

Serotonergic Projections: Religiosity and Hyper-Religiosity

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Rec Date: October 13, 2014; Acc Date: October 16, 2014; Pub Date: October 23, 2014

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Editorial

Religiosity is a widespread and important influence on human behavior and well-being. In a recent national poll, 95 percent of Americans professed a belief in God, and 67 to 75 percent of respondents reported that they pray on a daily basis [1]. Research findings showed that although regular attendance at church was not necessary, a strong personal importance placed on spirituality or religion was most protective against major depression in people who were at high familial risk. Religious beliefs serve an important function in the daily lives and attitudes of most of us. Religious activity embraces beliefs, experiences, and practice. Conversely, a person's fervent religious practices can also signify other, gloomier facets of his or her mental health. The term used to define such a case is hyper-religiosity in the case of religious beliefs. The question of excess or hyper becomes a factor when the religion begins adversely affecting people's social behavior and their ability to function rationally. A number of potential genetic and pathophysiological causes of violence and aggression have been investigated over recent years. Research now points to the discovery that impulsive aggression and violence arise as a consequence of defective emotion regulation circuitry in the brain.

Neuroscientists have been examining the religious experience and their potential enhancement through psychopharmacological research and explored the effect of psychedelic drugs in relation to religious experience. The drugs that have been studied include epinephrine derivatives (mescaline) and serotonin derivatives (LSD, psilocybin, Dimethyltryptamine- DMT). It has been observed that these drugs cause transcendental or spiritual experiences as well as intense visual hallucinations. Serotonin is the foundation of a great neurochemical system important not only for depression but for many other brain functions including anxiety, **memory**, sleep and the regulation of consciousness itself. The neurotransmitter serotonin affects the parts of the brain that relate to emotions and perceptions. Serotonin, the **brain** chemical crucial to mood and **motivation**, also shapes **personality** to become vulnerable to **spiritual** experiences.

Serotonergic neurons project to the basal ganglia, the amygdala, the hippocampus, cortex and several others areas of the brain. Central serotonergic neurons originate from the raphe nuclei in the brainstem. The serotonin (5-HT) system has long been of interest in biological models of human personality. The remarkable finding is that these entire drugs act on one specific type of receptor called serotonin 2A (or 5-HT_{2A}) receptors, which are found all over the cortical surface of the brain. 5-HT_{2A} receptors are stimulatory, that means when these drugs acts on certain areas of the brain, they increase production of serotonin in the brain, and this gross overstimulation of the 5-HT_{2A} receptors guides to what are translated as religious experiences. A second line of evidence regarding the serotonin system was published in the American Journal of Psychiatry in 2003 on the effect of 5-HT_{1A}

receptors, which are inhibitory. According to Farde, the receptor neurologists call 5-HT_{1A} "is one of the most important because it serves as a marker for the entire serotonin system." The serotonin system may serve as a biological basis for spiritual experiences [2]. Low 5HT_{1A} increases impulsivity in humans and primates and this could be possibly related to decrease of 5HT inhibition of dopaminergic function as 5HT modulates the function of dopamine and norepinephrine. Although the hallucinogenic drugs share dopaminergic and noradrenergic properties, current views affiliate their psychedelic properties with serotonergic agonist activity, particularly at 5-HT₂. 5-HT₂, 5-HT_{1A}, and 5-HT_{1C} receptors are widely distributed and innervate major brain regions, such as the in basal ganglia, hypothalamus, the limbic system, and the neocortex[3]. These areas are abundantly interconnected and appear to act in unity in respect to mystical experience as may be induced by LSD [4]. LSD acts by blocking serotonin and thus disinhibiting the amygdala.

Studies have also identified the hippocampus as a brain region potentially involved in religious beliefs and spiritual practices. Research on temporal lobe epilepsy indicates that features of hyper-religiosity may be positively associated with hippocampal atrophy [5]. Research on biological pathways by which stress may influence hippocampal volumes has primarily explored neuronal death [6], decreased neurogenesis [7]. Research also indicates that hippocampal volumes may be affected by exposure to elevated glucocorticoids, particularly cortisol, a hormone released in response to stress [8] and that cumulative cortisol exposure may lead to hippocampal atrophy through various pathways. This atrophy has been associated with mental health outcomes, including depression [9] The hippocampus may also influence the generation of attention and emotion through connections with the amygdala [10], and moderate cortical arousal and responsiveness through interconnections with the amygdala, hypothalamus, prefrontal cortex, and other areas [10]. Intense activation of the temporal lobe, hippocampus, and amygdala has been reported to give rise to religious and spiritual experiences and chronic hyperstimulation can induce an individual to become hyper-religious. Serotonin system regulates our perception and the variety of stimuli reaching our awareness. One term used to describe such a case is hyper-religiosity in the case of religious beliefs; the question of having too much becomes a factor when the religion starts adversely affecting people's social behavior, their ability to function rationally, and even their own physical health. Brain areas associated with both moral reasoning and antisocial behavior significantly overlap [11]. A person with a weak 'sensory filter' is used to various perceptions and may be more likely to accept religious worldviews. Hyperreligiosity often is a major feature of mania, obsessive-compulsive disorder, schizophrenia, temporal-lobe epilepsy and related disorders, in which the ventromedial dopaminergic systems are highly activated and exaggerated attentional or goal-directed behavior toward

extrapersonal space occurs. The evolution of religion is linked to an expansion of dopaminergic systems in humans, brought about by physiological influences [12].

Serotonergic neurons project to the orbitofrontal cortex (OFC), and patients with impulsive aggression show decreased orbitofrontal metabolism on positron emission tomography (PET) in response to serotonergic stimulation [13]. Serotonin may inhibit and dopamine may enhance violent behavior. Serotonergic neurons project to the orbitofrontal cortex, and patients with impulsive aggression show decreased orbitofrontal metabolism on PET in response to serotonergic stimulation. Orbitofrontal lesions are most implicated, and violence occurs when OFC inhibition cannot control limbic impulses [14], most notably the amygdalae, can be excessively activated under certain circumstances to produce violence resulting in impulsive violence that is more likely than predatory violence [15]. Impulsive violence associated with hyper-religiosity is the new phenomenon we are witnessing today. Imaging studies have found either reduced volume or blood flow or structural asymmetry in the hippocampus that can be diffusive from limbic system to forebrain, in violent criminals [16]. The reciprocal innervation from the limbic areas enables the OFC to regulate not only its own 5-HT input but also the 5-HT input to the rest of the forebrain. Orbitofrontal atrophy also promotes impulsivity, leading to greater willingness to accept and proclaim religious explanations. Serotonin plays an important role in facilitating OFC in limbic inhibition. Serotonin may facilitate prefrontal limbic inhibition. Studies have showed increased orbitofrontal metabolism on PET and clinical improvement after 12 weeks of fluoxetine in impulsive aggression patients [17]. Initial findings indicate that the hippocampus is activated during treatment with medication, especially serotonin reuptake inhibitors and meditation [18], and that larger hippocampal volumes are associated with long-term meditation practice [10].

The nature of the underlying biological framework in an individual is likely to govern the shape, significance and environment of religious experience and expression that psychosocial destitution and emotional state aggravate. We must acknowledge here, the very significant role that religion and spirituality play, in helping human beings maintain optimal emotional well being or indeed achieve restoration of emotional health after a breakdown. The typical monotheistic explanation of a God with its inherent fundamentalist view becomes complicated, since we find that the capacity for religious experience seems to be as different among the populace as any other personality trait, individual perception or inherent capability.

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