

2301 Group Essay Rough Draft

Group # 4

Use this doc to share topic contributions and collaborate to complete the essay. You may include the topic letters here as a guide to keep content in order but the rough draft should be edited to flow from one topic to the next in a conversational tone of well developed paragraphs before final submission.

****group should set a deadline for topic (a-h) rough drafts & topic (i-L) feedback contributions.**

****second deadline should be set for topic i-L rough draft paragraphs**

****set deadline for rough draft edit into final draft at least a couple days before assessment due date of June 18th.**

Topics A-H: each person write or paste your rough draft for your 2 selected topics below.

- A-
In "The Brain on Drugs: From Reward to Addiction," Nora D. Volkow and Marisela Morales explore how drug addiction affects the brain's reward system using scientific and statistical methods. Their research emphasizes that addiction is not merely a failure of willpower but a chronic brain disease driven by changes in dopamine signaling. The authors explain that dopamine neurons fire at different frequencies depending on stimulation, and drugs intensify this firing, producing a euphoric high. The speed at which a drug enters the brain plays a key role in how rewarding it feels, with faster delivery methods resulting in stronger dopamine spikes and a higher potential for addiction.

The study relies heavily on neuroimaging tools such as positron emission tomography (PET) scans to track dopamine activity in the brain. Using chemical tracers, researchers measure how much dopamine is released and how it interacts with receptors during drug use. The article also examines the ratio of AMPA to NMDA receptors in brain cells, important markers of synaptic plasticity. A higher AMPA/NMDA ratio suggests stronger reinforcement of drug-seeking behaviors, indicating how the brain learns and adapts to repeated substance exposure.

Statistical techniques like regression analysis are used to show correlations between brain changes and behavior, such as the relationship between rapid dopamine increases and reported intensity of the drug high. Volkow and Morales argue that understanding these neurobiological mechanisms can improve addiction treatment by promoting targeted, personalized approaches. Their research supports a shift in how addiction is treated and perceived, framing it as a medical condition influenced by measurable brain

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activity rather than a moral shortcoming. This insight has critical implications for clinical practice, public health policy, and future scientific investigation.

- B: Although the article *The Brain on Drugs: From Reward to Addiction* doesn't include actual math equations, it uses several scientific and mathematical ideas to explain how drug addiction changes the brain. These concepts help show that addiction is not just about willpower—it's about how our brain circuits respond to chemicals over time. Here's a breakdown of the key math-related ideas, explained in plain terms.

1. Brain Cell Firing Speeds

The article explains that dopamine neurons—brain cells that release the chemical responsible for feelings of reward—fire at different speeds depending on what's happening. These speeds are measured in hertz (Hz), which is how many times per second they fire. Slow firing (called *tonic*) happens regularly, like a calm hum (1–8 Hz). Fast, intense firing (called *phasic*) happens during unexpected rewards or drug use, like a jolt (>15 Hz), and this is what makes the brain feel that “high” (Volkow & Morales, 2015).

2. Timing and Drug Reward

One major concept in the article is how the speed of drug delivery affects how rewarding it feels. Drugs that enter the brain quickly—such as through smoking or injecting—cause a rapid spike in dopamine and create a strong feeling of pleasure. Slower delivery methods, like taking a pill, lead to a weaker effect. This is shown in time-activity curves in brain imaging studies, which track how quickly dopamine rises and how long the “high” lasts (Volkow & Morales, 2015).

3. PET Scans and Dopamine Measurement

Scientists use positron emission tomography (PET) scans to measure how much dopamine is released in the brain. They do this by using special tracers that bind to dopamine receptors. When dopamine levels go up, fewer tracers bind, and scientists use binding potential calculations to measure how much dopamine is present. This helps researchers understand how addicted brains respond differently from non-addicted ones (Volkow & Morales, 2015).

4. Brain Chemical Ratios

The article also talks about chemical ratios, especially between two types of brain receptors—AMPA and NMDAR. These ratios help explain how strong or weak brain connections become after drug use. A higher AMPA/NMDA ratio means the brain is reinforcing certain behavior, like the craving and pursuit of drugs. This kind of change is part of synaptic plasticity, the brain's way of learning and adapting (Volkow & Morales, 2015).

5. Statistics and Behavioral Patterns

Finally, the authors use statistical tools like regression analysis and correlation to explore how certain brain changes relate to behavior. For example, they show that when dopamine levels spike faster, people report feeling a stronger high. They also show how lower dopamine receptor levels are linked to more compulsive drug use. These

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relationships are shown with graphs and trend lines, which illustrate how strongly one factor predicts another (Volkow & Morales, 2015).

While there aren't any traditional math problems in the article, there's plenty of scientific and statistical thinking going on. The authors rely on brain imaging, dopamine timing, receptor ratios, and data analysis to support their claims. These measurements help prove that addiction affects how the brain functions and learns—making it clear that addiction is a medical condition rooted in biology.

- C-

Nora D. Volkow's article, "*The Brain on Drugs: From Reward to Addiction*," published in *Cell* in 2016, remains a timely and authoritative source for understanding the neuroscience of addiction. Although nearly a decade old, the article's central insights regarding dopamine dysregulation, neuroplasticity, and impaired self-regulation continue to inform contemporary research. Many recent studies build upon or reference Volkow's framework, indicating its continued relevance in both academic and clinical settings.

The source's credibility is reinforced by its publication in *Cell*, a top-tier, peer-reviewed scientific journal, and by Volkow's position as the Director of the National Institute on Drug Abuse (NIDA). Her coauthors are also respected figures in neuroscience and psychology. Together, they provide a rigorous, interdisciplinary analysis that draws from human neuroimaging, behavioral studies, and animal models of addiction. The article appropriately correlates findings across molecular neuroscience, cognitive science, and public health. Lending it both academic depth and practical significance.

In terms of methodology, the article's reliance on neuroimaging techniques like PET and fMRI is appropriate and standard for addiction research. These tools effectively illustrate changes in brain activity and dopamine transmission associated with drug use. The integration of longitudinal and comparative studies, along with data from animal models, further supports the article's conclusions about the chronic, relapsing nature of addiction and its biological underpinnings.

Overall, "*The Brain on Drugs: From Reward to Addiction*" is a credible, well-sourced, and methodologically sound article. Its contributions remain central to the ongoing understanding and treatment of substance use disorders.

- D- The study discusses how drugs hijack the brain's reward system, which oversees survival behaviors like eating and social bonding. Learning how the neurobiological mechanisms of addiction affects individuals has aided in individual diagnosis, treatment, and recovery. By thinking of addiction as a brain disease rather than a person failing, clinicians can offer personalized interventions that will target the specific

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neuromechanical imbalances or behavioral patterns in individuals (Volkow et al., 2016). The neuroscience of addiction is relevant for advancing individualized treatment, and for shaping population-level strategies in healthcare, prevention, and policies. As stated in the Article The genetics of alcohol dependence: "Pharmacogenetics can guide treatment decisions, such as selecting medications like naltrexone or buprenorphine based on individual genetic profiles or metabolic rates (Kranzler & Edenberg, 2010)". Tailoring behavioral therapies with pharmacotherapy can significantly improve the outcome of addiction and reduce relapse risks. Behavioral therapies are reliable components of addiction treatment; these can be used as standalone interventions or with combining medications. These therapies are aimed at the modification of unhealthy habits, understanding irrational thoughts and faulty thinking. In addition, they also help restore functions related to self-control, decision-making, and stress regulation (Carroll & Onken, 2005).

- E- Since this kind of education is beneficial and enables providers to be much more knowledgeable in understanding what may be happening to the patient's brain while on drugs and how it affects them emotionally, mentally, and physically, as well as being able to identify drug abuse and knowing signs and symptoms of relapsing, I believe that having this information is crucial for a clinical practice.
- F- In this section, we evaluate the reliability of the primary source used in our analysis: "*The Brain on Drugs: From Reward to Addiction*" by Nora Volkow and Marisela Morales. This article is a critical foundation for understanding the biological mechanisms of addiction and was chosen due to its high scientific credibility and comprehensive approach.

The article was published in *Cell*, a prestigious peer-reviewed journal widely respected in the scientific and medical research communities. The authors are both affiliated with the National Institute on Drug Abuse (NIDA), which operates under the National Institutes of Health (NIH). Notably, Dr. Volkow is the director of NIDA and an internationally recognized leader in addiction science. The reputability of the journal and the authors' credentials provide a strong indication that the information presented is both valid and thoroughly vetted. The article presents data drawn from multiple types of studies, including brain imaging (PET scans), animal research, molecular biology, and behavioral science. Key concepts such as dopamine release, receptor activity, and synaptic plasticity are supported with concrete examples and visual data (e.g., time-activity brain scans and regression models). The evidence is up-to-date, well-documented, and references a broad range of peer-reviewed sources, which strengthens the argument that addiction is a chronic brain disease rather than a moral failing. The conclusions drawn in the article are supported by the evidence provided. Overall, "*The Brain on Drugs: From Reward to Addiction*" is a highly reliable source for our group's research. It is authored by leading experts, grounded in rigorous evidence,

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and provides well-supported conclusions that contribute meaningfully to the scientific understanding of addiction. As such, it is a strong anchor for the arguments developed in our paper.

- G- The reason the study was conducted to see how different types of drugs affect the brain by the neuroplastic change, rewarding system, function of the brain while using, to see how the brain adapts to the drug's and the effects that in many ways trigger the dopamine neurons. The technology helps break down the timing that the drug began to work on a user and it also shows images and graphs to provide further details on the methods that the drug was consumed. The research that's conducted to try and help recognize the addiction as a brain disease and to help reduce stigma, improve public health and gain insight into the brain mechanisms of addiction.
- H- The study by Volkow and Morales (2015) provides an understanding of how drugs alter how the brain's reward system functions. Future researchers can build on the concepts already provided, and test new hypotheses while applying the knowledge to real-world problems. In the article it is emphasized that chronic drugs use leads to long lasting changes in synaptic plasticity in regions of the brain such as the nucleus accumbent and the prefrontal cortex. These changes will weaken a person ability to self-regulate, and strengthen the need for drugs (Volkow, N.D., & Morales, M. 2015) Future studies to investigate if non-invasive neuromodulation techniques like transcranial magnetic stimulation (TMS) would be beneficial in whether repeated sessions of TMS would reduce relapse rates by normalizing disrupted prefrontal activity and aid in reducing cravings in individuals recovering from stimulant addictions.
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Topics I-L: each person should write or paste their feedback/opinion/experience for these topics below. Once this is completed, the person responsible for each topic should combine all feedback for the individual topic into a well formed topic paragraph.

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I-What did you learn from this research, and what are the biggest takeaways you will remember?

Montana- I learned that drugs alter and physically change the way your brain works, and that it is not solely a choice you make. The research makes it clear how drugs manipulate dopamine signals, and over time change how a person experiences things like pleasure, motivation, and faulty thinking.

Dana Joe- The effects of drugs on the brain and the various ways of ingesting them, such as smoking, oral, and intravenous injection, increase the amount of the drug in the brain more quickly. Additionally, addiction is recognized as a chronic brain disorder with a strong genetic component. In addition, it informs you that drug use could indicate a biological vulnerability or a decision.

J. Will you implement any new behaviors or considerations after reading this? Does it apply to anything specific in your lives or careers?

Montana- My father was a life-long addict, which ultimately led to his untimely death, as a child and early adulthood I never understood the reasons behind choosing drugs. This research has provided me with more clarity, and understanding. After reading this research I will speak more compassionately about addiction. I now understand and know it is a brain disease, not just a behavioral problem. Taking this research into my own life helps me to reflect on my own personal habits, and how it affects my brain over time. This will guide me in making more conscious decisions.

Dana Joe- Indeed, this enables me to observe patients in order to recognize their behaviors, mood fluctuations, and natural reinforcers, which can help steer them away from drug usage. I may share what I have learned now that I have a little more education.

K. Did you all find yourselves able to understand this paper more or less than you expected? What were the harder and easier points to process, and do you feel more confident in your ability to evaluate primary research?

Montana- The paper was easy to understand and was well written. The easiest point was the concept of the brain's reward system and how drugs stimulate dopamine release. The article points out how drugs and nicotine increase dopamine in the nucleus accumbens, which reinforces the behavior and make them want to repeat it. Additionally challenging the concept that people can just stop when they want too. The hardest and emotionally challenging concept within the paper was how chronic drug use causes long term-neuroplastic changes. This means someone may not feel pleasure from normal life due to the long term effects on the brain.

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Dana Joe- As I began to read the article, I was a bit overwhelmed not knowing a lot of the terms and not being able to understand some things. But, then after writing out the terms and breaking down the article it became easier to understand. I do feel a little more confident in evaluating primary research.

L. Did this paper lead to any constructive discussion between group members? What type of conversation did it provoke?

Montana- After researching why addicts relapse after recovery, and it being linked to the brain's altered conditions from long term drug usage. It concludes how the brain's adaptations don't immediately reverse when the drug use stops, leading to the individuals relapsing.

1. What stood out to you the most after reading this article? What important things about addiction or the brain will stick with you going forward?

ERICA RUBALCABA-What really stood out to me was how addiction physically changes the brain—especially how it rewires the reward system and weakens a person's ability to make decisions or feel joy from normal things. I always thought addiction was more about behavior or lack of self-control, but now I understand it's actually a brain disease. The idea that dopamine levels and how fast a drug hits your system can affect how addictive it becomes is something I'll definitely remember.

2. Did this article make you think differently about something in your own life—like parenting, your job, or how you view people who struggle with addiction? Will it change anything you do or how you treat others?

ERICA RUBALCABA-Yes, for sure. I have people in my life who've struggled with substance abuse, and I used to think, "Why can't they just stop?" Now I understand it's not that simple. Their brains have been changed by the drug use, and that impacts how they feel, think, and act. This will help me have more empathy, patience, and maybe even be more supportive if someone I care about is trying to get clean. I'm also a parent, so this research made me more aware of how important it is to talk to my kids early and help them build coping skills and confidence.

3. Did the article make sense overall, or was it harder to understand than you thought it would be? What parts were clear, and which parts were tough? After working on this, do you feel more comfortable reading scientific research now?

ERICA RUBALCABA-I was nervous at first because it's a research article from a top science journal, and those can be really dense. But once I slowed down and took it section by section, it started to make more sense. The brain imaging and dopamine parts were clear because they had real-world examples, like how fast drugs reach the brain. The harder parts were the technical terms about brain receptors and

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some of the stats, but once I broke them down, it felt manageable. I definitely feel more confident now in reading and understanding primary research, especially when it relates to health and behavior.

-Carroll, K.M., & Onken, L.S. (2005). Behavioral therapies for drug abuse. *American Journal of Psychiatry*, 162(8), 511-525.

-Krazler, H.R., & Edenberg, H.J. (2010). The genetics of alcohol dependence: Evidence and implications. *Nature Reviews Gastroenterology & Hepatology*, 7(9), 487-495

-Volkow, N.D., Koob, G. F., & McLellan, A.T. (2016). Neurobiological advances from the brain disease model of addiction. *New England Journal of Medicine*, 374 (4), 363-371

-NIDA. (2018). Understanding Drug Use and Addiction Drugfacts.