

In the “Int’l Court” of Quantum Mind 2003 )

(at the first concurrent session 3/15/2003) )

**In Re:** )

**SPIN-MEDIATED  
CONSCIOUSNESS THEORY** )

**Huping Hu and Maoxin Wu** )

**- “Petitioners” -** )

---

© Biophysics Consulting Group  
<http://www.QuantumBrain.org>

Sub-caption of the “Case”

## **Biology**

**Possible Roles of Neural Membrane and Protein Nuclear Spin Ensembles and Unpaired Electronic Spins of Rapidly Diffusing O<sub>2</sub> and Other Molecules in Consciousness and Memory.**

## **Physics**

*Spin is the seat of consciousness and the linchpin between mind and the brain, that is, spin is the “mind-pixel.”*

# Outline of the Presentation

- Present the physics
- Describe the model
- Make predictions
- Offer evidence
- Give summation

## The “Constitution”

- Consciousness exists (not an illusion).
- Consciousness is quantum mechanical.
- The “process” generating quantum effects also generates consciousness.

# Spin is the Process Generating Quantum Effects

- Spin is embedded in the microscopic structure of spacetime and is likely the cause of spacetime itself (Dirac equation, spin network [Penrose] & spin foam [e.g., Smolin]).
- In the Bohmian picture, the “internal motion” associated with spin is recently shown to be responsible for the quantum potential (Recami & Salesi [1998], *Phys. Rev. A*, **57**, p. 98; Esposito [1999], *Found. Phys. Lett.*, **12**, p. 165; Bogan, quant-ph/0212110).
- In the Hestenes picture, the zitterbewegung associated with spin is said to be responsible for all the quantum effects of the relativistic electron (see, Hestenes [1983], *Found. Phys.*, **15**, p. 63).
- Some authors also expressed the view that electron is Compton wavelength vortex and the wave function is about “quantum vorticity” (e.g., Sidharth, physics/0203079; Kiehn, <http://www22.pair.com/csdc/pdf/bohmlus.pdf>).

# Spin Is the “Mind-Pixel”

- Consciousness is intrinsically connected to quantum mechanical spin, that is, spin is the seat of consciousness (Hu & Wu, [quant-ph/0208068](#)).
- Spin is a self-referential process which drives spacetime dynamics and underlies quantum mechanics (Hu & Wu, [Cogprints: ID2827](#)).
- The probabilistic structure of quantum mechanics is due to the self-referential collapse of spin state (Hu & Wu, [Cogprints: ID2827](#)).
- Said collapse is contextual, noncomputable, nonlocal and irreversible (See Penrose's books; Hu & Wu, [Cogprints: ID2827](#)).

## The Model: General Considerations

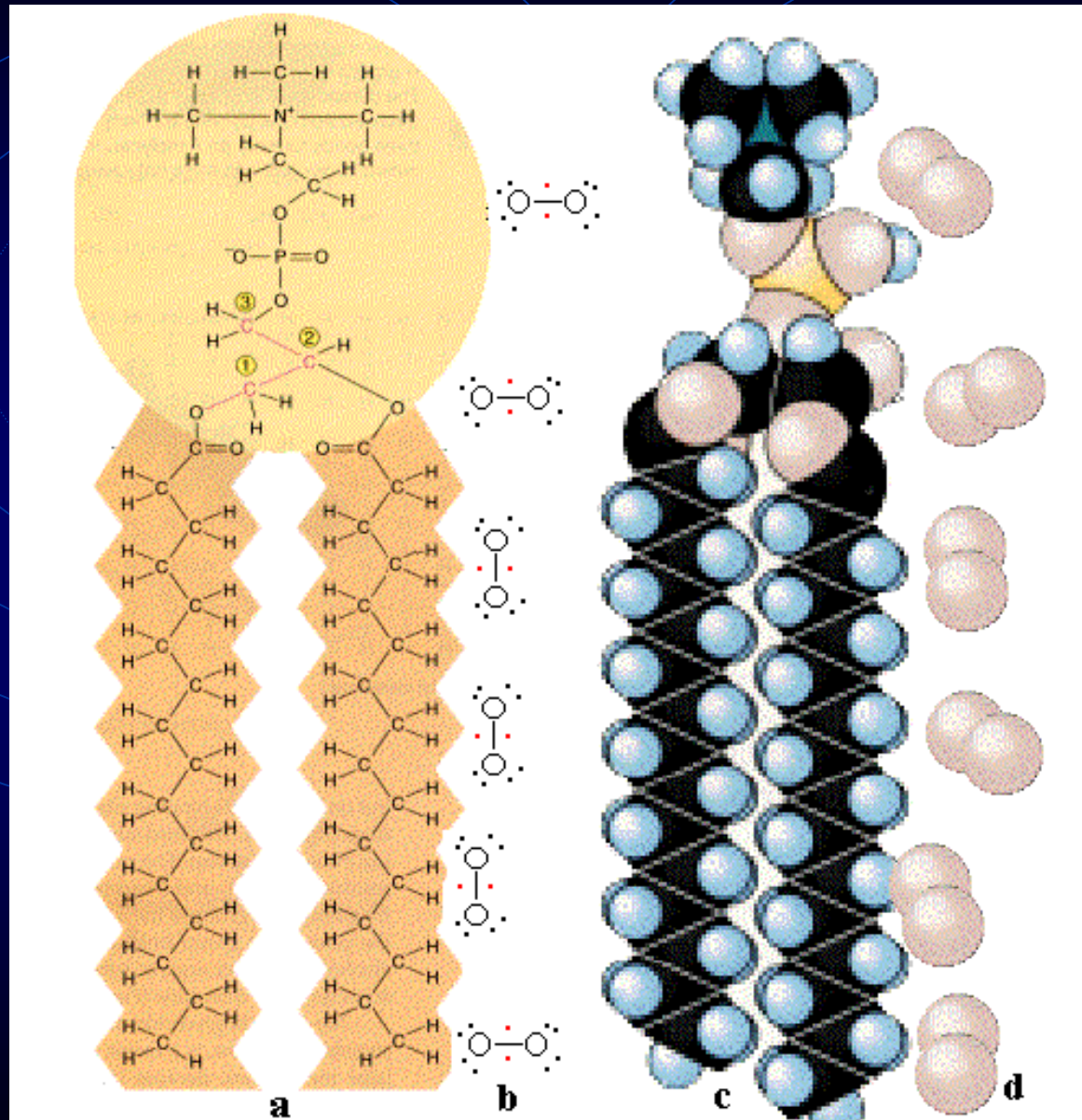
- The most abundant unpaired spins in the brain are the proton nuclear spins of all the molecules and electronic spins carried by  $O_2$ .
- Neural membranes are the matrices of most vital brain functions and phospholipids/proteins are saturated with proton nuclear spins.
- $O_2$  play crucial roles in brain functions and is hypothesized by us to be involved in the mechanism of anesthetic action (Hu & Wu [2002], *Medical Hypotheses*, **57**, p. 619).

## The Model: Neural Substrates

- Unpaired nuclear spins in neural membranes and possibly proteins are the mind-pixels since atomic nuclei are almost immobile and shielded from much of the noise in the “warm and wet” brain.
- Unpaired electronic spins of rapidly diffusing  $O_2$ , NO etc are the spin beam for pixel-activation since they are very mobile, can generate strong fluctuating E.M. fields *via* their large magnetic dipoles associated with their spins, and strongly couple to unpaired nuclear spins.
- Spin chemistry is the bridge to classical neural activities since biochemical reactions mediated by free radicals are very sensitive to small changes of magnetic energies.



# Phospholipid with Diffusing O<sub>2</sub>



# Quantum Effects

- Activations of neural nuclear spin states through strong interactions with unpaired electrons of rapidly diffusing  $O_2$ , NO etc.
- Entanglement of various neural nuclear spin states through intra- and intermolecular spin-spin interactions.
- Decoherence, and survivals of the “fittest” entangled spin states in decoherence-free subspaces or through Zeno Effects.
- Collapse of fittest entangled spin states through spacetime dynamics driven by self-referential spin processes.

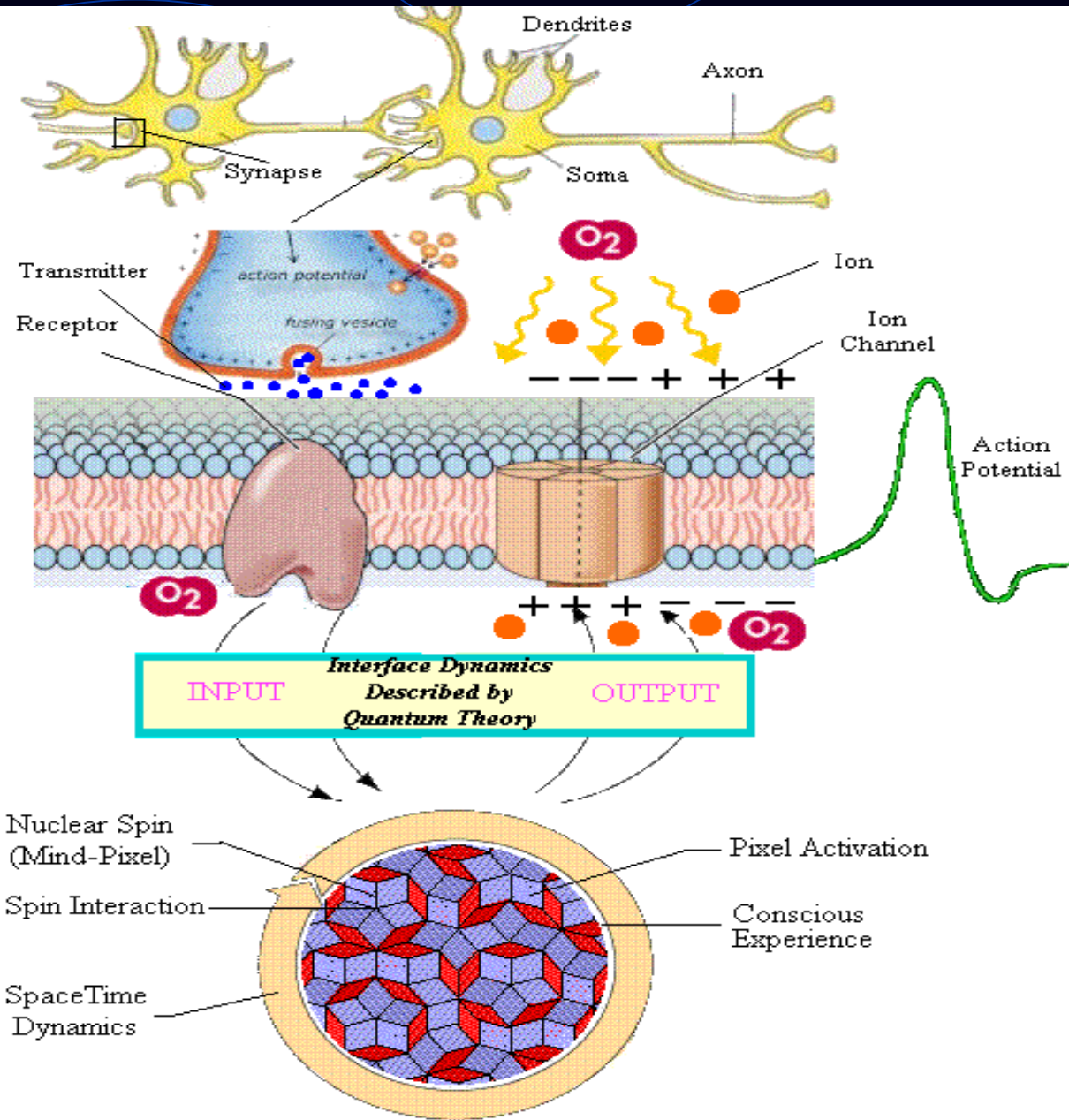
# Evidence for Brain Nuclear Spin Quantum Effects

- Proton nuclear spins in nematic liquid crystal can achieve long-lived intra-molecular quantum coherence with entanglement in room temperature for information storage (Khitrin et al, *quant-ph/0202035*, 0205040 & 0208136).
- Long-ranged (>10 microns) intermolecular multiple-quantum coherence in NMR spectroscopy was discovered about a decade ago (Warren, et al [1993], *Science*, **262**, p. 2005).
- Long-lived (>.05 milliseconds) entanglement of two macroscopic spin ensembles in room temperature has been achieved recently (Julsgaard et al [2001], *Nature*, **413**, p. 400 ).
- NMR quantum computation in room temperature is reality (See Nielsen & Chuang [2000], *Quantum Computation and Quantum Information*. Cambridge Universal Press).

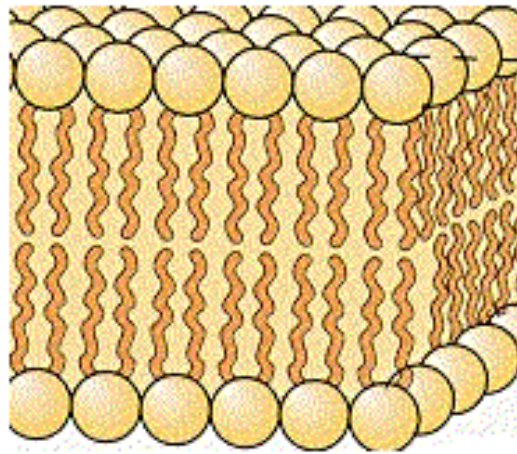
# “Consciousness Explained”

- Nuclear spin ensembles in neural membranes/proteins (“NSE”) are activated through strong interactions with unpaired electronic spins of rapidly diffusing  $O_2$  etc that extract information from their diffusing pathways in the brain.
- NSE process said information such that conscious experiences emerge from the collapses of NSE entangled quantum states through spacetime dynamics driven by self-referential spin processes.
- In turn, NSE has effects through spin chemistry on the classical neural activities thus influencing the classical neural networks of the brain.

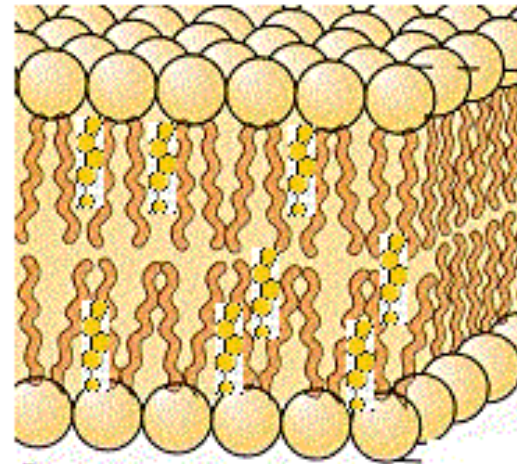
# Spin-Mediated Consciousness



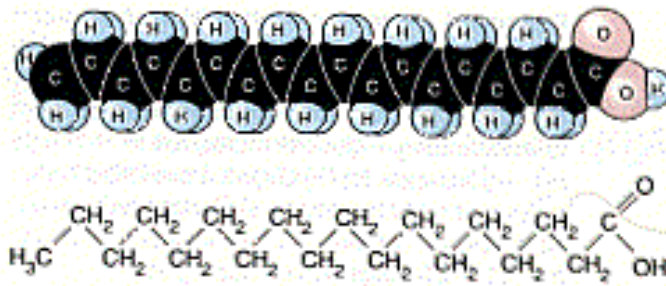
# Associative Memory Model



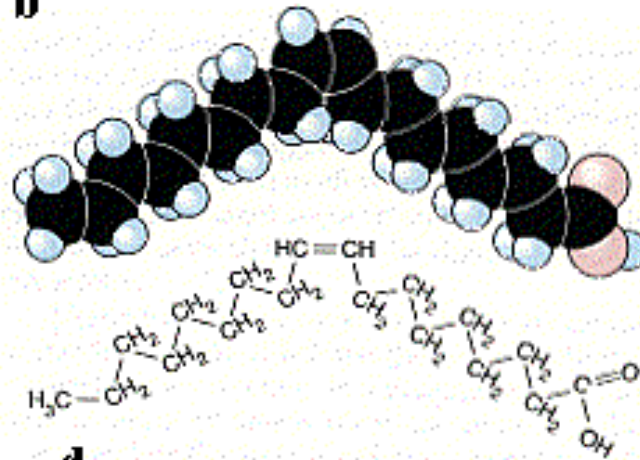
**a**



**b**



**c**

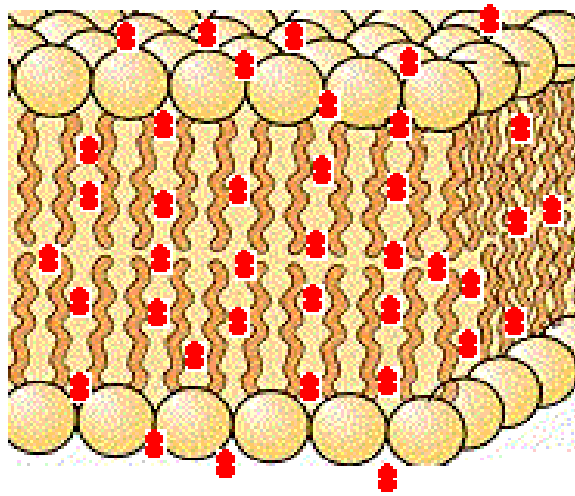


**d**

# Predictions

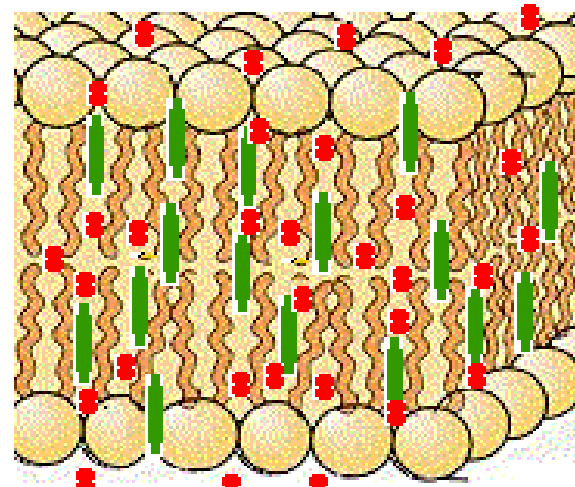
- Replacement of hydrogen with deuterium will block consciousness.
- Interference with the dynamics of neural nuclear spin ensemble will affect consciousness.
- Perturbation of membrane structures and dynamics will affect consciousness.
- Perturbation/blockage of oxygen pathways in the membrane will affect/block consciousness.

# Mechanism of Anesthetic Action



**a**

• Oxygen Molecule



**b**

■ Anesthetic Molecule



# Supporting Evidence for the Model

- Transcranial magnetic stimulations affect awareness and consciousness functions (see Chicurei [2002], *Nature*, **417**, p. 114 [news feature]) which can be explained as the stimulations interfering with neural nuclear spin dynamics.
- General anesthetics cause unconsciousness which can be explained as said anesthetics perturbing  $O_2$  pathways and neural membrane structures and dynamics (Hu & Wu [2002], *Medical Hypotheses*, **57**, p. 619).
- Temporary hypoxia causes unconsciousness which can be explained as deprivation of  $O_2$  spin beam functions.
- $D_2O$  has various neurological effects (see Kushner et al [1999], *Can. J. Physiol. Pharmacol.*, **77**, p. 79) some of which may be explained as brain losing mind-pixels.

## Summation

- **Physics: Spin is the seat of consciousness and the linchpin between mind and the brain. Biology: Unpaired neural membrane/protein nuclear spins are the mind-pixels and unpaired electron spins of O<sub>2</sub> and other molecules are the pixel-activating spin beam.**
- **If speculation, theory and accepted theory is the order of progress, our proposal is a qualitative theory.**
- **If no evidence, some evidence, “preponderance” and “beyond reasonable doubt” is the order of proof, our proposal is at the stage of having some evidence.**