Cognitive enhancement
Outline of lecture

• Definition: What is a CE?
• Drugs with CE potential
• Stimulants: (How) do they work as CEs?
• Epidemiology of CE use
• Ethical, legal and social issues
What is cognitive enhancement?

- Improving the cognition of a **cognitively normal** person
- Corneliu Giurgea, mid-century Romanian psychopharmacologist: “Man is not going to wait passively for millions of years before evolution offers him a better brain”
- Virtually all CE drugs were developed for treating neuropsychiatric illness
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Drugs with CE potential

• Many! See Morganthaler & Dean’s “Smart Drugs”

• Most research on
  – ADHD drugs (stimulants, eg amphetamine, methylphenidate)
  – Alzheimer drugs (eg Acetylcholinesterase inhibitors)
  – Modafinil

• By far, most research and most use of stimulants
Stimulants as CEs

- Amphetamine (most commonly as Adderall)
- Methylphenidate (aka Ritalin)
- How do these drugs affect cognition?
  - catecholamines, esp dopamine
Stimulants as CEs

Stimulants as CEs

Executive function enhancement: sharp dependence on individual characteristics. E.g. Mattay et al. 2003, PNAS
Questions about robustness of effects

- Recent review papers concluding no effect of stimulants on normal healthy cognition, or even negative effects!
- Similar conclusions emerging re other drugs
- How to explain persisting use of stimulants and modafinil?
  - Noncognitive effects that enable better cognitive performance
Objective and subjective cognitive enhancing effects of mixed amphetamine salts in healthy people

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ABSTRACT

Psychostimulants such as mixed amphetamine salts (MAS, brand name Adderall) are widely used for cognitive enhancement by healthy young people, yet laboratory research on effectiveness has yielded
Scott Vrecko’s interviews

- Students who use Adderall for enhancement
  - Motivation
  - Energy
  - Confidence
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Who’s using, where, why?

• McCabe et al, 2005, *Addiction*:
  – ~11,000 college students
  – Lifetime prevalence overall: 6.9%
  – Campuses ranged from 0-25% past year prevalence

• Reasons, methods, frequencies... much to be learned

• People other than US college students... much to be learned
Poll results: look who's doping

In January, Nature launched an informal survey into readers' use of cognition-enhancing drugs. Brendan Maher has waded through the results and found large-scale use and a mix of attitudes towards the drugs.

The US National Institutes of Health is to crack down on scientists 'brain doping' with performance-enhancing drugs such as Provigil and Ritalin, a press release declared last week. The release, signed by evolutionary biologist Jonathan Eisen of the University of California, Davis, turned out to be an April Fool's prank. And the World Anti-Brain Doping Authority website that linked to it was likewise fake. But with a number of co-conspirators spreading rumours about receiving anti-doping affidavits with their first R01 research grants, the ruse no doubt gave pause to a few of the respondents to Nature's survey on readers' use of cognition-enhancing drugs.

The survey was triggered by a Commentary by behavioral neuroscientists Barbara Sahakian and Sharon Morein-Zamir of the University of Cambridge, UK, who had surveyed their colleagues on the use of drugs that purportedly enhance prescribed for cardiac arrhythmia that also have an anti-anxiety effect. Respondents who had not taken these drugs, or who had taken them for a diagnosed medical condition were directed straight to a simple questionnaire about general attitudes. Those who revealed that they had taken these drugs, or others, for non-medical, cognition-enhancing purposes behind the 'other' which received a few interesting reasons, such as 'party', 'house cleaning' and 'to actually see if there was any validity to the aforementioned article'.

Our question on frequency of use, for those who took drugs for non-medical purposes, revealed an even split between those who took them daily, weekly, monthly, or no more than once a year. Roughly half reported unpleasant side effects, and some discontinued use because of them. Some might expect that negative side effects would correlate positively with a low frequency of use, but that doesn't seem to be the case in our sample (see bar graph, below). Reported side effects included headaches, jitteriness, anxiety and sleeplessness.

Neuroscientist Anjan Chatterjee of the University of Pennsylvania in Philadelphia predicts a rise in the use of these drugs and other neuroenhancing products and procedures as they become available (A. Chatterjee)}

The Vermont vacation problem…. much to be learned
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Ethical, legal and social issues

- Safety (note esp addiction risk w stimulants)
Ethical, legal and social issues

- Safety
- Fairness

Midway through the exam, Allen pulls out a bigger brain.
Ethical, legal and social issues

- Safety
- Fairness
- Freedom
Ethical, legal and social issues

• Safety
• Fairness
• Freedom
Ethical, legal and social issues

- Safety
- Fairness
- Freedom
- Legality, professional ethics
Ethical, legal and social issues

• Safety
• Fairness
• Freedom
• Legality, professional ethics
• Personhood, agency, deserts