

*2018 ANNUAL INTERNATIONAL CONFERENCE ON ADHD:*  
**ADHD AND ADDICTION; AN OFTEN  
OVERLOOKED PROBLEM**

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  - *Nobody*
- Specific Disclosure Statement of Financial Interest:
  - I, Todd Love, DO NOT have a financial interest/arrangement or affiliation with the hosting organization that could be perceived as a real or apparent conflict of interest in the context of the subject of this presentation.



## Disclaimer

- Not an MD; Not offering medical advice
- Academic bias; possibly overly technical
- Pro-med approach
- Bias towards experience



## ADHD Disclosure/Disclaimer *(owning it)*

- **Yes, I've got ADHD.** Which means I have the potential to...
  - *...talk fast, jump around, interrupt myself, trail off, etc.*
- Freeze response at podium
  - Confession: *It I look like I'm reading, I probably am*
- ***Please hold questions until the end.***
- Reference styles will vary (too boring & tedious to fix)



# What is ADHD?

- *Among other things, it involves...*
- Executive Function challenges
- Inattention
- Impulsivity
  - Inability to delay gratification
- Novelty seeking
- *...and much more stuff not mentioned here.*



# What is Addiction?

- *Among other things, it involves...*
- Executive Function challenges
- Inattention
- Impulsivity
  - Inability to delay gratification
- Novelty seeking
- *...and much more stuff not mentioned here.*



## Correlations between ADHD & Addiction:

- Research reports 25–40 % of people with Substance Use Disorder also have ADHD
- Compared with control subjects without ADHD, children with ADHD were:
  - twice as likely to have a lifetime history of nicotine use
  - nearly 3 times more likely to report nicotine dependence in adolescence/ adulthood
  - almost 2 times more likely to meet diagnostic criteria for alcohol abuse or dependence
  - 1.5 times more likely to meet criteria for marijuana use disorder
  - twice as likely to develop cocaine abuse or dependence; and
  - more than 2.5 times more likely to develop an SUD overall.

Lee, S. S., et al. (2011). "Prospective association of childhood attention-deficit/hyperactivity disorder (ADHD) and substance use and abuse/dependence: a meta-analytic review." *Clinical psychology review* 31(3): 328-341.



## ADHD and Cannabis Use

- The prevalence of ADHD in adults seeking treatment for cannabis use disorders is estimated to be between **34% and 46%**
  - Notzon, D. P., et al., (2016) ADHD is highly prevalent in patients seeking treatment for cannabis use disorders. *Journal of attention disorders*.
- Results revealed that only **inattentive symptoms predicted problematic cannabis use in women**, whereas **hyperactive and impulsive symptoms**, but not inattentive symptomatology, **predicted cannabis misuse in men**
  - Kolla, N. J., et al. (2016). "Adult attention deficit hyperactivity disorder symptom profiles and concurrent problems with alcohol and cannabis: sex differences in a representative, population survey." *BMC Psychiatry* 16(1): 50.





## Whats the connection between ADHD & Addiction?

### **Physiological**

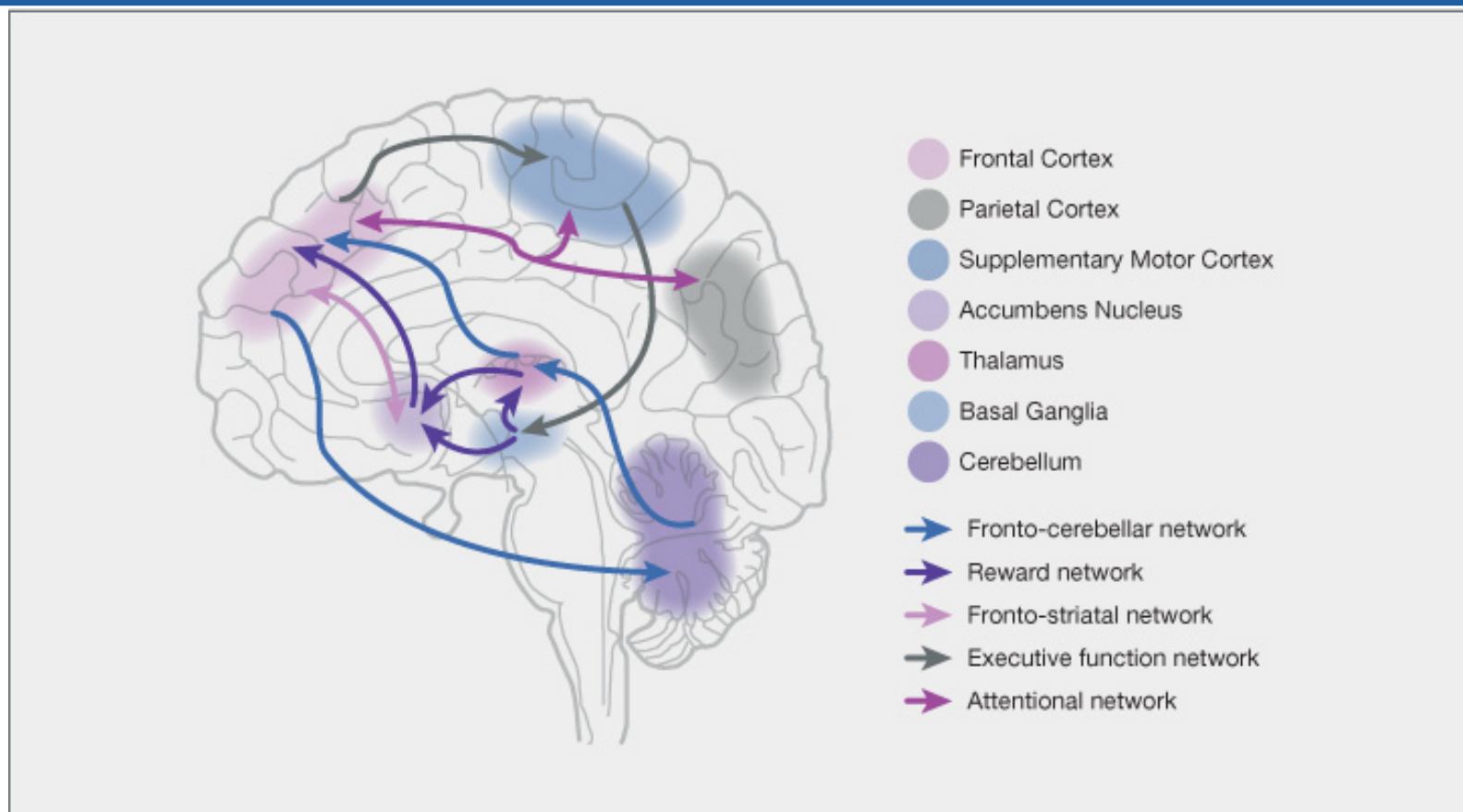
- ADHD brain has an inherent neurobiological predisposition
- More likely to respond positively to addictive stimuli
- Impulse control issues & Poor judgment (EF)
- Craves Novelty

### **Psychological**

- Curious, more likely to experiment
- Self-medicating
  - Anxiety
  - Boredom
  - Stress – work, school, relationships
  - Low self esteem, shame, emotional trauma, etc.
    - *The self-medication hypothesis is compelling in ADHD considering that the disorder is chronic and often associated with demoralization and failure, factors frequently associated with SUD.*



# ADHD Neurobiology



- Purper-Ouakil D, Ramoz N, Lepagnol-Bestel AM, et al. Neurobiology of attention deficit/hyperactivity disorder. *Pediatr Res* 2011; 69: 69R-76R./



# Potential ADHD-related Genes

- DAT1 – (480 bp)
- DBH – TaqI (A2 allele)
- **DRD2**
- **DRD4** – (7 + Repeat)
- MAOA
- SNAP25
- <more>



- Faraone, S. V. and E. Mick (2010). "Molecular genetics of attention deficit hyperactivity disorder." *Psychiatr Clin North Am* 33(1): 159-180.



# Dopamine & ADHD

- Fernandez-Jaen, A., et al. "Cingulate Cortical Thickness and Dopamine Transporter ( Dat1) Genotype in Children and Adolescents with Adhd." *J Atten Disord* 22.7 (2018): 651-60.
- Volkow, N. D., et al. "Motivation Deficit in Adhd Is Associated with Dysfunction of the Dopamine Reward Pathway." *Mol Psychiatry* 16.11 (2011): 1147-54.
- Volkow, N. D., et al. "Evaluating Dopamine Reward Pathway in Adhd: Clinical Implications." *JAMA* 302.10 (2009): 1084-91.
- Volkow, N. D., et al. "Depressed Dopamine Activity in Caudate and Preliminary Evidence of Limbic Involvement in Adults with Attention-Deficit/Hyperactivity Disorder." *Arch Gen Psychiatry* 64.8 (2007): 932-40.
- Swanson, J. M., et al. "Etiologic Subtypes of Attention-Deficit/Hyperactivity Disorder: Brain Imaging, Molecular Genetic and Environmental Factors and the Dopamine Hypothesis." *Neuropsychol Rev* 17.1 (2007): 39-59.
- Asherson, Philip, et al. "Confirmation That a Specific Haplotype of the Dopamine Transporter Gene Is Associated with Combined-Type Adhd." *American Journal of Psychiatry* 164.4 (2007): 674-77.
- Li, Dawei, et al. "Meta-Analysis Shows Significant Association between Dopamine System Genes and Attention Deficit Hyperactivity Disorder (Adhd)." *Human molecular genetics* 15.14 (2006): 2276-84.
- Faraone, Stephen V, et al. "Meta-Analysis of the Association between the 7-Repeat Allele of the Dopamine D4 Receptor Gene and Attention Deficit Hyperactivity Disorder." *American Journal of Psychiatry* 158.7 (2001): 1052-57.
- Swanson, J. M., et al. "Dopamine Genes and Adhd." *Neurosci Biobehav Rev* 24.1 (2000): 21-5.
- Dougherty, D. D., et al. "Dopamine Transporter Density in Patients with Attention Deficit Hyperactivity Disorder." *Lancet* 354.9196 (1999): 2132-3.
- Swanson, J. M., et al. "Association of the Dopamine Receptor D4 (Drd4) Gene with a Refined Phenotype of Attention Deficit Hyperactivity Disorder (Adhd): A Family-Based Approach." *Mol Psychiatry* 3.1 (1998): 38-41.
- LaHoste, Gerald J, et al. "Dopamine D4 Receptor Gene Polymorphism Is Associated with Attention Deficit Hyperactivity Disorder." *Mol Psychiatry* 1.2 (1996): 121-24.
- Cook Jr, Edwin H, et al. "Association of Attention-Deficit Disorder and the Dopamine Transporter Gene." *American journal of human genetics* 56.4 (1995): 993.



## Dopamine and ADHD – some key findings

- Imaging studies have shown that brain dopamine neurotransmission is disrupted in ADHD, & these deficits may **underlie core symptoms of inattention and impulsivity**.
- The ... dopamine pathway, which projects from the VTA in the midbrain to the NAc is critically involved in reward and motivation, and has been hypothesized to **underlie the reward and motivational deficits** observed in ADHD.
- Studies showed decreased NAc activation with processing of reward in participants with ADHD.
- The lower than normal D2/D3 receptor - availability in the - midbrain - supports the hypothesis of an impairment of the dopamine reward pathway in ADHD.
- The reward deficits in ADHD are characterized by a **failure to delay gratification..., and preference for small immediate rewards** over larger delayed rewards



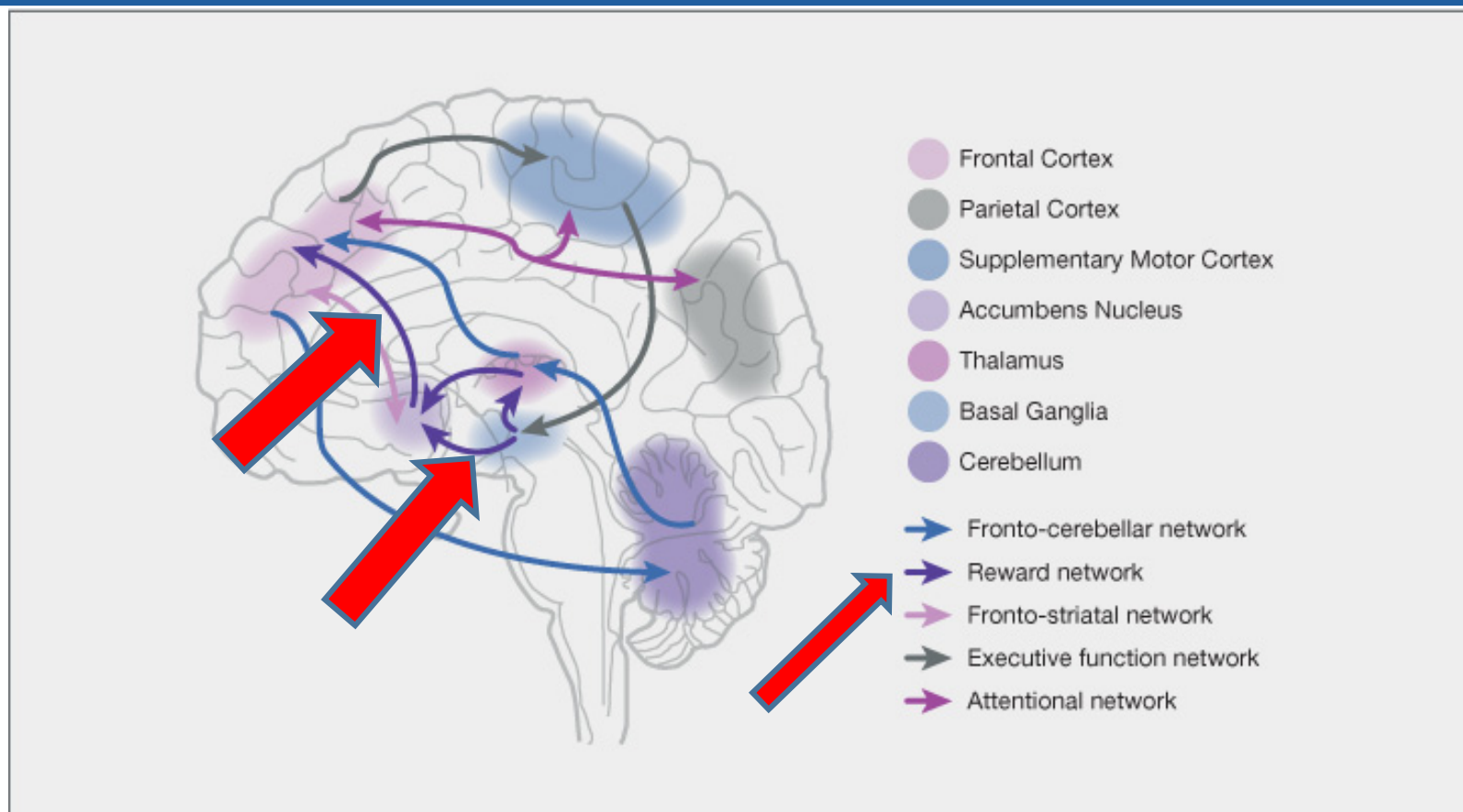
Volkow, N. D., et al. (2009). "Evaluating dopamine reward pathway in ADHD: clinical implications." *JAMA* 302(10)

## Dopamine and ADHD

- “...the D2/D3 receptor measures ... implicate the dopamine reward pathway in the symptoms of inattention in ADHD. This could provide an explanation of why the attentional deficits in individuals with ADHD are most evident in tasks that are considered boring, repetitive, and uninteresting.”
  - Volkow, N. D., et al. (2009). "Evaluating dopamine reward pathway in ADHD: clinical implications." *JAMA* 302(10): 1084-1091. (*Journal of the American Medical Association*)
- Nora Volkow, Director of the National Institute on Drug Abuse (NIDA)



# Addiction Neurobiology



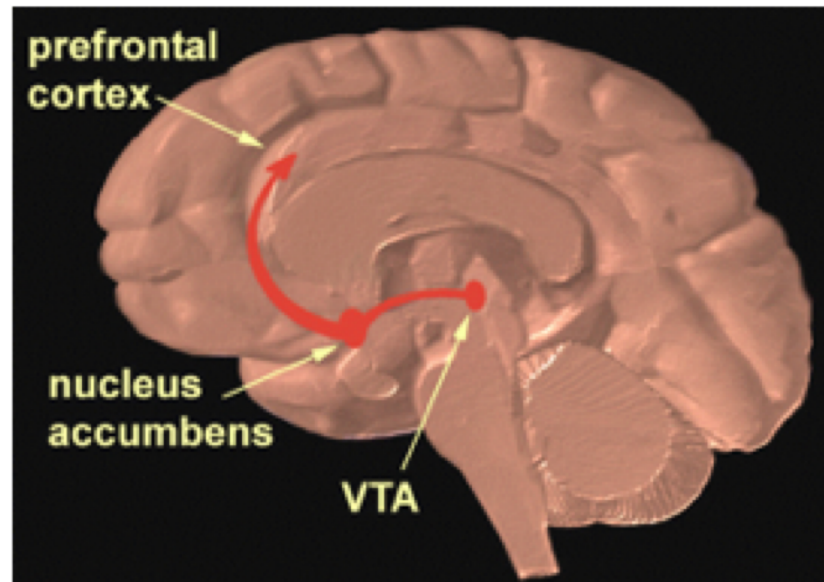
- Purper-Ouakil D, Ramoz N, Lepagnol-Bestel AM, et al. Neurobiology of attention deficit/hyperactivity disorder. *Pediatr Res* 2011; 69: 69R-76R./



# Addiction Neurobiology

## Mesocorticolimbic Dopamine System/Network:

1. **Mesolimbic pathway:** (horizontal red line) Midbrain, limbic, emotions, etc. Pathway that is most closely associated with impulsivity & motivation.
2. **Mesocortical pathway:** (vertical red line) Downward connection from frontal lobe to midbrain. associated with cognitive functions such as executive functions.





## Addiction Neurobiology – 3-Phase model

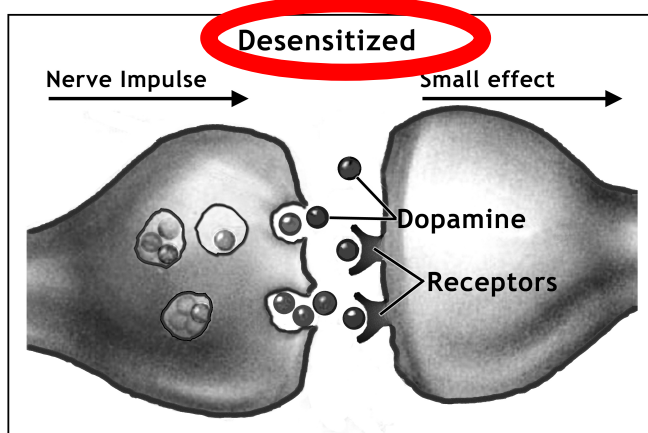
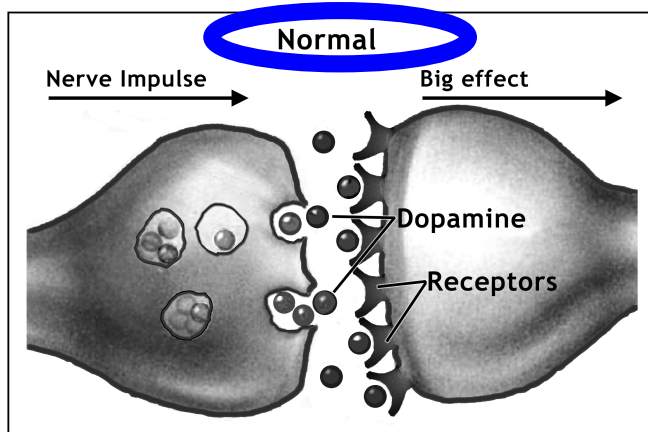
- **Stage 1: Binge/intoxication**
    - “Sensitization” “Thrills & excitement”
  - **Stage 2: Withdrawal/negative affect**
    - “Desensitization” “Numbed pleasure response”
    - (*ADHD natural state - boredom*)
  - **Stage 3: Preoccupation/anticipation**
    - “Hypofrontality: Willpower erodes”
    - (*ADHD natural state - impulsivity*)
- + Dysfunctional Stress Circuits**
- Can make even minor stress lead to cravings and relapse because they activate powerful sensitized pathways.
    - “**Anti-Reward**”
    - (*ADHD innate stress reactivity*)

Koob, George F., and Nora D. Volkow. "Neurocircuitry of addiction." *Neuropsychopharmacology* 35.1 (2010): 217.

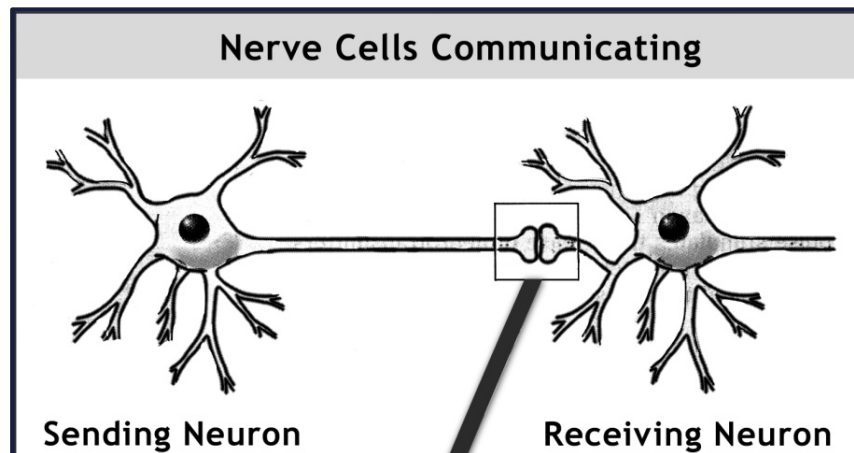


## Another fancy science slide – Neural Synapses

### Overstimulation Leads to Desensitization



### Nerve Cells Communicating



- **Addiction results in a change in dopamine dopamine signaling.**
  - *In some respects, this similar to the natural starting state of the ADHD brain\**



# Dopamine & Addiction

- van Holst, R. J., et al. "Increased Striatal Dopamine Synthesis Capacity in Gambling Addiction." *Biol Psychiatry* (2017).
- Majuri, J., et al. "Dopamine and Opioid Neurotransmission in Behavioral Addictions: A Comparative Pet Study in Pathological Gambling and Binge Eating." *Neuropsychopharmacology* 42.5 (2017): 1169-77.
- Nutt, D. J., et al. "The Dopamine Theory of Addiction: 40 Years of Highs and Lows." *Nat Rev Neurosci* 16.5 (2015): 305-12.
- Trifilieff, Pierre, and Diana Martinez. "Imaging Addiction: D<sub>2</sub> Receptors and Dopamine Signaling in the Striatum as Biomarkers for Impulsivity." *Neuropharmacology* 76 (2014): 498-509.
- Huys, Q. J., et al. "The Role of Learning-Related Dopamine Signals in Addiction Vulnerability." *Prog Brain Res* 211 (2014): 31-77.
- Blum, Kenneth, et al. "Neurogenetics and Nutrigenomics of Reward Deficiency Syndrome (Rds): Stratification of Addiction Risk and Mesolimbic Nutrigenomic Manipulation of Hypodopaminergic Function." *Omics for Personalized Medicine*. Springer, 2013b. 365-98.
- Blum, K, et al. "Dopamine Genetics and Function in Food and Substance Abuse." *Journal of genetic syndrome & gene therapy* 4.121 (2013).
- Taber, Katherine H, et al. "Neuroanatomy of Dopamine: Reward and Addiction." *The Journal of Neuropsychiatry and Clinical Neurosciences* 24.1 (2012): 1-4.
- Hou, H., et al. "Reduced Striatal Dopamine Transporters in People with Internet Addiction Disorder." *J Biomed Biotechnol* 2012 (2012): 854524.
- George, Olivier, Michel Le Moal, and George Koob. "Allostasis and Addiction: Role of the Dopamine and Corticotropin-Releasing Factor Systems." *Physiology & behavior* 106.1 (2012): 58-64.
- Volkow, N. D., et al. "Addiction: Beyond Dopamine Reward Circuitry." *Proc Natl Acad Sci U S A* 108.37 (2011): 15037-42.
- Kim, S. H., et al. "Reduced Striatal Dopamine D2 Receptors in People with Internet Addiction." *Neuroreport* 22.8 (2011): 407-11.
- Volkow, N. D., et al. "Dopamine in Drug Abuse and Addiction: Results from Imaging Studies and Treatment Implications." *Mol Psychiatry* 9.6 (2004): 557-69.



## Neurobiological Overlap of ADHD and Addiction

- “This study reveals depressed dopamine activity in <brain> regions in adults with ADHD ... and ... suggests that dopamine dysfunction ... may also contribute to substance abuse comorbidity in ADHD.”
  - Volkow, N. D., et al. (2007). "Depressed dopamine activity in caudate and preliminary evidence of limbic involvement in adults with attention-deficit/hyperactivity disorder." Arch Gen Psychiatry, 64(8): 932-940.



## Caffeine to Self-Medicate ADHD

- *Adolescents with ADHD were nearly twice as likely to use more caffeine than were adolescents without ADHD*
  - Walker, L. R., Abraham, A. A., & Tercyak, K. P. (2010). Adolescent caffeine use, ADHD, and cigarette smoking. *Children's Health Care*, 39(1), 73-90.
- ...**potential for caffeine** treatment **to normalize** frontocortical dopaminergic function and to abrogate **attention** and cognitive changes characteristic of ADHD.
  - Pandolfo, P., et al. (2013). "Caffeine regulates frontocostriatal dopamine transporter density and improves attention and cognitive deficits in an animal model of attention deficit hyperactivity disorder." *Eur Neuropsychopharmacol* 23(4): 317-328.
- Caballero, M., et al. (2011). "**Caffeine improves attention deficit in** neonatal 6-OHDA lesioned rats, an animal model of **attention deficit hyperactivity disorder (ADHD)**." *Neurosci Lett* 494(1): 44-48.



## Nicotine to Self-Medicate ADHD

- **...nicotine may be useful in treating the symptoms of ADHD.** Nicotine caused an overall significant reduction in reaction time on the CPT, as well as, ... , a significant reduction in another index of inattention... It is concluded that nicotine deserves further clinical trials with ADHD.
  - Levin, E. D., et al. (1996). "Nicotine effects on adults with attention-deficit/hyperactivity disorder." *Psychopharmacology (Berl)* 123(1): 55-63.
- This small study provided **evidence that nicotine treatment can reduce severity of attentional deficit symptoms** and produce improvement on an objective computerized attention task.
  - Levin, E. D., et al. (2001). "Effects of chronic nicotine and methylphenidate in adults with attention deficit/hyperactivity disorder." *Exp Clin Psychopharmacol* 9(1): 83-90.
- **Nicotinic modulating agents are being evaluated for the treatment of ADHD.**
  - Wilens, T. E. and N. R. Morrison (2011). "The intersection of attention-deficit/hyperactivity disorder and substance abuse." *Curr Opin Psychiatry* 24(4): 280-285



## 3 Myths about ADHD & Addiction

1. Stimulant medication treatment of ADHD in childhood can lead to addiction later in life.
2. Long-term use of stimulant medication will lead to addiction.
3. People with ADHD will abuse their stimulant medication



## 1: Childhood stimulant use does NOT lead to Addiction

- “Pharmacologic treatment of ADHD **does not appear to increase the risk** for development of SUD in ADHD patients.”
  - Wilens, T. E. and H. P. Upadhyaya (2007). "Impact of substance use disorder on ADHD and its treatment." *J Clin Psychiatry* 68(8):e20.
- “This study **concurs with 11 previous studies in finding no compelling evidence** that stimulant treatment of children with ADHD disorder leads to an increased risk for substance experimentation, use, dependence, or abuse by adulthood.”
  - Barkley, R. A., et al. (2003). "Does the treatment of attention-deficit/hyperactivity disorder with stimulants contribute to drug use/abuse? A 13-year prospective study." *J Pediatrics* 111(1): 97-109.





## Stimulant use can REDUCE the risks for Addiction

*i.e. Medications may offer a protective effect*

- “Consistent with findings in untreated ADHD in adults, untreated ADHD was a significant risk factor for SUD in adolescence. In contrast, **pharmacotherapy was associated with an 85% reduction in risk for SUD in ADHD youth.**”
  - Biederman, J., et al. (1999). "Pharmacotherapy of attention-deficit/hyperactivity disorder reduces risk for substance use disorder." *Pediatrics*, 104(2): e20-e20.
- Conclusions: We found no indication of increased risks of substance abuse among individuals prescribed stimulant ADHD medication; **if anything, the data suggested a long-term protective effect on substance abuse**
  - Chang, Z., et al. (2014). "Stimulant ADHD medication and risk for substance abuse." *J Child Psychol Psychiatry* 55(8): 878-885.



## 2: Long-term stimulant use does NOT lead to Addiction

- “ADHD medication was not associated with increased rate of substance abuse. Actually, the rate during 2009 was **31% lower among those prescribed ADHD medication...** Also, **the longer the duration of medication, the lower the rate of substance abuse.**”
  - Chang, Z., et al. (2014). "Stimulant ADHD medication and risk for substance abuse." *J Child Psychol Psychiatry*, 55(8): 878-885.
- Neurotypical Brain ≠ ADHD Brain



### 3: Stimulant medication rarely abused by ADHD'ers

- Neurotypical Brain ≠ ADHD Brain
  - Starbucks Syndrome
  - Zombie Mode
- Psychostimulants, ... are effective first-line pharmacotherapy for ADHD and when used appropriately in individuals with ADHD do not appear to be frequently abused by patients. ... *Short-acting psychostimulant formulations may have higher potential for abuse, misuse, and diversion..*
  - Kollins, S. H. (2008). "ADHD, substance use disorders, and psychostimulant treatment: current literature and treatment guidelines." *Journal of attention disorders*, 12(2): 115-125.
- *"Generation Adderall", New York Times article, 10/16/2016*



## 3 Myths about Addiction Treatment for people with ADHD

1. (“We don’t need to screen for that”)
2. “People with ADHD must discontinue their stimulant medication while in treatment for addiction in order to get sober”
3. “People with ADHD and history of substance abuse will be unable to safely use their medication to manage their ADHD symptoms after they become sober”



# 1: Addiction Treatment Programs MUST Screen for ADHD

## Addiction Treatment Programs: Inpatient/Outpatient

- Generally screen for and treat dual diagnosis
  - Mood Disorders: Bipolar, Depression, etc (nearly always screened for)
    - SSRI's: Prozac, etc.\*
    - Mood Stabilizers: Lithium\*
  - Thought Disorders: Schizophrenia, etc (sometimes screened for)
    - Antipsychotics: Abilify, Seroquel, etc \*
  - Attention Disorders: ADHD (rarely screened for)
    - Stimulant Medications: ~~Concerta~~, Vyvanes, etc.
    - Non-stimulant medications: Strattera
      - Takes 4-6 weeks before benefits kick-in
      - Takes 12-24 weeks for optimal efficacy
- Given the generally high prevalence of adult ADHD, all treatment seeking SUD patients should be screened and, after a confirmed diagnosis, treated for ADHD since the literature indicates poor prognosis of SUD in treatment seeking SUD patients with ADHD
  - van de Glind, G., et al. (2014). "Variability in the prevalence of adult ADHD in treatment seeking substance use disorder patients: results from an international multi-center study exploring DSM-IV and DSM-5 criteria." *Drug and alcohol dependence* 134: 158-166.
- \*Non-specific and non-exhaustive generalizations used,



## 2a: Addiction Tx MUST include ADHD Tx

- People with both ADHD and addiction problems need to have these two issues treated concurrently
- “Given the generally high prevalence of adult ADHD, **all treatment seeking SUD patients should be** screened and, after a confirmed diagnosis, **treated for ADHD** since the literature indicates poor prognosis of SUD in treatment seeking SUD patients with ADHD”
  - van de Glind, G., et al. (2014). "Variability in the prevalence of adult ADHD in treatment seeking substance use disorder patients: results from an international multi-center study exploring DSM-IV and DSM-5 criteria." *Drug and alcohol dependence* 134: 158-166.



## 2b: Addiction Tx can include ADHD Rx

### Stimulant medication can be beneficial for people with ADHD in addiction treatment

- **Conclusion:** When treating co-occurring ADHD and cocaine dependence with stimulant medication, abstinence is most likely preceded by improvement in ADHD, which tends to occur early with medication treatment
  - Levin, F. R., et al. (2018). "How treatment improvement in ADHD and cocaine dependence are related to one another: A secondary analysis." *Drug and alcohol dependence* 188: 135-140.
- Stimulant treatment resulted in an almost two-fold reduction in cigarette smoking and SUD in adolescent girls with ADHD
  - Wilens TE, et al. (2008) Effect of prior stimulant treatment for attention- deficit/hyperactivity disorder on subsequent risk for cigarette smoking and alcohol and drug use disorders in adolescents. *Arch Pediatr Adolesc Med*.



## ADHD'ers may benefit from their Rx while in SUD treatment

- Simultaneous and integrated treatment of ADHD and SUD, using a combination of pharmaco- and psychotherapy, is recommended.
  - Crunelle, C. L., et al. (2018). "International consensus statement on screening, diagnosis and treatment of substance use disorder patients with comorbid attention deficit/hyperactivity disorder." Eur Addict Res **24**(1): 43-51.
- Treatment for adults with ADHD and substance abuse should include a combination of addiction treatment/psychotherapy and <ADHD> pharmacotherapy.
  - Wilens, T. E. (2004). "Impact of ADHD and its treatment on substance abuse in adults."





### 3: L-T Use of ADHD Rx can support L-T Addiction Recovery

- Methylphenidate treatment reduces ADHD symptoms and the risk for relapse to substance use in criminal offenders with ADHD and substance dependence. (amphetamine)
  - Konstenius, M., et al. (2014). "Methylphenidate for attention deficit hyperactivity disorder and drug relapse in criminal offenders with substance dependence: a 24-week randomized placebo-controlled trial." *Addiction* 109(3): 440-449.



## 12-step position(s)

- Common local position:

- A person must quit ALL addictive drugs in order to get sober.
- Irrelevant if the medication is properly prescribed for a medical purpose

- Official position:

- Second, the spirituality of AA does not compete with medicine.

Alcoholics Anonymous published work is very clear that it is '*wrong to deprive any alcoholic of medication which can alleviate or control other disabling physical and/or emotional problems*' and that '*no AA member plays doctor*' [34, p.11].

- Alcoholics Anonymous. *The AA member medications and other drugs*. New York: Alcoholics Anonymous World Services (Undated pamphlet).



## Ann Myers story

- Insert Ann's TedX video here
- Ann Myers: [afmyers43@gmail.com](mailto:afmyers43@gmail.com)



*2018 ANNUAL INTERNATIONAL CONFERENCE ON ADHD:*

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OVERLOOKED PROBLEM**

**PART II**

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# “Addiction”

- Historical Concept of Addiction
  - “A chronic, relapsing brain disease that is characterized by compulsive drug seeking and use, despite harmful consequences” (NIDA, 2012)
  - Disputed Term: Descriptive vs. Pejorative
    - Eliminated in DSM-III, Reproposed for DSM-5
  - About Reward, not Pleasure
  - *Anticipation*

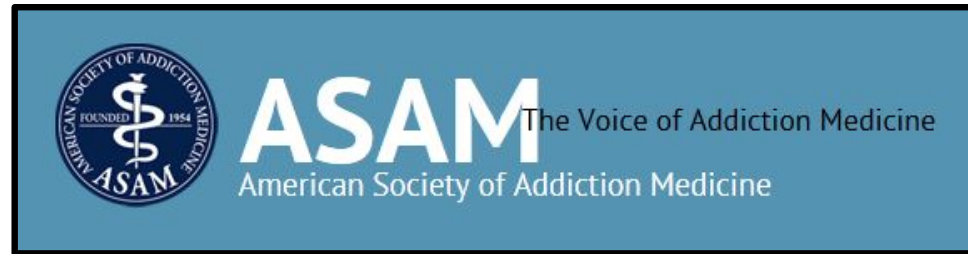


# Behavioral Addiction

- Not a new concept:
  - Orford (1985) “Excessive Appetites” – gambling, eating, sex
  - Marlatt, Baer, Donovan, & Kivlahan (1988) “Addictive behaviors”
- Multiple overlaps b/t behavioral addictions and chemical addictions:  
Comorbidity, course, genetic contribution, neurobiology, phenomenology (craving, intoxication, withdrawal), tolerance, and treatment response (Grant, Potenza, Weinstein, & Gorelick, 2010; Leeman & Potenza, 2013) [\(more & more & more ...\)](#)



## Behavioral Addiction



- A primary, chronic disease of brain reward, motivation, memory and related circuitry...This is reflected in an individual pathologically pursuing reward and/or relief by substance use and other behaviors. (ASAM, 2011)



## Tolerance and Withdrawal

- **Tolerance** results from a homeostatic adaptation to chronic increased levels of dopamine in the Reward Center (potentially caused by alcohol, gambling, gaming, porn, sex, etc.)
  - Need more to maintain desired state
- **Withdrawal** – incorrectly thought to require external chemical consumption
  - Withdrawal is negative mood state resulting from loss of artificially elevated levels of dopamine due to cessation of chronic activities (chemical consumption or behavioral patterns)





## Example Addictive Behaviors

- Lifestyle-related
  - Gambling Disorder, Shopping Addiction, Sex Addiction, Workaholism, Exercise Addiction
- Technology-related
  - Internet-related Addictions
  - Cell Phone Addiction
  - Social Networking Addiction
  - Facebook Addiction (*now Snapchat or Instagram?*)
- Food-related
  - Binge Eating
    - Cortese, S., Bernardina, B. D., & Mouren, M. C. (2007). Attention-deficit/hyperactivity disorder (ADHD) and binge eating. *Nutrition reviews*, 65(9), 404-411.



## Escapism/Avoidance vs. Problematic Use vs Behavioral Addiction

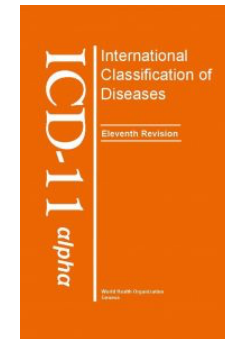
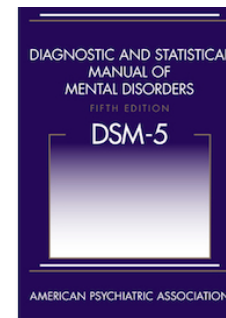
### *INTERNET USE* (Shopping, Surfing, Chatting, etc., etc., etc.)

- Escapism / Avoidance
  - Common in today's world
  - "Anti-mindfulness"
- Problematic Use
  - Behavior is starting to have life consequences
    - Work, school, relationships (intimate, family, friends, etc.).
- Behavioral Addiction
  - **Addiction-related brain changes have occurred**



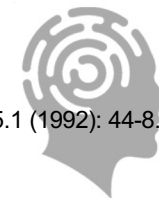
# Gambling Disorder

- Now officially an addiction in both the DSM-5 & ICD-11 (*upcoming*)
  - Substance-Related and Addictive Disorders
    - Substance-Related Disorders
      - Drugs, alcohol, nicotine, caffeine
    - Non-Substance-Related Disorders
      - [Gambling Disorder](#)
  - Disorders due to substance use or addictive behaviors
    - Disorders due to substance use
      - Drugs, alcohol, nicotine, caffeine
    - Disorders due to addictive behaviors
      - [Gambling Disorder](#)



## Gambling Disorder & ADHD

- Reid, Rory C, et al. "Characteristics of Treatment Seeking Problem Gamblers with Adult Adhd." *International Journal of Mental Health and Addiction* (2018): 1-16.
- Mak, C., K. K. Tan, and S. Guo. "Adhd Symptoms in Pathological and Problem Gamblers in Singapore." *Int J Environ Res Public Health* 15.7 (2018): 1307.
- Waluk, OR, GJ Youssef, and NA Dowling. "The Relationship between Problem Gambling and Attention Deficit Hyperactivity Disorder." *Journal of gambling studies* 32.2 (2016): 591-604.
- Theule, Jennifer, et al. "Exploring the Relationships between Problem Gambling and Adhd: A Meta-Analysis." *Journal of attention disorders* (2016): 1087054715626512.
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# Gambling Disorder & ADHD

- Common research findings:
  - ~25% of people with Gambling Disorder also meet criteria for ADHD
  - ADHD predicts earlier onset and greater severity of gambling problems
  - ADHD a risk factor for the persistence of gambling problems over time
- *“...a considerable proportion of treatment-seeking problem gamblers report ADHD...They highlight the need for specialist gambling agencies to develop screening, assessment, and management protocols for co-occurring ADHD to enhance the effectiveness of treatment.”*
  - Waluk, O., et al. (2016). "The relationship between problem gambling and attention deficit hyperactivity disorder." Journal of Gambling Studies.
- “It seems that **stabilization of dopamine signaling that occurs when ADHD is treated** is itself also **a treatment for certain forms of problem gambling.**”
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- Interesting recent findings:
  - Gamblers with ADHD significantly more prone to betting on a sporting event or animal races
  - *None* of the gamblers with ADHD reported problems with purchasing *lottery tickets*
    - Compared to 6% of problem gamblers without ADHD
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## Internet-Related Addictions

- Internet Addiction
  - Internet Gaming Disorder
  - Internet Pornography Addiction
- 
- Problematic Internet Use
  - Problematic Gaming
  - Problematic Pornography Use



## Internet Addiction (Problematic Internet Use)

- Officially Proposed for DSM-5 (not accepted)
  - Block (2008) 4 key components: *excessive use, withdrawal, tolerance, & adverse consequences*
- Internet Addiction Disorder (IAD)
- Internet Use Disorder (IUD)
- Compulsive Internet Use (CIU)
- Problematic Internet Use (PIU)
- Internet Communication Disorder (ICD) (SNS focused)



## Internet Pornography Addiction (IPA)

- #2 of 3 original subtypes of Internet Addiction
- Alternate terms for IPA
  - IPVD – Internet Pornography Viewing Disorder
  - IPD – Internet Pornography Use Disorder
  - PPU – Problematic Pornography Use
- *“Compulsive Sexual Behavior Disorder” (CSB)*
  - *Official ICD-11 diagnosis (upcoming release)*





# Porn Induced Erectile Dysfunction (PIED)

- *Another Problem w/ Repeated Porn Use*



Time Magazine cover article (04/11/2016)



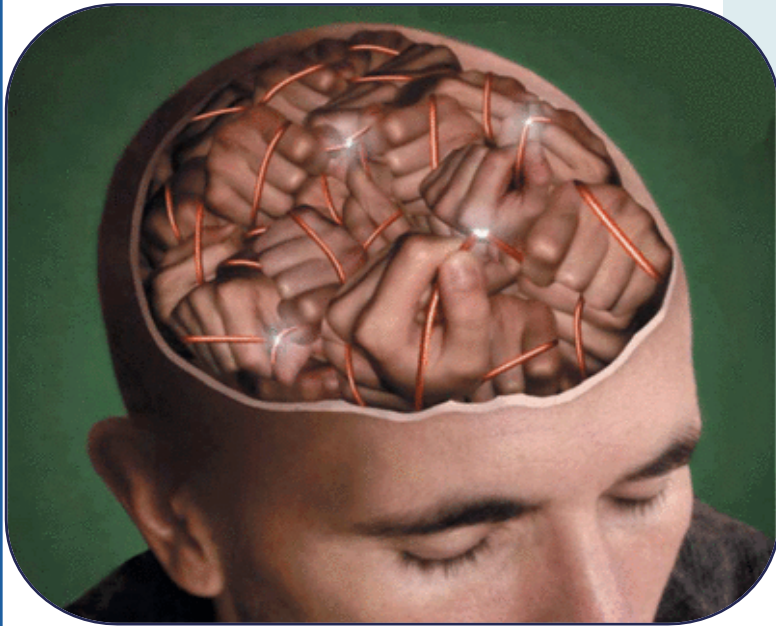
## Internet Gaming Disorder (IGD)

- #1 of 3 originally proposed subtypes of Internet Addiction
- Listed in Section III “Conditions for further study” in the DSM-5
- Accepted by WHO as “Gaming Disorder” in the ICD-11
- Other terms:
  - Internet Gaming Addiction
  - Online Gaming Addiction
  - Problematic Online Game Use (POGU)
  - Problem Video Game Playing (PVGP)
  - Video Game Addiction // Video Gaming Disorder



# Neurobiology of Internet Addiction

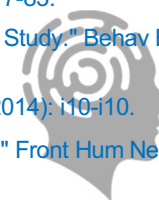
**Neuroplasticity**: the brain's ability to change and adapt as a result of experience



1. Sensitization
2. Desensitization
3. Hypofrontality

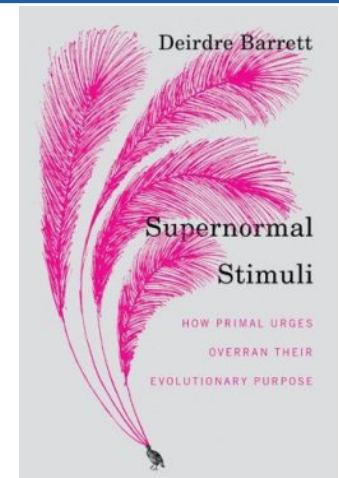
## Neuroscience Research on Internet Addiction in the last 5 years

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- Zhu, Y., H. Zhang, and M. Tian. "Molecular and Functional Imaging of Internet Addiction." *Biomed Res Int* 2015 (2015): 378675.
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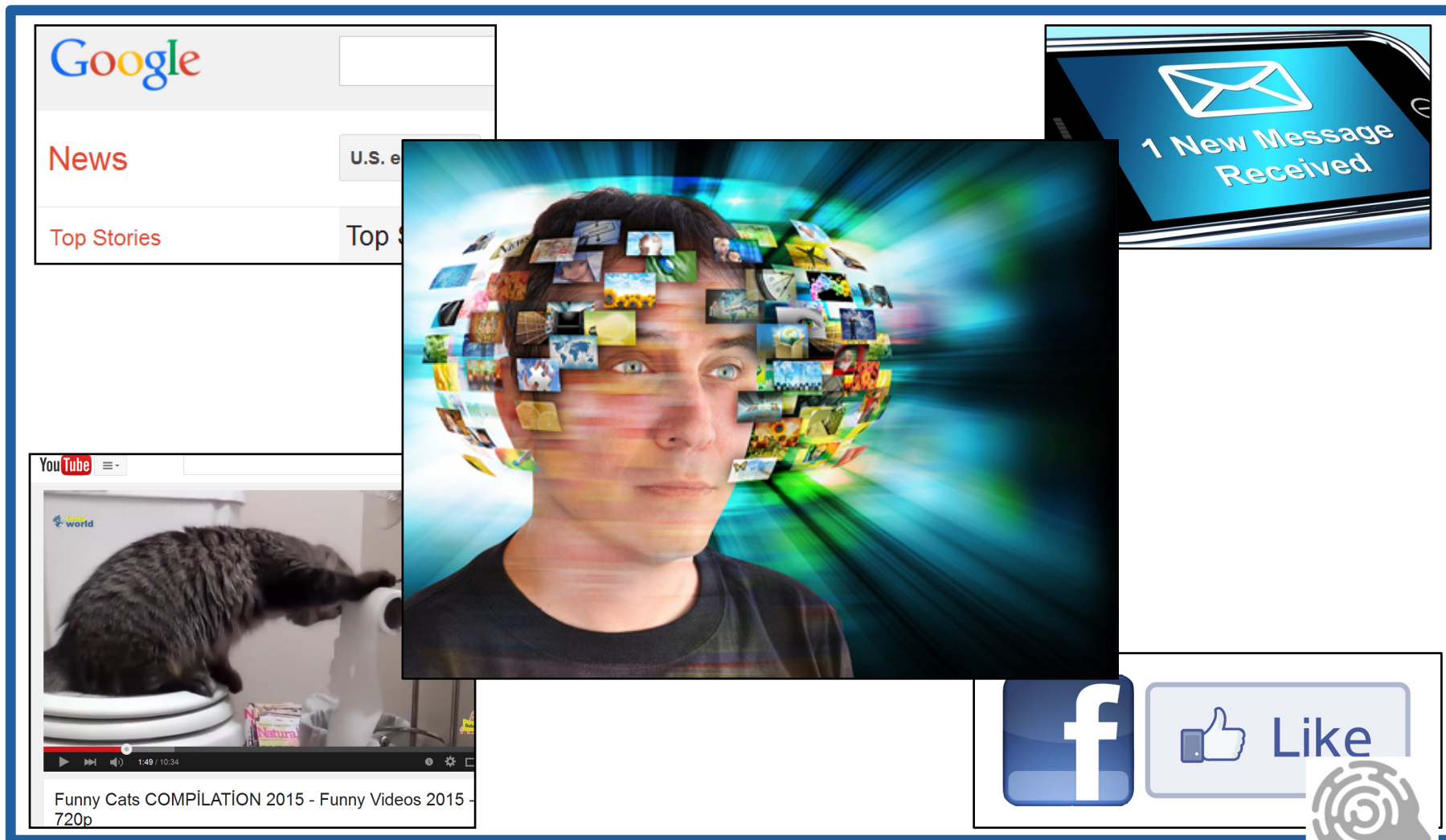


# Supernormal Stimulus

- Tinbergen
  - Bird Eggs & Butterfly Wings
- Deirdre Barrett



# Information Overload – Classical Conditioning

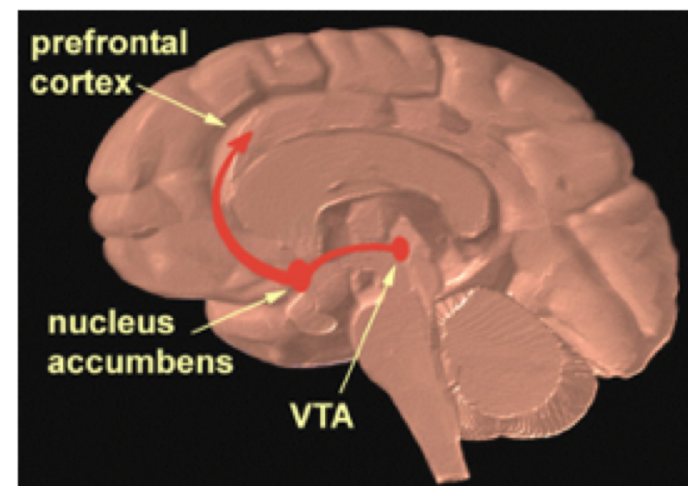
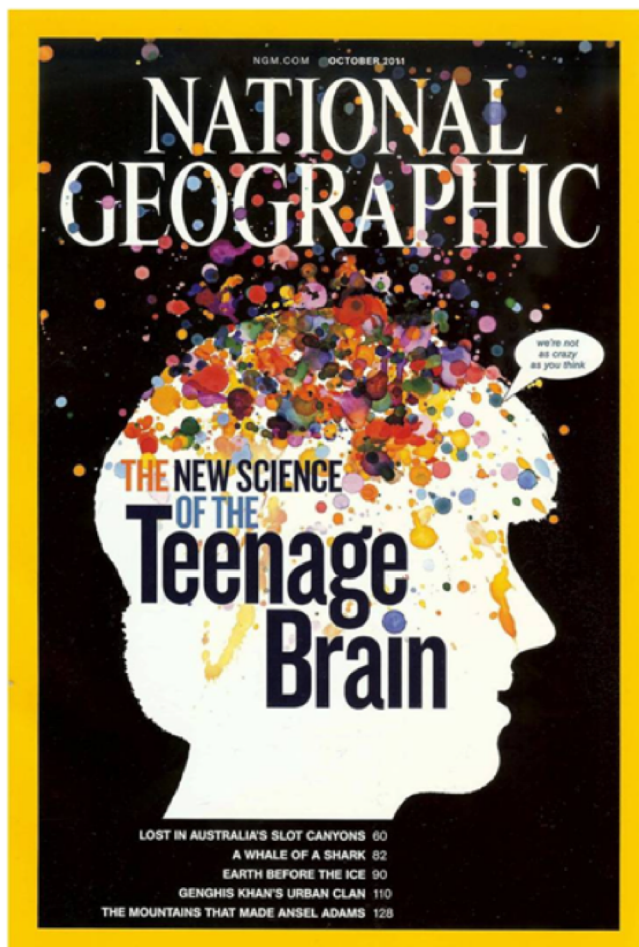


## Dopamine and the Internet

- *Anticipation*
- *Searching & Seeking*
- *Endless Novelty*



# Special Considerations: Adolescents





Consequences without addiction: Decreased motivation & failure-to-launch  
Video: Philip Zimbardo Ted Talk: “The Demise of Guys”



## Myths about ADHD & the Internet:

- “Too much Internet use/gaming causes ADHD”
  - Wrong!
    - Impossible if ADHD is “pre-wired” in the brain.
    - $A \Rightarrow B$
    - $B \nRightarrow A$
- *However:*
  - ...inattention and hyperactivity symptoms in Internet Addiction should not solely be accounted by an independent ADHD disorder but should consider the possibility of ... symptoms related to Internet Addiction.
  - Functional and structural brain abnormalities associated with excessive and pathologic Internet usage might be related to these [ADHD-like symptoms](#).
    - Kim, D., et al. (2017). "Association between childhood and adult attention deficit hyperactivity disorder symptoms in Korean young adults with Internet addiction." *Journal of Behavioral Addictions* 6(3): 345-353.
- What else does the research say? ...



## Research on ADHD and Internet Addiction in Korea

- Park, J. H., et al. (2017) Comparison of Qeeg Findings between Adolescents with Attention Deficit Hyperactivity Disorder (Adhd) without Comorbidity and Adhd Comorbid with Internet Gaming Disorder. Journal of Korean Medical Science.
- Lee, D., et al. (2017) Altered Functional Connectivity in Default Mode Network in Internet Gaming Disorder: Influence of Childhood Adhd. Prog Neuropsychopharmacol Biol Psychiatry. \*
- Kim, D., et al. (2017) Association between Childhood and Adult Attention Deficit Hyperactivity Disorder Symptoms in Korean Young Adults with Internet Addiction. Journal of Behavioral Addictions. \*
- Park, J. H., et al. (2016) Effectiveness of Atomoxetine and Methylphenidate for Problematic Online Gaming in Adolescents with Attention Deficit Hyperactivity Disorder. Human Psychopharmacology: Clinical and Experimental.
- Han, D. H., et al. (2009) The Effect of Methylphenidate on Internet Video Game Play in Children with Attention-Deficit/Hyperactivity Disorder. Compr Psychiatry.
- Yoo, H. J., et al. (2004) Attention Deficit Hyperactivity Symptoms and Internet Addiction. Psychiatry Clin Neurosci.
- Cho, S. C., et al. (2001) Biogenetic Temperament and Character Profiles and Attention Deficit Hyperactivity Disorder Symptoms in Korean Adolescents with Problematic Internet Use. Cyberpsychology, Behavior and Social Networking.



## Research on ADHD and Internet Addiction in Taiwan

- Chou, W. J., et al. (2018) Boredom Proneness and Its Correlation with Internet Addiction and Internet Activities in Adolescents with Attention-Deficit/Hyperactivity Disorder. Kaohsiung J Med Sci.
- Yen, J. Y., et al. (2017) Association between Internet Gaming Disorder and Adult Attention Deficit and Hyperactivity Disorder and Their Correlates: Impulsivity and Hostility. Addictive behaviors.
- Chou, W. J., et al. (2016) Social Skills Deficits and Their Association with Internet Addiction and Activities in Adolescents with Attention-Deficit/Hyperactivity Disorder. Journal of behavioral addictions.
- Chen, Y. L., et al. (2015) Adhd and Autistic Traits, Family Function, Parenting Style, and Social Adjustment for Internet Addiction among Children and Adolescents in Taiwan: A Longitudinal Study. Research in Developmental Disabilities.
- Yen, J. Y., et al. (2009) The Association between Adult Adhd Symptoms and Internet Addiction among College Students: The Gender Difference. Cyberpsychol Behav.
- Yen, J. Y., et al. (2007) The Comorbid Psychiatric Symptoms of Internet Addiction: Attention Deficit and Hyperactivity Disorder (Adhd), Depression, Social Phobia, and Hostility. J Adolesc Health.



## Research on ADHD and Internet Addiction in China & Japan

### China

- Wang, B. Q., et al. (2017) The Association between Attention Deficit/Hyperactivity Disorder and Internet Addiction: A Systematic Review and Meta-Analysis. BMC Psychiatry.
- Li, W., et al. (2016) The Association of Internet Addiction Symptoms with Impulsiveness, Loneliness, Novelty Seeking and Behavioral Inhibition System among Adults with Attention-Deficit/Hyperactivity Disorder (Adhd). Psychiatry Research.
- Nie, J., et al. (2016) Impaired Inhibition and Working Memory in Response to Internet-Related Words among Adolescents with Internet Addiction: A Comparison with Attention-Deficit/Hyperactivity Disorder. Psychiatry Research.

### Japan

- Tateno, M., et al. (2018) Internet Addiction and Attention-Deficit/Hyperactivity Disorder Traits among Female College Students in Japan. Journal of the Korean Academy of Child and Adolescent Psychiatry.
- So, R., et al. (2017) The Prevalence of Internet Addiction among a Japanese Adolescent Psychiatric Clinic Sample with Autism Spectrum Disorder and/or Attention-Deficit Hyperactivity Disorder: A Cross-Sectional Study. Journal of Autism and Developmental Disorders.
- Tateno, M., et al. (2016) Internet Addiction and Self-Evaluated Attention-Deficit Hyperactivity Disorder Traits among Japanese College Students. Psychiatry and Clinical Neurosciences



## Research on ADHD and Internet Addiction in Europe

### **Germany**

- Paulus, F., et al. (2017) Computer Gaming Disorder and Adhd in Young Children—a Population-Based Study. International Journal of Mental Health and Addiction
- Bielefeld, M., et al. (2017) Comorbidity of Internet Use Disorder and Attention Deficit Hyperactivity Disorder: Two Adult Case–Control Studies. Journal of Behavioral Addictions.

### **France**

- Bioulac, S., et al. (2008) Attention Deficit/Hyperactivity Disorder and Video Games: A Comparative Study of Hyperactive and Control Children. Eur Psychiatry.

### **UK**

- Panagiotidi, M., et al. (2018) The Relationship between Internet Addiction, Attention Deficit Hyperactivity Symptoms and Online Activities in Adults. Comprehensive Psychiatry.
- Panagiotidi, M. (2017) Problematic Video Game Play and Adhd Traits in an Adult Population. Cyberpsychology, Behavior and Social Networking.
- Finlay, F, et al. (2014) G355 Internet Addiction Disorder/Problematic Internet Use and ADHD. Archives of Disease in Childhood.



## Research on ADHD and IAD in Turkey, Brasil, & Canada

### **Turkey**

- Evren, B., et al. (2018) Relationship of Internet Addiction Severity with Probable ADHD and Difficulties in Emotion Regulation among Young Adults. Psychiatry Research.
- Mutluer, B. T., et al. (2017) Incidence of Internet Addiction in Adult Attention Deficit Hyperactivity Disorder. European Psychiatry 41.
- Dalbudak, E., et al. (2015) The Impact of Sensation Seeking on the Relationship between Attention Deficit/Hyperactivity Symptoms and Severity of Internet Addiction Risk. Psychiatry Res
- Dalbudak, E., et al. (2014) The Relationship of Internet Addiction Severity with Attention Deficit Hyperactivity Disorder Symptoms in Turkish University Students; Impact of Personality Traits, Depression and Anxiety. Compr Psychiatry.

### **Brasil**

- Schmidek, H. C., et al. (2018). Internet Addiction and Attention Deficit Hyperactivity Disorder (ADHD): integrative review of the literature. Jornal Brasileiro de Psiquiatria.

### **Canada**

- Weiss, M. D., et al. (2011). The screens culture: impact on ADHD. Atten Defic Hyperact Disord.



## Research on ADHD and Internet Addiction in the USA

### ONE PAPER ONLY!!!!

- Chan, P.A. and Rabinowitz, T. (2006) A cross-sectional analysis of video games and attention deficit hyperactivity disorder symptoms in adolescents. Annals of General Psychiatry.
  - “Adolescents who play more than one hour of console or Internet video games may have more or more intense symptoms of ADHD or inattention than those who do not.”
- Subtopic of Video Games (not internet-related)
  - Mazurek, M.O. and Engelhardt, C.R. (2013) Video game use in boys with autism spectrum disorder, ADHD, or typical development. Pediatrics.





## Research on ADHD and Internet Addiction in Korea

### Neuroimaging:

- Lee, D., et al. (2017) "Altered Functional Connectivity in Default Mode Network in Internet Gaming Disorder: Influence of Childhood ADHD."
  - Our findings suggest that altered neural networks for executive control in ADHD would be a predisposition for developing IGD.

### Brainwave analysis:

- Park, J. H., et al. (2017) "Comparison of Qeeg Findings between Adolescents with ADHD w/o Comorbidity & ADHD Comorbid with Internet Gaming Disorder."
  - Compared to the ADHD-only group, the ADHD+IGD group showed <notable brainwave differences>.
  - Adolescents who show greater vulnerability to ADHD seem to continuously play Internet games to unconsciously enhance attentional ability. (*self-medicating?*)

### Medication-related studies:

- Park, J. H., et al. (2016) "Effectiveness of <Strattera> & Methylphenidate for Problematic Online Gaming in Adolescents with ADHD."
- Han, D. H., et al. (2009) "The Effect of Methylphenidate on Internet Video Game Play in Children with ADHD"
  - Internet Gaming might be a means of self-medication in children with ADHD.
  - MPH might be evaluated as a potential treatment of Internet addiction.



## Research on ADHD and Internet Addiction in Taiwan

- Chou, W. J., et al. (2018) “**Boredom Proneness and Its Correlation with Internet Addiction and Internet Activities in Adolescents with Attention-Deficit/Hyperactivity Disorder.**”
  - Boredom was...
    - ... significantly associated with a high tendency to engage in online gaming
    - ... significantly associated with a low tendency to engage in online studies
- Chou, W. J., et al. (2016) “**Social Skills Deficits and Their Association with Internet Addiction and Activities in Adolescents with Attention-Deficit/Hyperactivity Disorder.**”
  - Social skills deficits should be considered targets in prevention and intervention programs for treating Internet addiction among adolescents with ADHD.
- Yen, J. Y., et al. (2009) “The Association between Adult ADHD Symptoms and Internet Addiction among College Students: The Gender Difference.”
  - Association between ADHD and Internet addiction was more significant among female college students



## Research on ADHD and Internet Addiction in China & Japan

### China

- Wang, B. Q., et al. (2017): "The Association between ADHD and Internet Addiction" (~)
  - Individuals with IA were associated with more severe symptoms of ADHD.
  - **The monitoring of Internet use of patients suffering from ADHD is also necessary.**
- Li, W., et al. (2016): "The Association of Internet Addiction Symptoms with...Novelty Seeking... among Adults with ADHD" (~)
  - The results ... indicated that impulsiveness, loneliness, ...were significant predictors of Internet addition among adults with ADHD.

### Japan

- Tateno, M., et al. (2018): "IAD & ADHD Traits among Female College Students in Japan." (~)
  - The rates of IA in students with and without ADHD were 18.2% and 1.0%, respectively.
  - Results ... demonstrated the relation between IA & self-evaluated ADHD traits among female college students in Japan.
  - **Appropriate education for students on how to use the internet properly will be necessary to prevent IA.**



## Research on ADHD and Internet Addiction in Europe

### Germany

- Paulus, F. W, et al. (2017) "Computer Gaming Disorder and ADHD in Young Children" (~)
  - Studied nursery school kids.
  - Boys play computer games more often and longer than girls.
  - Boys were rated more often to be at risk or to have a computer gaming disorder than girls.
  - Children with elevated ADHD scores showed significantly higher computer gaming disorder scores.
  - Clinically relevant **inattention** scores were associated with longer and more computer gaming

### UK

- Panagiotidi, M., et al. (2018) "The Relationship between Internet Addiction, ADHD Symptoms and Online Activities in Adults." (~)
  - Our results suggest that younger adults with **higher level of ADHD symptoms** could be at higher risk of developing Internet Addiction.
- Panagiotidi, M. (2017): "Problematic Video Game Play & ADHD Traits in an Adult Population." (~)
  - Adults with **higher level of ... inattention symptoms** could be at higher risk of Internet Addiction



## Research on ADHD and Internet Addiction in Turkey

### Turkey

- Evren, B., et al. (2018) "**Relationship of Internet Addiction Severity** with Probable **ADHD** and Difficulties in **Emotion Regulation** among Young Adults."
  - Difficulties in Emotion Regulation predicted Internet Addiction.
  - Both Inattentiveness & hyperactivity/impulsivity of ADHD were related with the severity of IA
- Dalbudak, E., et al. (2015) "The Impact of **Sensation Seeking** on the Relationship between ADHD and Severity of Internet Addiction Risk."
  - **Inattention & boredom aversion key risk factors**
- Dalbudak, E., et al. (2014) "The Relationship of Internet Addiction Severity with ADHD Symptoms in Turkish University Students" (~)
  - **The severity of ADHD symptoms predicted the severity of Internet Addiction**
  - University students with severe ADHD symptoms, particularly hyperactivity/impulsivity symptoms may be considered as a risk group for IA



## Common Findings about ADHD and Internet Addiction

- ~20% of young adults with ADHD struggle with Internet Addiction
- Often co-occurs with Depression and/or Anxiety
- The severity of ADHD symptoms links to the risk for and severity of Internet Addiction
- All subtypes of ADHD are vulnerable to IAD
- There is an overlap between ADHD brain wiring and IAD brain wiring
- ADHD meds can help with ADHD+IAD treatment
- Social skills deficits in ADHD'ers are tied to IAD risk



## IGD Differential Diagnosis – not always a “disorder”

- Generation Z = The “iGeneration” (born 1995-2002) (ages 6-23)
  - 94% online daily, 25% online “almost constantly”
  - Regular gaming is today's norm
- Pro-social aspects
  - What appears as isolating may actually be socializing
  - Professional gaming – e-Sports
- Clinical aspects for multiple populations



# e-Sports

- Professional



- Collegiate





## Therapeutic Use of Video Games & “Digital Medicine”

- Akili’s prescription digital medicine is delivered through a creative and immersive action video game experience.
- Treatments leverage art, music, storytelling, and reward cycles to keep patients engaged and immersed for the delivery of therapeutic activity.
- Recently achieved top-line results from the STARS-ADHD pivotal study of its investigational digital therapeutic medicine AKL-T01.
- Plans upcoming FDA filing to become a first-of-its-kind prescription digital medicine treatment for pediatric ADHD.



## Healthy Internet Use Tips for the Digital Age

- **Net Negotiations**- productive family dialog regarding technology use
- **Digital Diet** – keep a digital log to control/monitor how much consume
- **Digital Nutrition** - make better choices about what to consume; learn to choose between healthy/unhealthy Internet content



# FIN

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