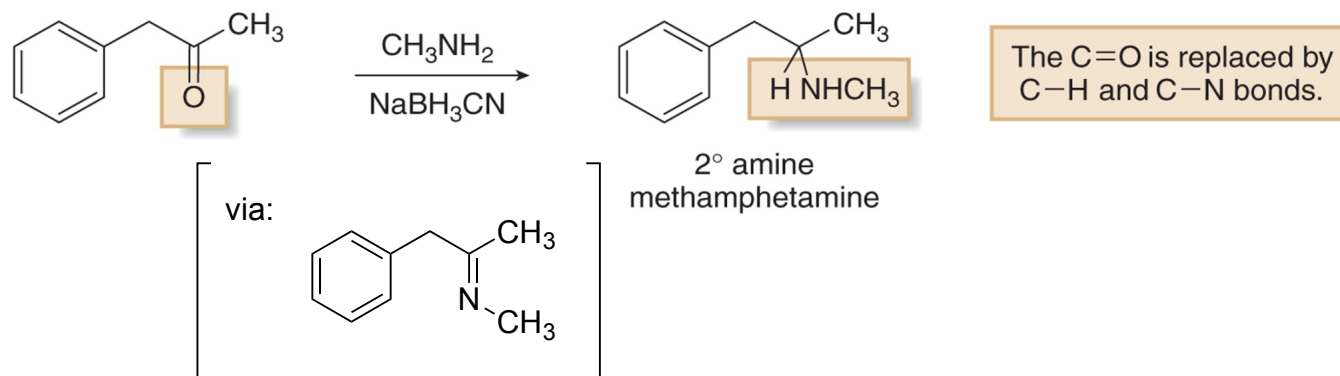
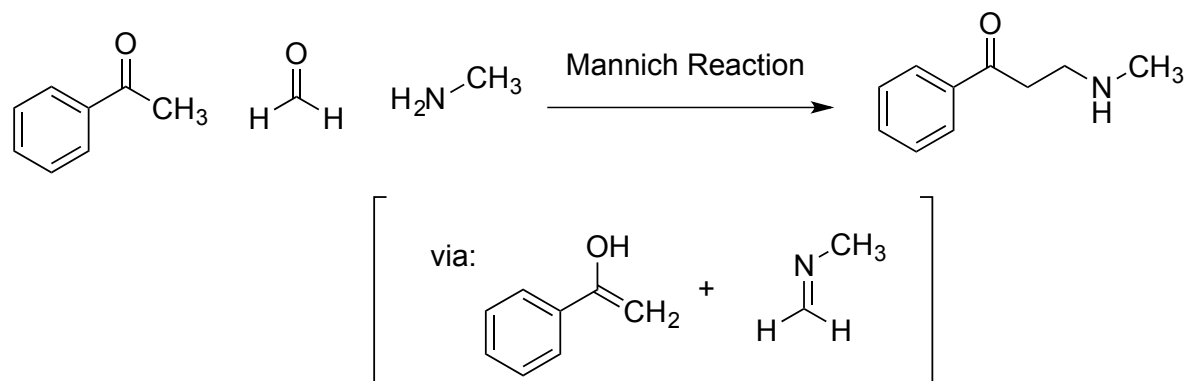


# Additions to imines

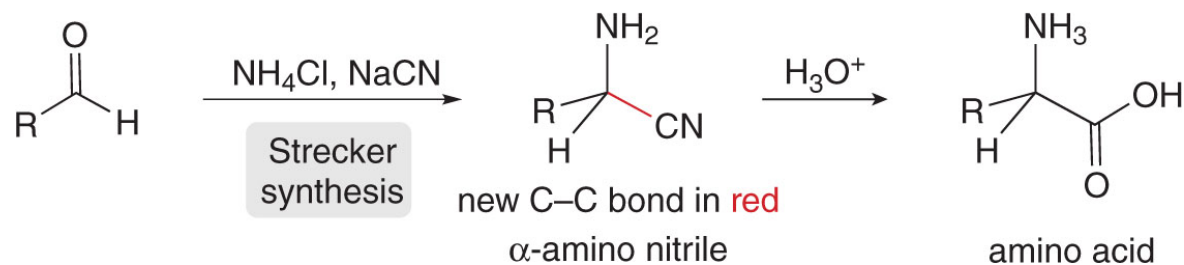
## Reductive amination



## Mannich reaction

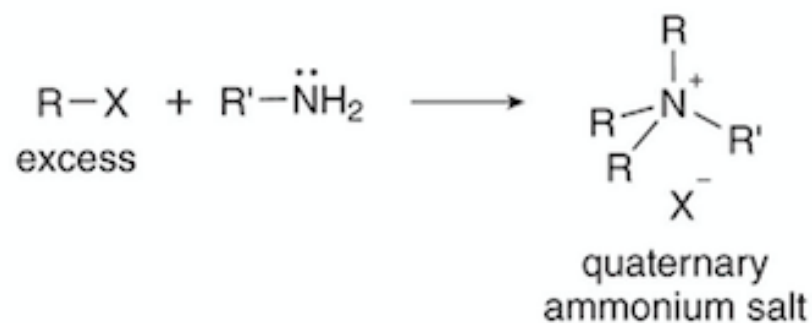
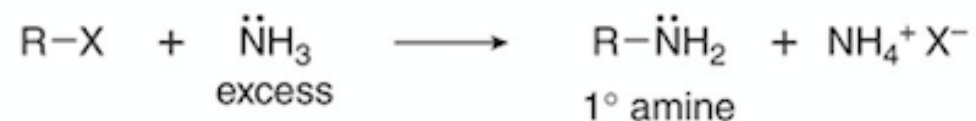


## Strecker reaction

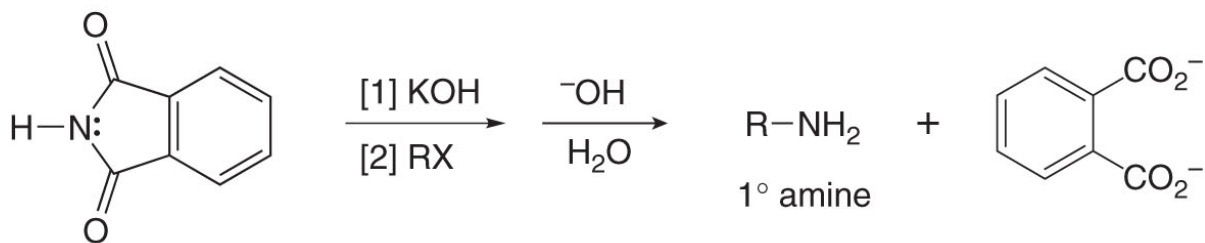


# Alkylation reactions

## Simple alkylation with alkyl halides

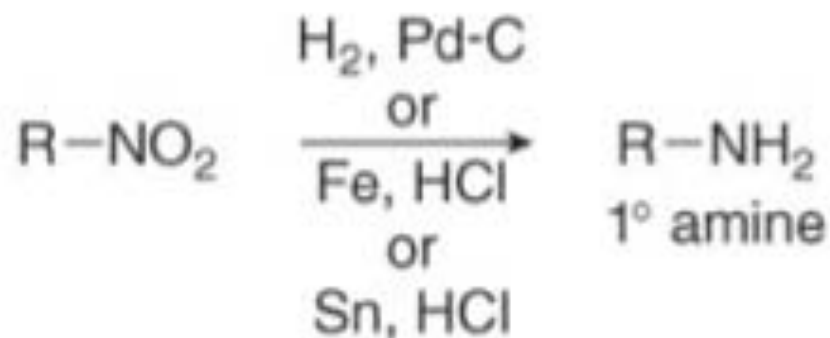


## Gabriel synthesis

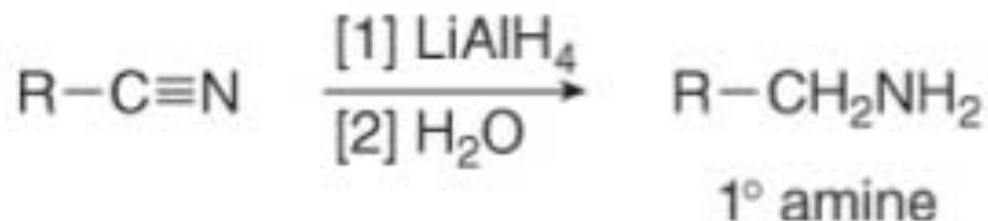


## Preparation of amines: By reduction

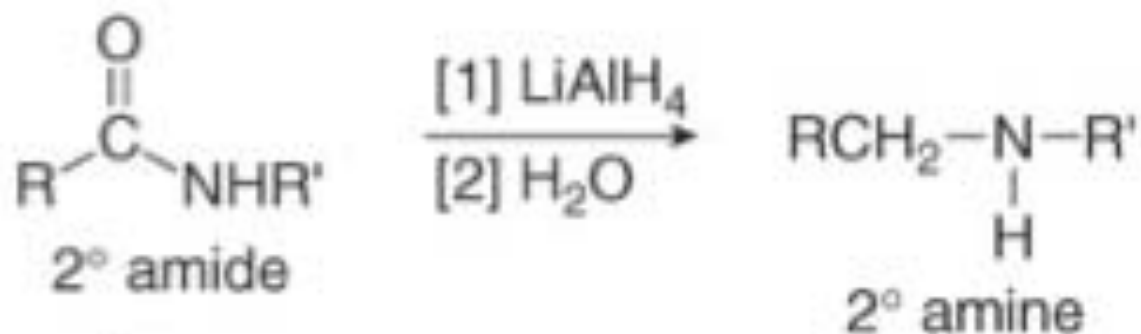
Nitro compounds



Nitriles

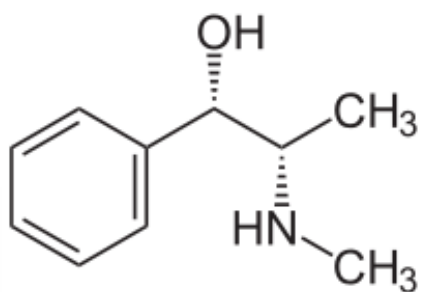


Amides



# Amines: Key components of bioactive compounds

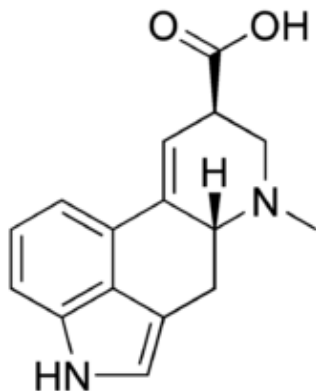
## Synthetic medicinal agents



pseudoephedrin



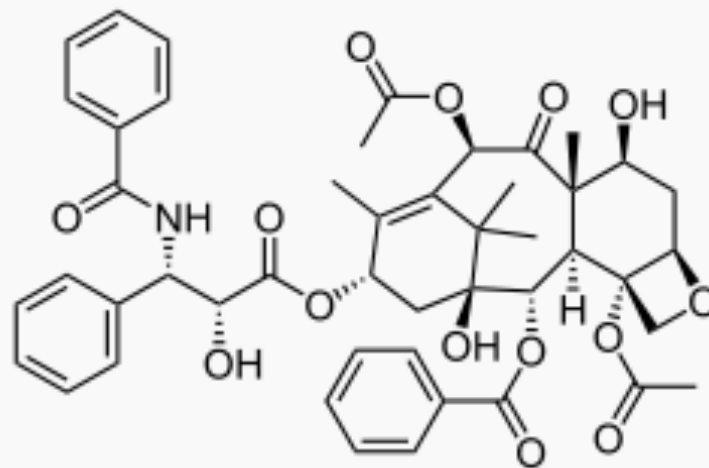
## Infamous natural products



Lysergic acid



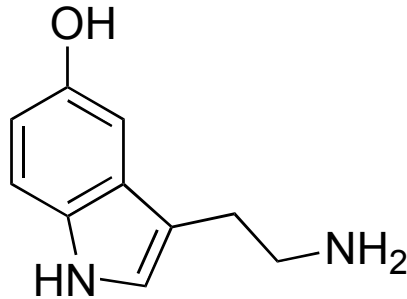
## Beneficial natural products



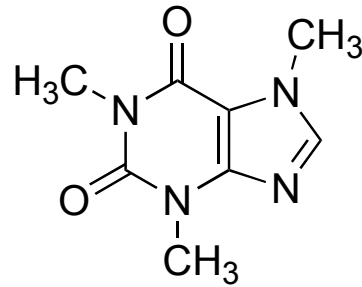
Taxol®  
From Yew tree



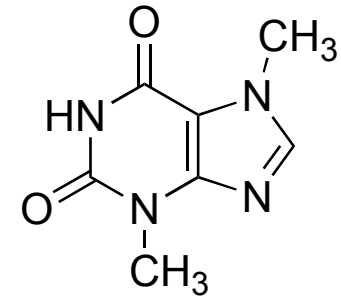
# Alkaloids: Nitrogen-containing Natural Products



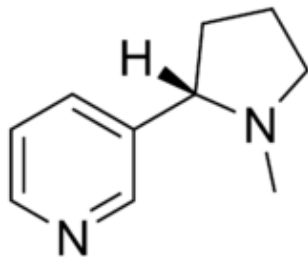
serotonin



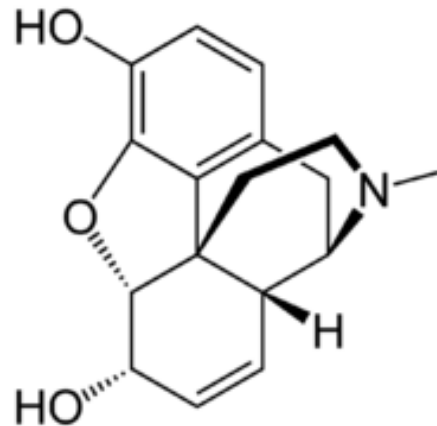
caffeine



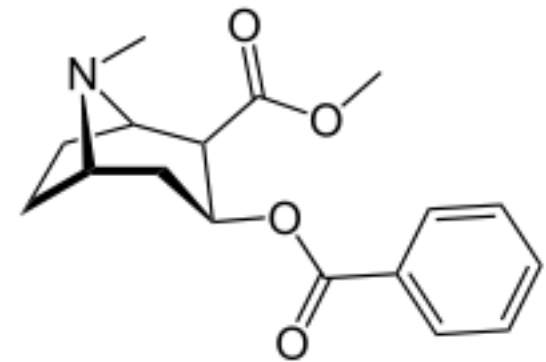
theobromine



nicotine



morphine



cocaine

Often target our receptors... and have a bitter taste

# Natural Product: Quinine

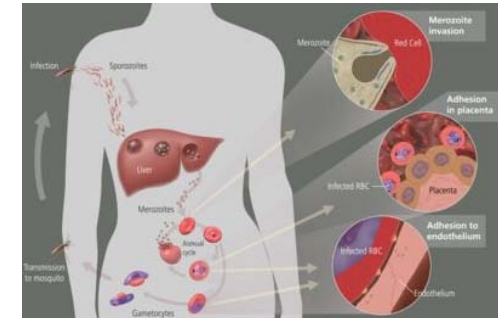
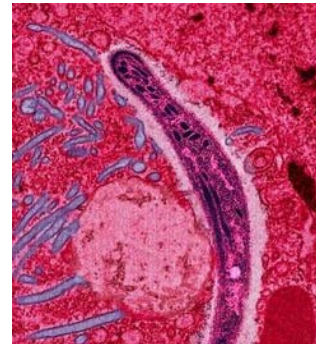
chemical defense systems

Isolated from cinchona tree  
(South America):



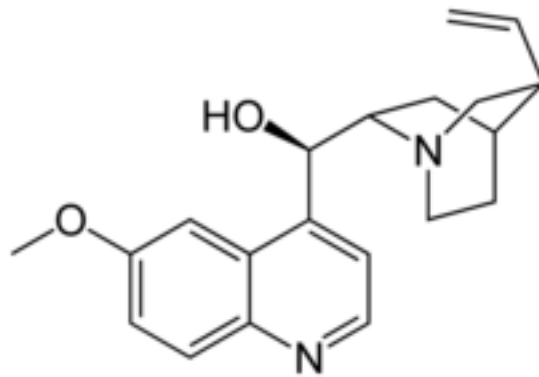
“Quina-Quina”  
Muscle relaxant used by  
Quechuas

1st used to treat malaria  
In Rome, 1631:

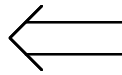


# Quinine: the active ingredient

Isolated in early 1800' s

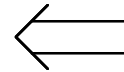
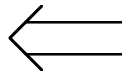


# Tonic Water: Contains Quinine





# Tonic Water: Contains Quinine



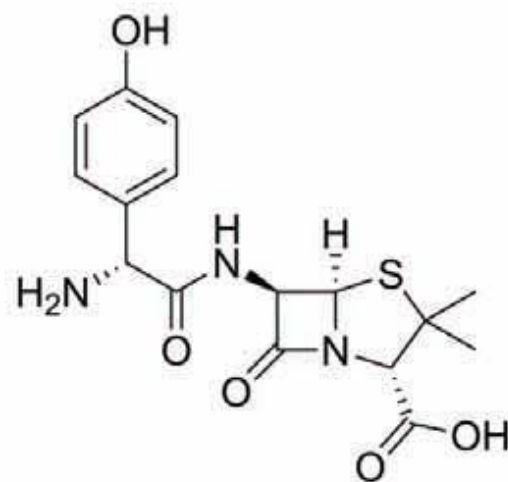
# Pharmaceutical agents containing amines

Amines provide great properties:  
bind enzymes and exhibit good pharmacokinetics

Most pharmaceutical agents contain N



ventolin



amoxicillin



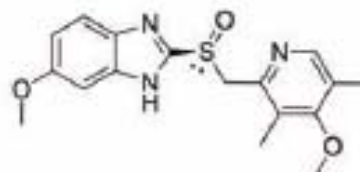
# Top 5 name-brand drugs 2012 (by US sales)

<http://cbc.arizona.edu/njardarson/group/top-pharmaceuticals-poster>

1

**NexIUM**

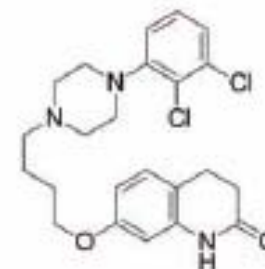
( Esomeprazole )



2

**Abilify**

( Aripiprazole )



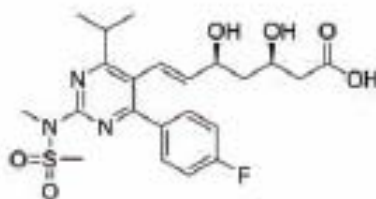
Otsuka

\$5,870 Million  
ANTIPSYCHOTICS

3

**Crestor**

( Rosuvastatin )

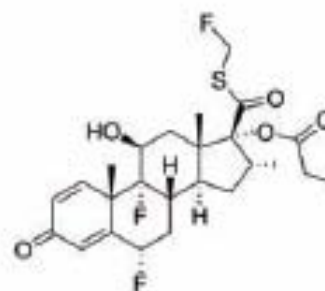


\$5,092 Million  
CHOLEST&TRIGLY.REGULATOR

4

**Advair Diskus**

( Fluticasone Propionate )



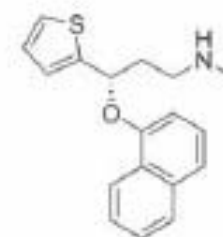
GlaxoSmithKline

\$4,889 Million  
CORTICOIDS

5

**Cymbalta**

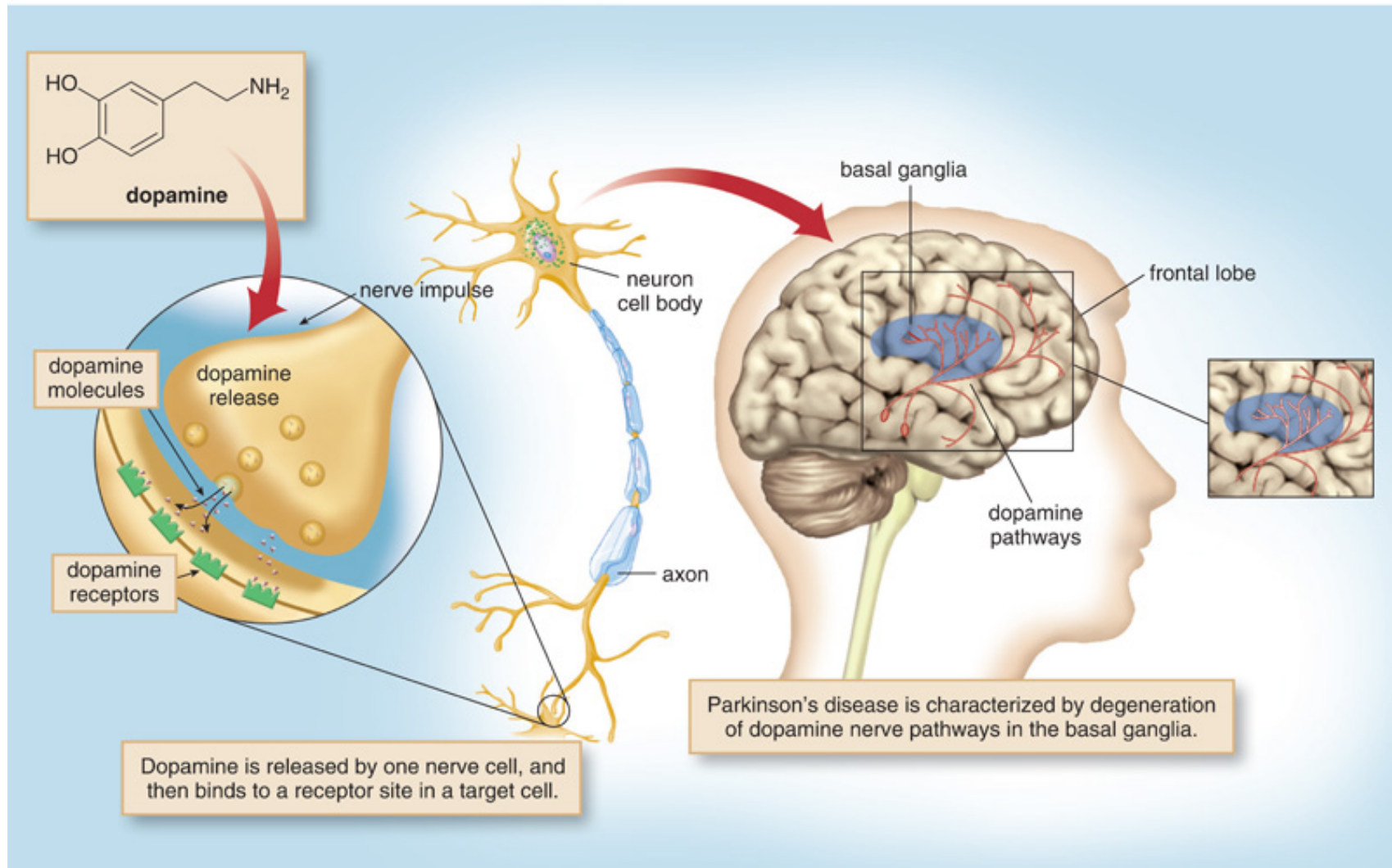
( Duloxetine )



\$4,720 Million  
ANTIDEPRESS.& MOOD STAB.

# Dopamine: for Parkinson's

**Figure 25.6** Dopamine—A neurotransmitter



**See the movie: Awakenings (starring Robin Williams and Robert DeNiro)**