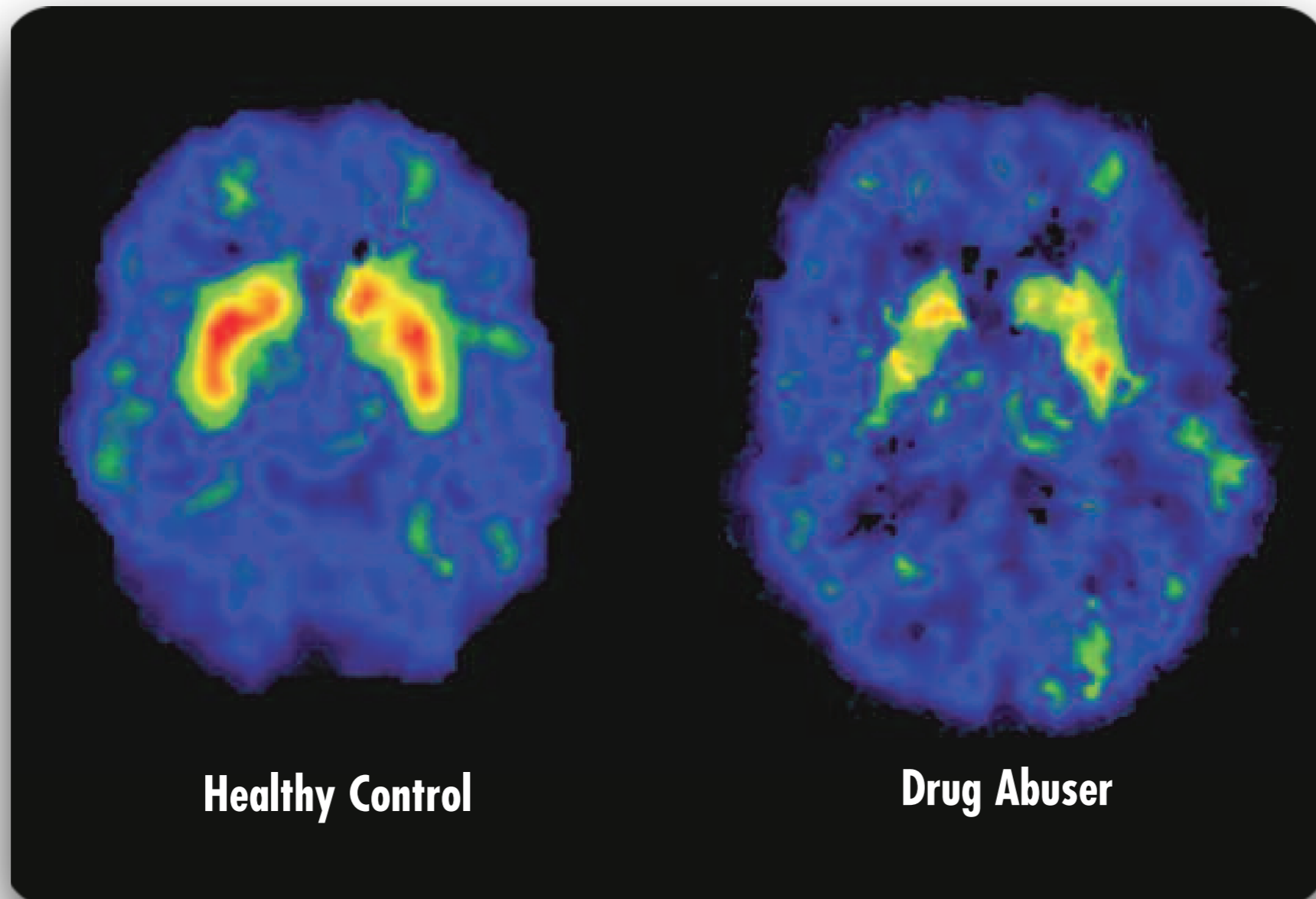


Neurobiology of Drug Abuse and Addiction

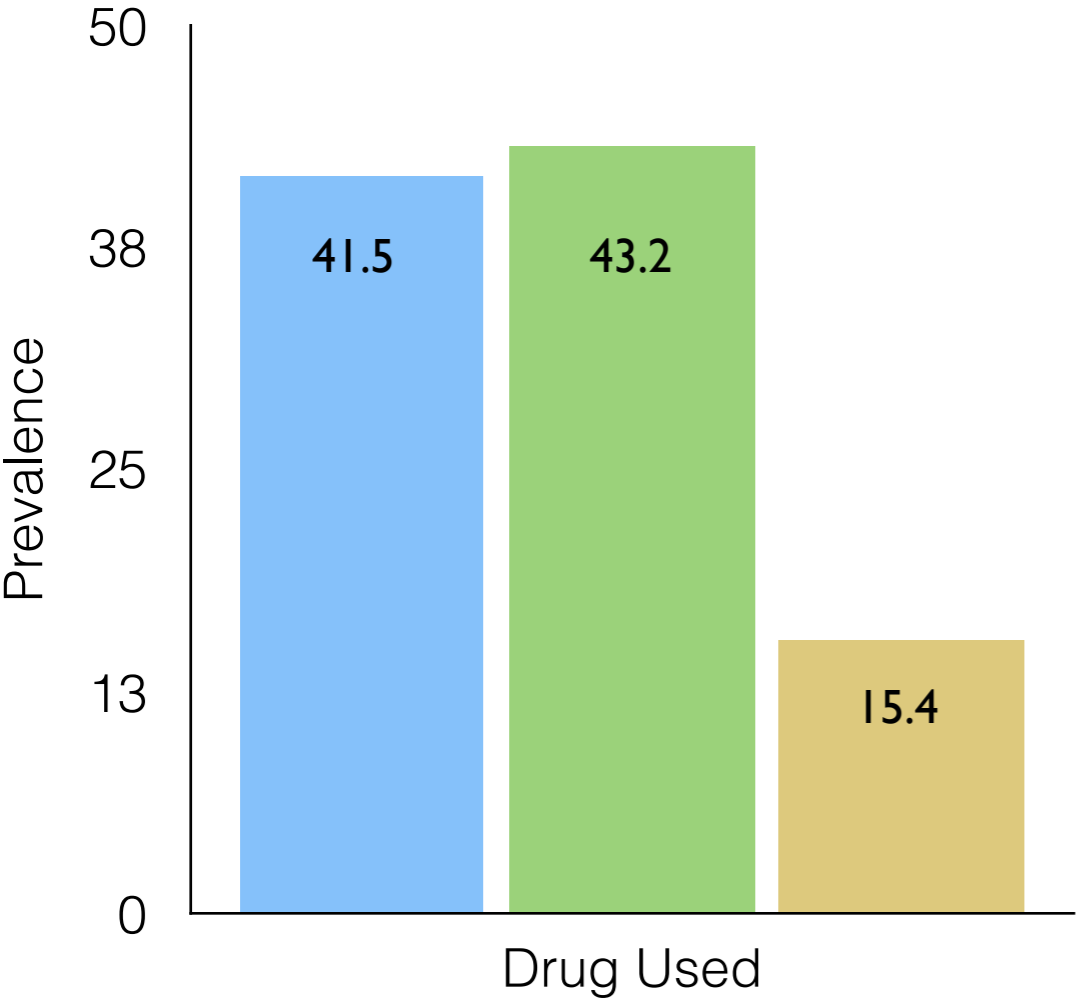
PSYC 450



Illicit drug use, lifetime and past year, in Canada

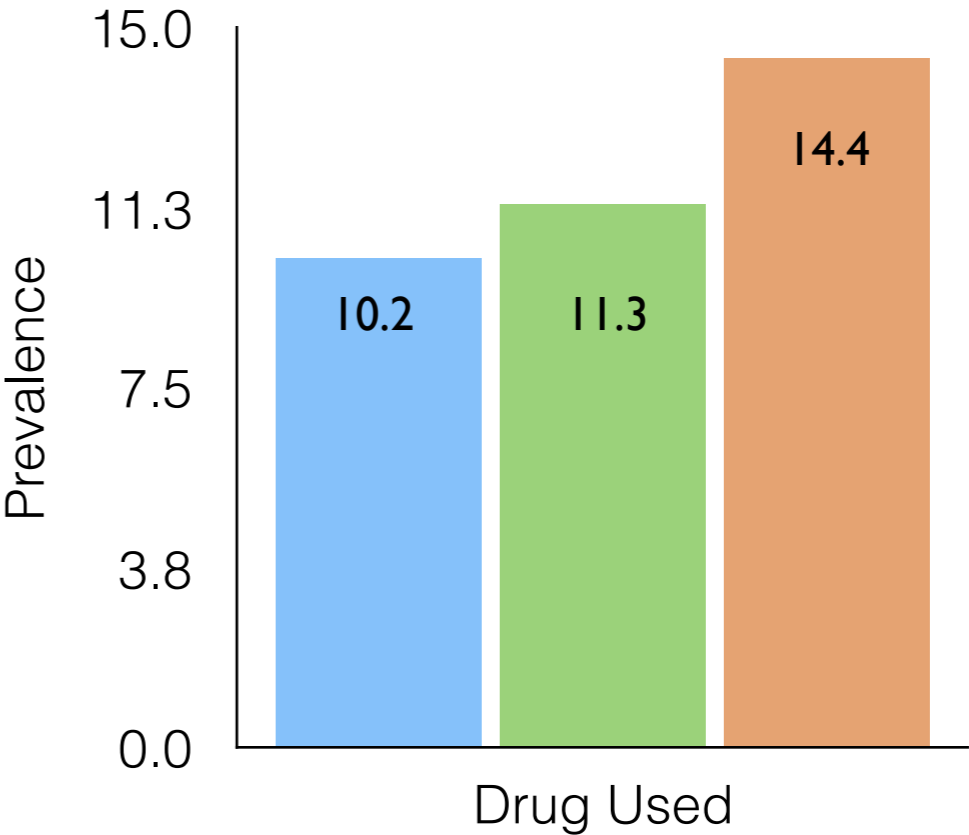
(CADUMS 2012)

- Canabis only
- Any drug
- Any of 5 drugs (without canabis)



Lifetime

- Canabis only
- Any drug
- (Risky alcohol use; past 7 days)

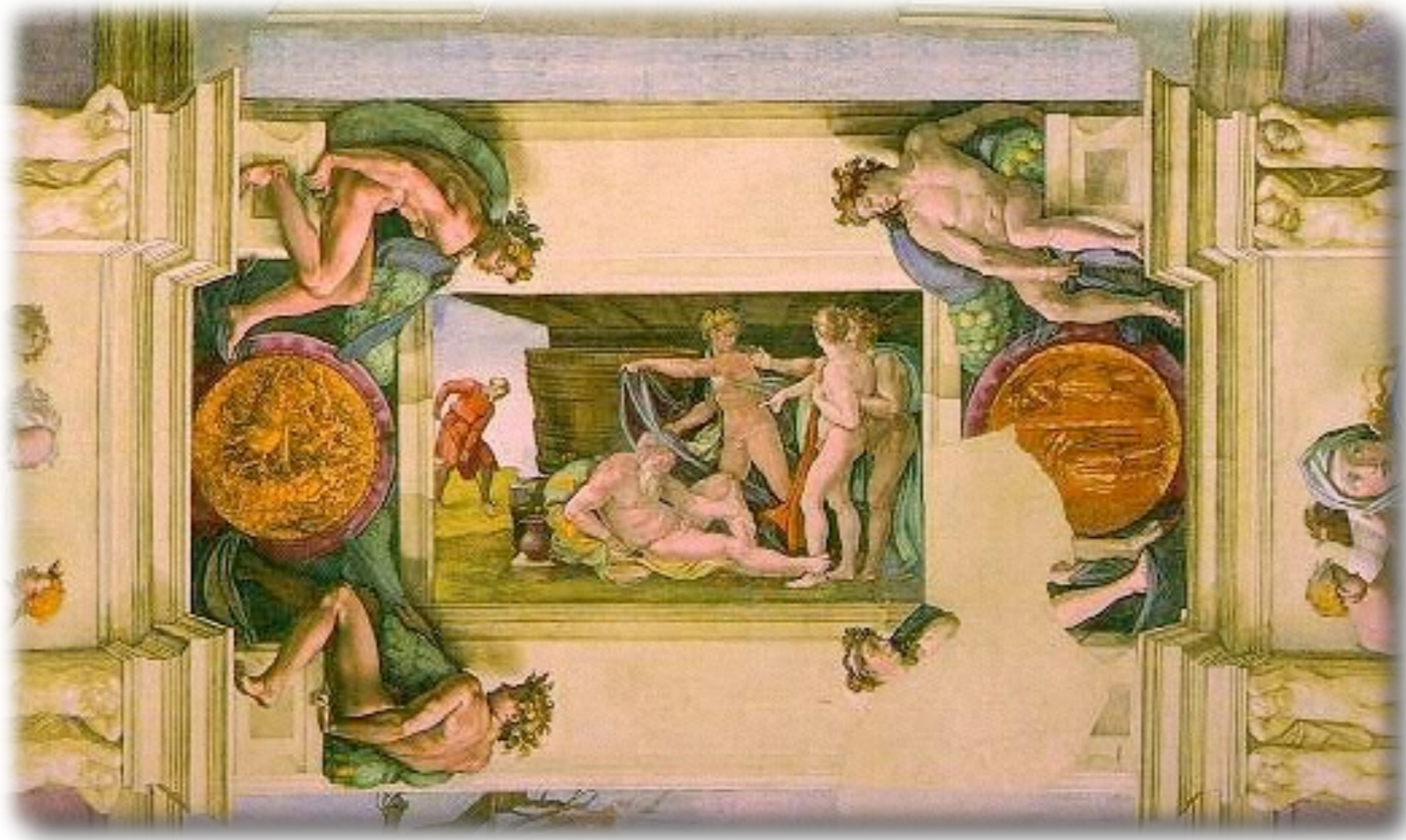


Past year

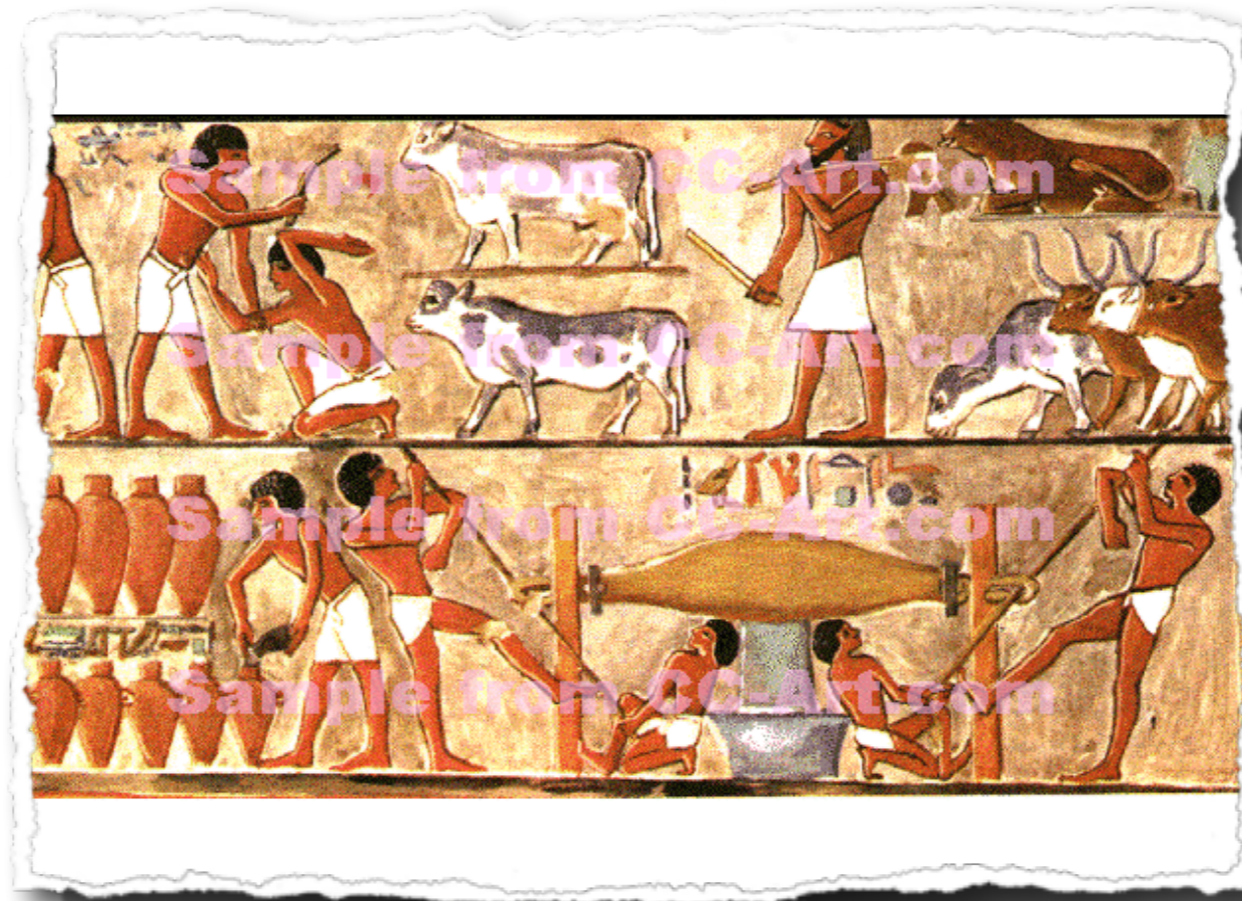
Psychoactive drugs: Historical perspective



Psychoactive drugs: Historical perspective



Psychoactive drugs: Historical perspective



Psychoactive drugs: Historical perspective



Psychoactive drugs: Historical perspective



Psychoactive drugs: Historical perspective



48 LSD Blotter Designs
Image by Erowid, © 2000 Erowid.org



99 Ecstasy (MDMA) Tablets
Image © 2000 Erowid.org



Cannabis spp. Leaves
Anonymous Photographer, © 2000 Erowid.org

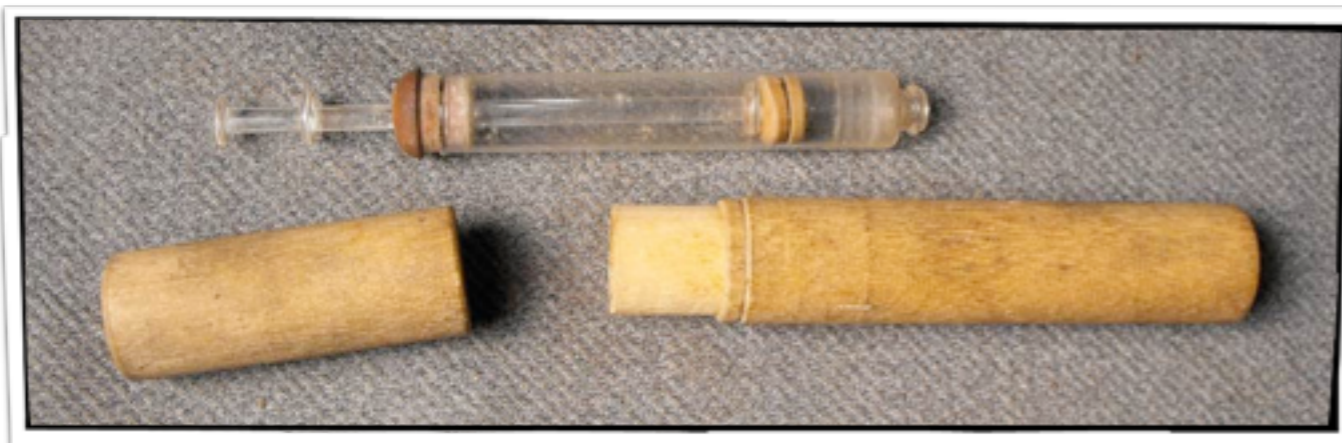
Drugs and the Law

- Opium and laudanum were used for recreation and pain relief in the 18th and 19th centuries



Drugs and the Law

- Chemical and technical advancement allowed wide spread use of morphine and heroin



BAYER Pharmaceutical Products
HEROIN-HYDROCHLORIDE
is pre-eminently adapted for the manufacture of cough elixirs, cough balsams, cough drops, cough lozenges, and cough medicines of any kind. Price in 1 oz. packages, \$4.85 per ounce; less in larger quantities. The efficient dose being very small (1-48 to 1-24 gr.), it is

Drugs and the Law

- Cocaine was used to treat fatigue and a large variety of ailments

**HIS HOLINESS POPE LEO XIII
AWARDS GOLD MEDAL**
In Recognition of Benefits Received from



VIN MARIANI
MARIANI WINE TONIC
FOR BODY, BRAIN AND NERVES

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MARIANI & Co., 52 WEST 15TH ST. NEW YORK.
FOR SALE AT ALL DRUGGISTS EVERYWHERE. AVOID SUBSTITUTES. BEWARE OF IMITATIONS.
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**COCAINE
TOOTHACHE DROPS**
Instantaneous Cure!
PRICE 15 CENTS.
Prepared by the
LLOYD MANUFACTURING CO.
119 HUDSON AVE., ALBANY, N. Y.
For sale by all Druggists.
(Registered March 1885.)

1885 Advertisement for Cocaine Toothache Drops

**TIRED,
THEN
DRINK
Coca-Cola**

IT RELIEVES EXHAUSTION

When the BRAIN is tiring under full pressure send down to the FOUNTAIN for a glass of

Coca-Cola

you will be surprised how quickly it will ease the Tired Brain--soothe the Rattled Nerves--and restore Wasted Energy to both Mind and Body.
It enables the entire system to readily cope with the strains of any excessive demands upon it.

AT ALL FOUNTAINS
ALSO IN BOTTLES 5c.

Drugs and the Law

1906 - Pure Food and Drug Act



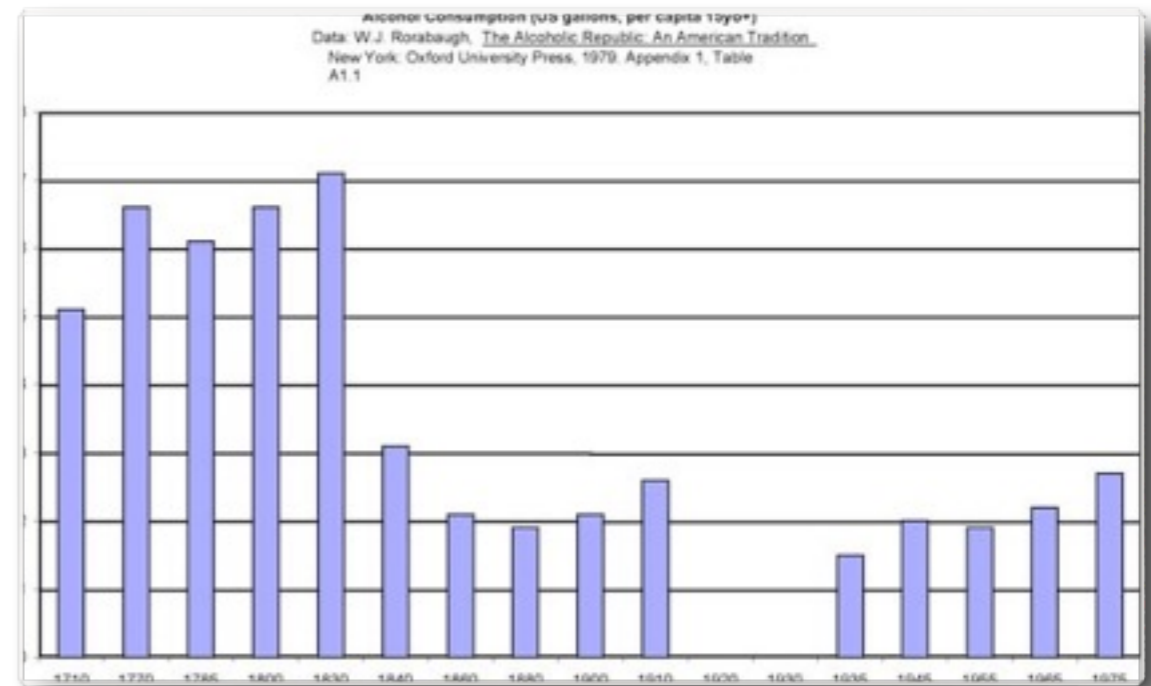
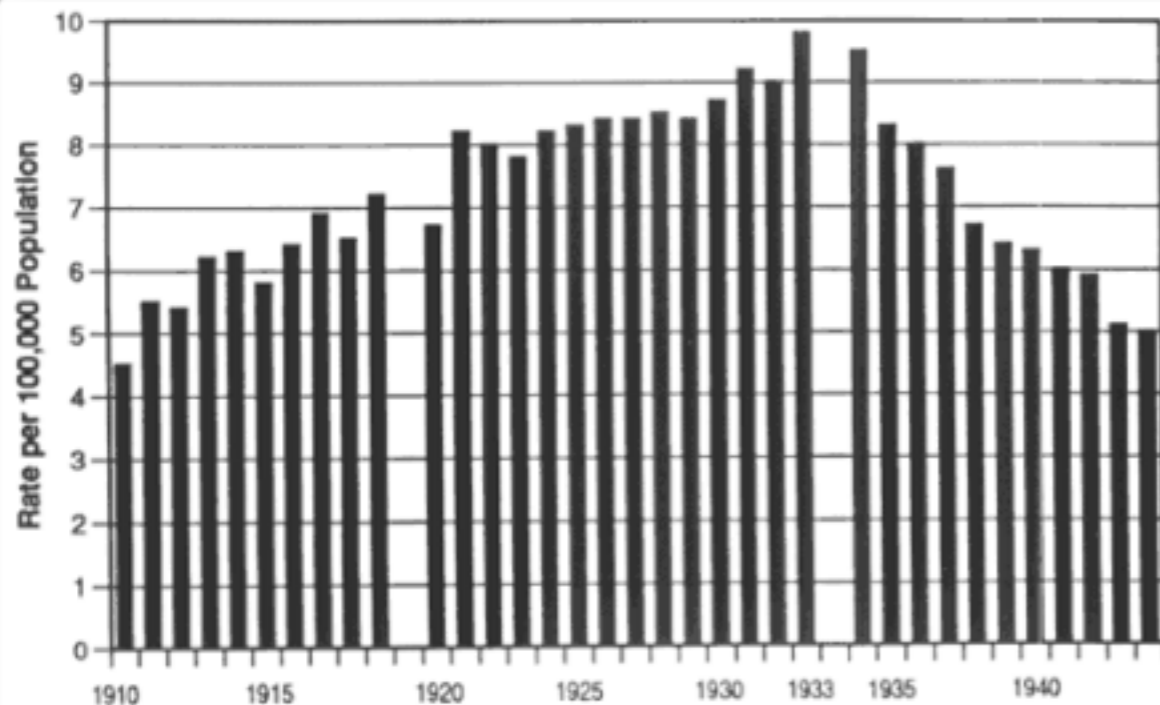
1914 - Harrison Act



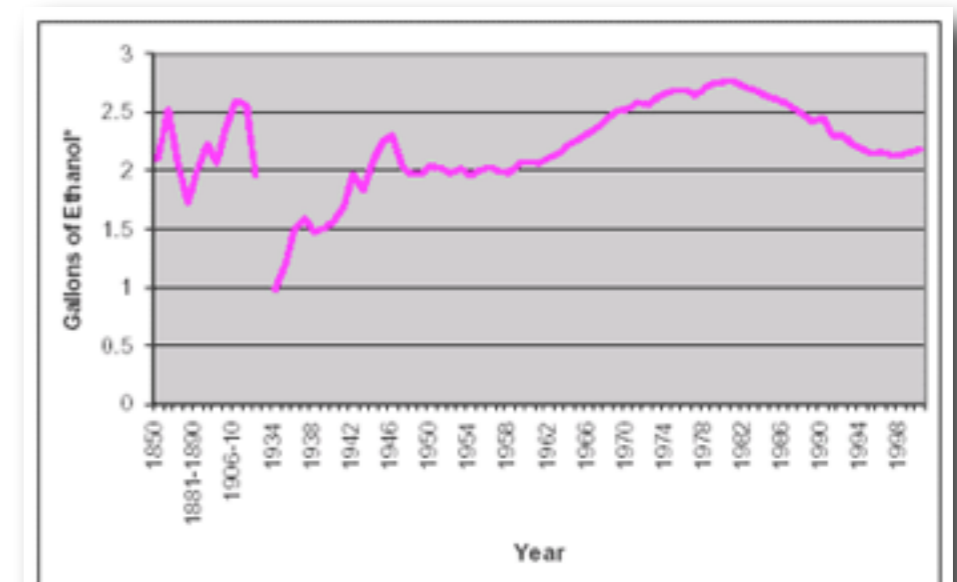
Drugs and the Law

1920 (to 1933) - 18th Constitutional Amendment (Alcohol prohibition)

Homicide rate



Consumption per capita

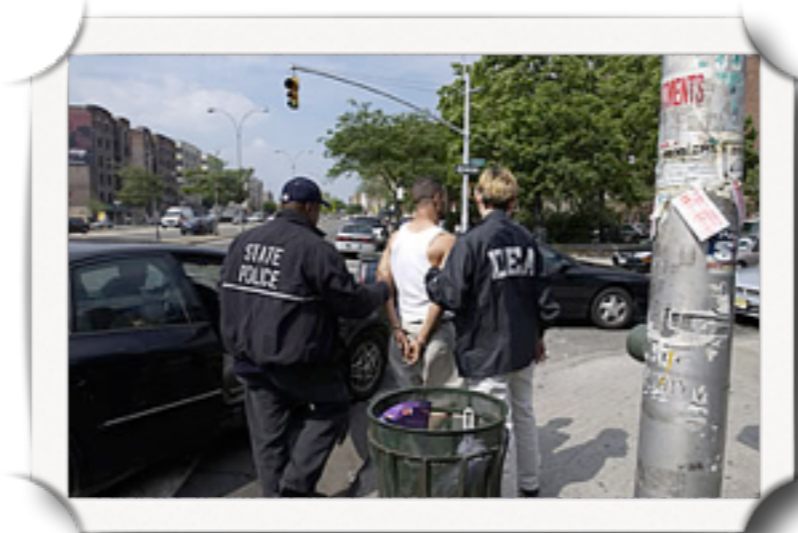


Drugs and the Law

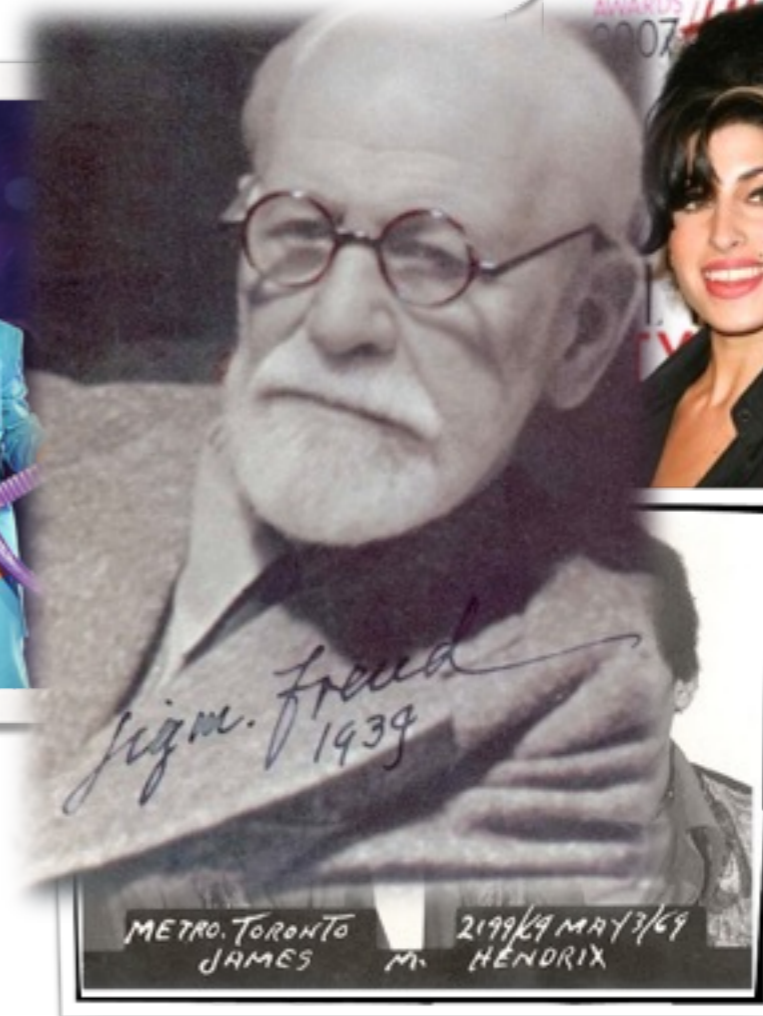
1937 - Marijuana Tax Act



1970 - Controlled Substance Act



What is Addiction?



“Certain individuals use certain substances in certain ways thought at certain times to be unacceptable by certain other individuals for reasons both certain and uncertain.”

Tolerance

Diminished response to drug administration following repeated exposure

- Reversible when drug use stops
- Dependent on dose, frequency, and drug-taking context
- Tolerance can develop to different effects of a drug at different rates and disappear at different rates. Some effects may never develop any tolerance

Tolerance: mechanisms

- Metabolic (dispositional) Tolerance: Changes in the body's ability to metabolize the drug (enzyme induction)
- Physiological (pharmacodynamic) Tolerance: Changes in the cellular function compensate for the repeated presence of the drug
- Behavioural (conditioned) tolerance: tolerance that arises for learning or conditioning mechanisms

Sensitization

The effects of a drug increase when administered repeatedly

- Development is dose and frequency dependent
- There is cross-sensitization between drug (like cocaine & amphetamine) and environmental events (stress)
- Persists for a very long time (for ever?)

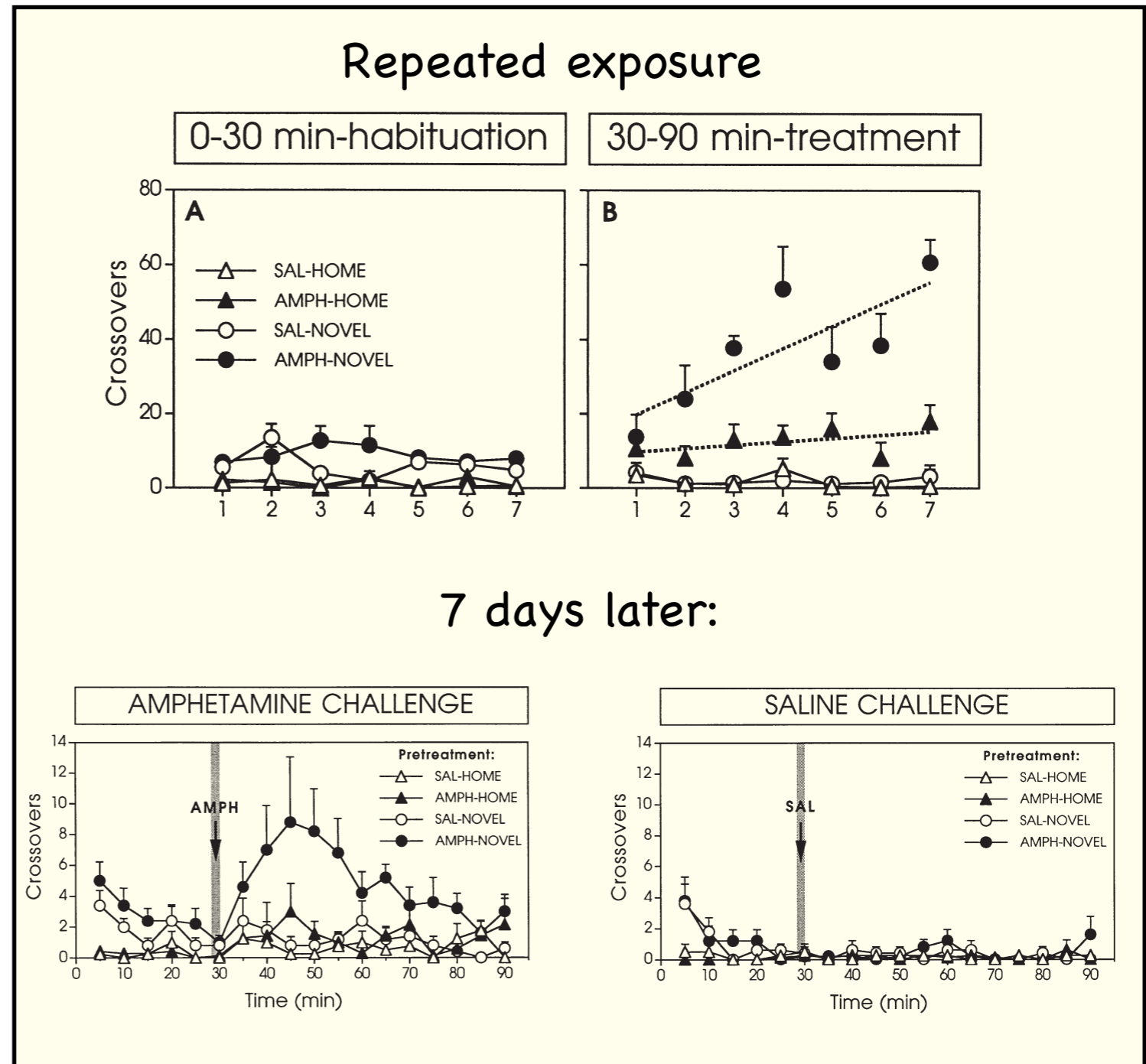
Sensitization: mechanisms

- Physiological adaptations (cellular and molecular)
- Conditioned effects

Sensitization

Effects of repeated administration of amphetamine on locomotor activity in rats

- 0.375 mg/kg (i.v.) amphetamine
- 7 days repeated exposure to AMPH or saline, followed by 7 undisturbed days



Withdrawal Symptoms

Physiological changes that occur when the drug use is stopped or the dose decreased

- Different drugs produce different withdrawal symptoms
- Some drugs cause severe withdrawal when use stops (heroin, alcohol), while abstinence from other drugs results in very mild symptoms or none at all (marijuana)

What is Addiction?

DSM-V “Opioid Use Disorder” Criteria

A problematic pattern of opioid use leading to clinically significant impairment or distress, as manifested by at least two of the following, occurring within a 12-month period:

Impaired control

1. Opioids are often taken in **larger amounts or over a longer period** than was intended.
2. There is a **persistent desire or unsuccessful efforts** to cut down or control opioid use.
3. **A great deal of time is spent** in activities necessary to obtain the opioid, use the opioid, or recover from its effects.
4. **Craving**, or a strong desire or urge to use opioids.

Social impairment

5. Recurrent opioid use resulting in a **failure to fulfill major role obligations** at work, school, or home.
6. Continued opioid use despite having **persistent or recurrent social or interpersonal problems** caused or exacerbated by the effects of opioids.
7. Important social, occupational, or recreational activities **are given up or reduced** because of opioid use.

DSM-V “Opioid Use Disorder” Criteria (cont’d)

Risky use of drug

8. Recurrent opioid use in situations in which it is **physically hazardous**.
9. Continued opioid use despite knowledge of having a **persistent or recurrent physical or psychological problem** that is likely to have been caused or exacerbated by the substance.

Pharmacological criteria

10. **Tolerance**, as defined by either of the following:
 - a. A need for markedly increased amounts of opioids to achieve intoxication or desired effect.
 - b. A markedly diminished effect with continued use of the same amount of an opioid.

Note: This criterion is not considered to be met for those taking opioids solely under appropriate medical supervision.
11. **Withdrawal**, as manifested by either of the following:
 - a. The characteristic opioid withdrawal syndrome (refer to Criteria A and B of the criteria set for opioid withdrawal).
 - b. Opioids (or a closely related substance) are taken to relieve or avoid withdrawal symptoms.

Note: This criterion is not considered to be met for those individuals taking opioids solely under appropriate medical supervision.

The most addictive substances (?)

Schedule of controlled substances:

- I. No accepted medical use and high abuse potential (heroin, LSD, [Marijuana](#), MDMA)
- II. High abuse potential with severe psychic or physical dependence liability [opium, codeine, cocaine, amphetamine, methylphenidate (Ritalin), phencyclidine (PCP)]
- III. Less abuse potential than substances in I & II, including compounds containing limited amounts certain narcotic and non-narcotic drugs (barbiturates other than listed in another schedule, ketamine, products with low doses of hydrocodone-Vicodin)
- IV. Abuse potential less than Schedule III (Valium, Xanax, phenobarbital)
- V. Less abuse potential than those in Schedule IV, including preparations containing limited amounts of narcotics (generally cough suppressants and antidiarrheal drugs: Robitussin, Parepectolin)

Note that alcohol and nicotine are not controlled substances!

The most addictive substances (?)

Relationship between route of administration and addiction potential

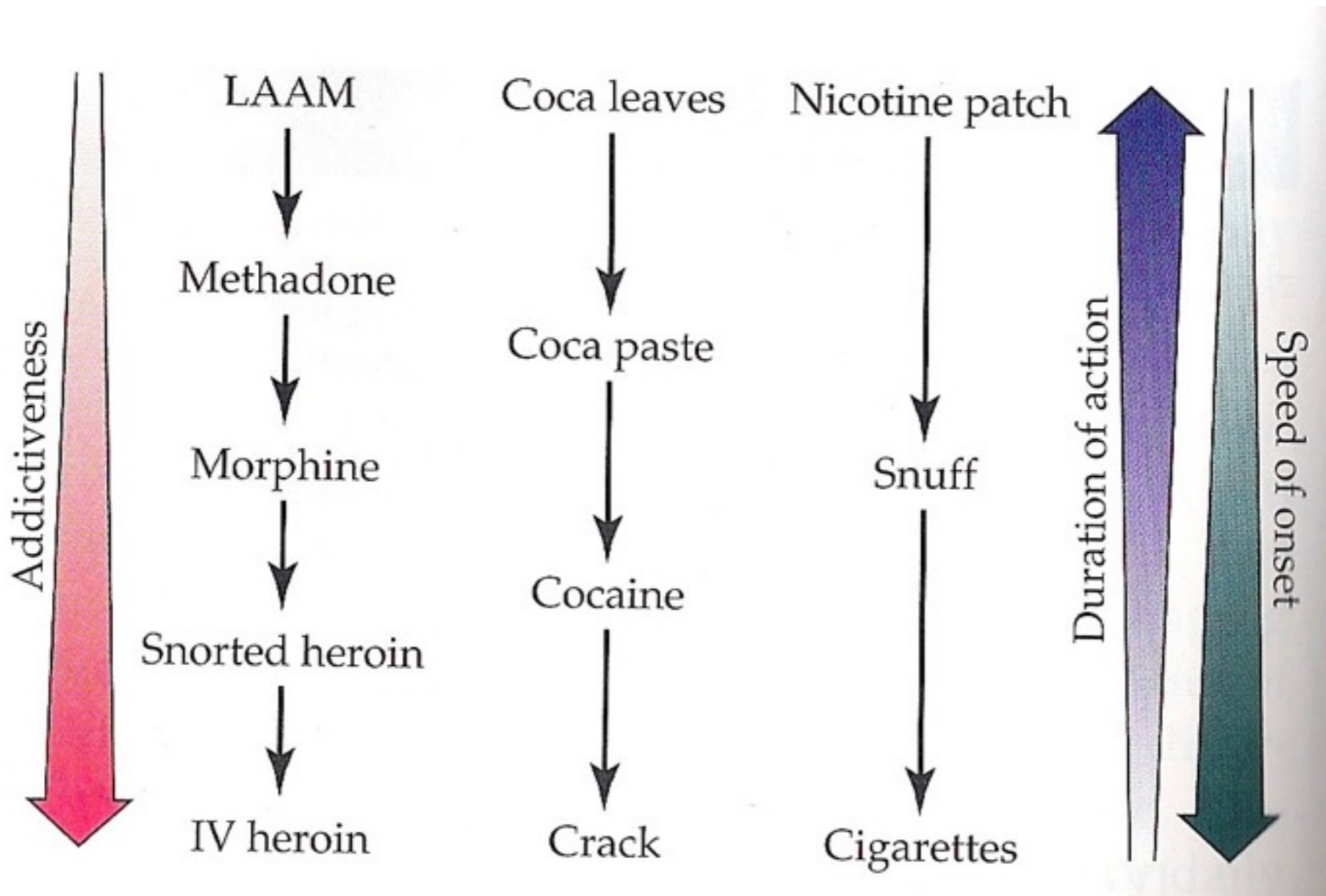


Figure 9.6 Meyer & Quenzer 2ed ed.