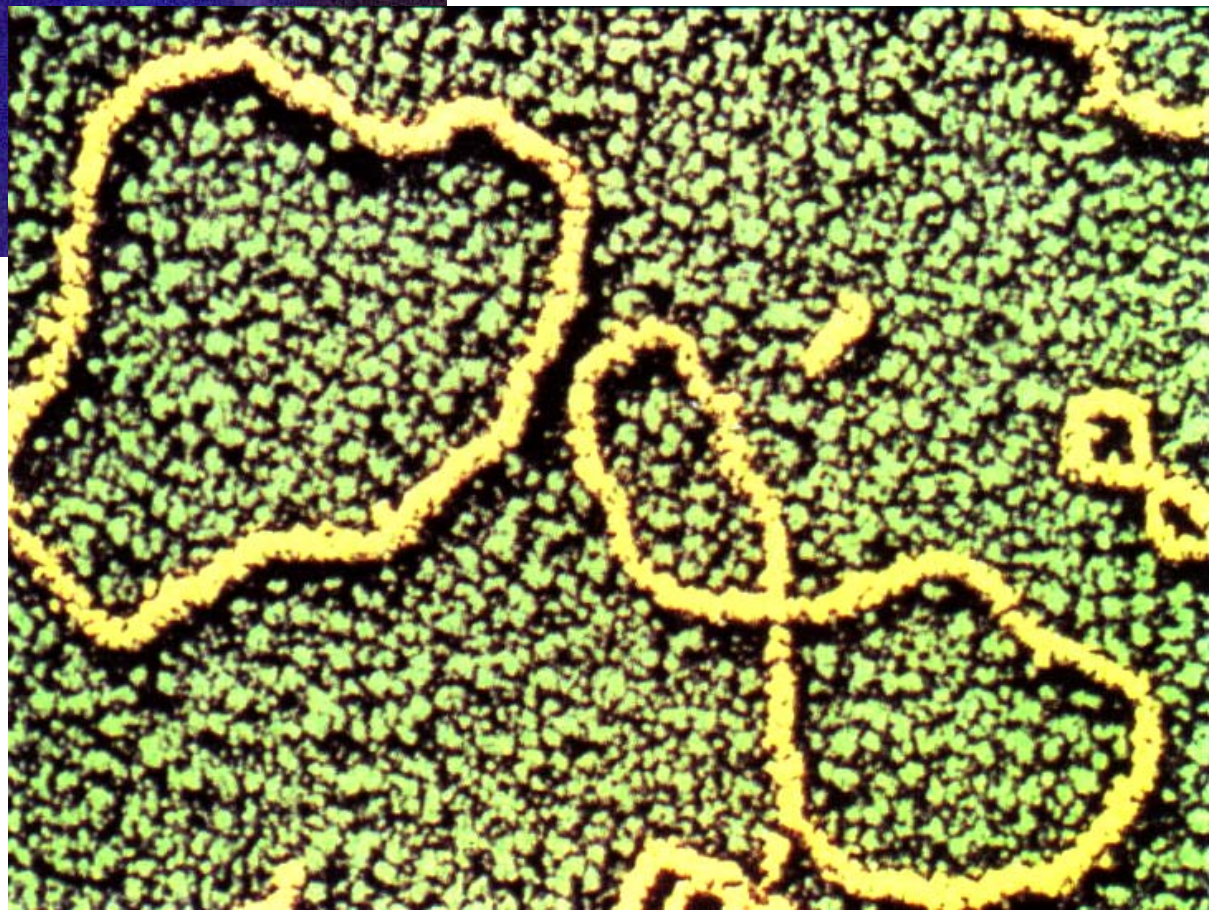
Juang RH (2007) BCbasics

質體 Plasmid



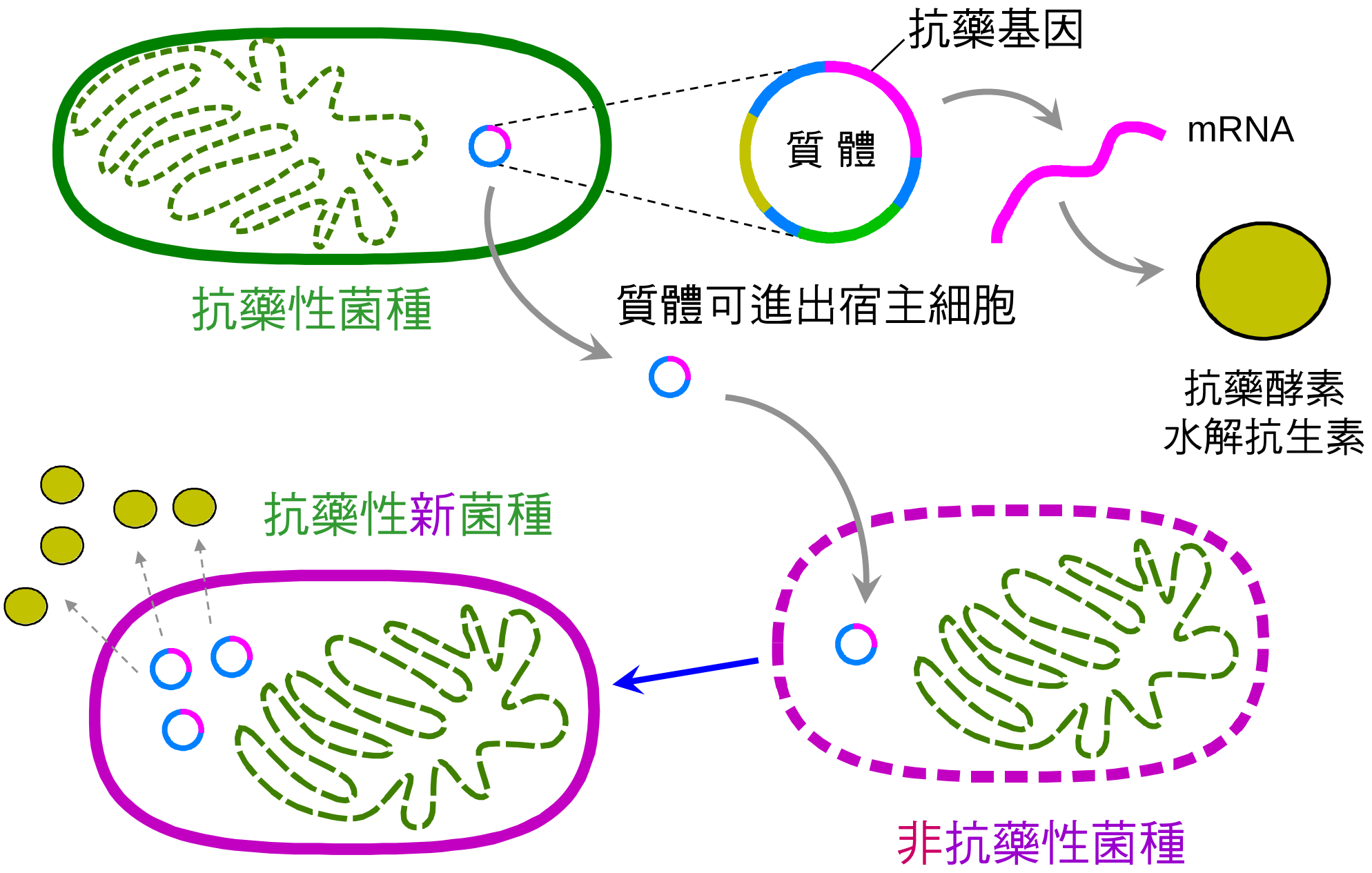
質體可以大量製備

質體是環狀的獨立核酸



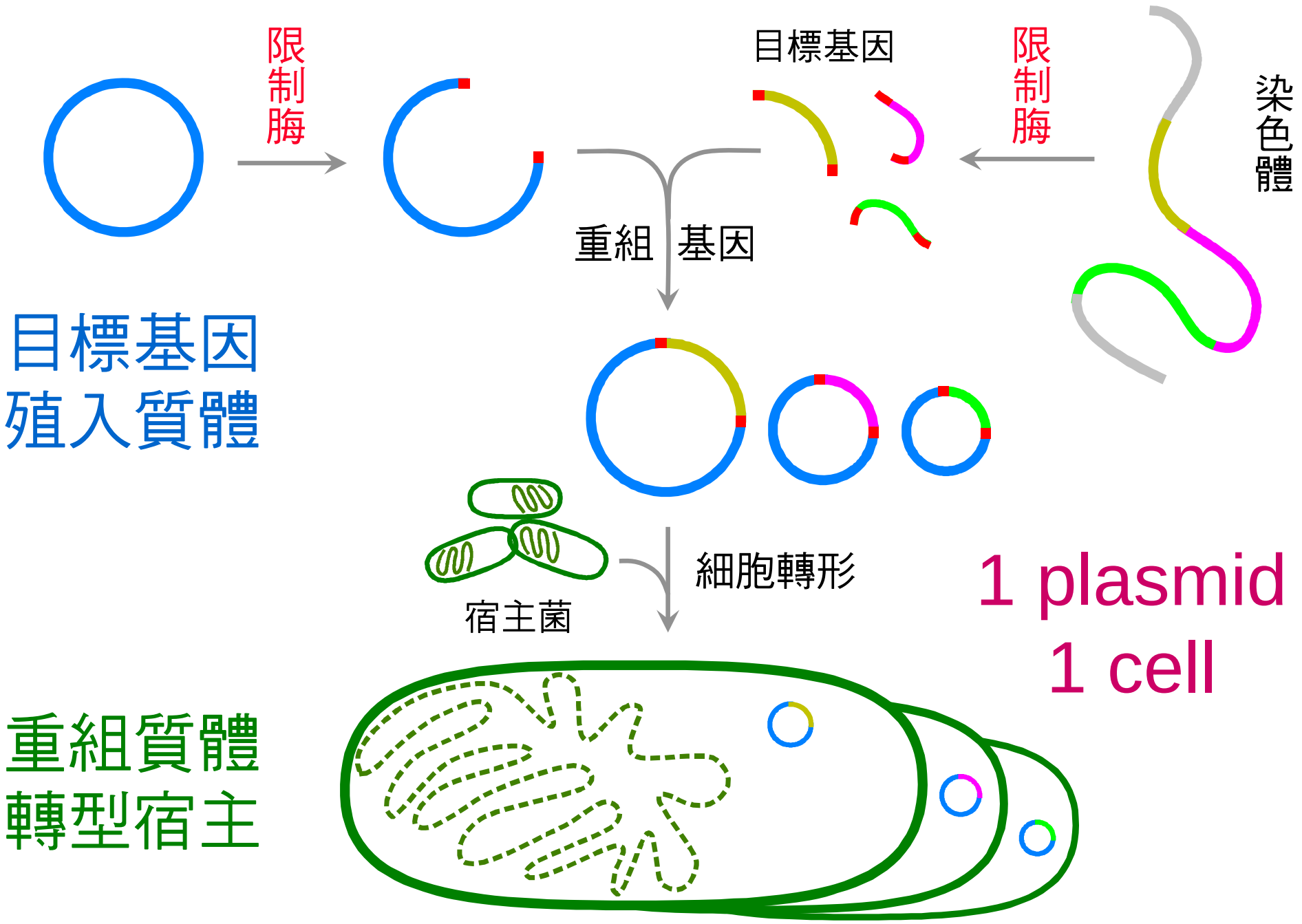
Kleinsmith & Kish (1995) Principles of Cell and Molecular Biology (2e) p.101

抗藥性質體可在細菌間傳遞



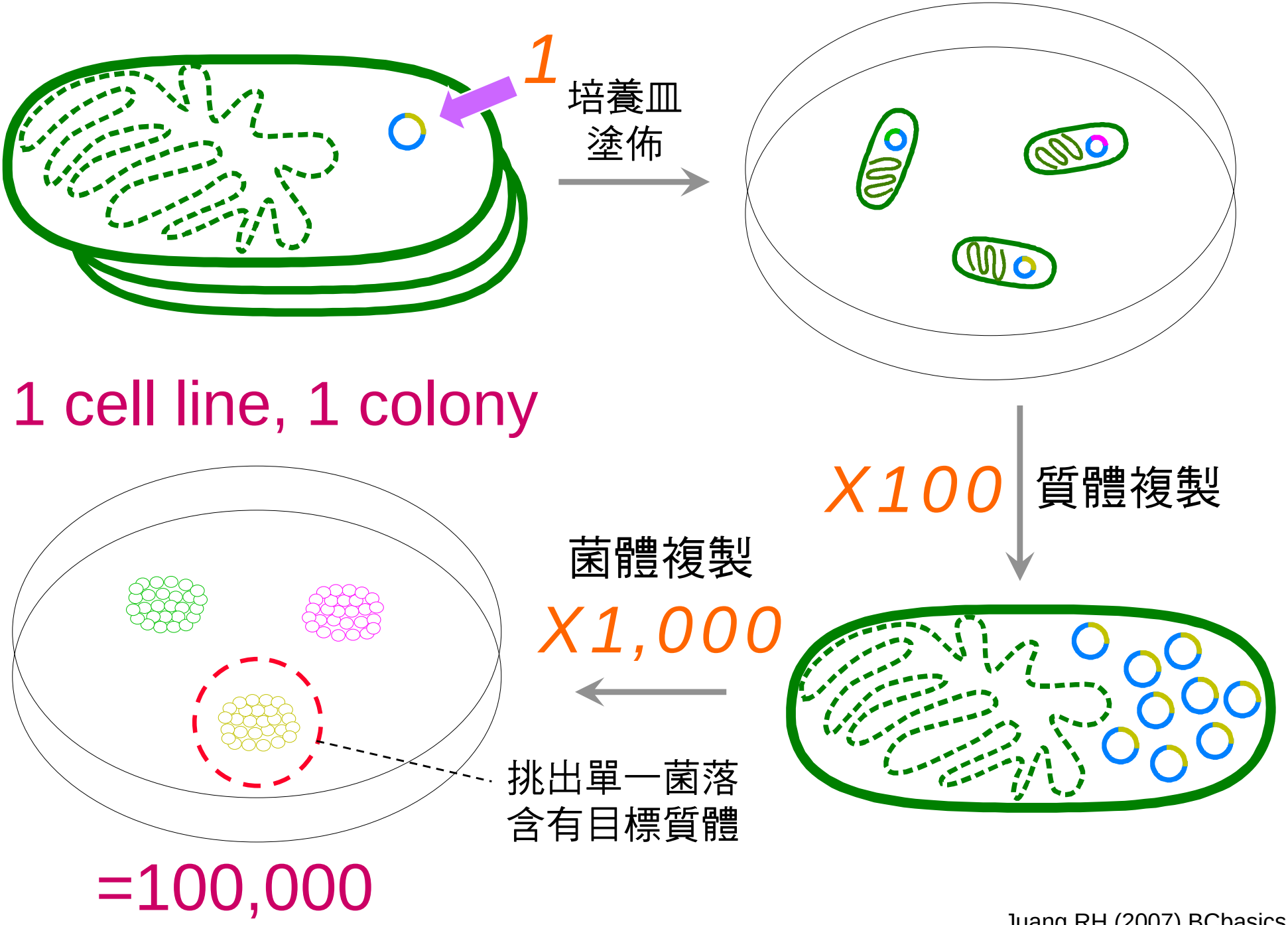
Juang RH (2007) BCbasics

目標基因殖入質體並轉形宿主菌



Juang RH (2007) BCbasics

目標基因的放大與篩選



Juang RH (2007) BCbasics

核酸構造

核苷酸 → 一級構造 → 限制脢 — EcoRI → sticky ends; EcoRV → blunt ends

一級構造 → 二級構造 → 分子群殖 — 基因的放大與純化

二級構造 → 三級構造 — L = T + W

N1

核酸表現

Central Dogma → DNA 到 RNA — mRNA, rRNA, tRNA

DNA 到 RNA → Template → Antisense → Intron Exon → cDNA

Intron Exon → Hemoglobin

cDNA → Libraries

N2

性質功能

生理功能 — ATP, UDPG, NADH, cAMP, Adenosine

變性復性 → Hyperchroism → 核酸組成 → C_0t

Hyperchroism → Hybridization → 核酸探針 → Southern blotting

N3

研究技術

PCR　核酸抽取　核酸定序　生物晶片

N4