



Neuroethics



Ann Fink, Ph.D.

Fri 9/20/2019

BioS 010 : Bioscience in the 21st Century

Mind, brain, and biomedical science



<http://www.brainfacts.org/3D-Brain>



Brain 2025: Seven Priority Research Areas

One Discovering diversity: Identify and provide experimental access to the different brain cell types to determine their roles in health and disease.	Two Maps at multiple scales: Generate circuit diagrams that vary in resolution from synapses to the whole brain.	Three The brain in action: Produce a dynamic picture of the functioning brain.	Four Demonstrating causality: Link brain activity to behavior with precise interventional tools that change neural circuit dynamics.
Five Identifying fundamental principles: Produce conceptual foundations for understanding the biological basis of mental processes.	Six Advancing human neuroscience: Develop innovative technologies to understand the human brain and treat its disorders.	Seven From BRAIN Initiative to the brain: Integrate new technological and conceptual approaches.	

Source: BRAIN 2025, A Scientific Approach

The “neuro-turn”: prioritizing brain-based explanations of mind and behavior

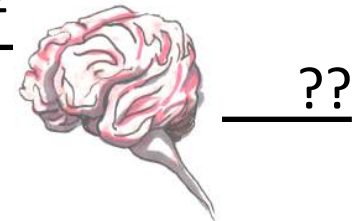
Neuroethics (recap)

How “ought” we to consider, research, and treat
brains in health and illness?

How should we study



Who should do the
studying of

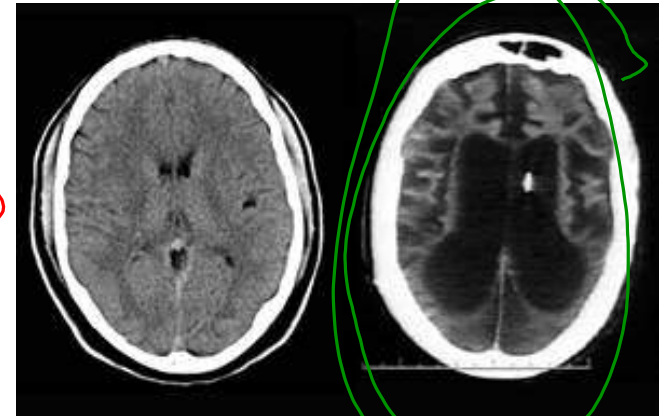


Whose  should we study??

*How should we use the
knowledge that we gain from
brain research?*

History, Ethics and Neuroscience

In February of 1990 at the age of 26, Terri Schiavo collapsed at home and oxygen was cut off from her brain for several minutes. As a result, she fell into a coma. In May of 1990, she emerged from her coma but remained unconscious in a **permanent vegetative state**. Although severely brain-damaged, Terri Schiavo was able to breathe, and maintain a heartbeat and blood pressure on her own. While her vision was impaired, her eyes were open and functional and she could move her limbs. She needed a feeding tube connected to her stomach to sustain her life. For many years, Terri's husband, Michael, and Terri's parents worked with doctors to try to help Terri regain consciousness. However, years of rehabilitation failed, and Terri did not improve. Arguing that it would have been Terri's wish to die, Michael, who was Terri's legal guardian, sought to discontinue life support. Terri Schiavo's family challenged this decision. On March 18, 2005, following a prolonged legal battle and media attention, her feeding tube was removed. Terri Schiavo died on March 31, 2005.



Left: [CT scan](#) of normal brain, Right: Schiavo's 2002 CT scan provided by [Ronald Cranford](#), showing loss of brain tissue. The black area is liquid, indicating [hydrocephalus ex vacuo](#).^[30]

Fair use,
<https://en.wikipedia.org/w/index.php?curid=1667265>

Text / case downloaded from: <https://med.nyu.edu/highschoolbioethics/module/schiavo>

The Case of the Substance-Dependent Brain



Drug Use, Drug Abuse/Misuse, Drug Addiction?



What is the difference?

Using a drug as intended

Excess

- * No Dr's prescription
- Consent/medical reason
- * Harm?

Addiction

Dependence

Sacrificing well-being or needs

— lack of concern for negative effects

Addiction: Could be defined as a persistent seeking of a drug and habitual, compulsive use despite significant negative consequences.

Models of Addiction in Ethics

Moral Model

- Addiction as a choice and a “moral failing”
- Emphasizes individual willpower, “virtue” and responsibility
- Clinical models have moved away from moral framings.

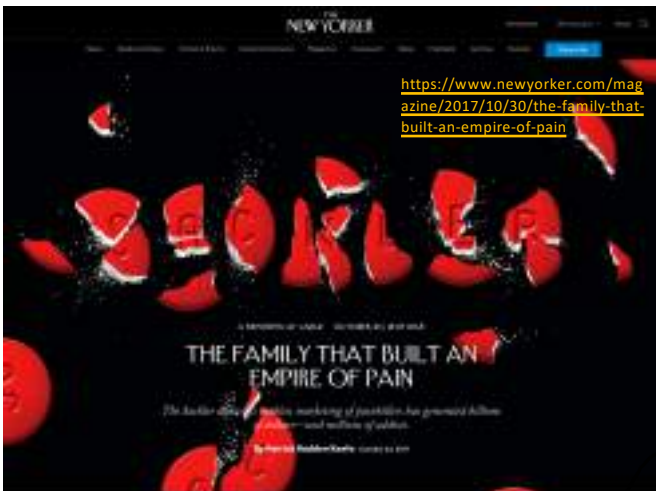
Medical (“Brain Disease”) Model

- Addiction as a “disease” located in the brain
- Widely applied in neuroscience.
- The idea: If researchers can identify the brain mechanisms associated with addiction, they can develop biomedical treatments for addiction
- Raises questions like: if addiction changes the brain in predictable ways, are people responsible for behaviors they engage in as a result of that addiction?

Social-Contextual Model

- Addiction arises in certain social conditions ; addiction is also *defined* in social context.
- If social conditions (like poverty, exposure to violence, abuse, etc.) push people toward addiction, is the responsibility for addiction shared as a society?
- Raises questions like: How do we, as a society, define addiction? What is an acceptable addiction? Who is responsible for the causes and consequences of addiction?

Purdue Pharma, Oxycontin, and Opioid Addiction



HEALTH AND SCIENCE

Nearly every US state is now suing OxyContin maker Purdue Pharma

PUBLISHED TUE, JUN 6 2018 | 1:06 PM EDT | UPDATED THU, JUN 8 2018 | 1:47 PM EDT

Berkeley Lovelace Jr. @BERKELEYLJ

<https://www.cnbc.com/2019/06/04/nearly-every-us-state-is-now-suing-oxycontin-maker-purdue-pharma.html>

The maker of OxyContin will reportedly pay billions to settle opioid epidemic lawsuits

Purdue Pharma and the Sackler family have agreed to a tentative settlement, according to news reports.
By Gervan Lopez | @gervanlopez | gervanlopez@vox.com | Updated Sep 15, 2019, 7:05pm EDT

<https://www.vox.com/policy-and-politics/2019/9/11/20861226/purdue-oxycontin-settlement-opioid-epidemic>

Purdue Pharma, maker of OxyContin, files for bankruptcy

The move is the first step of an agreement to settle thousands of lawsuits related to the opioid epidemic.
By Gervan Lopez | @gervanlopez | gervanlopez@vox.com | Sep 16, 2019, 11:00am EDT

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<https://www.vox.com/policy-and-politics/2019/9/16/20868487/purdue-pharma-oxycontin-bankruptcy-opioid-epidemic>

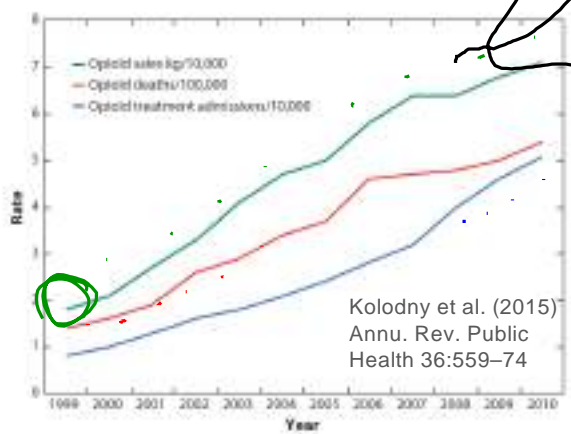
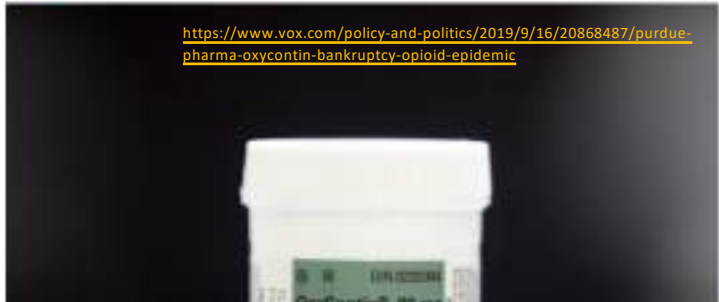


Figure 1
Rates of OPR sales, OPR-related unintentional overdose deaths, and OPR addiction treatment admissions, 1999-2010. Abbreviation: OPR, opioid pain reliever. Source: 10.

Purdue Pharma, Oxycontin, and Opioid Addiction



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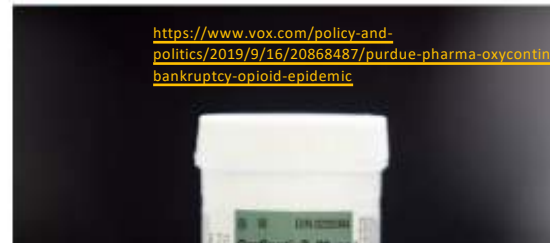
By German Lopez | <https://www.vox.com/policy-and-politics/2019/9/11/20861226/purdue-oxycontin-settlement-opioid-epidemic> | Updated Sep 11, 2019, 7:25pm EDT

- Data →
- Won-
addictive

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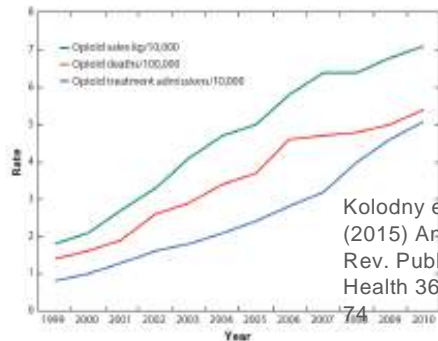
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^^

(Where's the data?
What about claims
that these drugs
were really "not
addictive?")

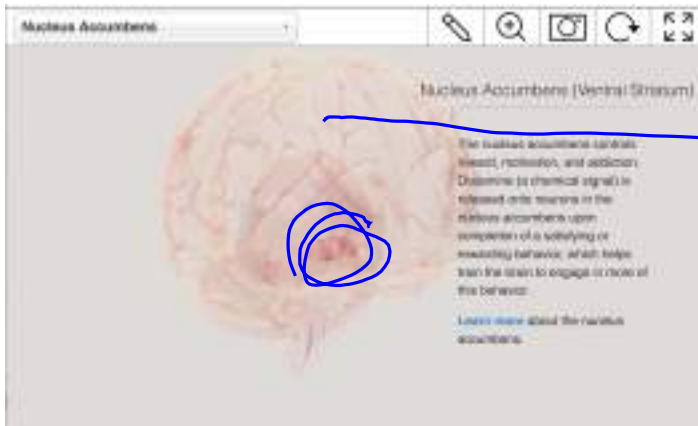
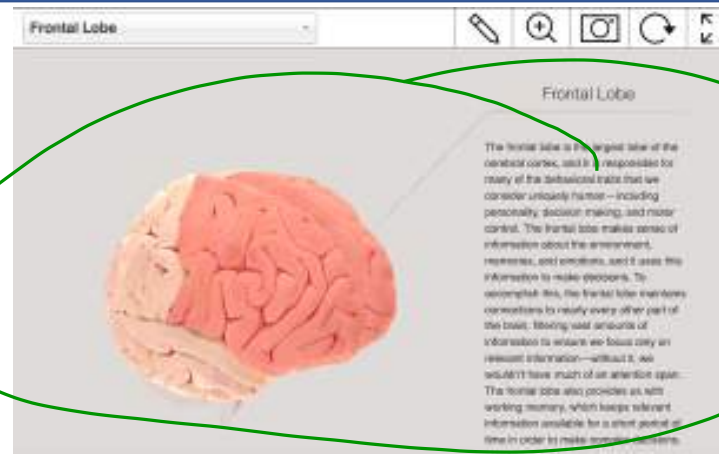
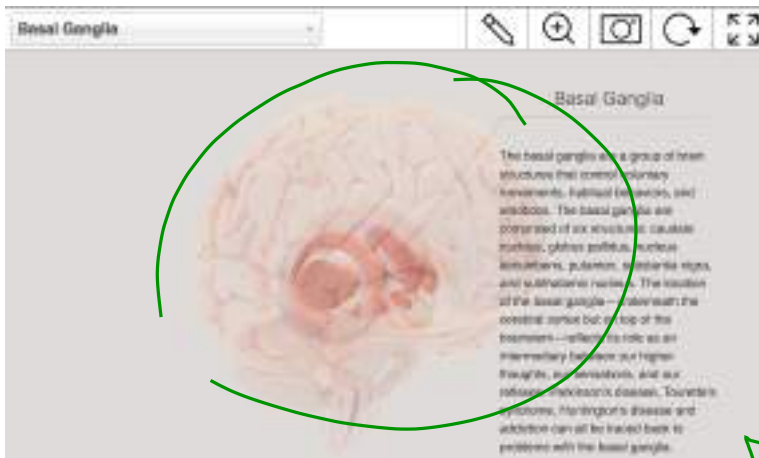


Kolodny et al. (2015) Annu. Rev. Public Health 36:559-74

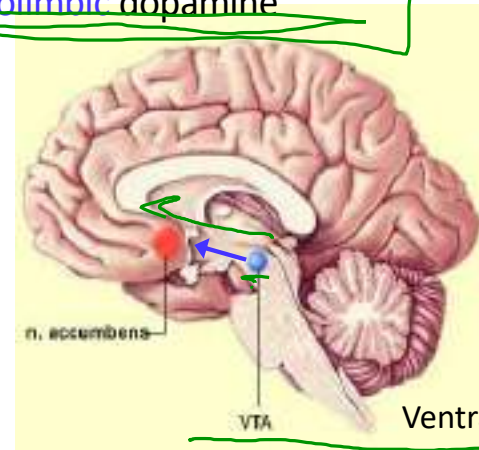
Figure 1. Rates of OPR sales, OPR-related unintentional overdose deaths, and OPR addiction treatment admissions, 1999–2010. Abbreviation: OPR, opioid pain reliever. Source: 10.

What ethical questions arise? What else would you want to know?

Addictive Processes and Reward: Key Brain Regions



The **mesocorticolimbic dopamine pathway:**



<http://www.brainfacts.org/3D-Brain>

<https://thebrain.mcgill.ca>

Tolerance, Withdrawal, and Stress

Psychoactive drugs fit into membrane proteins (receptors, transporters) like keys in locks.



They act like neurotransmitters OR can increase activity in neurotransmitter systems...

like DOPAMINE, GABA, GLUTAMATE or ACETYLCHOLINE

A. FINK 2019

After a while neurons might get used to this added activity...

And reduce receptors OR neurotransmitter release, to keep a balance.

This is how TOLERANCE can happen.



The problem is, with fewer receptors, people need to take more drug to feel good. And when people quit SOME drugs suddenly, their own neurotransmitter systems aren't working at full speed. This is when people experience WITHDRAWAL. It takes time for the brain's ENDOGENOUS neurotransmitter systems to come back online.

The MEMORY of that reward, the STRESS of tolerance and withdrawal and ongoing life stresses can be challenging when people want to stop using.

HELLO, EXTENDED AMYGDALA...



After learning more about addiction neuroethics, what do you think?
Who is responsible for negative consequences arising from addiction?
What about the case against Purdue Pharma (and the Sackler family)?

1. Beneficence and Non-maleficence

- Are drugs ever helpful?
- Adequate steps to minimize risks?
- Accuracy of claims / evidence

2. Autonomy

- Informed Consent

3. Justice – (*fairness*)

4. Personhood and identity

5. Social and Individual responsibilities?

- **Deontological ethics** – (*duty-based*)
- **Utilitarian ethics** - (*greatest good for the greatest number of people*)

Your questions, concerns & recommendations:




The Case of the Augmented Mind

Cognitive enhancement: a familiar issue?

“Enhancement”

Loosely defined
as beyond
healthy
functioning



The Atlantic


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The drug modafinil was recently found to enhance cognition in healthy people. Should you take it to get a raise?

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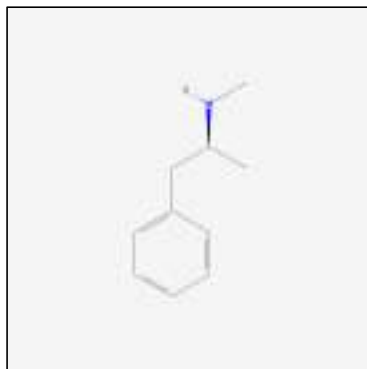
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A primer on cognitive enhancement

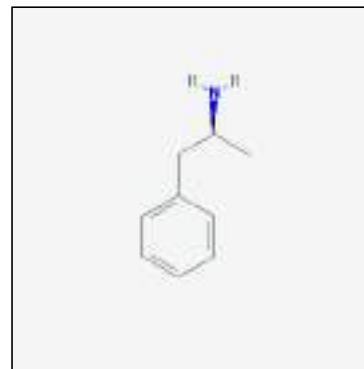
Some common drugs that are used as cognitive enhancers:

- Dextroamphetamine (®Adderall)
- Methylphenidate (®Ritalin)

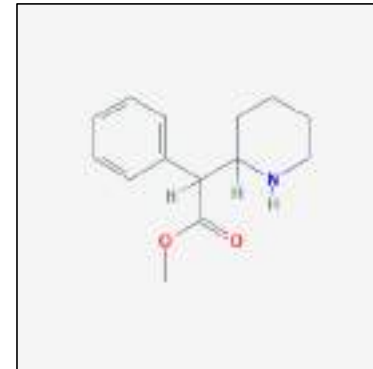
Methamphetamine



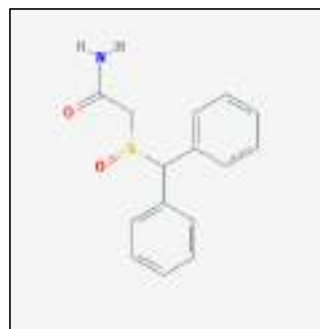
Dextroamphetamine



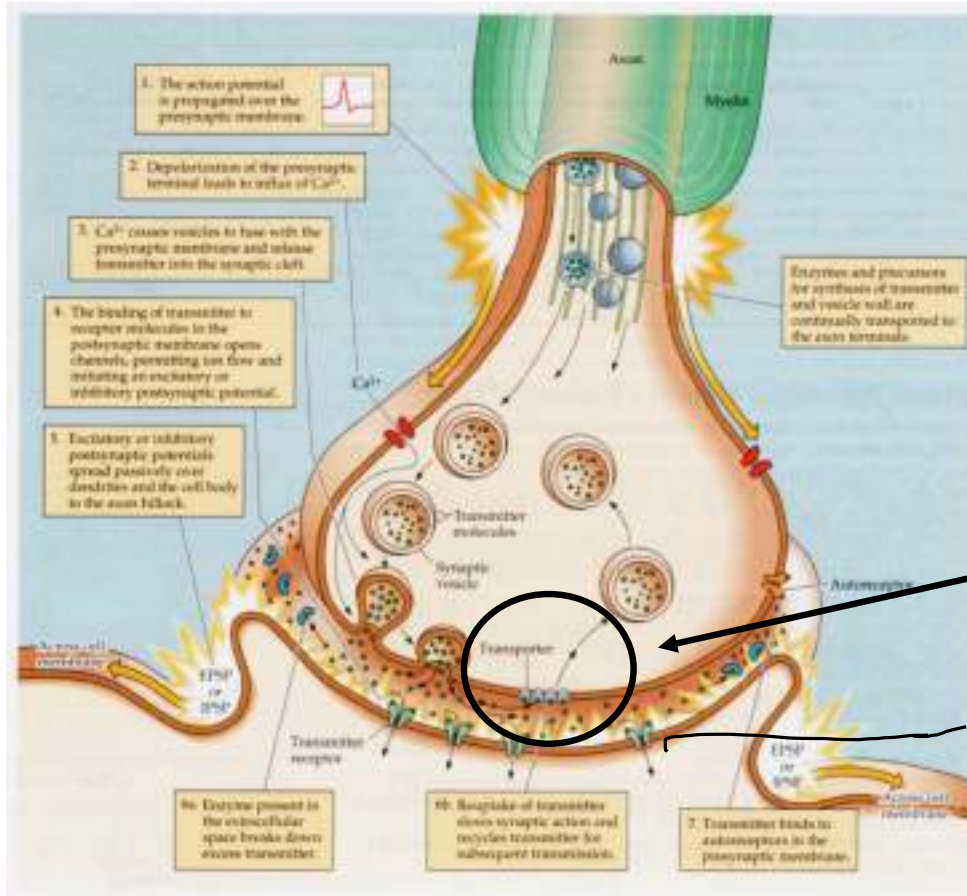
Methylphenidate



- Modafinil (®Provigil):



Synaptic transmission and reuptake



1. Calcium (Ca^{2+}) enters the *axon terminal*.
2. Neurotransmitters are released from *vesicles*
3. *Receptors* are activated on the *postsynaptic neuron*.

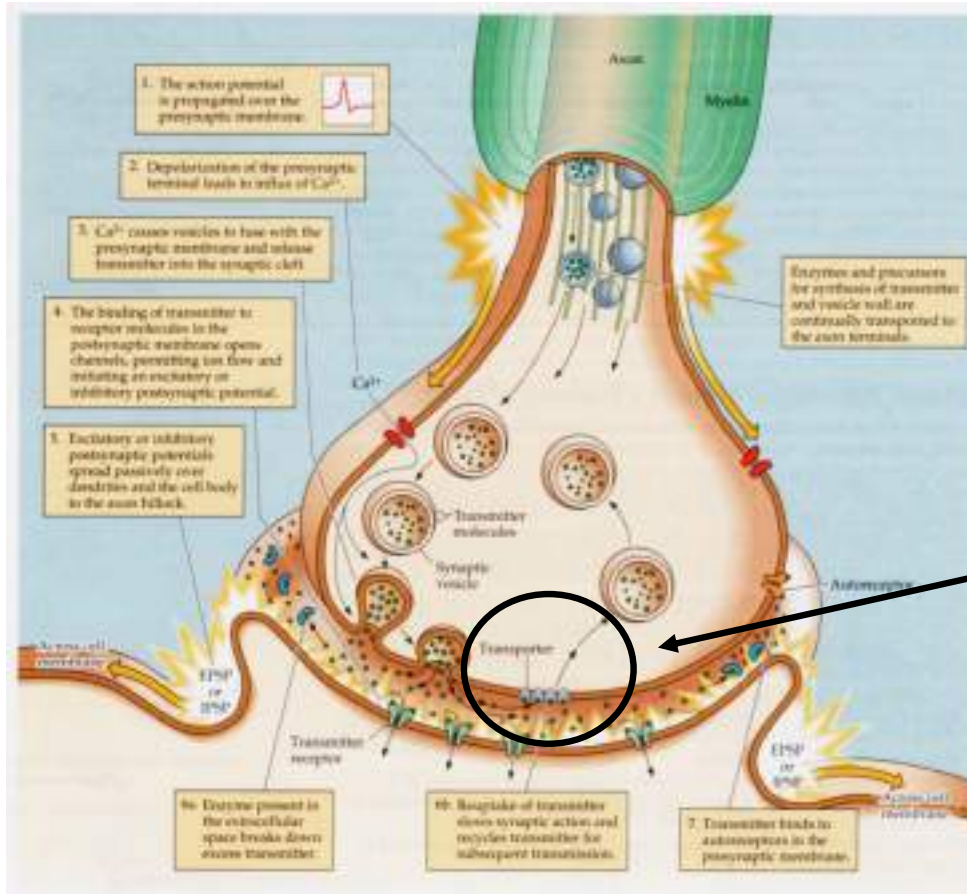
Finished, right?

4. Not yet! Neurotransmitter is degraded in the synapse OR
5. Taken back up into the cell by transporters (reuptake)

These steps keep too much neurotransmitter from building up in synapses.

From: Breedlove, S. Marc. (2010). Biological psychology : an introduction to behavioral, cognitive, and clinical neuroscience. Sunderland, Mass: Sinauer Associates, Inc.

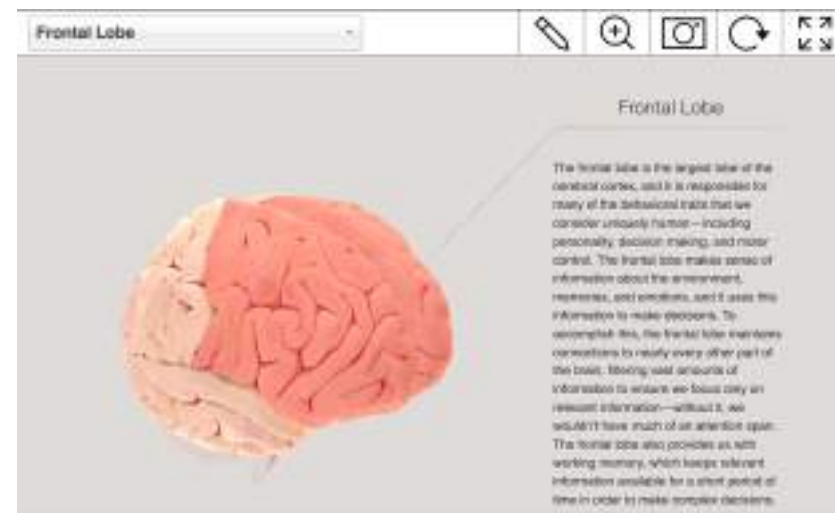
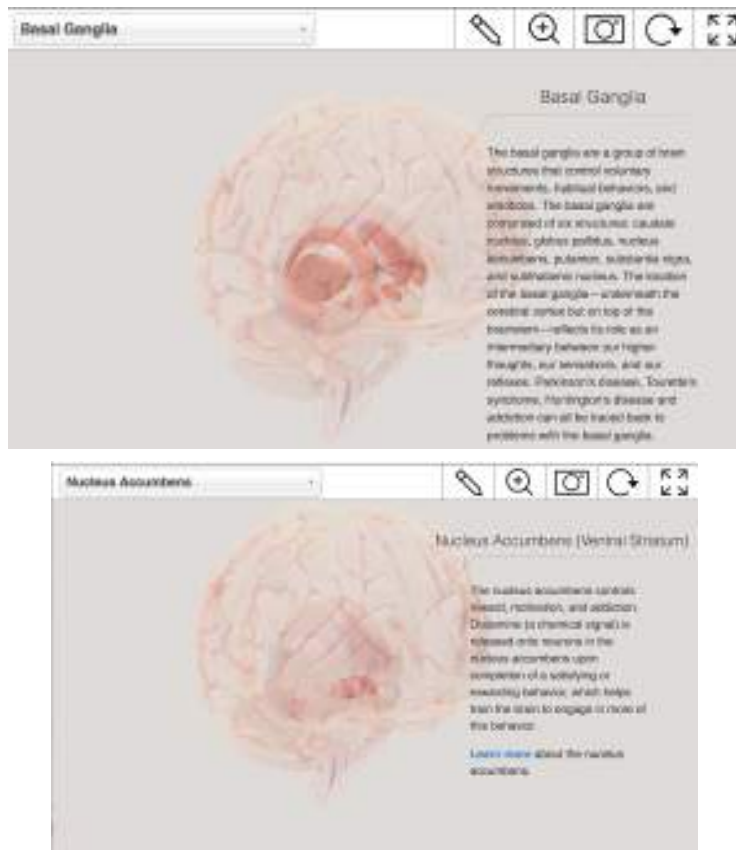
Synaptic transmission and reuptake



- Methylphenidate, Dextroamphetamine and methamphetamine all *block reuptake* of the neurotransmitter **dopamine**.
- Modafinil probably does this too but its precise mechanism is unknown.
 - Can increase excitation through **glutamate**
 - Can decrease inhibition through **GABA**

From: Breedlove, S. Marc. (2010). Biological psychology : an introduction to behavioral, cognitive, and clinical neuroscience. Sunderland, Mass: Sinauer Associates, Inc.

Cognitive enhancers: key brain regions



<http://www.brainfacts.org/3D-Brain>

Keep in mind: the entire brain – and multiple neurotransmitter systems - probably undergo changes. We don't know what all of them will be!

After learning more about them, do you think cognitive enhancers should be allowed? Why? When? And for whom?

1. Beneficence and Non-maleficence

- Are the drugs actually helpful?
- Adequate steps to minimize risks?
- Accuracy of claims / evidence

2. Autonomy

- Informed Consent

3. Distributive Justice – (fairness)

4. Personhood and identity

5. Social and Individual responsibilities?

- **Deontological ethics** – (duty-based)
- **Utilitarian ethics** - (greatest good for the greatest number of people)

Your questions, concerns & recommendations:

When
- A person has ↓ "normal"
cognitive → treatment /
enhancement
- Necessity for
functioning

One major problem to consider is the "treatment-enhancement distinction"...

Others? (addictive potential, long-term effects, etc.)

Who should decide...?

See this essay by an undergraduate contributor on the topic of cognitive enhancement:



Sahu, S. (2016). Cognitive Enrichment on Cognitive Enhancement at the Michigan Undergraduate Philosophy Conference. The Neuroethics Blog. Retrieved on September 21, 2018, from <http://www.theneuroethicsblog.com/2016/05/cognitive-enrichment-on-cognitive.html>