Don’t Stop Till You Get Enough?
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
   I. Classification
   II. Facts and Figures
   III. Systems Affected

II. Cocaine
   I. How it works
   II. Side effects

III. Amphetamines
   I. How it works
   II. Side effects

IV. Heroin
   I. How it works
   II. Side effects

V. Popular Drugs of the 21st Century
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

<table>
<thead>
<tr>
<th>Goal</th>
<th>Legal Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrumental Use</td>
<td></td>
</tr>
<tr>
<td>Taking No Doz to stay awake on a long trip</td>
<td>Taking amphetamines without a prescription to stay awake the night before a test</td>
</tr>
<tr>
<td>Taking Valium with a prescription to relieve anxiety</td>
<td></td>
</tr>
<tr>
<td>Recreational Use</td>
<td></td>
</tr>
<tr>
<td>Having an alcoholic drink to relax before dinner</td>
<td>Smoking marijuana to get high</td>
</tr>
<tr>
<td>Smoking a cigarette or a cigar for enjoyment</td>
<td>Taking LSD for the hallucinogenic effects</td>
</tr>
</tbody>
</table>
Illicit Drug Use Prevalence Rates For U.S. College Students In 2008

**TABLE 1.2**

Percentage of illicit drug use among college students, aged 19-22

<table>
<thead>
<tr>
<th></th>
<th>EVER IN LIFETIME</th>
<th>IN PAST TWELVE MONTHS</th>
<th>IN PAST THIRTY DAYS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marijuana</td>
<td>47.5</td>
<td>31.8</td>
<td>16.8</td>
</tr>
<tr>
<td>Hallucinogens</td>
<td>9.1</td>
<td>4.9</td>
<td>1.3</td>
</tr>
<tr>
<td>Cocaine</td>
<td>8.5</td>
<td>5.4</td>
<td>1.7</td>
</tr>
<tr>
<td>Crack cocaine</td>
<td>1.3</td>
<td>0.6</td>
<td>0.1</td>
</tr>
<tr>
<td>Heroin</td>
<td>0.5</td>
<td>0.2</td>
<td>0.1</td>
</tr>
</tbody>
</table>

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

More than four times as many Americans die from tobacco-related illnesses such as cardiovascular and respiratory diseases and cancer as die from alcohol-related and illicit drug-related problems combined.
Routes of Drug Administration
The Brain

- Cerebral cortex
- Thalamus
- Corpus callosum
- Nucleus accumbens
- Hypothalamus
- Pituitary gland
- Pons
- Medulla
- Cerebellum
- Spinal cord
Synaptic Transmission
# Drugs and the CNS

## TABLE 3.1

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

The Major Stimulants: Cocaine
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: Cocaine
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 Major Stimulants: Amphetamines
The Narcotics: Heroin
The Narcotics: 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
The Narcotics: Heroin
21st Century Drugs
Performance-Enhancing Drugs
Performance-Enhancing Drugs

- Androgenic - acting to promote masculinizing changes in the body

- Anabolic - acting to promote growth and muscular development

- Anabolic-androgenic steroids (anabolic steroids) - a group of drugs patterned after the testosterone molecule, producing anabolic and androgenic effects
Performance-Enhancing Drugs

- Shrunken testicles
- Diminished sperm count
- Enlarged breasts
- Frequent, sustained, painful penile erections (priapism)
- Acne on shoulders and back
- Increased facial hair, accelerated balding
Performance-Enhancing Drugs

- Lower voice
- Increased facial hair
- Enlarged clitoris
- Increased aggressiveness
- Increased appetite and decreased body fat
- Diminished menstruation
- Decreased breast size
- Increased body hair
- Increased loss of scalp hair
# Performance-Enhancing Drugs

## Suspension Penalties for Steroid Use

The 2005 agreement on regulations against steroid use in major league baseball (MLB) included a ban on “all substances regarded now, or in the future, by the federal government as steroids” as well as human growth hormone and steroid precursor hormones such as androstendione. Suspension penalties for positive-test infractions under these new regulations are shown in comparison to previous MLB regulations and those of other U.S. and international athletic organizations.

<table>
<thead>
<tr>
<th>POSITIVE TEST</th>
<th>First</th>
<th>Second</th>
<th>Third</th>
<th>Fourth</th>
<th>Fifth</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Major League Baseball</strong></td>
<td>counseling</td>
<td>15 days</td>
<td>25 days</td>
<td>50 days</td>
<td>1 year</td>
</tr>
<tr>
<td>Pre-2005</td>
<td>50 games</td>
<td>100 games</td>
<td>lifetime suspension, with right of rein-statement after two years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Late 2005</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Minor League Baseball</strong></td>
<td>15 days</td>
<td>30 days</td>
<td>60 days</td>
<td>1 year</td>
<td>lifetime</td>
</tr>
<tr>
<td><strong>National Football League</strong></td>
<td>4 games</td>
<td>6 games</td>
<td>1 year</td>
<td>1 year</td>
<td>1 year</td>
</tr>
<tr>
<td><strong>National Basketball Association</strong></td>
<td>5 games</td>
<td>10 games</td>
<td>25 games</td>
<td>25 games</td>
<td>25 games</td>
</tr>
<tr>
<td><strong>National Hockey League</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>World Anti-Doping Association</strong> (Olympic sports)</td>
<td>2 years</td>
<td>lifetime</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Truth About Painkillers

Once prescribed, these drugs open the door to a tenacious addiction and a life of dependency.

"Say no to drugs, say no!"
Misuse of Prescription Drugs

Diprivan