

HETEROCIKLUSOS VEGYÜLETEK

Heterociklusos vegyületek

1. Nómenklatúra



etilén-oxid
oxirán



etilén-imin
azeridin



trimetilén-oxid
oxetán



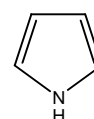
furán
oxol



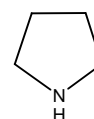
tetrahydrofurán
oxolán



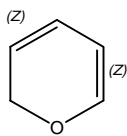
tiofén
tiol



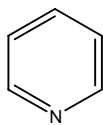
pirrol
1H-azol



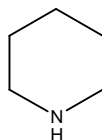
pirroloidin
azolidin



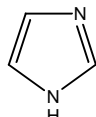
pirán
2H - pirán



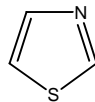
piridin



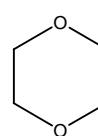
piperidin
perhidropiridin



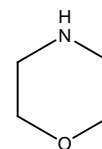
imidazol
1,3-diazol



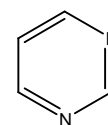
thiazol
1,3-tiazol



dioxán
1,4-dioxán

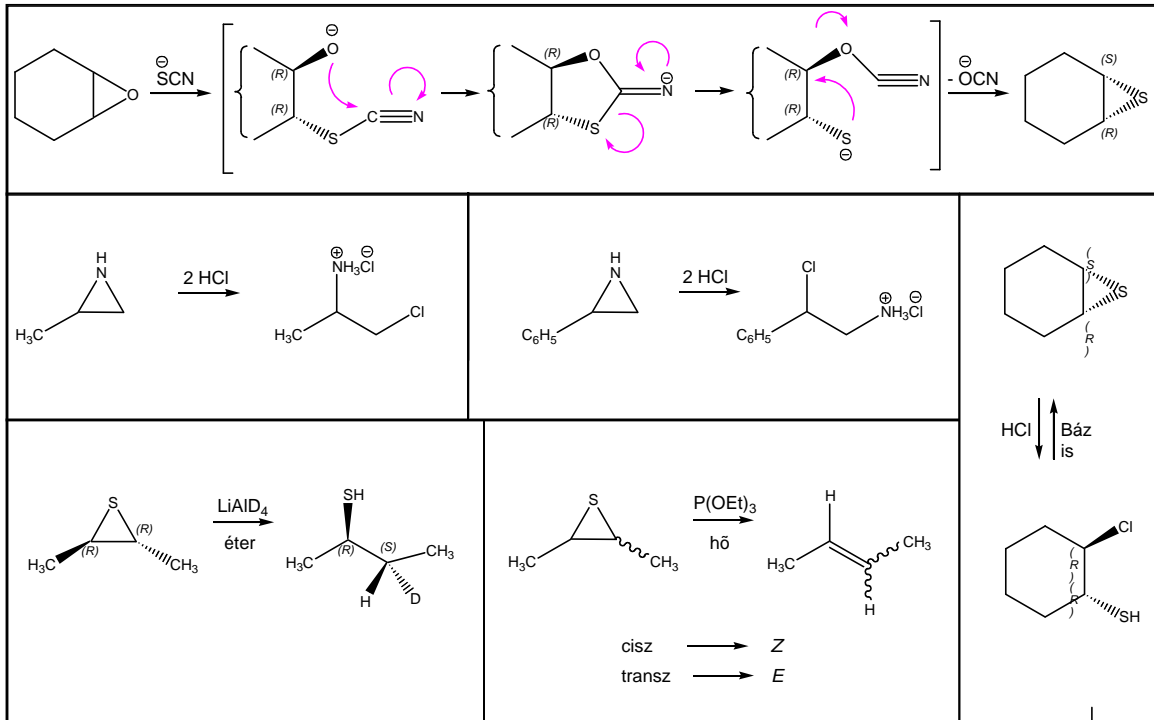


morfolin
tetrahydro-1,4-oxazin

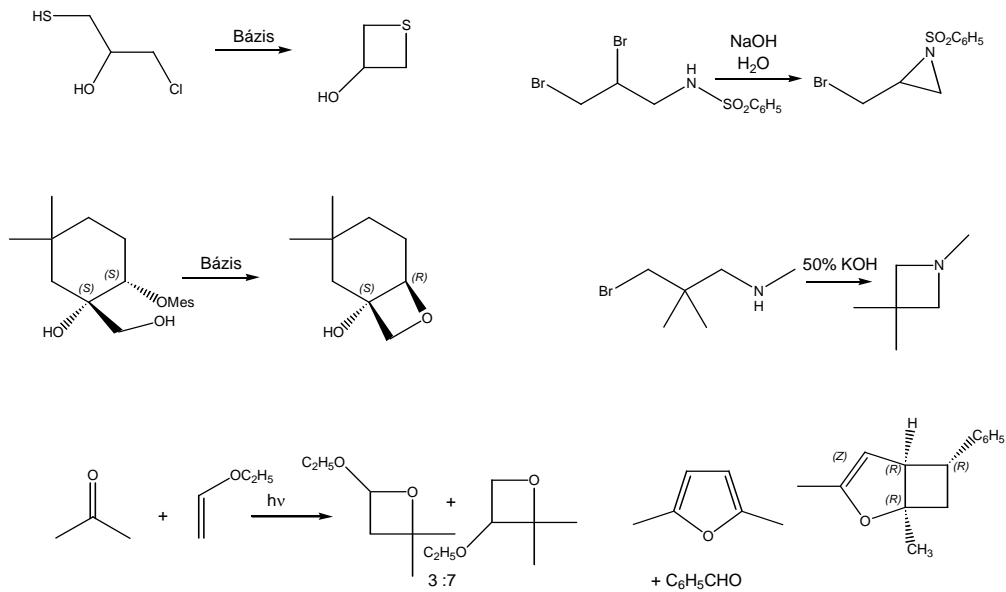


pirimidin
1,3-diazin

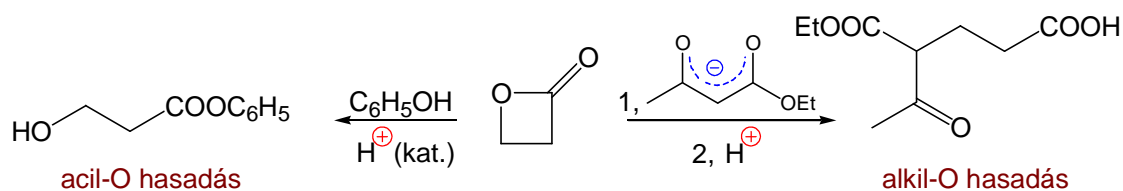
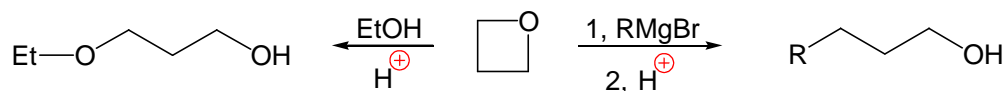
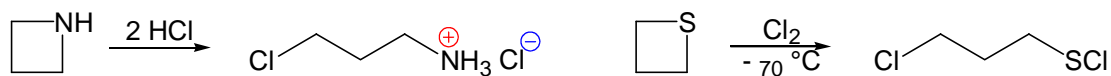
TIIRÁNOK ÉS OXIRÁNOK



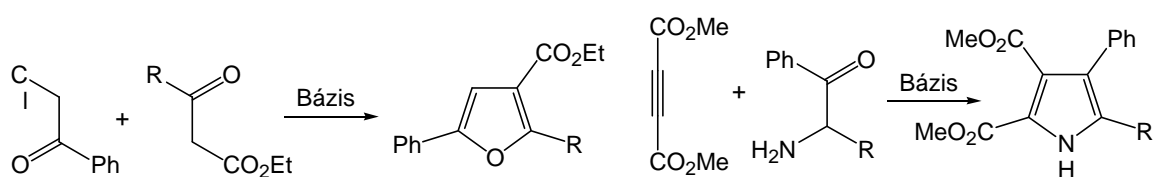
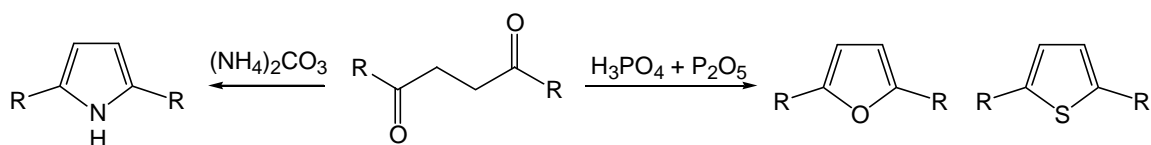
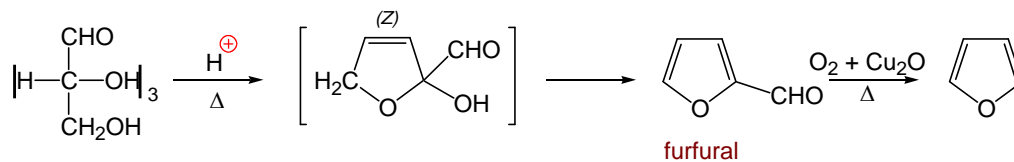
HÁROM ÉS NÉGYPHAGÚ GYŰRŰK EGY HETEROATOMMAL



GYŰRŰFELNYÍLÁSI REAKCIÓK

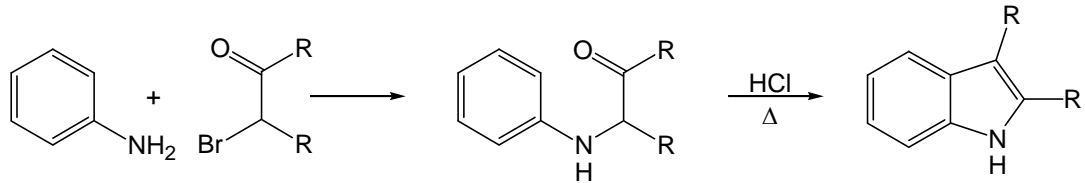


ÖTTAGÚ GYŰRŰK EGY HETEROATOMMAL

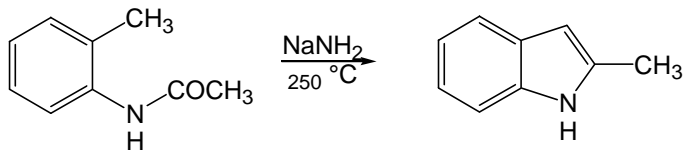


INDOL SZINTÉZISEK

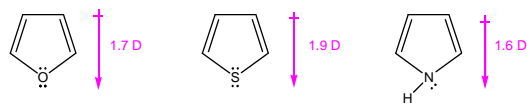
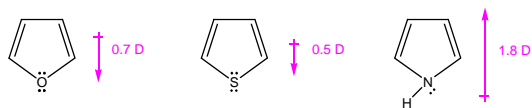
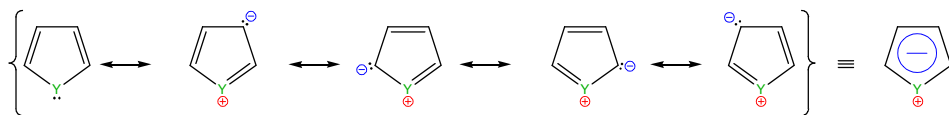
Bischler indol-szintézis



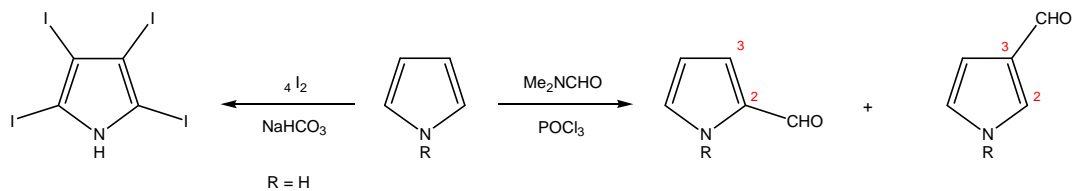
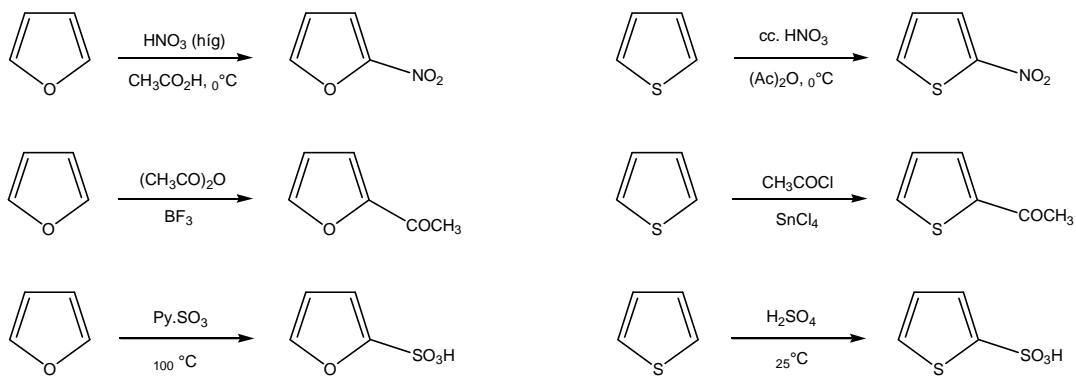
Madeliung indol-szintézis



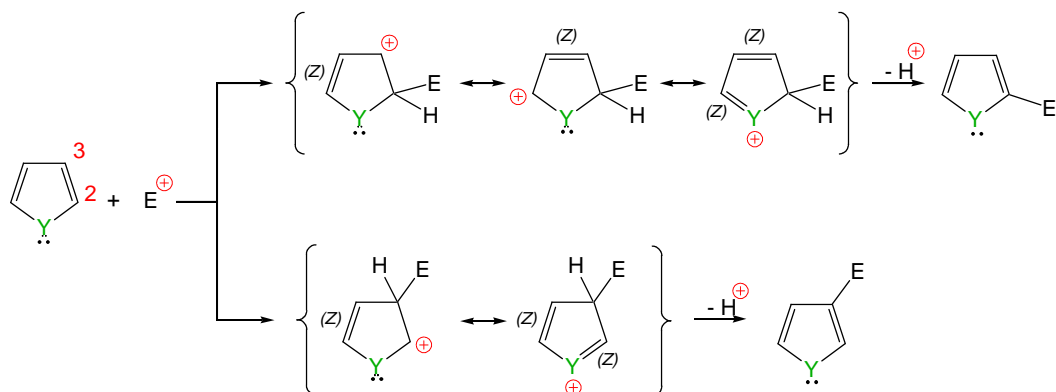
FURÁN, TIOFÉN ÉS PIRROL ELEKTROELOSZLÁSA



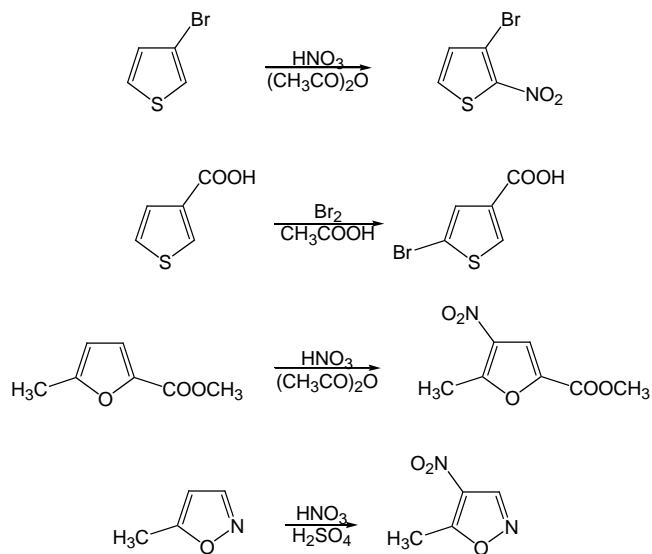
FURÁN, TIOFÉN ÉS PIRROL SZUBSZTITÚCIÓS REAKCIÓI



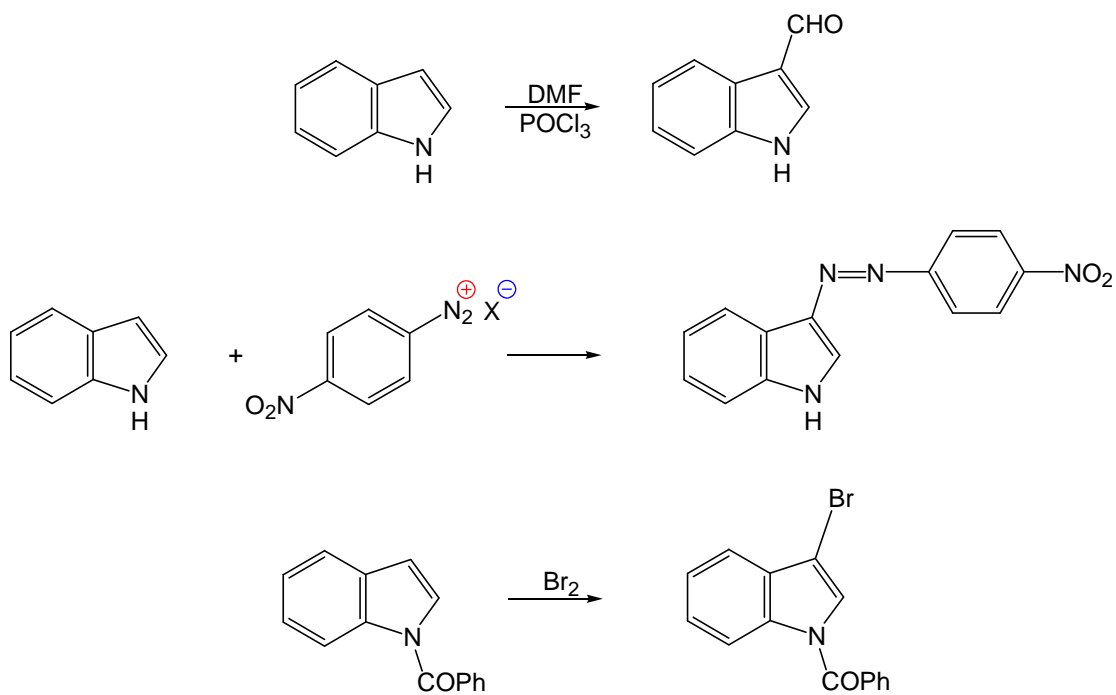
HETEROATOM IRÁNYÍTÁSA S_E REAKCIÓKBAN



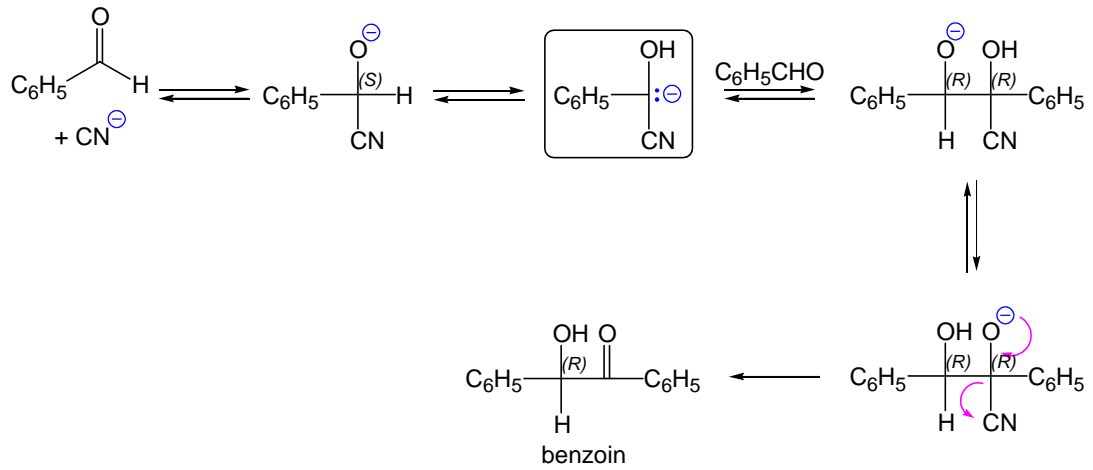
ELEKTROFIL SZUBSZTITÚCIÓS REAKCIÓK



INDOLSZÁRMAZÉKOK S_E REAKCIÓI

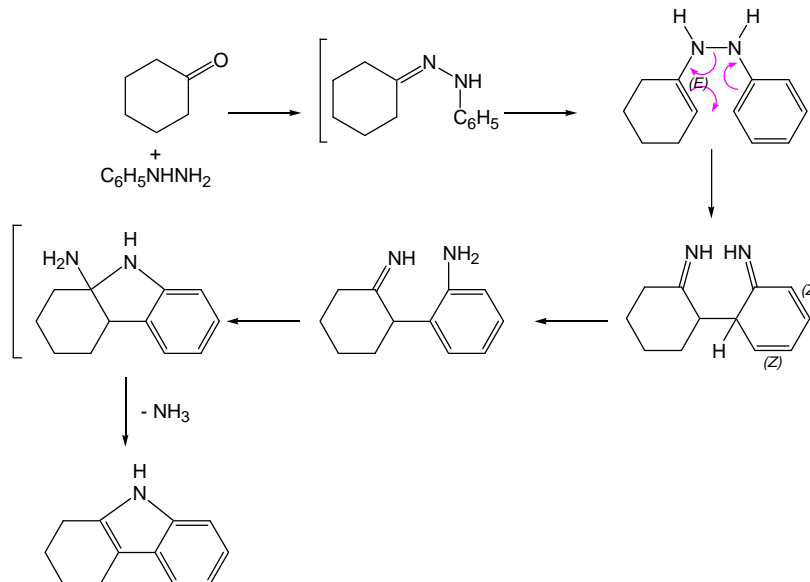


BENZOIN KONDENZÁCIÓ

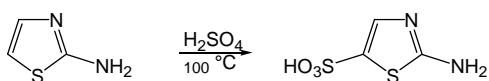
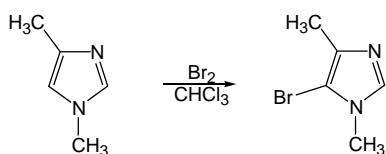
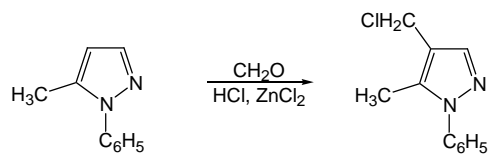


FISCHER INDOL SZINTÉZIS

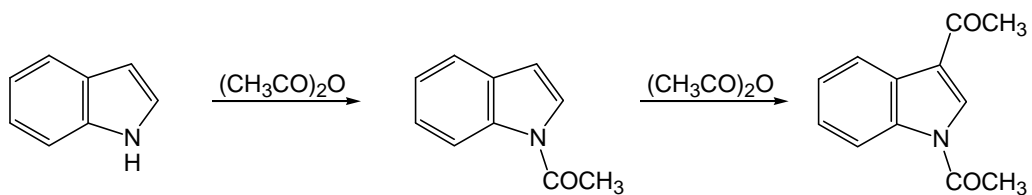
Fischer indol-szintézis



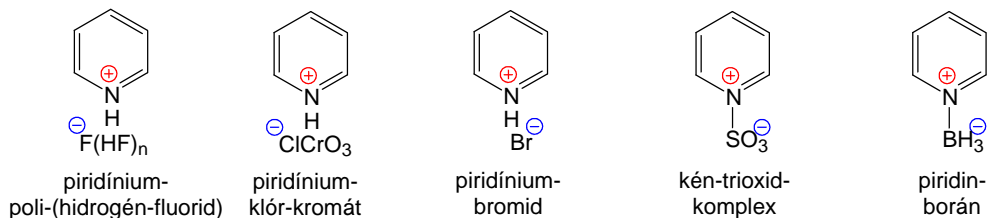
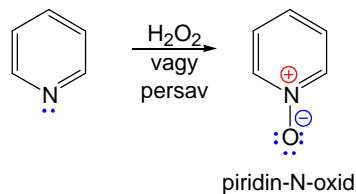
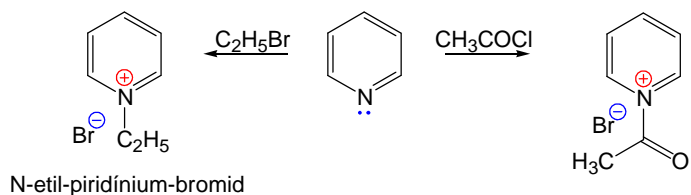
KÉT HETEROATOMOS ÖTTAGÚ GYŰRŰK REAKCIÓI



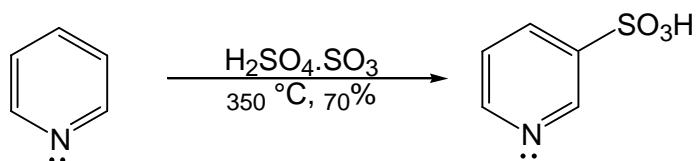
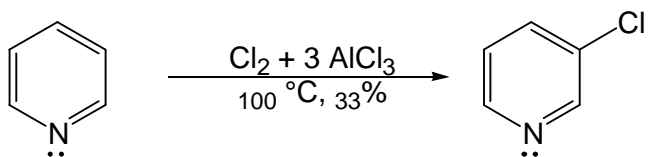
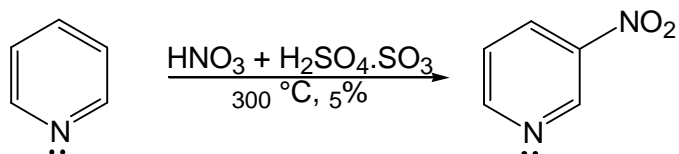
INDOL ACETILEZÉSE



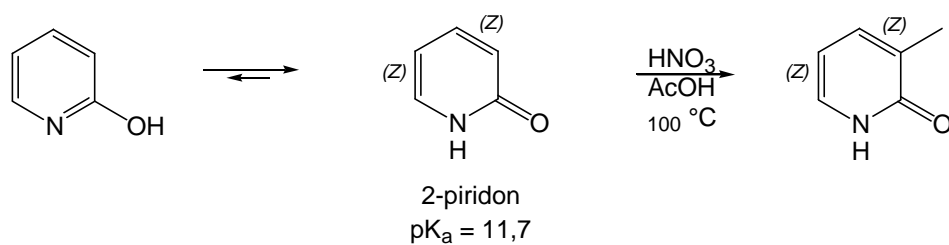
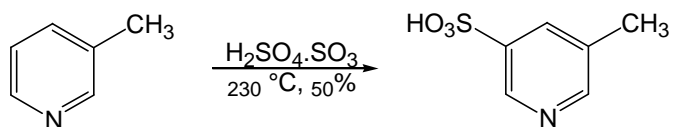
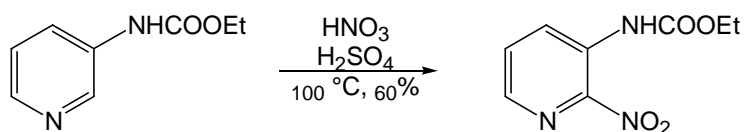
PIRIDIN N-SZÁRMAZÉKOK



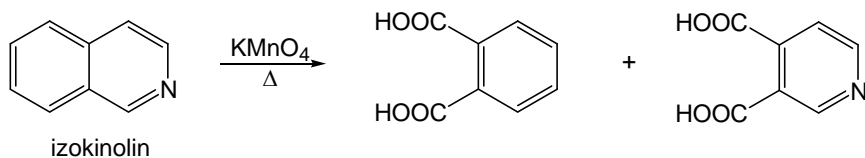
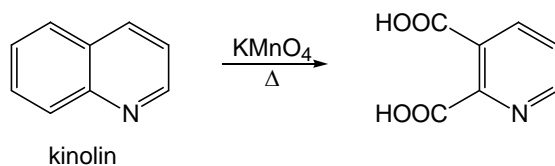
PIRIDIN ELEKTROFIL SZUBSZTITÚCIÓS REAKCIÓI



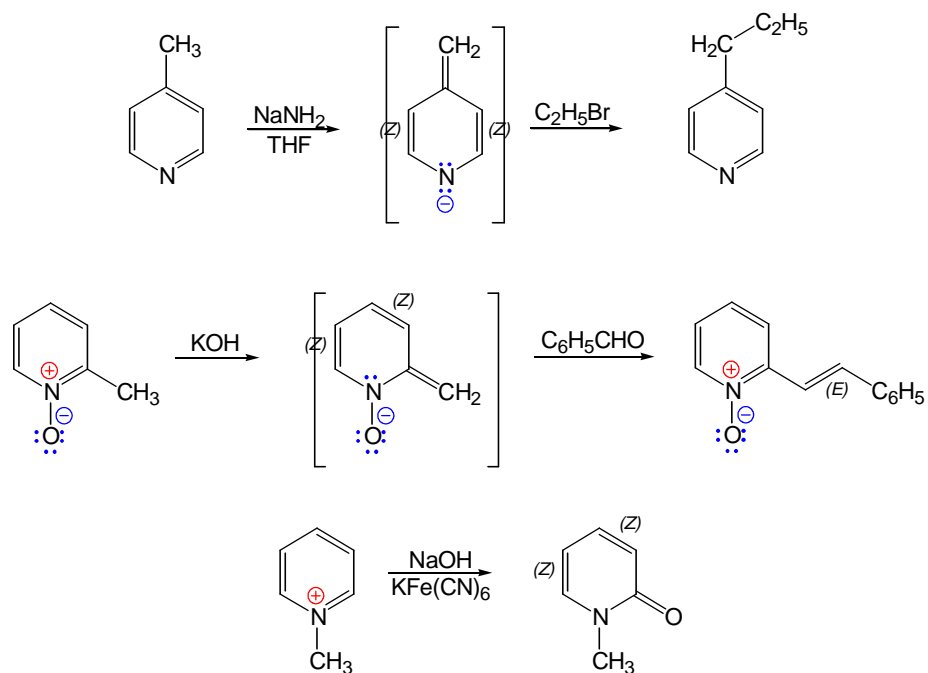
PIRIDINSZÁRMAZÉKOK REAKCIÓI



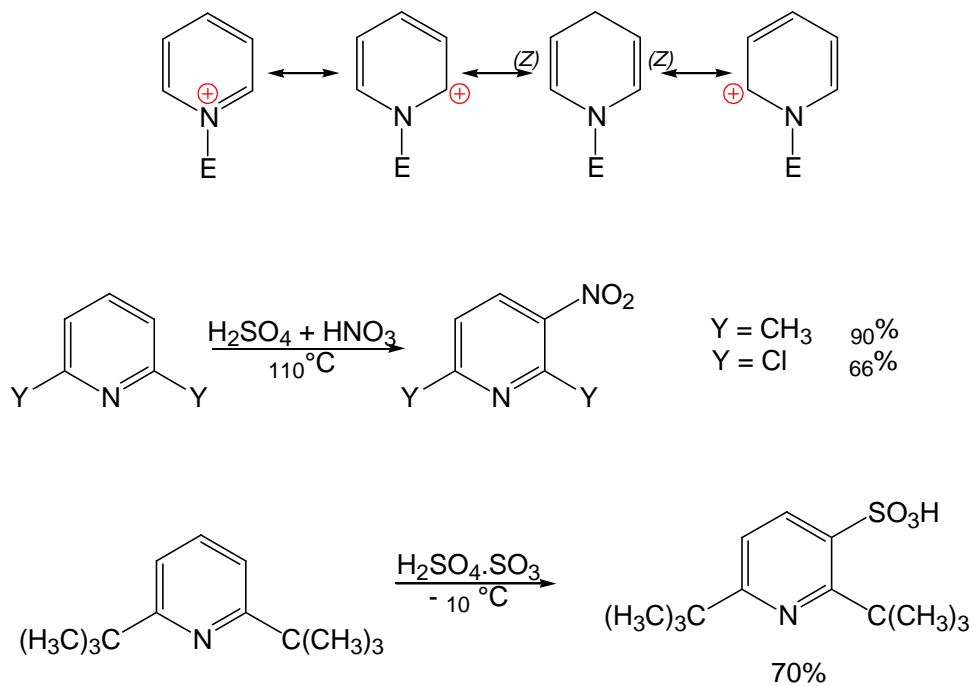
KINOLIN ÉS IZOKINOLIN OXIDÁCIÓJA



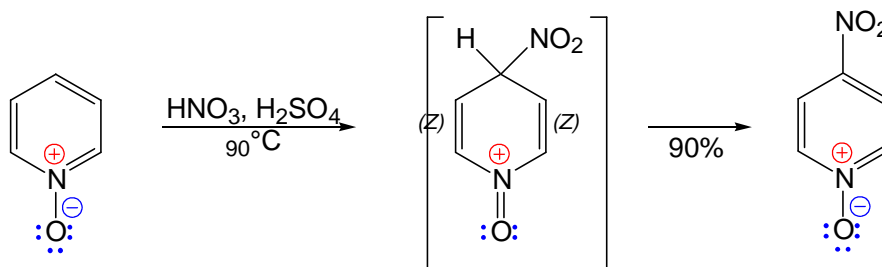
PIRIDIN REAKCIÓI ERŐS BÁZISOKKAL



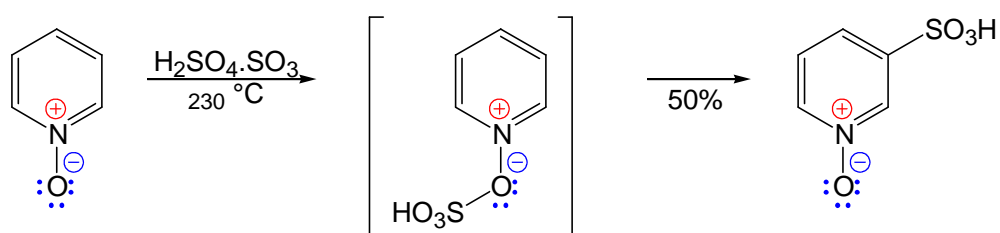
PIRIDIN: ELEKTROFIL SZUBSZTITÚCIÓ



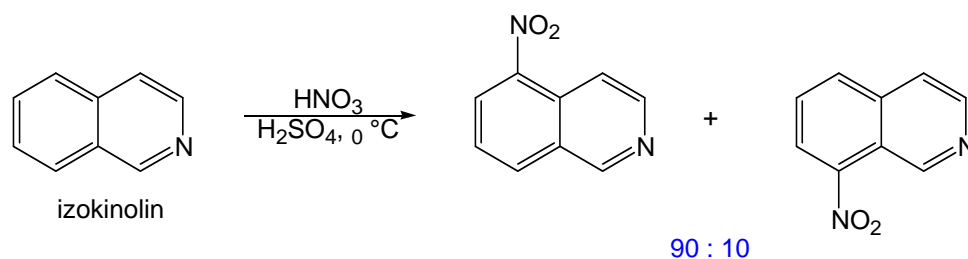
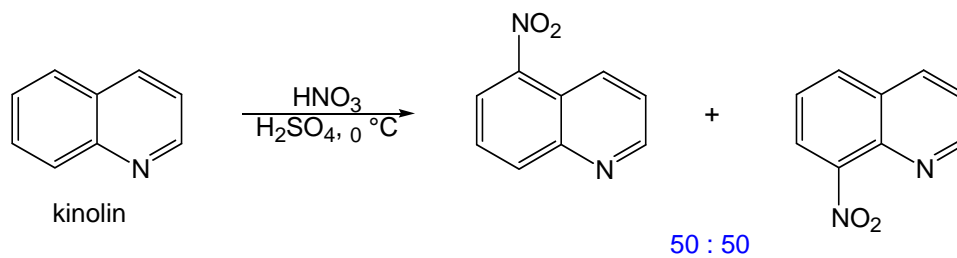
PIRIDIN N-OXID ELEKTROFIL SZUBSZTITÚCIÓJA



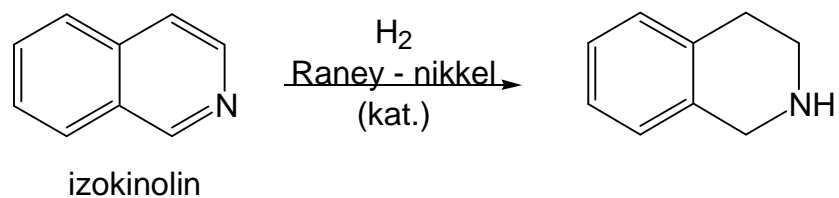
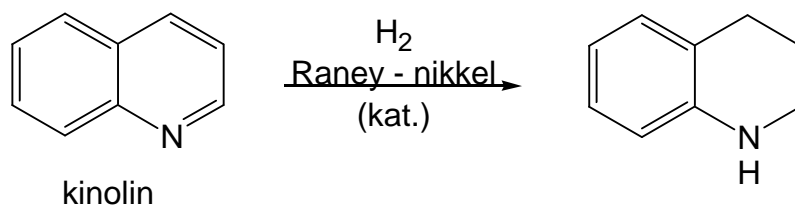
piridin-N-oxid
 $\text{pK}_a = 0,9$



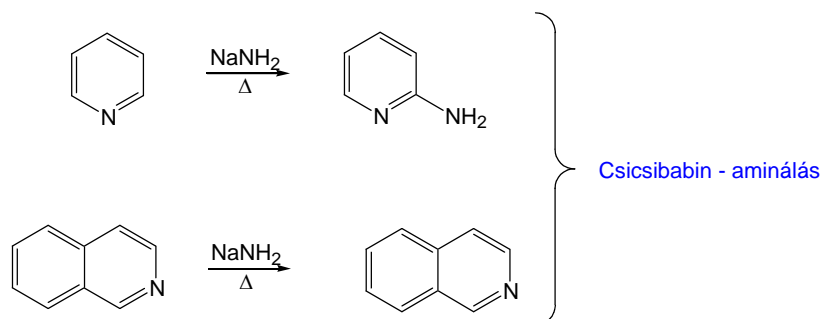
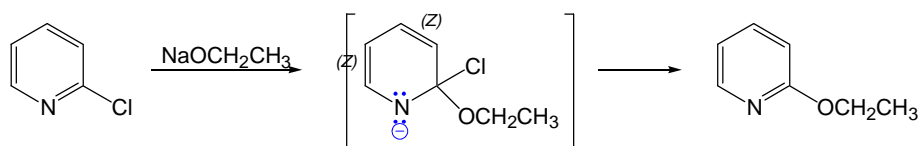
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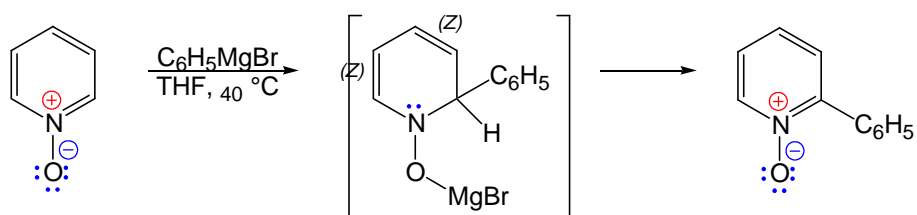
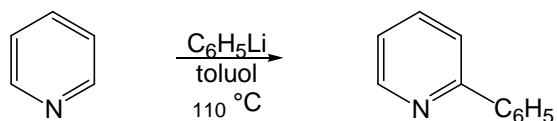
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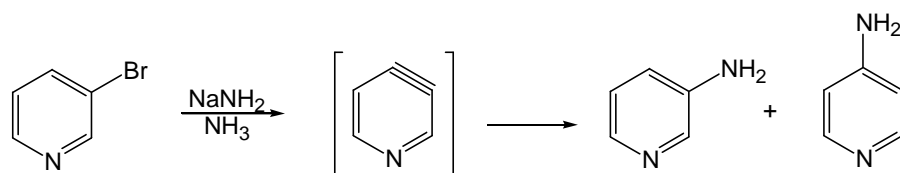
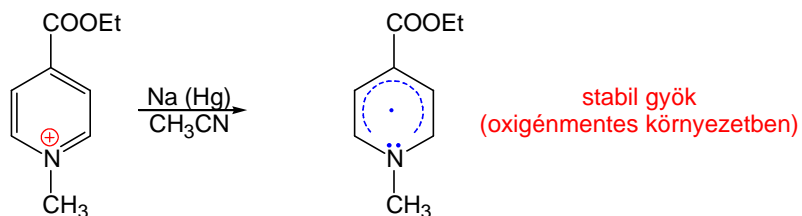
NUKLEOFIL SZUBSZTITÚCÓ PIRIDIN ÉS KINOLIN RENDSZEREKEN



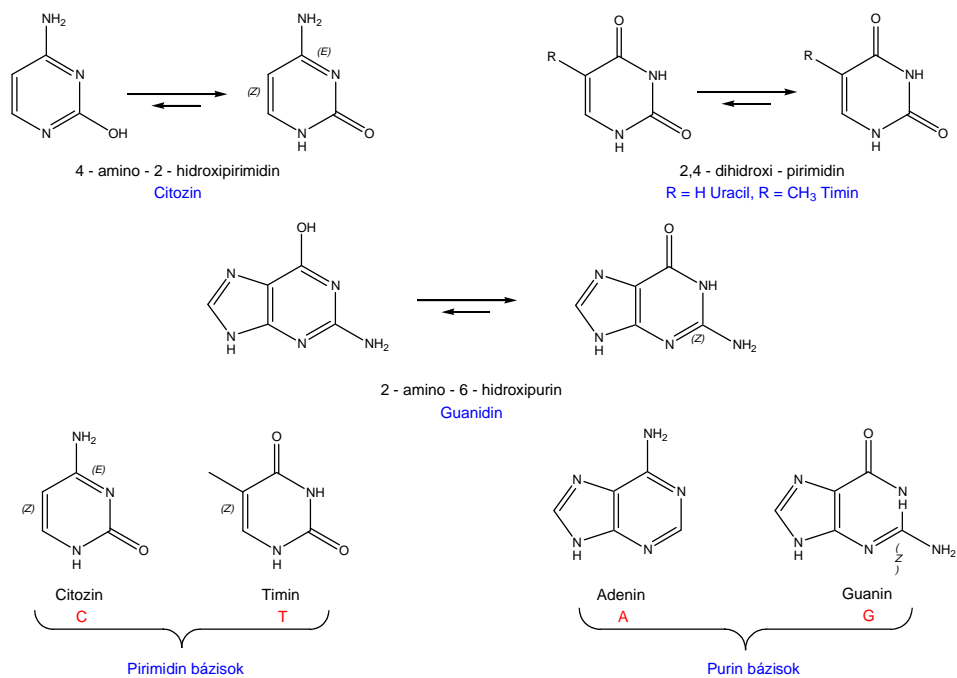
REAKCIÓK FÉMORGANIKUS REAGENSEKKEL



STABIL GYÖK ÉS BENZYN INTERMEDIER



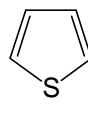
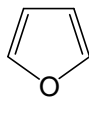
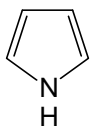
TAUTOMÉRIA PIRIDIN ÉS PURIN SZÁRMAZÉKOK KÖRÉBEN



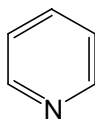
HETEROAROMÁS VEGYÜLETEK

Konstitúció és elnevezés

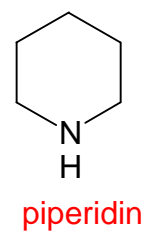
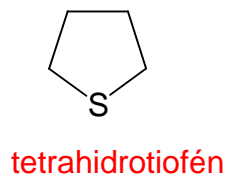
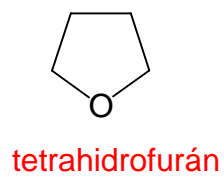
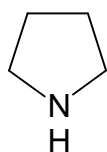
egy heteroatom, öttagú gyűrű



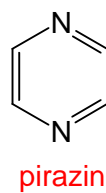
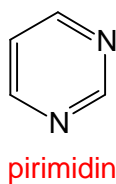
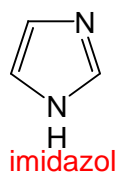
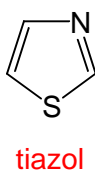
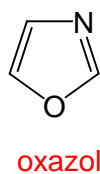
egy heteroatom, hatagú gyűrű



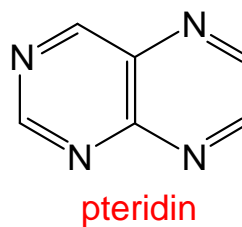
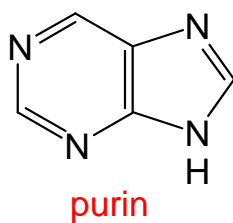
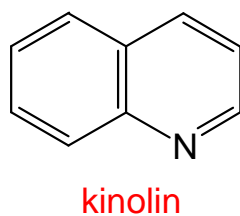
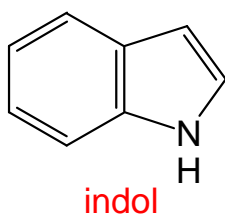
telített (nem aromás) származékok



több heteroatomos gyűrűk

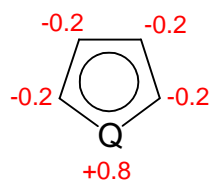
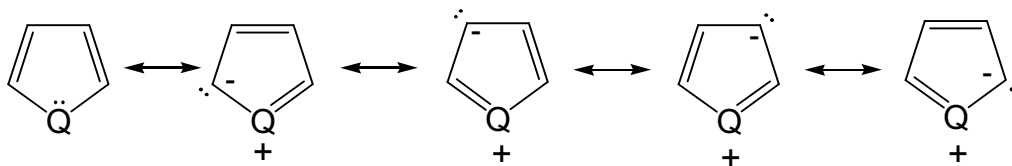


kondenzált gyűrűs származékok

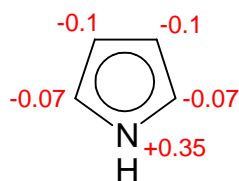


Elektronszerkezet

pirrol, furán, tiofén

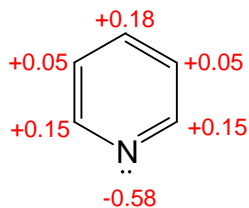
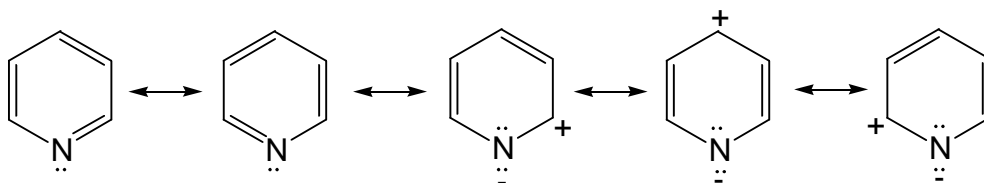


"egyenletes" elektroneloszlás

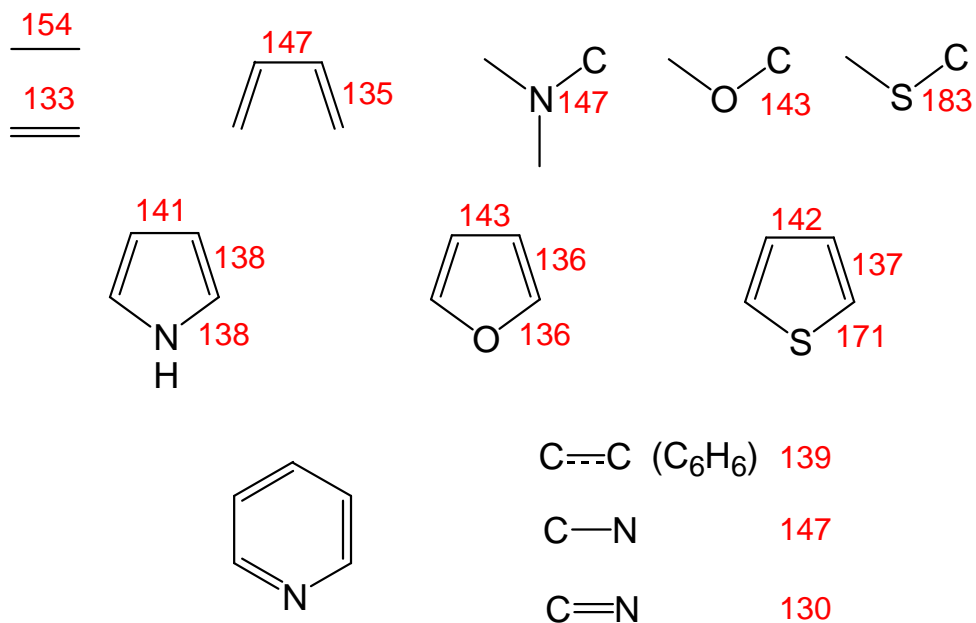


valóságos elektroneloszlás

piridin

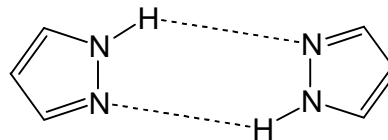


Térszerkezet kötéshosszak (pm)



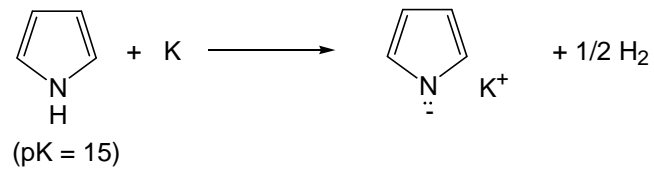
Fizikai tulajdonságok

	fp. (°C)	H-kötés
benzol	80	-
tiofén	84	-
piridin	115	-
pirrol	131	+
pirazol	187	+ (dimer)
imidazol	256 (op. 90 °C)	+ (polimer)

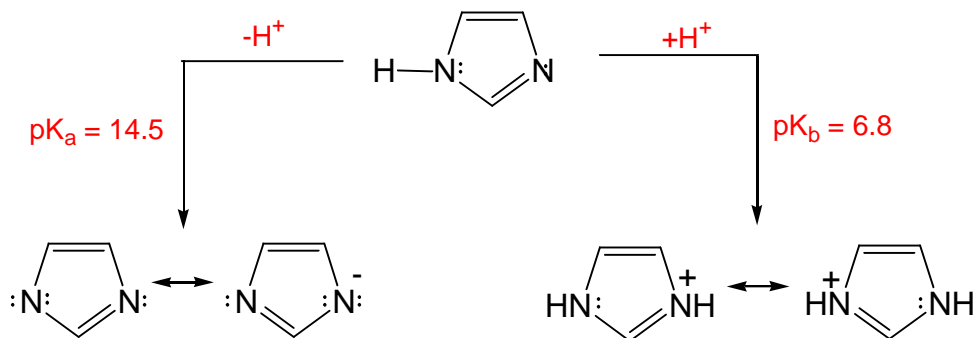
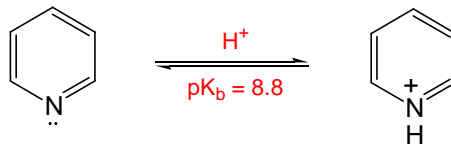
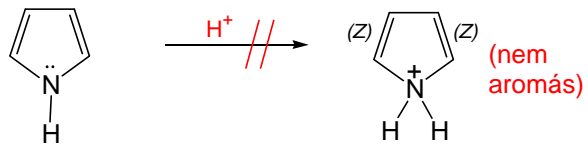


Sav-bázis tulajdonságok

savi jelleg

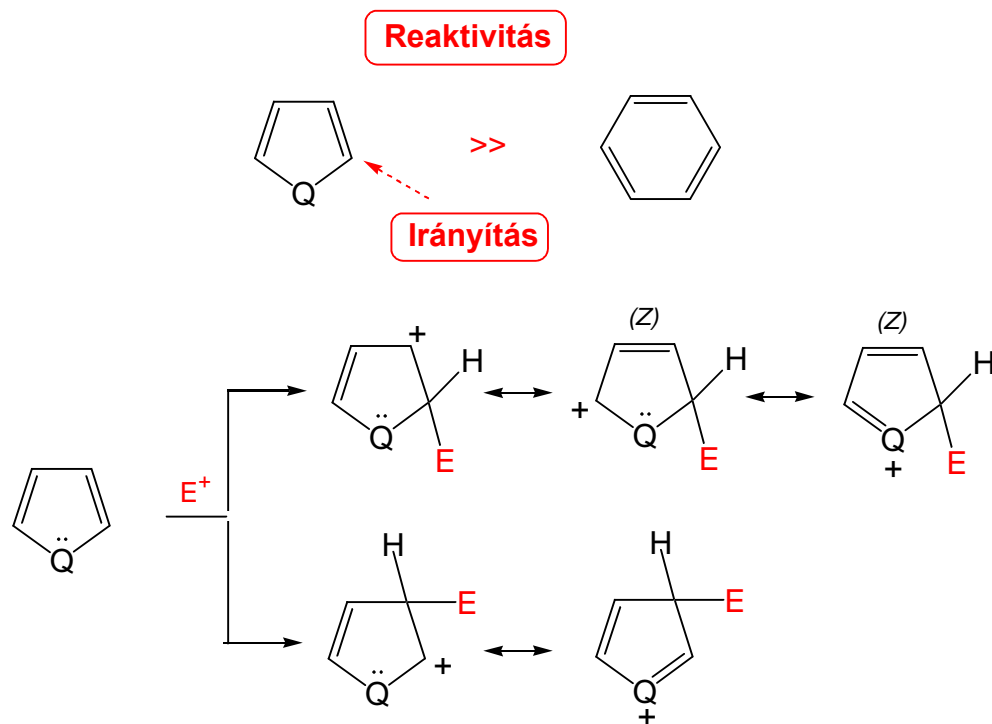


bázicitás

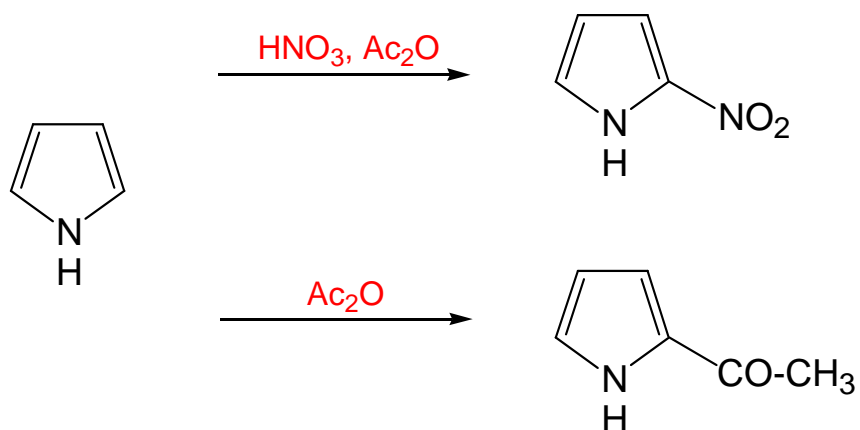


Kémiai tulajdonságok

A pirrol, furán és tiofén elektrofil szubsztitúciós reakciója

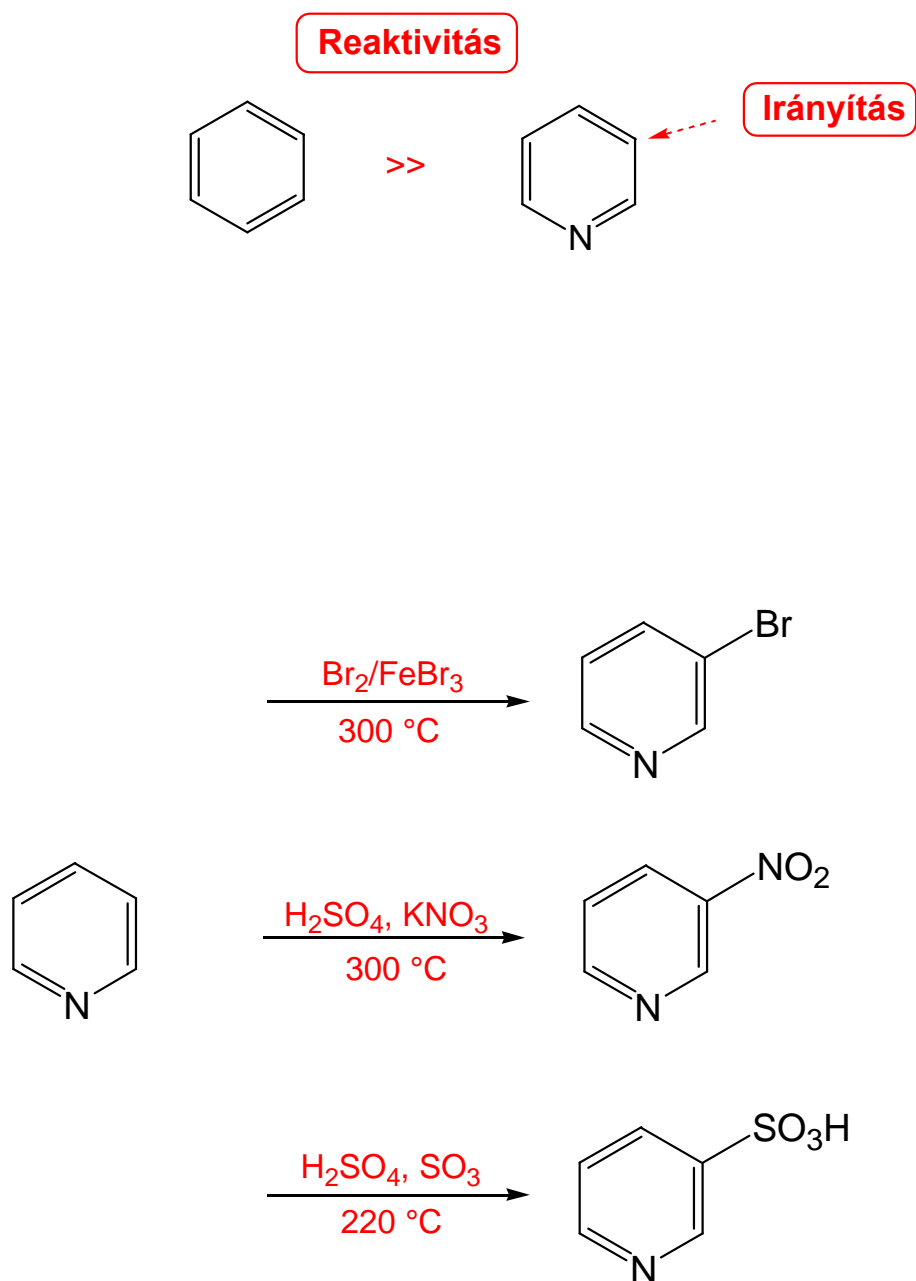


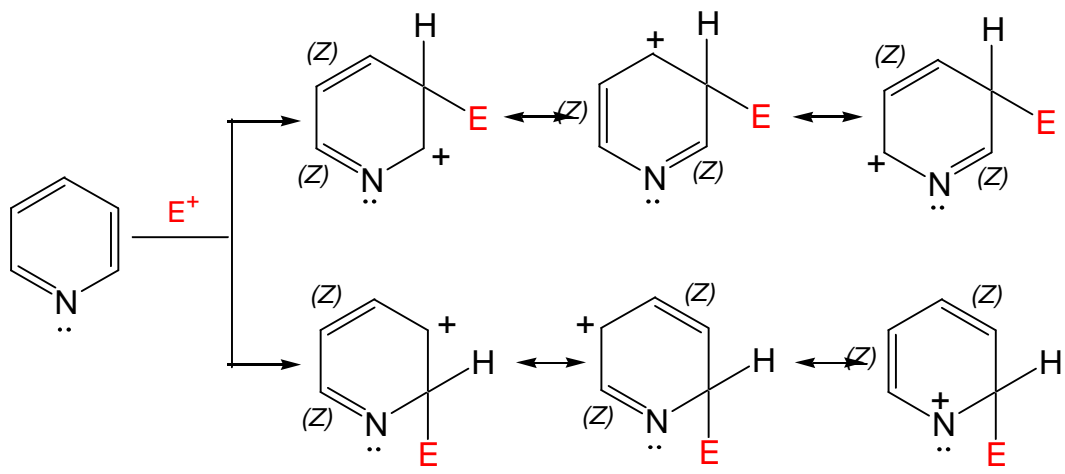
Példa



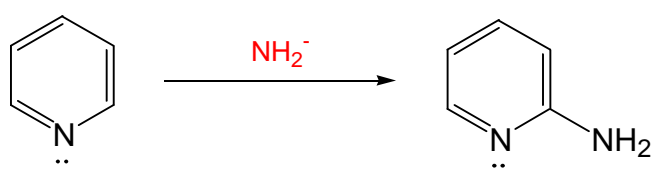
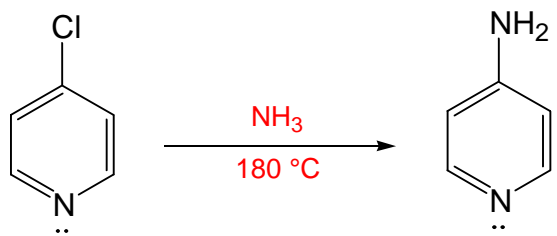
A piridin reaktivitása

Elektrofil szubsztitúció

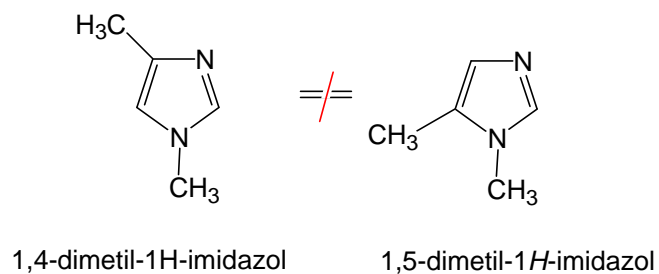
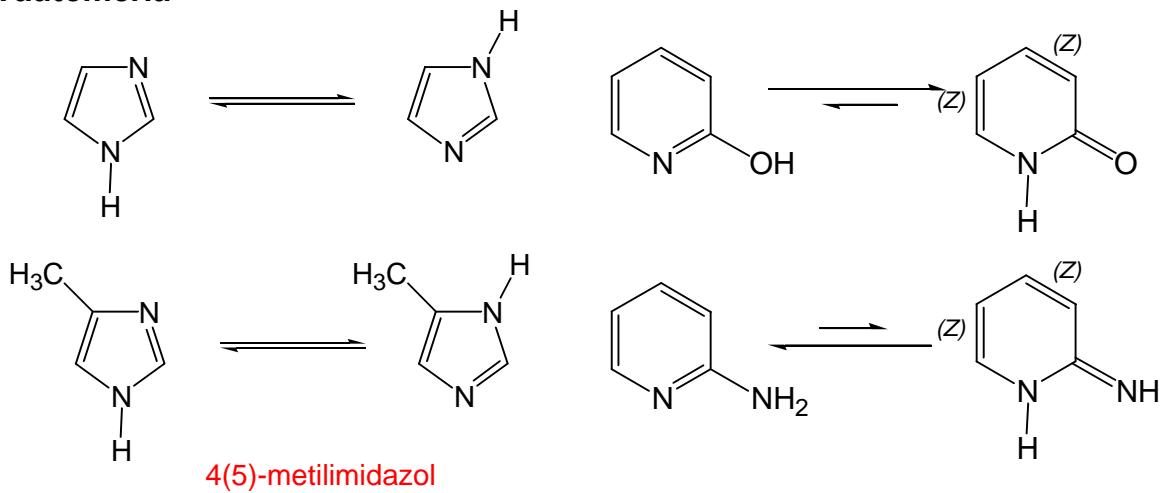




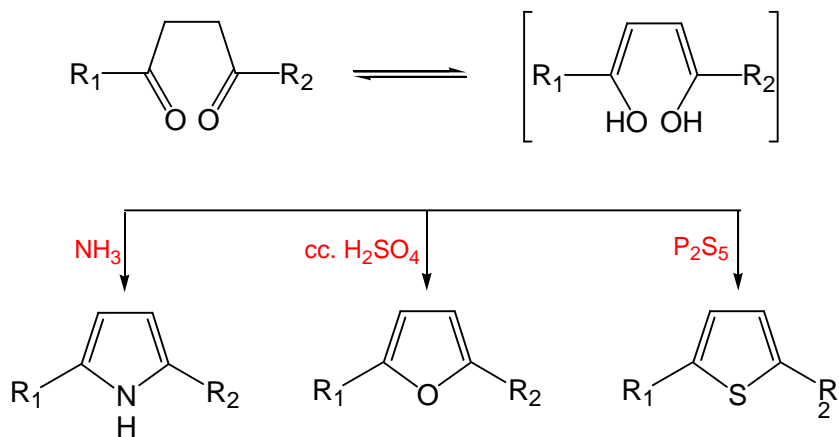
Nukleofil szubsztitúció



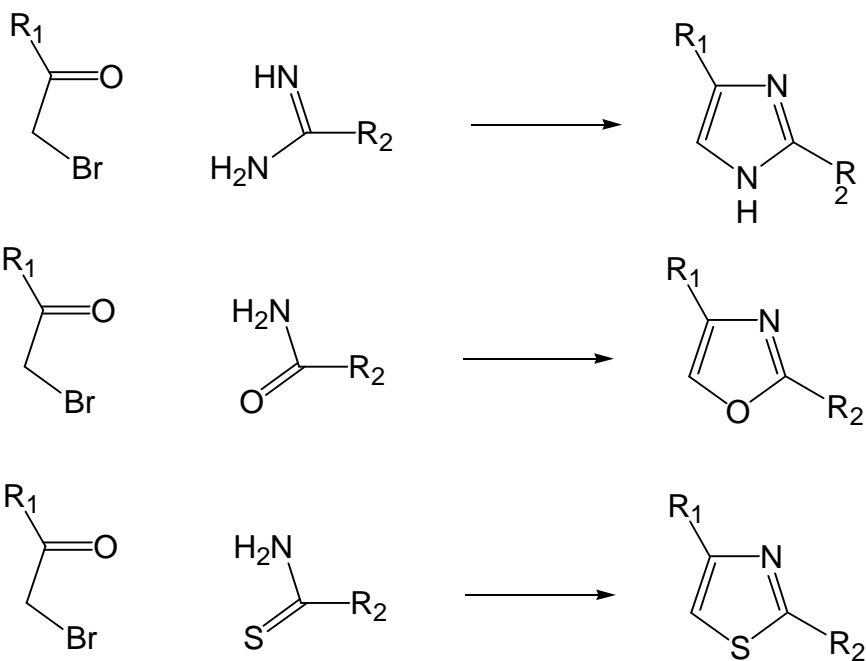
Tautoméria



Heterociklusos vegyületek előállítása



Példák

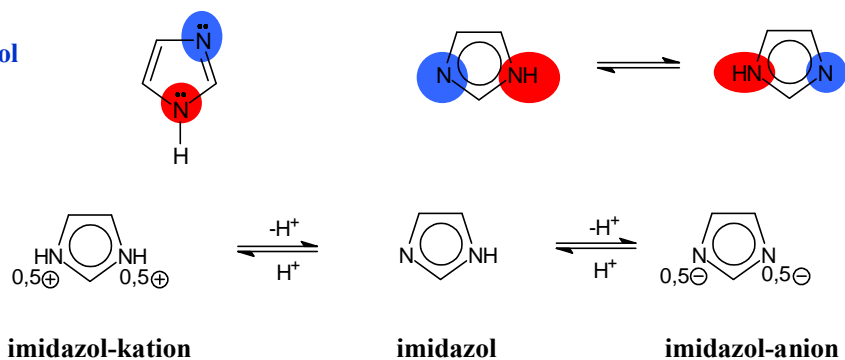


Öttagú heterociklusok két heteroatommal

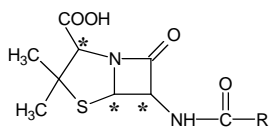


- aromás jelleg
- csekély mértékű hajlam elektrofil szubsztitúcióra
- bázikus tulajdonság

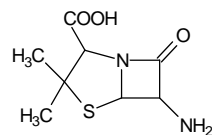
Imidazol



Penicillin

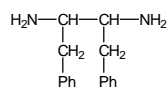
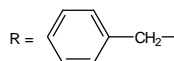


Fleming, 1929
Penicillium notatum
Penicillium chrysogenum
Szerkezet: 1943-45
Stabilitás: pH = 5-8



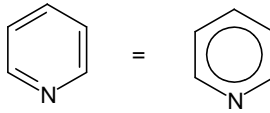
6-Amino-penicillánsav

G-penicillin

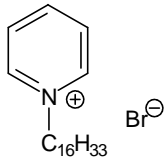


só

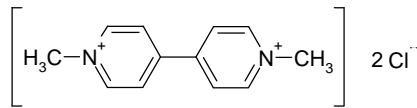
Piridin és származékai



Gyenge bázis, sőt képez S_E nehezen játszódik le

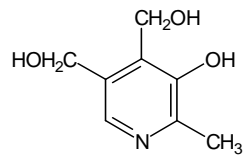


Cetilpiridinium bromid
Vízoldható, kationaktív detergens
invert szappan
Sterogénol



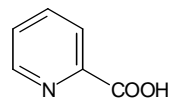
Paraquat (Gramoxon)
gyomirtó

B₆-Vitamin
piridoxin

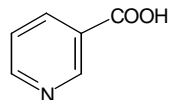


B₆-Vitamin hiány: **idegesség**
álmatlanság
hasi fájdalmak
gyengeség

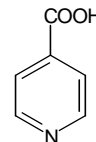
Karbonsavak



Pikolinsav

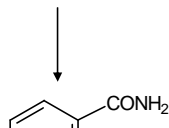


Nikotinsav

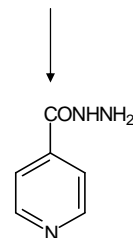
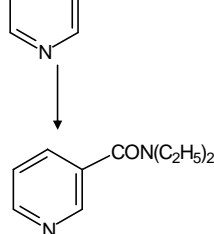


Izonikotinsav

Nikotinsavamid
a NAD építőeleme

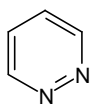


N,N-dietil-nikotinsavamid
Légzőközpontot izgatja,
szívműködést fokozza

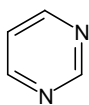


Izonikotinsav-hidrazid
TBC ellen

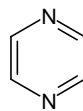
Hatagú heterociklusok két heteroatommal



Piridazin
1,2-Diazin

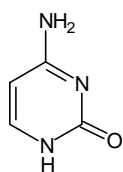


Pirimidin
1,3-Diazin

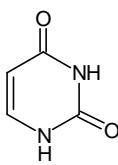


Pirazin
1,4-Diazin

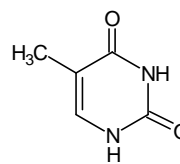
- Pirimidin bázisok



Citozin

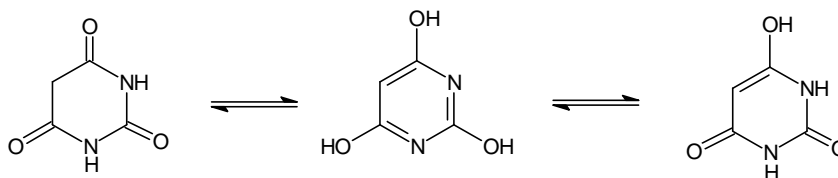


Uracil

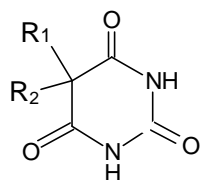


Timin

Barbitursav (tautomer formák)



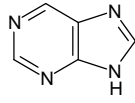
5,5-diszubsztituált barbitursav-származékok



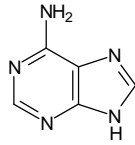
R ₁	R ₂	
C ₂ H ₅	C ₂ H ₅	Barbital (Veronal)
C ₂ H ₅	C ₆ H ₅	Phenobarbital (Luminál)
C ₂ H ₅	C ₆ H ₉	Cyclobarbital (Phenodorm)

fontos nyugtató-, altató és narkotizáló szerek

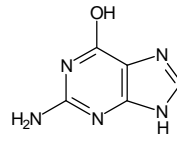
Purin



- Purin bázisok

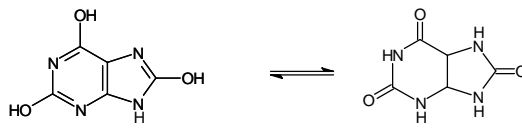


Adenin

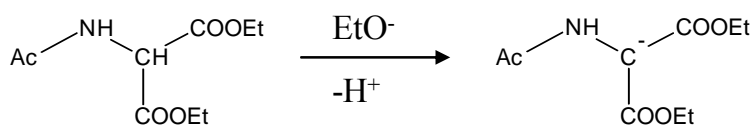


Guanin

- Húgysav

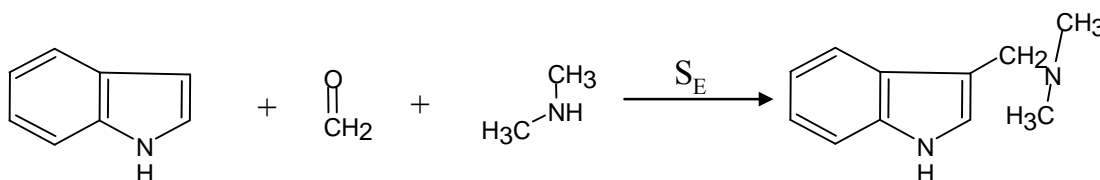


Példa: triptofán szintézise (indol S_E reakció)

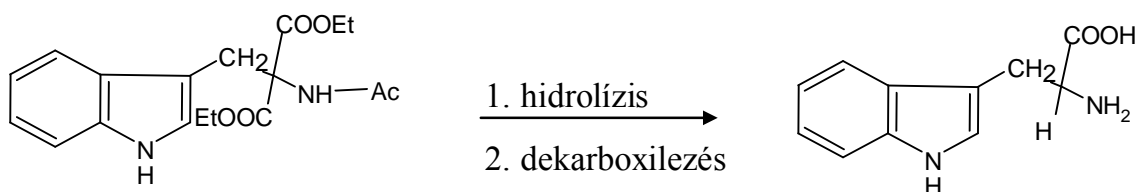
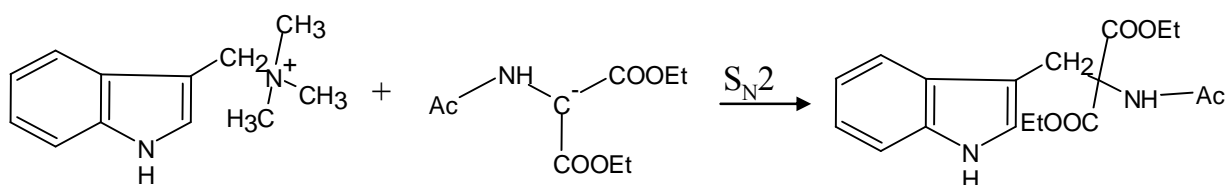
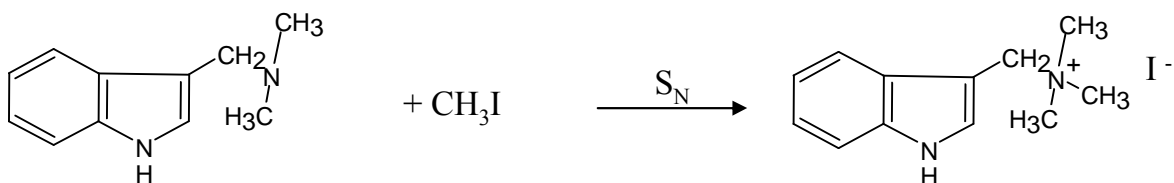


acetamido-
malonészter

Aminometilezés

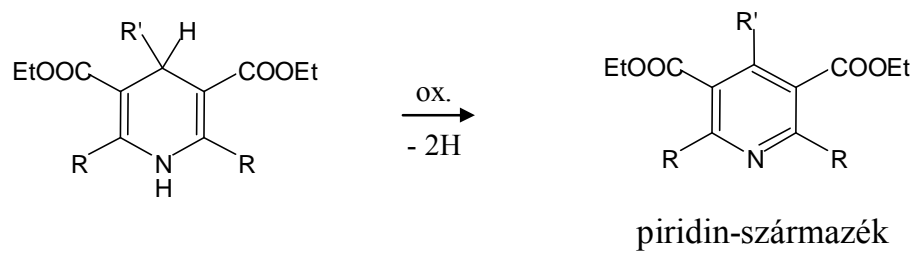
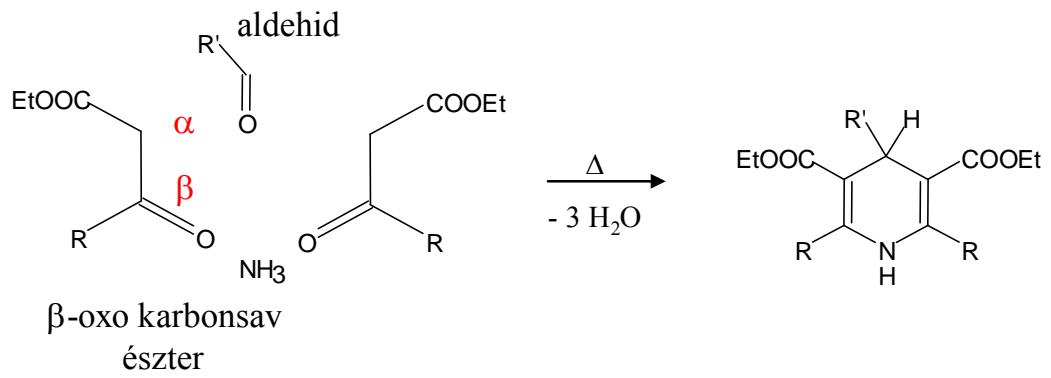


Alkilezés

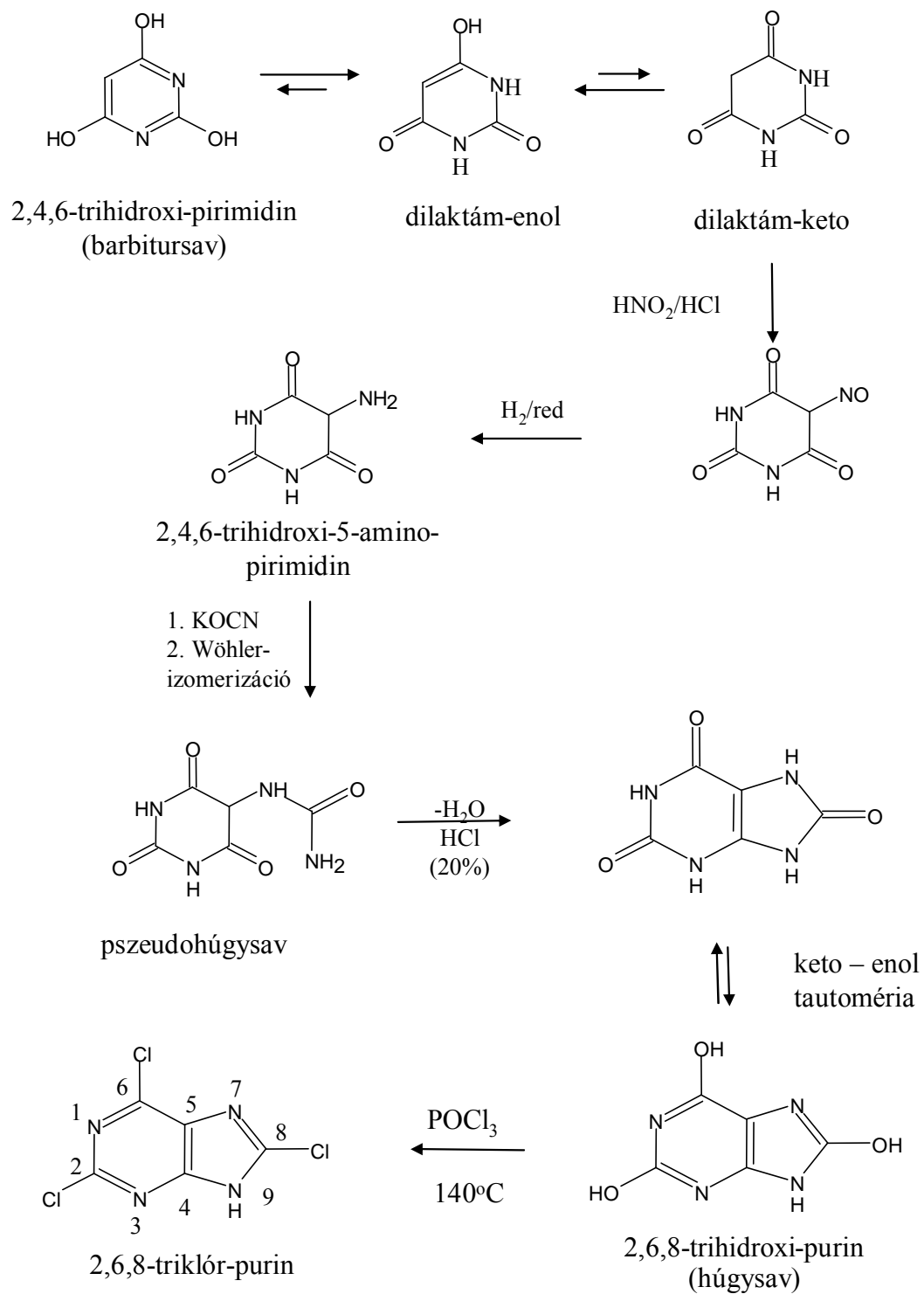


triptofán

Piridin szintézis (Hantzsch)



Purin szintézis



Purin szintézis (folytatás)

