Introduction to Medical Psychology
Lecture 12: Substance Abuse

Richard Veale

Graduate School of Medicine
Kyoto University

https://youtu.be/PolSXo3quGU

Lecture video at above link.

Today: Substance Abuse & Dependence

Substance abuse and dependence

- Abuse and dependence – definitions
- Alcohol use disorder
- Short and long-term effects of alcohol intake
- Tolerance and withdrawal
- Comorbidities
- Environmental factors
- Therapy for substance use disorders

Abuse vs Dependence

Substance abuse:

1) Excessive use of a substance resulting in potentially hazardous behavior (drunk driving, getting into fights, abusing family).
2) Continued use despite persistent social, psychological, occupational, or health problems.

Substance dependence:

Marked physiological need for increasing amounts of the substance; tolerance (more is needed for the same effect) and withdrawal symptoms (drug abstinence leads to unpleasant physical symptoms).

Example: Alcohol Use

Alcohol use disorder

A problematic pattern of alcohol use leading to significant impairment or distress, with two of the following:

1) Alcohol is consumed in larger amount or longer than intended.
2) Desire to control alcohol use.
3) A great deal of time is used to obtain or use alcohol or to recover from its effects.
4) Craving for alcohol.
5) Recurrent alcohol use resulting in a failure to fulfill obligations (work, school, or home).
6) Continued alcohol use despite interpersonal problems caused by the effects of alcohol.
7) Important social, occupational, or recreational activities are given up.
8) Recurrent alcohol use in situations in which it is dangerous.
9) Alcohol use despite knowledge of having a problem with it.
10) Tolerance
11) Withdrawal effects

based on Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-V)

Alcohol is an *Addictive Dangerous Drug*

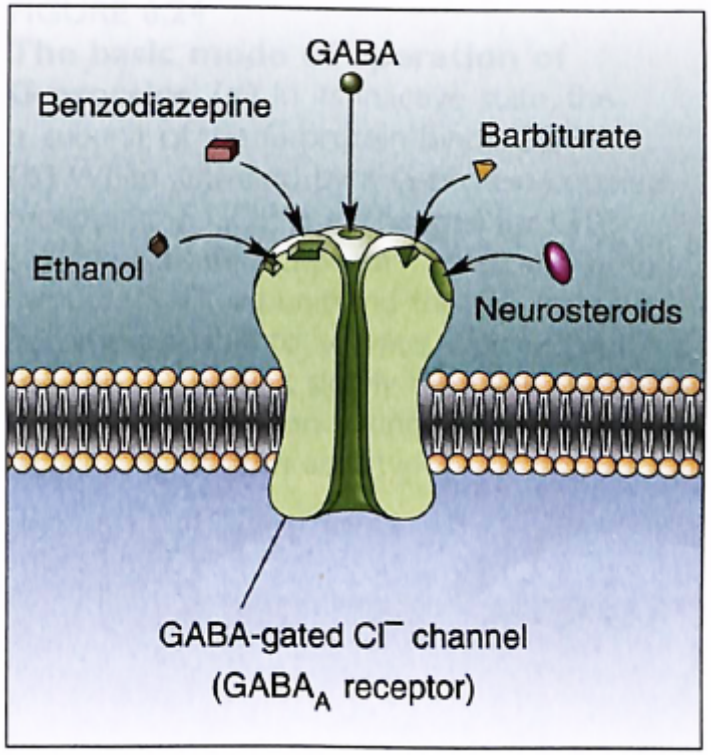
Alcohol (ethanol) has effects on various neurotransmitter receptors. It is water and fat soluble. It enhances activity of GABA (gamma-amino-butyric acid) receptors. GABA is the main inhibiting neurotransmitter in the central nervous system.

Low doses of alcohol can feel stimulating (disinhibition), but higher doses suppress brain function due to GABA's inhibitory effect.

Very high doses (blood level of 0.5%) of alcohol can lead to depression of respiration and death.

What other addictive hard drugs do you know?

→ Heroin, Methamphetamines, …?



Bear, Neuroscience

Mechanisms of most recreational drugs

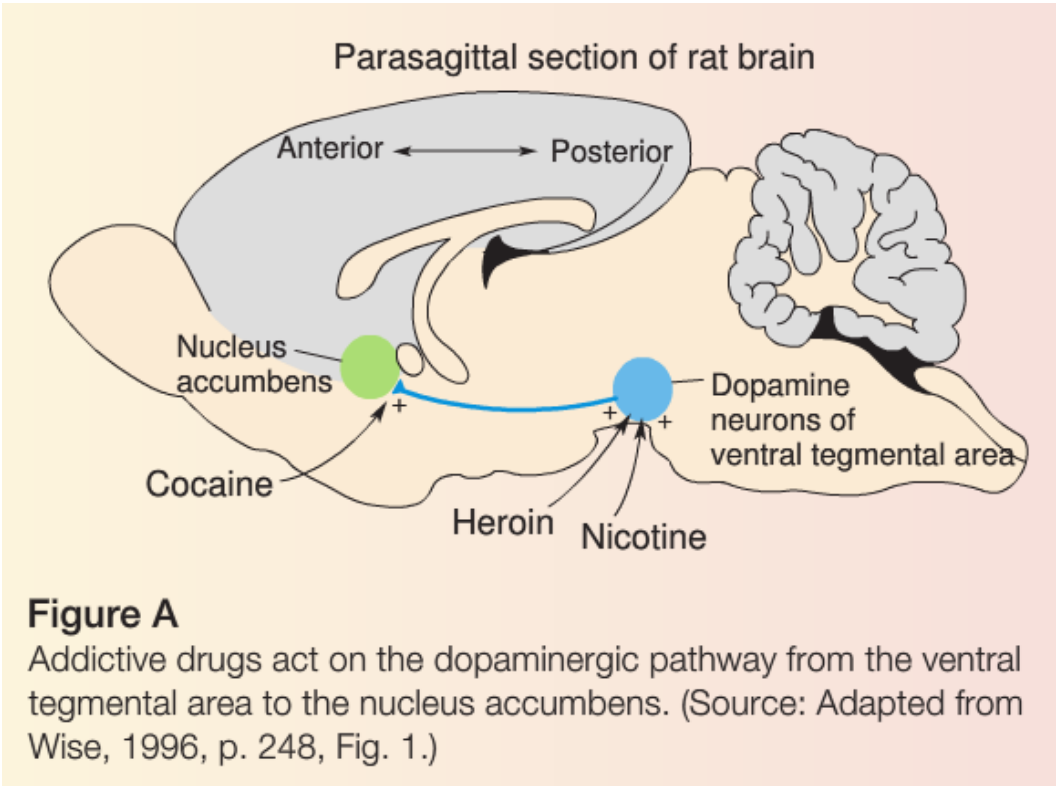
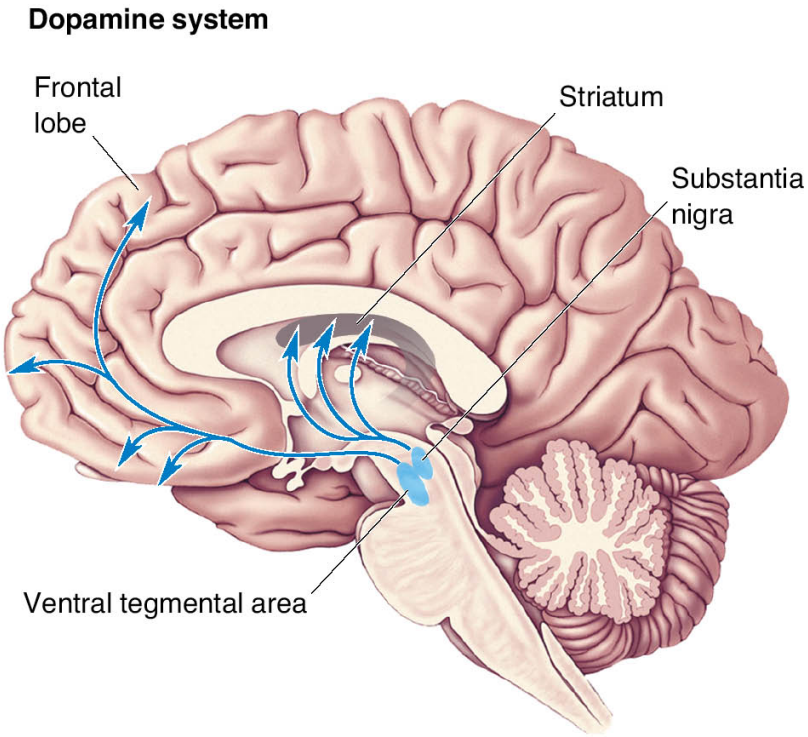


Figure A
Addictive drugs act on the dopaminergic pathway from the ventral tegmental area to the nucleus accumbens. (Source: Adapted from Wise, 1996, p. 248, Fig. 1.)

Most of the drugs taken for pleasure have an effect on the dopamine "reward" system. Alcohol affects this system too.



Two major dopaminergic pathways:
Mesocorticolimbic pathway from ventral tegmental area to frontal lobe (reward system).
Nigrostriatal pathway from substantia nigra to striatum.

Damage done by alcohol (social, personal)

Alcohol abuse is associated with

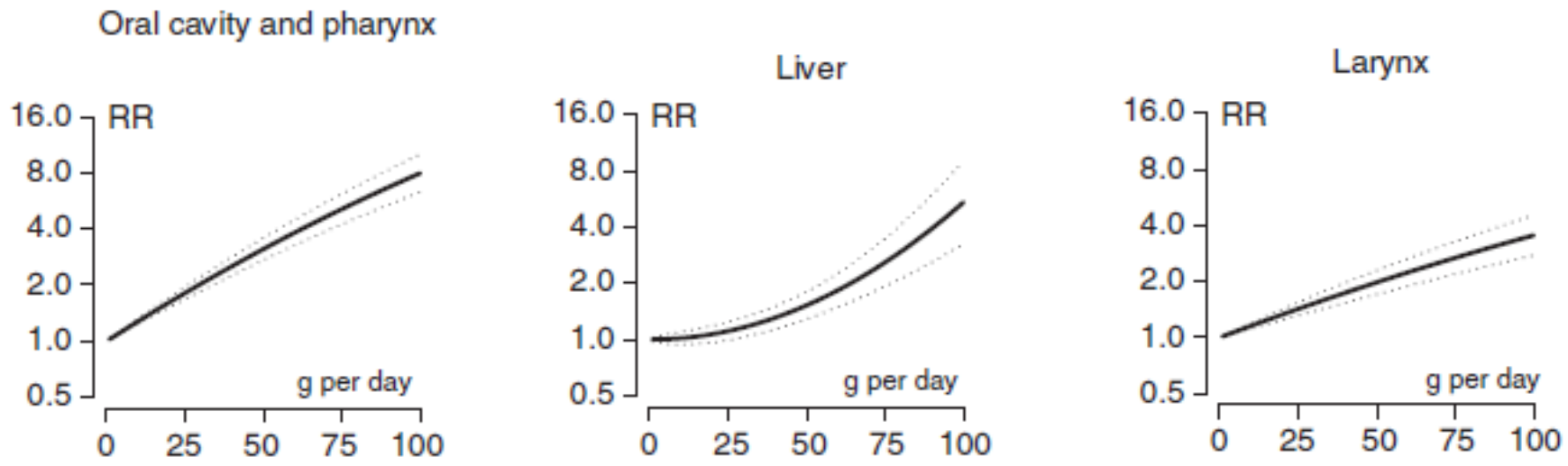
- 40% of deaths in automobile accidents
- 40-50% of murders
- >50% of rapes

(Butcher, Hooley, Mineka, Abnormal Psychology)

Liver cirrhosis
Brain damage
(both direct and indirect by insufficient vitamin B1 uptake -> Korsakoff's syndrome)
Cancers (even in regular low-to moderate drinkers)

Damage done by alcohol: Cancer

Even low intake of alcohol/day increases the risk for some cancers (Bagnardi et al., BJC, 2015). 25g of alcohol is about one pint of beer (568ml) or a large glass (250ml) of wine.



RR: Relative Risk: likelihood that some event (cancer) occurs under one circumstance (e.g., drinks 100g/day) compared to non-occurrence of this circumstance (e.g., drinks 0g/day).

Tolerance

The body adapts itself to increased substance intake and can endure more of that substance:

1) **Metabolic tolerance**

The amount of a substance that reaches the site of action (receptors in the brain) is reduced. It is metabolized before it has any effect.

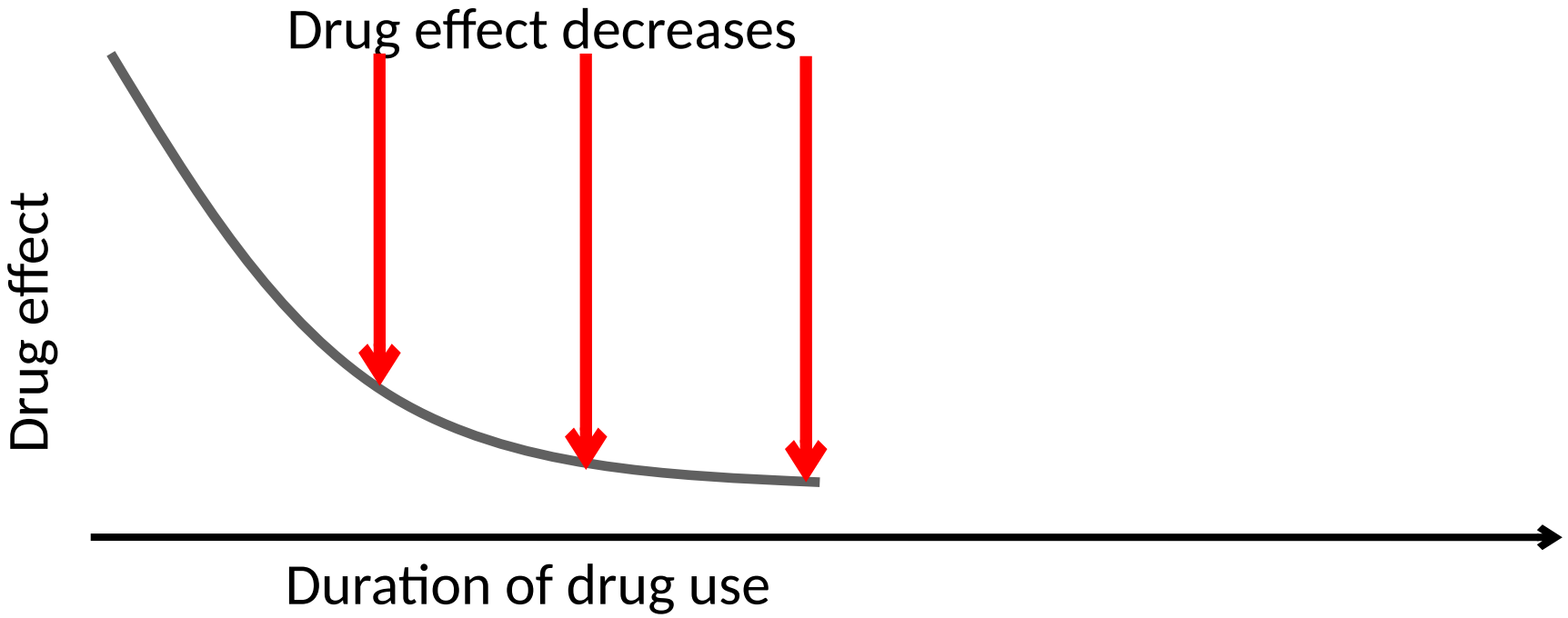
For example, long-term alcohol consumption leads to increased production of the enzyme alcohol dehydrogenase (causes strain to the liver, will result in liver deficiency and reduced alcohol tolerance in the long run).

2) **Functional tolerance**

Decreased sensitivity at the site of action of a substance.

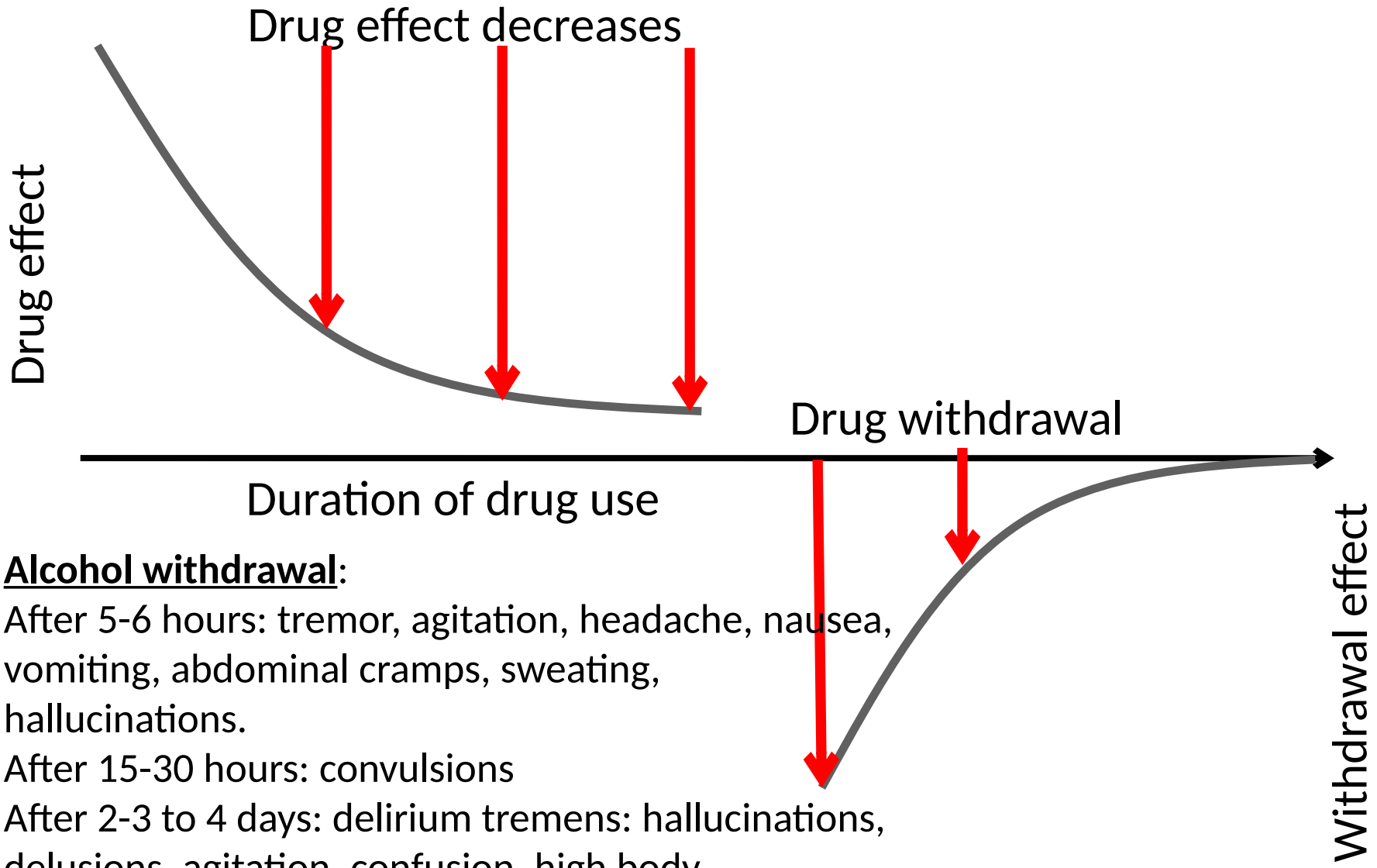
For example, long-term alcohol consumption decreases sensitivity of GABA receptors to alcohol, possibly by changes in receptor density or receptor protein modification.

Withdrawl



Withdrawal effects are assumed to be caused by the neural adaptations (red arrows) that occur during the build-up of drug tolerance.

Withdrawl



<u>Alcohol withdrawal</u>:
After 5-6 hours: tremor, agitation, headache, nausea, vomiting, abdominal cramps, sweating, hallucinations.
After 15-30 hours: convulsions
After 2-3 to 4 days: delirium tremens: hallucinations, delusions, agitation, confusion, high body temperature, rapid heartbeat.

Co-morbidity

Comorbidity describes the likelihood that patients with one disorder/disease also suffer from another.

Patients with alcohol dependence:

are **3.6** times more likely to have a **mood disorder** (depression, etc.) than the normal population

are **2.6** times more likely to suffer from an **anxiety disorder**

are **2.2** times more likely to suffer from **PTSD**

(National Institute on alcohol abuse and alcoholism, 1996)

The reasons for this comorbidity may be various, but it has been proposed that many patients use alcohol for “self-medication”.

Environmental Factors

Pictures: Platoon

Studies reported that 1970-71, 34% of army men in Vietnam have tried heroin, 20% were addicted (Robin L.N., Addiction, 1993).

How could these men be reintegrated into society?

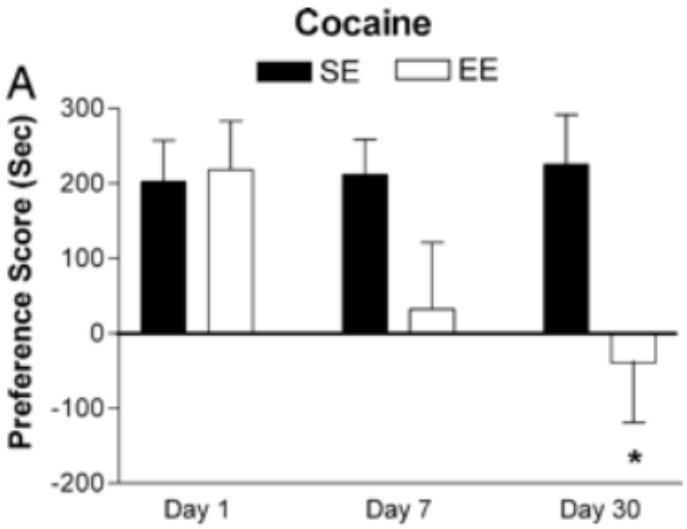
To everyone's surprise, only 5% of heroin-addicted servicemen used heroin at home after coming back to the US (1-year follow-up).

This is in contrast to other non-war-related addict populations, that show relapse rates of 70% or more after 6 months.

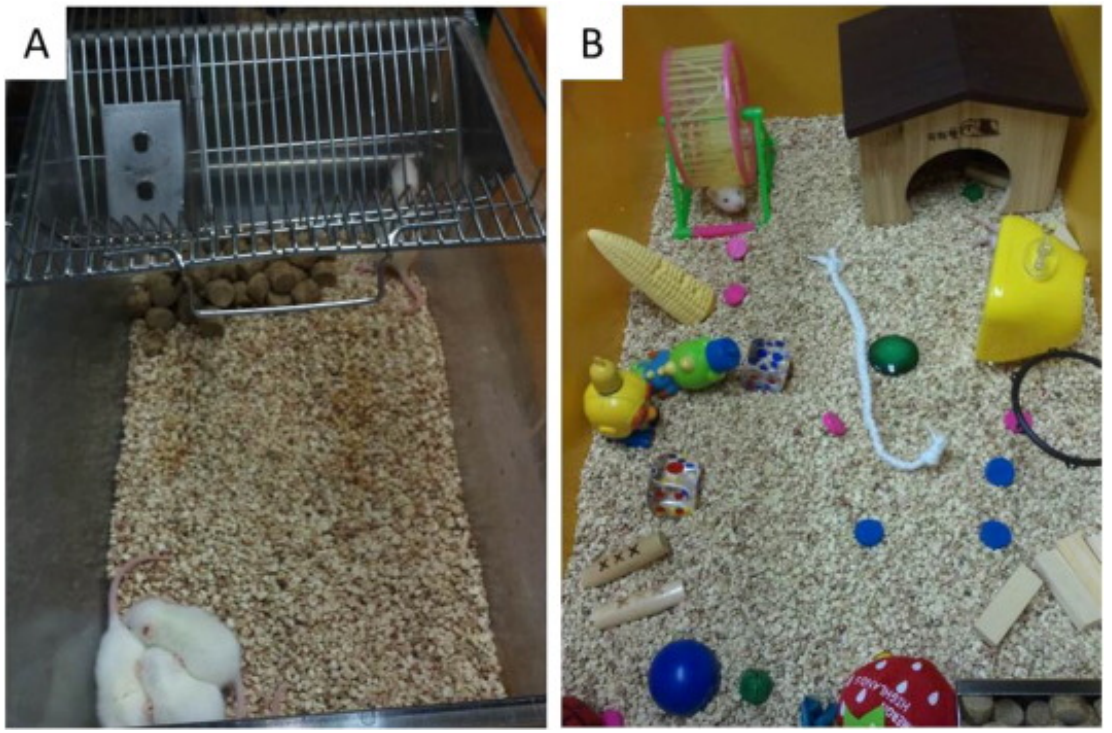
One factor that is discussed is the drastic change to a better environment when returning.

Environmental Enrichment

In mice, growing up in an enriched environment can protect against drug addiction (e.g. cocaine, Solinas et al., Neuropsychopharmacology 2009).

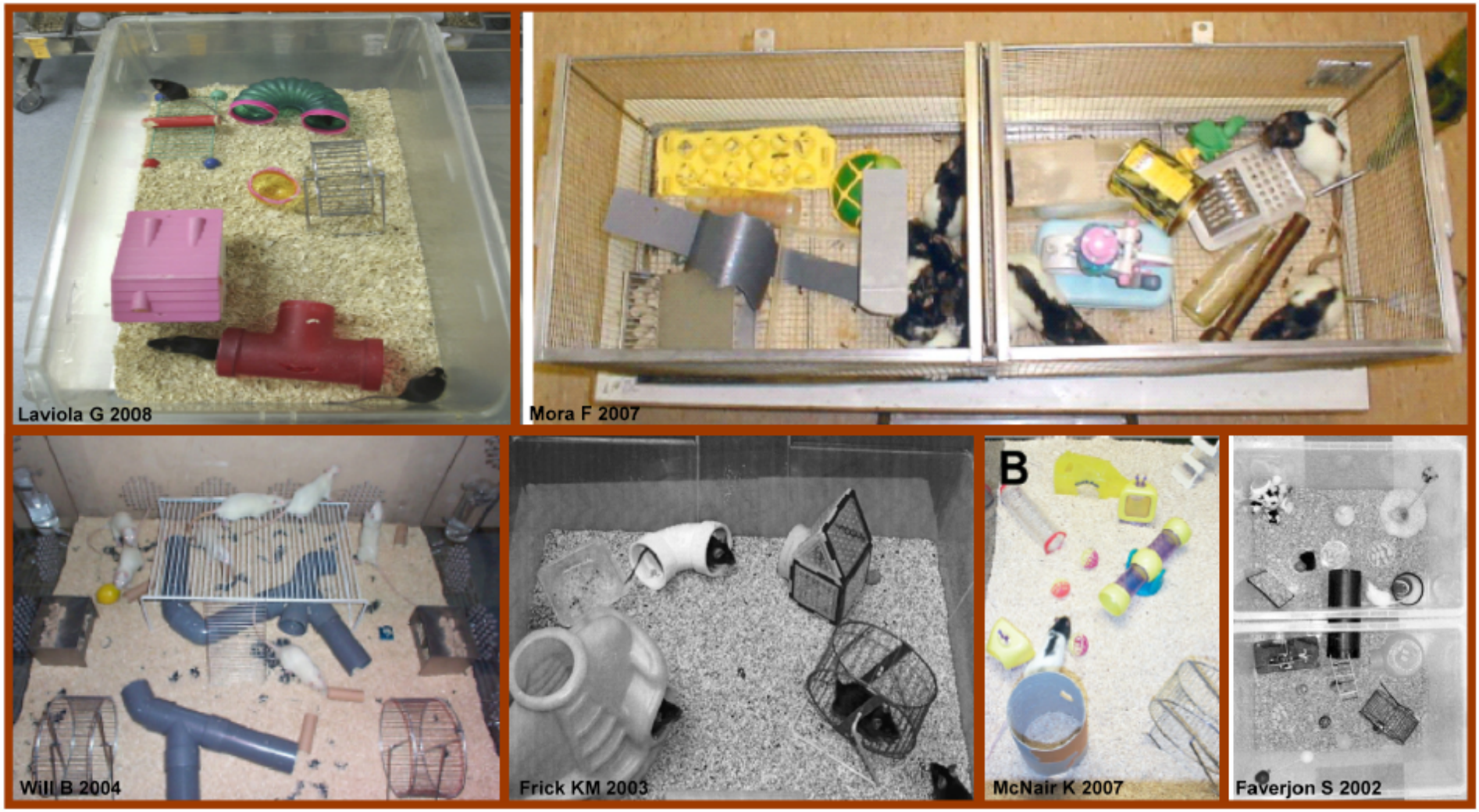


Standard Environment(SE) Enriched Environment(EE)



Botanas et al., Physiology and Behavior, 2016

Left graph: mice, “addicted” to cocaine and conditioned with cocaine to prefer a specific place, can lose this conditioning when put in an enriched environment (Solinas et al., PNAS, 2009).


Laviola G 2008
Mora F 2007
Will B 2004
Frick KM 2003
B
McNair K 2007
Faverjon S 2002

Therapy for Dependence/Abuse

Detoxification: elimination of alcohol from the body, treatment of withdrawal symptoms (insomnia, headache, gastrointestinal distress, delirium, seizures)

Long-term rehabilitation:

Group therapy: face problems, stop denial, find ways to deal with addiction
Family treatment: integrate family in a constructive way (sometimes their behavior can uphold substance dependence: codependency)

Environmental intervention: change aversive life situation (joblessness, impoverishment)
Cognitive-Behavioral therapy: learn stress coping skills, self-control skills, social skills

Relapse prevention and management: know when relapses become likely and what to do in such a situation or when a relapse has occurred

Summary: Substance Abuse & Dependence

- Abuse and dependence – definitions
  - abuse: use leads to hazardous behavior, use in spite of problems
  - dependence: abuse + physiological need, tolerance, withdrawal
- Alcohol use disorder
- Short and long-term effects of alcohol intake
  - accidents, crime, brain and liver damage, cancer
- Tolerance and withdrawal
  - tolerance: more of the drug is needed to achieve the same effect (metabolic/functional); withdrawal: abstinence leads to aversive physiological symptoms
- Comorbidities
  - mood disorder, anxiety disorder, PTSD
- Therapy for substance use disorders
  - detoxification, group/family therapy, environmental intervention, cognitive-behavioral therapy, relapse prevention/management