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Document of Trapani on animal consciousness and quantum brain function: A hypothesis

Massimo Cocchi^{a,*}, G. Bernroider^b, Mark Rasenick^c, Lucio Tonello^a, Fabio Gabrielli^d, and Jack A. Tuszynski^e

^aDepartment of Veterinary Medical Sciences, University of Bologna, Italy

^bNeurosignaling Unit, University of Salzburg, Austria

^cDepartment of Physiology and Biophysics, College of Medicine, University of Illinois, Jesse Brown VAMC, Chicago, IL, USA

^dTheological Faculty of Northern Italy, Italy

^eDepartment of Physics, University of Alberta, Edmonton, Alberta, T6G 2J1, Canada

On this day of October 27, 2017 a core international group of investigators (Bernroider, Cocchi, Gabrielli, Rasenick, Tonello, Tuszynski), with expertise in the fields of psychiatry, biochemistry, physics, computational neuroscience, mathematics, philosophy and theology, gathered in Trapani, Sicily, to assess the characteristics of quantum brain function in human and animal consciousness.

The topic of the discussion from which to draw a plausible hypothesis for the issuance of a statement concerns the distinctive quantum aspect of brain function between in human and animals.

In light of the differences of the cognitive capacities and of the consciousness complexity between the animal and man, the concern is if the concept of quantum brain function has two different interpretations (animal and human) or if the quantum brain function is a common feature to both and if the latter, at what level of consciousness does it manifest itself?

We know from the Cambridge Declaration on Consciousness (July 7, 2012) that: “*The absence of a neocortex does not appear to preclude an organism from experiencing affective states. Convergent evidence indicates that nonhuman animals have the neuroanatomical, neurochemical, and neurophysiological substrates of conscious states along with the capacity to exhibit intentional behaviours. Consequently, the weight of evidence indicates that humans are not unique in possessing the neurological substrates that generate consciousness. Nonhuman animals, including all mammals and birds, and many other creatures, including octopuses, also possess these neurological substrates*”.

*Corresponding author. massimo.cocchi@unibo.it.

We believe that the above-mentioned declaration is a real turning point in the interpretation of animal behavior since it suggests a precise relation with consciousness. A critical analysis of the results obtained by the Department of Veterinary Medical Science, University of Bologna shows evidence of molecular analogies between animal and man mood disorders and, because of that, points to different state of consciousness [6–8]. Supposing that consciousness is the result of a cytoskeletal quantum network processing mechanism, then it should be stated that *“a potential for generating consciousness can be expressed by any cell containing a cytoskeletal network, in any animal species, and this could represent the biological interface between physical and mental phenomena. A hidden animal consciousness probably uses tubulin and microtubules as substrates for the cognitive processes in order to self-determine a state of consciousness, limited to what is required to exist, without emotional expressions and with the development of a critical mass relationship between tubulin, synapses, cortex, and serotonin. Thus, we start leaning towards a growing neuro-correlated consciousness event (classic information) with expressions of a more complex and differentiated emotional consciousness. It is assumed that consciousness survives even with basic conditions and this assumption is proven, at the bio-molecular level, by the hypothesis according to which a Schrodinger protein (e.g. tubulin but possibly other proteins as well, especially ion channels) is the biological interface from quantum physics to classic computation, the basis of quantum/classic consciousness processes. It can also position itself at the crossroad of memory and learning skills”*. Figure 1 shows the positions of animals on the self-organizing map (SOM) of human depression. The positions obtained, by using the same evaluation criteria used for humans, seem to be compatible with animal features too (see Fig. 1).

Is it possible to argue that the “quantum brain function” is a unique feature for both, animals and humans? After the courageous efforts to develop a physical and biological model of consciousness by Hameroff and Penrose, that is, the formulation of the Orch OR theory [15], where consciousness is supposed to be part of a biological phenomenon, the hypothesis of cell’s interactome involvement has also been consolidated [5].

Based on the above argumentation, we hypothesize the existence of a proto level of consciousness in animals as shown schematically in Fig. 2.

In addition, the world of plants can be included in this hypothesis and regarded as having a first level of consciousness. Tryptophan and some plant intermediates (oxygen and reduced cofactors), forms serotonin: the role of all these is to ensure the utilization of light, essential for life [1]. In fact, as a protoself exists in animals and humans, linked to the fulfillment of basic living needs (hunger, thirst, pleasure, pain), so there is a type of pre-protoself plant, expression of the dialectic-tryptophan-intermediate substances-serotonin-light, which guarantee the existence of biological life. Furthermore, plants interact in animals.

According to Dennett [10], Griffin [14], Bekoff and Allen [2] and Gozzano [13], animal consciousness could be incorporated at the pure organic and bio-eco-logical levels. Bekoff and Peirce [4] and Bekoff, Allen and Burghardt [3] even believe that the animals show a wide range of moral behavior, including sense of justice, empathy, trust and reciprocity: a hypothesis that would lead us to an even higher level of consciousness, to the extent that

morality would be understood as an evolutionary trait that humans share with other social mammals.

Quaranta et al. [17] argue, on the other hand, that the lateralization, appeared before language, is not just a prerogative of man but also of very different organisms (i.e. dogs). Mascialoni et al. [16], studying the chicks (chicken), concluded that in the brains of vertebrates there is an innate neural mechanism underlying the recognition of animate objects (along with physical causality, the distinction between animate and inanimate objects constitutes a kind of Kantian genetic a priori).

It is up to Jacques Derrida [11] who deconstructed the human/animal couple, starting from the linguistic level: no longer thinking of the animal to the singular, but to the plural, animals, or as Derrida calls them: animot (the animal we know is that that we have invented [animot], that is, the animal-word that exists only in that it is opposed to the word man). In this sense, we must ask ourselves whether we are sure that animals cannot talk to us and answer us, just because we start from the anthropocentric concept of human language that relegates to the arbitrary concept of other non-human beings. In addition, we are not only looking at animals, but they are also watching us (Derrida makes the example of his cat who sees him naked out of the bathroom).

So, are we sure, the look as a form of recognition is just a prerogative of the human animal?

Not all this means to flatten all the differences, but to recognize the concept of others, without the basis of stereotypical codes of exquisite human matrix. Animals, in this sense, they are nothing other than humans just for exclusion, because we do not think they have language, conscience, design, etc., or, at best, they do not have them in the same form as we humans.

In short, the other, the animal, is different, not inferior and is consistent with his vital project.

Quantum approaches to consciousness can and should propose some lines of research that confirm this. Such approaches can confirm that there is no exclusively human consciousness that acts as a hierarchical barrier to animals.

To make progress in the understanding of aspects behind the demanding phenomena of life and experience the conception behind quantum physics offers the most promising approach within standard sciences. There are several reasons for this view: First, it seems reasonable to refine physics to its highest resolution when we are looking for a physical access to some underlying ontology. Second, quantum physics can explicate those inferences that are required to bridge from a physical description of states to 'interaction' among states, i.e. to dynamics. Whereas dynamics is only inferential in classical physics (e.g. in the Newtonian equations of motion), in quantum physics some properties of transitions are explicated through the construction of an operator applied to a wave function corresponding to a probability amplitude, the operator being an instruction of manipulations that describes the nature of the transition that binds cause and effects through its application. Yet, there is a third reason that strongly reaches into the fundamentals of biology: To go down to the roots

of organizational principles, to the radicals of science, a promising way is to discern those properties of life and experience that are ‘highly conserved’ in a comparative evolutionary sense. The examples are around, e.g. in the light harvesting apparatus and energy transfer in photo-synthesis [12], in the organization of oxidative phosphorylation pathways within the inner mitochondrial membranes [18], in the (quantum-) physics of the magnetic compass of navigating animals [9] and in signal processing of the brain [19]. It turns out that these ‘first principles’ discern mechanisms that occur in all cells, from pro-to eukaryotes, from plants to animals. As these principles become organized into advanced nervous systems as in animals and men, and thereby become combined with complex information processing structures, highly ‘intelligent’ abilities evolve. Due to the evolutionary conservation of ‘first principles’ however, the emerging difference between the human and animal brain is only a gradual one, very much in the sense of Charles Darwin. It turns out that experience is inevitably bound to life all together.

Quantum physics was born at the turn of 19th and 20th centuries as a result of only a handful of experiments, which turned out to be inexplicable using the laws of classical physics. It took almost a century to demonstrate a handful of quantum effects in biology. These effects (photosynthesis, mitochondrial metabolism, some mental processes), however, appear to be at the core of what life is. Quantum approaches to consciousness have been proposed for over two decades but there is still a need for a direct experimental proof of this to be true. We do not doubt that in the coming years such experimental demonstrations will occur. What our document proposes is to include animal consciousness in the broad definition of the phenomenon not only because it may be easier to demonstrate its quantum nature but also because it is inextricably linked to human consciousness, albeit it may be less advanced and less differentiated.

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Fig. 1.

Positions of animals on the self-organizing map of human mood disorders. Each animal seems to have a characteristic bipolar position according to men diagnosed with Bipolar Disorder. Sheep is classified in the position corresponding to normal humans. Different breeds of dogs (German shepherd and Alaskan malamute) are classified, as for humans, in both positions: Bipolar Disorder and Major Depression.

Fig. 2.
Description of consciousness levels.