

## Review Article

# Cell Membrane and Consciousness: A Journey Through Biology, Mathematics and Philosophy

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The use of experimental procedures aimed at identifying the molecular modifications of the neuron (from Quantum Biology to Quantum Psychiatry) opens up important perspectives in the care of mood disorders.

Particularly, the use of an artificial 21st Century for the quantitative analysis of some platelet fatty acids (Arachidonic acid, Palmitic acid and Linoleic acid), as a way of interpreting the neuron, leads to the identification of a specific predictive, and therefore diagnostic, biochemical marker able to distinguish Major Depression from Bipolar Syndrome. The objective biological path should prove as a valuable antidote against the *diagnostic imperialism* of a psychiatry that is still highly ideological.

**Introduction**

The neuron is a fundamental element of the brain. Its membrane, in particular, plays an important role. Cell membrane is indeed a sort of interface between the inside of the cell and the external world. It is important for many regulation mechanisms and communication dynamics and performs many other relevant tasks.

The basic structural components of the membrane are Fatty Acids (FAs). Each FA has specific physical and chemical properties, so a cell membrane expresses different dynamics and behaviors according to its particular FA profile. In other words, the behavior of a neuron membrane rich in a particular FA, e.g. the Arachidonic Acid, is likely to be different from the behavior of another, not that rich, membrane.

This is why many researchers are trying to investigate whether the neuron FAs profile is different in normal versus psychopathological subjects [1,2]. It should be noted here that some researchers are studying platelet profile instead of neuron profile because, at least from the membrane FAs profile point of view, platelet dynamics are quite similar to neurons’ but much easier to manipulate [3,4].

In any case, an extensive literature reports that psychopathologies are linked to an unbalanced profile or to a dysregulation of polyunsaturated FAs [5,6].

In particular, the authors of the present document analyzed the FAs profile through Artificial Neural Network (ANN) models as well as other linear and non-linear mathematical tools [7]. They reached very important results; in particular, they set up a very powerful diagnostic tool, called ADAM, an algorithm based on the so-called Self Organized Map, a kind of ANN. ADAM can say whether subjects are potentially healthy or not by just knowing their amount of 3 platelet FAs (Arachidonic, Palmitic and Linoleic Acid).

Moreover, recent results [8] suggest that the particular ratio relating the 3 FAs allows ADAM to classify not only Healthy and Major Depressive subjects but also subjects with Bipolar Disorder, OCD, Psychosis and Suicide Ideation. So, considering psychopathologic states as somehow altered states of consciousness, FAs may provide clues to the different states of consciousness [9].

Let’s consider ADAM once again. It is just a mathematical tool. It doesn’t know what FAs or neurons are; nor does it know what psychopathologies or consciousness are. It just works with 3 numbers. But, just by knowing 3 numbers, it can classify a subject consciousness state.

Then, should we think that consciousness follows strong math rules? Maybe we should just think that consciousness follows some kind of rules, like any biological/physical phenomenon...

Indeed, results and findings coming from ADAM seem to be consistent with the most popular quantum consciousness models [9].

**Cell membrane and consciousness**

The actual mainstream state of the art in neuropsychiatry seems to be inconsistent and shows equivocal evidence. That is maybe why, a growing number of other approaches have arisen and are developing.

In particular, quantum theories of mind, brain and consciousness seem to offer a promising way to deeply change the present approach. Currently, among the most notable, it is worth remembering: the Orch OR model by Hameroff and Penrose [10-12], and the TBD model [13-17] but many other should be taken into account.

Even if these models seem very promising, in authors’ opinions, they have one main problem: they are “just” models. At the moment, there are no convincing experiments or demonstrations showing clear evidence supporting them. They are hypotheses, theories... models.

Hence, this talk suggests a possible way to integrate neuroscience with quantum models in order to address crucial issues in psychopathology. In particular, our starting point is the cell membrane.

In fact, it has been deeply studied to better understand psychopathologies and find possible biomarkers. Different approaches have been proposed. Among the most important, it should be noted the one from Mark Rasenick’s Group [18,19]. This research focuses on the dislocation of G-protein within its membrane lipid raft micro domain as a basic element of vulnerability in depression and suicide. So, investigating G-protein dislocation within brain cells membrane

or other peripheral tissues, such as platelets, Rasenick has shown evidence for diagnosing Depression [it should be noted that, at least for this kind of studies, platelets seem to give the same results as brain cells. This is why platelets are known as “the neuron’s mirror” [20].

Our model of reasoning is not only quite simple, but follows the accurate classification - we obtained through the combination of non linear mathematics and biology - of various psychiatric disorders, namely:

1. Major Depression
2. Bipolar Disorder
3. Psychosis
4. Obsessive Compulsive Disorder
5. Suicidal ideation

We can assume that these psychiatric disorders correspond to different states of consciousness.

For this reason, a reflection is required on the concept of the domain where the processing and/or the expression of consciousness, takes place.

It is necessary, in our opinion, to investigate the molecular modifications of the neuron according to the different modifications of the viscosity of the neuronal membrane.

A valuable help to the understanding of the neuron functioning can come from quantum molecular computation, which should allow for the interpretation of neuron modifications, in the occurrence, at least, of the abovementioned psychiatric disorders.

### A look to the future: Quantum neuron molecular mapping (q-nemoma project)

The Q-NeMoMa project, practically, wants to investigate the molecular modifications of the neuron according to different modifications of the viscosity of the neuronal membrane.

The most important experts in the world have come together to identify the experimental procedures to be carried out.

From this important research, it will be possible to obtain data needed to assess whether it is possible to take corrective actions against the devastating conditions affecting people with mood disorders.

A valuable help to the understanding of the neuron functioning can come from quantum molecular computation, which should allow for the interpretation, in the occurrence of the most important mood disorders such as Major Depression and Bipolar Disorder.

The suggested path could start from the largest scale: the cell membrane.

Five parallel and interacting approaches should be addressed (Figure 1):

Quantum chemical scale of neural signals by Bernroider [21,22].

The Fatty Acid profile (Palmitic, Linoleic and Arachidonic Acids dynamics) of Cocchi and Tonello [6,9,20,23,24].

The role of lipid raft and G protein of Mark Rasenick [18,19,25].

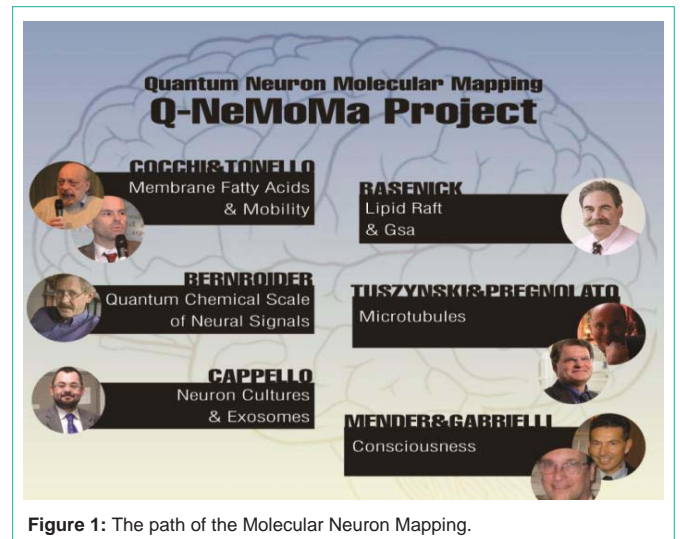


Figure 1: The path of the Molecular Neuron Mapping.

Cytoskeleton modifications (Microtubules and Tubulins) studied by Tuszynsky [26-28].

The exosomes studied by Francesco Cappello [29].

The whole path could be supervised by Gabrielli [Philosopher] [30] and Mender [Psychiatrist] [31] scientists of rigorous intellectual skills with a profound vision of the theoretical and conceptual aspects of psychopathology and quantum consciousness.

## Conclusion

For any society, the disease is an event subject to interpretation [32], that is to say not just a biological fact but also a cultural one. In other words, the disease is a representation, the way individuals in a given social contest interpret the overall reality or one of its parts [33]. The medical description of the human body and disease is linked to culturally determined meanings [34].

In medical-anthropological terms, it is possible to talk about *disease* (biomedical classification), *illness* (personal experience), and *sickness* (social determination of the disease).

When talking about mental diseases, social and cultural influences almost take on a metaphysical value because of the mismatch between classification and natural object, nosology and actual disease reality.

Hence, the danger that a strong medical ideologism could flare up into *diagnostic imperialism* [35,36].

The weak points of DSM classifications, especially in relation to the distinction between MD and BD, result from the lack of a strong and real biological equivalent, showing evidence for diagnoses which are merely narrative or based on literature.

In light of these remarks, we believe that our experimental path led us to identify the biological markers which provide the MD and BD diagnoses with an extremely real foundation to be used for establishing a DSM free from pseudophenomenology - or, even worse, ideology - and focused on the *presence here and now* of consciousness in its *real bio-molecular flesh*.

## References

1. Hamazaki K, Hamazaki T, Inadera H. Abnormalities in the fatty acid

- composition of the postmortem entorhinal cortex of patients with schizophrenia, bipolar disorder, and major depressive disorder. *Psychiatry Res.* 2013; 30: 346-350.
2. Yao JK, van Kammen DP. Membrane phospholipids and cytokine interaction in schizophrenia. *Int Rev Neurobiol.* 2004; 59: 297-326.
  3. Mazereeuw G, Herrmann N, Bennett SA, Swardfager W, Xu H, Valenzuela N, et al. Platelet activating factors in depression and coronary artery disease: a potential biomarker related to inflammatory mechanisms and neurodegeneration. *Neurosci Biobehav Rev.* 2013; 37: 1611-1621.
  4. Cocchi M, Tonello L, Gabrielli F. Molecular Uniqueness of Major Depression: Biological Remarks and Theoretical Implications. *Journal of Consciousness Exploration & Research.* 2012; 3: 380-391.
  5. Rapoport SI. Lithium and the Other Mood Stabilizers Effective in Bipolar Disorder Target the Rat Brain Arachidonic Acid Cascade. *ACS Chem Neurosci.* 2014.
  6. Cocchi M, Tonello L. Bio molecular considerations in major depression and ischemic cardiovascular disease. *Cent Nerv Syst Agents Med Chem.* 2010; 10: 97-107.
  7. Cocchi M, Tonello L, Cappello G, Nabacino L, Passi S, Baldini N, et al. Biochemical Markers in Major Depression as interface between Neuronal Network and Artificial Neural Network (ANN). *J Biol Res.* 2006; LXXXI: 77-81.
  8. Benedetti S, Bucciarelli S, Canestrari F, Catalani S, Mandolini S, Marconi V, et al. () Platelet's Fatty Acids and Differential Diagnosis of Major Depression and Bipolar Disorder through the Use of an Unsupervised Competitive-Learning Network Algorithm (SOM). *Open Journal of Depression.* 2014; 3: 52-73.
  9. Tonello L, Cocchi M. The cell membrane: a bridge from psychiatry to quantum consciousness? *NeuroQuantology.* 2010; 8: 54-60.
  10. Hameroff SR, Penrose R. Orchestrated reduction of quantum coherence in brain microtubules: A model for consciousness. In: Hameroff SR, Kaszniak, Scott AC, editors. *Toward a Science of Consciousness, The First Tucson Discussions and Debates.* 1996a; 507-540.
  11. Hameroff SR, Penrose R. Conscious events as orchestrated space time selections. *Journal of Consciousness Studies.* 1996b; 3: 36-53
  12. Hameroff S. The "conscious pilot"-dendritic synchrony moves through the brain to mediate consciousness. *J Biol Phys.* 2010; 36: 71-93.
  13. Vitiello G. Dissipation and memory capacity in the quantum brain model. *Int J of Modern Physics B.* 1995; 9: 973-989.
  14. Vitiello G. *My Double Unveiled.* Amsterdam: John Benjamins. 2001.
  15. Vitiello G. Quantum dissipation and information: A route to consciousness modeling. *Neuro Quantology.* 2003; 1: 266-279.
  16. Globus G. *Quantum closures and disclosures.* Amsterdam: John Benjamins. 2003.
  17. Globus G. *The transparent becoming of world: a crossing between process philosophy and quantum neurophilosophy.* Amsterdam: John Benjamins. 2009.
  18. Allen JA, Halverson-Tamboli RA, Rasenick MM. Lipid raft microdomains and neurotransmitter signalling. *Nat Rev Neurosci.* 2007; 8: 128-140.
  19. Donati RJ, Dwivedi Y, Roberts RC, Conley RR, Pandey GN, Rasenick MM. Post-mortem Brain Tissue of Depressed Suicides Reveals Increased Gs Localization in Lipid Raft Domains Where it is Less Likely to Activate Adenylyl Cyclase. *J Neuroscience.* 2008; 28: 3042-3050.
  20. Cocchi M, Tonello L, Gabrielli F. "Considerations on Blood Platelets: A Neuron's Mirror for Mood Disorders?" *Open Journal of Blood Diseases.* 2012; 2: 22-29.
  21. Bernroider G, Summhammer J. Can Quantum Entanglement Between Ion Transition States Effect Action Potential Initiation? *Cognitive Computation.* 2012; 4: 29-37.
  22. Summhammer J, Salari V, Bernroider G. A Quantum-mechanical description of ion motion within the confining potentials of voltage gated ion channels. *Journal of Integrative Neuroscience.* 2012; 11: 123-135.
  23. Cocchi M, Tonello L. "Biological, Biochemical and Mathematical considerations about the use of an Artificial Neural Network (ANN) for the study of the connection between Platelet Fatty Acids and Major Depression" *J Biol Res.* 2006; LXXXI: 82-87.
  24. Cocchi M, Tonello L. Running the hypothesis of a bio molecular approach to psychiatric disorder characterization and fatty acids therapeutical choices. *Ann Gen Psychiatry.* 2010; 9: S26.
  25. Cszysz AH, Rasenick MM. G-Protein Signaling, Lipid Rafts and the Possible Sites of Action for the Antidepressant Effects of N-3 Polyunsaturated Fatty Acids. *CNS Neurol Disord Drug Targets.* 2013; 12: 466-473.
  26. Saha AA, Craddock TJ, Tuszynski JA. An investigation of the plausibility of stochastic resonance in tubulin dimers. *Biosystems.* 2012; 107: 81-87.
  27. Craddock TJ, Tuszynski JA, Hameroff S. Cytoskeletal signaling: is memory encoded in microtubule lattices by CaMKII phosphorylation? *PLoS Comput Biol.* 2012; 8: e1002421.
  28. Craddock TJA, Tuszynski JA. A critical assessment of the information processing capabilities of neuronal microtubules using coherent excitations. *J Biol Phys.* 2010; 36: 53-70.
  29. Campanella C, Bucchieri F, Merendino AM, Fucarino A, Burgio G, Corona DF, et al. The odyssey of Hsp60 from tumor cells to other destinations includes plasma membrane-associated stages and Golgi and exosomal protein-trafficking modalities. *PLoS One.* 2012; 7: e42008.
  30. Cocchi M, Tonello L, Gabrielli F. Mood Psychopathologies: An Integrated Complexity- Based Interpretation. *Psychology.* 2014; 5: 192-203.
  31. Mender D. From Quantum Wetware to Mental Illness: A Section Editor's First Interim Progress Report. *NeuroQuantology.* 2010; 8: 115-119.
  32. Auge M, Herzlich C, Le sens du mal. *Anthropologie, histoire, sociologie de la maladie, Éditions des archives contemporaines.* 1984.
  33. Young A. The anthropologies of illness and sickness. *Annual Review of Anthropology.* 1982; 11: 257-285.
  34. Good JB. *Medicine, Rationality and Experience: An Anthropological Perspective,* Cambridge University Press, Cambridge. 1994.
  35. Foucault M. *History of Madness.* Oxon: Routledge. 2009.
  36. Gabrielli F. *Philosophy and Psychiatry. The violated body in the era of the invisible man.* *Neuro Quantology.* 2012; 10: 9-20.