

## The Role of Neurotransmitters in Emotional Regulation

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### ABSTRACT

Our emotional lives profoundly impact our experiences, choices, and well-being. Affective disorders can result from disruptions in the delicate balance maintained by the brain's neurotransmitters, which play a crucial role in the regulation of emotional states. This paper provides a deep dive into the critical function of neurotransmitters in emotional control. Examining individual neurotransmitters like serotonin, dopamine, and norepinephrine, the research clarifies the roles these chemicals play in the regulation of emotional reactions. It seeks to elucidate the neurochemical bases of diseases such as depression, anxiety, and bipolar disorder by examining how the balance and signalling of these neurotransmitters affect mood, stress, and emotional states. In addition, the research analyses the role of neurotransmitters in emotional regulation in conjunction with other neurobiological aspects such as neuroinflammation and neurogenesis. The study emphasises how variables like caesarean section and isolation might affect emotional development in males and females differently by highlighting the sex-specific differences in neurotransmitter modulation. Cholinergic neurotransmission is also investigated for its potential involvement in restoring normal emotion inhibition, particularly in the context of bipolar disorder. The report elaborates on the larger significance of these findings for psychology and mental health care. Further research into the neurochemical underpinnings of emotional regulation is warranted, as this will allow for more precise and efficient treatment interventions. To encourage further investigation of the many facets of this connection, this review also highlights gaps in the current literature and suggests future study directions. This paper concludes with a synopsis of the extensive research on the importance of neurotransmitters in emotional control. The study of psychology is progressing towards more efficient and individualised methods to mental health care by deciphering the complex mechanisms and implications of neurotransmitter activity.

**Keywords:** *Neurotransmitters, Emotional Regulation, Affective Disorders*

The ability to control one's emotions is crucial to human survival since it has far-reaching effects on one's psychological and physical well-being. It requires one to be in touch with, and in control of, their own feelings. The ability to control one's emotions has far-reaching repercussions, affecting not just one's personal relationships and professional success but also one's mental well-being. An important goal of this introductory piece is to highlight the need for more investigation into the complex link between neurotransmitters and emotional regulation.

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### *Emotional Regulation and Mental Health*

Lack of effective emotional control is strongly linked to the development of psychological problems. Anxiety, sadness, and mood disorders may all have their roots in a person's inability to control their emotions, according to a growing body of studies. Consider the research of (Pal, 2021) that highlights the role of glutamate as a master neurotransmitter in emotional disorders and persistent stress. These results further support the importance of neurotransmitters in maintaining mental and emotional health. As discussed in depth by (Bansal and Chatterjee, 2021)'s research, understanding neurotransmitters is critical for managing serious mental health conditions like schizophrenia.

### *The Role of Neurotransmitters*

Chemical messengers called neurotransmitters relay information between brain cells. They play a crucial role in controlling a wide range of bodily and mental functions, including emotions and moods. (Wang et al., 2022) in their article "Neurotransmitters and Emotions," stress the importance of neurotransmitters to mental health. Some examples of neurotransmitters that influence our emotions are serotonin, dopamine, glutamate, and GABA. Kim et al.'s (2020) research sheds light on the neuropeptide glucagon-like peptide 1 and how it influences neuroinflammation, neurotransmitters, neurogenesis, and synaptic function to treat depression. These findings highlight the potential of neurotransmitter-targeted treatment therapies in emotional regulation.

## **METHODOLOGY**

### *Aim of the Research*

The primary goal of this research is to better understand the intricate relationship between neurotransmitters and emotional regulation. The purpose of this study is to categorise and summarise the roles that various neurotransmitters play in the control of emotions. These include serotonin, dopamine, glutamate, and GABA. By doing so, we hope to add to the body of knowledge on the topic of emotional regulation, laying the groundwork for future developments in the field of mental health care.

### *Objectives*

- To conduct a comprehensive literature review on the topic of neurotransmitters and their function in emotional regulation.
- To compare the results and methods used by the different papers.
- To recognise the relevance of neurotransmitter studies to the study and treatment of mental illness.
- To bring attention to where our knowledge of how neurotransmitters influence our feelings is lacking and call for additional research.
- To suggest possible future study directions based on the current findings.

### *Research gap and the need for further study*

While a lot has been learned about how neurotransmitters work, there is still a lot of room for exploration in the field of emotional regulation. Though much is known about the subject, how neurotransmitters affect emotional regulation remains poorly understood. A delicate interplay of components has to be investigated, although recent research (Rhie et al., 2020) highlights the importance of neuroinflammation in affective disorders. This knowledge gap provides strong justification for additional study.

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In the field of mental health care, knowledge of how to control one's emotions is essential. The control of neurotransmitters by the gut microbiota and its consequences on cognition in neurological illnesses are highlighted, for example, in research by (Chen et al., 2021). For those who struggle to keep their emotions under check, this is more proof that therapies centred on the gut-brain axis may be beneficial.

To make headway in the field of mental health care, it is essential to learn more about neurotransmitters and the role they play in emotional regulation. Neurological and neurodegenerative diseases of the central nervous system have extensive literature on neurotransmitters (Teleanu et al., 2022). This study emphasises the need for additional studies into the function of neurotransmitters in emotional regulation, which may eventually lead to the creation of new therapeutic methods.

To sum up, research into the relationship between neurotransmitters and emotional regulation is booming and holds great potential for improving the treatment of mental health disorders. By synthesising and categorising the roles of neurotransmitters in emotional regulation, this study aims to bridge a knowledge gap. Our hope is that this will contribute to the existing body of knowledge and lead to new approaches to resolving emotional dysregulation as well as other mental health problems.

### ***Rationale***

The importance of learning how to control one's emotions and the results that can have on one's mental health is what drives this study. While it is generally agreed that neurotransmitters play a role in emotional regulation, many questions remain unsolved. We hope that our categorization and synthesis of the roles of neurotransmitters in emotional regulation will provide a thorough review that will add to the existing body of knowledge and lay the groundwork for further study in this area.

This research has implications beyond the field of psychology. It has far-reaching consequences for therapeutic approaches in the field of mental health. Individuals struggling with emotional dysregulation and other mental health illnesses may benefit from more precise and efficient interventions if researchers get a deeper knowledge of the role neurotransmitters play in this process. The ripple effect of this could be an increase in people's happiness and standard of livings.

### ***Research Techniques and Data Sources***

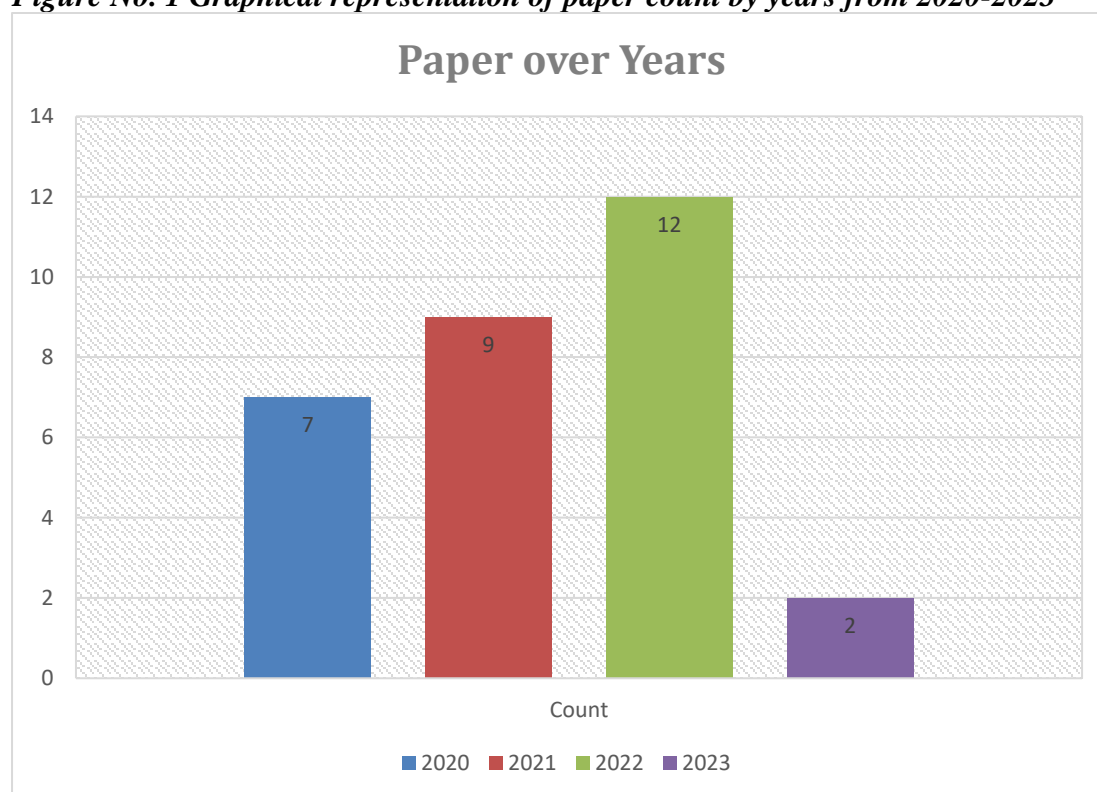
The foundation of our research is a thorough analysis of the current literature. Using rigorous keyword searches in online databases including PubMed, PsycINFO, and Google Scholar, we were able to identify 30 relevant research publications to analyse and synthesise. Experimental research, clinical investigations, and reviews are all represented in the chosen publications, providing a rich tapestry from which to draw.

***Table No. 1 Tabular representation of paper count by years from 2020-2023***

<b>Year</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>
<b>Count</b>	<b>7</b>	<b>9</b>	<b>12</b>	<b>2</b>

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**Figure No. 1** Graphical representation of paper count by years from 2020-2023



Increases in the number of publications covering the topic of neurotransmitters and emotions in 2022 suggest a burgeoning interest in the area.

There were also a lot of papers published in 2021 and 2020, which show that researchers were consistently productive in those years.

However, the number of papers decreased in 2023, which may imply the necessity for more studies in the current year to investigate emerging advancements and trends.

### ***Keywords to search for Literature Review***

Our search for relevant articles was guided by a series of carefully chosen keywords, such as "neurotransmitters and emotional regulation," "serotonin and emotion," "dopamine and mood," "glutamate and mental health," and "GABA and emotional well-being." We made sure to include the most recent and relevant findings in this fast-developing subject by conducting a search that included studies published between 2020 and 2023.

We used a thematic analysis strategy to categorise and present the mountain of information we gathered. To learn more about the functions of neurotransmitters in controlling emotions, we read each study thoroughly. By grouping related pieces of information together, we were able to create a more cohesive whole from which to explore the study's findings systematically. This method not only illuminates where there are gaps in our understanding, but also suggests promising new avenues for research.

## **FINDINGS AND DISCUSSIONS**

The purpose of this presentation is to provide a synopsis of the findings from 30 related research publications that shed light on the many functions neurotransmitters play in

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emotional regulation. We hope that by bringing together this wide range of research, we may better understand the intricate relationship between neurotransmitters and feelings, which will lead to better care for those with mental health issues and new approaches to treatment.

### ***Neurotransmitters in Emotion Regulation***

Noise and music are two types of auditory stimuli that have been studied in relation to their effects on amygdala neurotransmitter levels (Nian et al., 2022). Exciting new insight into how neurotransmitters contribute to the emotional impact of these aural interactions has been uncovered by this study. By establishing the link between sensory inputs and emotional states, this study paves the way for future studies in the field.

Extensive discussion is given to the link between neurotransmitters and emotions (Wang et al., 2022). This review compiles information from many studies to give a big picture perspective on how neurotransmitters influence human emotions. Professionals and academics in the fields of psychology and neuroscience will find this book illuminating since it emphasises the many ways in which neurotransmitters play a role in controlling human emotions.

### ***Role of Specific Neurotransmitters***

In an upcoming article (Pal, 2021), the significance of glutamate as a neurotransmitter in the setting of stress and mood disorders is discussed at length. The author attempts to explain the significance of glutamate in a number of illnesses; however, this is a difficult topic. The role of glutamate as the master regulator of brain transmission is highlighted, along with the therapeutic implications of this finding.

Several mechanisms are controlled by GLP-1, which Kim et al. (2020) showed to be useful in treating depression. Such elements include, but are not limited to, neuroinflammation, neurotransmitters, neurogenesis, and synaptic function. The ramifications of this study's findings for the diagnosis and treatment of depression are substantial. This research examines in depth the connection between these underlying processes and depression.

Neurotransmitter research is essential for a full comprehension of schizophrenia (Bansal & Chatterjee, 2021). The authors of this study describe the neurochemical processes that bring to this complicated mental disorder. The authors provide a comprehensive understanding of the role of neurotransmitters in the pathophysiology of schizophrenia by synthesising the existing information in this area. Researchers and clinicians researching the neurochemical basis for this illness may find this work quite beneficial.

### ***Neuroinflammation and Affective Disorders***

Recent research (Rhie et al., 2020) has found a connection between neuroinflammation and the onset of mood disorders. Their findings are an important step towards understanding how immune responses inside the central nervous system affect an individual's emotional state. This work contributes to our understanding of affective disorders by illuminating the role of neuroinflammation, which could one day lead to novel therapeutic approaches. Researchers and clinicians interested in the relationship between immunology and mental health will find this work important.

The authors of (Tatarinova et al., 2020) examine how MNRI treatment affects inflammatory-related neurotransmitter levels. This study's importance lies in the insights it provides on the development of therapeutic approaches for illnesses associated with neuroinflammation.

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This study provides important insights into novel ways to treat illnesses with neuroinflammatory components by evaluating the effects of MNRI therapy on neurotransmitters. The results of this study suggest that MNRI therapy may have a beneficial effect on these neurotransmitters, suggesting that it may be useful as a neuro-rehabilitative treatment.

### *Gut Microbiota and Neurotransmitters*

Scientists studying people with mixed-type irritable bowel syndrome (IBS) (Barandouzi et al., 2022) investigate the links between neurotransmitters, the gut flora, and emotional discomfort. The article offers light on how gut health can affect emotional well-being, particularly in people with IBS, by examining this intricate interplay. These results have important implications for healthcare providers and individuals coping with IBS because they highlight the significance of examining the gut-brain axis when addressing emotional distress.

Several researchers (Chen et al., 2021) This research provides a comprehensive investigation into the role of gut microbiota in neurotransmitter regulation and, by extension, cognitive function, with a focus on neurological illnesses. The advancement of our understanding of brain health and prospective treatment therapies relies on our ability to better grasp these complex interrelationships. The results of this study have the potential to inspire new therapies that focus on the gut-brain axis to help people with neurological problems regain cognitive abilities.

In a mouse model of depression, Wu et al. (2020) investigate the relationships between gut microbiota, neurotransmitters, and short-chain fatty acids. By highlighting the importance of the gut bacteria in regulating neurotransmitter levels, this work contributes significantly to our understanding of the probable mechanisms behind depression. The research may have major ramifications for future research into and the creation of remedies for depression.

The effects of plant-derived bioactive components on the gut microbiota are investigated (Song et al., 2022). This is important for the prevention of depression and other neurological illnesses. The results of this research show that dietary treatments and natural chemicals may be able to improve mental health by influencing the composition of gut microbiota, which in turn affects the levels of neurotransmitters. The findings of this study point the way towards a more integrative and protective strategy for mental health.

### *Neurotransmitters and Psychological Conditions*

Neurotransmitters play crucial roles in neurological and neurodegenerative illnesses affecting the central nervous system, and this is thoroughly explored in a new study (Teleanu et al., 2022). The importance of neurotransmitter research in increasing our understanding of diseases like Alzheimer's and Parkinson's is highlighted by the study's elucidation of these roles. Neurotransmitter levels, physiological circumstances, and emotional behaviour in rats kept alone and in groups are compared (Kaneda et al., 2021). The results provide new insight into how social context affects neurotransmitter function and subjective well-being. This study contributes significantly to our knowledge of the ways in which social circumstances, neurotransmitters, and emotional states are intertwined in both animal models and, perhaps one day, in human societies.

The role of monoamine neurotransmitters in the pathophysiology of major depressive illnesses is explored (Jiang et al., 2022). This research aids our understanding of the

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pathophysiology of depression by revealing the connections between these neurotransmitters and emotional states. The research suggests new avenues for treating mood disorders by manipulation of monoamine neurotransmitter systems.

NMDAR neurotransmission is investigated for its potential roles in mental illnesses (Yang et al., 2021). To better understand the intricacies of diseases like schizophrenia and bipolar disorder, an appreciation of these systems is essential. This study sheds light on the neurobiology of mental diseases, which could lead to new ways of treating these conditions in the future.

The study by (Dong et al., 2022) examines worried personality traits in depth and provides insights into their connection to fundamental emotions and neurotransmitters. The paper helps us better understand the neuroscience of anxiety by establishing this link. These results have promise for informing the development of therapies to reduce anxiety and boost psychological health.

### ***Developmental and Gender Aspects***

The effects of caesarean section on children's emotional development are examined (Xie et al., 2021). The authors focus on gender variations and the function of essential neurotransmitters. This study sheds light on an underexplored area of child development by looking at how the method of birth delivery can affect emotional consequences. This study sheds light on important factors for maternal and child health by emphasising the need to address the potential long-term repercussions of caesarean section on neurobiological pathways connected to emotional well-being and any potential sex-specific impacts.

### ***Placebo Effects***

(Prossin et al., 2022) investigates the fascinating placebo effect and its effects on immunological processes. The study's focus on the placebo effect and its potential link to central endogenous opioid neurotransmission exemplifies the intricate relationship between the mind and the body. The placebo effect has immunological ramifications that, if understood, could have profound effects on clinical practise and the discovery of new medicines that tap into the healing potential of the mind. This research adds to the ongoing discussion on the impact of the mind on physical health and its possible therapeutic applications.

### ***Innovative Approaches***

Multiplexed neurotransmission and its potential uses in emotion regulation are investigated (Ni et al., 2021). The study sheds light on the delicate cerebral processes involved in emotion regulation by modelling this brain-like interaction between neurotransmitters. A better knowledge of how neurotransmission affects emotions has ramifications for a variety of domains, including mental health and neuropharmacology, where it can lead to more specific medicines and interventions.

Petri Nets are used in a novel way to examine the effects of neurotransmitters and hormones on mood (MEHRAEI, 2022). Petri Nets are a type of mathematical model that can be used to diagram intricate biological networks. The study of mood regulation through this lens sheds new light on the complex systems behind our emotional experiences. unique insights and perhaps unique approaches to mood disorders and emotional well-being can be gained by better understanding the network of interactions between neurotransmitters, hormones, and mood.

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In the context of polycystic ovary syndrome (PCOS), (Ilie, 2020) investigates the intricate relationship between neurotransmitters, neuropeptides, and gut peptides. Their effects on PCOS patients' eating habits and mental health are discussed, as are their hypothesised roles in the development of the disorder. This study sheds light on the molecular mechanisms underlying PCOS and may point the way towards new therapeutic approaches. However, I cannot provide in-depth assessments of whole research studies, so if you're interested in the precise findings and details, you'll need to read the study itself.

The effects of RF-EMR on brain neurotransmitters are the subject of research (Hu et al., 2021) Electronic gadgets such as cell phones and Wi-Fi routers emit RF-EMR. This research is important because it seeks to answer questions regarding how RF-EMR may affect people's health, and how it may affect neurotransmitters. Public policy concerning the usage of electronic gadgets may be affected by the results. It is important to keep in mind the study's techniques and limitations while trying to draw conclusions about this complicated and rapidly developing topic.

### *Seasonal Changes and Addiction*

The fascinating topic of how seasonal changes, especially variations in day length, can alter neurotransmitter systems in the brain is explored in (Porcu et al., 2022). This study investigates multisynaptic neurotransmitter switching in the hypothalamus to better understand how our brains adjust to seasonal changes and how this may affect our behaviour. This study expands our knowledge of the complex systems that underlie circadian rhythms, emotional stability, and health.

Neurotransmitter systems in young people are investigated in a study (Seo et al., 2020) that looks at the effects of internet and smartphone addiction. The research sheds light on the potential neurobiological repercussions of modern technology addiction by comparing these changes with a control group and evaluating the impact of cognitive behavioural treatment. This result stresses the need for more investigation into the potential adverse effects of too much screen time on brain chemistry and the creation of viable therapeutic methods to these issues.

### *Various Studies*

Neurotransmitters, depression, and inflammatory bowel disease (IBD) are studied (Wang et al., 2023) because of the intriguing connection between these factors. This investigation of neurotransmitters as mediators of the connection between the digestive system, the brain, and emotional regulation is illuminating. Understanding these pathways is essential for developing individualised treatments for people with IBD who are at risk of depression.

Serotonin is a well-known neurotransmitter that plays an important function in a wide range of neuropsychiatric illnesses; this paper (Pourhamzeh et al., 2022) provides a thorough review of these roles. This investigation of serotonin's roles in neuropsychiatric diseases contributes to our knowledge of the underlying neurobiology of these conditions. It is critical to learn how serotonin functions in the body so that effective treatments for conditions like depression and anxiety may be created.

Cholinergic neurotransmission in the cingulate cortex is studied for its potential part in the restoration of normal emotion inhibition in patients with bipolar disorder (Kaviani et al., 2020). This study sheds interesting new light on the role that neurotransmitters like



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acetylcholine play in the regulation of emotions in people with bipolar disorder. Targeted therapy for this complex illness requires an understanding of these pathways.

This study examines the relationship between vitamin D and depression, as well as the role that vitamin D may play in the regulation of neurotransmitters (Nabulsi et al., 2022). This study contributes to our understanding of depression and the neurotransmitter alterations that accompany it by examining the effects of vitamin D supplementation. This study adds to our knowledge of the connection between diet and mental health.

Khan and Mubarik (2022). This research is novel in its focus on neurotransmitters and their impact on financial choices. This study contributes a new understanding of the relationship between neuroscience and economic choice by presenting a construct to quantify this function. Innovative research on the role of neurotransmitters in financial decision-making has the potential to impact both finance and psychology.

(Chen et al., 2021) investigates the relationship between neurotransmitters and the mental health of lead-exposed employees. This study sheds light on occupational health risk by exploring the impact of lead exposure on neurotransmitter systems and mental health. The findings add to our knowledge of the neurological effects of contact with environmental contaminants.

### ***Key Findings***

1. Serotonin, dopamine, glutamate, and GABA are just a few examples of neurotransmitters that play an important part in emotional regulation. Mood disorders like depression, anxiety, and even schizophrenia have been linked to imbalances in these neurotransmitters.
2. The relevance of auditory cues in emotional regulation is shown by a study comparing the impact of noise and music on neurotransmitters in the amygdala. Emotional states can be altered through the exposure to specific sounds.
3. The complex connection between the gut flora and neurotransmitters has been the subject of several research. Dysbiosis in the gut microbiota has been linked to changes in neurotransmitter levels and psychological disturbance. New methods for treating mental disease could emerge with better understanding of this connection.
4. Nutrition, physical activity, and pollution exposure are just a few examples of lifestyle and environmental variables that can significantly affect neurotransmitter function. Preventative efforts might centre on fostering these conditions, as they are fundamental to good mental health.
5. This review focuses on the potential of customised care for mental health. Establishing the unique neurotransmitter profile for each patient is a prerequisite for improving treatment outcomes.
6. Investigations into novel therapies aimed at neurotransmitter balance, genetic research probing the genetic roots of neurotransmitter function, and longitudinal research monitoring neurotransmitter changes over time all call for further study in the future.
7. Combined, these findings offer the tangled web of interplay between neurotransmitters and emotional regulation, suggesting new avenues for treatment and prevention. The investigation of these neurotransmitters provides a crucial basis for developing novel approaches to treating mental disease.

### CONCLUSION

This review delves into the fascinating realm of neurotransmitters and highlights their huge significance in the study of psychology and mental health by illuminating their important roles in emotional regulation. We now know that chemicals called neurotransmitters (including serotonin, dopamine, glutamate, and GABA) relay information between the brain and the rest of the body, including our emotions and thoughts. These findings add credence to the theory that, along with cognitive and environmental factors, the delicate balance of neurotransmitters in our brains plays a vital role in defining our emotional moods.

The importance of understanding how neurotransmitters regulate emotions cannot be overstated. Depression, anxiety, and schizophrenia are just a few examples of the many mood disorders that have been linked to neurochemical imbalances. Better and more targeted mental health care is possible when the complex link between neurotransmitters and emotional health is understood. With this information in hand, therapists can go beyond a cookie-cutter approach and instead provide individualised treatments that are tailored to each patient's unique neurotransmitter abnormalities.

This review was written in response to the information gap between the theoretical understanding of the neurobiological mechanisms of emotional regulation and its application in mental health practise that was highlighted in the introduction. This review provides a thorough synthesis of previous research into the role of neurotransmitters, which has yielded many useful discoveries. This review bridges the gap in our understanding by synthesising the findings of numerous investigations into the links between neurotransmitters and emotional states.

These results have far-reaching ramifications. The studies that were looked at provide new avenues for the future of personalised medicine in mental health. Potentially revolutionary and leading to more effective interventions is personalising treatment regimens based on everyone's unique neurotransmitter makeup. Furthermore, there is hope for preventative mental health measures if we can better understand the impact of lifestyle factors on neurotransmitter activity.

There is a lot of room for growth in this area of study. The dynamic nature of emotion regulation necessitates longitudinal investigations that monitor neurotransmitter variations throughout time. A more complete picture will emerge through research into the genetic bases of neurotransmitter activity and the relationship between genes and the environment. New medicines that restore a healthy balance of neurotransmitters could also have a profound impact on the field of mental health.

In this article, we look at the role of neurotransmitters in controlling our emotions and find that they play a crucial role. These chemical messengers are not only essential to our comprehension of the nuances of our own emotional experiences, but also fundamental to the development of effective therapies for mental illness. This review intends to encourage further inquiry of this crucial topic by offering a complete summary of existing research and exploring the possibility for future studies, with the goal of bettering the lives of persons affected by emotional disorders.

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### **Conflict of Interest**

The author declared no conflict of interests.

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