EDITOR PROJECT

ARTIST:
CAMELA TEMACINI[1]
[1] Bachelor of Biochemistry (Honours), Class of 2028,
McMaster University

The Neurobiology of Happiness and Naturopathic Influences

doi: 10.35493/medu.48.14

AUTHORS:
SRUTI PRABAKARAN[2], JOEL ABRAHAM[3] & RITA GERGIS[4]
[2] Bachelor of Science (Honours Integrated Sciences) Class of 2027, McMaster University
[3] Bachelor of Health Sciences (Honours) Class of 2028, McMaster University
[4] Bachelor of Biochemistry (Honours) Class of 2027, McMaster University

INTRODUCTION

Happiness can be understood as a mental state of subjective well-being.[1] Studies have identified four key neurotransmitters—dopamine, serotonin, oxytocin, and endorphins—as being influential in the control of happiness.[2] Understanding the function and production of each neurotransmitter provides insight into the biological mechanisms that contribute to happiness, and how these mechanisms can be supported through naturopathic interventions. Naturopathic interventions are holistic therapeutic approaches focused on supporting the body's natural ability to heal itself.[3] These interventions often focus on the underlying cause of disrupted balances in the body and address them through lifestyle changes.[3] Naturopathic interventions aid in maintaining homeostasis and generally have few adverse effects when used appropriately.[3] However, it is important to note that these interventions are not a substitute for pharmacological treatments that may be required for diagnosing, treating, or preventing disease. Exploring how naturopathic interventions influence key neurotransmitters can further highlight the biological mechanisms that contribute to happiness.

DOPAMINE

Dopamine is involved in improving pleasure, reward, and motivation.[4] Dopamine production is a two-step process, beginning with the amino acid tyrosine. Tyrosine is catalyzed into L-DOPA and subsequently dopamine by the enzymes tyrosine hydroxylase and aromatic L-amino acid decarboxylase, respectively.[5] Catalyzation is regulated in the ventral tegmental area and the substantia nigra of the brain.[5] Dopamine's evolutionary function is to reinforce behaviours that ensure survival, such as feeding, socialization, and reproduction.[4] Animal studies indicate that almost all learned behaviours depend on dopamine function, often facilitated through reinforcement mechanisms.[4] Regulation of the neurotransmitter occurs through multiple mechanisms. The primary mechanism involves dopamine transporters that actively pump the neurotransmitter back into the presynaptic vesicle where it is stored.[6] Dopamine that is not reabsorbed is enzymatically degraded by catechol-O-methyltransferase and monoamine oxidase B.[6] Further regulation involves autoreceptors and dopaminergic receptors which inhibit the synthesis and release of dopamine.[6]

Naturopathic interventions often focus on the relationship between dopamine and sleep. Dopamine levels are highest upon waking, promoting alertness, and gradually decrease throughout the day before getting replenished during sleep.[7] People experiencing acute sleep deprivation show increased dopamine release. However, receptor availability is reduced, which limits the overall dopaminergic effects.[8] Deep relaxation techniques, such as Non-Sleep Deep Rest (NSDR), have garnered significant interest for their potential to regulate dopamine in a manner similar to sleep. Sleep yoga, a form of NSDR, has been shown to increase endogenous dopamine in the brain by up to 65% after a single session.[9] Sessions of NSDR resemble non-rapid eye movement (REM) sleep, which is associated with an increase in dopaminergic activity.[9] Most importantly, meditative forms like NSDR often involve reducing the body's adrenergic activity, which favours dopamine synthesis.[10] However, NSDR cannot serve as a substitute for proper sleep, as it lacks processes like full REM sleep where the majority of dopamine is produced.[9] Overall, while NSDR can complement sleep by enhancing dopamine production, high-quality sleep remains more effective in regulating dopamine levels.

SEROTONIN

Serotonin is an essential monoamine neurotransmitter that regulates mood, memory, behaviour, and sleep.[11] By modulating these processes, serotonin promotes feelings of calm and emotional balance.[11] Serotonin is synthesized in two steps, beginning with the essential amino acid tryptophan.[12] Tryptophan is first hydroxylated by tryptophan hydroxylase, forming 5-hydroxytryptophan, which is then decarboxylated to form 5-hydroxytryptamine, also known as serotonin.[12] While most serotonin is produced in the gastrointestinal tract, it is serotonin synthesized in the raphe nuclei of the brainstem that can cross the blood-brain barrier and influence mood.[11] Serotonin can bind to postsynaptic receptors or presynaptic autoreceptors.[12] Binding to autoreceptors results in the reuptake of serotonin through serotonin transporters, where it is stored in vesicles or degraded by monoamine oxidase.[12]

In addition to these regulatory mechanisms, lifestyle factors and environmental conditions, such as sun exposure, have been associated with changes in serotonin levels.[13] In a randomized controlled trial, Aan Het Rot et al. examined the influence of bright light on serotonin-related mood changes in healthy women with mild seasonal mood symptoms.[14] It was found that bright light prevented the drop in mood, such as increased irritability, associated with acute tryptophan depletion. A broader connection between serotonin and sunlight exposure was identified by Lambert et al., where the brain's serotonin turnover across different seasons was lowest in the winter.[15] Additionally, increased serotonin production was positively correlated with increased duration and luminosity of light.[15] These findings suggest that serotonin varies with light exposure, as higher levels are associated with greater serotonin turnover. Regular exposure to natural or artificial light may support serotonin activity and contribute to emotional well-being.

ENDORPHINS

Endorphins are hormones released by the hypothalamus and the pituitary gland in response to pain and stress.[16] There are three major classes of endorphins: β-endorphins, enkephalins, and dynorphins. In particular, β-endorphins have a prominent effect on the reward system. They are produced in the anterior pituitary gland in response to corticotropin-releasing hormone sent from the hypothalamus. β-endorphins bind to μ-opioid receptors and hyperpolarize neurons in the cerebral cortex, brainstem, and thalamus. The hyperpolarization of these cells inhibits the release of substance P, a neuropeptide essential for pain transmission.[17] Through this mechanism, β-endorphin binding decreases the sensation of pain. High-intensity interval training (HIIT) may enhance β-endorphin levels.[18] Saanijoki et al. investigated β-endorphin levels after one hour of moderate-intensity or HIIT exercise. They found that β-endorphin release was positively correlated to the negative emotions that participants experienced during rigorous parts of the HIIT exercise. This suggests that the neuroendocrine system releases β-endorphins to moderate low mood during exercise. Therefore, HIIT exercise may elevate circulating β-endorphin levels, which are associated with reductions in negative mood and improved emotional well-being.

OXYTOCIN

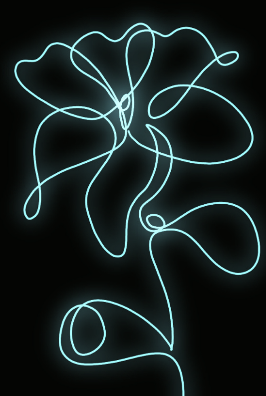
Oxytocin is a neuropeptide hormone that plays an important role in reproduction and social behaviour in humans.[19] The hormone is produced in the supraoptic and paraventricular nuclei of the hypothalamus, where it is released by neuronal projections to the posterior pituitary gland. Oxytocin binds to its G protein-coupled receptors in reward-associated brain regions, such as the amygdala and nucleus accumbens, activating downstream signalling pathways through increased intracellular calcium ion permeability and protein kinase activity. Through this mechanism, oxytocin can increase the pleasure resulting from social contact.

Physical touch, such as massage therapy, has been shown to increase oxytocin levels.[19] Physical stimulation of glabrous skin, located on the palms of the hand and soles of the feet, as well as all non-glabrous skin across the body, induces specialized sensory neurons. These neurons trigger neural impulses leading to oxytocin release.[19] This signal is sent to the central nervous system, decreasing the perception of pain. Morhenn et al. investigated oxytocin level changes after a 15-minute moderate-pressure massage and found a 17% increase compared to controls, demonstrating the elevation of oxytocin production from physical touch.[20] Social activities such as conversations, acts of altruism, and social music listening may enhance oxytocin production as well.[20] Thus, activities including physical stimulation and social behaviours may elevate oxytocin levels, promoting feelings of happiness.

LIMITATIONS AND CONCLUSION

It is important to note that opportunities to engage in activities which influence levels of happiness hormones may be limited by socioeconomic factors, underlying health conditions, seasonal variations, or geographic isolation.[21] Some interventions also require consistent effort, which may be difficult for individuals with demanding schedules or limited support.[22] Moreover, the lack of diverse representation in existing research reduces its generalizability. For example, the study by Aan Het Rot et al. examined the effect of light exposure exclusively in mildly seasonal healthy women, limiting the applicability of the results.[13] Consequently, these lifestyle strategies and data may not be universally applicable across populations.

Happiness is not solely a psychological concept but also a biological process shaped by neurotransmitter regulation. Therefore, understanding these mechanisms provides a scientific framework for how everyday behaviours can influence emotional health and happiness.



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REVIEWED BY: DR. KARA PETRUNICK (ND)

Dr. Kara Petrunick is a naturopathic doctor in Ontario with a storied history in naturopathic medicine clinical practice.

EDITED BY: ADITYA MISRA, DILNOOR RANDHAWA, & ANDREW YANG