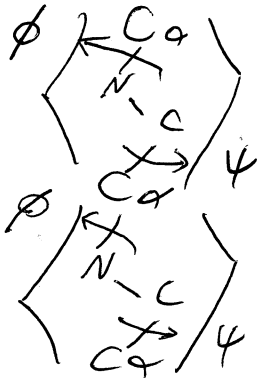
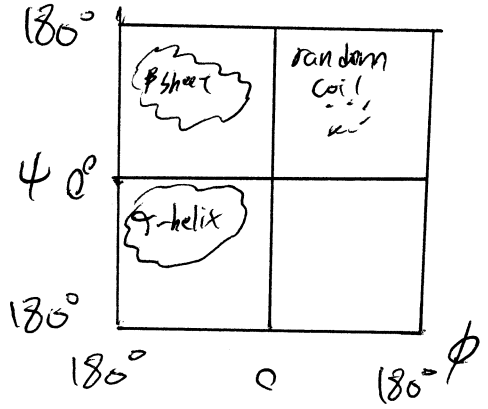
生化導 2015 期中考

CH. Yeh 2021/11/08

I.

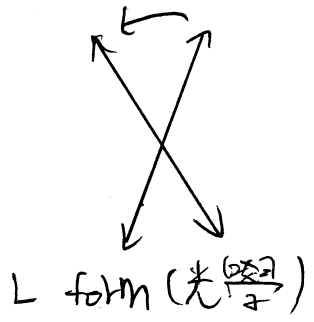
1. Ramachandran plot (ϕ, ψ map)



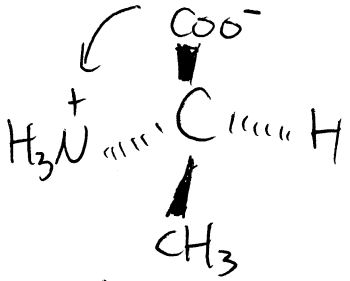


protein 中有 ϕ 和 ψ 的兩面角，作圖可以知道蛋白質的二級結構

2. L form and S configuration of an amino acid



L form (光學)



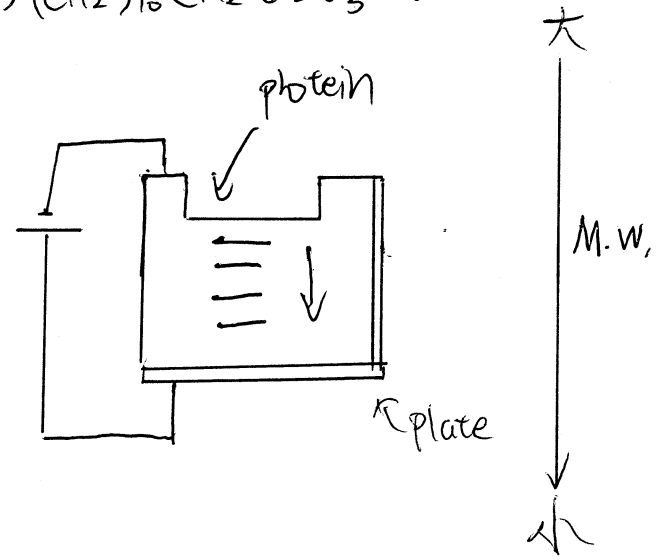
S-configuration

可以用此判斷為何種異構物，因為不同異構物的 chemical properties 不同，可能會將有害物質誤認為無害。

3. SDS-PAGE

SDS: Sodium dodecyl sulfate

$CH_3(CH_2)_{10}CH_2OSO_3Na$



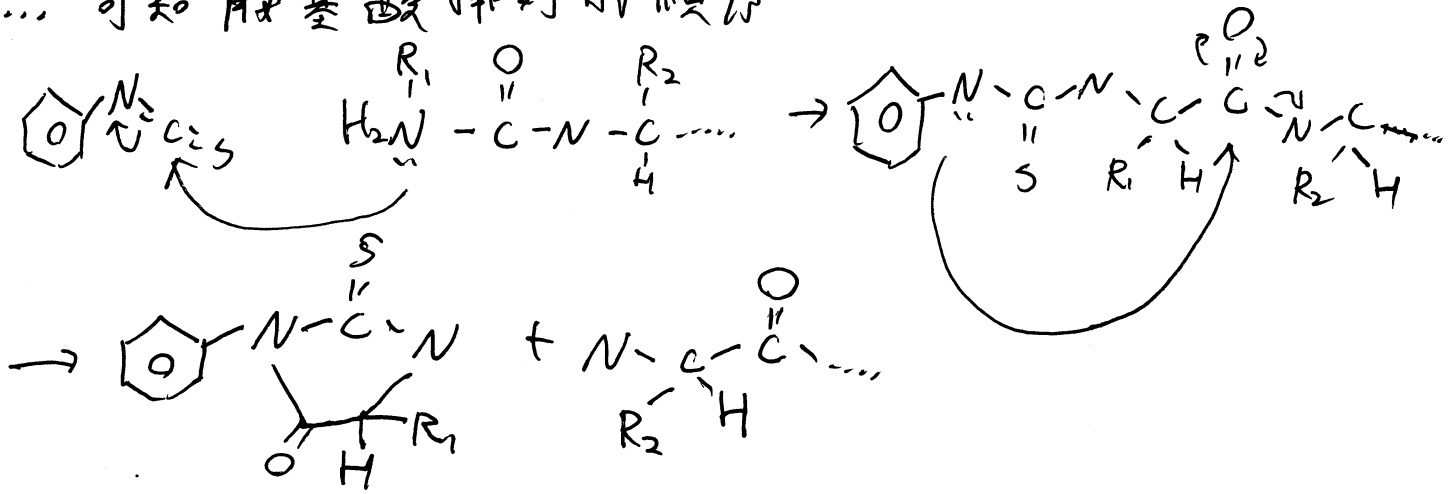
為一種分離 protein 的方式。將 sample 注入凹槽中通以穩定電流，則 protein 會因 M.W. 不同而有不同距離的移動。M.W. 大的在上，反之小的在下

4. Promoter：一段可使特定基因轉錄的DNA序列

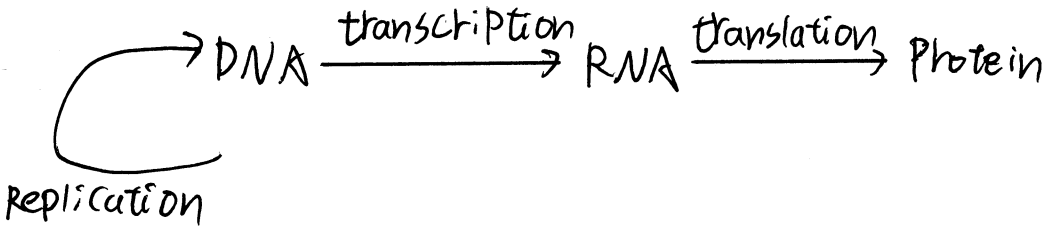
DNA propoters contains three elements：TSS、-10 region、-35 region

5. Edman degradation

將蛋白質和 phenylisothiocyanate 結合，得到 PTH-R_1，PTH-R_2，..... 可知胺基酸排列的順序



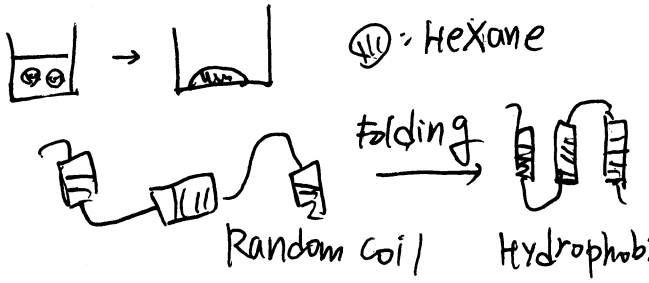
6. Center dogma of molecular biology



7. Semi-Conservation of DNA replication

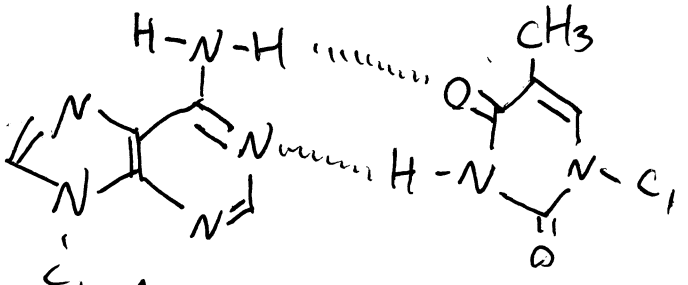
DNA 複製時，所產生的 DNA 一端為舊股，另一端為新股（半保留複製）

8. Hydrophobic interaction

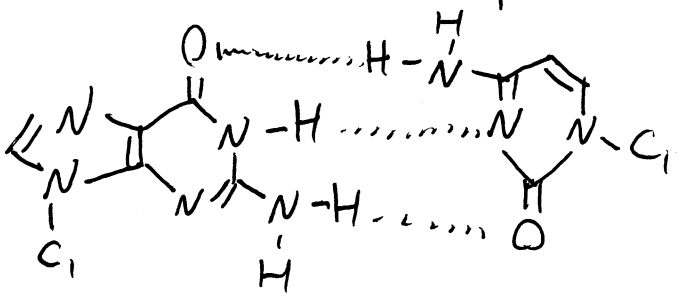


疏水的分子在此效應下會受吸引而自我聚集，而在protein中，而在protein中，疏水性較高的胺基酸會彼此作用，形成下一級的結構

9. Hydrogen bonds between base pairs



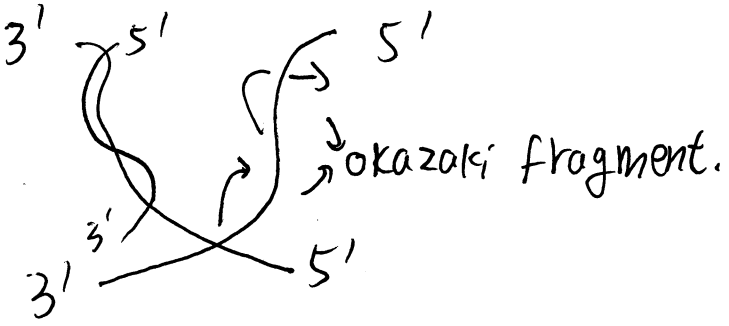
A T



G C

10, okazaki fragment

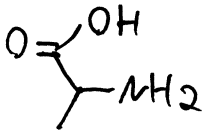
When DNA replicates, the uncontinuous fragment (lagging strand) is the okazaki fragment



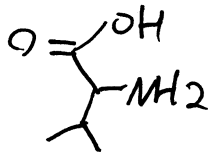
II.

1. Non-Polar

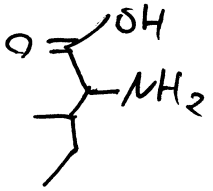
Ala (A)



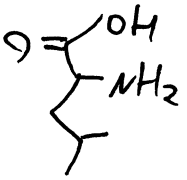
Val (V)



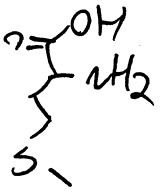
ile (I)



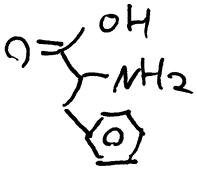
Leu (L)



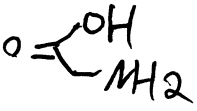
Met (M)



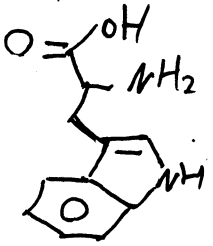
Phe (F)



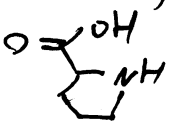
Gly (G)



Trp (W)

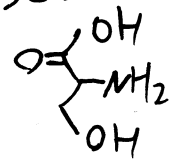


Pro (P)

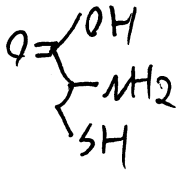


2. Polar

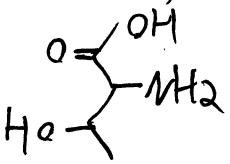
Ser (S)



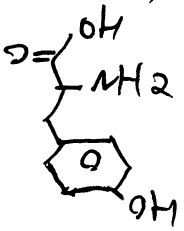
Cys (C)



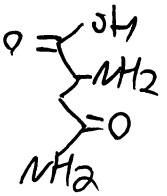
Thr (T)



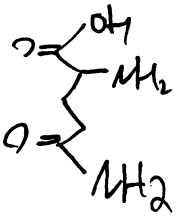
TYr (Y)



Asn (N)

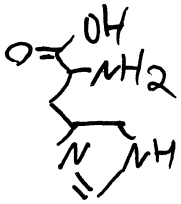


Gln (Q)

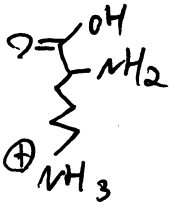


3, Positively charged side-chain (aka Base)

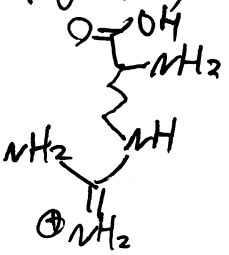
His (H)



Lys (K)

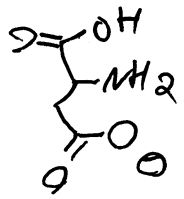


Arg (R)

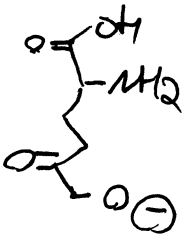


4. Negatively side chain (aka Acidic)

Asp (D)



Glu (E)



VI. Method : $E+S \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} ES \xrightarrow{k_2} E+P$

Use steady-state approximation and materials balence to delive

a. steady-state approximation for ES

$V_{form} = V_{desctruc} \Rightarrow k_1[E][S] = k_{-1}[ES] + k_2[ES]$ .... ①

b. Material balence : $[E]_T = [ES] + [E]_{free} = [ES] + [E]$

$\Rightarrow [E] = [E]_T - [ES]$ ... ②, ② substitute into ①

$$k_1\left([E]_T - [ES]\right)[S] = k_{-1}[ES] + k_2[ES] = [ES](k_{-1} + k_2)$$

$$\Rightarrow \frac{k_{-1} + k_2}{k_1} = \frac{([E]_T - [ES])[S]}{[ES]} = K_M$$

$$\Rightarrow [ES]K_M = [E]_T[S] - [ES][S]$$

$$\Rightarrow [ES]\left(K_M + [S]\right) = [E]_T[S] \Rightarrow [ES] = \frac{[E]_T[S]}{K_M + [S]}$$

$$\text{Rate} = V = k_2[ES] = \frac{k_2[E]_T[S]}{K_M + [S]}, \text{ when } [S] \to \infty$$

$$[E]_T = [ES]$$

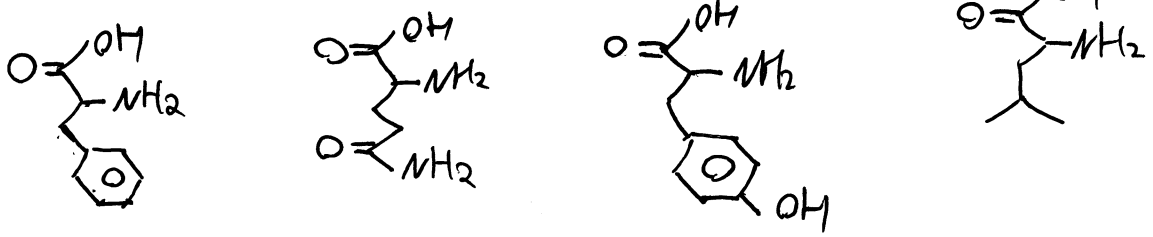
Rate has maximum

$$\therefore V = \frac{k_2[ES][S]}{K_M + [S]} = \frac{V_m[S]}{K_M + [S]}$$

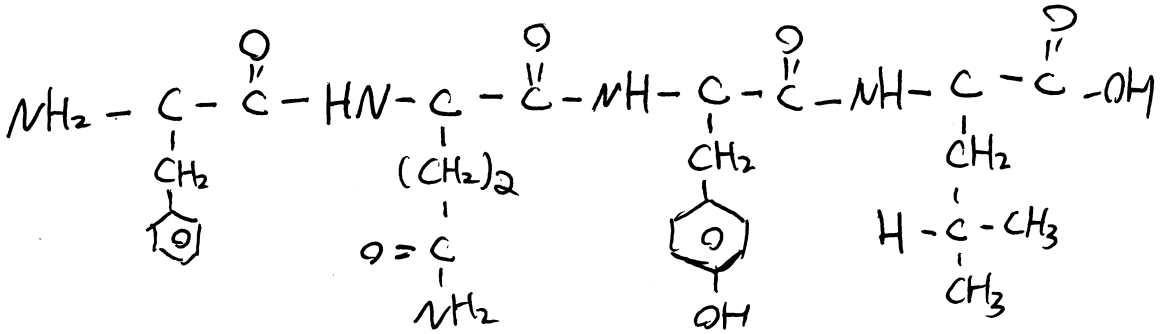
Ⅲ. $PrP^{scrapie}$, $PrP^{scrapie}$ 為 PrP^{c} mis-fold 之後的結果，兩者的順序相同、結構不同

Ⅳ. 當 tryptophan 很多時，會使 repressor 被活化，接在 promotor 上，使得 RNA 聚合酶不能在 promotor 上，生成 tryptophan。反之，若 tryptophan 很少時，RNA 聚合酶可以接在 promotor 上，生成 phomotor.

Ⅴ. Phe (F) Gly (G) Tyr (Y) Leu



⇒ Phe - Gly - Tyr - Leu：



VI. By Michealis-Menten equation:

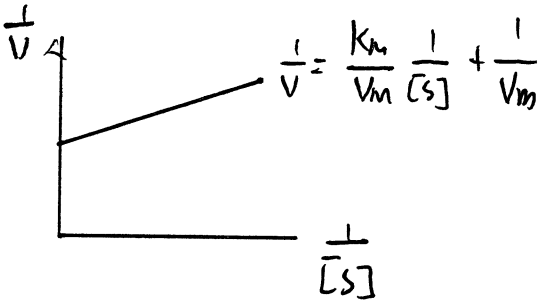
$$V = \frac{V_{max}[S]}{K_M + [S]} \Rightarrow \frac{1}{V} = \frac{K_M + [S]}{V_M [S]} = \frac{K_M}{V_M} \times \frac{1}{[S]} + \frac{1}{V_M}$$

由題給表格:

S	$\frac{1}{S}$ L(mmol)$^{-1}$	$\frac{1}{V}$ M^{-1}sec
1.25	$\frac{1}{1.25} = 0.8$	36×10^3
2.5	$\frac{1}{2.5} = 0.4$	20×10^3
5	$\frac{1}{5} = 0.2$	12×10^3
20.0	$\frac{1}{20} = 0.05$	6×10^3

注意單位 of $\frac{1}{S}$ 為 $(mmol)^{-1}L$ 非 $(mol)^{-1}L$

Draw the $\frac{1}{V} - \frac{1}{[S]}$ line graph



注意 unit

$$\text{Slope} = \frac{(20-36)\times 10^3}{(0.4-0.8)} = 4 \times 10^4 = \frac{K_M}{V_M} \frac{\text{sec}}{1000}$$

$$\Rightarrow 36 \times 10^3 = (4 \times 10^4) \times 0.8 + \frac{1}{V_M} \Rightarrow V_M = \left(36 \times 10^3 - 4 \times 10^4 \times 0.8\right)^{-1}$$

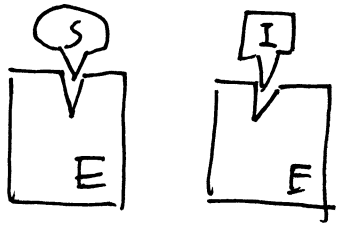
$$= 2.5 \times 10^{-4} \text{ M sec}^{-1}$$

$$\Rightarrow K_M = 4 \times 10^4 \times 2.5 \times 10^{-4} \times \frac{\text{sec}}{1000} = 10 \times 10^{-3} = 10^{-2} \text{ (M/sec)}$$

(M sec^{-1})

VII.

- competitive inhibition



$EI \overset{I}{\rightleftharpoons} E+S \rightarrow E+P \quad K_I = \frac{[E][I]}{[EI]}$

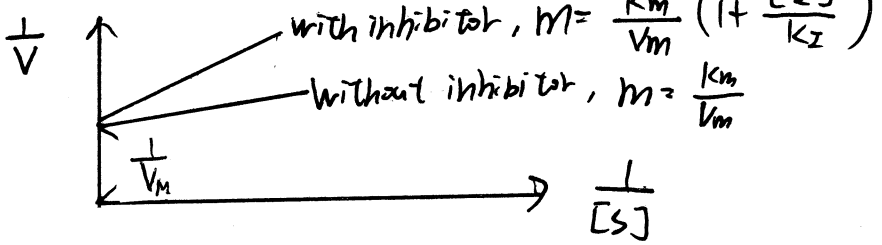
without inhibitor: $\frac{1}{V} = \frac{K_M}{V_M}\frac{1}{[S]} + \frac{1}{V_M}$

with inhibitor: $K_M^I \xrightarrow[\text{a factor}]{\text{increase}} \left(1+\frac{[I]}{K_I}\right)K_M$

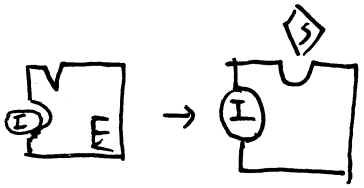
Substrate 和 inhibitor 的結構相似 ⇒ 競爭 enzyme 的 active site

$\Rightarrow \frac{1}{V} = \frac{\left(1+\frac{[I]}{K_I}\right)K_M}{V_M}\frac{1}{[S]} + \frac{1}{V_M}$

So comparing the lines



- non-competitive inhibition



$$\begin{array}{ccc} E & \overset{S}{\rightleftharpoons} & ES \rightarrow E+P \\ \uparrow & & \downarrow\uparrow \\ EI & \rightleftharpoons & ESI \end{array}$$

With non-competitive inhibitor

$V_{max}^I = \frac{V_M}{1+\frac{[I]}{K_I}}$

$\Rightarrow \frac{1}{V} = \frac{K_M}{V_M}\left(1+\frac{[I]}{K_I}\right)\frac{1}{[S]} + \frac{1}{V_M}\left(1+\frac{[I]}{K_I}\right)$

Substrate 和 inhibitor 的結構不同，inhibitor 和 Enzyme 結合後，會改變 substrate 的 active site 的構型，使 substrate 無法結合

So comparing the lines