



Week 15: Neurochemical Addiction

Psychology 372

Physiological Psychology

Week 15 Topics

- Lecture 1:
 - What is addiction?
 - Factors mediating addiction
- Lecture 2:
 - Commonly abused Drugs
 - Mechanisms of addiction
 - Prevention and Treatment
 - Review
 - Wrap-up

Commonly Abused Drugs (from NIDA)

- **Cannabinoids** (Hashish, Marijuana)
- **Depressants** (Barbiturates, Benzodiazepines, flunitrazepam, GHB, methaqualone, alcohol)
- **Dissociative Anesthetics** (ketamine, PCP)
- **Hallucinogens** (LSD, mescaline, psilocybin)
- **Opioids and Morphine Derivatives** (codeine, fentanyl, heroin, morphine, opium, oxycodone HCL, hydrocodone bitartrate, acetaminophen)
- **Stimulants** (amphetamine, cocaine, MDMA, methamphetamine, methylphenidate, nicotine)
- **Others** (anabolic steroids, dextromethorphan, inhalants)

DEA Schedule of Drugs

- Schedule I (*“illegal” drugs*)
 - High potential for abuse
 - Available for research only
 - No approved medical use
- Schedule II
 - High potential for abuse
 - Available by unrefillable prescription only
- Schedule III and IV
 - Prescription only with 5 refills in 6 months
- Schedule V
 - Some available as over-the-counter

Opioids and Morphine Derivatives

Types	Aliases	DEA Schedule/ How Administered
codeine	<i>Empirin with Codeine, Fiorinal with Codeine, Robitussin A-C, Tylenol with Codeine: Captain Cody, schoolboy; (with glutethimide) doors & fours, loads, pancakes and syrup</i>	II, III, IV, V/injected, swallowed
fentanyl and analogs	<i>Actiq, Duragesic, Sublimaze: Apache, China girl, China white, dance fever, friend, goodfella, jackpot, murder 8, TNT, Tango and Cash</i>	I, II/injected, smoked, snorted
heroin	<i>Diacetyl-morphine: brown sugar, dope, H, horse, junk, skag, skunk, smack, white horse</i>	I/injected, smoked, snorted
morphine	<i>Roxanol, Duramorph: M, Miss Emma, monkey, white stuff</i>	II, III/injected, swallowed, smoked
opium	<i>laudanum, paregoric: big O, black stuff, block, gum, hop</i>	II, III, V/swallowed, smoked
oxycodone HCL	<i>Oxycontin: Oxy, O.C., killer</i>	II/swallowed, snorted, injected
hydrocodone bitartrate, acetaminophen	<i>Vicodin: vike, Watson-387</i>	II/swallowed

Opioids and Morphine Derivatives

- **Intoxication Effects:** pain relief, euphoria, drowsiness
 - Heroin: staggering gait
- **Potential Health Consequences:** nausea, constipation, confusion, sedation, respiratory depression and arrest, tolerance, addiction, unconsciousness, coma, death
 - Codeine: less analgesia, sedation, and respiratory depression than morphine

Neurophysiological Effects of Opioids

- Direct agonist for opiate receptors
 - In particular, the μ (mu) receptor
- Release dopamine in nucleus accumbens
- Both of the above effects are highly reinforcing \rightarrow highly addictive
 - Blocking either effect reduces reinforcement
 - Nalaxone blocks opiate receptors
 - Pimozide blocks dopamine receptors
- Emergency Treatment: nalaxone
- Long-term Treatment: methadone maintenance
 - Slower uptake \rightarrow no “high”
 - Alleviates withdrawal symptoms

Non-alcohol Depressants

Types	Aliases	DEA Schedule/ How Administered
barbiturates	<i>Amytal, Nembutal, Seconal, Phenobarbital</i> : barbs, reds, red birds, phennies, tooies, yellows, yellow jackets	II, III, V/injected, swallowed
benzodiazepines (other than flunitrazepam)	<i>Ativan, Halcion, Librium, Valium, Xanax</i> : candy, downers, sleeping pills, tranks	IV/swallowed, injected
flunitrazepam	<i>Rohypnol</i> : forget-me pill, Mexican Valium, R2, Roche, roofies, roofinol, rope, rophies	IV/swallowed, snorted
GHB	<i>gamma-hydroxybutyrate</i> : G, Georgia home boy, grievous bodily harm, liquid ecstasy	I/swallowed
methaqualone	<i>Quaalude, Sopor, Parest</i> : ludes, mandrex, quad, quay	I/injected, swallowed

Depressants (including alcohol)

- **Intoxication Effects:** reduced anxiety; feeling of well-being; lowered inhibitions; slowed pulse and breathing; lowered blood pressure; poor concentration
 - Barbituates, benzodiazepines, alcohol: sedation, drowsiness
 - Methaqualone, alcohol: euphoria
- **Potential Health Consequences:** fatigue; confusion; impaired coordination, memory, judgment; addiction; respiratory depression and arrest; death
 - Barbiturates, alcohol: unusual excitement, fever, irritability, slurred speech, dizziness, life-threatening withdrawal
 - Benzodiazepines, alcohol: dizziness
 - Flunitrazepam: visual and gastrointestinal disturbances, urinary retention, memory loss
 - GHB: drowsiness, nausea, vomiting, headache, loss of consciousness, loss of reflexes, seizures, coma, death
 - Methaqualone: poor reflexes, slurred speech, coma

Neurophysiological Effects of Depressants

- Many increase GABA activity
 - GABA is the prime inhibitory neurotransmitter in the brain
 - Produces slowed brain function, drowsiness, calmness (anxiolytic)
- Can trigger apoptosis (neuronal death)
- Alcohol also produces euphoria
 - NMDA antagonist
 - Increases activity of dopaminergic neurons and release of dopamine in nucleus accumbens → addiction
 - Disrupts long term potentiation in hippocampus
 - Tolerance and withdrawal are due to release from long-term suppression of NMDA receptors and decreased levels of dopamine receptors
 - Triggers release of endogenous opioids

Treatment of Alcohol Abuse

- Use opiate antagonists to block “euphoric” reinforcing effects
 - Nalaxone
 - Naltrexone
 - Acamprosate (NMDA antagonist) can help reduce seizures

Cannabinoids

Types	Aliases	DEA Schedule/ How Administered
hashish	boom, chronic, gangster, hash, hash oil, hemp	I/swallowed, smoked
marijuana	blunt, dope, ganja, grass, herb, joints, Mary Jane, pot, reefer, sinsemilla, skunk, weed	I/swallowed, smoked

- **Intoxication Effects:** euphoria, slowed thinking and reaction time, confusion, impaired balance and coordination
- **Potential Health Consequences:** cough, frequent respiratory infections; impaired memory and learning; increased heart rate, anxiety; panic attacks; tolerance, addiction

Neurophysiological Effects of Cannabinoids

- Tetrahydrocannabinol (THC)
 - Acts on CB1 receptors (also stimulated by endogenous cannabinoids
 - Block CB1 receptors → no “high”
 - Stimulates dopaminergic neurons
 - if injected into nucleus accumbens → addiction
 - but not for injection in ventral tegmental area
 - Causes excessive activation of CB1 receptors in CA1 region of hippocampus
 - Disrupts formation of long-term memories

Dissociative Anesthetics

Types	Aliases	DEA Schedule/ How Administered
ketamine	<i>Ketalar SV</i> : cat Valiums, K, Special K, vitamin K	III/injected, snorted, smoked
PCP and analogs	<i>phencyclidine</i> ; angel dust, boat, hog, love boat, peace pill	I, II/injected, swallowed, smoked

- **Intoxication Effects:** increased heart rate and blood pressure, impaired motor function
 - Ketamine (at high doses): delirium, depression, respiratory depression and arrest
 - PCP: possible decrease in heart rate and blood pressure, panic, aggression, violence
- **Potential Health Consequences:** numbness, memory loss, nausea, vomiting (PCP: loss of appetite, depression)

Neurophysiological Effects of Dissociative Anesthetics

- PCP: indirect antagonist for Ca^{+} in NMDA receptors, which regulate the number of dopamine receptors
 - Decreased dopamine receptors in frontal lobe produces decreased metabolic activity in frontal lobes
 - Hyperactivity of dopamine receptors in nucleus accumbens → addiction
- Produces schizophrenic symptoms

Stimulants

Types	Aliases	DEA Schedule/ How Administered
amphetamine	<i>Biphetamine, Dexedrine:</i> bennies, black beauties, crosses, hearts, LA turnaround, speed, truck drivers, uppers	II/injected, swallowed, smoked, snorted
cocaine	<i>Cocaine hydrochloride:</i> blow, bump, C, candy, Charlie, coke, crack, flake, rock, snow, toot	II/injected, smoked, snorted
MDMA (methylenedioxy-methamphetamine)	Adam, clarity, ecstasy, Eve, lover's speed, peace, STP, X, XTC	I/swallowed
methamphetamine	<i>Desoxyn:</i> chalk, crank, crystal, fire, glass, go fast, ice, meth, speed	II/injected, swallowed, smoked, snorted
methylphenidate (safe and effective for treatment of ADHD)	<i>Ritalin:</i> JIF, MPH, R-ball, Skippy, the smart drug, vitamin R	II/injected, swallowed, snorted
nicotine	cigarettes, cigars, smokeless tobacco, snuff, spit tobacco, bidis, chew	not scheduled/ smoked, snorted, taken in snuff and spit tobacco

Stimulants

- **Intoxication Effects:** increased heart rate, blood pressure, metabolism; feelings of exhilaration, energy, increased mental alertness
 - Amphetamine: rapid breathing
 - Cocaine: increased body temperature
 - MDMA: mild hallucinogenic effects, increased tactile sensitivity, empathic feelings
 - Methamphetamine: aggression, violence, psychotic behavior

Stimulants

- **Potential Health Consequences:** rapid or irregular heart beat; reduced appetite, weight loss, heart failure, nervousness, insomnia
 - Amphetamine: tremor, loss of coordination, irritability, anxiousness, restlessness, delirium, panic, paranoia, impulsiveness, aggressiveness, tolerance, addiction, psychosis
 - Cocaine: chest pain, respiratory failure, nausea, abdominal pain, strokes, seizures, headaches, malnutrition, panic attacks
 - MDMA: impaired memory and learning, hyperthermia, cardiac toxicity, renal failure, liver toxicity
 - Methamphetamine: memory loss, cardiac and neurological damage, impaired memory and learning, tolerance, addiction
 - Nicotine: tobacco exposure effects including adverse pregnancy outcomes, chronic lung disease, cardiovascular disease, stroke, cancer, tolerance, addiction

Neurophysiological Effects of Stimulants

- Potent Dopamine agonists that increase dopamine levels in nucleus accumbens → addiction
 - Cocaine
 - deactivates dopamine transporter proteins and blocks reuptake by pre-synaptic neuron
 - Amphetamine
 - Inhibits reuptake
 - Stimulates release of dopamine by pre-synaptic neuron
- Chronic abuse associated with
 - Reduction in dopamine transporters & receptors
 - Lower frontal lobe activity (hypofrontality)

Treatments for Stimulants

- Excessive Dopamine
 - Gamma-vinyl GABA (GVG) injections act as GABA agonists and decrease dopamine release in nucleus accumbens
- Stimulate immune system to develop antibodies to prevent cocaine molecules from crossing the blood-brain barrier
- Nicotine
 - Substitute chewing gum or patch to break smoking habit
 - Reduce nicotine levels slowly
 - Drugs that block CB1 receptors

Hallucinogens

Types	Aliases	DEA Schedule/ How Administered
LSD	<i>lysergic acid diethylamide:</i> acid, blotter, boomers, cubes, microdot, yellow sunshines	I/swallowed, absorbed through mouth tissues
mescaline	buttons, cactus, mesc, peyote	I/swallowed, smoked
psilocybin	magic mushroom, purple passion, shrooms	I/swallowed

Hallucinogens

- **Intoxication Effects:** altered states of perception and feeling, nausea
 - LSD, mescaline: increased body temperature, heart rate, blood pressure, loss of appetite, sleeplessness, numbness, weakness, tremors
 - LSD: persistent mental disorders
 - Psilocybin: nervousness, paranoia
- **Potential Health Consequences:** persisting perception disorder (flashbacks)
- **Neurophysiological Effects**
 - Agonist for Serotonin 5-HT_{2A}
 - Inhibitory effects on visual cortex and orbitofrontal cortex
 - No apparent effects on dopaminergic neurons → non-addictive

Other Compounds

Types	Aliases	DEA Schedule/ How Administered	<i>Intoxication Effects/ Potential Health Consequences</i>
anabolic steroids	<i>Anadrol, Oxandrin, Durabolin, Depo-Testosterone, Equipoise: roids, juice</i>	III/injected, swallowed, applied to skin	<i>no intoxication effects/hypertension, blood clotting and cholesterol changes, liver cysts and cancer, kidney cancer, hostility and aggression, acne; in adolescents, premature stoppage of growth; in males, prostate cancer, reduced sperm production, shrunken testicles, breast enlargement; in females, menstrual irregularities, development of beard and other masculine characteristics</i>

Other Compounds

Types	Aliases	DEA Schedule/ How Administered	<i>Intoxication Effects/ Potential Health Consequences</i>
Dextromet horphan (DXM)	<i>cough and cold medications; Robotripping, Robo, Triple C</i>	not scheduled/ swallowed	<i>Dissociative effects, distorted visual perceptions to complete dissociative effects</i>
inhalants	<i>Solvents (paint thinners, gasoline, glues), gases (butane, propane, aerosol propellants, nitrous oxide), nitrites (isoamyl, isobutyl, cyclohexyl): laughing gas, poppers, snappers, whippets</i>	not scheduled/ inhaled through nose or mouth	<i>stimulation, loss of inhibition; headache; nausea or vomiting; slurred speech, loss of motor coordination; wheezing/ unconsciousness, cramps, weight loss, muscle weakness, depression, memory impairment, damage to cardiovascular and nervous systems, sudden death</i>