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Hypothesis

Cosmological dark matter and ensoulment

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Abstract

Allocortical structures such as hippocampal formation and amygdala are involved in the emotions and memory, and regarded as the seat of personhood. Human body is a composite of a biological organism and an intellective soul. It was suggested that cerebral allocortex is the main region harboring the soul and the beginning of a human person as an individual living organism is at the 13th week of development when an adult type allocortex is already formed.

No experimental data can be sufficient to bring us to the recognition of a soul, but there must be a substance as the basis of personal identity, for without space-occupying substance, there would be no way to account for the soul's ability to interact with the body. It was suggested that the soul substance consists of cosmological dark matter. The dark matter constitutes most of the mass in our universe, but its nature remains unknown. The soul is likely to work into man's physical body directly via that dark matter. We thought that while the soul has a material component as dark matter, there must be an open window to the brain for the entrance of the soul with dark matter.

In this respect, vomeronasal organ which is found in the nasal cavity and which has connections with the brain only between the 12th and 14th weeks of human development - a period including the time of ensoulment at 13th week - seems to be the most appropriate window through which the soul and dark matter can enter the brain.

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ALLOCORTICAL BIRTH AT 13TH WEEK OF DEVELOPMENT

One of the most controversial topics in modern bioethics, science, and philosophy is the beginning of individual human life (personhood) [1-3]. Allocortical birth is a theory which maintains that a fetus becomes a human being when an adult type allocortex is already formed at 13th week [4]. Brain cortex is necessary for the personhood but there exist two different types of cerebral cortex with two different stages of development. The bulk of the brain cortex is a six-layered structure called neocortex (young cortex). The remaining of the cortex is known as allocortex (other cortex) [5]. Allocortex has a relative elementary structure with three basic layers and is composed mainly of the hippocampal formation and amygdala [5]. The most striking feature of the human fetal brain is the early differentiation of allocortical structures [6]. While neocortex does not begin to get organized before 24 weeks [7], an adult type allocortex is already formed at 13th week of development [8-10]. From now on, the

macroscopic aspect of the allocortex remains unchanged until birth, and this period is characterized by an increase in its volume [11-19]. Thus, three-layered adult laminar pattern of allocortex appears at 13th weeks [9, 10] and allocortical birth could be located at the occurrence of this first minimal level of structural organization of allocortex at the 13th week of development [5].

Major allocortical structures are hippocampal formation and amygdala. Hippocampal formation plays a key role in memory and emotion [17], and it is essential for the preservation of identity [5]. The human amygdala on the other hand is the area of the brain that is best correlated with emotional reactions [5]. Thus, allocortex can be regarded as the seat of emotion, memory and personhood. At 13th week, fetus has an adult type allocortex by functional and anatomic definition [6, 14, 20, 21] and it is the most reasonable time at which to fix the start of individual human life (personhood) [4].

Allocortical birth theory suggests that an individual human life or personhood cannot begin until the development of the allocortex. At the 13th week, fetus also has distinctive human characteristics and possesses the primordia of all the internal and external organs and parts. Before the allocortex gets organized, what we have is a set of tissues or a series of organ systems. Allocortical birth, the emergence of a mature allocortex is therefore proposed as a reasonable time to demarcate the beginning of individual human life (personhood) [4, 22]. Most religious traditions hold that what makes one a person is the possession of a soul and they treat the human body as a composite of a biological organism and an intellectual soul [23, 24]. When the body meets with the soul, it comes to be a human person, with all the attendant rights, especially its basic right to life [25, 26]. If we accept that the soul essentially has the capacity for personhood, it seems that the soul does not begin to exist until there occurs an appropriate seat for the soul in the fetal brain [27]. This position would seem to require that the immortal soul only be infused into a fetus with sufficient cortical development [4, 28]. Therefore, a role was attributed to allocortex to be a seat for the soul to work into man's physical body and the beginning of a human individual's life was suggested as 13th week of development when an adult type allocortex is formed [4]. According to this view, ensoulment occurs when allocortex is formed at 13th week of development and we do not begin to exist until 13 weeks after conception, when there is evidence for the seat of soul or personhood. The soul, it seems, must await the development of the allocortex in order for personhood to become possible.

SOUL MUST HAVE MATERIAL COMPONENT

Mental functions are powers that the soul has exercised by means of the physical entity called the brain [29]. A question is raised: "How is it possible for an immaterial substance to interact with a physical body?" [29]. No experimental data can be sufficient to bring us to the recognition of a soul, but there must be a substance as the basis of personal identity, for without space-occupying substance, there would be no way to account for the soul's ability to interact with the body [30, 31]. It was suggested that the soul substance consists of cosmological dark matter [32]. The dark matter is a universal connecting medium, filling all space to the furthest limits, penetrating the interstices of the atoms without a break in its continuity. So completely does it fill space that it is sometimes identified with space itself, and universe is built up in this fluid and move through a sea of it [32]. Astrophysical observations indicate that dark matter constitutes most of the mass in our universe, but its nature remains unknown [33]. It is called dark matter since it neither emits nor absorbs

light. The existence of dark matter is inferred by its gravitational effects on ordinary matter and radiation [34, 35]. With the conception that the dark matter is the primary form of all substance, that all other forms of matter are merely differentiations of it, then it seems that soul substance which is in this life linked organically with the body can be identical with the dark matter. The soul is likely to work into man's physical body directly via that dark matter [32]. Evidence of the existence of dark matter has been found in large high-energy particle accelerators at the European Organization for Nuclear Research (CERN; (Switzerland) and Fermi National Accelerator Laboratory (Fermilab; IL, USA) [36].

VOMERONASAL SYSTEM AS A POINT OF ENTRY FOR THE SOUL TOGETHER WITH DARK MATTER

We thought that while the soul has a material component (dark matter), there must be an open window to the brain for the entrance of the soul with dark matter. In this respect, vomeronasal organ (VNO) which is found in the nasal cavity and which has connections with the brain only between the 12th and 14th weeks of human development - a period including the time of ensoulment at the 13th week - seems to be the most appropriate window through which the soul and dark matter can enter the brain [37]. Actually, VNO is said to be the place in the body where the nervous system is closest to the external world [38]. Sensory cells of the vomeronasal system (VNS) are located within the sensory epithelium of the VNO, bipolar in shape with a single dendrite and an axon originating from its soma. The dendrite reaches the surface of the lumen of the VNO to form a dendritic terminal that bears microvilli [39]. The axon leaves the sensory epithelium, forming the vomeronasal nerve with neighboring axons, traveling toward the brain, and terminate on dendrites of second-order neurons in the accessory olfactory bulb [38, 39]. Axons of the second-order neurons of the VNS make close connections with the amygdala and hippocampus [38-40], the seat of emotion, memory and personality; shortly the seat of the soul.

The VNO is a fluid-filled, tubular structure located at the base of the nasal septum that opens into the nasal cavity via a duct at its anterior end [41]. It is a chemoreceptive structure with direct axonal connections to the accessory olfactory bulb in many terrestrial vertebrates [42]. Pheromones presumably bind to the VNO and exert behavioral or physiologic responses, thereby allowing chemical communication between animals of the same species [43]. The effects of pheromones are thought to be mediated by signals from the accessory olfactory bulbs to the amygdala and hypothalamus [41]. The VNS is well developed and

functional in adult animals [44], while human VNO becomes rudimental before birth [45]. VNO in the human embryo contains bipolar cells similar to the developing vomeronasal sensory neurons of other species, but the structure becomes more simplified later in development [46-52], having no obvious way of communication with the brain. In humans the VNO, including the vomeronasal nerve and associated ganglion cells, is first recognizable at 8th week of development [53]. VNO is well developed during the 12-14th weeks of development [37], but VNO loses receptor cells and becomes a ciliated, pseudostratified epithelium after 14th week of age [54, 55]. Moreover, the vomeronasal nerve connecting the VNO with the accessory olfactory bulb (AOB) degenerates between week 14 and 28 [56, 57] leaving the function of the human VNO unclear. The AOB which is a primary brain center for the VNS [40, 51], is present in human embryos and certain stages of fetuses, but becomes degenerated and it is not identifiable after 7 months [58]. These observations support the view that the VNO functions mainly during the intrauterine period in humans, especially during the period of ensoulment [4, 59]. Thus the development of the vomeronasal structures seems to be limited to a restricted time frame in humans, when they play a role for the ensoulment [48]. We propose here that the human VNO has functions mainly during fetal development when the VNO, along with the vomeronasal nerve, contributes to the transfer of the soul and its dark matter to their proper sites in the brain.

Although no anatomical connection has been demonstrated in adult humans, Monti-Bloch *et al* deduces a physiological connection with the brain because stimulus delivery to the VNO elicited several systemic responses [60-62] such as changes in blood pressure and heart rate, small but significant changes in hormonal levels [62] and some changes in mood [63]. Functional brain imaging studies revealed consistent activation of the hypothalamus, amygdala and cingulate gyrus-related structures during adult human VNO stimulation [60]. Several indirect reports of the presence of pheromone-like substances, influencing human behavior, have also been published [63]. These findings support the view that VNO is strongly related with allocortex harboring the soul even in the absence of anatomical connections. This close relationship may form the basis of the system in humans which detects non-odorant molecules in extreme dilution for homeopathic medicines which appears to trigger a healing response in psychiatric disorders [64].

CONCLUSION

Allocortex is the primary center harboring the soul and the human life (personhood) begins at the 13th week of development with a delayed ensoulment. Above

considerations make it appear likely that the soul may have a component of dark matter; and the soul may enter the brain with dark matter through the window of VNO which is functional and has connections with the brain only during the time of ensoulment.

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COMPETING INTERESTS

None to declare

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