THE SCOPE OF THE FIELD OF HETEROCYCLIC CHEMISTRY

- Heterosubstituted rings are those in which one or more carbon atoms in a purely carbon-containing ring (known as a carbocyclic ring) is replaced by some other atom (referred to as a heteroatom).
- In practice,the most commonly found heteroatom is nitrogen, followed by oxygen and sulfur.

1

Heterocyclic

Cyclic تقسم إل قسمين

١_ homocyclic :- حلقة يوجد عليها فقط كربونات

٢- heterocyclic:- حلقة يتم فيها إستبدال كربونة بإحدى ذرات الاخرى مثلا (S/O/N) الاكثر N>O>S hetero

- In a 1983 report, the International Union of Pure and Applied Chemistry (IUPAC) recognized 15 elements coming from Groups II to IV of the Periodic System capable of forming cyclic structures with carbon atoms.

- Heterocyclic compounds are far from being just the result of some synthetic research effort. Nature abounds in heterocyclic compounds,
- THE SCOPE OF THE FIELD OF HETEROCYCLIC CHEMISTRY many of profound importance in biological processes.
- We find heterocyclic rings in **vitamins, coenzymes, porphyrins (like hemo globin), DNA, RNA,** and so on.
- The plant kingdom contains thousands of nitrogen heterocyclic compounds, most of which are **weakly basic and called alkaloids** (alkali like).
- Complex heterocyclic compounds are elaborated by **microorganisms** and are useful as antibiotics in medicine.
- **Marine animals and plants** are also a source of complex heterocyclic compounds and are receiving much attention in current research efforts.

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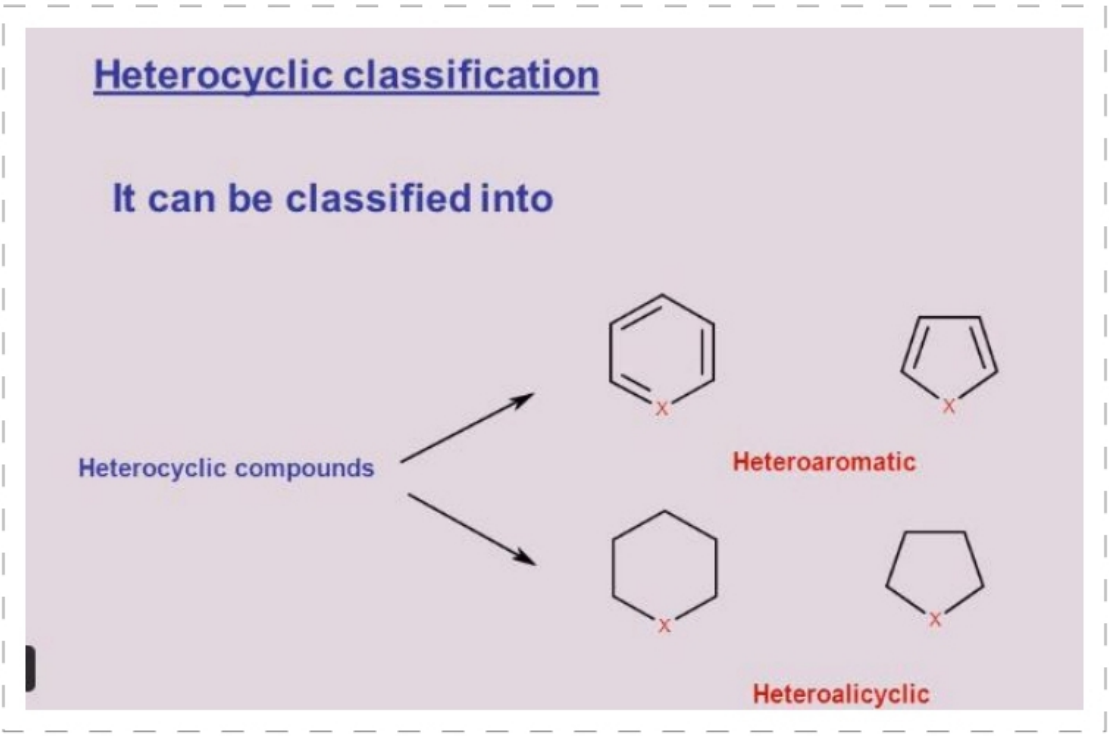
اهمية وجود heterocyclic وأماكن وجودها



The IUPAC rules of nomenclature allow the continued use of well-established common names for some of these fundamental ring systems, but as we will find, there are systematic names also in us

تقسم حلقات ال hetreocyclic إلى قسمين

1- حلقات aromatic :- حتى نستطيع إطلاق اسم aromatic هناك ثلاث شروط ١_حلقي

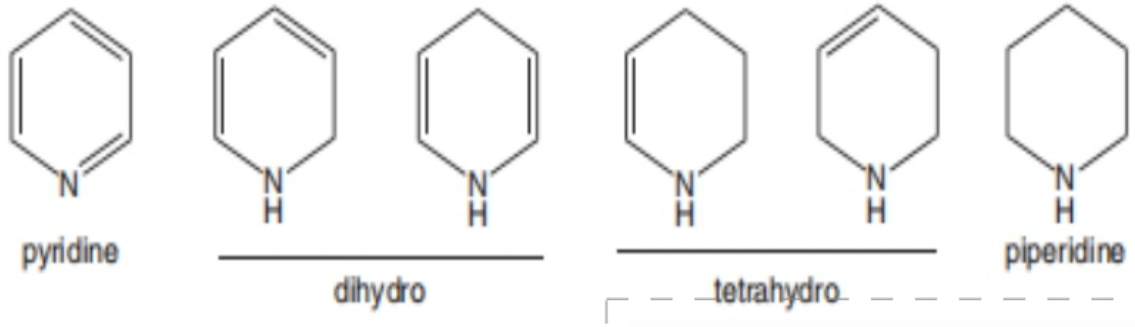
٢_ conjugated يعني تتابع روابط أحادية وثنائية (باي وسيجما)

٣- قاعدة Hukle:-4n+2=πe (شرط يطلع معك n عدد صحيح) (روابط باي هي الثنائية وكل رابطة يوجد فيها زوج من الالكترونات بتوضع عددهن وبتعوض اذا ما فهمت ابحث عاليوتيوب وشوف كيف طريقة الحل)

اذا استوفت الشروط الثلاث إذن هي اروماتيك

2- حلقات ali :- هي حلقة لا تكون تتابع أحادي ثنائي على الحلقة

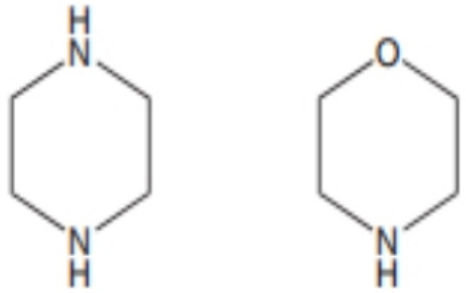
- The compound pyridine is an excellent example of a simple heterocycle. Here, one carbon of benzene is replaced by nitrogen, without interrupting the classic unsaturation and aromaticity of benzene. Similarly, replacement of a carbon in cyclohexane by nitrogen produces the saturated heterocycle piperidine. Between these extremes of saturation come several structures with one or two double bonds.



4

أمثلة على تحول الحلقة homo الى حلقة hetro
عن طريق استبدال ذرة كربون بذرة اخرى مثل (N,O,S)

Rings may have more than one heteroatom, which may be the same or different, as in the examples that follow.



To broaden the field, other rings may be fused onto a parent heterocycle. This gives rise to many new ring systems.

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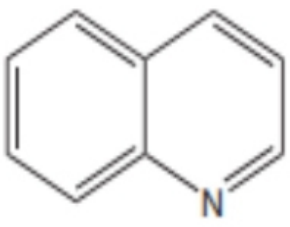
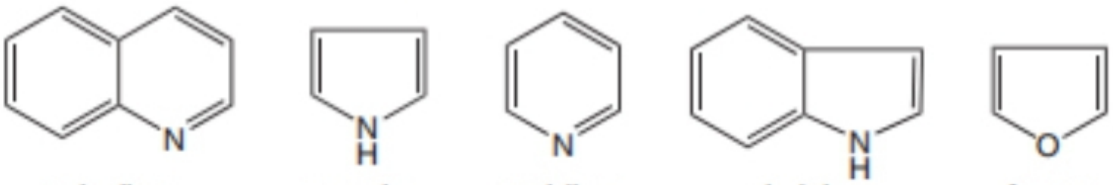


ويمكن إضافة ايضا اكثر من ذرة

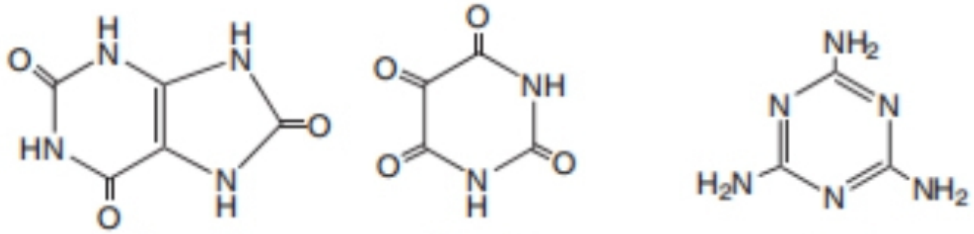
Table 2.1. Some Early Heterocyclic Compounds of Natural Origins

A. Compounds That Are Parent Rings



quinoline pyrrole pyridine indole furan

B. Compounds With Functional Groups



uric acid alloxan melamine

ويمكن الدمج بين حلقتين

The IUPAC rules allow three nomenclatures.

I. The Hantzsch-Widman Nomenclature.

II. Common Names

III. The Replacement Nomenclature

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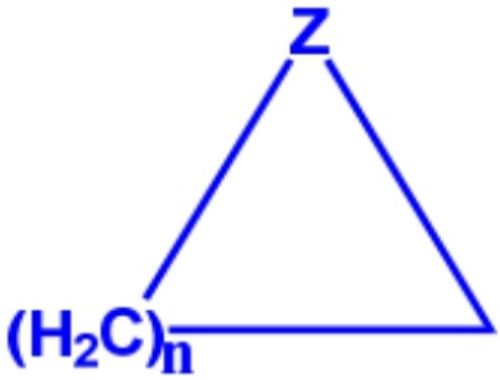
قواعد التسمية

1-نظام widman

2- نظام replacement nomenclature

3- نظام common name

I. Hantzsch-Widman Nomenclature



n = 1,2,3, ...

The Hantzsch-Widman nomenclature is based on the type (Z) of the heteroatom; the ring size (n) and nature of the ring, whether it is saturated or unsaturated .

This system of nomenclat
three-to-ten-membered r

قاعدة widman

تعتمد على بندين 1- type hetero يعني الذرة الغير متجانسة

2- حجم الحلقة

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The endings indicate the size and degree of unsaturation of the ring.

Table II: Stems to indicate the ring size and degree of unsaturation of heterocycles

Ring size	Saturated	Unsaturated	Saturated (With Nitrogen)
3	-irane	-irine	-iridine
4	-etane	-ete	-etidine
5	-olane	-ole	-olidine
6	-inane	-ine	
7	-epane	-epine	
8	-ocane	-ocine	
9	-onane	-onine	
10	-ecane	-ecine	

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ملاحظة يضاف مقطع بداية التسمية للدلالة على ان الحلقة مشبعه (أحادية) ام غير مشبعه (ثنائية)

I. Type of the heteroatom

The type of heteroatom is indicated by a prefix as shown below for common hetreroatoms:

Hetreroatom	Prefix
O	Oxa
N	Aza
S	Thia
P	Phospha

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هون موضح كل ذرة ماذا تسمى عند تسمية الحلقة

II. Ring size (n)

The ring size is indicated by a suffix according t
Table I below. Some of the syllables are derived fro
Latin numerals, namely ir from tri, et from tetra, e
from hepta, oc from octa, on from nona, ec fro
deca.

Table I: Stems to indicate the ring size
heterocycles

Ring size	Suffix	Ring size	Suffix
3	ir	7	ep
4	et	8	oc
5	ol	9	on
6	in	10	ec

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تسمية الحلقة حسب حجم الخلية (المقطع الذي يضاف)

According to this system heterocyles are named by combining appropriate prefix/prefixes with a stem from Table II. The letter “a” in the prefix is omitted where necessary.

Each suffix consists of a ring size root and an ending intended to designate the degree of unsaturation in the ring.

It is important to recognize that the saturated suffix applies only to completely saturated ring systems, and the unsaturated suffix applies to rings incorporating the maximum number of non-cumulated double bonds.

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Systems having a lesser degree of unsaturation require an appropriate prefix, such as "dihydro"or "tetrahydro".

Saturated 3, 4 & 5-membered nitrogen heterocycles should use respectively the traditional "iridine", "etidine" & "olidine" suffix.

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Examples

Oxa+irane= Oxirane

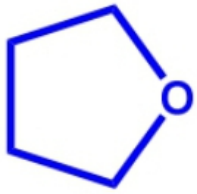
Thia+irane= Thiirane

Aza+iridine= Aziridine

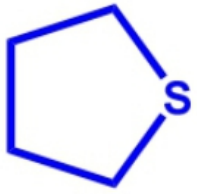
Oxa+etane=Oxetane

Thia+etane=Thietane

Aza+etidine=Azetidine



Oxa+olane= Oxolane



Thia+olane= Thiolane

Aza+olidine= Azolidine

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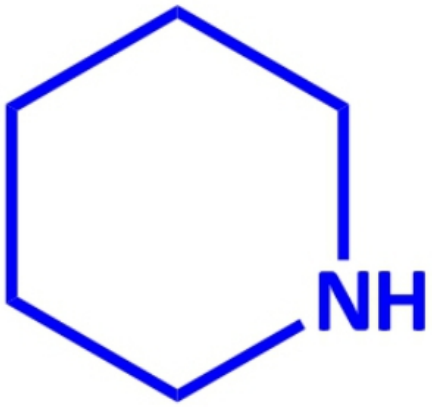
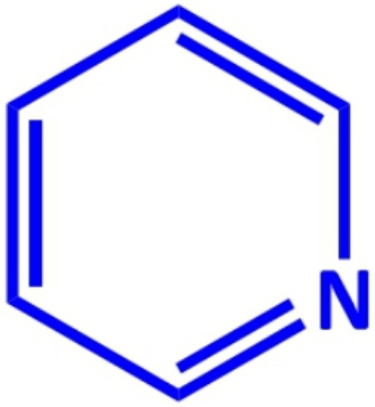


Azinane



Azine

Pyridine

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حالة استثنائية بتسمية N

بسبب انه عند التسمية يلتقي حرفين علة ف تم استخدام اسماء خاصة فيه