

The Neuroscience of Drugs and Their Modifying Effects on the Human Body

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BioS 10

Bioscience in the 21st Century

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Outline

I. Overview of Drugs and Neuroscience

- I. Classification
- II. Facts and Figures
- III. The Brain
- IV. The Neuron at Rest
- V. The Neuron Active

II. Cocaine

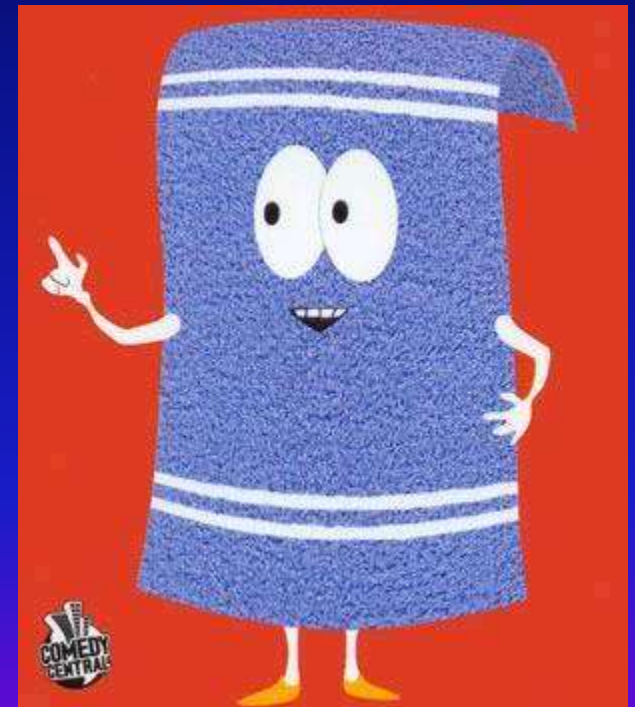
- I. How it works
- II. Side effects

III. Amphetamines

- I. How it works
- II. Side effects

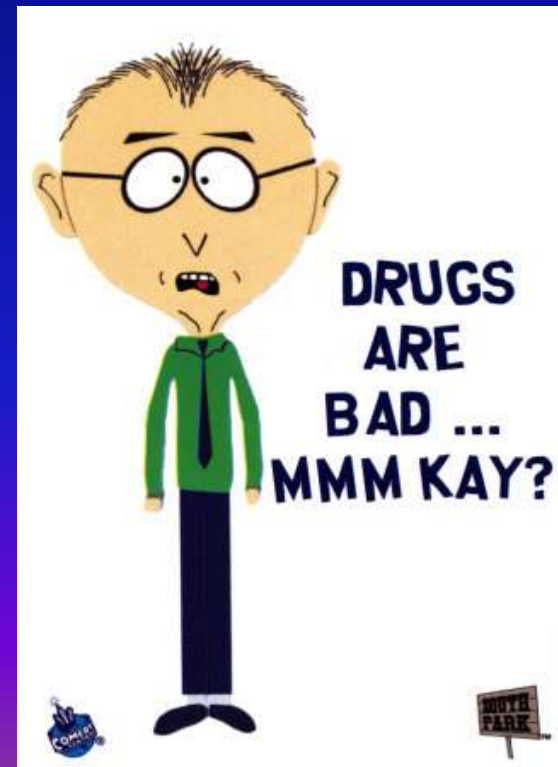
IV. Heroin and Opioids

- I. How It works
- II. Side effects
- III. In the News



What is a Drug?

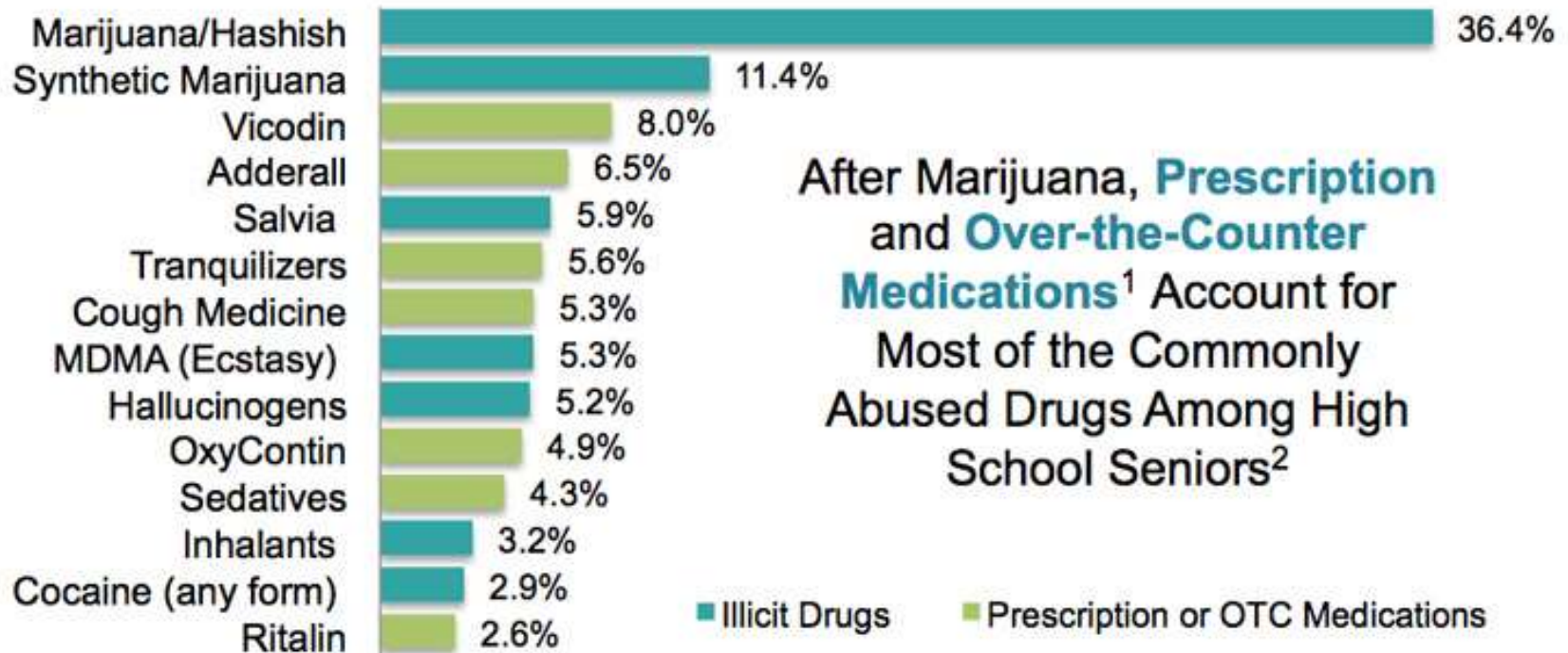
- **Drug** --- A chemical substance that, when taken into the body, alters the structure or functioning of the body in some way



Four Categories of Drug-Taking Behaviors, Derived From The Combination of Goal and Legal Status

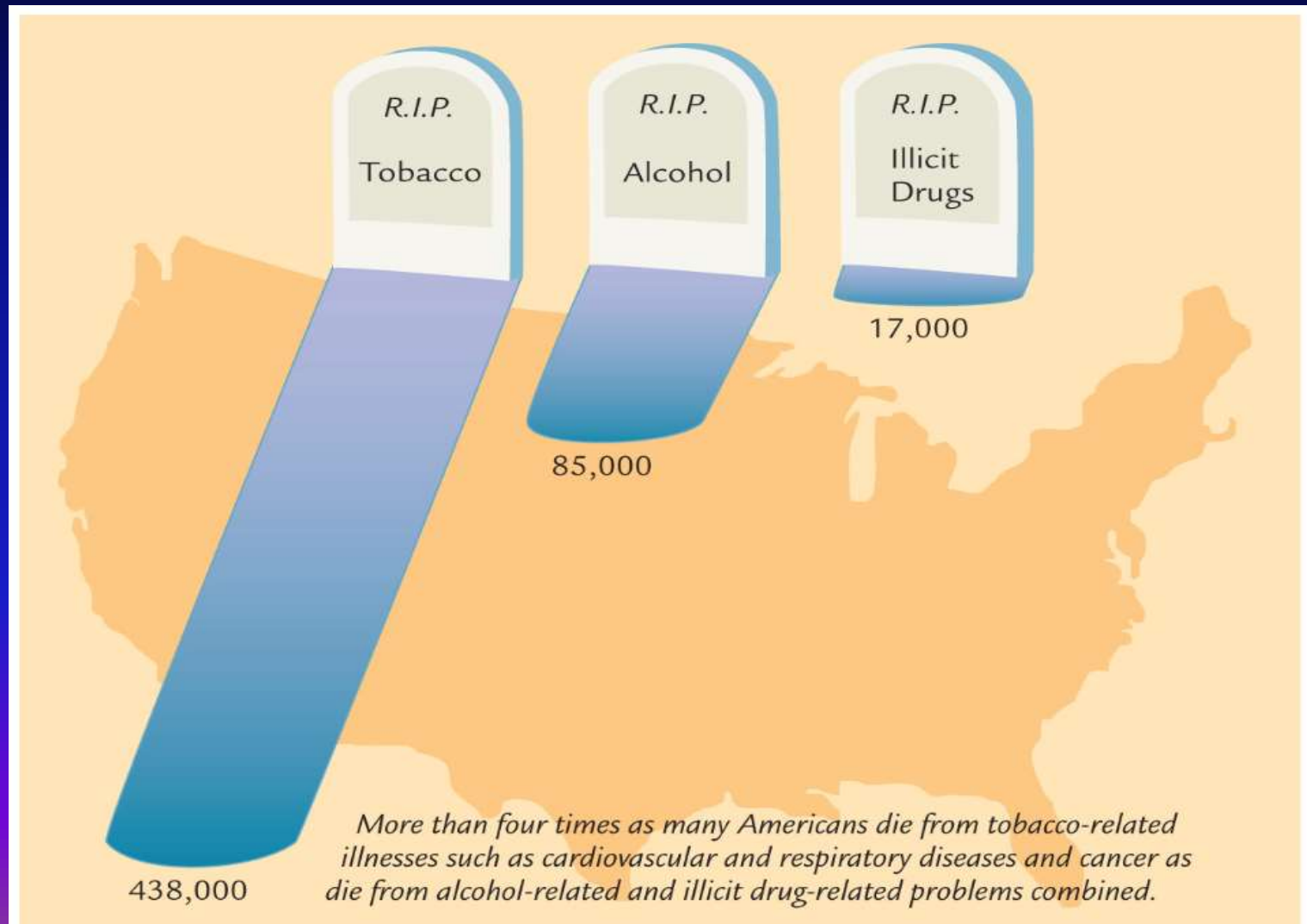
	Licit	Illicit
Instrumental Use	<p>Taking Valium with a prescription to relieve anxiety</p> <p>Taking No Doz to stay awake on a long trip</p>	<p>Taking amphetamines without a prescription to stay awake the night before a test</p> <p>Taking morphine without a prescription to relieve pain</p>
Recreational Use	<p>Having an alcoholic drink to relax before dinner</p> <p>Smoking a cigarette or a cigar for enjoyment</p>	<p>Smoking marijuana to get high</p> <p>Taking LSD for the hallucinogenic effects</p>

Illicit Drug Use Prevalence Rates

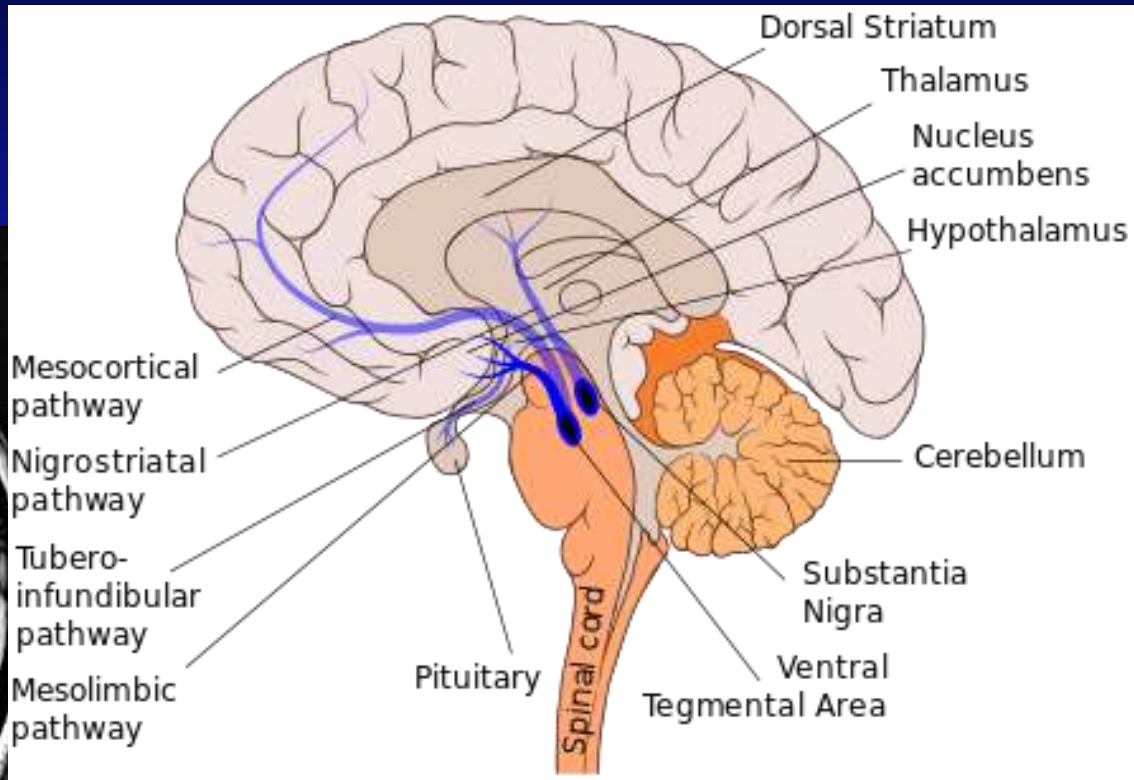
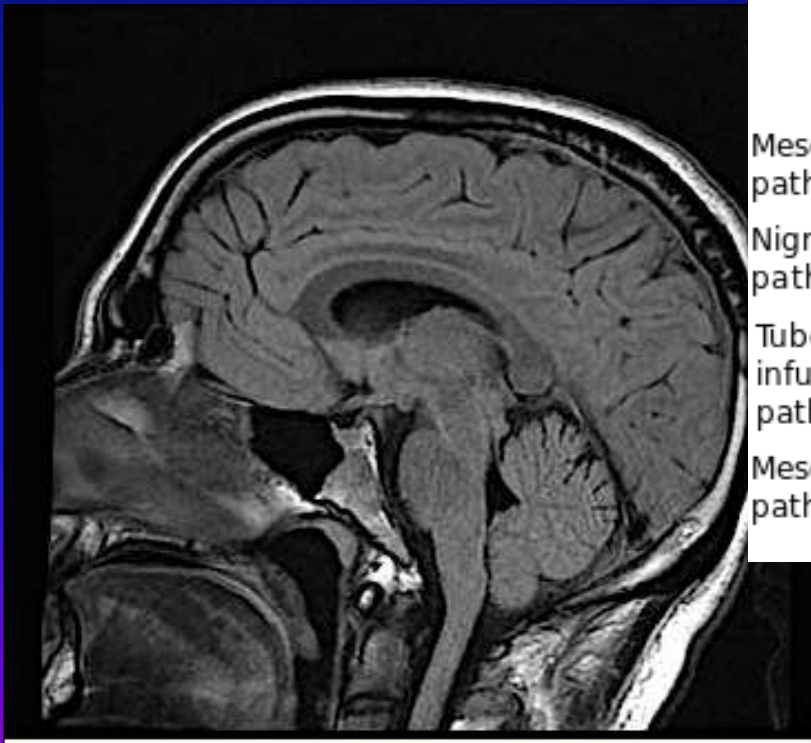


Source: <https://www.drugabuse.gov>

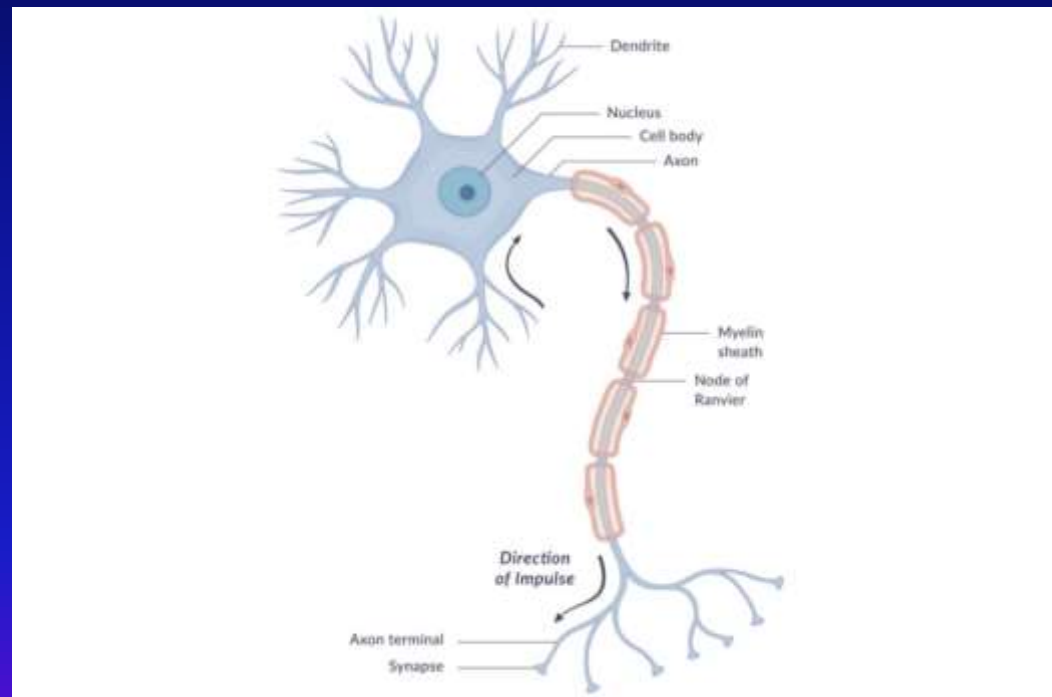
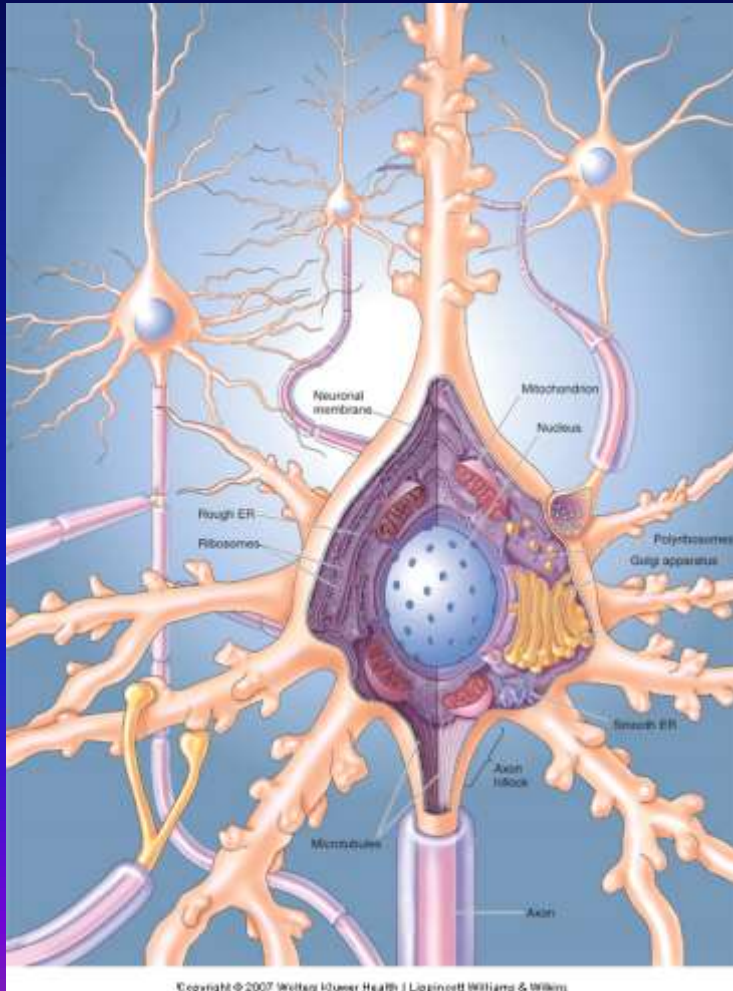
U.S. Deaths per Year From Tobacco, Alcohol, and Illicit Drug Use



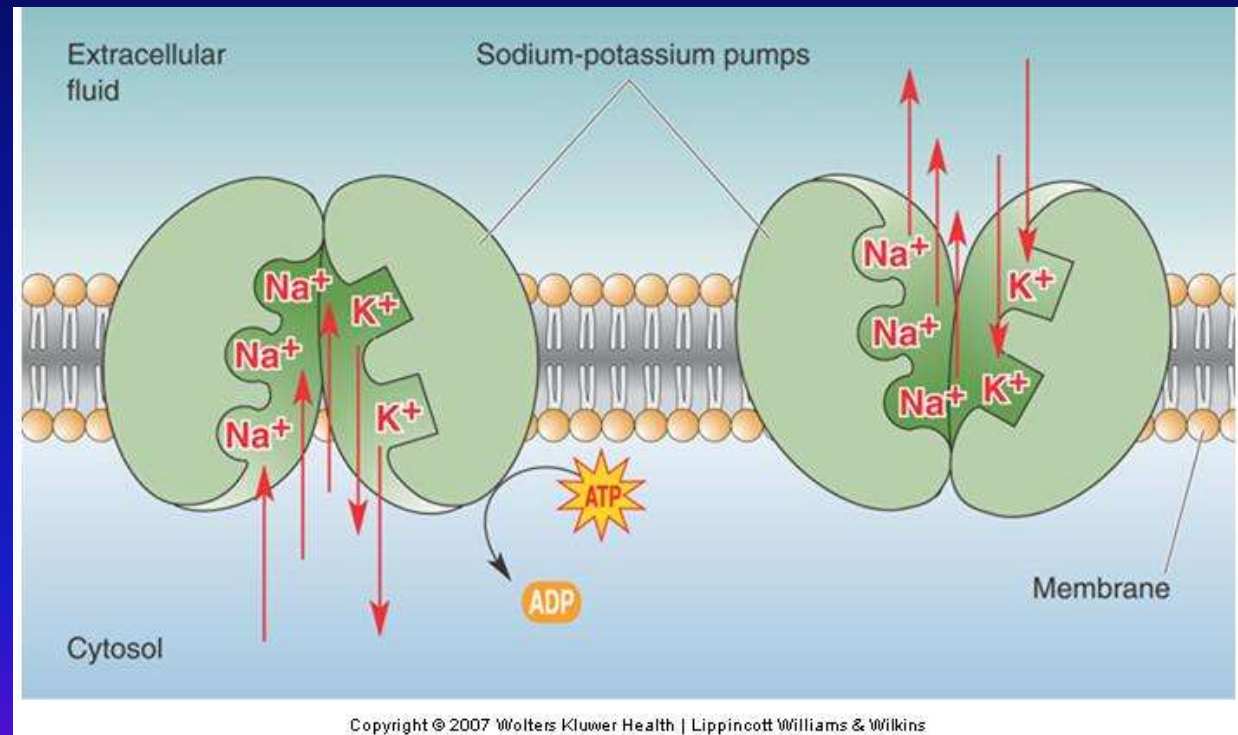
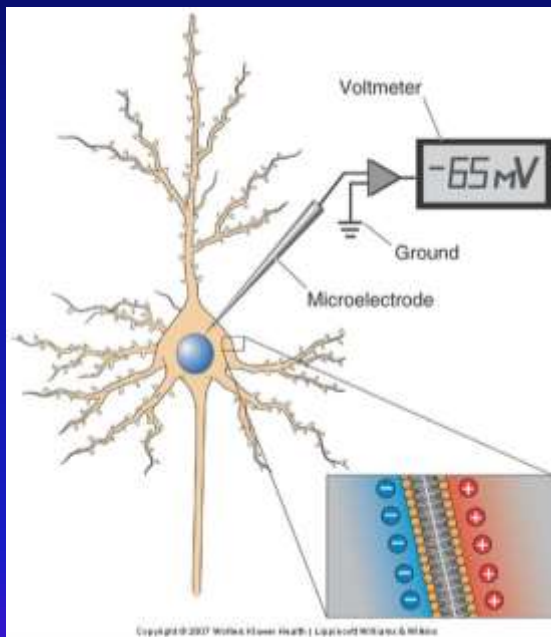
The Brain



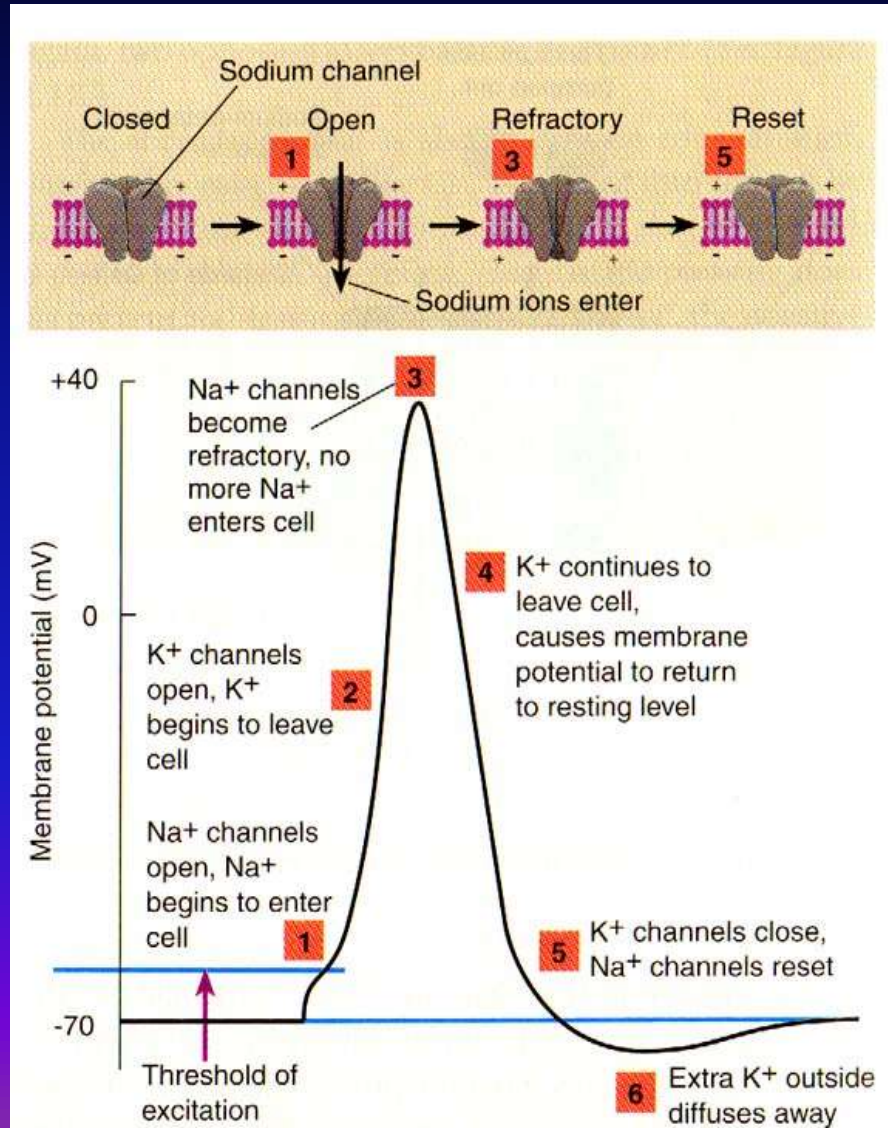
The Anatomy of a Neuron



The Neuron: at Rest

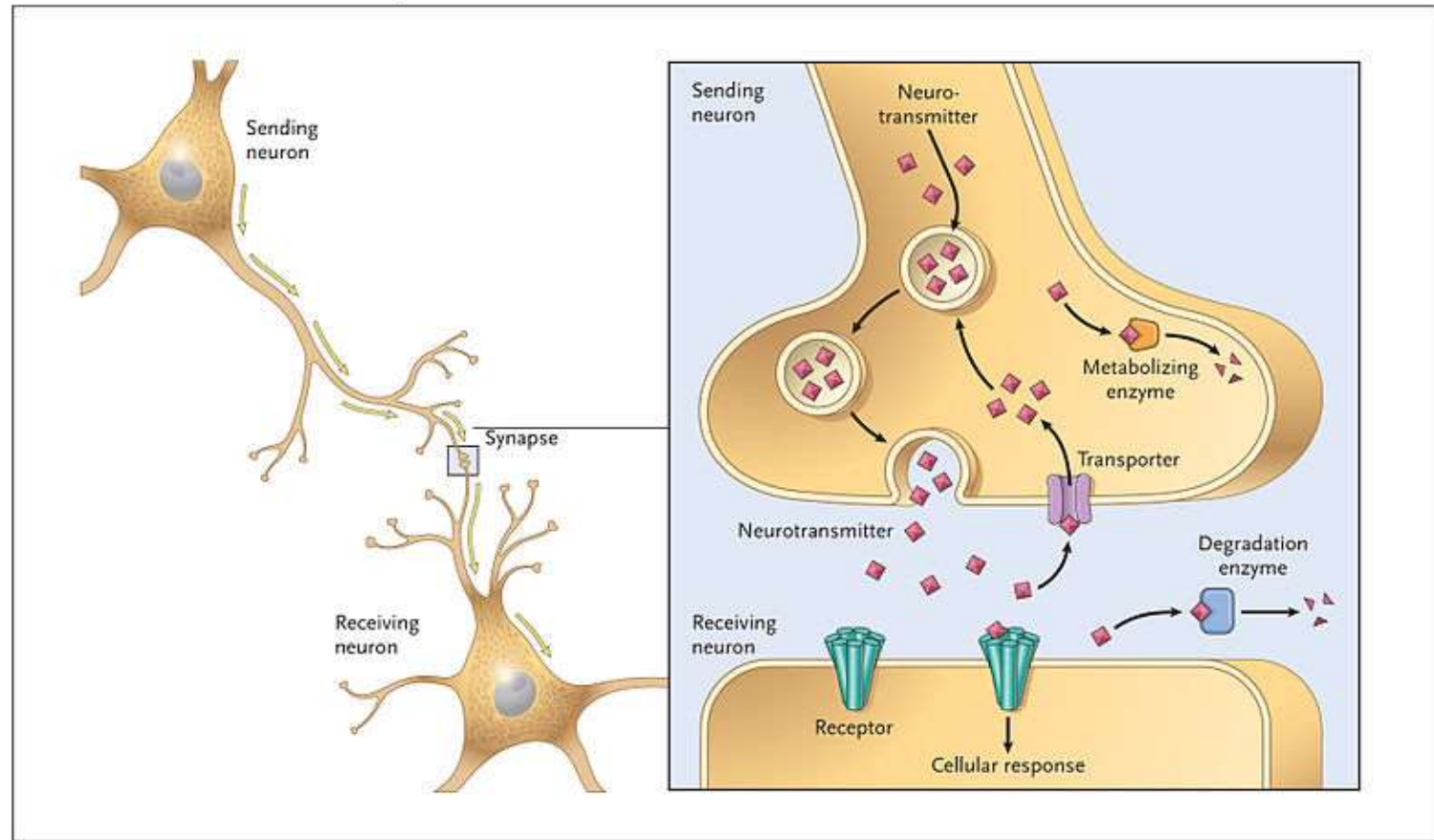


The Neuron: when Active



Synaptic Transmission

Generic Neurotransmitter System



Drugs and the CNS

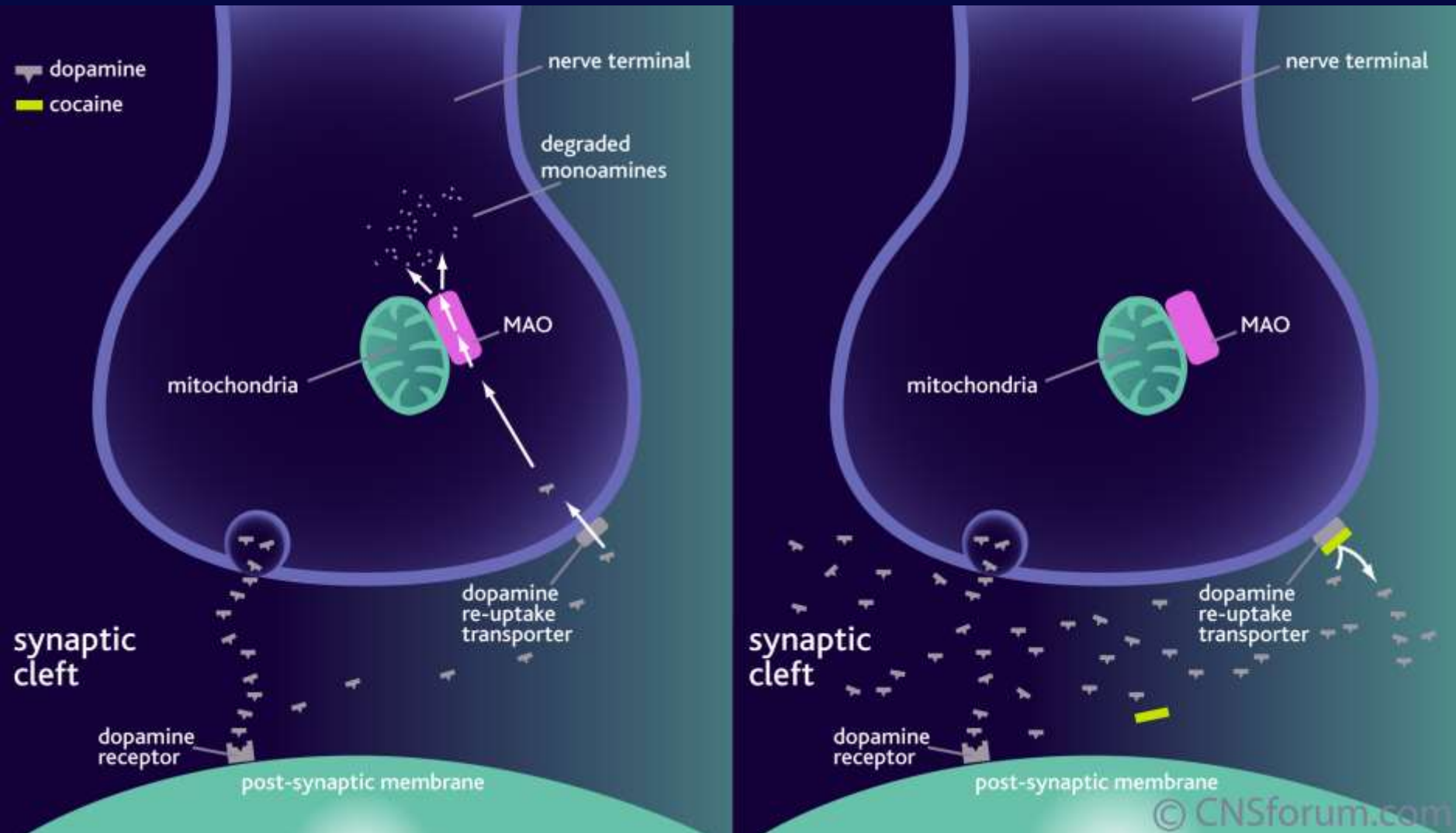
TABLE 3.1

Drug Effects and Synaptic Communication in the Nervous System

DRUG	RESULT	MECHANISM
amphetamines	CNS stimulation	Mimicking of norepinephrine at its receptor sites
antianxiety drugs	Reduction in anxiety	Stimulation of GABA receptors in the brain
in general	and stress	
antidepressant drugs, MAO-inhibitor type	Reduction in depressive symptoms	Inhibition of enzymes that metabolize norepinephrine and serotonin
antidepressant drugs, tricyclic type	Reduction in depressive symptoms	Slowing down of reuptake of norepinephrine and serotonin at their receptor sites
antipsychotic drugs, typical type	Reduction in schizophrenic symptoms	Dopamine blocked from entering receptor sites in the brain
caffeine	CNS stimulation	Adenosine (an inhibitory neurotransmitter) blocked from entering its receptor sites
cocaine	CNS stimulation and local anesthesia	Blocking the reuptake of norepinephrine and dopamine at their receptor sites
LSD	Visual hallucinations and disordered thinking	Stimulation of receptor sites sensitive to serotonin
morphine, heroin, and codeine	Pain relief and euphoria	Stimulation of endorphins at their receptors in the spinal cord and brain

Source: Grilly, David M. (2006). *Drugs and human behavior* (5th ed.) Boston: Allyn and Bacon.

The Major Stimulants: Cocaine



The Major Stimulants: Cocaine



COCAINE TOOTHACHE DROPS

Instantaneous Cure!

PRICE 15 CENTS.

Prepared by the

LLOYD MANUFACTURING CO.

219 HUDSON AVE., ALBANY, N. Y.

For sale by all Druggists.

(Registered March 1885.)

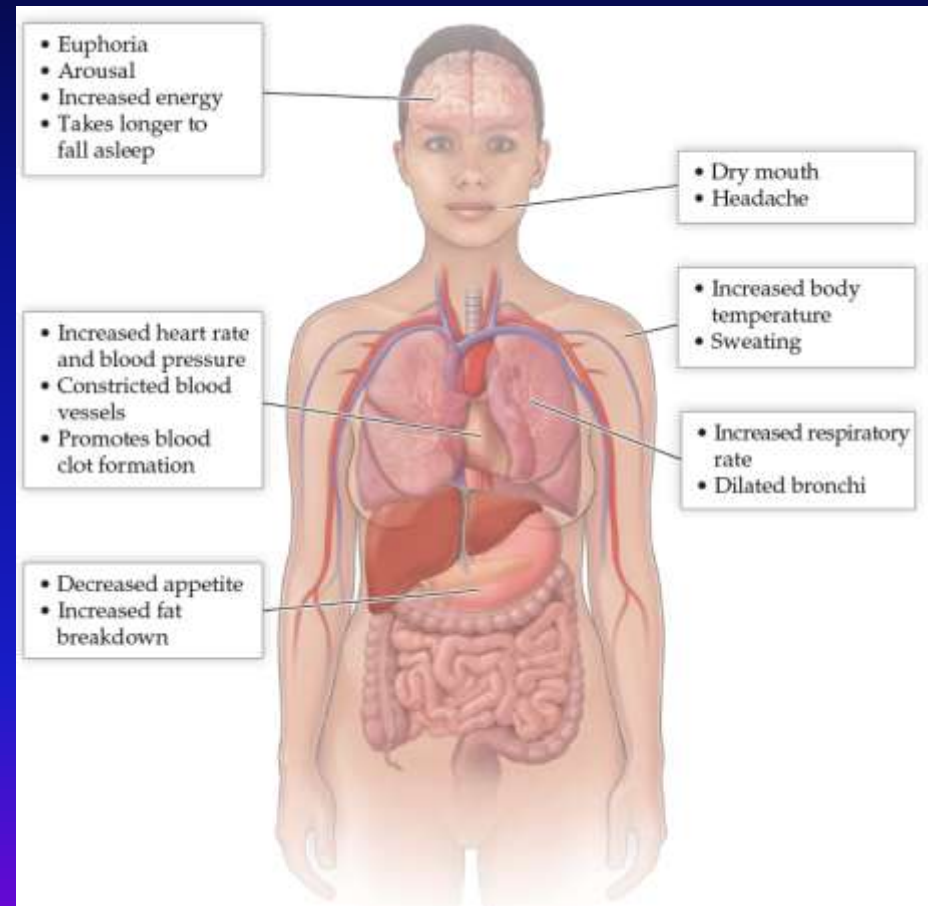
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In the late 1800s in the United States, cocaine was an ingredient in over-the-counter medications.

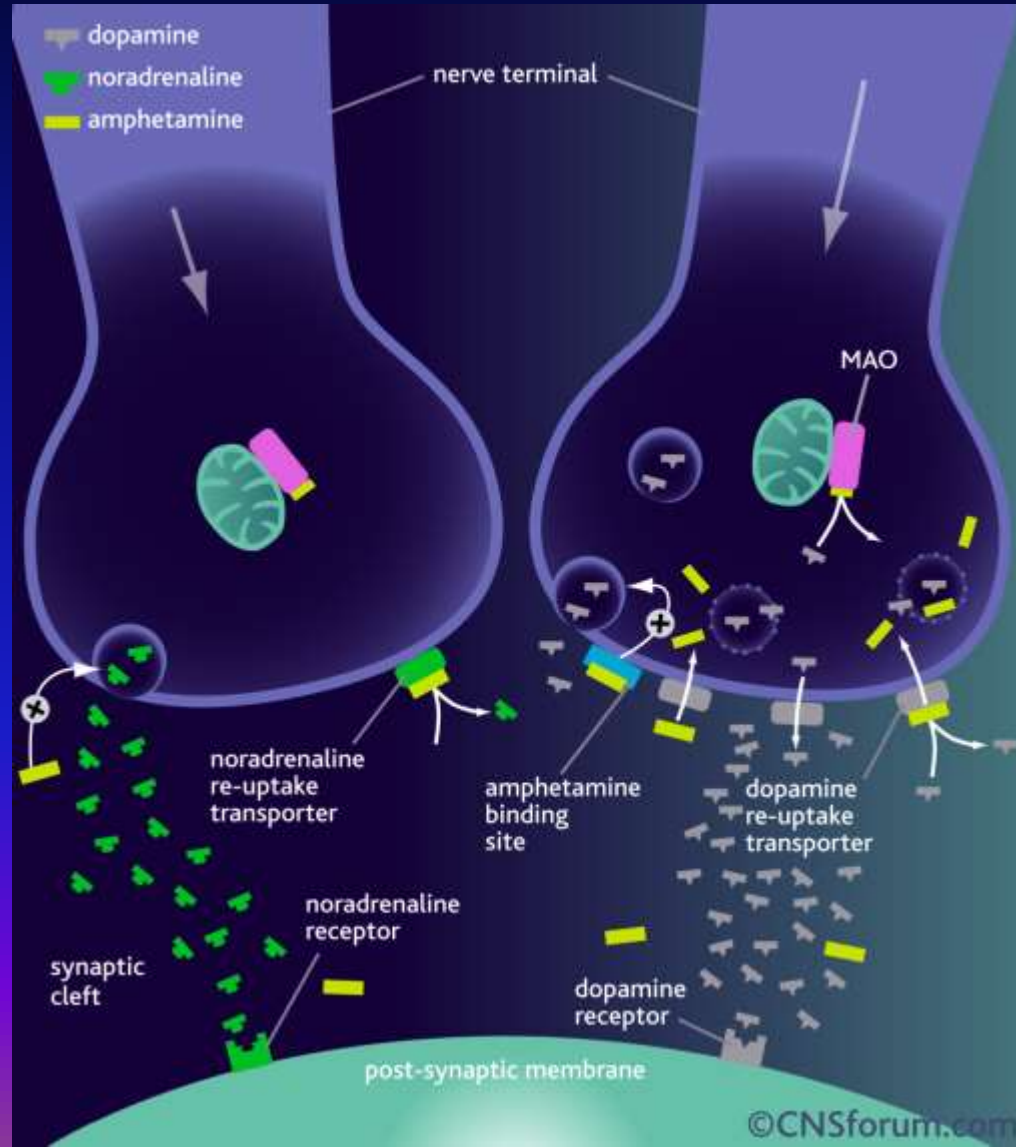
The Major Stimulants: Cocaine

Side Effects

- Powerful burst of energy
- General sense of well-being
- Heart rate and respiration are increased
- Appetite is diminished
- Blood vessels constrict and blood pressure is increased
- Pupils are dilated
- Continuously stuffy or runny nose
- Hallucinations (cocaine psychosis)

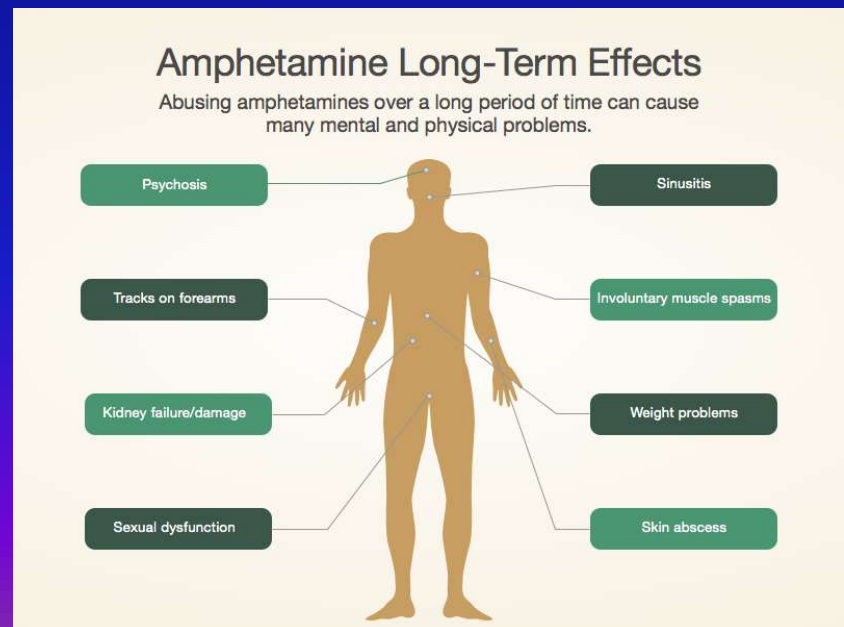


The Major Stimulants: Amphetamines

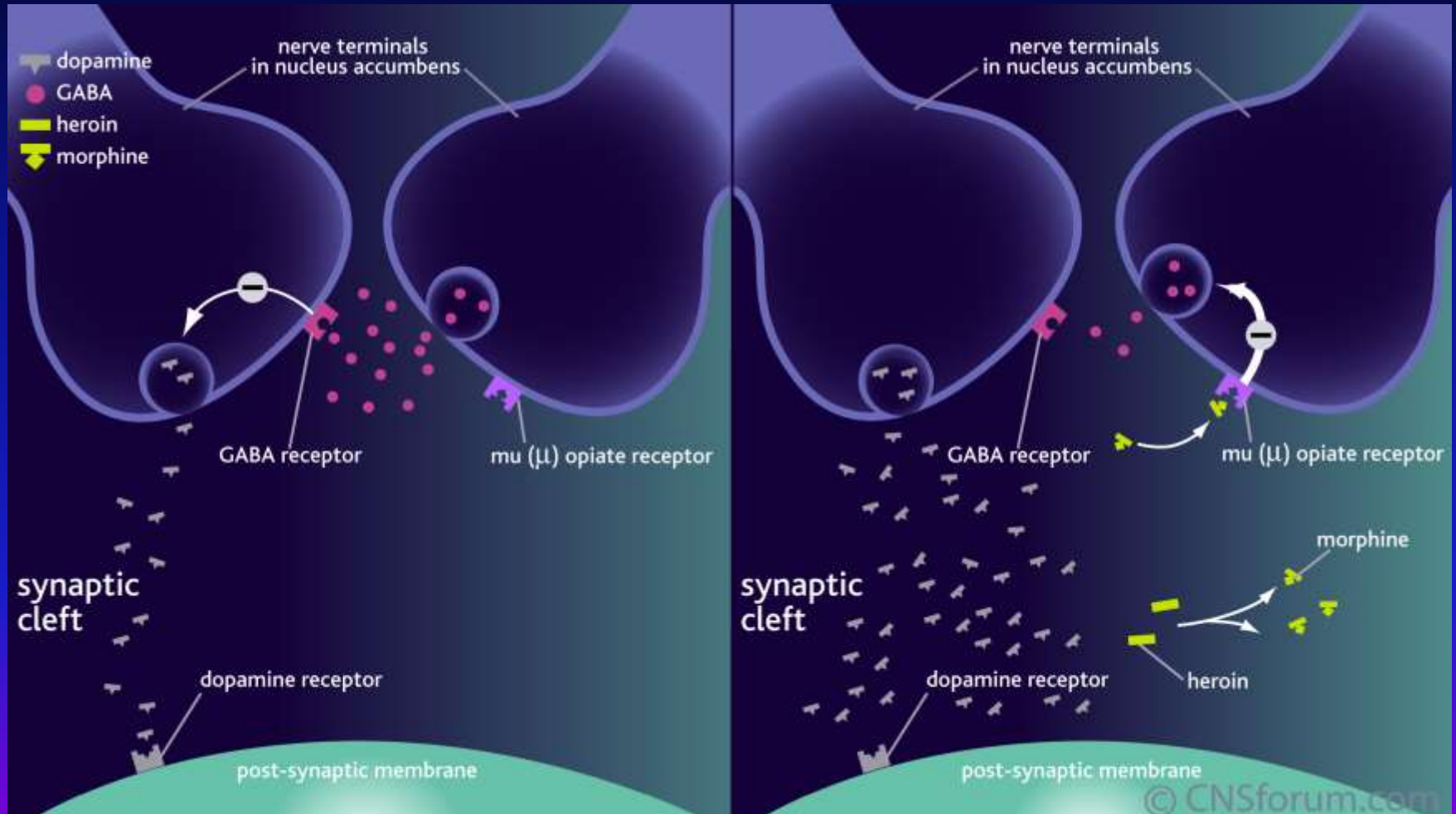


The Major Stimulants: Amphetamines

- Euphoria
- Insomnia
- Increased heart rate
- Increased blood pressure
- Dilated pupils
- Parkinson's-like symptoms
- Tremors
- Convulsion
- Paranoia
- Hallucinations
- Strokes
- Cardiovascular collapse, death



The Opioids: Heroin



The Opioids: Heroin

Side Effects

- Intense euphoria
- Subsequent tranquil drowsiness
- Elevated body temperature

Withdrawal

- Increased blood pressure
- Tearing, runny nose
- Diarrhea
- Spontaneous ejaculations
- Restlessness
- Involuntary kicking movements
- Pain and irritability
- Depression and anxiety



Prescription Heroin and Opioid Epidemic Awareness Week (September 8-14th, 2019)

HEROIN AND OPIOID AWARENESS

Prevention • Enforcement • Treatment



The Opioids: In the News and On the Rise

THE OPIOID EPIDEMIC BY THE NUMBERS



130+

People died every day from opioid-related drug overdoses¹ (estimated)



11.4 m

People misused prescription opioids²



47,600

People died from overdosing on opioids²



2.1 million

People had an opioid use disorder²



81,000

People used heroin for the first time²



886,000

People used heroin²



2 million

People misused prescription opioids for the first time²



15,482

Deaths attributed to overdosing on heroin²



28,466

Deaths attributed to overdosing on synthetic opioids other than methadone²

SOURCES

1. 2017 National Survey on Drug Use and Health, Mortality in the United States, 2016
2. NCHS Data Brief No. 293, December 2017
3. NCHS, National Vital Statistics System. Estimates for 2017 and 2018 are based on provisional data.



Opioid Related Deaths



By Peter Mucha and Frank Kummer
Breaking News Desk

An accidental overdose of heroin caused the Aug. 5 death of Garrett Reid, son of Eagles head coach Andy Reid, Northampton County Coroner Zachary Lysek announced at an afternoon news conference.

The cause of death will be listed as "acute opiate (heroin) toxicity" and classified as "accidental," Lysek said.

The finding confirms what many, including the coach himself, suspected, because of Garrett Reid's history of drug abuse.

Some are likely to wonder, though, if the release of the findings, about ten weeks after the death, was delayed to coincide with the Eagles having a bye week.

The body of Garrett Reid, 29, was found in a Lehigh University dormitory room during Eagles training camp. He was working for the club as a strength and conditioning coach, and had been

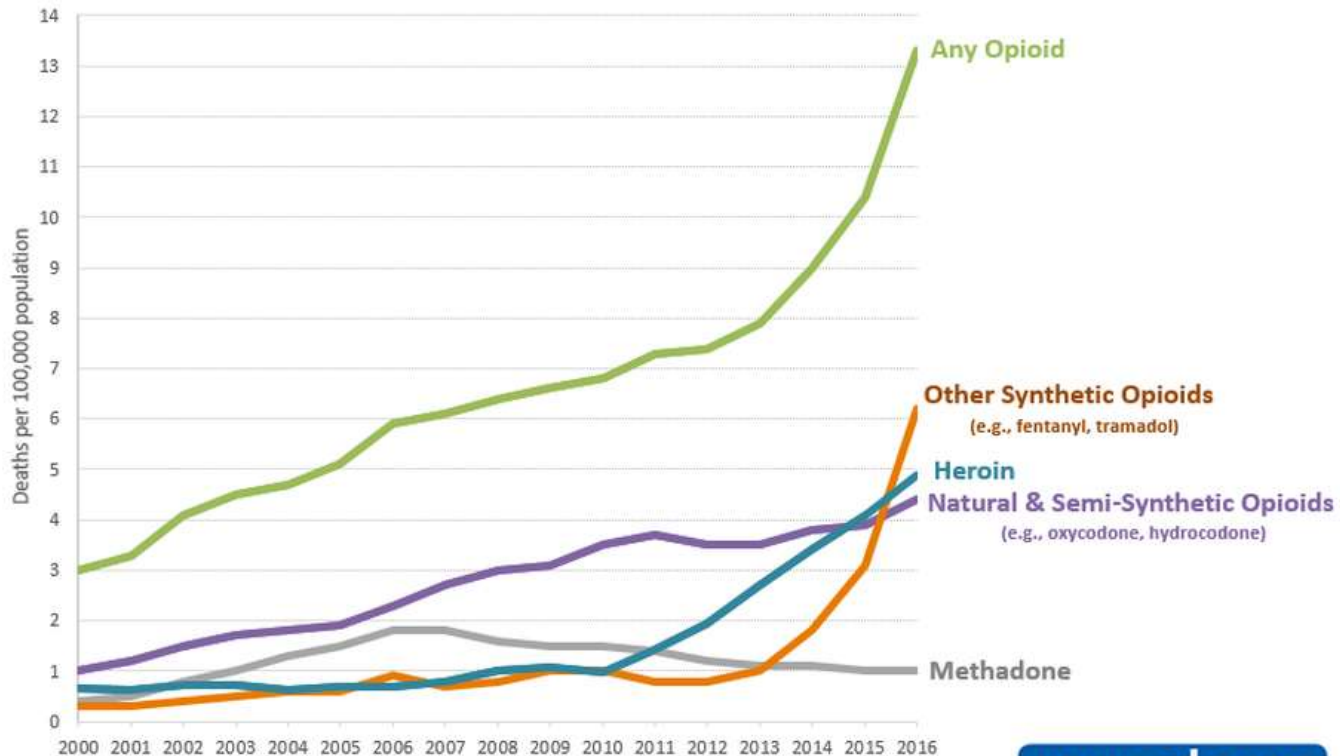


Garrett Reid, son of Eagles coach Andy Reid, seen in a photograph from his funeral booklet. He



Opioid Related Deaths

Overdose Deaths Involving Opioids, by Type of Opioid, United States, 2000-2016



SOURCE: CDC/NCHS, National Vital Statistics System, Mortality. CDC WONDER, Atlanta, GA: US Department of Health and Human Services, CDC; 2017. <https://wonder.cdc.gov/>.

www.cdc.gov
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