

Cognitive enhancement



Center for Neuroscience & Society
UNIVERSITY of PENNSYLVANIA

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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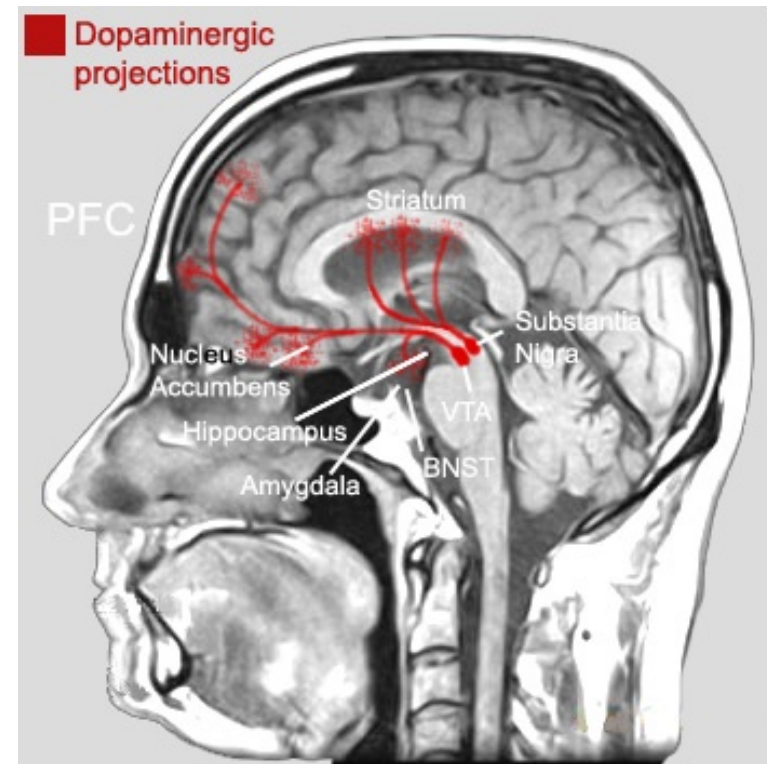


Drugs with CE potential

- Many! See Morgenthaler & 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

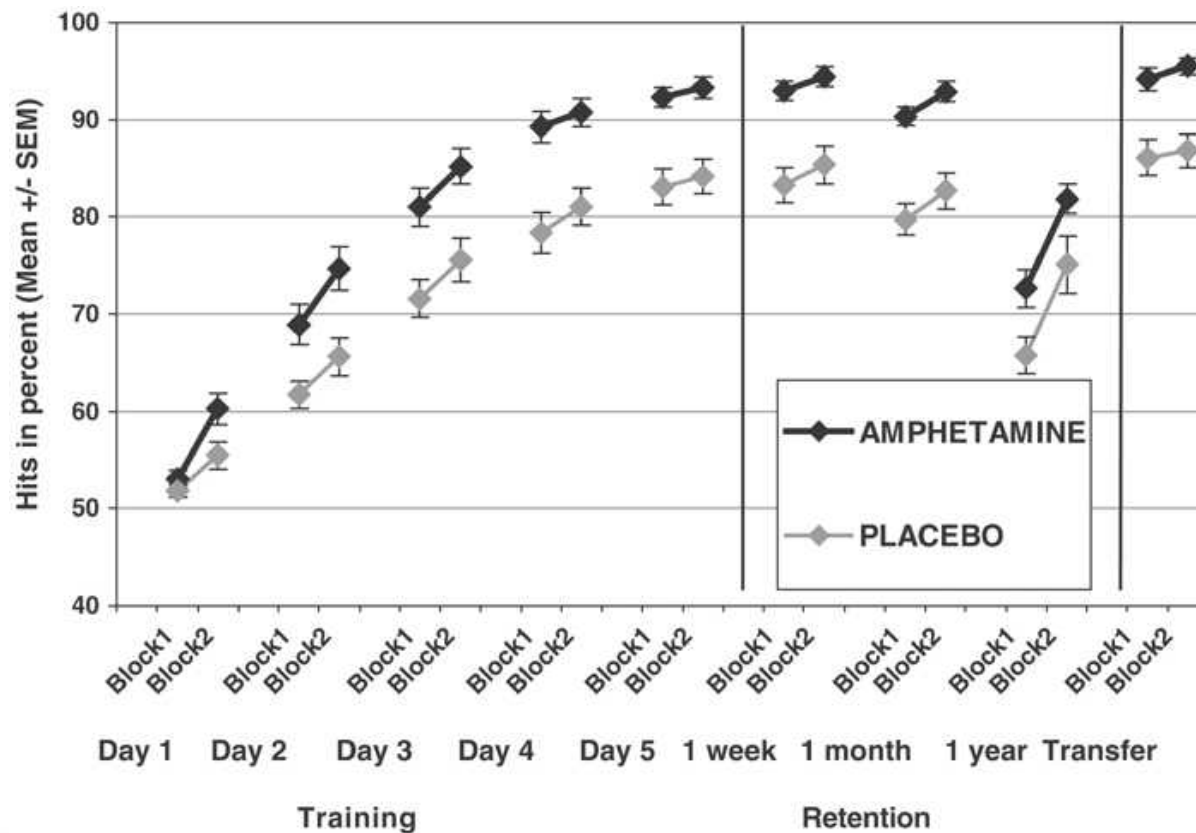
Stimulants as CEs

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



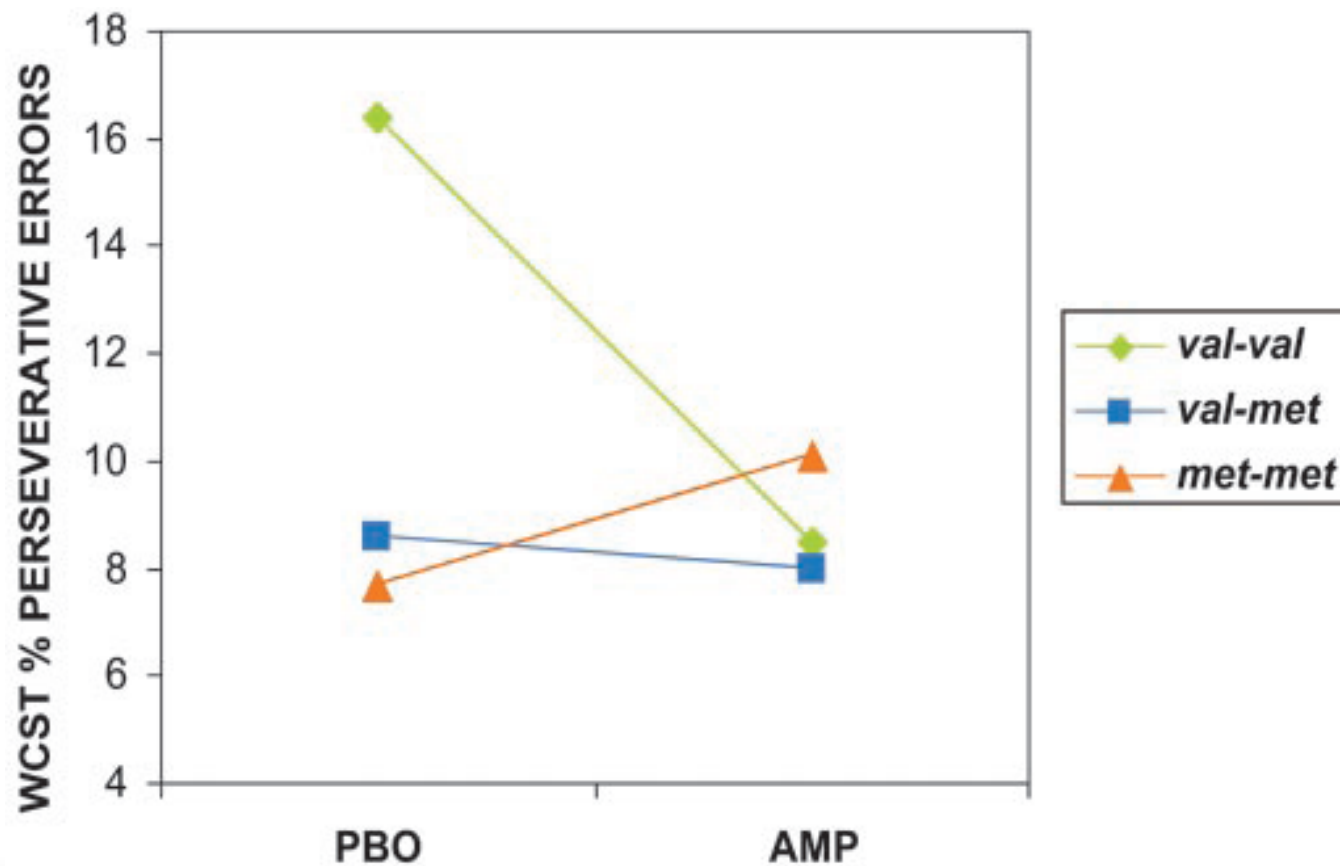
Stimulants as CEs

Memory enhancement: From: Breitenstein, et al. (2004). *Neuropsychopharm.*



Stimulants as CEs

Executive function enhancement: sharp dependence on individual characteristics. E.g. Mattay et al. 2003, *PNAS*



Questions about robustness of effects

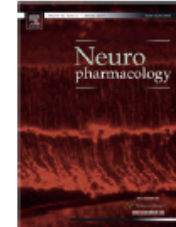
- Recent review papers concluding no effect of stimulants on normal healthy cognition, or even negative effects!
- Similar conclusions emerging re other drugs
- How to explain persisting use of stimulants and modafinil?
 - Noncognitive effects that enable better cognitive performance



Contents lists available at [SciVerse ScienceDirect](#)

Neuropharmacology

journal homepage: www.elsevier.com/locate/neuropharm



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



Nature poll

NEWS

NATURE | Vol 452 | 10 April 2008

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, brainchild of evolutionary biologist Jonathan Eisen of the University of California, Davis, turned out to be an April Fools' prank. And the World Anti-Brain Doping Authority website that it linked to 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 behavioural 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 'other' which received a few interesting reasons, such as "party", "house cleaning" and "to actually see if there was any validity to the afore-mentioned article".

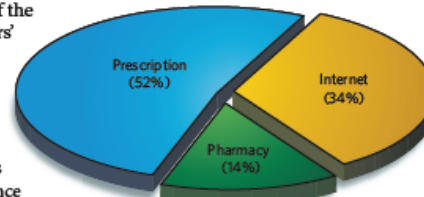
Our question on frequency of use, for those who took drugs for non-medical purposes, revealed an even split between those who took them daily, weekly, monthly, or no more than once a year. Roughly half reported unpleasant side effects, and some discontinued use because of them. Some might expect that 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

DRUG SOURCES

Answered question: 201
Skipped question: 1,227



The Vermont vacation problem.... much to be learned



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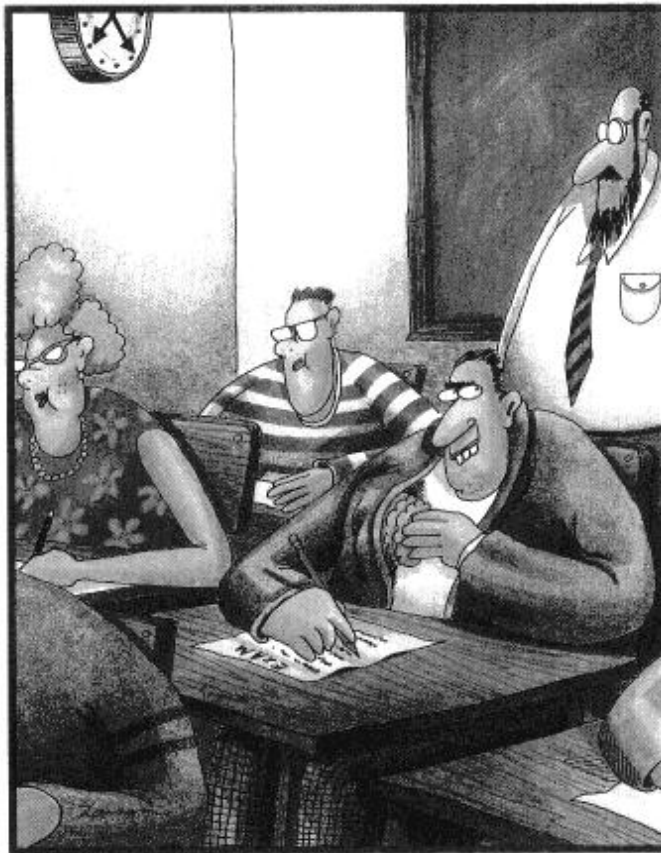
Ethical, legal and social issues

- 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

SPECIAL ARTICLE

Responding to requests from adult patients for neuroenhancements
Guidance of the Ethics, Law and Humanities Committee

ABSTRACT
In the last decade, persons who have no diagnosed medical or mental health condition are increasingly seeking and utilizing, for the ostensible purpose of enhancing their memory or cognitive skills, prescription drugs that were originally developed to improve executive function or memory in persons diagnosed with disorders such as attention deficit hyperactivity disorder or Alzheimer disease. Evidence suggests that this practice, now known as neuroenhancement, is gathering momentum. As a result, neurologists may be encountering patients without a diagnosed illness asking for medications with the goal of improving their memory, cognitive focus, or attention span. Strong arguments have been made for and against this practice, often reflecting strongly held convictions concerning the appropriate practice of medicine. The purpose of this report is to provide neurologists with an overview of the ethical, legal, and social issues surrounding the use of pharmaceuticals prescribed to enhance or augment normal cognitive or affective functioning as well as practical guidance for responding to an adult patient's request for neuroenhancement. *Neurology*® 2009;73:1406-1412.

GLOSSARY
ELHC - Ethics, Law and Humanities Committee; FDA - Food and Drug Administration.

In the last decade, persons with no diagnosed medical or mental health condition have been increasingly seeking and utilizing, for the purpose of enhancing their memory or cognitive skills, prescription drugs originally developed to improve executive function or memory in persons with disorders such as attention deficit hyperactivity disorder or Alzheimer disease.¹⁻³ This practice, now known as neuroenhancement, is gathering momentum.^{4,5} As a result, neurologists may be encountering patients without illness who request medications with the goal of improving their memory, cognitive focus, or attention span. Arguments have been made for and against this practice, often reflecting strongly held convictions concerning the appropriate practice of medicine.^{6,7}

Although much has been written about prescribing drugs for the purpose of neuroenhancement, the current literature consists mainly of ethically informed opinions that provide little or no practical clinical guidance for neurologists who may face these questions.^{8,9} Also, no professional or societal consensus exists regarding how clinicians should approach the issue. The purpose of this report is to provide neurologists with 1) an overview of the ethical, legal, and social issues surrounding the use of pharmaceuticals prescribed to enhance normal cognitive or affective functioning; and 2) practical guidance for responding to an adult patient's request for neuroenhancement. This report and guidance should not be construed either to promote or discourage the prescription of neuroenhancements.

Notwithstanding debate regarding the definition of normal or abnormal, "normal patients" in the present context may be defined as patients who do not have sufficient signs, symptoms, or abnormalities of use results to satisfy criteria for a medical or mental health condition (referred to in this article as "normal" or "well"). Admittedly, the boundary be-

Supplemental data at
www.neurology.org

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*Members and staff of the AAN Ethics, Law and Humanities Committee who participated in development of this report and guidance are listed in the appendix.
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Approved by Ethics, Law and Humanities Committee on April 28, 2009, approved by the AAN Board of Directors on September 5, 2009.
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Ethical, legal and social issues

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

