SOCI 270

Drugs, Society and Behavior

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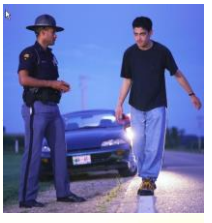
"Goodbye Stranger"

Supertramp

Goodbye Mary, Goodbye Jane, will we ever meet again
Feel no sorrow, feel no shame, come tomorrow, feel no pain
Sweet devotion (Goodbye Mary), it's not for me (Goodbye Jane)
Just give me motion (Will we ever) and set me free (Meet again)
And land and the ocean (Feel no sorrow), far away (Feel no shame)
The life I've chosen (Come tomorrow), every day (Feel no pain)
So goodbye Mary (Goodbye Mary), goodbye Jane (Goodbye Jane)
Will we ever (Will we ever) meet again (Meet again)

Now some they do and some they don't and some you just can't tell
And some they will and some they won't, with some it's just as well
You can laugh at my behavior that'll never bother me
Say the devil is my savior but I don't pay no heed
And I will go on shining, shining like brand new
I'll never look behind me, my troubles will be few



Chapter 5

The Actions of Drugs

1. Drug Facts

a. Sources: Most drugs come from ***plants*** or are chemically derived from plants; ***bio-cultural coevolution*** has created the "niche" of drug-to-neuron that creates physiological and psychoactive effects.

1. Drug Facts

b. Naming

i. Chemical name: Complete chemical description of the molecule

- *Example:* N'-[2-[[5-(dimethylaminomethyl)-2-furyl] methylsulfanyl]ethyl]-N-methyl-2-nitro-ethene-1,1-diamine

ii. Generic name: Official (legal) name listed in the *United States Pharmacopoeia*

- *Example:* ranitidine

iii. Brand name: Specific drug or formulation trademarked by manufacturer; can be patented for 20 years;

- *Example:* Zantac® (an acid reflux drug)

1. Drug Facts

c. Categories

Categorization is "in the eye of the beholder" *(p 107)*

1. Stimulants produce wakefulness, a sense of energy

2. Depressants slow nervous system activity

3. Opioids (narcotics) reduce pain

4. Hallucinogens produce altered perceptions

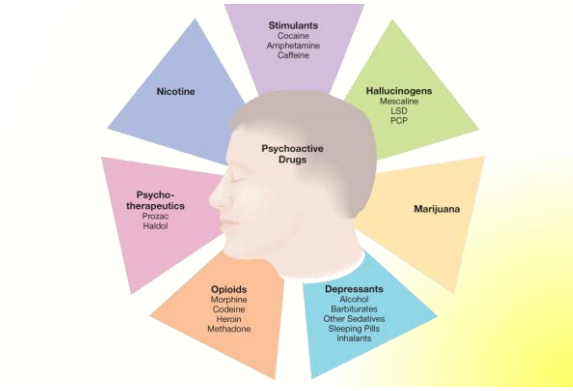
5. Psychotherapeutics control mental disorders

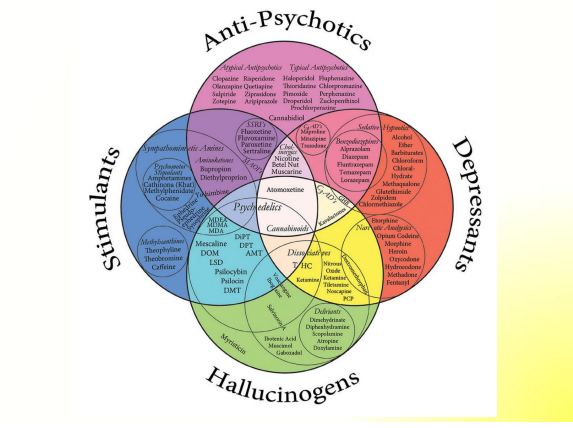
Some drugs have effects typical of more than one category

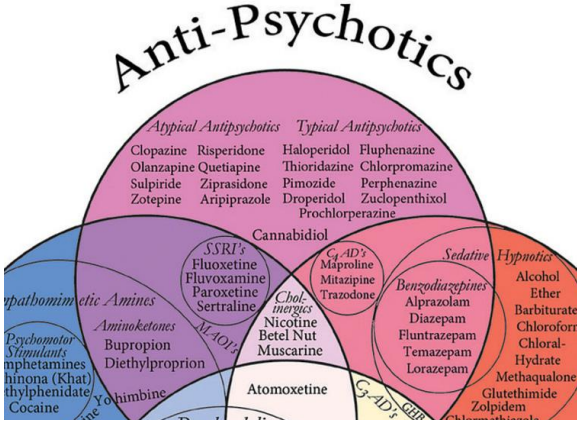
6. Marijuana

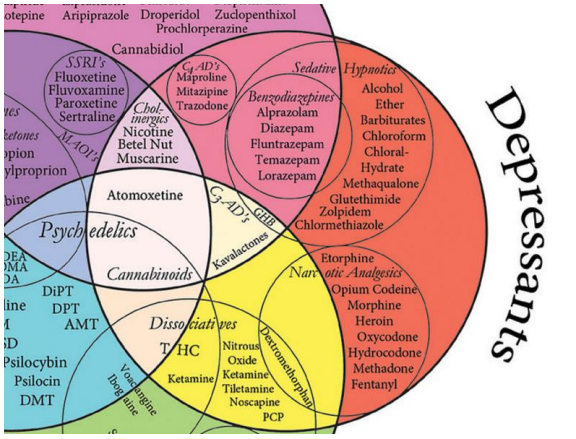
7. Nicotine

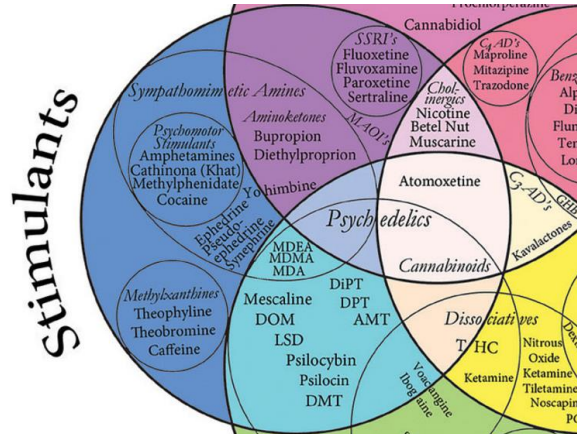
Classification of Psychoactive Drugs








Depressants
Cannabidiol
SSRI's
Fluoxetine
Fluvoxamine
Paroxetine
Sertraline
Chol-inergics
Nicotine
Betel Nut
Muscarine
MAOI's
GABAD's
Maproline
Mitazipine
Trazodone
Benzodiazepines
Alprazolam
Diazepam
Fluntrazepam
Temazepam
Lorazepam
Sedative Hypnotics
Alcohol
Ether
Barbiturates
Chloroform
Chloral-Hydrate
Methaqualone
Glutethimide
Zolpidem
Chlormethiazole
Atomoxetine
GABAD's
GHB
Kavalactones
Psychedelics
Cannabinoids
Etorphine
Narcotic Analgesics
Opium Codeine
Morphine
Heroin
Oxycodone
Hydrocodone
Methadone
Fentanyl
DiPT
DPT
AMT
Dissociatives
THC
Nitrous Oxide
Ketamine
Tiletamine
Noscapine
PCP
Dextromethorphan
Voacangine
Ibogaine
Psilocybin
Psilocin
DMT


Stimulants
Cannabidiol
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Fluoxetine
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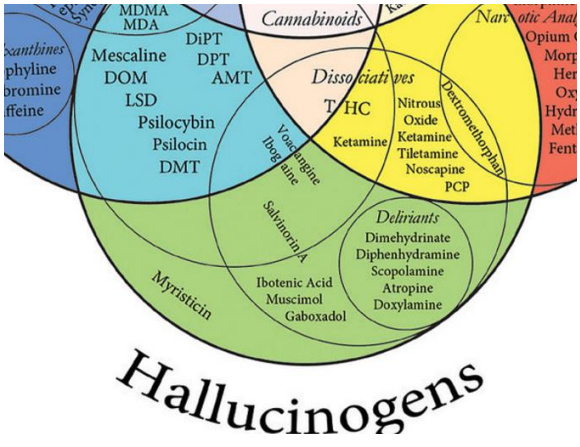
Paroxetine
Sertraline
GABAD's
Maproline
Mitazipine
Trazodone
Sympathomimetic Amines
Aminoketones
Bupropion
Diethylproprion
Psychomotor Stimulants
Amphetamines
Cathinona (Khat)
Methylphenidate
Cocaine
Chol-inergics
Nicotine
Betel Nut
Muscarine
MAOI's
Yohimbine
Ephedrine
Pseudo-ephedrine
Synephrine
Atomoxetine
GABAD's
Psychedelics
Cannabinoids
Kavalactones
MDEA
MDMA
MDA
DiPT
DPT
AMT
Methylxanthines
Theophylline
Theobromine
Caffeine
Mescaline
DOM
LSD
Psilocybin
Psilocin
DMT
Dissociatives
THC
Ketamine
Nitrous Oxide
Voacangine
Ibogaine


Hallucinogens
MDMA
MDA
Cannabinoids
DiPT
DPT
AMT
Mescaline
DOM
LSD
Psilocybin
Psilocin
DMT
Dissociatives
THC
Ketamine
Nitrous Oxide
Ketamine
Tiletamine
Noscapine
PCP
Dextromethorphan
Voacangine
Ibogaine
Salvinorin A
Deliriants
Dimehydrinate
Diphenhydramine
Scopolamine
Atropine
Doxylamine
Ibotenic Acid
Muscimol
Gaboxadol
Myristicin

1. Drug Facts

d. Identification

- It is important that both legal and illicit drugs be **identifiable by appearance**
- The ***Physician's Desk Reference*** (*PDR.net*) includes color photographs of many legally manufactured pharmaceuticals
- **Illegal drugs** are sometimes shaped, marked, or packaged in an identifiable way
- Drugs can be tested and identified by **chemical analysis**

Valium

2. Drug Effects

- **Nonspecific effects** derive from the user's unique background, expectations, perceptions, and environment (setting); e.g. a "bad acid trip", "happy drunk or sad drunk?"
- **Specific effects** depend on the presence of a chemical at certain concentrations; e.g. alcohol ataxia, dilation of eyes
- **Placebo effects** are those produced by an inactive chemical that the user believes to be a drug
  - Especially important in treating pain and psychological depression

2a. Double-Blind Procedure

- Because of nonspecific effects (for instance bias of subject to act in a way expected by a doctor or researcher) **double-blind tests** are needed to evaluate the effectiveness of a drug;
- Neither the test subjects nor the evaluators knows whether a subject is receiving an experimental drug or a placebo until the drug trial is over.

2b. Animal Testing: Effective and Lethal Doses

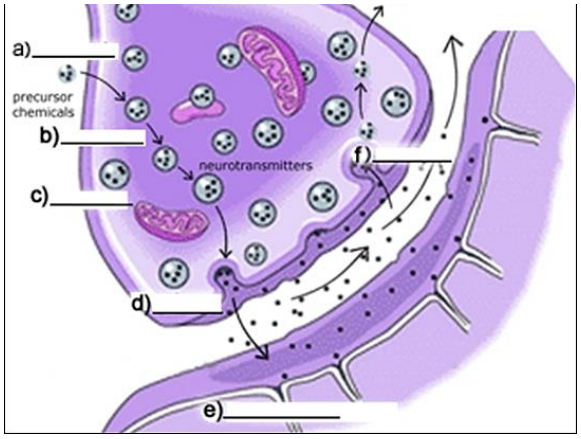
- **Effective dose** = the dose of a drug that produces a meaningful effect in some percentage of test subjects
  - ED_{50} refers to the effective dose for half the animal subjects in a drug test
- **Lethal dose** = the dose of a drug that has a lethal effect in some percentage of test subjects
  - LD_{50} refers to the lethal dose for half the animal subjects in a drug test
- **Therapeutic index** = LD_{50}/ED_{50}
  - Always greater than one

2c. Potency, Toxicity, and Safety Margin

- **Potency** = measured by the amount of a drug required to produce a given effect
- **Toxicity** = capacity of a drug to do damage or cause adverse side effects
- **Safety margin** = difference between:
  - Dose that produces the desired therapeutic effect in most patients
  - Lowest dose that produces an unacceptable toxic reaction
- Most drugs have an LD_1 well above the ED_{95}

2.d.Mechanisms of Drug Action

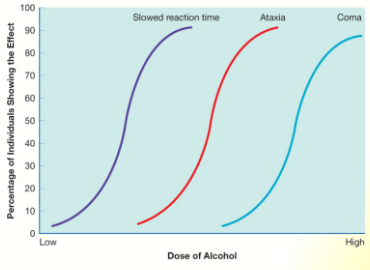
- Drugs have effects on all neurons
- Certain drugs have effects on specific neurotransmitter systems
  - **Drugs may alter** the availability of a neurotransmitter by changing the rate of **synthesis, metabolism, release, or reuptake**
  - Drugs may **activate or prevent the activation of a receptor**



2di.Dose-Response Relationship

- **Dose-response relationship** = correlation between the **response and quantity** of drug administered
- **Threshold** = the **dose at which an effect is first observed**
  - **Some response systems have higher thresholds than others**, so dose-response curves can be created for different drug effects (*ex. vomit response vs. dilation of eyes*)
  - Some drugs have an ***all-or-none* dose-response relationship** (for example, *ibuprofen* or *aspirin*) – **side effects** may accumulate but not drug response (*taking more than the recommended dose won't help and may hurt*).

Dose-Response Curve



Dose-response graph showing size of response relative to amount of drug administered; different systems/effects have different response thresholds

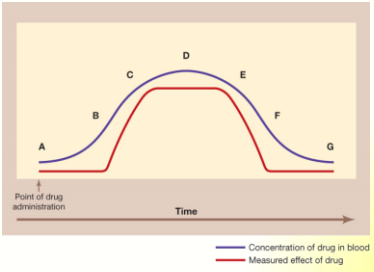
3. Time-Dependent Factors

Drugs vary in the timing of the onset, duration, and termination of their effects.

a. The **time course** of a drug **depends on how the drug is administered, how rapidly is it absorbed, and how it is eliminated** from the body

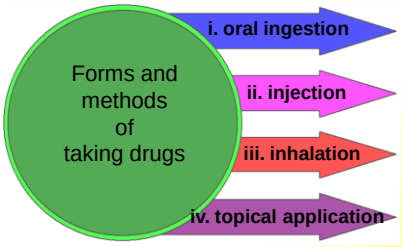
- Drug effects can be prolonged by taking additional doses at intervals determined by the time course of the drug (like ***time-release*** *capsules*)
- Taking multiple doses too close together will increase the maximum blood level of the drug (***cumulative effects***.)

3. Time-Dependent Factors

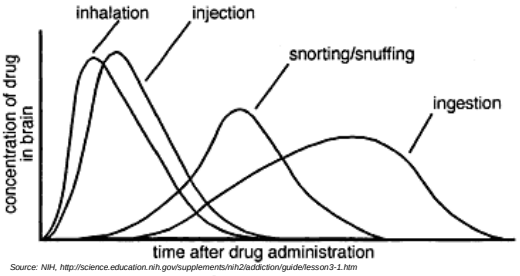


Possible relationship between drug concentration in the body and measured effect of the drug

3b. Routes of Administration



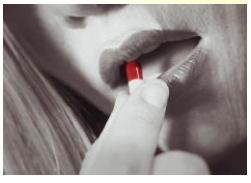
b. Routes of Administration: Time to Max. Concentration



Source: NIH, http://science.education.nih.gov/supplements/nih2/addiction/guide/lesson3-1.htm

b. Routes of Administration: i. Oral Ingestion

- Absorption from the gastrointestinal (GI) tract is a complicated process
- **Drugs must withstand the digestive processes** and pass through the cells lining the GI tract into the bloodstream
- Drugs from the GI tract travel **through veins first to the liver**, where they may be metabolized



b. Routes of Administration: ii. Injection

ii.1. Intravenous (IV) injection involves putting the drug directly into the bloodstream

- Effects are **rapid**
- **High concentrations** can be delivered
- Irritating material can be injected this way
- ***Veins can be damaged*** over time
- ***Infections*** can be directly introduced into the bloodstream

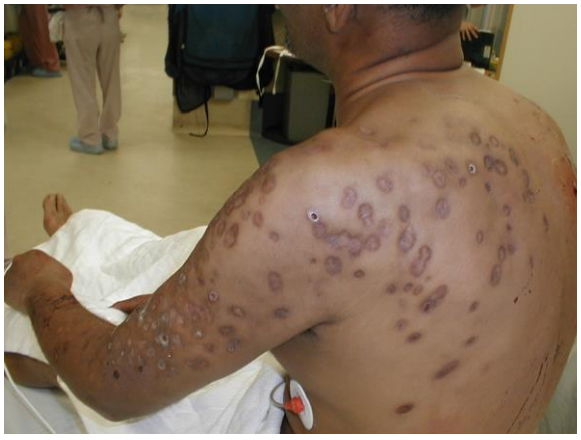
b. Routes of Administration:
ii. Injection

ii.2. Subcutaneous injection (under the skin)

- Known as “skin popping” (most commonly cocaine, opiates and barbiturates)
- Can cause skin necrosis

ii.3. Intramuscular injection (into a muscle)

- Absorption is more rapid than subcue injection due to the greater blood supply in muscles



b. Routes of Administration:
iii. Inhalation

- The drug moves from the **lungs into the bloodstream through capillary walls**
- Effects are rapid because **blood moves quickly from the lungs to the brain**

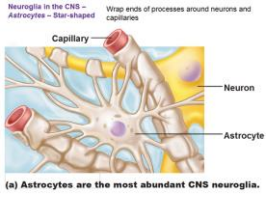
b. Routes of Administration:
iv. Topical Application

- Absorption through the skin can provide **slow, steady drug delivery**
- Absorption through the mucous membranes occurs more rapidly

When a user snorts cocaine, the drug is absorbed through the mucous membranes in the nose; it is not inhaled.

3.c. Blood-Brain Barrier (BBB)

- Some drugs can't cross the **blood-brain barrier**; they act only on peripheral nerves (e.g. some pain meds)
- **Only lipid(fat)-soluble substances can leave capillaries in the brain and effect neurons**
- **Index of compounds regarding the BBB**
- Many brain capillaries are covered with glial cells, also increasing the difficulty for compounds to pass out of the capillaries
- **Active transport systems** may be needed to move chemicals in and out of the brain
- Trauma and infections can impair the blood-brain barrier



(a) Astrocytes are the most abundant CNS neuroglia.

3.d. Drug Interaction

- Combining **depressants** can cause respiratory depression
- **Stimulants + antidepressants** can lead to overexcitement, high blood pressure, and arrhythmia
- **Stimulants + depressants** can lead to explosive and dangerous behaviors
- **Cocaine + alcohol** produces a potent and toxic substance called *cocaethylene*

4. Drug Deactivation

a. A drug ceases to have an effect when it is **excreted unchanged from the body or is chemically changed**

b. The key **drug-metabolizing liver enzymes** are a group known as **CYP450**

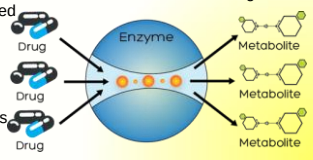
- The resulting metabolite no longer has the same action as the drug
- The resulting metabolite can be excreted by the kidneys

4.c. Enzyme Induction

When the body's cells detect the presence of foreign **drugs**, they **trigger production of more of the specific metabolizing enzyme**:

- Causes **tolerance**
- Causes **interaction of drugs broken down by the same enzyme**

- Enzyme activity returns to normal some time after the inducing drug is no longer being used
- **Enzyme induction** and tolerance can occur after use of prescription and OTC drugs, dietary supplements, or illicit drugs



4.d. Mechanisms of Tolerance and Withdrawal Symptoms

- **Drug-disposition tolerance:** A drug may induce ***metabolization or chemical change*** in the body that moderates its effect;
- **Behavioral tolerance:** Drug may have the same biochemical effect but a reduced behavioral effect as a ***drug user learns to compensate*** for nervous system impairment
- **Pharmacodynamic tolerance**
  - ***Sensitivity of neurons changes*** after repeated drug use
  - Can cause withdrawal reactions