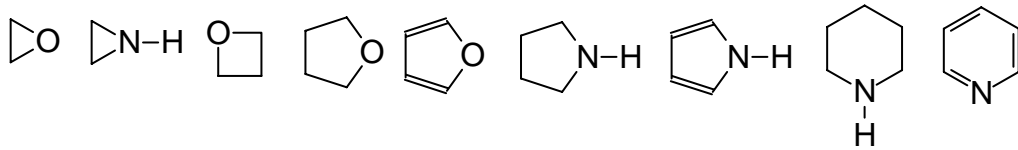
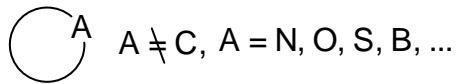


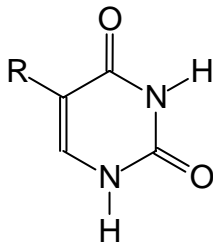
# Chapter 1 Introduction

Heterocyclic compounds(雜環化合物):

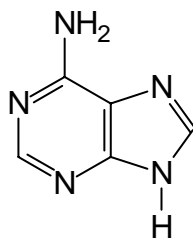


Heterocyclic compounds in living system:

Nucleic acid bases: Pyrimidine, Purine

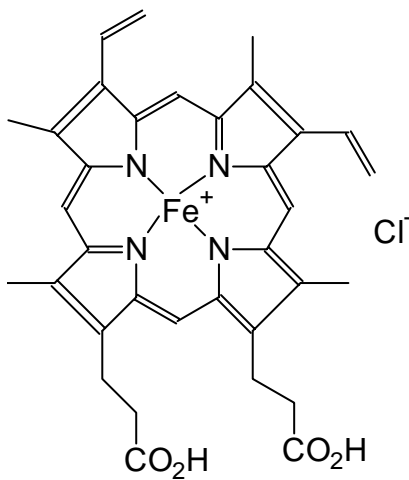


Pyrimidine

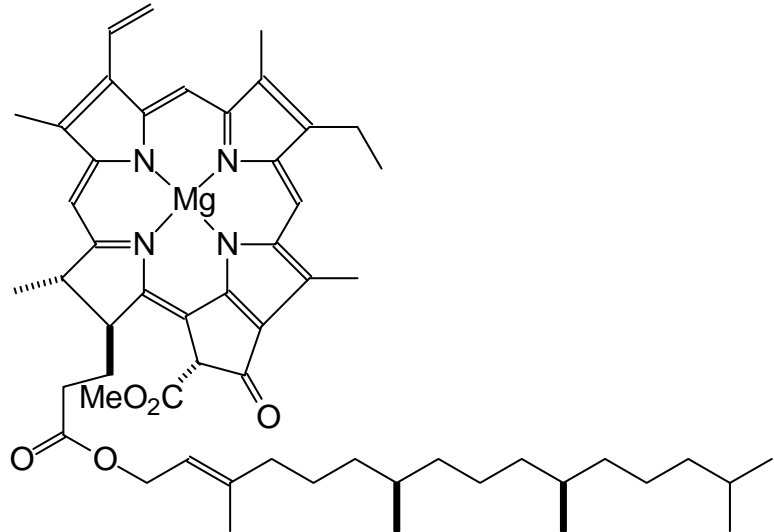


Purine

Porphyrin: Chlorophyll (photosynthesis), Heme (oxygen transport)

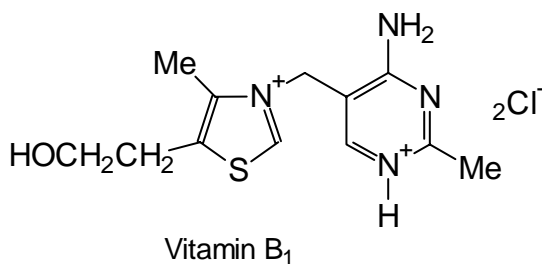


Heme (血質)

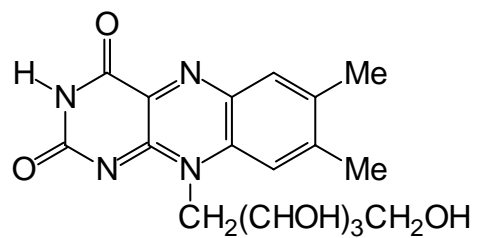


Chlorophyll a (葉綠素)

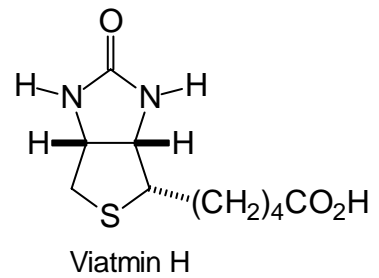
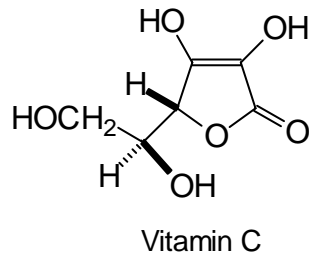
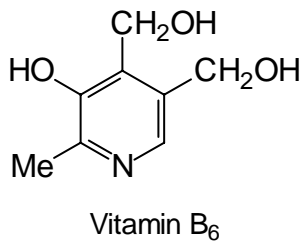
Essential diet: Vitamin B<sub>1</sub>, B<sub>2</sub>, B<sub>6</sub>, C, H



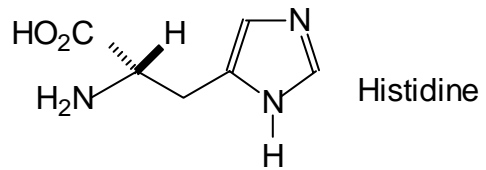
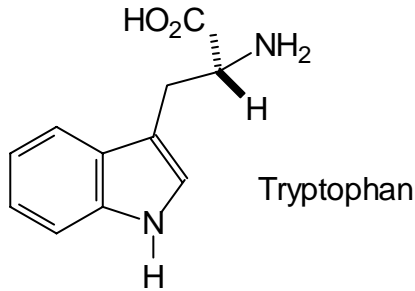
Vitamin B<sub>1</sub>



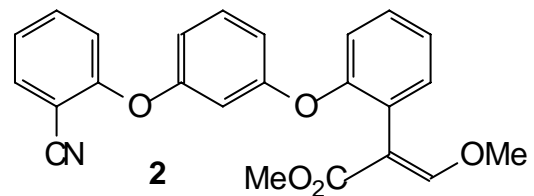
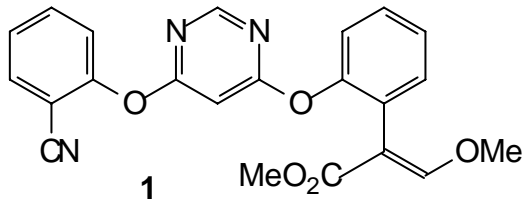
Vitamin B<sub>2</sub>



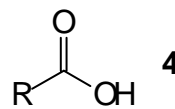
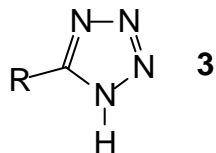
### Amino acids: Tryptophan, histidine



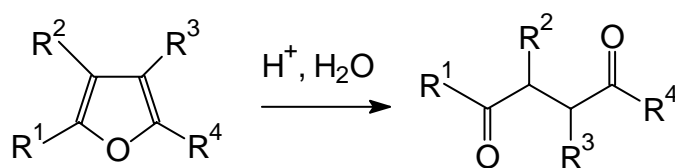
雜環化合物被廣泛使用的理由之一是其結構可以被巧妙地處理以達到所需要的功能，很多雜環可以代替一些官能基的結構，而其總體性質相似，但官能基間確有顯著的變化。這顯著的變化包括酸鹼性差異，與 nucleophile and electrophile 反應的難易程度，還有極性的差別。這種改變包括改變雜原子的種類與位子，例如將化合物 2 變成化合物 1 可改善其水溶性。

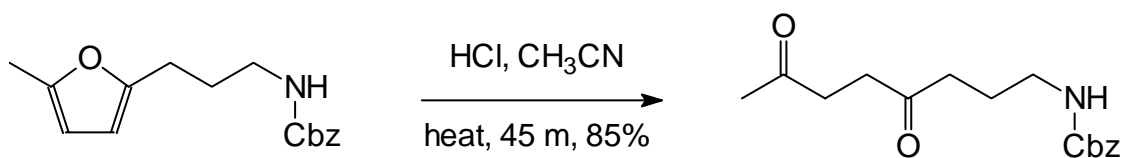


有些雜環化合物可能整合了一些官能基，而變成一種取代基或成為環的一部份，例如 1H-tetrazole 3 可以模擬 carboxylic acid 4 的功能。



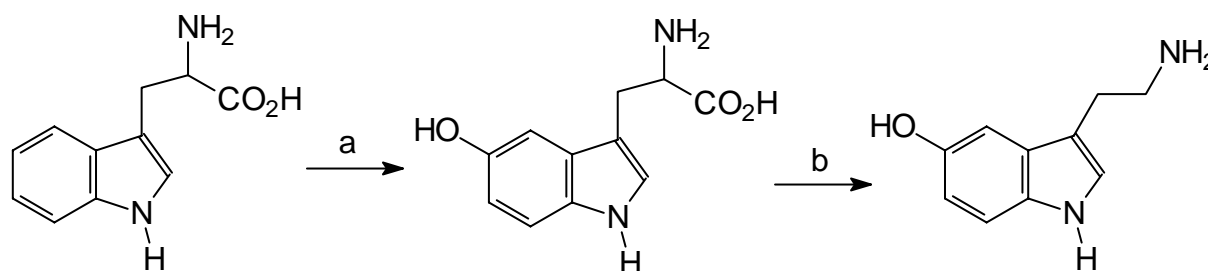
雜環化合物也可用於有機合成的中間體，因環的穩定性可以合成數步之後，在必要的階段將雜環分解，產生其他官能基。例如 furan 可以分解產生 dicarbonyl compound。





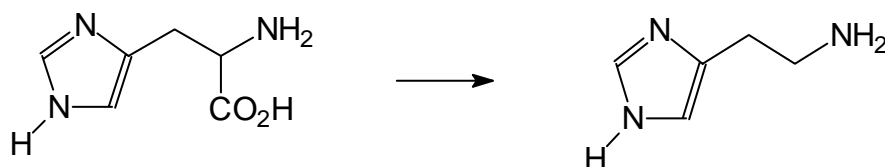
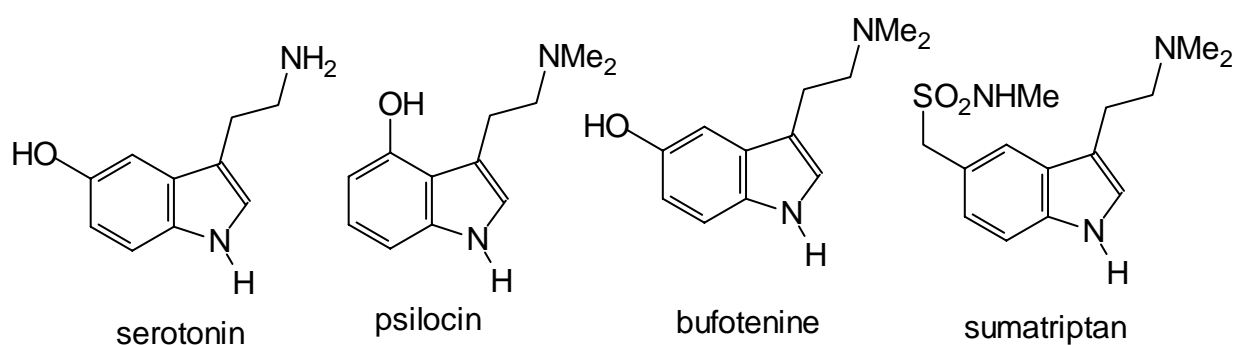
*Heterocycles*, **2000**, 2247 - 2252.

Heterocyclic chemist 可以提供合成方法、化學結構、化合物的性質等資訊，以幫助建立這些化合物的生物功能性(biological function)，進而幫助設計有用的藥物的相關結構。以天然物 serotonin 和 histamine 為例，因分離不易，且產量很少，因此實驗室合成有可能解決此問題。



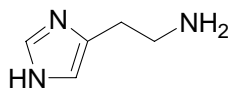
- a. Reagent: *Claviceps* sp. PRL 1980, mannitol-succinic acid; Solvent: H<sub>2</sub>O; Time: 15 days; Temp: 25 °C, *Phytochemistry*, **1982**; 1975-1976.
- b. Reagent: pyridoxal phosphat; mammalian aromatic L-amino acid decarboxylase; *Tetrahedron*, **1990**, 4685-4696; *Agric. Biol. Chem.* **1981**, 2543-2552; *Biosci. Biotechnol. Biochem.* **1993**, 1210-1211.

與 serotonin 相關的化合物：

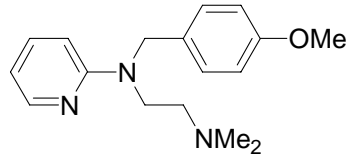


Reagent: conc hydrochloric acid; Temp: 265 - 270 °C. *J. Chem. Soc.***1911**, 344.

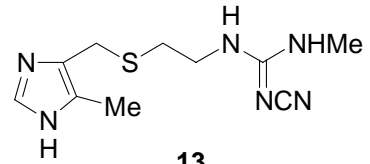
與 histamine 相關的化合物：



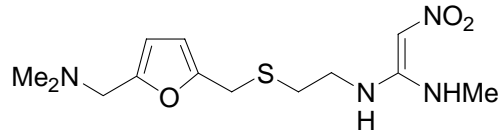
**11**  
histamine



**12**  
pyrilamine

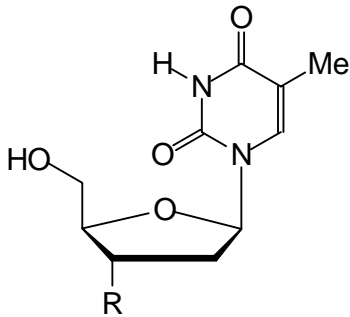


**13**  
cimetidine

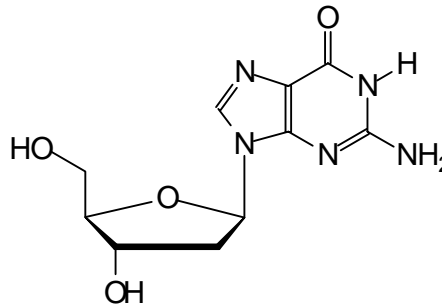


**14**  
ranitidine

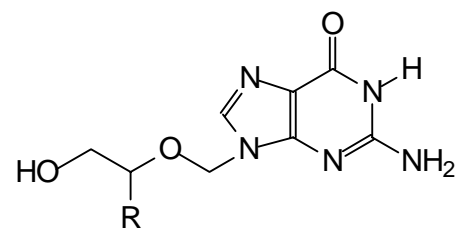
**Nucleoside analogues :**



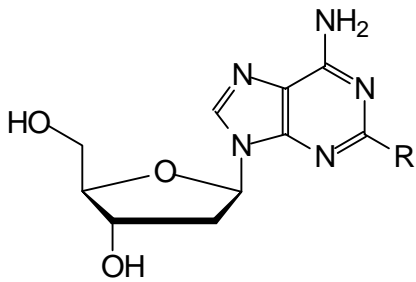
**15**  
2'-deoxythymidine (R = OH)  
zidovudine (AZT) (R = N<sub>3</sub>)



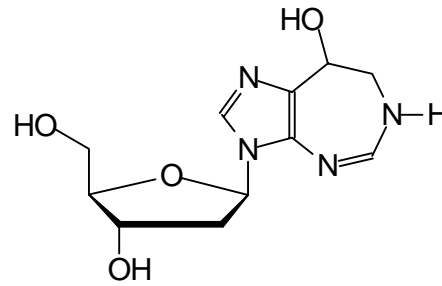
**16**  
Deoxyguanosine



**17**  
acyclovir (ACV) (R = H)  
ganciclovir (R = CH<sub>2</sub>OH)

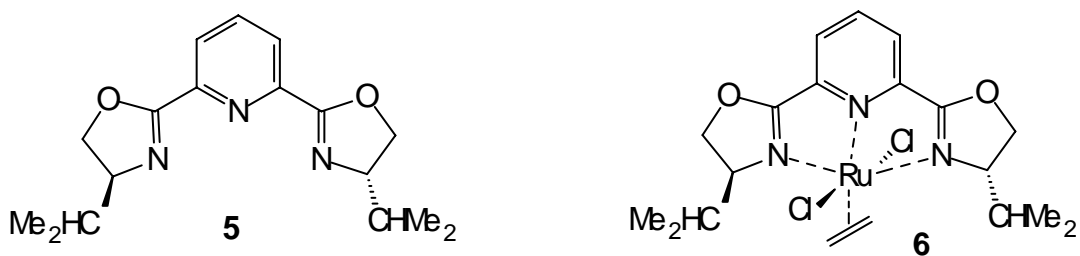


**18**  
2'-deoxyadenosine (R = H)  
cladribine (R = Cl)

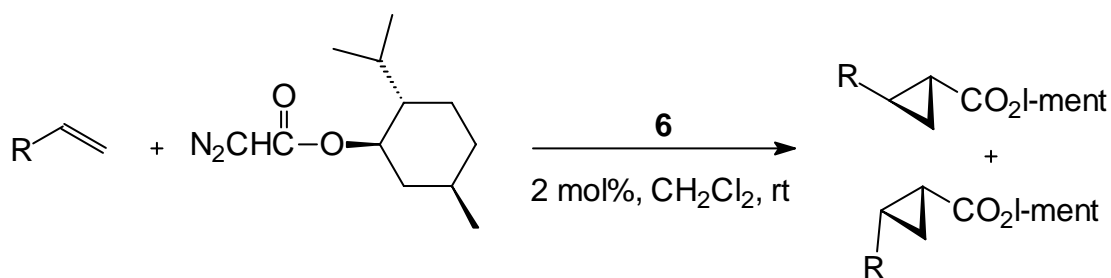


pentostatin

Pyridines, imidazoles 和其他雜環化合物常用來作為金屬的 ligands，若這些為 chiral ligands，則所產生之 complexes 可作為 asymmetric synthetic reaction 之催化劑。例如化合物 5 與 Ruthenium 生成 complex 6 可作為產生 chiral cyclopropane 之催化劑。



*Angew. Chem. Int. Ed. Engl.* **1991**, 542; *J. Am. Chem. Soc.* **1994**, 2223 - 2224.



$\text{R} = \text{Ph}$ , yield = 84%, dr (trans : cis) 98 : 2, trans 96 ee%, cis 84 ee%.  
*J. Am. Chem. Soc.* **1994**, 2223; *Bull. Chem. Soc. Jpn.* **1995**, 1247.