Understanding Addiction and Drugs Of Abuse

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There is a lot of epidemiological evidence that addiction begins before brain maturity, and lately some biological evidence.
Addiction can rapidly develop at a time in life when a person may be virtually incapable of making wise decisions.
Drugs Change The Brain

• The chronic presence of drugs can cause short and long-lasting changes in the nervous system
  – Tolerance and withdrawal
    • Brief changes as the brain chemistry resets itself
  – Dependence/Addiction
    • Long lasting changes in brain chemistry and wiring, like strong memories

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Addiction comes from a normal brain activity—stimulation of the brain reward system

This system is what gives us the tools to preserve the species
---the buzz from sex
---the anticipation of good food
---the joy of cooperation
---the euphoria of winning

When we anticipate a reward it gives us the tools to get it…
Attention, Focus, Power, Suppression of Fear, Euphoria (The Anticipation Response)
The brain chemical dopamine is released by the reward system, and.....

• ALL addicting drugs release this brain chemical.
• Many release much more than natural stimuli
Neural Basis of Addiction

Dopamine
All Addictive Drugs Activate this Circuit

Cocaine
DA
Alcohol
Heroin
Nicotine
Repeated Stimulation Changes The Brain: The Addiction Cycle

Drug use: Pleasure

ADDICTION
Withdrawal, Craving

Repeated use
Pleasure circuit adapts

Need drug to Feel Good at all
Does The Reward/Addiction System Work Better in Adolescents? Probably

- Adolescents are impulsive and risk-taking – risk factors for drug taking

- The earlier kids start smoking or drinking, the more quickly they progress to dependence
Cocaine Increases Dopamine More in Adolescent Rats

Time Course of Cocaine-Induced Increase in Released Dopamine

Fig 4. DA release after cocaine (10 mg/kg) at t = 0. Adolescents are different from adults, p < .01 by ANOVA.
Now, about alcohol and other drugs...

Understanding the basics...
Every drug has two effects....

The one you know about, and.....
The one you don’t!
Know the T.R.U.T.H. About Alcohol and Other Drugs

• **Toxicity**—Dead now, dead later, or wish you were dead
• **Reinforcement**—The heart of addiction
• **Understand**—So what’s the addict getting from this drug?
• **Time**—What are the pharmacokinetics of the drug and what are the consequences of its repeated use?
Toxic effects of alcohol

Alcohol kills (acutely) in 3 ways
  – Suppressing respiration
  – Suppressing reflexes
  – Producing cardiac instability

• People do not understand how little alcohol is required for impairment and death
• People need to know the lethal level for their body weight
• Women are more sensitive than men
Aspiration and Alcohol

- Alcohol paralyzes flap that closes trachea during swallowing
- Stomach contents enter lungs
- Acid and material cause inflammation
- Secondary infection
Non-lethal toxicity of alcohol

- Significant liver toxicity, especially in women
- ? Cancer, bone loss, etc.
- Significant brain effects for >21 drinks/week
- Neuropathological effects of binge drinking

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Alcohol Tolerance

• Regular use of any drug causes the brain to adapt.

• Don’t be surprised if you find people functioning fairly effectively at alcohol levels that would may you or I comatose. They are tolerant.
Does alcohol have positive health effects?

• Yes, at low levels of consumption
• The National Institute of Health (NIAAA) recommends:
  • For women, one drink per day maximum
  • For men, two drinks per day maximum
Reinforcement or Reward

- We know alcohol is addicting
- Kids are more vulnerable to addiction—WHY?
Have you ever heard this phrase?

• I just can’t drink like I once could?
Adolescents respond differently to alcohol

- Preliminary information based on human and animal studies
- Less sleepy and sedated
- A greater “Buzz”
- More learning impairment so they cannot remember the consequences (blackouts)
- 30-50% of kids 13-15 yrs. who regularly drink will become alcoholics.

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The T.R.U.T.H.

Understand how the drug affects the brain.
What is the person getting from the drug?
Is there and underlying treatable medical condition?

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A critical role for treatment professionals--find the problem

• Self medicating--for what?
  – Anxiety – alcohol reduces it
  – Stress—alcohol relieves it
  – Depression—alcohol treats its symptoms
  – Social phobia—alcohol is disinhibiting

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The T.R.U.T.H.

Time: How long does the drug last?

• Most people do not understand pharmacokinetics.

• Do not assume the drug effect is over when the buzz is gone.
Alcohol

• **Time**
  - Rapid rise in levels
  - Slow fall--- $\frac{1}{2}$ to 1 drink/hour
  - Performance better on rising phase
In summary....

• Alcohol is a toxic drug that has to be used with care
• It is safe and maybe healthy used minimally
• It has different effects in kids, making them especially vulnerable

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Marijuana

• Toxicity
  – Long-term toxicity similar to tobacco use
  – Possible interactions with the immune system
Marijuana

- **Reinforcement—addicting?**
  - Clearly some people become dependent
  - Because of anxiety-reducing effects, users tend to not deal with their problems, their problems get worse, they smoke more, and they get into real trouble.

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Marijuana

• Understanding how it works
  – Reduces anxiety
  – Produces euphoria in some people
  – Impairs all kinds of learning by the brain
    • Academics
    • Music
    • Athletics
    • Social skills

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Marijuana

- **Time**
  - Stays in the body for weeks—8 days to eliminate 90% of one dose
  - Stored in fat
  - Metabolized into active compounds
  - The brain adapts to its presence
THC: Slow Removal from Body

Half life = 12-18 hours
Marijuana Withdrawal

From Pope et al,
A Major Problem With Marijuana

• The adolescent brain is not mature
• For proper development, the brain needs learning mechanisms to work properly
• Marijuana is persistent and impairs learning
• Thus regular marijuana use *MAY* impair proper brain maturation

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Cocaine and Methamphetamine (Stimulants)

• Toxicity
  – Constricts blood vessels
  – Minor and major strokes
  – Cardiac irregularities
  – With binges, direct damage to neurons
  – Quite safe when used medically (attention deficit disorder – Ritalin, Adderal)
• **Reinforcement**
  
  – The most highly reinforcing drugs because they elevate dopamine without sedative effects
  
  – Extremely addictive when used by inhalation or I-V
  
  – Animals will work to their death for these drugs
• Understanding how stimulants work
  – Power
  – Euphoria
  – Focus
  – Disinhibition
  – Physical stimulation
• With continued abuse, mental changes, including paranoia
• **Time**
  - For cocaine in the nose, 30-60 minutes
  - For smoked crack cocaine, a few minutes
  - For amphetamines, hours

• Depression upon withdrawal

• Amphetamine abusers can go into marked agitated and psychotic states upon withdrawal
Opiates (Heroin and Pharmaceuticals)

• Toxicity
  – Lethal from overdose by respiratory depression
  – Otherwise, not much damage
  – The distress from opiate use is economic
• **Reinforcement**
  
  - Highly addictive especially if used by smoking or I-V---release dopamine in the reward system
  - People can become addicted to oral agents
  - Rush Limbaugh’s case---oxycontin
• Understanding how opiates work
  – Painkilling by activating the brain’s natural painkilling system
  – Sedating
  – Produce euphoria
  – Withdrawal has powerful physical symptoms that inhibits abstaining
  – Methadone and other drugs suppress the physical withdrawal symptoms without providing the euphoria

• Time: Hours
Club Drugs---Ecstasy, GHB, Ketamine

• ECSTASY (MDMA) is toxic acutely and over the long term to the brain’s serotonin system, which regulates mood, and lots of basic body functions like appetite, temperature, etc.

• It produces a profound sense of love, empathy, and acceptance---exactly what kids seek most from their peers.
GHB (gamma-hydroxybutyrate)

• GHB is acutely toxic
• A narrow range between “effective dose” and lethal dose
• Suppresses respiration
• Produces disinhibition like alcohol, but no hangover
• Synergistic with alcohol

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GHB Tolerance and Withdrawal

• Tolerance is slow to develop but extremely problematic
• Withdrawal can be lethal
Ketamine

• Anesthetic agent made commercially
• Used for kids and animals because it produces hallucinations
• Does not depress the CNS as much as other anesthetics, thus relatively few deaths.
• Kids like it for the hallucinations
The T.R.U.T.H.

Happiness

– Does not come in a pill
– Cannot be found in a bottle
– Is not achieved by constantly pursuing hyper-stimulation of the reward system
Ways to improve relationships—The Anticipation Response

• When we anticipate a reward, we get…..
  – Attention, Focus, Power, Suppression of Fear, Euphoria

• If you want anyone to do anything, the more you can associate that with expectation of reward the more you can invoke the anticipation response.

• What does the brain like most? Novel hedonic experiences!
Ways to improve relationships—The Anticipation Response

• Provide unexpected pleasures enough times…
  - Compliments
  - Presents
  - Surprise activities
  - Sincere thanks
  - Anything that the other person finds pleasurable

• And that person can become “addicted” to you
Remember... fear produces just the opposite—people respond, but they build up aversive cues to you.

So try to use rewards whenever possible.