The Problem of Mind/Body Dualism in Psychiatry- Part 2

Consciousness, Phenomenal First Person Experience, Qualia, Free Will, and the Soul

Lower level neurobiological processes in our brain cause all our conscious states, without exception, and they are realized in the brain as higher-level system features. It’s about as mysterious as the liquidity of water [12]. The conscious mind, its ability to have phenomenological experiences (so called “qualia”), its apparent exercise of free will and its expansion into concepts such as the self and the soul is intuitively felt to be non-reducible to biological terms [13]. Qualia have frequently been cited as evidence for an “explanatory gap” which ontologically separates the physicalist/materialistic account of reality and the individual (first person) experience. Qualia lie at the core of the so-called “hard problem” of consciousness [14]. An empirical physical theory of consciousness has to be consistent with evolution and reject any explanatory ideas outside of the physical universe such as dualism. Frameworks for such an approach to consciousness have been formulated [15-18].

We will attempt to deconstruct the claim that consciousness, and phenomenological experience, cannot be studied in neuroscientific terms; we will examine empirical constraints on the concept of free will and examine the idea of the soul and its possible function in the human animal. Our focus will be on very recent results from the neurosciences which in the aggregate suggest that physicalism provides an adequate account of the mind/brain with its emergent manifestations.

Mind/Brain is a Product of Evolution

The brain and its sensory organs are adapted to the environment the animal inhabits and implement the behaviors necessary for survival and reproductive success. The evolution of the brain is a demonstration of the conservation of structural and functional features linking the human brain to distant relatives in profound ways. It is difficult to identify an entry point for non-physical entities such as the soul in this continuous chain of evolutionary adaptations. There is a vast literature in this field. We will highlight only some very recent findings that serve as examples of the profound connectedness of neuronal function and the circuitry implementing behaviors throughout evolution. Dopamine is the neurotransmitter involved in the reward circuits [19] from the drosophila nervous...
system to the human brain [20]. There are converging genetic data pointing to a deep homology of vertebrate basal ganglia and the arthropod central complex, suggesting that the circuits essential for behavioral choices have been conserved through deep evolutionary time [21]. The default mode network in humans, which supports self-referential cognitive functions such as recollection, conceptual processing and conscious awareness [22-24], is found both in other primates [25] and in the evolutionarily distant rodent brain [26,27]. The evolutionary roots of consciousness of affective experiences we share with other animals probably involve areas in the upper brainstem [28]. We share highly evolved social cognitions such as empathy with our primate relatives [29]. Recently, an evolutionary molecular mechanism has been found that may drive the expansion of cognitive complexity in vertebrates involving gene duplications [30,31]. Also, the genetic basis of heritable complex behavioral adaptations in rodents affecting distinct behavioral modules has been identified [32] providing first direct evidence for the “extended phenotype”.

**Consciousness is not Beyond the Scope of Science**

Phasic cycling of internally generated activity, accessing first primary sensory but then successively more general and abstract processing units of the homotypical cortex, should allow for continual updating of the perceptual image of self and self-in-the-world as well as matching functions between that perceptual image and impinging external events. This internal readout of internally stored information, and its match with the neural replication of the external continuum, is thought to provide an objective mechanism for conscious awareness. That mechanism is not beyond the reach of scientific inquiry (Mountcastle, 1982). The study of consciousness has long been avoided by neuroscience because of the “mistake of supposing that the subjectivity of consciousness made it beyond the reach of an objective science” [33]. Consciousness emerges as a result of the coordinated activity of brain networks spanning many scales of space and time. These networks have “small world” architecture [34] and enable high efficiency information processing, particularly at higher frequencies [35]. Neuroscience is responding to the challenge of modeling how functionally distinct brain states emerge from interactions of a large number of brain regions, each containing millions of neurons, by rapid, real-time integration without the supervision of an executive controller [36]. These networks, while providing long range connectivity of cortical regions which may facilitate sensory-motor integration, preserve a fractal small world topology which allows for correlated high frequency (gamma
band) oscillations. These in turn provide the substrate of temporal binding and permit rapid state-related changes [37]. The function of neural circuits in bringing about mental states is emergent, arising from complex and constantly changing interactions of many neurons [38]. A number of strategies have been used to identify brain states that are required for consciousness. The thalamocortical system plays a critical role in the breakdown and re-emergence of consciousness as shown in studies using anesthesia [39]. The conscious state requires the coupling of subcortical and limbic regions with parts of the frontal and inferior parietal cortex [40]. Loss of consciousness induced by the anesthetic propofol is associated with a rapid change in cortical network dynamics and a resultant decrease of communication between distant cortical areas [41]. The fading of consciousness at the onset of sleep is also associated with a breakdown of connectivity between cortical regions [42]. Coherent oscillations of distributed cortical networks are the physical substrate for perceptual, motor and cognitive representations in the brain, with gamma phase synchrony as a possible mechanism for large scale cognitive integration [43,44] summarize a number of studies which show that converging neuroimaging and neurophysiological data, acquired during minimal experimental contrasts between conscious and nonconscious processing, point to objective neural measures of conscious access: late amplification of relevant sensory activity, long-distance cortico-cortical synchronization at beta and gamma frequencies, and “ignition” of a large-scale prefronto-parietal network. These studies are consistent with theoretical models of conscious processing, including the Global Neuronal Workspace (GNW) model according to which conscious access occurs when incoming information is made globally available to multiple brain systems. The Global Workspace Theory was originally formulated by [45] and has been able to accommodate an increasing number of empirical findings. Experiments on visual perception using binocular rivalry show that the onset of a new conscious percept coincides with the emergence of a new gamma-synchronous neuronal assembly locked to an ongoing theta rhythm, suggesting that oscillatory networks linking relevant cortical regions are critical for furnishing consciousness for the percept [46]. The “perception” and monitoring of one’s own cognitive processes (metacognition), a hallmark of conscious awareness, has been shown in an error detection paradigm to involve brain mechanisms distinct from more automated and unconscious mental processes [47]. Recently, differential oscillatory coupling of prefrontal, parietal and parahippocampal cortices has been shown to mediate temporal versus spatial components of episodic memory [48]. The conscious processing of
mathematical expressions has been traced with fMRI and Magneto-Encephalography (MEG) suggesting that mathematical syntax becomes compiled into visual-spatial areas in trained mathematicians [49].