Addiction Neuroethics

The ethical and social implications of neuroscience research on addiction

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Overview

• What is “Addiction Neuroethics”?  
• Review of neuroscience research of addiction  
  • Is addiction a “brain disease”?  
• Australian clinician and neuroscientists views  
• Claims made for the benefits of addiction neuroscience  
  • Improved treatment and prevention of addiction  
  • Reduced stigma and more humane treatment  
• Analyses of some possible policy misuses  
  • Public health policy simplifications  
  • Neurosurgical “cures” of addiction (deep brain stimulation)  
  • Treatment seeking and quitting behaviour  
• A way forward?
What is “Addiction Neuroethics”?

• Analysis of the public policy and ethical implications of neuroscience research on addiction:
  • How we understand addiction?
  • How we treat addiction?
  • How we research addiction?

• Philosophical implications for free will and responsibility
Addiction is a ‘chronic, relapsing brain disease’ (NIDA Directors: Leshner, 1997; Volkow, 2005)

- Chronic use of addictive drugs produces changes in the brain that “drive people to drug use”
- People with an addiction have been “hijacked” by the drug (Dackis and O’Brien, 2005)
- Clinical observations and treatment outcomes
  - Chronic relapsing disorders: inebriety
  - High rates of relapse to drug use
  - More like diabetes or heart disease, than infectious diseases
Evidence for a Brain Disease Model 1

• Adoption and twin studies of human addiction
  • High heritability of most common forms of addiction (40-60%)
  • Candidate genes: some protect and some increase risk

• Animal models of addictive behaviour
  • Animals self-administer addictive drugs
  • Identified the dopaminergic “reward” pathway

• Human neuroimaging studies
  • Identified changes in brain regions analogous to animal models
  • Differences between “normal” and “addicted” brains
  • Changes persist beyond abstinence

![Images of brain scans showing changes in D2 receptors and glucose metabolism between control and cocaine abuser groups.]
Evidence for a Brain Disease Model 2

- Cognitive impairments
  - Learning and memory, attention and impulsivity

- Dopamine-induced compulsive disorders
  - Parkinson's patients treated with dopaminergic medications (e.g. DA agonists)
  - Pathological gambling, hypersexuality, compulsive overeating
Evidence cited by “brain disease” sceptics

- Observational evidence (Cross-sectional, longitudinal)
  - Most persons who meet diagnostic criteria for dependence are not dependent at the time of their interview
  - Most addicted persons quit without assistance (Heyman, 2009; Chapman, 2010)
  - Most adolescent drug users mature out of addiction
  - Cessation the norm, often in absence of treatment

- Drug use is price sensitive
  - Taxes reduce drug use

- Efficacy of contingency management
  - Small financial incentives can reduce drug use
  - Incompatible with strong form of brain disease model of addiction
Reconciling the “two worlds” of addiction

- Addictive disorders vary greatly in severity
  - Mild to moderate disorders common in young adults
  - Most remit: marriages, mortgages and children
  - Can be chronic and cause harm and harm others in a minority
  - Can’t use lifetime prevalence of addiction as estimates of severe, chronic addiction as described by BDMA

- Who develops chronic addictive disorders?
  - Antisocial males: early initiators, with drug using peers
  - Poorly educated, few relationships, reduced life choices
  - Self-medication of comorbid anxiety and depression
How compelling is neuroscience evidence?

• Animal studies provide poor model of human addiction
  • Utilise specially bred rat strains
  • Highly controlled environment; not replicated in “enriched environments”
  • Large neurocognitive and social differences

• Genetic evidence
  • Large numbers of risk alleles involved
  • Weak predictors of addiction risk

• Neuroimaging and neuropsychological evidence
  • Small studies underpowered that fail to replicate (Ioannidis, 2011)
    • excess significance bias (av. power of imaging studies 8%)
  • Demonstrate group averages or trends: not all addicted individuals exhibit changes; some controls do
  • Cause or Consequence of drug use
  • Does not prove that drug use is involuntary; only possibly impaired
Is there a consensus view that addiction is a "brain disease"?

Drug addiction is a disease. Images of the brains of addicts show alterations in regions crucial to learning and memory, judgement and decision-making, and behavioural control. Drugs

None of that is particularly controversial, at least among scientists.

Addiction is a primary, chronic disease of brain reward, motivation, memory and related circuitry. Dysfunction in these circuits leads to
Is there a consensus view that addiction is a “brain disease”?

Addiction: Not just brain malfunction

Derek Heim

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Letter signed by 94 leading addiction researchers
What do Australian addiction clinicians and neuroscientists think?

Methodology

• 1hr semi-structured interviews
• Australian sample (n=31)
  Addiction neuroscientists (n=15)
  Animal researchers (7), Behaviour geneticist (1), Neuropathologists (1), Cognitive neuroscientists (4)
  Addiction clinicians (n=16)
  Psychiatrists (3), Clinical psychologists (11), Addiction Physicians (2)
  (Alcohol, heroin and psychostimulants)

• Descriptive thematic analysis

Impact of neuroscience on:

• Treatment of addiction
• Addicted individual’s treatment behaviour (e.g. self-efficacy, treatment seeking)
• Clinical treatment
What do Australian addiction clinicians and neuroscientists think?

- 10 respondents strongly endorsed "I think it’s overwhelmingly helpful, because people generally need some explanation that is reasonably scientifically based"

- 21 ambivalent (n=14) or negative (n=7) response
  "It is fairly seriously flawed in all sorts of ways as a basic model. In particular it ignores all sorts of factors"
  "I think it’s simplistic in the extreme"
  "double-edged sword"

Policy and the Brain Disease Model

• How *useful* is it to think of severe forms of addiction as chronic, relapsing brain diseases?

• What are the potential *advantages* and *disadvantages* of a brain disease approach to addiction?
The Therapeutic Promise

• **More effective and rational drug treatments**
  - Drugs that target brain mechanism more effectively and directly with fewer side effects
  - Drug vaccines for relapse prevention
  - Neurosurgical “cures” (e.g. DBS)
  - Maintenance drugs with lower OD risk

• **Treatment matching and preventing addiction**
  - Genetic testing (e.g. Pharmacogenetics; population screening)
  - Neuroprediction (e.g. fMRI, EEG and psychometric testing)

Promises not yet realised despite NIDA’s best efforts
The potential policy payoffs

**GREATER:**
- Acceptance of addiction as a “real” disorder that should be treated therapeutically
- Public funding of addiction research and treatment
- Access to treatment for those not receiving it

**LESS:**
- Punitive responses to addiction
- Imprisonment
- Stigma and discrimination
Possible policy downsides

*If* ... brains are “hijacked” by the drug

- Implies limited self-efficacy; undermines quitting
- Possible policy simplifications:
  - Focus on medical responses at expense of social policies
- Justify the use of risky or invasive cures to ameliorate a diseased brain
  - Deep brain stimulation
  - Implantable prostheses
- Justifies ↑ use of coercion: for their “own good”
- Impair consent to research and treatment
Possible Public Health Policy Simplifications
Possible policy simplifications of the BDMA

• Give priority to treating those at high risk of addiction
  • Ignores population strategies (e.g. taxation, ad bans)

• Focus attention on addressing addiction
  • Ignores harm of non-addicted use
  • Intoxication more important for alcohol

• Overemphasis on neurobiology as a:
  • *Cause* of addiction: undermines social policies that address social drivers of addiction
  • *Cure* of addiction: undermines psychosocial and population level interventions to reduce drug-related harm
Industry and the Brain Disease Model

- **Tobacco Industry**
  - Long interest in genetics of smoking and cancer
  - Harm located in individual, not their product

- **Alcohol industry**
  - Problem alcohol use affects a minority of consumers
  - Identify at risk or “problem drinkers”
  - Why punish the many for sins of the few?

- **Gambling industry**
  - Funding genetic and neuroscience research
  - Focus on restraining “addictive gamblers”
Direct Treatment Of Addicted Brain

Neurobiological surgery & deep brain stimulation
Ablative neurosurgery for heroin addiction

- 1960 and 70’s: “positive reports” on drug use (e.g. aCG, NAc)

- Modern era of neurosurgery (2000-05)
  - Russia: 300+ bilateral cingulotomies
    - blocked obsessional thoughts about drugs
  - China: 500+ bilateral ablation of NAc
    - blocked rewarding effects of drugs

- Rationale
  - Based on “brain disease” model of addiction
  - Heroin addiction is “untreatable”
  - Brain surgery “cures” a brain disease: centrally blocking opioid effects
Deep Brain Stimulation (DBS)

- Less invasive & “reversible”
- Introduced in France in early 1990s for Parkinson’s (PD)
- Approved by FDA in USA
  - Essential tremor in 1997
  - PD in 2002 (STN)
- Now being trialled for intractable psychiatric disorders
  - Depression, OCD, Tourette's
  - Addiction
Trials of DBS in addiction
(Carter & Hall, 2012, *Addiction*)

• Suggestive evidence of efficacy in addiction
  • Animal studies in which DBS reduces drug use
  • Promising reports in patients treated for PD/psychiatric conditions
  • Some positive case reports (n=5) in patients treated for addiction

• Caveats
  • Small studies, highly selected population, no control group
  • Limited follow up or evaluation
  • Publication bias
Opportunity costs of trialling DBS

• DBS is very expensive:
  • US$ 50,000 surgery; $10,000 every 2-3yrs

• Opportunity costs of conducting DBS trials in addiction:
  • Impacts on access to other forms of treatment?
  • Reduce number of addicted individuals treated
  • Fewer trials of other types addiction treatment?
  • Fewer trials of DBS for other neurological conditions

• Public health impact on addiction marginal
  • Very few highly selected patients will be treated
  • Unlikely to be the severe cases
    • cause the majority of harm (social and economic)
    • used to justify trials
  • Unlikely to receive similar quality of treatment as trials
Medicalisation Of Addiction Treatment
Impact of “brain-disease” explanations on treatment behaviour

PROS:
• Increased treatment seeking and compliance
• More likely to be effective: “magic bullets”
• Less likely to seek treatment for a “character flaw” (Cunningham et al., 1993)

CONS:
• Incurable (Herman, 2001) and untreatable (Phelan, 2002)
• May reduce unassisted cessation attempts (Chapman & McKenzie, 2010)
• Psychological explanations of mental illness = more curable and less debilitating (Lam et al., 2005)
• Brain-based explanations = harder to overcome (Lam et al., 2005)
Views of Australian addiction clinicians on the impact of neuroscience on treatment

- Facilitates change
  - Gain insight and make sense of situation
  - Removes guilt and self-punishment: “It means I’m not a bad person or a weak person. I’m not morally bad; it means that there have been some changes in my brain”
  - Motivating: “creates optimism”; “treatable”; “empowering”

- Hinders change
  - Fatalism: “it’s a disease that I have and there’s nothing I can do about it” .... “my brain’s stuffed”
  - Learned helplessness: “it is a disease and you’re always going to have it and it gives them a sense of helplessness I think.”
  - Removes responsibility

A Way Forward …

Acknowledging neurobiology, but avoiding policy pitfalls
Giving neurobiology its policy due

We can and should accept that:

1. Drugs act on brain reward systems
2. Chronic drug use can produce (persistent?) changes in brain function
3. Not ordinary commodities (Babor et al, 2003)
4. Treatment may need to address these changes
5. There are biological (and social) differences in individual addiction vulnerability
In giving neurobiology its policy due ...

We do not have to accept policy simplifications that

1. Addiction is best thought of as a chronic, brain disease
2. High risk medical strategies are the most successful
3. Biological interventions are routinely required
4. More coercion is necessary (or effective) in treatment

Addiction is highly variable

- There are those who are more severely addicted and psychosocially impaired for whom brain disease view fits

Maximise autonomy rather than denying and over-riding
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Coerced Treatment

Greater forced treatment of “addicts” for their “own good”
Legally coerced treatment of addiction

- Compulsory treatment *to protect public welfare*
  - Compulsory treatment systems: California, Sweden and Russia

- Paternalistic coerced treatment *for “addict’s own good”*
  - Preceded “brain disease model”, although common justification
  - Renewed advocacy in NSW & Victoria in past decade (NSW trials)
  - NT mandatory alcohol treatment
  - Treatment offered as an alternative to imprisonment (drug courts)
    - Pre-adjudication, pre-sentencing or post-imprisonment

- Mandatory naltrexone implants for opioid dependence
  - Autonomy of addicted persons is impaired (Caplan, 2008)
  - Unable to act in their own best interests
  - State obligated to act to restore their autonomy
Evidence for coerced treatment

- Majority of addicted individuals do not fit criteria for compulsory treatment
  - Not supported by neuroscience evidence
  - Australian experience suggests most relapse
  - High risk of overdose in newly abstinent opioid dependents

- Evidence of effectiveness for coerced treatment unclear
  - Poorly designed studies with insufficient follow-up
  - Unethical in the absence of proven effectiveness

- Strongest ethical case for legal coercion (e.g. drug courts)
  - Offer of treatment as alternative to incarceration for criminal convictions (excl. violent or sexual offences)
  - Motivation must be therapeutic *not* punitive
  - Choice of treatment modality (incl. substitution)