Chapter 8a

Drugs and the Mind
<table>
<thead>
<tr>
<th>Drug</th>
<th>Lifetime</th>
<th>Past Year</th>
<th>Past Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any illicit drug</td>
<td>59.8</td>
<td>35.5</td>
<td>20.2</td>
</tr>
<tr>
<td>Marijuana and hashish</td>
<td>53.8</td>
<td>29.8</td>
<td>17.3</td>
</tr>
<tr>
<td>Cocaine</td>
<td>15.4</td>
<td>6.7</td>
<td>2.0</td>
</tr>
<tr>
<td>Crack</td>
<td>3.8</td>
<td>0.9</td>
<td>0.2</td>
</tr>
<tr>
<td>Heroin</td>
<td>1.6</td>
<td>0.4</td>
<td>0.1</td>
</tr>
<tr>
<td>Hallucinogens</td>
<td>24.2</td>
<td>8.4</td>
<td>1.9</td>
</tr>
<tr>
<td>LSD</td>
<td>15.9</td>
<td>1.8</td>
<td>0.1</td>
</tr>
<tr>
<td>PCP</td>
<td>2.7</td>
<td>0.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Ecstasy</td>
<td>15.1</td>
<td>5.8</td>
<td>1.1</td>
</tr>
<tr>
<td>Inhalants</td>
<td>15.7</td>
<td>2.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Nonmedical use of any prescription-type</td>
<td>27.7</td>
<td>14.2</td>
<td>5.4</td>
</tr>
<tr>
<td>psychotherapeutic</td>
<td>Pain relievers</td>
<td>22.1</td>
<td>11.4</td>
</tr>
<tr>
<td>Tranquilizers</td>
<td>11.2</td>
<td>4.9</td>
<td>1.6</td>
</tr>
<tr>
<td>Stimulants</td>
<td>10.8</td>
<td>3.7</td>
<td>1.2</td>
</tr>
<tr>
<td>Methamphetamine</td>
<td>5.7</td>
<td>1.7</td>
<td>0.5</td>
</tr>
<tr>
<td>Sedatives</td>
<td>2.1</td>
<td>0.5</td>
<td>0.2</td>
</tr>
<tr>
<td>Any illicit drug other than marijuana</td>
<td>40.1</td>
<td>20.2</td>
<td>7.9</td>
</tr>
</tbody>
</table>

SOURCE: The 2002 National Survey on Drug Use and Health, of the Substance Abuse and Mental Health Services Administration, Department of Health and Human Services.
Psychoactive Drugs Alter Communication between Neurons

• Psychoactive drugs alter the communication between neurons by stimulating, inhibiting or dampening the release of a neurotransmitter, or by altering the binding site of the neurotransmitter
Molecules of neurotransmitter in synaptic vesicle

Receptor (of sodium ion channel) on postsynaptic membrane
The natural sequence of events: molecules of neurotransmitter released by one neuron diffuse across a gap and fit into receptors on the membrane of a receiving neuron, causing a response.
A psychoactive drug may increase the number of neurotransmitter molecules released, increasing the response of the receiving neuron.
A psychoactive drug may decrease the number of neurotransmitter molecules released, decreasing the response of the receiving neuron.
A psychoactive drug may fit into the receptors for a neurotransmitter, causing a similar response by the receiving neuron.
A psychoactive drug may fit into the receptors for a neurotransmitter and prevent the neurotransmitter from entering the receptor, blocking the response by the receiving neuron.
Tolerance to Psychoactive Drugs

• Tolerance: takes more and more of the drug to achieve the same effect
• Homeostatic mechanisms leading to tolerance
  1. Increased prodn. of enzymes that bkd the drug (at both synapse and liver)
  2. Decrease in # of post-synaptic receptors
  3. Decrease prodn. of neurotransmitter
  4. Decrease in # of pre-synaptic neurotransmitters released
Psychoactive drugs typically act at the:

A. Gene
B. Chromosome
C. Nucleus
D. Synapse
E. Glial cells
Effects of Alcohol on the CNS
Alcohol Depresses the CNS

- Absorption: Starts in stomach, continues in gut
- Distribution: All tissues, fat & water solb.
- Elimination: metabolism to CO2
- Liver effects: fat accumulation
<table>
<thead>
<tr>
<th>Alcoholic Beverage</th>
<th>Percent Alcohol (Ethanol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light beer</td>
<td>4.5</td>
</tr>
<tr>
<td>Most beer</td>
<td>~5</td>
</tr>
<tr>
<td>Flavored malt beverages (coolers)</td>
<td>5</td>
</tr>
<tr>
<td>Ice beer</td>
<td>5.5–5.9</td>
</tr>
<tr>
<td>Dark beer (stout, porter, bock)</td>
<td>6–7</td>
</tr>
<tr>
<td>Malt liquour</td>
<td>8</td>
</tr>
<tr>
<td>French and German wines</td>
<td>8.5–10</td>
</tr>
<tr>
<td>American wine (most)</td>
<td>12–14</td>
</tr>
<tr>
<td>Sherry and port</td>
<td>18–21</td>
</tr>
<tr>
<td>Distilled liquor (vodka, gin, scotch,</td>
<td></td>
</tr>
<tr>
<td>whiskey, rum, brandy, cognac)</td>
<td>Most 40% (80 proof); some 45%</td>
</tr>
<tr>
<td></td>
<td>(90 proof) or 50% (100 proof)</td>
</tr>
</tbody>
</table>

Table 8a-1 Biology of Humans, 2/e
© 2007 Pearson Prentice Hall, Inc.
Alcohol Depresses the CNS

• In the brain, it causes a loss of cognitive ability, impairs judgment, slows reflexes and impairs balance and coordination (cerebellum effects)

• Excessive amounts of alcohol can cause unconsciousness, coma and death – acts on medulla oblongata to stop breathing
Alcohol Depresses the Central Nervous System

- A person who drinks heavily is at least twice as likely to develop cancer of the mouth, tongue or esophagus
Alcohol Depresses the Central Nervous System

- In moderate amounts, alcohol reduces stress and increases blood HDL
  - Beneficial cardiovascular effects

- However, when consumed in larger quantities it damages the heart and blood vessels
Alcohol Depresses the Central Nervous System

- Alcohol consumption can have devastating effects on the fetus
- Even limited chronic consumption while pregnant may lead to fetal alcohol syndrome (FAS)
Small head circumference
Low nasal bridge
Vertical skin folds in the inner eyelid
Small midface
Short nose
Indistinct depression in area under nose
Thin upper lip
Fetal Alcohol Syndrome
Laws regulating the purchase of alcohol

A. Should not be changed (21 age limit to buy)
B. Should be lowered to age 18
C. Should be raised to age 25
D. Purchase of alcohol should be illegal at any age
Marijuana’s Psychoactive Ingredient Is THC

- Marijuana binds to THC receptors in the brain
  - THC mimics natural chemicals (anandamide) in the brain and elsewhere in the body
  - THC binds to endocannabinoid receptors (a.k.a., CB1 & CB2) in brain
  - Endocannabinoids act on many body systems
Effects of Marijuana/THC

• Endocannabinoids: produce feeling of well-being & euphoria; stimulates appetite; affect learning and memory, emotions, and more

• Effects on Reproduction?
  – Lower testosterone and sperm counts suggested in males.
  – Effects on reproduction in females unknown and unclear
Cocaine and Amphetamines

• Cocaine brings about a rush of intense pleasure, a sense of self-confidence and power, clarity of thought, and increased physical vigor
Cocaine and Amphetamines

• Mechanism of Action: Augments Neurotransmitters
  – Decreases dopamine re-uptake in synapse
  – Also augments the effects of norepinephrine
Cocaine and Amphetamines

• This high is very short lived followed by depression, anxiety and extreme fatigue

• Cocaine has negative effects on the cardiovascular system. Can cause heart seizure and death (e.g., Len Bias)
Image Challenge

Q: Which one of the following drugs of abuse is most typically associated with the illustrated complication?

1. Ketamine
2. Heroin
3. Cocaine
4. Phencyclidine
5. Mescaline
Q: Which one of the following drugs of abuse is most typically associated with the illustrated complication?

Answer:

3. Cocaine

Perforation of the nasal septum and palate are well recognized complications of intranasal cocaine use.

Opiates Reduce Pain

- Opiates are natural or synthetic drugs that reduce pain, produce a sense of euphoria and reduce anxiety.

- Examples: Morphine, Heroin, Codine
Opiates

• Mechanism of Action
  – Binds to and mimics endogenous endorphin, enkephalin, dynorphin receptors
Opiates

- Non-toxic in *low doses*

- Breathing stops at higher doses - death ensues

- Lifestyle often dangerous (sharing needles, etc)
Ecstasy

- MDMA (methylenedioxymethamphetamine)
- Mechanism of Action
  1. Induces release of serotonin
  2. Blocks reuptake of serotonin
  3. Binds to serotonin receptors in the brain
- Increases: heart rate, BP, body temp, energy
- Does E kill brain cells? Unclear.
Psychelelic Drugs

• Mescaline (peyote), LSD
• Mechanism of Action
  – May mimic/augment serotonin and/or norepinephrine
• Hallucinogenic
• Craving and withdrawal reactions unknown
Special K (Ketamine)
Special K (Ketamine)

- Ketamine produces hallucinogenic effects similar to PCP
- Ketamine produces a dissociative state, characterized by a sense of detachment from one's physical body
Special K (Ketamine)

- K blocks the NMDA (Glutamate) neurotransmitter receptor
- Improved the mood of patients with Major depression in as little as 2 hours
- Ketamine injection gives relief from depression in one day compared to 2 months with standard antidepressants
How should drugs (Cocaine, Heroin (opiates), Amphetamines, be controlled /regulated in the United States?

A. Drugs should be illegal. Penalties for selling, dealing or using
B. Drugs should be regulated by the government. Available, but by prescription only
C. Drugs should be fully legal. Sold like alcohol and cigarettes