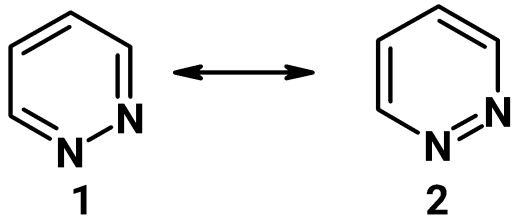
Шестичленные гетероциклы с несколькими атомами азота
Пиридазины

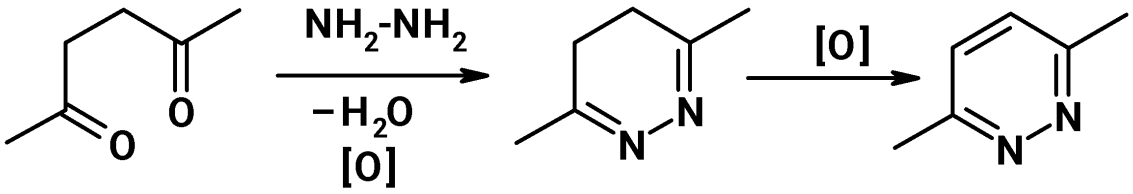


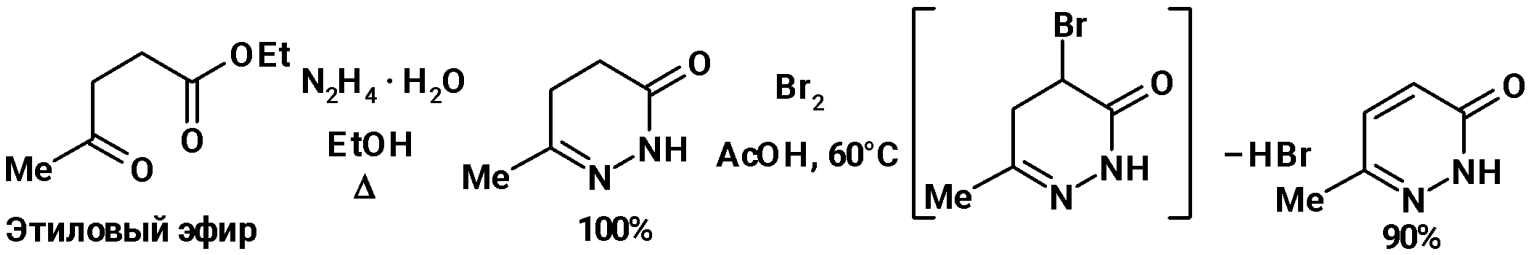
1 2

Структура 1 более устойчива

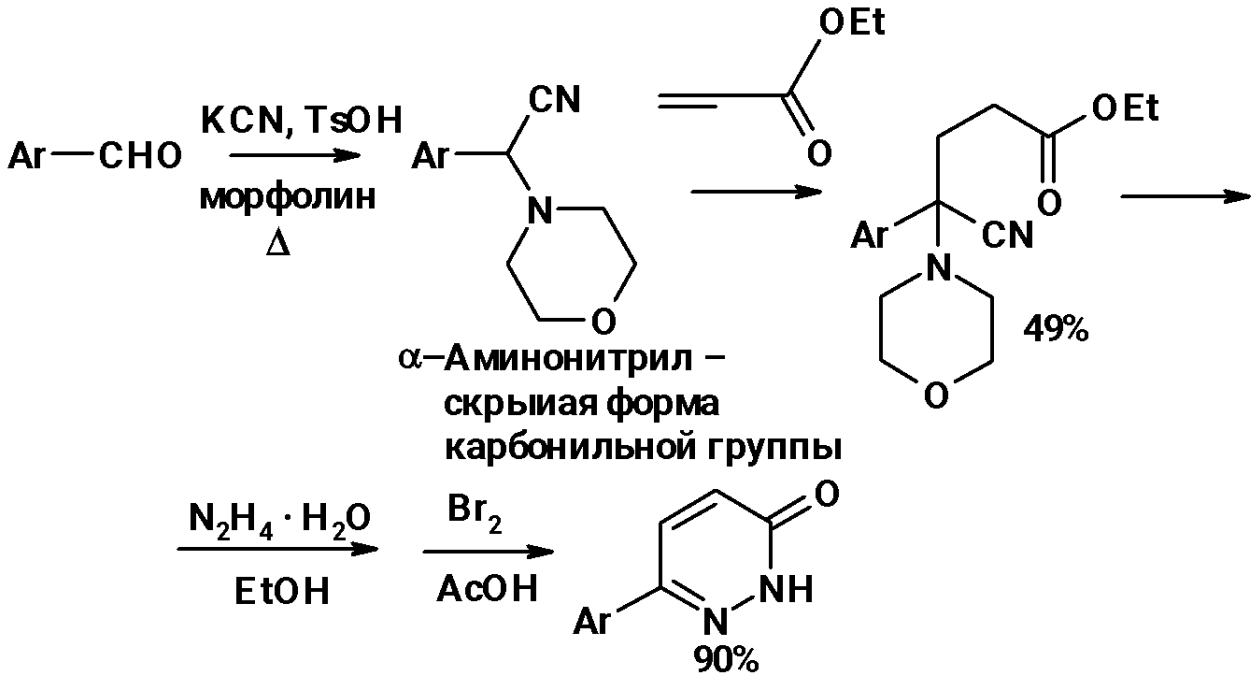
Методы синтеза

Использование 1,4-дикарбонильных соединений

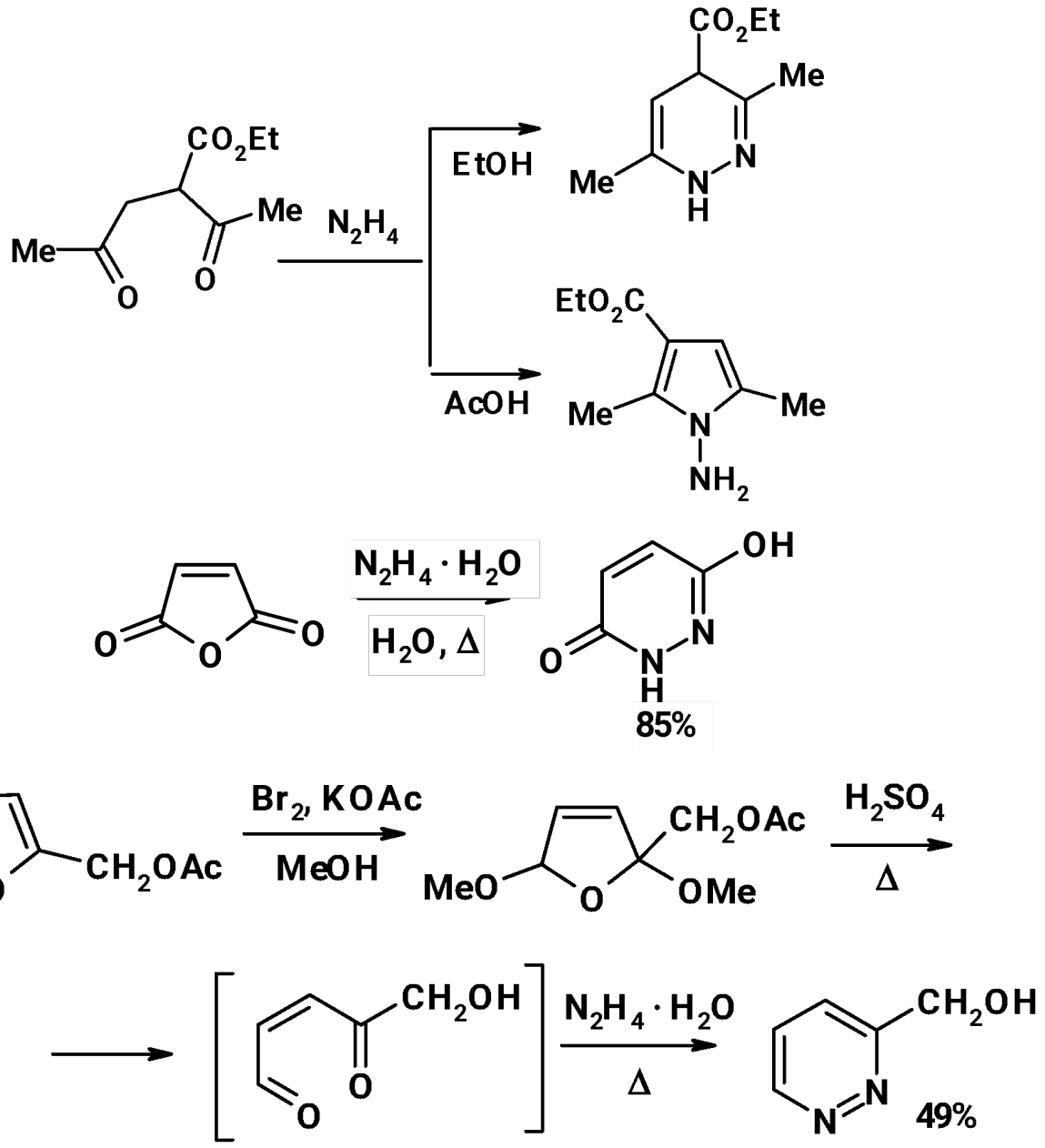




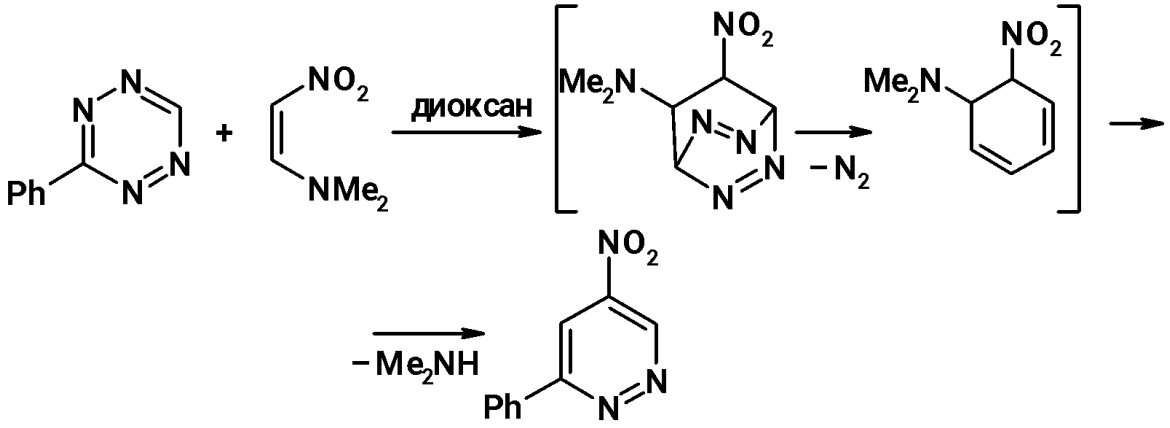
Этиловый эфир
левулиновой кислоты

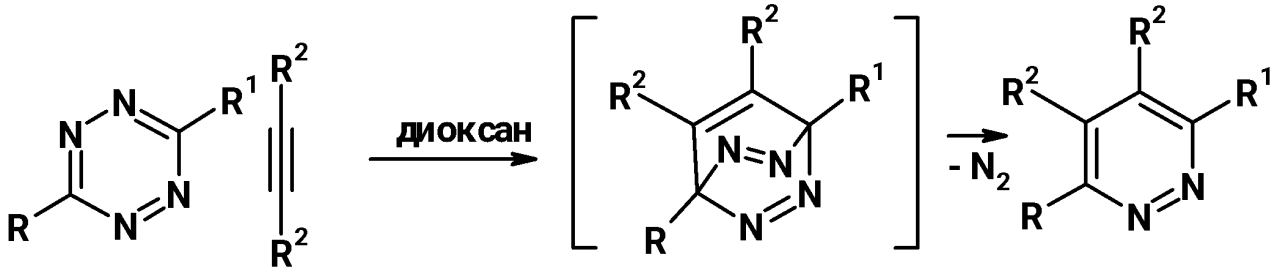


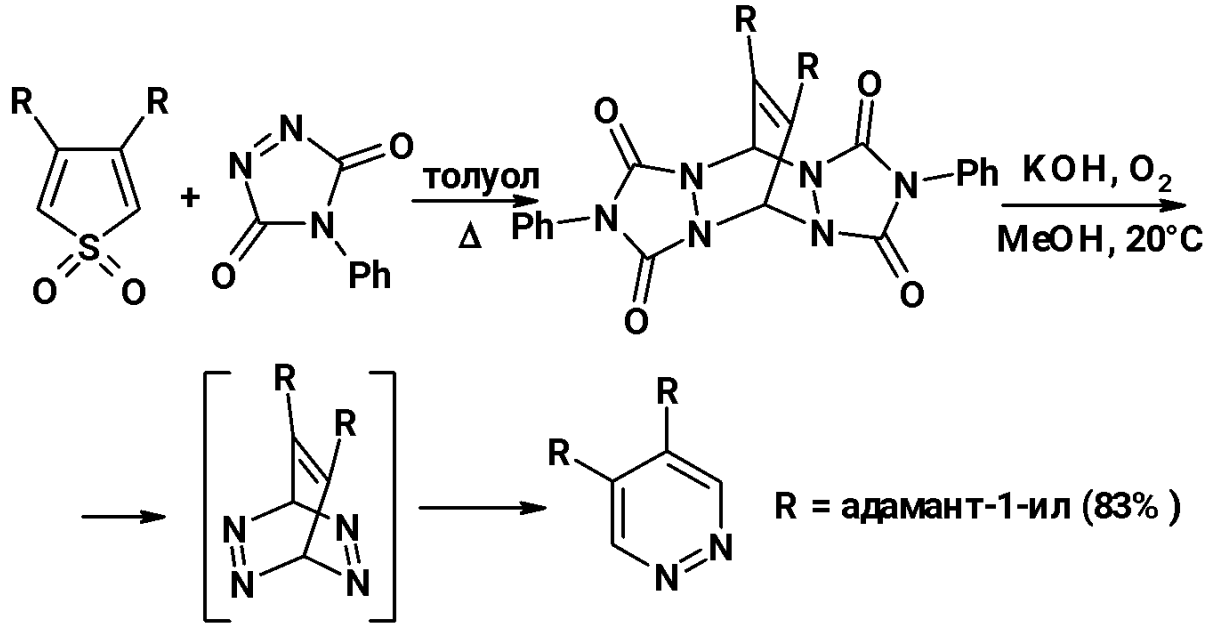
α–Аминонитрил –
скрыиая форма
карбонильной группы


CO2Et
Me
Me
O
O
N2H4
EtOH
AcOH
Me
N
N
H
EtO2C
Me
Me
N
NH2
O
O
O
N2H4 · H2O
H2O, Δ
OH
O
N
N
H
85%
O
CH2OAc
Br2, KOAc
MeOH
CH2OAc
MeO
O
OMe
H2SO4
Δ
CH2OH
O
O
N2H4 · H2O
Δ
CH2OH
N
N
49%

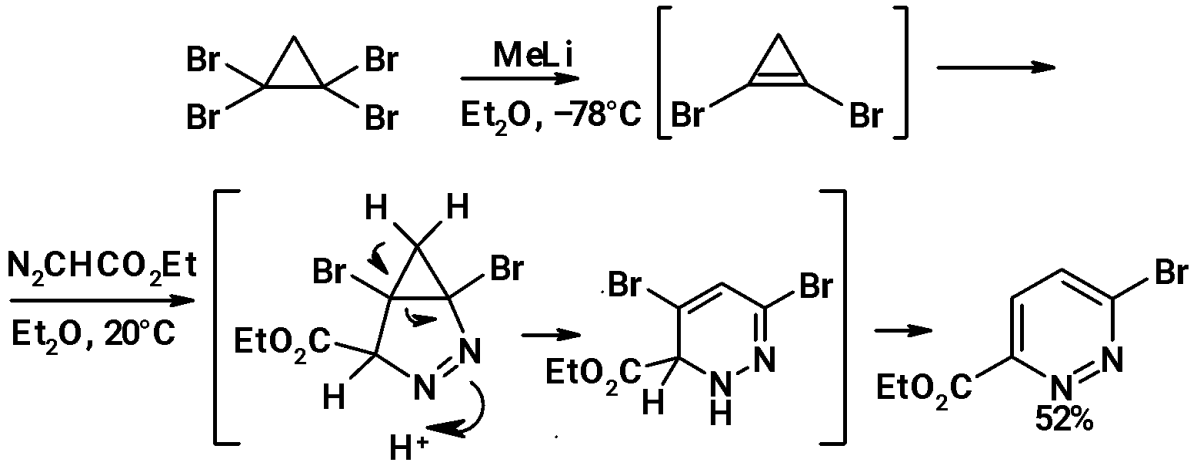
Трансформации других гетероциклов





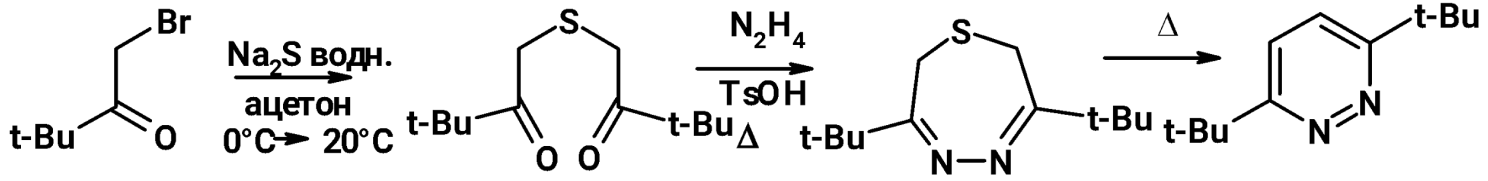


Синтез с использованием галогензамещённых циклопропенов

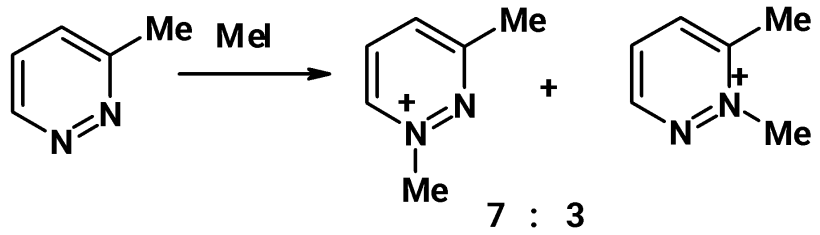


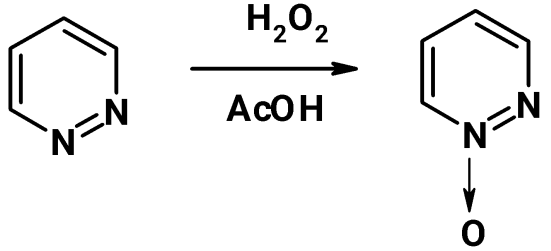
[3+2]-циклоприсоединение

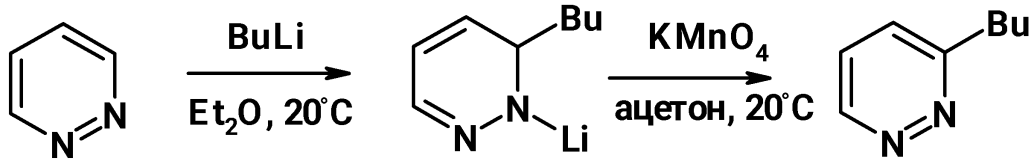
Синтез пиридазинов через сульфиды

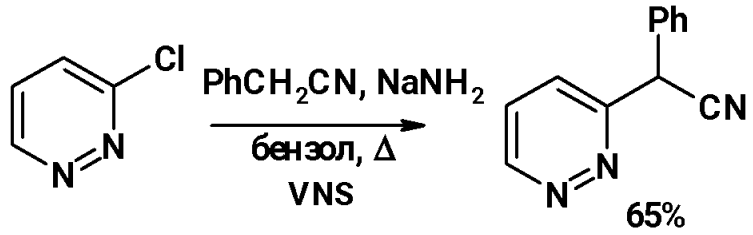


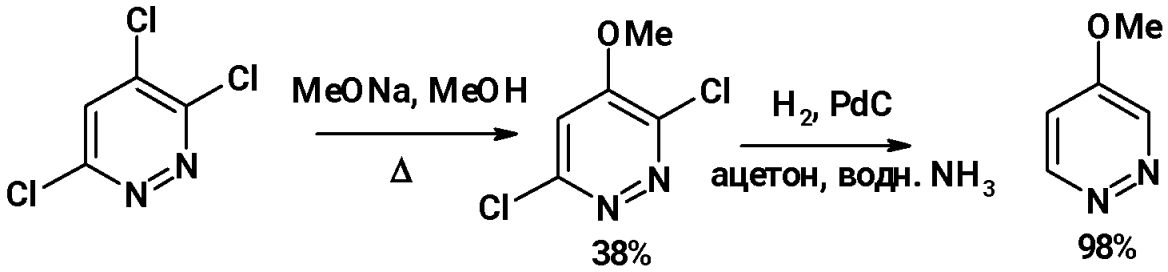
Химические свойства пиридазинов

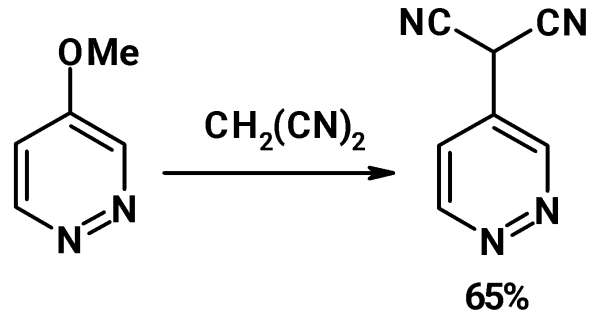


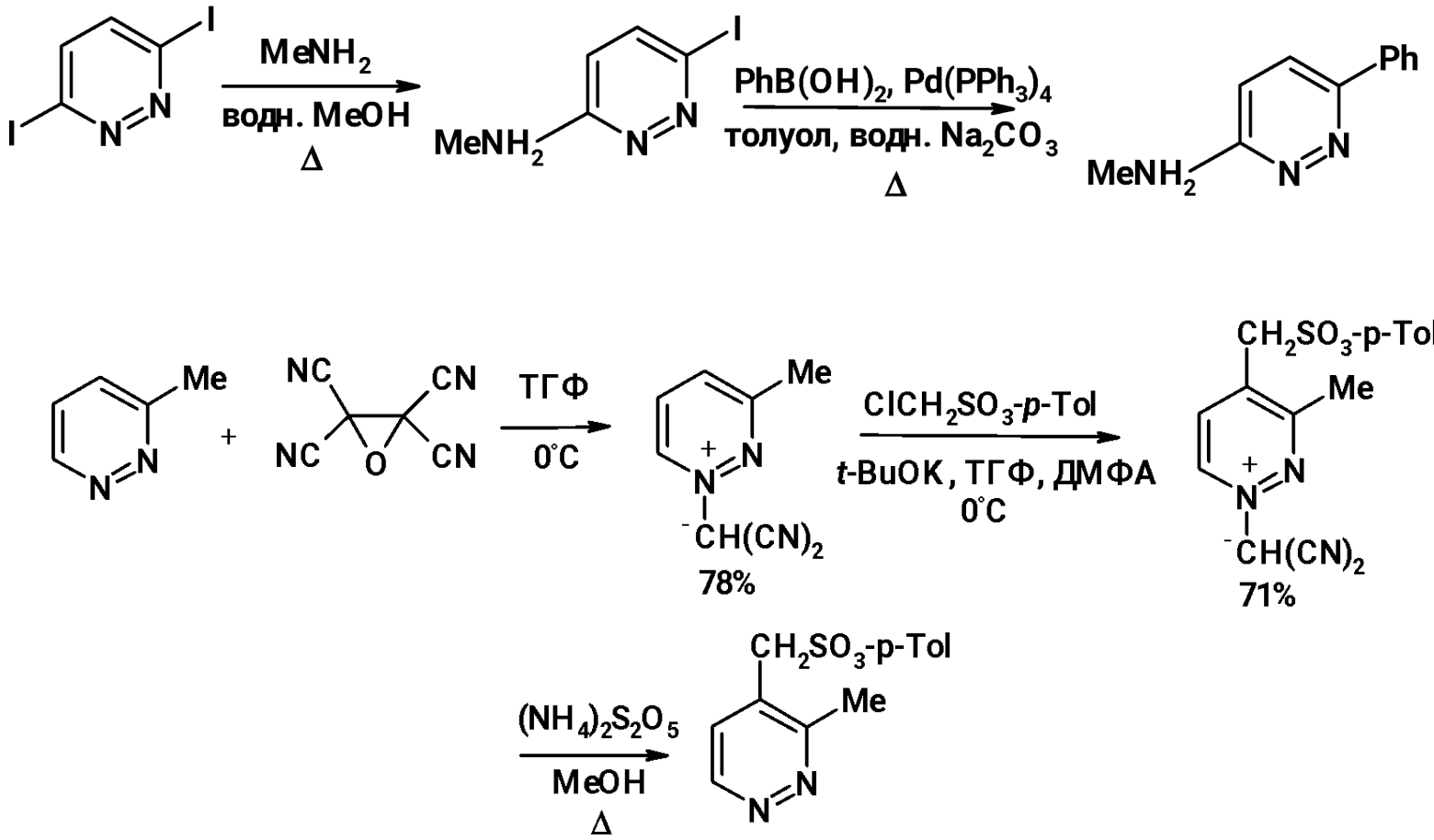



BuLi
Et2O, 20°C
Bu
Li
KMnO4
ацетон, 20°C
Bu

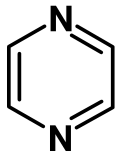

Cl
PhCH2CN, NaNH2
бензол, Δ
VNS
Ph
CN
65%


Cl
Cl
Cl
MeONa, MeOH
Δ
OMe
Cl
Cl
38%
H2, PdC
ацетон, водн. NH3
OMe
98%


OMe
CH2(CN)2
NC
CN
65%

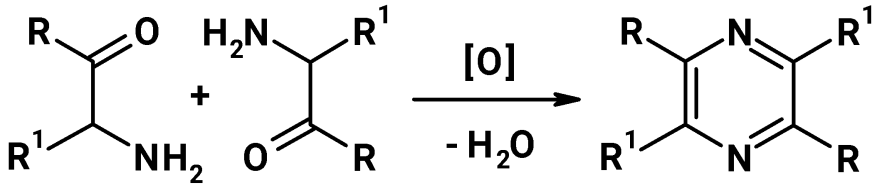

MeNH2
водн. MeOH
Δ
PhB(OH)2, Pd(PPh3)4
толуол, водн. Na2CO3
Δ
Ph
MeNH2
Me
NC
CN
NC
CN
O
ТГФ
0°C
78%
ClCH2SO3-p-Tol
t-BuOK, ТГФ, ДМФА
0°C
CH2SO3-p-Tol
71%
(NH4)2S2O5
MeOH
Δ

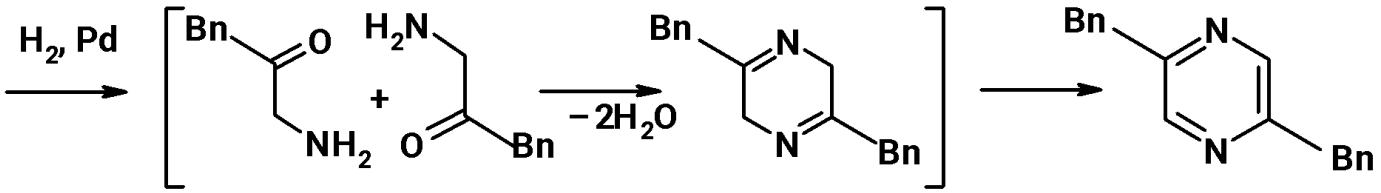
Пиразины

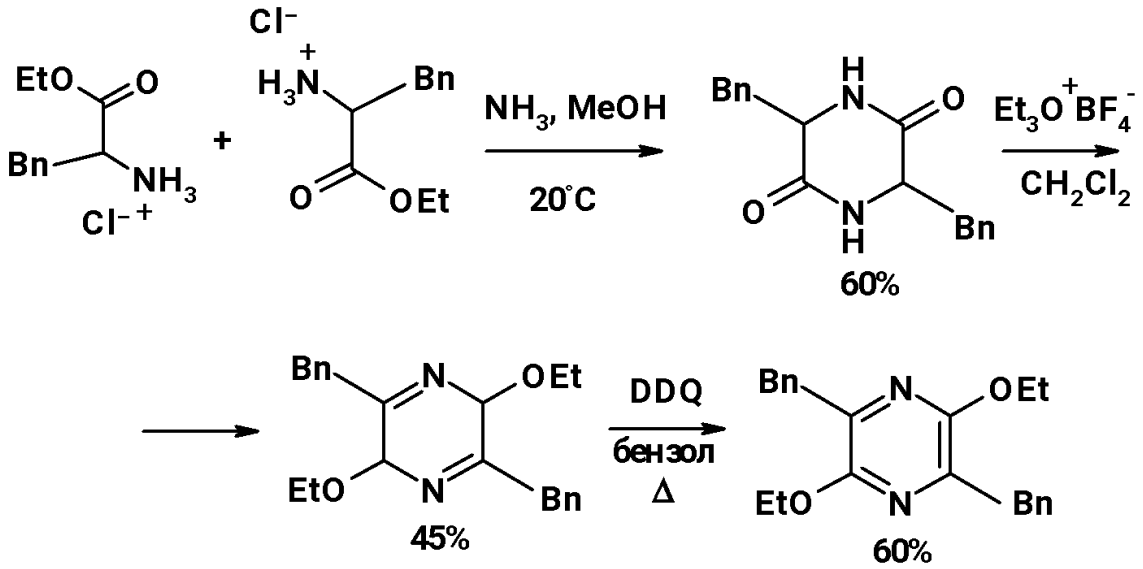


Методы синтеза

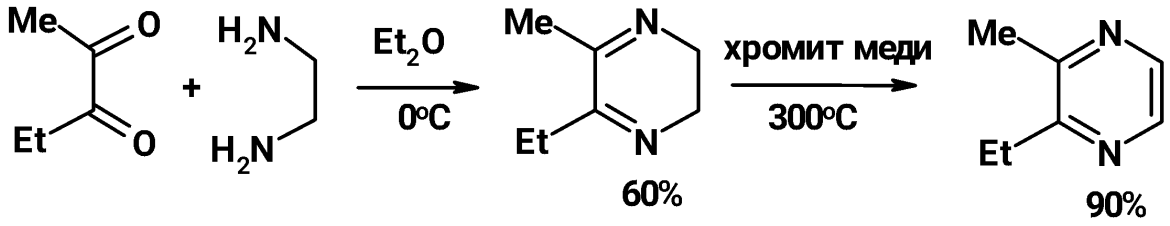
Самоконденсация 2-аминокетонов

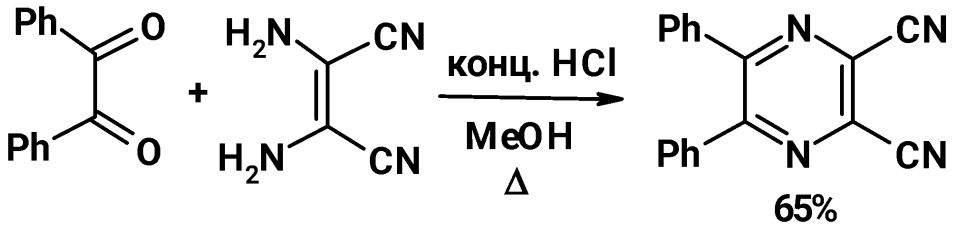




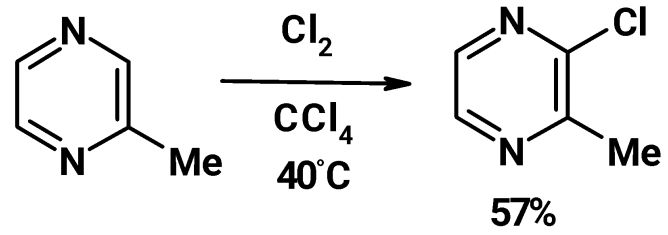


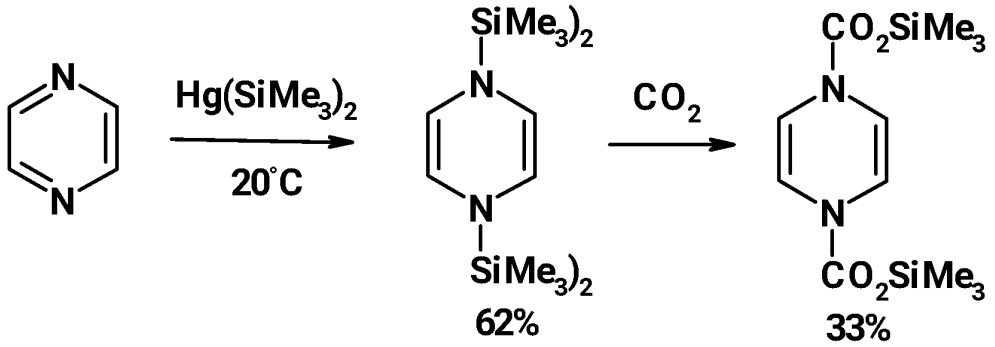
Из 1,2-дикарбонильных соединений и 1,2-диаминов



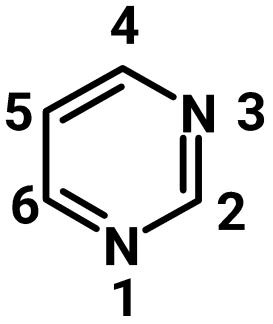


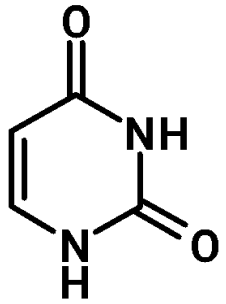
Химические свойства пиразинов



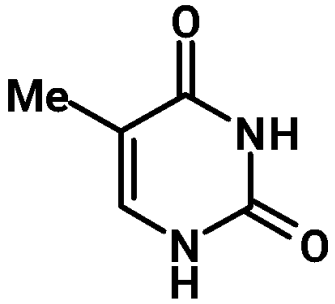


Пиримидины

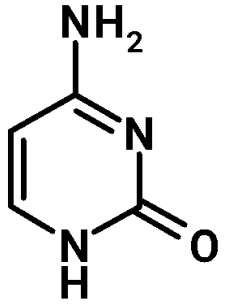




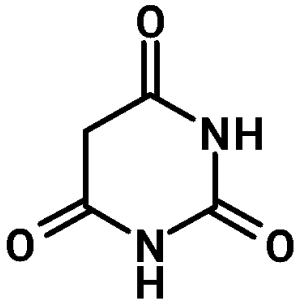
урацил



тимин

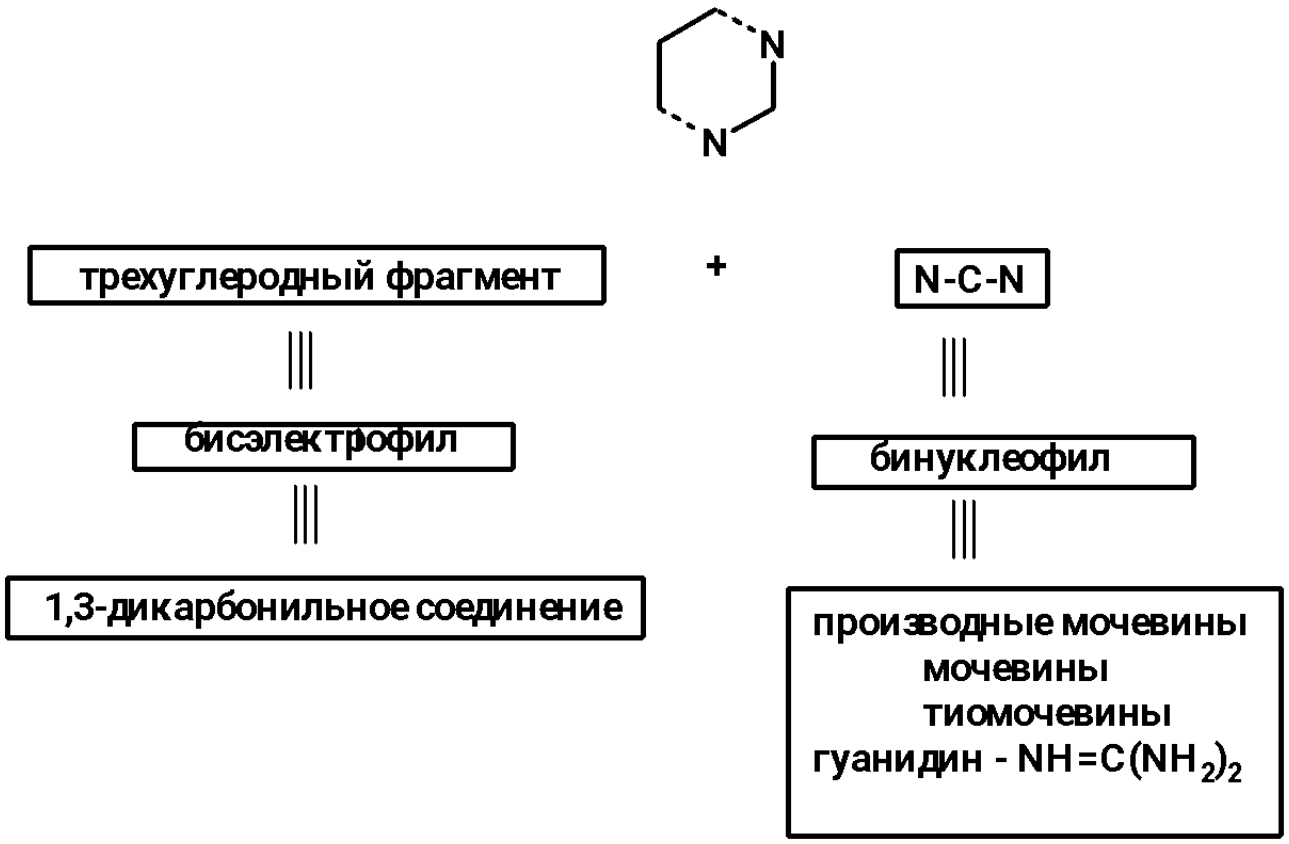


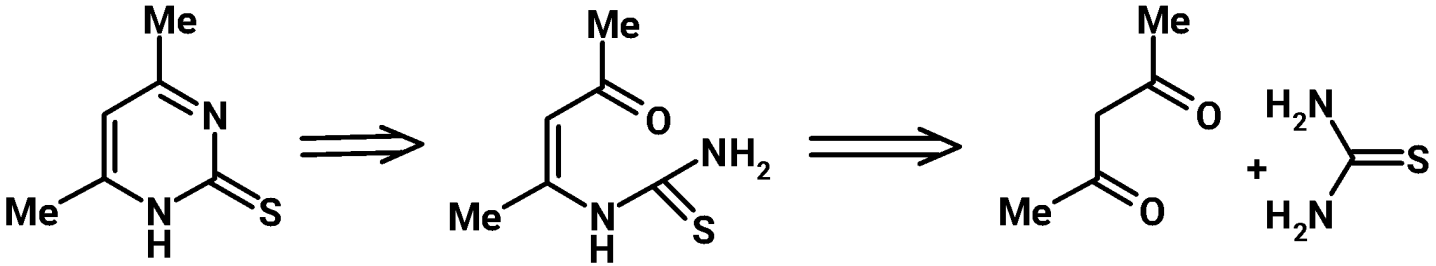
цитозин



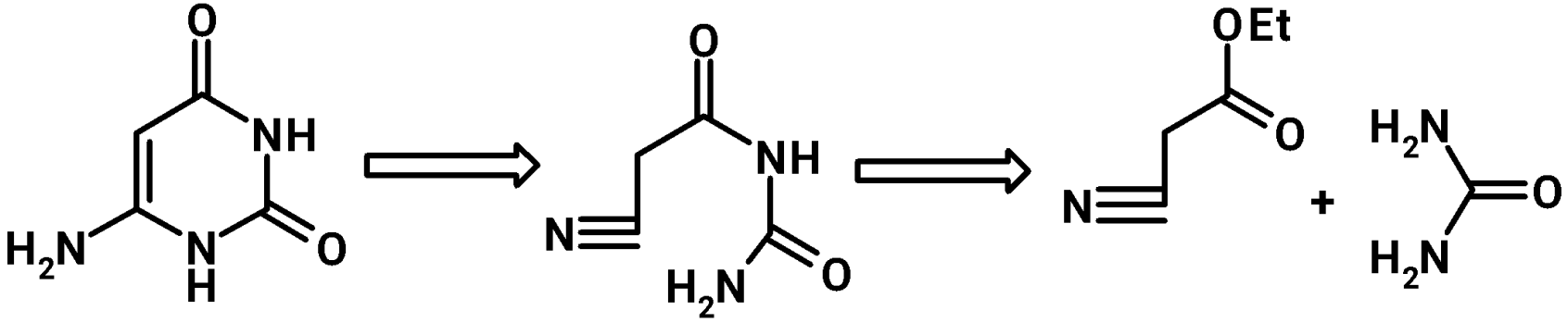
барбитуровая кислота

Методы синтеза пиримидинов

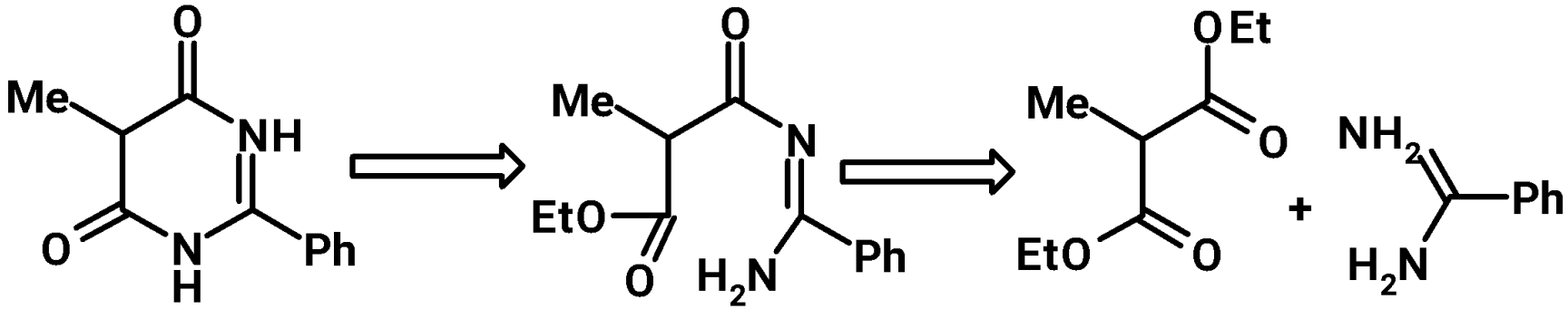




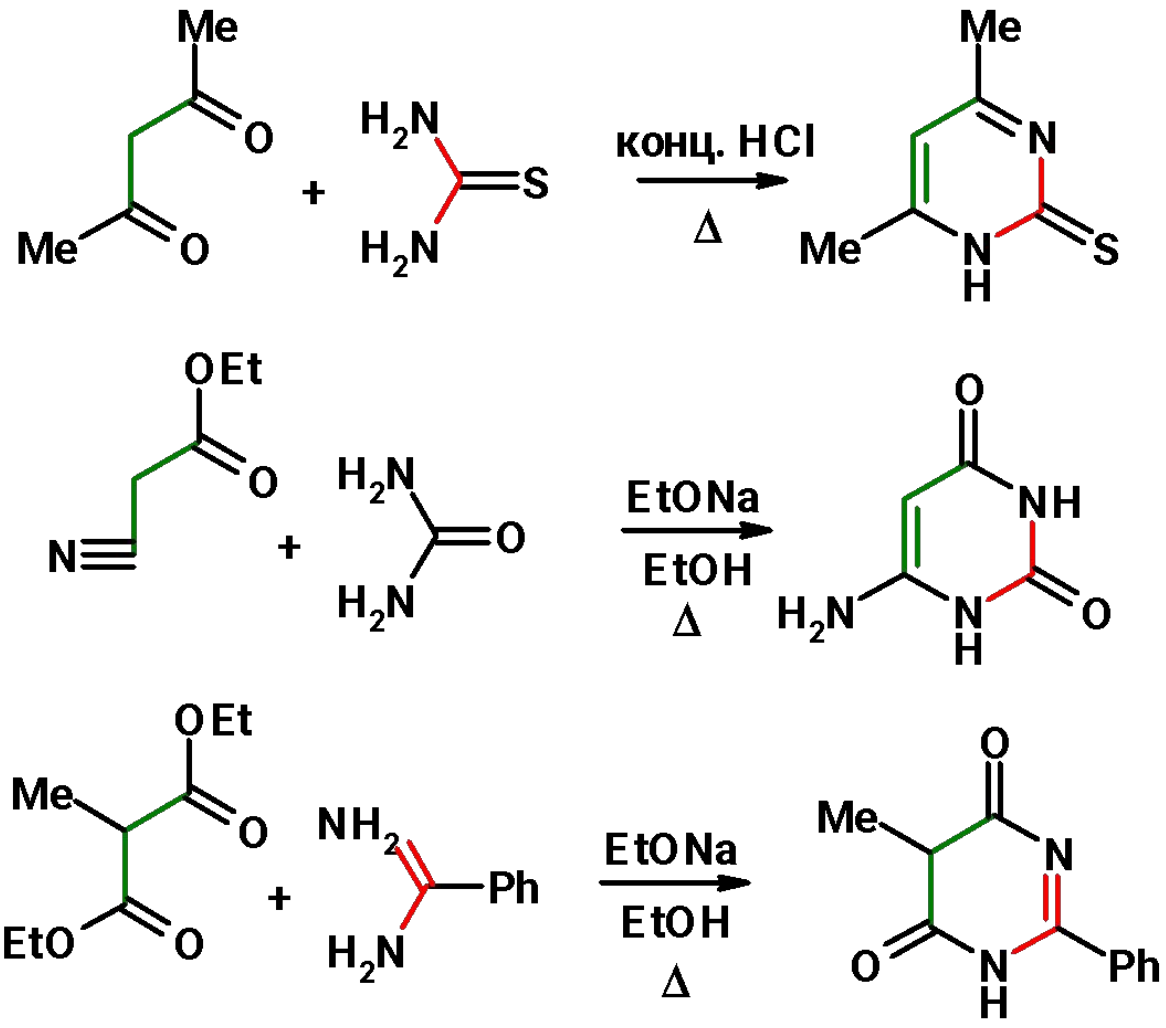
4,6-пиримидин-2-тион

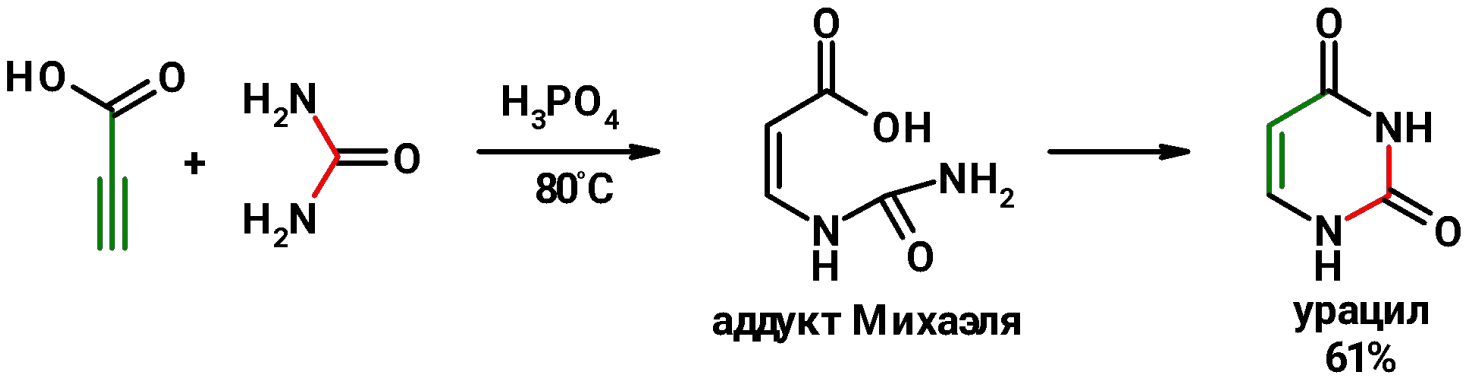


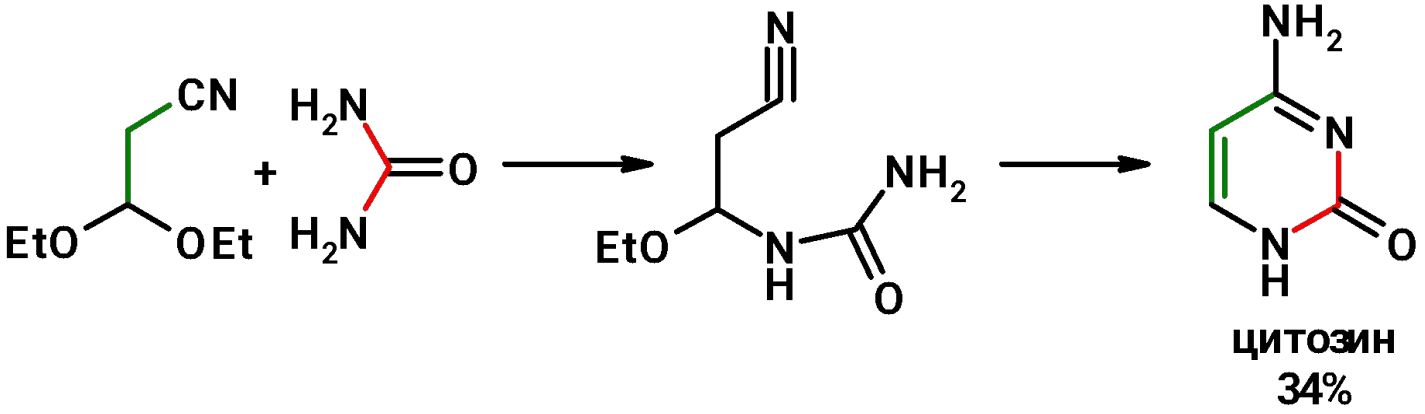
6-аминоурацил

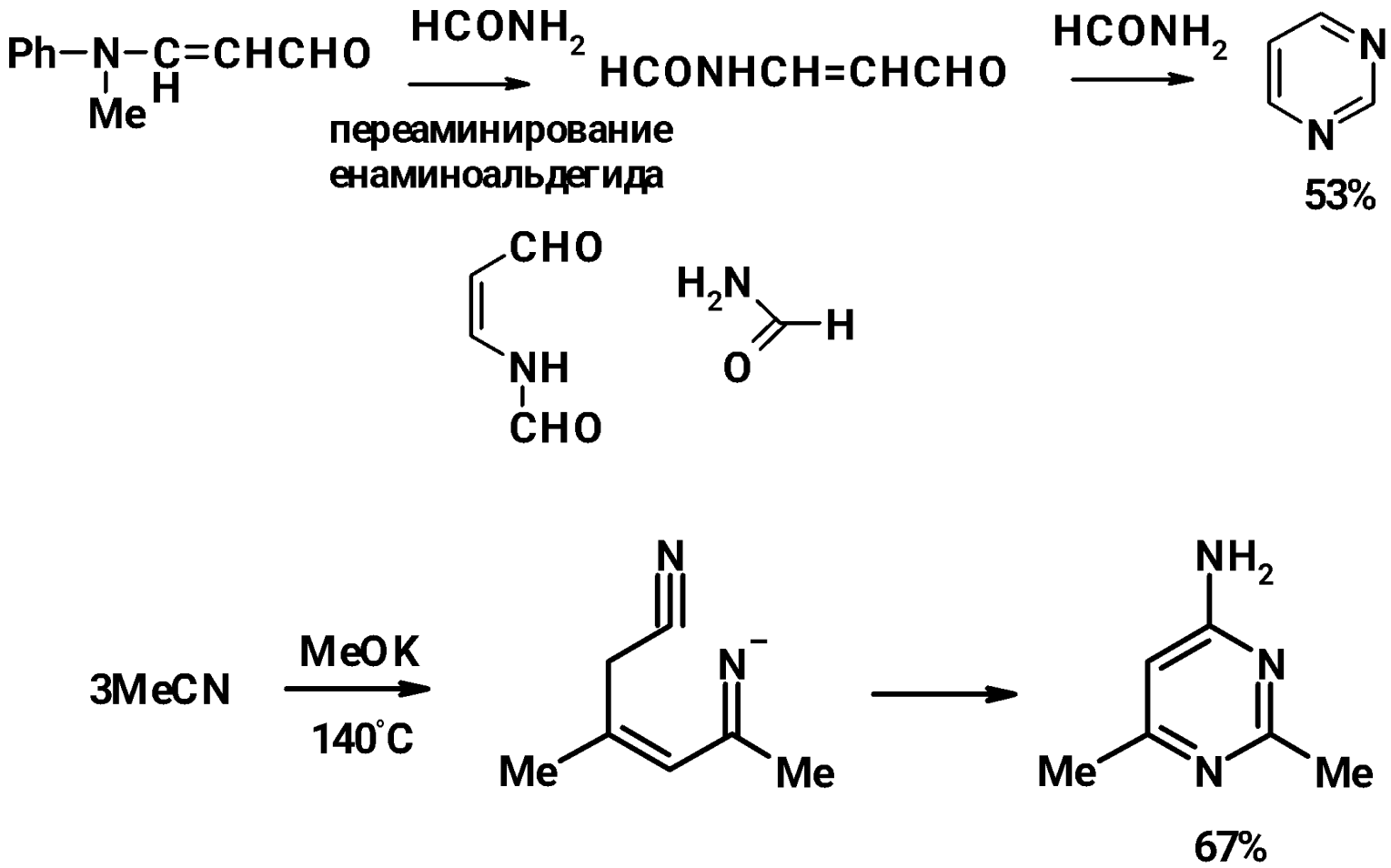


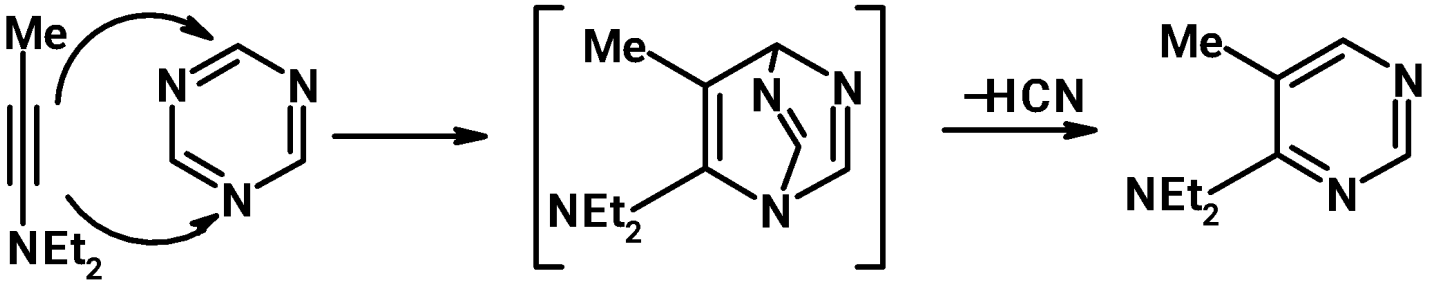
5-метил-2-фенилпиримидин-4,6-дион


Me
O
Me
O
+
H2N
S
H2N
конц. HCl
Δ
Me
N
Me
N
H
S
OEt
O
N
+
H2N
O
H2N
EtONa
EtOH
Δ
O
NH
H2N
N
H
O
OEt
Me
O
EtO
O
+
NH2
Ph
H2N
EtONa
EtOH
Δ
O
Me
N
O
N
H
Ph

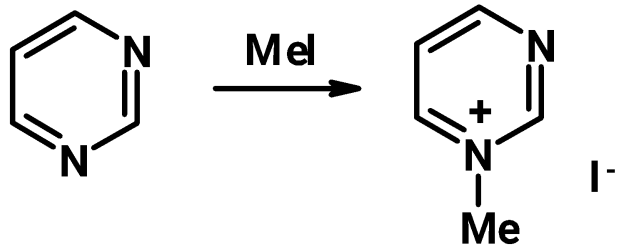

HO
O
+
H2N
O
H2N
H3PO4
80°C
O
OH
NH2
N
H
O
аддукт Михаэля
O
NH
N
H
O
урацил
61%

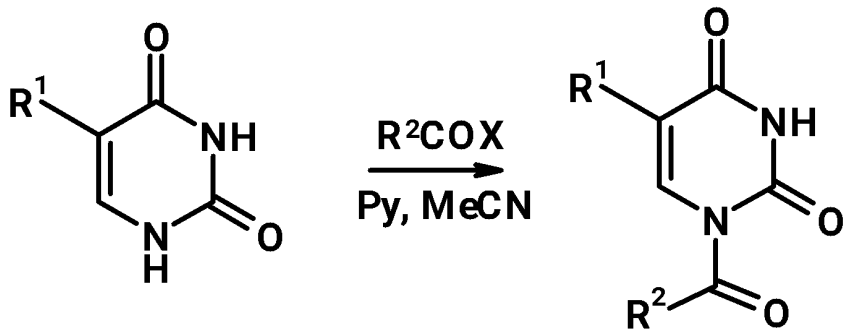

CN
EtO
OEt
+
H2N
O
H2N
N
NH2
EtO
N
H
O
NH2
N
N
H
O
цитозин
34%


Ph–N(Me)–C(H)=CHCHO
HCONH2
HCONHCH=CHCHO
переаминирование
енаминоальдегида
HCONH2
N
N
53%
CHO
NH
CHO
H2N
H
O
3MeCN
MeOK
140°C
N
N−
Me
Me
NH2
N
Me
N
Me
67%



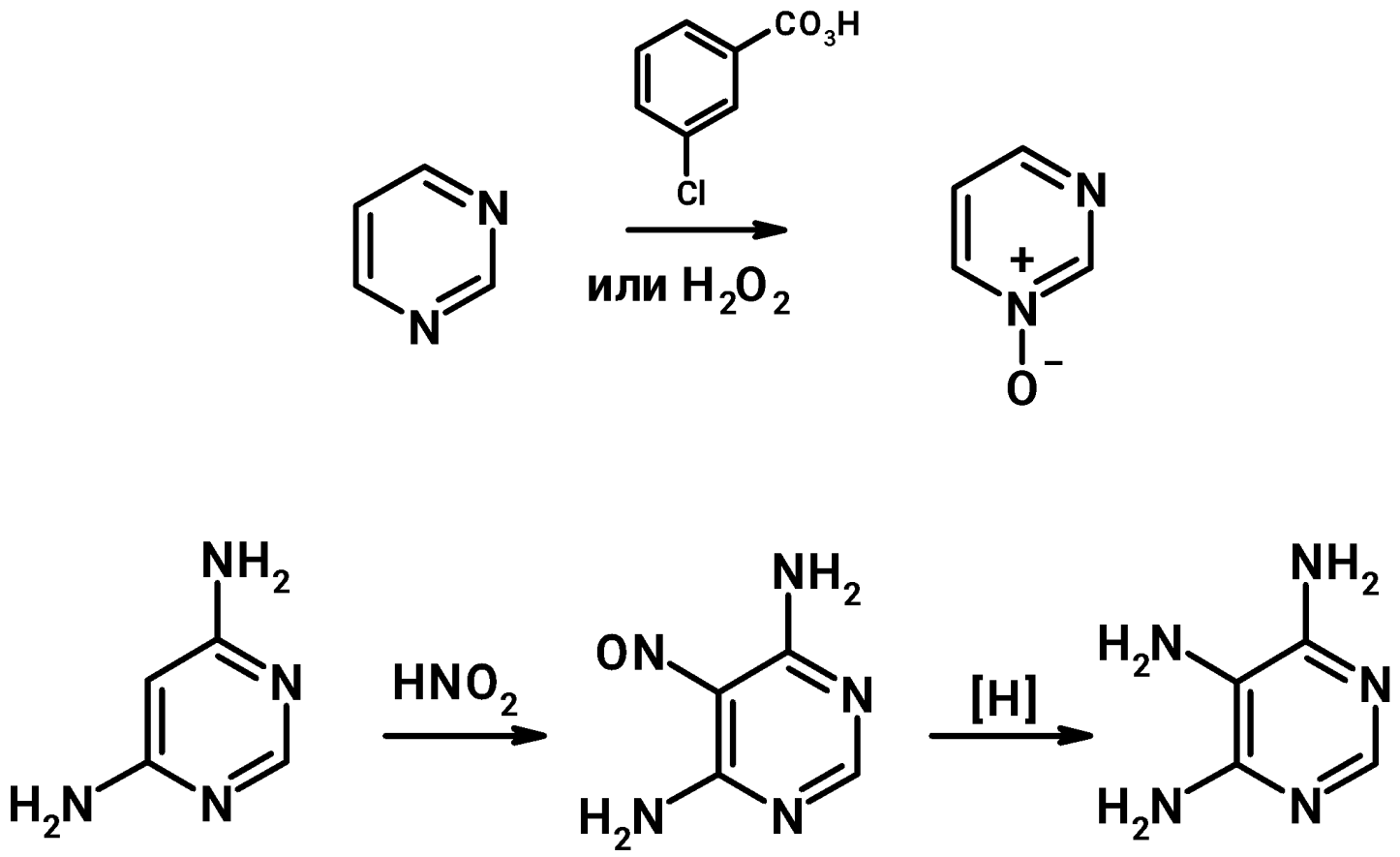
Химические свойства производных пиримидина





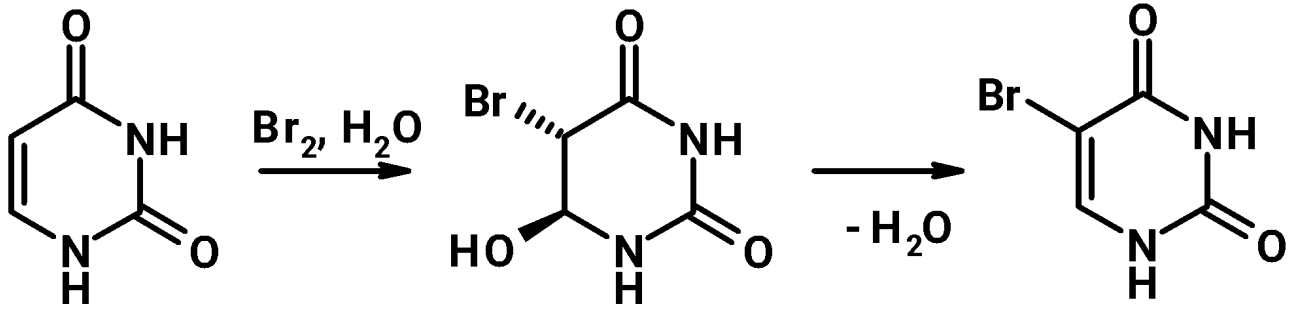
R^1 = H - урацил

R^1 = Me - тимин

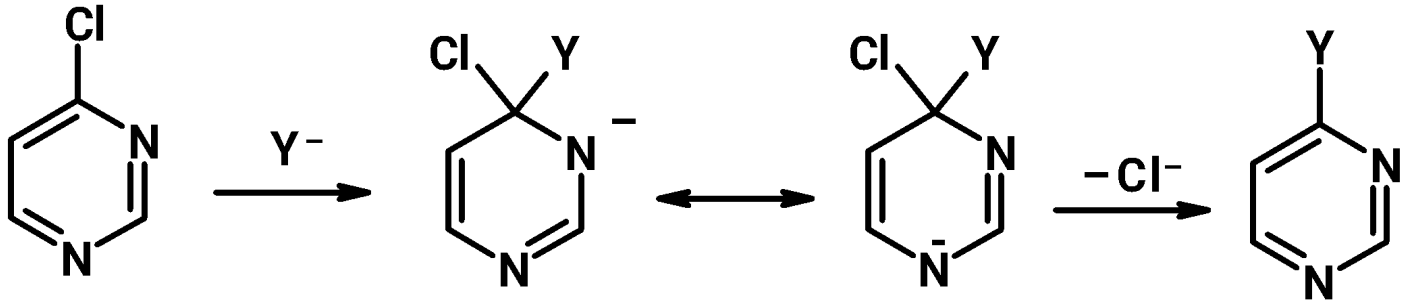

CO3H
Cl
или H2O2
NH2
N
H2N
HNO2
ON
[H]

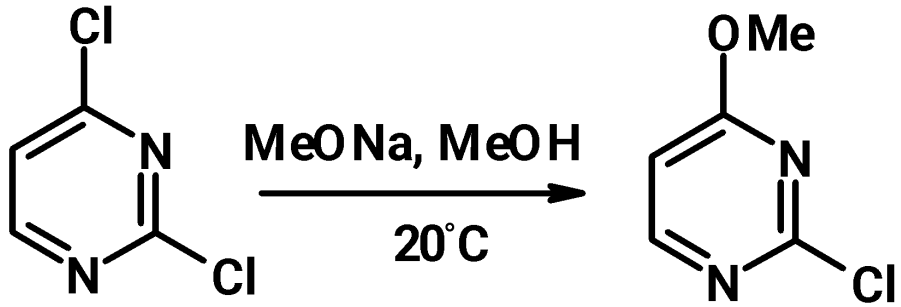
Электрофильное замещение в молекуле урацила

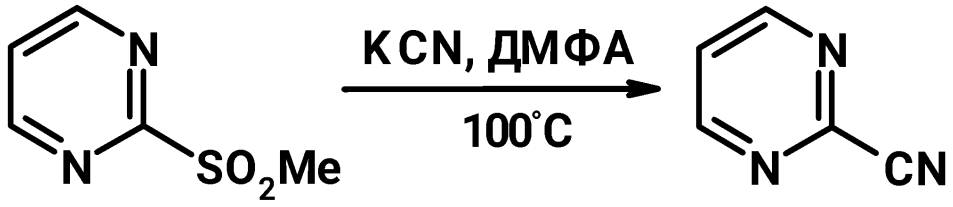
Электрофил	Условия реакции	Выход, 5
NO_2^+	HNO_3 (*d*=1.5), 75°C	90
Br^+	Br_2, H_2O, 100°C	90
Cl^+	N-хлорсукцинимид, AcOH, 50°C	52
F^+	F_2, AcOH, 10°C	92
$CH_2=N^+Me_2$	$(CH_2O)n$, Me_2N, 78°C	76
$^+CH_2Cl$	$(CH_2O)n$, HCl, 80°C	57



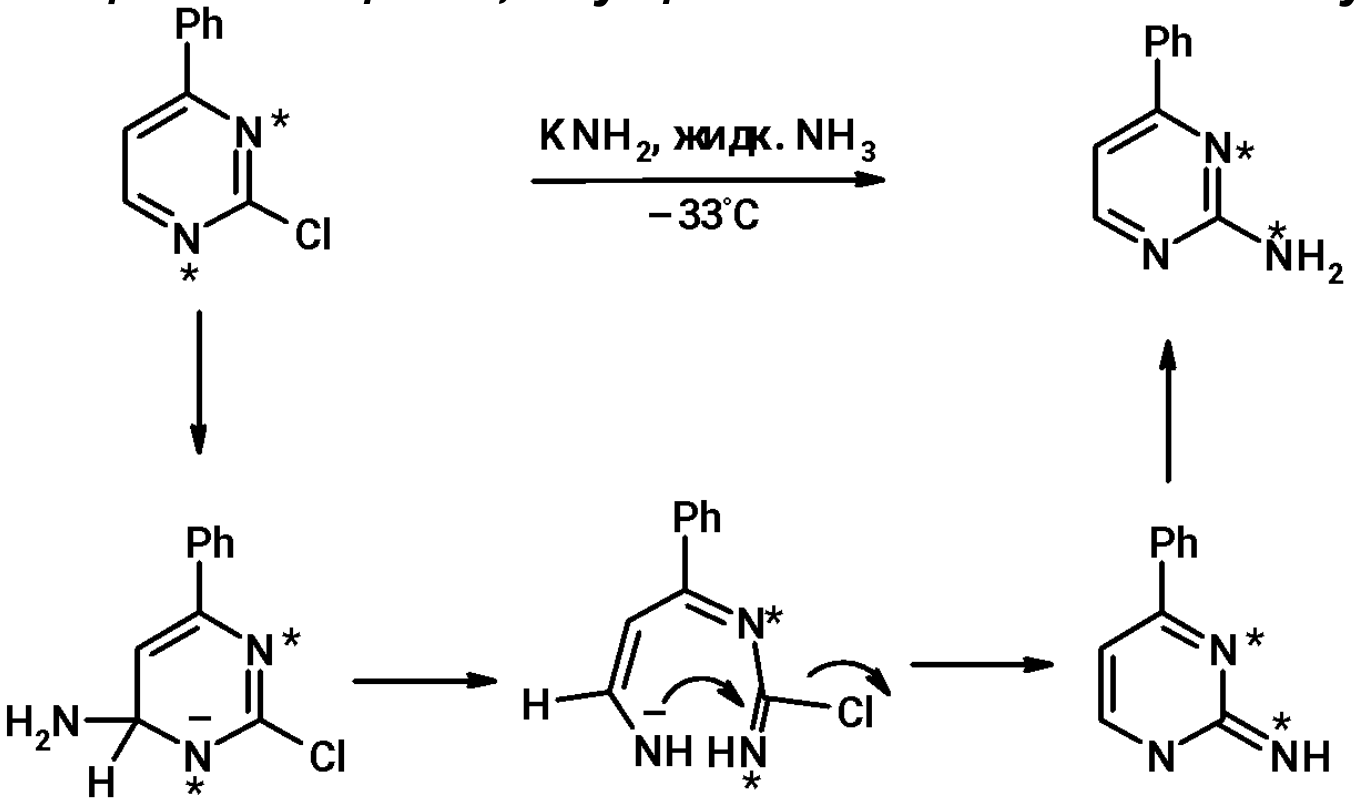
Нуклеофильное замещение



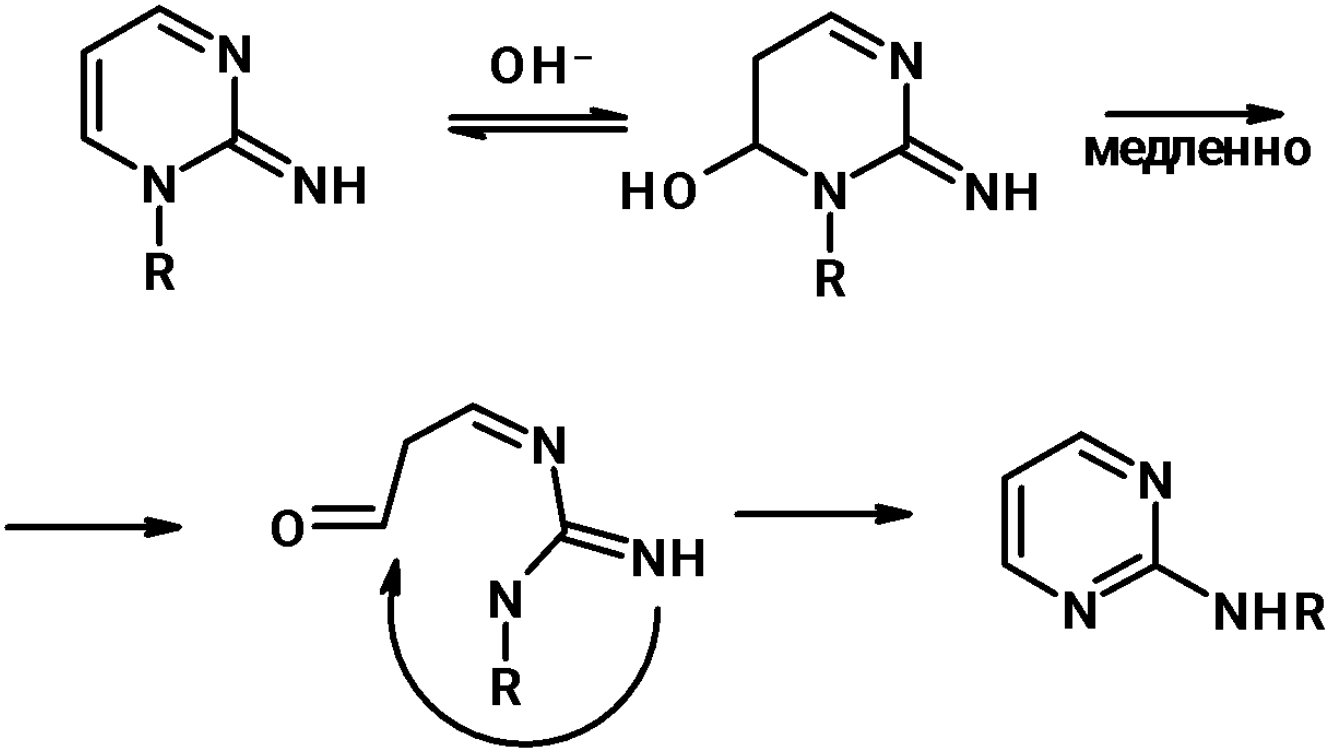




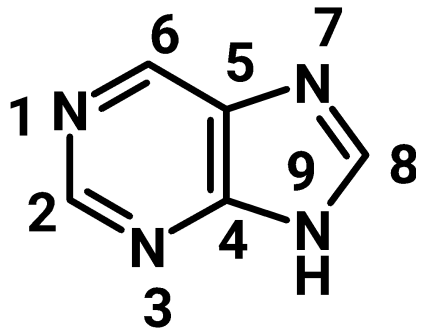
Реакции замещения, идущие по ANRORC-механизму



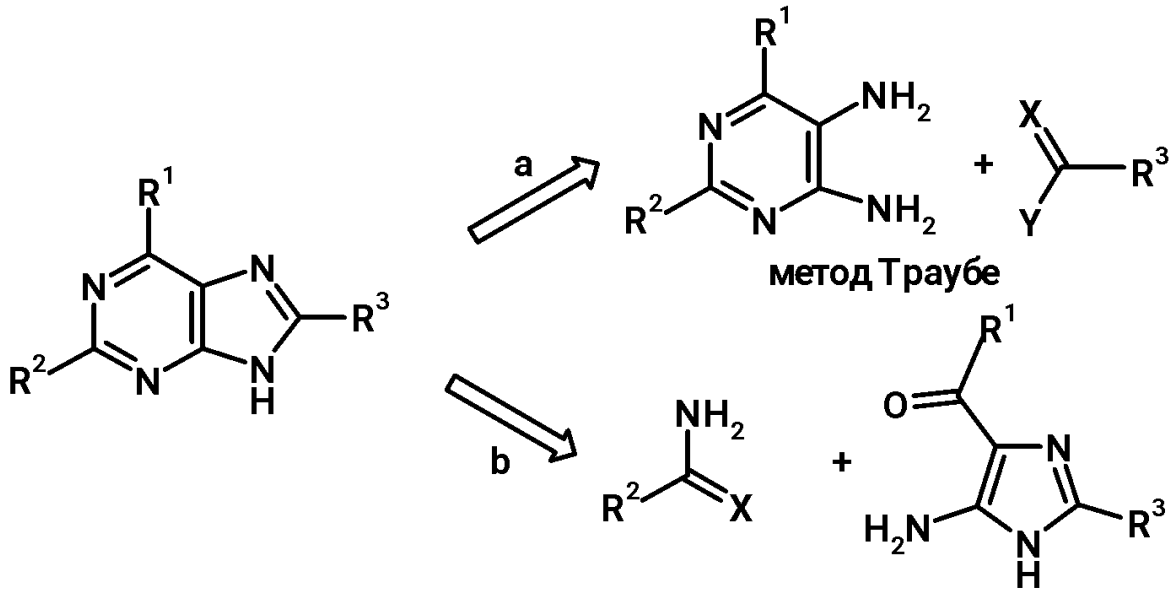
Перегруппировка Димрота



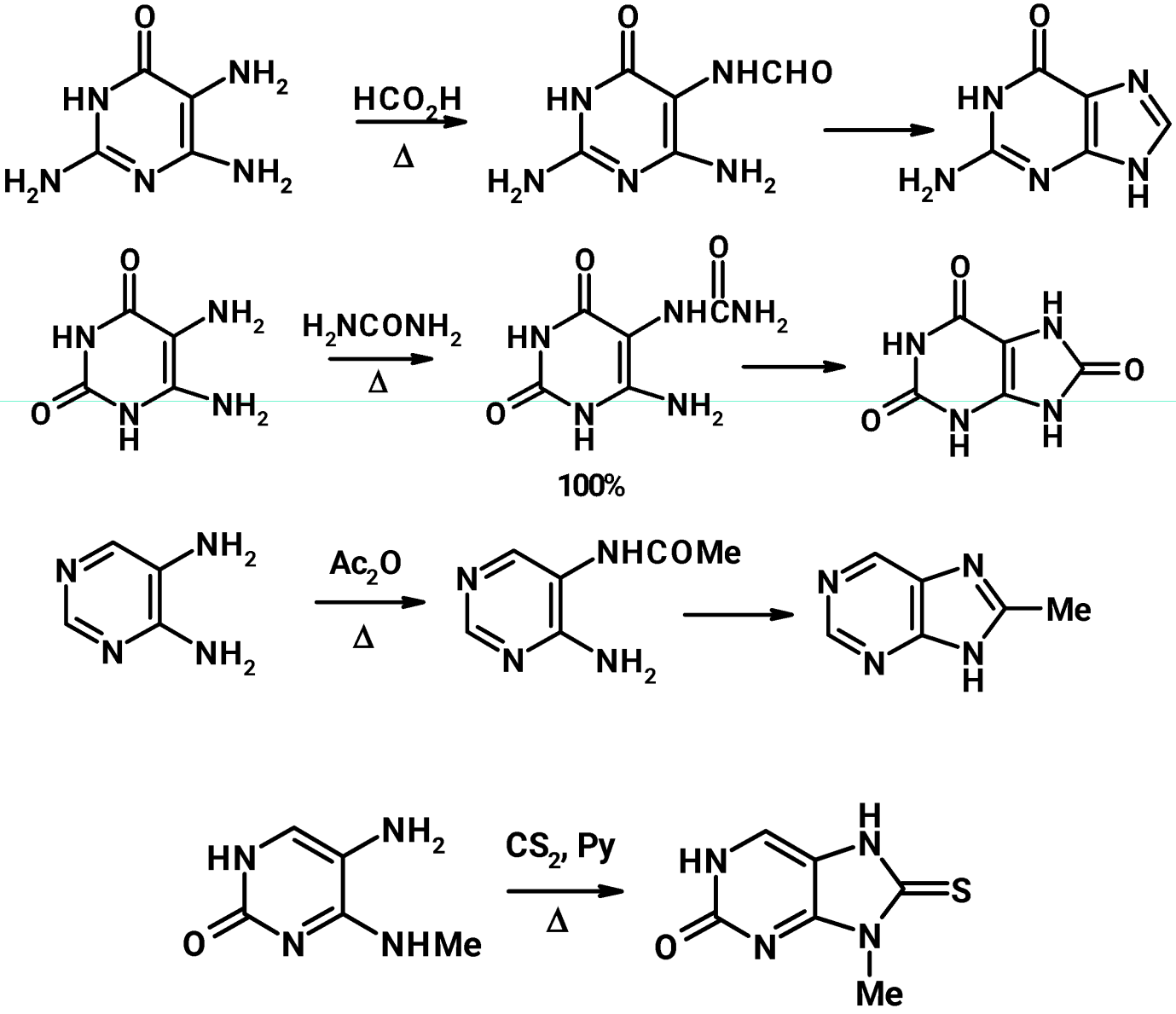
Пурины

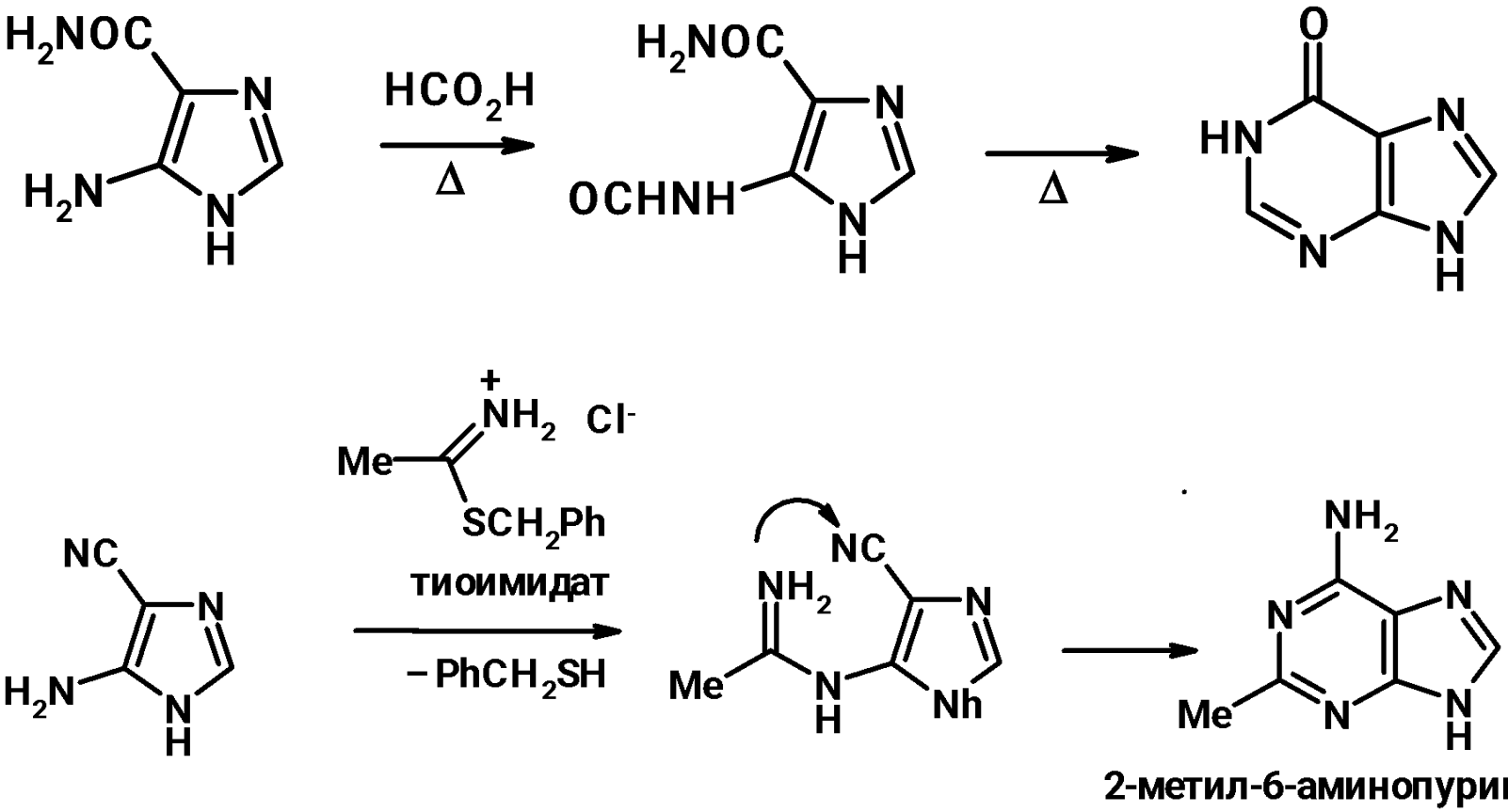


Методы получения пуринов

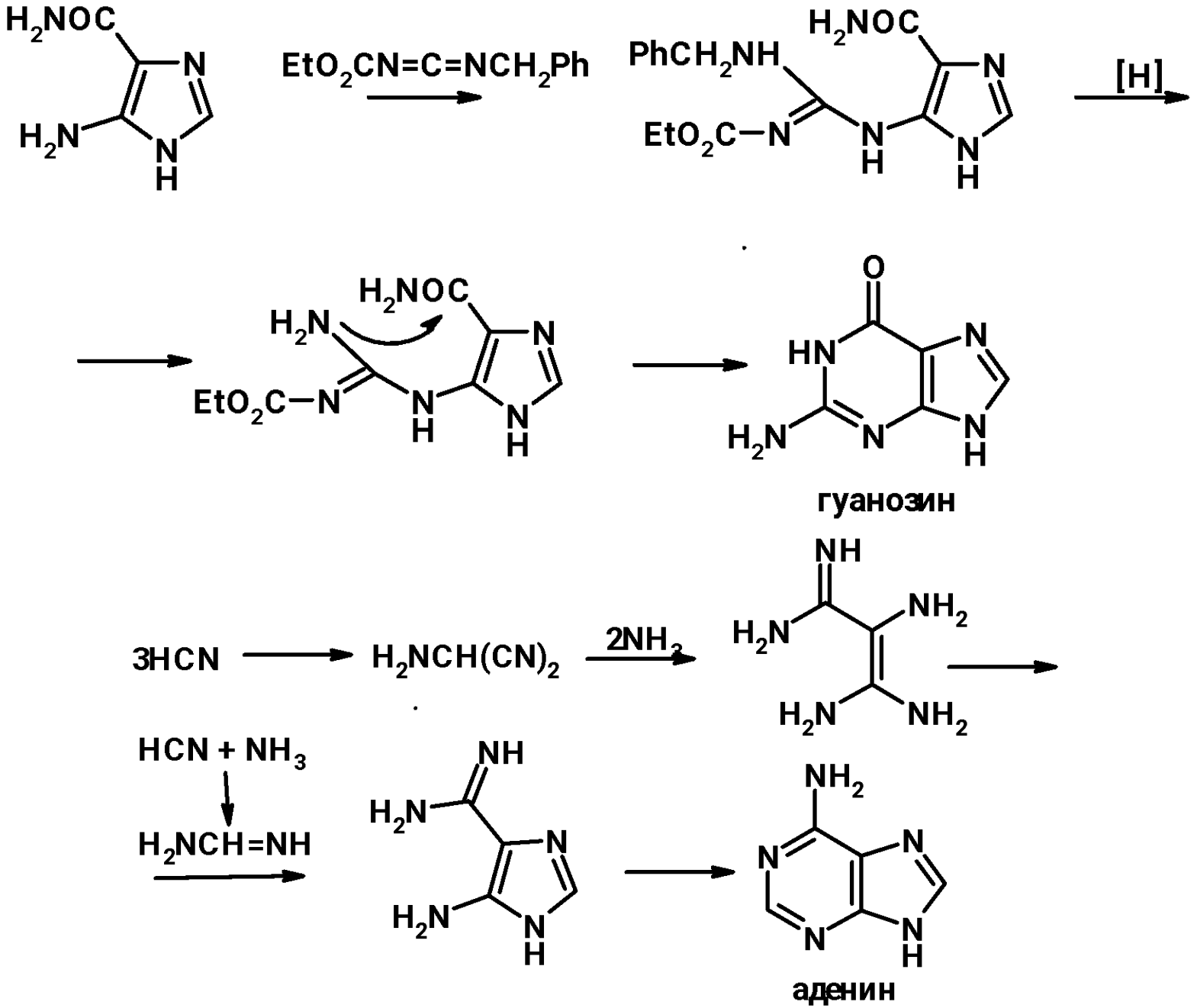


Синтез Траубе

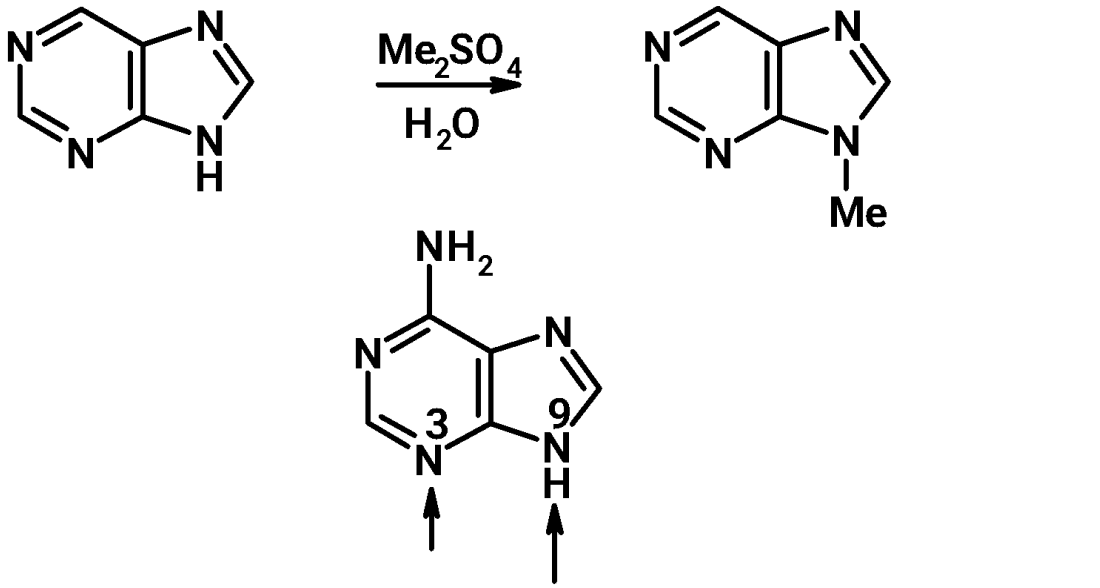


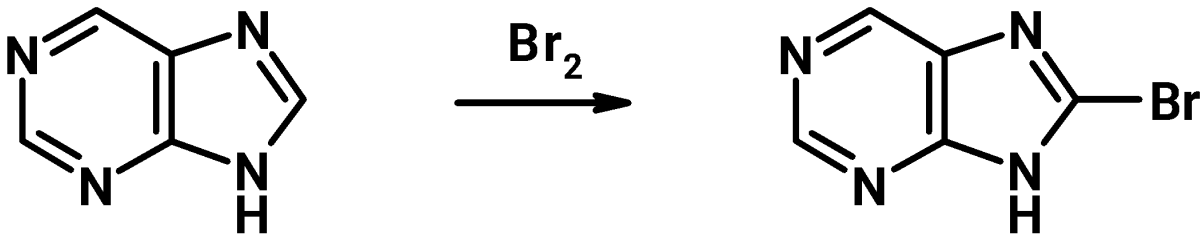


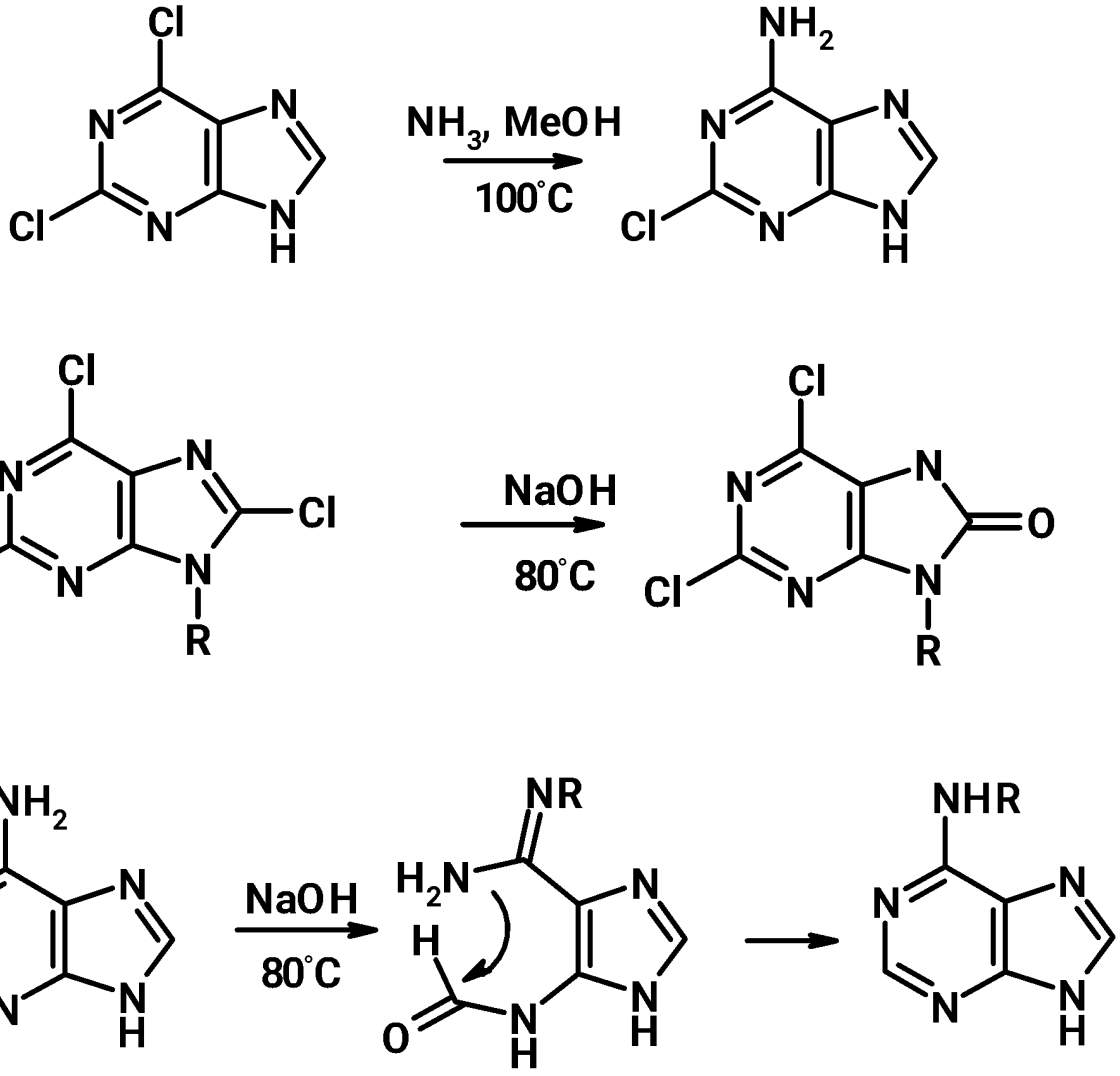
2-метил-6-аминопурин


EtO2CN=C=NCH2Ph
[H]
гуанозин
3HCN
H2NCH(CN)2
2NH3
HCN + NH3
H2NCH=NH
аденин

Химические свойства пуринов






Cl
N
N
Cl
N
N
H
NH3, MeOH
100°C
NH2
N
N
Cl
N
N
H
Cl
N
N
Cl
Cl
N
N
R
NaOH
80°C
Cl
N
N
O
Cl
N
N
R
NH2
R
N+
N
N
N
H
NaOH
80°C
NR
H2N
H
O
N
N
H
NHR
N
N
N
N
H