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Are self-consciousness and mindfulness altered by aging?

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ABSTRACT

It is well known that aging is the process of becoming older. It is also associated normally with a progressive loss of biological functions - both physical and mental –, underlied by naturally-occurring changes at the molecular level that may lead to the development of so-called aging-related health problems – e.g., Parkinson's Disease, dementia, memory loss, cerebrovascular problems and Alzheimer's Disease. Along this idea, a fundamental question remains – are self-consciousness and mindfulness also affected by these physiological or pathophysiological changes? This short article summarizes briefly some of the key sementic, conceptual, methodological and physiological issues that shall be addressed prior to tentatively providing answers to comparable questions.

Keywords : elderly, meditation, mind, soul, awareness

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Main text :

Self-consciousness, awereness and mindfulness do not mean the same thing for everyone. Some people have defined consciousness as a state of mind or as a level of awareness – i.e., to be aware of an object, a phenomenon, a person, or a sensation (e.g., proprioception)(1). Others consider consciousness more globally as the mental capacity of a creature, either animal or human, of sensing and responding to its world (2). There is also self-consciousness or self-awareness that some philosophers have referred to as the capacity of to be aware using their sensory system while being aware of being aware (3). One of them, John Locke in 1690, said that consciousness is simply the perception of what passes in a man's own mind (4). To most people, mindfulness and self-consciousness may sound as synonyms but according to Evans, Baer and Segerstrom, mindfulness is a form of self-consciousness – a present-centered, non-judgmental, and non-reactive type of awareness (5). Mindfulness – defined by Kabat-Zinn – is the ability to focus on the present moment and to perceive without any judgment or choice current internal or external impulses, which are emerging at a given moment of consciousness (6). As such, he said that mindfulness allows someone to stay "above" the particular content of thoughts, emotions, or imaginations while remaining aware of the process of consciousness itself. Over the years, many other descriptions have been proposed (7). As a result, debates among philosophers, religions, and scientists are still ongoing.

Those mental states or functions are probably controlled by several specific brain areas. This is indeed another subject still being debated – are self-consciousness, awareness and/or mindfulness exclusively of mental origin? Do they depend only on specific structures of the brain or are they also partially spiritual or non-biological (8)? Some religious leaders may believe that these capabilities are spiritual rather than biological. But if we instead accept that they are essentially of biological origin, the next main question becomes: which specific brain area(s) control(s) them? Two thousand years ago, Socrates said : 'do you think one can acquire any particular knowledge of the nature of the soul without knowing the nature of the whole man?' Since then, his view has received abundant support from neurosurgeons and neuroscientists. Dr. Penfield (McGill University) found indeed a few decades ago in patients with epilepsia that electric stimulation of small areas in the brain can trigger very specific and vivid memories – e.g., the smell of toasts or the visualization of friends laughing on a farm in South Africa! Those fascinating findings brought for the first time psychical phenomena into the field of neurophysiology (9). This breakthoug led neuroscientists to examine closer the role of many other brain areas in consciousness. For instance, they found that the latter is associated with synchronous oscillation of neurons, NMDA-mediated transient neural assemblies, patterns of cortical activation modulated by the thalamus, reentrant cortical loops, continuous action-prediction-assessment loops involving the frontal and midbrain areas, and somatosensory processes based in the frontal-limbic or periaqueductal gray area (10-13). Prof. Dr. Greenfield (Oxford University) has even suggested that the soul, the mind and self-consciousness are located nowhere in particular in the brain but everywhere at the same time. She said : 'The soul, like the seat of consciousness (in its neurological sense) lies in 'the cocktail of brain soup and spark' within the deep cerebrum and brainstem, whence dopamine, noradrenaline, acetylcholine are released 'in a fountain-like arrangement on to the more sophisticated regions of the (cerebral) cortex and immediate subcortical structures' to produce a series of electrical and chemical events.'(14). Obviously, further research is needed before a consensual agreement may be reached by neuroscientists.

Given that aging is associated with progressive brain dysfunctions and diseases, levels of self-

consciousness and mindfulness should decrease over time. It is generally known that all organs of the body progressively undergo some loss of functions over time that can potentially lead to severe dysfunctions and diseases in elderly. For instance, the cardivascular system normally undergoes a loss of function and becomee less efficient – the VO_{2max} of healthy adults is normally 55 ml/kg/min in 20 year-old men but only 40 ml/kg/min in 50 year-old men (15). Aging causes also changes to brain size (e.g., 5% less every decade after 40 year-old), vasculature, cognition, neurotransmitters (e.g., dopamine and serotonin levels decrease by 10% every decade), and memory (16). Oxidative stress, DNA damage, loss of circuits and reduced plasticity are believed to affect virtually all brain areas and structures (17). When becoming pathological, some of those changes contribute to the development of aging-related health problems – e.g., Parkinson's Disease, dementia, confusion and memory loss, cerebrovascular problems and Alzheimer's Disease. If self-consciousness, awareness or mindfulness depend upon one or on several specific brain areas, it would be reasonable to believe that lower functional levels and capabilities may be experienced by elderly compared with younger adults. However, to my knowledge, this has never been explored experimentally except in those suffering already of mental problems or diseases (18).

Some indirect evidence may suggest that those mental functions can be restored, enhanced or modulated. Neuroscientists found recently a sustained increase in neural signal diversity – a measure of the complexity of brain activity and thus of consciousness levels – in people under the influence of some psychedelic drugs (19). Along the same idea, activation of a specific region of the brain using vagal nerve stimulation was found to restore consciousness in a man suffering of coma for 15 years. (20). Based on the definition of mindfulness proposed by Kabat-Zinn, Mindfulness Based Cognitive Therapy (MBCT) and Mindfulness Based Stress Reduction (MBSR) approaches were reported to enhance attention, memory and executive function abilities measured by objective neuropsychological tests (21-23). Others found differential effects on memory induced by various meditative approaches that led some of them to conclude that transcendental meditation was better (24). It remains unclear though if increased memory or attention often found in those studies means also that self-consciousness or awareness are equally enhanced – the validity of those correlates for assessing and measuring self-consciousness and mindfulness has not been established.

Valid correlates, surrogate endpoints and biomarkers remain to be identified. Memory and attention, often measured quantitatively or qualitatively to estimate consciousness levels, are mental functions that are not specific to self-consciousness. In other words, a change in memory skills (e.g., enhanced episodic memory) does not mean a change in self-consciousness level. As a comparison, in other fields such as cardiology, cardiovascular function – a biological function as complex as self-consciousness – can not either be directly measured. Therefore, it is indirectly assessed using an extensive series of validated and reliable correlates, surrogate endpoints and biomarkers – e.g., circulating levels of triglycerides, blood pressure, heart rate at rest, cardiac ejection fraction, $VO_{2ma}x$, etc (25). Alone, none of them may be considered as a reliable indicator. However, assessed altogether, they can provide a valuable indication of cardiovascular function levels and changes. It would be imperative for researchers in this relatively new field of research to determine also clearly what is the best series of correlates, surrogate endpoints and biomarkers that are capable of indirectly assessing mindfulness and self-consciousness levels (26).

Concluding remarks. One of the first problems with attempts made by some scientists to investigate these fascinating questions remains undoubtedly of sementic origin. Definitions given

to attention, mindfulness, or self-consciousness still differ significantly from one research group to another. Over the years, many descriptions have been proposed making it difficult for researchers to study these concepts and compare their data. Scientists will probably have to agree upon what those functions are precisely and where they are located specifically in the brain. Otherwise, it will be difficult for this area of research to be moving forward significantly. Researchers will have to agree on valid and reliable correlates, surrogate endpoints and biomarkers that can standardly monitor mindfulness and self-consciousness levels. These questions are important from a spiritual point of view and, if significant advances are made, for medical purposes also – novel therapeutic approaches could be potentially envisaged for patients with aging-related diseases and mental illnesses (27).

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