



INTERSECTION BETWEEN SPIRITUALITY AND NEUROSCIENCE: BIOLOGICAL BASES OF TRANSCENDENTAL EXPERIENCES

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ABSTRACT

Objective: The objective of this study is to investigate the relationship between religion, spirituality and neuroscience, with a focus on understanding the biological bases of religious experiences. The study aims to analyze how different spiritual practices affect the human brain, identify the brain regions involved, and examine the impact of these practices on mental health and emotional well-being. Furthermore, we seek to discuss the ethical implications of including religious themes in medical and psychological practice.

Method: The study uses a qualitative literature review approach in English and Portuguese, based on national and international sources. Scientific articles, case studies and research related to the neuroscience of religion and spirituality were analyzed. The data was collected and organized to identify the biological foundations of spiritual experiences, the social and psychological implications, as well as the ethical issues associated with this theme.

Results and conclusion: The results indicate that different spiritual practices activate several brain areas, including the frontal cortex, prefrontal cortex, nucleus accumbens and striatum, associated with rewards, emotions, moral reasoning and concentration. The mystical mind is considered an innate capacity of the human brain, enabling transcendental experiences in all cultures. Furthermore, the frequent practice of spirituality can lead to profound brain changes, favoring discernment, empathy and better decisions. Religiosity and spirituality have a positive impact on mental health, helping to cope with anxiety, fears and promoting emotional well-being.

Research implications: This study has significant implications in the area of mental health and clinical practice, highlighting the importance of considering patients' spirituality and religiosity as an integral part of their emotional health. Furthermore, the research paves the way for a greater understanding of the biological bases of religious and spiritual experiences, which may have applications in clinical treatments and the promotion of psychological well-being. The ethical implications raised are also relevant for healthcare professionals, who must approach these issues with sensitivity and respect, avoiding the imposition of personal values. On a broader scale, research contributes to intercultural understanding and peaceful coexistence between different religious groups, promoting tolerance and mutual respect.

Keywords: Spirituality, Neuroscience, Religion, Neuroethics.

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INTERSECÇÃO ENTRE ESPIRITUALIDADE E NEUROCIÊNCIA: BASES BIOLÓGICAS DAS EXPERIÊNCIAS TRANSCENDENTAIS

RESUMO

Objetivo: O objetivo deste estudo é investigar a relação entre religião, espiritualidade e neurociência, com foco na compreensão das bases biológicas das experiências religiosas. O estudo visa analisar como diferentes práticas espirituais afetam o cérebro humano, identificar as regiões cerebrais envolvidas e examinar o impacto dessas práticas na saúde mental e no bem-estar emocional. Além disso, busca-se discutir as implicações éticas da inclusão de temas religiosos na prática médica e psicológica.

Método: O estudo utiliza uma abordagem de revisão qualitativa da literatura em inglês e português, com base em fontes nacionais e internacionais. Foram analisados artigos científicos, estudos de caso e pesquisas relacionadas à neurociência da religião e espiritualidade. Os dados foram coletados e organizados para identificar os fundamentos biológicos das experiências espirituais, as implicações sociais e psicológicas, bem como as questões éticas associadas a essa temática.

Resultados e conclusão: Os resultados indicam que diferentes práticas espirituais ativam diversas áreas cerebrais, incluindo o córtex frontal, pré-frontal, núcleo accumbens e estriado, associadas a recompensas, emoções, raciocínio moral e concentração. A mente mística é considerada uma capacidade inata do cérebro humano, permitindo experiências transcendentais em todas as culturas. Além disso, a prática frequente de espiritualidade pode levar a mudanças cerebrais profundas, favorecendo o discernimento, empatia e decisões mais acertadas. A religiosidade e espiritualidade têm um impacto positivo na saúde mental, auxiliando no enfrentamento de ansiedade, medos e promovendo o bem-estar emocional.

Implicações da pesquisa: Este estudo tem implicações significativas na área da saúde mental e na prática clínica, destacando a importância de considerar a espiritualidade e religiosidade dos pacientes como parte integrante de sua saúde emocional. Além disso, a pesquisa abre caminho para uma maior compreensão das bases biológicas das experiências religiosas e espirituais, o que pode ter aplicações em tratamentos clínicos e na promoção do bem-estar psicológico. As implicações éticas levantadas também são relevantes para profissionais de saúde, que devem abordar essas questões com sensibilidade e respeito, evitando a imposição de valores pessoais. No âmbito mais amplo, a pesquisa contribui para a compreensão intercultural e a coexistência pacífica entre diferentes grupos religiosos, promovendo a tolerância e o respeito mútuo.

Palavras-chave: Espiritualidade, Neurociência, Religião, Neuroética.

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1 INTRODUCTION

Spirituality has been a constant search of human beings throughout history, motivated by the uncertainties of life and the need to find meaning and connection with something greater. Religion, as one of the ways of experiencing spirituality, sets standards of behavior and rituals for a deeper connection with the transcendental. Neuroscience reveals that different spiritual practices activate several brain areas, providing long-term mental and physical benefits. Regardless of the form chosen, spirituality plays an essential role in people's lives, deserving respect and consideration (AMARAL, 2021).

About 80% of people consider themselves religious or practice spirituality-oriented rituals. If on the one hand religion is manifested by acts of worship, rites and religious expressions, often more cultural than spiritual, on the other hand spirituality is a characteristic dimension of human beings, revealing the totality of being and its connection with something greater (FERGUSON *et al.*, 2021; SILVA & SILVA, 2014).



One can say that the second expresses itself in unconditional love and in the open vision of the world, deepening our faith and understanding of the cosmos. Thus, developing spirituality enriches human life and its existential dimension (SILVA & SILVA, 2014).

In this way, it is proposed a deep investigation on the relationship between religion and neuroscience, seeking to understand the biological and neurological bases behind religious experiences. Religion has been an essential part of human experience for thousands of years, shaping beliefs, values, behaviors, and societies. On the other hand, modern neuroscience has advanced rapidly in understanding the functioning of the human brain and how it responds to different stimuli and experiences.

The central objective of this theme is to examine how the human brain responds to religious practices, meditation, prayers, rituals and mystical experiences through a qualitative review of literature in the English and Portuguese languages contained in the national and international databases.

2 SPIRITUAL EXPERIENCES AND NEUROSCIENCE

Neuroscience has advanced significantly and influenced several fields of knowledge, including the psychology of religion. The sciences of religion still use outdated concepts, and studies of consciousness and mind increasingly approach the discoveries of neurosciences. However, it is noted that the mind-body relationship remains ambiguous and prevents the clear connection between emotion, reason, brain and cultural, ethical and religious values (VALLE, 2002).

2.1 Biological Fundamentals of Spiritual Experiences

How do these religious and spiritual experiences influence emotions and cognition? What happens in the brain during spiritual and religious activities such as prayer, meditation or participation in rituals? These questions permeate the curiosity of both science and of people who experience processes and rituals.

The mystical mind is regarded as an innate capacity of the human brain that allows for mystical experiences in all cultures. Such experiences arise from the interactions between cultural patterns and neurochemical networks in the brain. It is argued that the mind/brain has intrinsic conditions to generate mystical states and the derived experiences are characterized by a fusion of opposites and a sense of transcendent unity (VALLE, 2002).

Some authors have investigated the act of turning a blind eye during prayer in the Christian context and highlight related neuropsychic aspects. During the act, the synapse releases chemicals that bind to receptors in the brain, impacting cognitive, affective, and behavioral functions. Activation of dopamine, serotonin and oxytocin receptors correlates with spiritual states, and practices such as meditation can stimulate these reactions and improve emotional and cognitive capacity towards transcendent goals (BARRÍA, ADAM & PUNTEL, 2022).

On the other hand, recent studies corroborate that different brain regions mediate religious and spiritual experiences. Therefore, these experiences are multidimensional and involve perception, cognition, and emotion, with greater activity in the frontal and prefrontal cortex during such experiences. Other research investigates drug induction experiments and religious beliefs, pointing to the activity of specific areas of the brain, such as the frontal and parietal lobes. Mediumship showed a decrease in the activity of attentional networks during spiritual communication (PERES & NEWBERG, 2013).

Scientists at Harvard University used imaging tests to study the relationship between faith and spirituality in the human brain. They discovered a specific circuit, periaqueductal



gray matter (SCP), associated with functions such as fear conditioning, pain modulation, altruism, and unconditional love. This preserved evolutionary structure is also linked to prayer and desire for answers, showing how the brain coordinates our thoughts, memories and bodily functions (MENDONÇA, 2022).

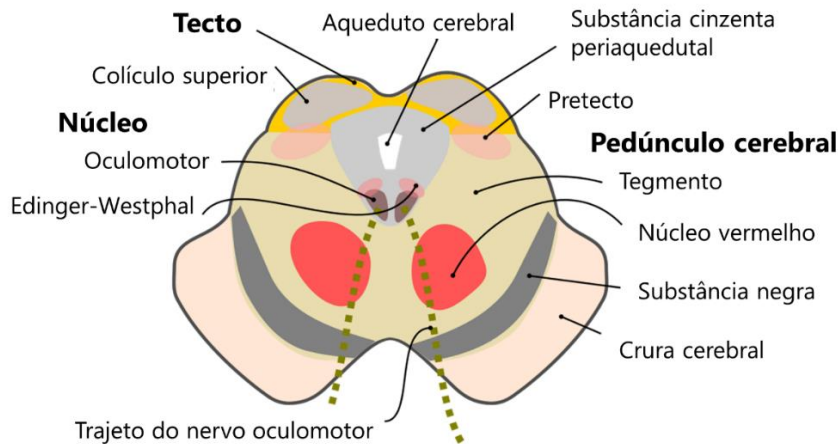


Figure 1 - Midbrain

Source: Prepared by Wikipedia-adapted author.

Ferguson *et al.* (2021) identified that brain lesions associated with changes in spiritual acceptance are connected to a brain circuit centered on the periaqueductal gray matter (SCP) or central gray matter (Figure 1). This connection was also associated with religiosity and cases of hyper-religiosity. SCP performs various functions, such as fear conditioning, pain modulation, and altruistic behaviors. These findings suggest that SCP may be related to aspects of spirituality and religiosity, such as mediating emotional responses, analgesia, and connections to other people. However, these correlations do not actually imply specific religious or spiritual beliefs.

Finally, the frontal and temporal lobe play an important role in storing fundamental aspects of religious beliefs and behaviors, affecting supernatural interpretations. Social cognition networks, such as regions of mind theory and emotional regulation, contribute to the rationalization of intentions and emotions attributed to God. The dorsolateral prefrontal cortex, in turn, assists in regulating magical interpretations of religious experiences. Additionally, the processing of religious beliefs involves regions related to reward and evaluation. Conversely, in patients with neurodegenerative disorders such as Parkinson's and frontotemporal, religious beliefs may be affected due to brain degeneration. Still, studies suggest that religious beliefs can provide emotional comfort during illness (GRAFMAN *et al.*, 2020).

2.2 Religious Beliefs and Identity

In the 20th century, psychology sought to explain religious behavior as a result of the subconscious or unconscious. Researchers of religion have taken a cognitivist approach to studying religious practices and beliefs, postulating that belief in intentional agents is a byproduct of human cognitive evolution. Neuroscientific studies indicate that religious practices such as meditation positively affect the brain, leading to better emotional regulation and attention, with applications in clinical treatments (SILVA & SANTOS, 2017).

Spirituality and religiosity can be said to refer to transcendent, non-materialistic beliefs. However, he points out their differences: religiosity is related to beliefs and public worship of a divine being, while spirituality involves the private world and the intimate connection between the human and the divine (BARRÍA, ADAM & PUNTEL, 2022).



Silva e Silva (2014) understand that religion represents a transformation of consciousness by numinous, giving rise to *Homo Religiosus* with values that guide life. Since early times, humans have demonstrated faith in nature and beliefs recorded in sacred books. These religions worship a superior being and recognize the sacred in subjective experiences. On the other hand, spirituality is a belief system that gives vitality and meaning to the events of life. Practicing spirituality implies seeking contact with the essence and establishing connection with the universe. Spiritual well-being, an essential dimension of human health, contributes to the reduction of distress and the promotion of mental health.

In one experiment, researchers simulated religious practices in a controlled environment, scanning participants' brains while experiencing spiritual feelings. The activated areas included the nucleus accumbens and striatum, associated with rewards, and the medial prefrontal cortex, linked to evaluation and moral reasoning. In addition, religious sensations have also activated concentration-related regions (MENDONÇA, 2022).

Are there neural differences between individuals of different religious traditions or between religious and atheists?

During a survey, the brain responses of Christians and atheists were analyzed while visualizing the painful faces of people with the same religious or neutral beliefs. They found that the brain response to painful expressions was stronger when the faces were of people with the same religious affiliation, evidencing preference and empathy for the same religious group. A Danish study has shown that intercessory prayers affect brain activity in Christians, decreasing activity in the prefrontal cortex and possibly weakening critical thinking. This suggests that trust in religious authorities can influence perception and reinforce belief (GRAFMAN *et al.*, 2020).

3 NEUROSCIENCE OF TRANSCENDENCE

Thinking about what neuroscience can tell us about transcendent experiences and altered states of consciousness associated with religious practices can be complex. Work related to this intersection is recent. In this sense, Barría, Adam and Puntel (2022) state that the complex functioning of the brain, especially in relation to spirituality and religion, is still in the early stages of discovery in neuroscience.

It is known, however, that spiritual practices have a positive influence on cognitive and emotional development, connecting us with others and with the environment. In this way, love plays a relevant role in this connection with reality and with life, allowing for the development of more tolerant and receptive communities of faith. Thus, cultivating love can lead to a full life in a diverse and constantly changing world (BARRÍA, ADAM & PUNTEL, 2022).

This is the essence of spirituality!

3.1 Social and Psychological Impact

Sigmund Freud (1856-1939) and Carl Jung (1875-1961) theorized about the role of religion in different ways. While Freud associated religion with human instincts and the subconscious, Jung saw it as an expression of the collective unconscious, containing sacred archetypes. Therefore, the psychology of this period sought to explain religious behavior from the subconscious, not limited to divine revelations or cultural institutions. Thus, mental life and its religious dimensions were considered common to all human beings and subject to scientific studies (SILVA & SANTOS, 2017).

The ordinariness of the origin of spirituality in the human brain reveals that religious practices tend to influence the mental health, well-being and social behavior of practitioners.



From this perspective it is relevant to think that religious experiences shape the individual's perspective on himself and the world around him.

In light of the above, Murakami and Campos (2012) understand that religious practices positively impact mental health, helping to confront anxiety, fears and other negative feelings. Meditation, for example, reduces tension, anxiety and improves self-knowledge. Religion promotes values of cooperation and emotional well-being. Faith can produce beneficial emotions and improve the quality of life. Healthcare professionals should consider patients' religiosity and integrate spirituality into clinical practice to provide more complete care. Collecting information about the patient's religious background is essential to understanding how their beliefs influence their mental health.

In this sense, the practice of spirituality can alter parts of the brain related to chemical and biological reactions, resulting in behavioral changes and a new perspective of the environment. Spiritual experiences open up to the world, allowing for better discernment, empathy and better decisions. Frequent practices can lead to deeper brain changes, bringing benefits to both the individual and his community (BARRÍA, ADAM & PUNTEL, 2022).

In hospital settings, for example, several studies highlight positive results related to religious and spiritual aspects in the hospital context and in patients with chronic diseases. Religion and spirituality are recognized as coping resources and health support, especially in HIV/AIDS patients, geriatric patients, and cancer patients. In addition, spirituality is also relevant in the training of medical and psychology professionals, aiming at the integral approach of the patient (MONTEIRO *et al.*, 2020).

3.2 Religion and Morality

Ethics and morals are complex behaviors related to human emotions and values, connected to specific neural circuits, not caused by brain damage. An example is the difficulty in changing opinion, linked to the low activity in the frontal lobes, fundamental for the formation of ideas and ethical conscience, inseparable from notions essential to humanity, such as dignity, freedom, religion and ethics (VALLE, 2002).

Researchers have examined the relationship between religiosity and morally relevant behaviors, such as charitable donations and prejudice. While religiosity seems to influence donation to religious institutions, there is no correlation in private and secular donations. In addition, religiosity may be associated with prejudices against minorities. Investigating how unbelievers and believers conceptualize morality can offer insights into their cultural and cognitive views and differences (STÅHL, 2021).

Studies have found no systematic differences in conceptions of morality between unbelievers and believers, although cultural stereotypes suggest that atheists lack a moral compass. Research suggests that both share moral concerns with protection of vulnerable, freedom/oppression, and epistemic rationality. However, unbelievers are less inclined to endorse moral values that promote group cohesion and more inclined to judge morality based on specific consequences of actions. These differences may be influenced by cultural and motivational factors related to religious disbelief (STÅHL, 2021).

3.3 Ethical Implications

Neuroethics arose from the interests of several fields of study, including neuroscience, psychology, medicine, and philosophy. Its institutionalization took place through the establishment of scientific associations, the holding of congresses and the creation of specialized journals in the field. Since 1973, ethical questions related to research with newborns have been analyzed. Currently, neuroethics faces ethical dilemmas arising from



technological advances in neuroscience, such as neuroprostheses and psychiatric drugs. The search to understand the ethical motivations of human behavior and the relationship between neuroscience and ethics drives the debates in the area (HAMDAN, 2017).

Moreover, the inclusion of religious and spiritual topics in medical and psychological practice raises ethical questions about professional boundaries. The DSM-IV recognizes the relevance in treatment. However, professionals should be trained to approach them with empathy and respect, avoiding value conversion and lack of neutrality. The American Psychiatric Association (APA) suggests procedures to address spirituality and religiosity with respect to the individuality of the client. Therapists should be prepared to explore religious and spiritual beliefs, showing empathy and respect, even if they do not share the same beliefs (PERES, SIMÃO & NASELLO, 2007).

4 FINAL CONSIDERATIONS

Neuroscience has played a significant role in influencing various areas of knowledge, including the psychology of religion. However, the mind-body relationship still presents ambiguity, hindering the clear connection between emotion, reason, brain, and cultural, ethical, and religious values.

Investigations into the biological foundations of spiritual experiences have revealed connections between brain activities and religious practices, such as prayer and meditation, with activation of areas related to reward and emotion. Transcendent neuroscience is an emerging field that seeks to understand how spiritual practices positively impact the cognitive and emotional development of the individual, contributing to the formation of more tolerant and receptive communities.

Furthermore, ethics and morals, intrinsic themes of religiosity, have also been investigated from the perspective of neuroscience, revealing important aspects for the understanding of religious beliefs and behaviors. The ethical implications of these research underscore the importance of addressing religious and spiritual topics with respect and empathy, considering the individuality of patients and the diversity of cultural beliefs.

Finally, discoveries like these can be applied to improve intercultural understanding and peaceful coexistence between different religious groups.

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