



**Title:**

**The Complex ~~interplay~~Interplay of Genetics and ~~environment~~Environment in Shaping the  
Human ~~Behaviour~~Behavior and Mental Health.**

**Commented [CP1]:** Dear Author,

Thank you for the opportunity to edit your manuscript. The text has been edited for clarity, conciseness, and improved logical flow. You will also find suggestions to further strengthen the paper. Overall, the paper is in good shape, language wise, but may benefit from additional details to make it more comprehensive.

Regards,  
S. M. Mathew

**Commented [CP2]:** In APA 7 format, you do not need to include the word "Title" before your main title. Instead, the title should be centered at the top of the first page, bold, in title case, and in the same font and size as the rest of the text (usually 12-point Times New Roman).

Please note that titles are not typically followed by periods since they are not complete sentences.

### Abstract

The interplay of genetic and environmental factors in shaping human ~~behaviour~~ behavior and mental health ~~stays~~ remains a ~~central~~ pivotal question in psychological research. This paper ~~gives~~ provides a comprehensive overview of the ~~existent~~ existing literature on ~~the relative contributions of the genes and the environment focusing~~ this topic, with a particular focus on twin and adoption studies, epigenetics, and gene-environment interactions. ~~The paper emphasises~~ It ~~emphasizes~~ the importance of considering both genetic ~~an~~ and environmental factors when investigating human ~~behaviour~~ behavioral development and mental health and highlights ~~potential~~ areas for future research.

### Introduction

**Commented [CP3]:** The overarching themes of the study are evident from this sentence.

**Commented [CP4]:** The core message of this paper is clear; however, the abstract could be strengthened by incorporating a few additional details, especially since it serves as a standalone section for readers. If the word limit permits, here are some suggestions to enhance it further:

1. Consider adding a sentence that emphasizes the broader significance of this research within the fields of psychology or public health. Demonstrating the relevance of the study's findings in a larger context can help readers grasp its importance more effectively.
2. While the abstract mentions potential areas for future research, providing specific examples or research questions that could be explored in subsequent studies would be beneficial. This addition will offer readers a clearer understanding of potential directions for further investigation and practical applications of the research.
3. It would be valuable to mention the practical implications of understanding the interplay between genetics and the environment on human behavior and mental health. Exploring how this knowledge can be applied in real-life settings could increase the research's relevance and appeal to a wide range of stakeholders, including clinicians, educators, and policymakers.

**Commented [CP5]:** Typically, keywords are provided after the abstract. If the submission guidelines require them, you may wish to consider the following relevant keywords: genetic and environmental factors, human behavior and mental health, twin and adoption studies, epigenetics, gene-environment interactions, behavioral development, literature review, nature and nurture, molecular genetics, prevention and intervention strategies.

**Commented [CP6]:** APA does not use the heading "Introduction", as it's assumed the text following the abstract is introductory.

## The Complex Interplay of Genetics and Environment in Shaping Human Behavior and Mental Health

Understanding the respective roles of genetic and environmental factors in shaping human behaviour/behavior and mental health is a fundamental question in psychology. Over the years, twin/twin and adoption studies, as well as advances/coupled with advancements in molecular genetics, have given/yielded valuable insights into the contributions/interplay of nature and nature/nurture. This literature review aims to provide a comprehensive overview of the literature, including existing research, elucidating the current State/understanding of Knowledge on gene-environment interactions, and discuss/discussing the implications for further research and potential applications in prevention and intervention strategies.

### Twin and Adoption Studies

Twin and adoption studies have been instrumental in disentangling genetic/the influences of genetics and environmental influence/environment on human behaviour/behavior and mental health. Twin studies compare the concordance rates of a specific trait/traits or disorder/disorders in monozygotic (identical) and dizygotic (fraternal) twins, while. In contrast, adoption studies compare the/examine similarities between adopted children and their biological and adoptive parents (Plomin et al., 2013). These study design/help to estimate/designs aid in estimating the heritability/heritability of a trait, which is/defined as the proportion of phenotypic variance attributable to genetic factors.

These studies have consistently demonstrated that genetic factors account for a significant proportion of the variance in numerous behavioural/various behavioral traits and mental disorders, including intelligence/intelligence, personality, and major depressive disorder (Kendler et al., 2012; Polderman et al., 2015; Kendler et al., 2012). But, it is important too note

**Commented [CP7]:** Please note that for professional papers following APA 7 guidelines, the heading should be repeated instead of using "Introduction" as the heading for the introductory section.

Further, note that APA uses double spacing throughout. I've ensured compliance with this rule throughout your document.

**Commented [CP8]:** APA does not use the heading "Introduction", as it's assumed the text following the abstract is introductory.

**Commented [CP9]:** These statements must be supported by proper citations.

**Commented [CP10]:** Consider stating few main findings, briefly, if possible.

**Commented [CP11]:** The paper's message is evident; however, the rationale for this review requires further elaboration. At present, readers may not discern the necessity of conducting a literature review and the specific gaps in the literature that this paper aims to address.

**Commented [CP12]:** I have three points that you might want to consider:

1. It would be beneficial to clarify whether this paper is intended to be a standalone literature review or part of a larger work.
2. Readers may be interested in understanding the selection criteria used to include the studies in the review to improve the transparency and reliability of the findings.
3. While the paper claims to offer a "comprehensive overview of existing research," it appears to provide more of a broad examination of various directions in genetics-mental health research. A comprehensive literature review might involve a more in-depth analysis of the selected studies, including critical examination of methodologies, strengths, limitations, and common themes across the literature. ... [1]

**Commented [CP13]:** Further to the previous note, the introduction briefly mentions that understanding the roles of genetic and environmental factors is a fundamental question in psychology. However, it does not explicitly ... [2]

**Commented [CP14]:** The paragraph cites some relevant studies, but to enhance its currency and validity, you might consider incorporating more recent sources that add depth and reflect the latest advancements in the field.

~~that~~. ~~However~~, heritability estimates ~~can~~~~may~~ vary ~~depending~~~~contingent~~ on the population and environmental conditions under study, ~~emphasising~~~~emphasizing~~ the need for caution when interpreting these findings. (Turkheimer, 2000).

### Epigenetics

Epigenetics ~~is~~, defined as the study of heritable changes in gene expression ~~that do not~~ ~~involve~~~~caused by~~ alterations in the DNA sequence, has emerged as a crucial factor in understanding the ~~gene-environment~~ interaction ~~between genetic and environmental factors~~. ~~Epigenetic modifications, such as DNA Methylation and Histone Modification, can be~~ ~~influenced by~~ Environmental factors, such as stress, nutrition, ~~and~~ exposure to toxins, ~~etc.~~~~(can~~ ~~influence epigenetic modifications, including DNA methylation and histone modification~~ (Feil & Fraga, 2012). These modifications ~~in turn~~ can have ~~lasting affects~~~~enduring effects~~ on gene expression ~~and contribute~~, ~~contributing~~ to individual differences in ~~behaviour~~~~behavior~~ and mental health (Nestler et al., 2016~~).~~).

Epigenetic research ~~has provided~~~~provides~~ ~~compelling~~ evidence for the role of environmental factors in shaping ~~behaviour~~~~behavior~~ and mental health ~~through changes in~~~~by~~ ~~influencing~~ gene expression ~~of~~~~within~~ DNA. For ~~examples~~~~example~~, studies have shown that early ~~life~~ stress can ~~lead to longlasting changes~~~~induce long-lasting alterations~~ in DNA methylation patterns, ~~which can increase~~~~potentially heightening~~ the risk of mental health disorders such as depression and anxiety (Labonté et al., 2012). ~~Also~~~~Furthermore~~, epigenetic changes can be transmitted across generations, suggesting that environmental influences on ~~behaviour~~~~behavior~~ and mental health can have transgenerational effects (Franklin et al., 2010~~).~~).

**Commented [CP15]:** In general contexts, the use of 'And' and 'But' as conjunctions at the start of sentences has gained acceptance in recent years. In academic work, it tends to add a touch of informality, which may not be desirable. We normally advise omitting these conjunctions in favour of more formal alternatives, such as 'Moreover', 'Furthermore', and 'In addition'. I've amended these throughout to improve the register.

**Commented [CP16]:** In addition to presenting a positive view of epigenetic research, I suggest acknowledging any potential counterarguments or challenges to the field of epigenetics, to provide a more balanced and comprehensive perspective, considering this is intended to be a literature review.

For example, you can state that the field is still relatively young and that there may be areas of uncertainty or controversy. You can discuss the need for further research to fully understand the extent and implications of epigenetic modifications on gene expression and subsequent outcomes.

Additionally, you can briefly mention any contrasting studies or findings that might offer different interpretations or challenge some of the established conclusions in the field of epigenetics. This does not negate the importance of the research but rather highlights the ongoing scientific inquiry and the need for continued investigation.

**Commented [CP17]:** It's best to avoid 'Also' as a conjunction in academic work. It's overly conversational and not considered standard formal usage.

## Gene-Environment Interactions

Gene-environment interactions refer to the interplay between genetic susceptibility and environmental exposure in shaping individual ~~differences~~ variations in ~~behaviour~~ behavior and mental health. ~~These interactions~~ The interaction between specific genetic variants and environmental factors can be investigated through candidate gene studies or genome-wide association studies (GWAS) that examine the interaction between specific genetic variants and environmental factors and how they interact (Duncan & Keller, 2011).

One well-known example is the interaction between the serotonin transporter gene (5-HTTLPR) and early life stress in predicting depression risk (Caspi et al., 2003). ~~Individual persons with~~ Individuals carrying a short allele of the 5-HTTLPR gene, who ~~also experience~~ have experienced early life stress ~~are at a bigger~~ exhibit an increased risk of developing depression compared to those ~~with~~ possessing a long allele or those who ~~did~~ have not ~~experience~~ experienced early life stress. This finding highlights the importance of considering both genetic and environmental factors when ~~investigating~~ exploring the ~~aetiology~~ etiology of mental health disorders.

Another example of gene-environment interaction is the interplay between the ~~FKBP~~ FKBP5 gene and childhood trauma in ~~the development of PTSD~~ (post-traumatic stress disorder). ~~Study's~~ Studies have shown that individuals carrying specific risk alleles of the FKBP5 gene and exposed to early-life trauma ~~are at a~~ have an increased risk of developing PTSD (Binder et al., 2008).

## Challenges and Future Directions

Despite ~~the~~ advances in understanding gene-environment interactions, several challenges remain. ~~one~~ A notable limitation is that most studies have focused on candidate genes with a

**Commented [CP18]:** I've updated the spelling of "behaviour" to align with U.S. spelling conventions, so it now appears as "behavior" throughout the document.

**Commented [CP19]:** While you have adequately explained this interaction and provided examples, I believe that in light of the topic being reviewed, readers might be interested in the relevance and contributions of these studies.

Expanding on this point, you can highlight that by elucidating how specific genetic variants interact with environmental factors, we gain the ability to identify vulnerable populations, discover potential biomarkers, and develop personalized interventions aimed at achieving better mental health outcomes. Including these insights would enhance the value of the discussion and provide a clearer understanding of the subject matter.

**Commented [CP20]:** I deleted the abbreviation as it has not been used elsewhere.

**Commented [CP21]:** I've selected more formal synonyms to express your ideas throughout, improving the register of your work. Note that formal writing tends to be more precise, so "conducted" or "finalized" is preferable to "done", "effective" or "appropriate" is preferable to "good" (dependent on context), etc.

known or ~~hypothesised role~~ hypothesized roles in the development of specific disorders.

~~This~~ Such an approach ~~might not~~ may fail to capture the full spectrum of genetic variants involved in gene-environment interactions (Manuck ~~and~~ & McCaffery, 2014). ~~Plus~~ Furthermore, many studies have ~~investigated only~~ focused on a single or ~~a few~~ limited number of environmental factors, ~~whereas~~ overlooking the ~~development~~ complexity of ~~behaviour~~ behavior and mental health ~~is~~, which are likely influenced by multiple environmental factors.

~~Future~~ For future research ~~should make sure, it is essential~~ to adopt more comprehensive approaches, ~~(such as polygenic risk scores), which that~~ consider the cumulative effect of multiple genetic variants, ~~and multivariate~~ such as using polygenic risk scores. Multivariate models ~~that, which~~ incorporate ~~multiple~~ numerous environmental factors, should also be employed (Belsky et al., 2013). ~~In addition to this, we need to do more~~ Additionally, further longitudinal studies ~~to spotlight~~ should be conducted to examine the temporal dynamics of gene-environment interactions and their influence on ~~behaviour~~ behavior and mental health across the lifespan.

### Conclusion

In conclusion, ~~a lot~~ the concept of gene-environment interactions emphasizes the necessity to consider both genetic and environmental factors when researching human behavior and mental health. A substantial body of research has provided evidence for the significant roles ~~of both~~ that genetic and environmental factors play in shaping human ~~behaviour~~ behavior and mental health. Twin and adoption studies have quantified the heritability of various traits and disorders, while epigenetic research has elucidated the molecular mechanisms through which environmental factors ~~can~~ influence gene expression. ~~Gene-environment interactions emphasize~~ the necessity for considering not only Together, these studies demonstrate that genetic ~~factors but~~

**Commented [CP22]:** Providing one or two examples of such studies would be beneficial.

**Commented [CP23]:** Note that APA uses ampersands for parenthetical citations and 'and' for narrative citations. I've ensured compliance with this rule throughout.

**Commented [CP24]:** APA uses a half-inch first-line indent without additional space between paragraphs. I've corrected this for you throughout the document.

**Commented [CP25]:** The conclusion is quite comprehensive and reiterates key takeaways of the paper. However, I feel that this paper has a tendency to present research findings in a predominantly positive light, emphasizing the significant roles of genetics and environmental factors in shaping human behavior and mental health, without considering the limitations of the studies cited. Considering this paper aims to offer a comprehensive review, you may consider the following points for a more balanced approach:

1. Discuss studies that challenge prevailing consensus and explore different viewpoints in the literature.
2. Briefly mention limitations, including sample sizes and methodological issues in existing studies.
3. Highlight both positive and negative outcomes of epigenetic modifications on behavior and mental health.

~~also and environmental factors when investigating the development of human behaviour and mental health. Combined, these show that both genetic and environmental factors have significant roles in~~significantly contribute to shaping human ~~behaviour~~behavior and mental health.

Despite these advances, much ~~remain~~remains to be discovered ~~about~~regarding the precise mechanisms through which genes and the environment interact to shape ~~behaviour~~behavior and mental health. Future research should focus on identifying specific gene-environment interactions, ~~—exploring the role of epigenetics in mediating as a mediator of~~ these interactions, ~~—~~and considering the potential implications for prevention and intervention strategies.

**Commented [CP26]:** I rearranged some of the sentences in this paragraph to improve flow. By beginning with a general statement about the importance of gene-environment interactions, the stage is set for the more specific points to follow. The paragraph now better guides the reader through the evidence supporting this concept (i.e., twin and adoption studies and epigenetic research), and finally sums up the collective contribution of genetic and environmental factors.

## References

**Commented [CP27]:** The references have been formatted for APA 7.

~~Turkheimer, E. Three laws of behavior genetics and what they mean. *Current Directions in Psychological Science*, (2000), 9(5), 160-64.~~

~~Caspi A, Sugden K, Moffitt TE, Taylor A, Craig IW, Harrington H, McClay J, Mill J, Martin J, Braithwaite A, Poulton R. (2003). Influence of life stress on depression: moderation by a polymorphism in the 5-HTT gene. *Science*, 301(5631), 386-89.~~

~~Duncan, L.E., & Keller, M.C. (2011). A critical review of the first 10 years of candidate gene by environment interaction research in psychiatry. *Am. J. Psych.*, 168(10), 1041-049.~~

~~Labonté B, Suderman M, Maussion G, Navaro L, Yerko V, Mahar I, Bureau A, Mechawar N, Szyf M, Meaney MJ, Turecki G. (2012). Genome-Wide Epigenetic Regulation by Early-Life Trauma. *Archives of general psychiatry*, 69 (7), 722-731.~~

~~Belsky, D. W., Moffitt, T. E., & Caspi, A. (2013). Genetics in population health science: ~~strategies~~ Strategies and opportunities. ~~American journal~~ Journal of public health Public Health, 103(S1), S73-S83. <https://doi.org/10.2105/AJPH.2012.301139>~~

**Commented [CP28]:** The entire reference needs a hanging indent in APA; I've corrected this for you throughout the reference list. See Office Support for guidance on how to add a hanging indent.

**Commented [CP29]:** In APA 7, the title of the journal should be in title case and italicized.

~~Binder, EB, E. B., Bradley RG, R. G., Liu, W., Epstein MP, M. P., Deveau TC, T. C., Mercer KB, K. B., Tang, Y., Gillespie CF, C. F., Heim CM, C. M., Nemeroff CB, C. B., Schwartz AC, A. C., Cubells JF, J. F., & Ressler KJ, K. J. (2008). Association of FKBP5 polymorphisms and childhood abuse with risk of posttraumatic stress disorder symptoms in adults. *JAMA*, 299(11), 1291-1305. Journal of the American Medical Association, 299(11), 1291-1305. <https://doi.org/10.1001/jama.299.11.1291>~~

**Commented [CP30]:** In APA 7, if a journal article has a DOI, you should include the DOI at the end of the reference. If the journal article does not have a DOI but does have a URL that will resolve for readers (e.g., it is from an online journal that is not part of a database), include the URL of the article at the end of the reference.

**Commented [CP31]:** In APA 7, the reference list is ordered alphabetically by the surname of the first author of each work. I have reordered your reference list accordingly.

Caspi, A., Sugden, K., Moffitt, T. E., Taylor, A., Craig, I. W., Harrington, H., McClay, J., Mill, J., Martin, J., Braithwaite, A., & Poulton, R. (2003). Influence of life stress on depression:

**Commented [CP32]:** In APA 7, you should avoid abbreviating journal titles unless the official title uses abbreviations (like PLOS ONE).



Moderation by a polymorphism in the 5-HTT gene. *Science*, 301(5631), 386–389.

<https://doi.org/10.1126/science.1083968>

Duncan, L. E., & Keller, M. C. (2011). A critical review of the first 10 years of candidate gene-

by-environment interaction research in psychiatry. *American Journal of Psychiatry*,

168(10), 1041–1049. <https://doi.org/10.1176/appi.ajp.2011.11020191>

Feil, R. ~~and~~, & Fraga, M. F. (2012). Epigenetics and the environment: ~~emerging~~ Emerging

patterns and implications. *Nature Reviews Genetics*, 13(2), 97–109.

<https://doi.org/10.1038/nrg3142>

Franklin, T. B., Russig, H., Weiss, I. C., Gräff, J., Linder, N., Michalon, A., ~~Vizi, S.~~ Vizi, S., & Mansuy,

I. M. (2010). Epigenetic transmission of the impact of early stress across generations.

~~*Biological psychiatry*~~ *Psychiatry*, 68(5), 408–415.

<https://doi.org/10.1016/j.biopsych.2010.05.036>

Kendler, K. S., Gatz, M., Gardner, C. O., & Pedersen, N. L. (2012). A Swedish national twin

study of lifetime major depression. *American Journal of Psychiatry*, 163(1), 109–~~114~~,

114. <https://doi.org/10.1176/appi.ajp.163.1.109>

Labonté, B., Suderman, M., Maussion, G., Navaro, L., Yerko, V., Mahar, I., Bureau, A.,

Mechawar, N., Szyf, M., Meaney, M. J., & Turecki, G. (2012). Genome-wide epigenetic

regulation by early-life trauma. *Archives of General Psychiatry*, 69(7), 722–731.

<https://doi.org/10.1001/archgenpsychiatry.2011.2287>

Manuck, S. B., & McCaffery, J. M. (2014). Gene-environment interaction. *Annual ~~review~~ Review*

~~of *psychology*~~ *Psychology*, 65, 41–70. <https://doi.org/10.1146/annurev-psych-010213->

[115100](https://doi.org/10.1146/annurev-psych-010213-115100)

**Commented [CP33]:** In APA 7, if a source has up to and including 20 authors, you should list all authors in the reference. If the source has 21 or more authors, list the first 19 authors, then insert an ellipsis (...), and finally add the last author's name.

Nestler, E. J., Peña, C. J., Kundakovic, M., Mitchell, A., & Akbarian, S. (2016). Epigenetic basis of mental illness. *The Neuroscientist*, ~~22(5, 447–63.)~~, 447–463.

<https://doi.org/10.1177/1073858415608147>

Plomin, R., DeFries, J. C., Knopik, V. S., & Neiderhiser, J. M. (2013). *Behavioral genetics*. ~~New York: Palgrave Macmillan.~~

Polderman, T. J., Benyamin, B., De Leeuw, C. A., Sullivan, P. F., Van Bochoven, A., Visscher, P. M., & Posthuma, D. (2015). Meta-analysis of the heritability of human traits based on fifty years of twin studies. *Nature genetics/Genetics*, 47(7), 702–09. ~~709.~~

<https://doi.org/10.1038/ng.3285>

Turkheimer, E. (2000). Three laws of behavior genetics and what they mean. ~~Labonté B,~~

~~Suderman M, Maussion G, Navaro L, Yerko V, Mahar I, Bureau A, Mechawar N, Szyf~~

~~M, Meaney MJ, Turecki G.~~ *Current Directions in Psychological Science*, 9(5), 160–164.

<https://doi.org/10.1111/1467-8721.00084>

~~Genome-wide epigenetic regulation by early-life trauma.~~ *Arch Gen Psychiatry*. 2012

~~Jul;69(7):722–31. doi: . PMID: 22752237; PMCID: PMC4991944.~~

**Commented [CP34]:** In APA 7, the volume number of a journal should be italicized. However, the issue number, which is in parentheses after the volume number, is not italicized.

**Commented [CP35]:** In APA 7 style, the publisher's location (city, state) is no longer included. The title of the book is in italics and in sentence case. Also, the full name of the publisher is provided.

**Commented [CP36]:** In APA 7, an en dash (–) should be used between the page numbers in a reference. An en dash is longer than a hyphen (-) and shorter than an em dash (—).

I have three points that you might want to consider:

1. It would be beneficial to clarify whether this paper is intended to be a standalone literature review or part of a larger work.
2. Readers may be interested in understanding the selection criteria used to include the studies in the review to improve the transparency and reliability of the findings.
3. While the paper claims to offer a "comprehensive overview of existing research," it appears to provide more of a broad examination of various directions in genetics-mental health research. A comprehensive literature review might involve a more in-depth analysis of the selected studies, including critical examination of methodologies, strengths, limitations, and common themes across the literature. Additionally, readers may expect the results of various studies to be synthesized to draw more substantial conclusions.

As it stands, the paper briefly touches on each topic—twin and adoption studies, epigenetics, and gene-environment interactions—without carrying out an in-depth investigation of the specific findings of important studies or their limitations. Expanding on the analysis and incorporating a more detailed exploration would enhance the depth and impact of this review.

Further to the previous note, the introduction briefly mentions that understanding the roles of genetic and environmental factors is a fundamental question in psychology. However, it does not explicitly state why this question is significant or why a literature review on this topic is necessary.

To strengthen the study rationale, the introduction could be expanded to provide a clearer justification for the review. For example, it could highlight the following points:

1. Importance of the topic: Explain why understanding gene-environment interactions is crucial in psychology and how it impacts our knowledge of human behavior and mental health. Discuss the potential implications of such knowledge on prevention, intervention, and treatment strategies.
2. Existing gaps in the literature: Identify any gaps or limitations in current research on gene-environment interactions. Highlight why a comprehensive review is needed to address these gaps and consolidate existing knowledge.
3. Relevance and timeliness: Elaborate on the current relevance and timeliness of the topic. Discuss any recent developments in the field and how this review contributes to the ongoing discourse on gene-environment interactions.

In other words, readers should be able to tell *how* this paper contributes to the existing literature.