

On pharmacological potential to modify human memory

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Abstract

This paper identifies the downsides and potential justifications of pharmaceutical memory alteration, a topic sparking many controversies. Recent advancements in psychiatry show the possibility of modifying and suppressing traumatic memories, which could be applicable primarily in PTSD patients. As conventional forms of treatment often fail or result in relapse, pharmacological solutions could offer a viable alternative. However, it raises profound bioethical concerns, mainly in the aspects of identity, authenticity, and moral responsibility with the risk of the distortion of testimonies or tampering with the historical truth. The discussion engages with the philosophical tension between the necessity of suffering as a formative human experience and the imperative to alleviate debilitating distress. PTSD not only disrupts personal well-being, but also significantly impacts interpersonal relationships, social functioning, and long-term psychological stability. This essay argues that memory modification should be the last resort, employed only when other treatments have been proven ineffective. The debate highlights the need for a balanced approach that prioritizes patient well-being while respecting ethical constraints in neuroenhancement.

Keywords: memory modification, memory-altering drugs, post-traumatic stress disorder (PTSD), trauma therapy, behavioral interventions, neuroethics

[...] when fathers speak to their sons to give them advice, they say that one must be just, as do all those who have others in their charge. But they do not praise justice itself, only the good reputation it brings [...]

Plato

Introduction

According to recent developments in psychiatry, it may be possible to precipitate the process of getting over a traumatic incident (Hennessy et al., 2022), altering memories (Nourkova, Bernstein & Loftus, 2004), or dampening their emotional intensity (Brunet, Saumier, Liu, Streiner & Tremblay, 2018). This would primarily apply to patients suffering from post-traumatic stress disorder (PTSD). Nevertheless, bioethical discourse reveals serious concerns about introducing pharmacological methods of memory modification, as remembering is considered a crucial part of our identity. The question of whether we should be allowed to manipulate human memory deeply divides the bioethical community, as it exposes a distinctly deontological dimension of the debate and raises a further issue concerning whether suffering is a moral duty or necessity, even when it could be prevented. Therefore, in this paper, the conception of altering memories pharmacologically in patients suffering from PTSD will be discussed, since their situation confronts us with the reflection on the tension between memory and personal identity and the postulate of being authentic known from the philosophy of morality.

The essay contends that altering memories should be considered only as a last resort,

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reserved for cases where all other treatments have failed. After all, not every memory heals well. To note that mental illnesses are indissolubly related to suffering and that we want to get rid of them would not be groundbreaking. Surely, one could also say that some traditional forms of psychotherapy may themselves also constitute a form of memory modification. For instance, cognitive-behavioral therapy (CBT) often involves cognitive restructuring, where patients are guided to reinterpret distressing memories, thereby changing their emotional response to those memories (Beck, 2011). However, in the case of pharmacological manipulation of memory, we should remember that we are referring to an external stimulus, without any further influence on its course from either the therapist or the patient.

Are “architects of memory” really necessary?

It is not a revelation that memories, particularly episodic ones, are flexible (Kroes & Fernández, 2012), allowing adaptive memory a specific valuation of acquired information. Hence, even though we are convinced of their authenticity, we must acknowledge that our reminiscences may be entirely false. Even 9/11 witnesses, a group affected by absolutely terrifying events that occurred in the US, had substantial inaccuracies in 40% of their memories just after 32 months (Hirst et al., 2009). Nonetheless, for we are discussing traumatic memories, it goes without saying that they are associated with extreme situations that might lead to PTSD. Such a recollection would not be just a feeling or a state of mind, but a potentially crippling mental health disorder (Kroes & Liivoja, 2019). Here we focus primarily on ‘exposure to actual or threatened death, significant harm, or sexual violence’ (Center for Substance Abuse Treatment, 2014), which does not fall under the category of forgetting, a tasteless dinner. Amongst the symptoms of PTSD, we find intrusive, unconsciously mooted memories, which can trigger defensive reactions, avoidance behaviors, and the uncontrollable recall of the traumatic event’s thoughts, feelings, or memories (Kroes & Liivoja, 2019). This disorder may also involve dissociations, nightmares, negative mood and cognitive changes, hypervigilance, or avoidance of stimuli connected to trauma (American Psychiatric Association, 2013). Upon assessing the scene of an accident or assault, or when reliving the incident, the sufferer may even experience a variety of somatic changes, such as an increase in heart rate, muscle tension, and perspiration (Visser et al., 2018). The symptoms might last for a long time and are often associated with worsening health.

It is clear that not all involuntary memories are pathological (Visser et al., 2018), but the ones pertinent to this discussion severely disrupt their daily life. PTSD is linked to deficiencies in interpersonal functioning, so if we think about military veterans, those affected would exhibit more antisocial behavior than their healthy colleagues (Booth-Kewley et al., 2010). The trauma has a devastating effect on their past, their present slips through their fingers, harming them and their loved ones, and, on top of that, their perspective of the future may have changed as a result of the trauma (Homan et al., 2019). They frequently exhibit signs connected to other mental conditions (Nichter et al., 2019), and it should be understood that there is a strong link between PTSD and self-destructive or suicidal inclinations (Sareen et al., 2005). Surprisingly enough, we can still come across an argument that people suffering from PTSD should *work through* their trauma (Henry, Fishman & Youngner, 2007). When their lives are completely disintegrating, it seems to be unconditionally unempathetic to always have such severe expectations toward them. We should acknowledge that some thoughts simply cannot be comfortingly wiped out. PTSD should then be considered without restraint a memory disorder (van Marle, 2015). No one tells those who have had a limb amputated to run, yet it is remarkably simple to ignore or overlook our neighbor’s mental state.

It should be also noted that therapy resistance in PTSD is sadly high (Schottenbauer et al., 2008), and even if we were to declare that psychotherapy appears to be effective in some situations, it is still conceivable to encounter a later recurrence of PTSD symptoms even after

the initial successful treatment (Vervliet, Craske & Hermans, 2013). For all these reasons, the search for new ways of treatment that would also stop the symptoms from reappearing is more than what can be comprehended. Hence, we must settle for a certain outcome because it appears that the dampening of a few memories, which leads to the issues of *neuroenhancement*, is factually flawed, but probably the only workable solution. If we accept that it could dull many entities' pain, help stabilize their lives and in extreme cases — save them — our perspective could swiftly change. However, it could change once again if we found out that the perpetrator may also be suffering from PTSD (Belet et al., 2020); questions arise whether the victim would want the offender to forget what he had done, or if the person who received the drugs would be just as eager to pursue justice. The waiter serving '*the waters of Lethe*' would be in real trouble.

The following compounds are most frequently mentioned when talking about memory alteration: propranolol (Vaiva et al., 2003), propofol (Girgirah & Kinsella, 2006), zeta inhibitory peptide (Kolber, 2011), hydrocortisone (Hennessy et al., 2022), mifepristone (Willyard, 2012) and midazolam (Nadin & Coulthard, 1997). Each of these interacts with the body in the other way and leads also to different outcomes, yet they all share interference with human identity as a common factor. Therefore, rather than analyzing their pharmacological mechanisms in depth, a more humanistic approach will be discussed, focusing on the ethical challenges we could face. But only to give an example, propranolol interacts with the levels of stress hormones (Miller, 2004), which may lessen the emotional discomfort brought on by remembering a distressing event, (Kolber, 2011) and their hormonal effects on overall arousal can alter the fight-or-flight response (Chu et al., 2022) significantly affecting people's behavior in the face of danger. As it has been proven that beta-blockers (to which propranolol belongs) can affect behavior and cognition (Bouret & Sara, 2005) they have an impact on decision-making (Doya, 2008). According to some studies, propranolol taken immediately after a stressful experience may even limit the formation of traumatic memories (Vaiva et al., 2003) and stop threat-conditioned reactions from returning (Dèbiec, Bush & LeDoux, 2011).

What should stop us here is the thought that not all traumas will evolve into disorders, yet PTSD prevention should also be under consideration (Hall & Carter, 2007). Surely not everyone would want to 'cancel out' their experience after going through a significant trauma; for instance, someone might believe that other people's cruelty should be broadly discussed in order to serve as a testimony. Nonetheless, it is challenging to make someone remember, or the desire to share and make it their moral obligation. Many Holocaust survivors have never returned to the topic of the camp again, but could we harbor resentment toward them? This rhetorical question is not even appropriate to ask.

Cognitive suicide attitude

Some scholars are also attempting to shift the focus from ethical to social concerns (Kroes & Liivoja, 2019). When we concentrate on memory manipulation, it is important to note that we are discussing the risks associated with adopting an authentic lifestyle, non-autonomous coping with traumatic experiences, or facing social pressure to preserve particular memories (Kroes & Liivoja, 2019). Sadly, this is where the slippery slope of this argument becomes apparent, because on what basis could we compare the collective memory of the nation with the mental health of an individual who, for example, is on the verge of suicide? Even today, testimonies are gathered as quickly as possible after the occurrence to try to keep them more consistent and freer from distortion. But, for this reason alone, we can be wary about testimony provided years afterwards and this raises a far larger question regarding the value of witness testimony (Kearns et al., 2012). We all realize that the inherent value of a conversation is irreplaceable, but we should assume that in such a situation, many of them would simply become martyrs.

I do not think it would diminish the role this kind of medication plays in the often-discussed concept of 'collective memory', if we assume that it wouldn't be something easily available in

a supermarket. While I do not want to downplay the importance of collective memory, it is worth considering whether it truly outweighs the individual one and the sufferer's mental health. I would not be able to look a battered victim deeply in the eyes and tell them that I will not be taking away their suffering in the end 'for the sake of national memory and preventing future mistakes'. I would lack the courage or nerve to do so. We should stop making heroes out of sufferers, and heroism out of suffering.

A somewhat terser argument is that if we distorted our memories, we would be committing a form of cognitive suicide (Kroes & Liivoja, 2019), as our personhood could be changed by altering our memories. Of course, we intuitively know that memory is a part of identity and that we are made up of our experiences, but if we completely believe episodic or autobiographical memory, we will not treat people with Alzheimer's as humans. Because of that, some may dispute any pharmacological intervention (President's Council on Bioethics, 2003, p. 214). When we consider a staggering human being, to what extent can we discuss identity or authenticity? In the psychiatrist's office, some patients may claim that they don't feel like themselves at all until they take their medication, that they have not recognized themselves in a while or have lost themselves somewhere. Because it would be impolite, I could not ask them in real life who exactly they were before. Taking a more established and factual example — military veterans with PTSD struggle to fit in with society have also already lost their sense of self (Donovan, 2010).

We must assume that there is some impersonality in complex cases of mental disorders that can only be 'fused' by extremely powerful factors. This defamiliarized memory manipulation would probably most likely assist the weak in returning to normal life and, as a result, may aid in maintaining identity rather than undermining it (Kroes & Liivoja, 2019). Continuity of people's memory does not seem to be a fundamental criterion of their identity. The preferences or core ethical beliefs may not be directly influenced by any memory disruptions and the narrative they construct about their life can remain completely intact. However, we should remember that altering even one memory has great potential to influence our psychological ability to fully understand our own actions through the lens of self-reflection. The thing worth pointing out here is that all these traumatic situations will somehow alter us, though such substantial association between memory modification and suicide mentioned previously, may not occur in all circumstances.

Conclusions

The internal divisions within the bioethics community should also be considered. To demonstrate the kind of voices that this discourse brings, one could look at a few examples of authority figures' standpoints. Firstly, the concerns about identity from *A Report of The President's Council on Bioethics*, which discusses that by altering memories pharmacologically, we might succeed in easing real suffering, although at risk of falsifying our cognitive abilities and undermining true identity (President's Council on Bioethics, 2003, p. 225). Then, Kolber believes that fears about such manipulation are totally overblown and excessive hand-wringing over the ethics of tampering with memory could stall research into preventing post-traumatic stress in millions of people (Kolber, 2011). Henig in NYT convinces the readers that, without having witnessed the torment of unremitting post-traumatic stress disorder, it is easy to exaggerate the benefits of holding on to unpleasant memories; if we decide it is better not to ease suffering because of some idealized view of what it means to be human, we might be revealing ourselves to have a twisted notion of what humanity really means (Henig, 2004). But obviously, there are also more retracted opinions of people claiming that possible use of memory manipulation techniques raises meaningful ethical, legal and social questions and not all these questions lend themselves to comprehensive and universal answers (Kroes & Liivoja, 2019). I would not wish to arbitrate, however I strongly believe that acknowledging

counterthoughts is sometimes truly necessary in gathering these measures.

We are now observing a cross-section of positions, as the topic continues to bubble up. Research is gaining momentum, with a recently published study *Accelerated forgetting of a traumatic event in healthy men and women after a single dose of hydrocortisone*, showing that such treatment can cause an even faster decline in the frequency of daily intrusions (Hennessy et al., 2022). This development appears to have the potential to assist those suffering from PTSD in a special way due to the suffering this disorder causes on both the psychological and somatic level. However, we need to keep in mind that actual traumatic memories are frequently more potent and extensive than aversive memories created in a lab (Visser et al., 2018) which is not good news either.

Changing traumatic memories could enhance or even preserve the quality of life. In addition to the social, ethical, and economic dimensions, we sometimes forget about the personnel. We should highlight it once again – PTSD makes it impossible to cope with the trauma. Let's be clear, as humans, we all do have a right to mental health (United Nations, 2020). Is it moral, then, to let people suffer for any cause if we have the means to save them from it? To observe that the person sitting next to us is unable to conduct themselves with dignity in the name of our imaginary visions of memory and identity. I agree that the topic is intricate, and, writing it directly, nobody would want to constantly see a rapist's face hovering over their body in front of their eyes. No one envies victims' experiences. The whole discussion is the defense attorney, as if there were really only the prosecutor and the executioner.

It is high time we realized that not everything can be resolved, despite the fact that motivational speakers probably wish it could be, and that the myth that hardships elevate one's character is one of the biggest deceptions in human history. Since this is the only way we can recognize the suffering of human beings within the patient, I believe it would be necessary to finally demarcate the epistemic strings in favor of the empirical ones. Otherwise, we risk harming those who are already on the verge of suffering psychosomatically by taking the 'magic pill for oblivion' approach. Unpleasant memories are undoubtedly an inevitable flaw in the human condition, and some researchers even claim that preventing or eliminating them would be an undesirable and inherently immoral alteration of our humanity (Glannon, 2007), but it is quite risky to associate a military veteran with someone who has a whim of forgetting something prosaic. Indeed, we would all like to be pain-free.

I think that manipulating memories should only be a last resort. At that point, when all other treatments have failed, the decision should be made with the patient's and doctor's consent and fully individualized. All the ethical issues and problems that interfere with a person's identity still apply, but sometimes there is no other option for the patient but to die. Because of this, maybe it would be just better to approach this phenomenon similarly to breaking ribs during resuscitation. It is not about causing unnecessary suffering; rather, medical law must provide a thorough and lucid explanation. In my opinion, although maybe a bit idealistic, not until this point can we finally see the light at the end of the tunnel.

Although the concerns in this matter are not surprising but rather fitting, the possibility of saving the most vulnerable people seems to be an indisputable argument and this dismisses the entire discussion. It is not about getting drunk on Lethe waters. Our traumatic experiences are illogical, yet they appear to influence everything that follows. To be completely honest, I still have more questions than answers. It is remorseful for mankind, but there is probably no easy way to get over trauma.

References

- AMERICAN PSYCHIATRIC ASSOCIATION. (2013): *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.). Washington: American Psychiatric Association.
- BECK, J. S. (2011): *Cognitive behavior therapy: Basics and beyond* (2nd ed.). London & New

York: Guilford Press.

BELET, B. et al. (2020): Trouble de stress post-traumatique en milieu pénitentiaire [Post-traumatic stress disorder in prison]. In: *L'Encéphale*, 46(6), pp. 493–499.

REPORT OF THE PRESIDENT'S COUNCIL ON BIOETHICS (2003): *Beyond Therapy: Biotechnology and the Pursuit of Happiness*. Washington D.C.

BOOTH-KEWLEY, S., LARSON, G. E., HIGHFILL-MCROY, R. M., GARLAND, C. F. & GASKIN, T. A. (2010): Factors associated with antisocial behavior in combat veterans. In: *Aggressive Behavior*, 36(5), pp. 330–337.

BOURET, S. & SARA, S. J. (2005): Network reset: A simplified overarching theory of locus coeruleus noradrenaline function. In: *Trends in Neurosciences*, 28(11), pp. 574–582.

BRUNET, A. et al. (2018): Reduction of PTSD symptoms with pre-reactivation propranolol therapy: A randomized controlled trial. In: *American Journal of Psychiatry*, 175(5), pp. 427–433.

CENTER FOR SUBSTANCE ABUSE TREATMENT (US). (2014): *Trauma-Informed Care in Behavioral Health Services*. Rockville, MD: Substance Abuse and Mental Health Services Administration (US). *Treatment Improvement Protocol (TIP)*, 57, Consensus Panel.

CHU, B., MARWAHA, K. & SANVICTORES, T., et al. (2022): Physiology, stress reaction. In: *StatPearls* September 12. [online] [Retrieved April 2, 2025] Available at: <https://www.ncbi.nlm.nih.gov/books/NBK541120/>.

DONOVAN, E. (2010): Propranolol use in the prevention and treatment of posttraumatic stress disorder in military veterans: Forgetting therapy revisited. In: *Perspectives in Biology and Medicine*, 53(1), pp. 61–74.

DÉBIEC, J., BUSH, D. E. & LEDOUX, J. E. (2011): Noradrenergic enhancement of reconsolidation in the amygdala impairs extinction of conditioned fear in rats: A possible mechanism for the persistence of traumatic memories in PTSD. In: *Depression and Anxiety*, 28(3), pp. 186–193.

DOYA, K. (2008): Modulators of decision making. In: *Nature Neuroscience*, 11(4), pp. 410–416.

GLANNON, W. (2007): *Defining right and wrong in brain science: Essential readings in neuroethics*. New York: Dana Press.

GIRGIRAH, K. & KINSELLA, S. M. (2006): Propofol and memory. In: *British Journal of Anaesthesia*, 97(5), pp. 746–748.

HALL, W. & CARTER, A. (2007): Debunking alarmist objections to the pharmacological prevention of PTSD. In: *The American Journal of Bioethics*, 7(9), pp. 23–25.

HENNESSY et al. (2022): Accelerated forgetting of a trauma-like event in healthy men and women after a single dose of hydrocortisone. In: *Translational Psychiatry*, 12, 354, pp. 1–11.

HENIG, R. M. (2004): The quest to forget. In: *The New York Times Magazine*, April 4. [online] [Retrieved April 2, 2025] Available at: <https://www.nytimes.com/2004/04/04/magazine/the-quest-to-forget.html>.

HENRY, M., FISHMAN, J. R. & YOUNGNER, S. J. (2007): Propranolol and the prevention of post-traumatic stress disorder: Is it wrong to erase the ‘sting’ of bad memories? In: *American Journal of Bioethics*, 7(9), pp. 12–20.

HIRST, W. et al. (2009): Long-term memory for the terrorist attack of September 11: Flashbulb memories, event memories, and the factors that influence their retention. In: *Journal of Experimental Psychology: General*, 138(2), pp. 161–176.

HOMAN, P. et al. (2019): Neural computations of threat in the aftermath of combat trauma. In: *Nature Neuroscience*, 22(3), pp. 470–476.

KROES, M. C. W. & FERNÁNDEZ, G. (2012): Dynamic neural systems enable adaptive, flexible memories. In: *Neuroscience & Biobehavioral Reviews*, 36(7), pp. 1646–1666.

KROES, M. C. W. & LIIVOJA, R. (2019): Eradicating war memories: Neuroscientific reality

and ethical concerns. In: *International Review of the Red Cross*, 101(1), pp. 69–95.

KEARNS, M. C. et al. (2012): Early interventions for PTSD: A review. In: *Depression and Anxiety*, 29(10), pp. 833–842.

KOLBER, A. (2011): Give memory-altering drugs a chance. In: *Nature*, 476(7360), pp. 275–276.

MILLER, G. (2004): Forgetting and remembering. Learning to forget. In: *Science*, 304(5667), pp. 34–36.

NADIN, G. & COULTHARD, P. (1997): Memory and midazolam conscious sedation. In: *British Dental Journal*, 183(11–12), pp. 399–407.

NICHTER, B. et al. (2019): Psychological burden of PTSD, depression, and their comorbidity in the U.S. veteran population: Suicidality, functioning, and service utilization. In: *Journal of Affective Disorders*, 256, pp. 633–640.

NOURKOVA, V., BERNSTEIN, D. M. & LOFTUS, E. F. (2004): Altering traumatic memory. In: *Cognition and Emotion*, 18(4), pp. 575–585.

SAREEN, J. et al. (2005): Anxiety disorders associated with suicidal ideation and suicide attempts in the National Comorbidity Survey. In: *Journal of Nervous and Mental Disease*, 193(7), pp. 450–454.

SCHOTTENBAUER, M. A. et al. (2008): Nonresponse and dropout rates in outcome studies on PTSD: Review and methodological considerations. In: *Psychiatry*, 71(2), pp. 134–168.

VAN MARLE, H. (2015): PTSD as a memory disorder. In: *European Journal of Psychotraumatology*, 6(s1), pp. 1–3.

VERVLIET, B., CRASKE, M. G. & HERMANS, D. (2013): Fear extinction and relapse: State of the art. In: *Annual Review of Clinical Psychology*, 9, pp. 215–248.

VISSER, R. M. et al. (2018): Multiple memory systems, multiple time points: How science can inform treatment to control the expression of unwanted emotional memories. In: *Philosophical Transactions of the Royal Society B: Biological Sciences*, 373(1742), 20170209, pp. 1–15.

WILLYARD, C. (2012): Remembered for forgetting. In: *Nature Medicine*, 18, pp. 482–484.

UNITED NATIONS. (2020): *Right of everyone to the enjoyment of the highest attainable standard of physical and mental health: Report of the Special Rapporteur on the right of everyone to the enjoyment of the highest attainable standard of physical and mental health (A/HRC/44/48)*. General Assembly, Human Rights Council, Forty-fourth session, Agenda item 3.

VAIVA, G. et al. (2003): Immediate treatment with propranolol decreases posttraumatic stress disorder two months after trauma. In: *Biological Psychiatry*, 54(9), pp. 947–949.