

Elucidating the Trigger of Alzheimer's Disease: A Complex Anticipatory Systems Approach

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Abstract. Recent discovery of ADDL protein (Amyloid β -Derived Diffusible Ligand) allows the trigger mechanism causing Alzheimer's Disease (AD) to be described by principles of complex systems theory. This entails a teleological cosmology with inherent self-organized / anticipatory parameters introducing a life principle (*élan vital*) providing the action driving self-organization in autopoietic living systems. Interaction between this Noetic Field (*élan vital*) and brain is defined in terms of a Hamiltonian-Lagrange operator called the Noetic Effect. If mind/body interactions mediating this Noetic Effect drive the system away from equilibrium catastrophes causing protein misfolds may trigger the onset of AD. The discovery of ADDL also promises an AD vaccine.

Keywords: Alzheimer's disease, Anticipatory systems, Complexity, Hyperincursion, Noetic cosmology

1. Introduction

The cause of Alzheimer's Disease (AD) has remained puzzling [1-3] since initial description by Alois Alzheimer in 1907. For decades five competing theories have struggled to clarify causation: 1. Genetic 2. Toxic 3. Infectious Agent 4. Immune Function and 5. Trauma. Significant evidence supports each AD model, with none mutually exclusive of the others [4]; making AD appear a complex multi-factor syndrome. Noetic Theory suggests all five putative causes relate in various degrees to a new form of biological / psychic stress [5] called the Noetic Effect defined as the mind/body interaction.

Two recent developments move the arena of speculation to a level where Complex Systems Theory can comprehensively model the cause of AD in a simplified manner. One 1994 breakthrough by C.E. Finch [6] led to the discovery of ADDL (Amyloid β -Derived Diffusible Ligand) shown by several research teams to correlate with both *Amyloid Plaques* and *Tau neurofibrillary tangles*. The other significant advance, by M. Stefani in 2001 [7], was the realization that misfolds are a much more general property of proteins than previously suspected. Stefani's team also found evidence that "the mortal blow" occurs *just before* the strand misfolds.

Recently the author has redefined the fundamental basis of living systems in terms of a new noetic 'life principle' (*élan vital*) beyond the limits of '*Biological Mechanism*' [8-9] currently ruling medicine and psychology. The *mortal blow* causing key protein misfolds is shown to be the result of forced imbalances (catastrophes) in the self-organized hierarchy of the noetic field. The resultant of this *Noetic Effect* arises when autoimmune / transpersonal stress over a period of years creates focused imbalances in coupled coherence domains maintained by the noetic field [10-12].

Seminal work intended to found a new field of integrative Noetic Science is summarized in this paper [15]. Penrose claims, "*A scientific world-view which does not*

profoundly come to terms with the problem of conscious mind can have no serious pretensions of completeness". Noetic Theory defines *Awareness* as a fundamental physical quantity like *charge* in electrodynamics [11,22,29]. This cosmological context delineates the origin of complexity in self-organized living-systems wherein the physical basis of qualia (active mental content) is formalized [11,23]. The dynamics of this teleological action principle, mediated by the unitary noetic field pervading all biochemical species, optimizes (purpose of self-organization the state of *well-being* through homeostasis. Future work will show this provides the basis for developing a *Moral Psychology*. Additionally the noetic model is empirically testable [13-14]. The hyperincursive and anticipatory properties [34] of the noetic effect inherent in the hierarchy of self-organized autopoietic living systems are formalized in terms of Double-Cusp Catastrophe Theory [15].

1.1 Emphasizing Noetic Nosology

Noetic Nosology elucidates the physical basis of the mind/body interaction. Until now effects like Benson's relaxation response, Selye's stress factor, psychosomatic medicine, Psychoneuroimmunology (PNI) [16] or free radicals have been correlated with observations based on psychological traits and biological stressors all with limited empirical correlation. The physical basis of the Noetic Field makes it quantifiable; and available for rigorous description by the noetic formalism. A pragmatic relationship between the noumenon of Qualia and noetic effects on physiology can be demonstrated in terms of resonant action of the *élan vital*. Stasis of the noetic field produces Catastrophes in quantum regimes regulating protein folding [7,15]. To empirically prove this noetic basis of disease like AD etiology, the psychology of both the individuals and their families (or employment) must be investigated. This implies the trigger has both autoimmune and interpersonal telergic aspects [5,17,18].

2. Structural-Phenomenological Micromagnetic Medium for Biochemical Systems

Biological molecules contain coupled coherence domains with long-range resonant interactions extending throughout the entire living system [30]. This resonant coupling produced by the noetic field driving its hierarchical self-organization has local, nonlocal and supralocal (complex HD) parameters [29]. The Schrödinger equation, extended by the addition of the de Broglie-Bohm quantum potential/pilot wave mechanism has been used to describe an electron moving on a neural manifold by Pribram [31] and Jibu & Yasue [32]; but this is not a sufficient extension to describe noetic aspects of living systems which requires further extension to include action of the noetic unitary field. The following is a brief review of quantum properties of water illustrating one regime in the noetic hierarchy [33].

Properties of water, the fluid medium supporting life, stem from the structure of individual H_2O molecules and intermolecular forces between the molecules dominated by Hydrogen bonds. The capacity of H_2O molecules to form diverse 3-D networks (hexagonal, square, & pentagon) of H bonds, while maintaining 4-fold bonding at each molecule is structurally significant. Liquid H_2O is a structurally random network of strained and broken H -bonds. This network is labile; bonds break in one place and reform nearby. Isolated H_2O molecules act as though each H -bond bore a $1/3$ proton charge, and as if the O bore $-2/3$. Dipoles of neighboring H_2O molecules are somewhat aligned, acting in concert under

polarizing influences of an *EM*-field. The net result of this alignment, and molecular polarizability is a large static dielectric constant, relating to H_2O 's ease in dissolving ionic crystals like alkali halides. Also H_2O 's small size allows close approach to ions. At room temperature ~ 1 in 55 million H_2O molecules dissociate into H^+ and OH^- ions that can readily be incorporated into the liquid's random *H*-bond network. H^+ & OH^- ions high mobility causes a net transfer of ionic charge along chains of *H*-bonds. Crucial conformations in the hydrophilic and hydrophobic chemical groups of complex biochemical molecules are caused by H_2O solvation. In liquid phase atoms are disordered and free to move; therefore the Noetic Field [19-29] can produce periodic symmetry with long-range coupling that can lead to the Noetic Effect [22,29] when sustained hyperincursion [34] produces catastrophe [15]. The shape of DNA is also caused by *H* bonds in water.

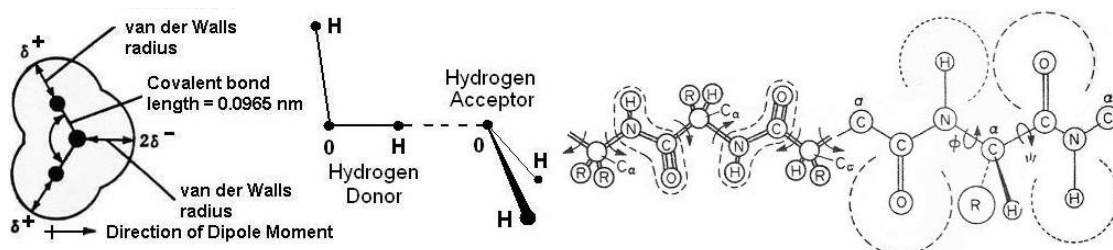


Figure 1. A) Dipole structure of water. B) Protein charge domains susceptible to conformational change.

This structural-phenomenology of atomic and molecular structure is full of domain walls amenable to description by combinations of Gauss' and Stokes' theorems in terms of Bessel Functions where boundary conditions create resonant cavities. As frequency increases central peaks occur with opposite or zero polarity at the domain edges. These properties are relevant to Ising Model [35] spin flips effecting homeostasis in planes of equilibrium. The noetic effect can maintain equilibrium or produce noetic catastrophes leading to medical problems [15].

3. Noetic Cosmology Summarized

Relevant to the discussion here, Noetic Cosmology provides the life principle (*élan vital*) driving Self-Organized Living Systems (SOLS); and introduces the basis for describing etiologies of a new class of "conscious" based medicine. The resonant mode of each continuous-state least unit hypercavity [38-39] is a simple harmonic oscillator emitting unified noetic field energy (*élan vital*) into every spacetime point and atom/molecule. This is the driving force for all autopoietic self-organized living systems. Noetic Cosmology is derived from an advanced form of Wheeler-Feynman Absorber Theory [22,38,39,42] based on an extension of Einstein's original Static Universe Model [43] that includes a complex energy-dependent spacetime metric $f : M_4 \rightarrow \hat{M}_4$ [42] in the context of a non-compactified Kaluza-Klein Theory [45] of twelve dimensions (11)12D [25,39]. The formalism for this highly ordered harmonic superspace $S_N = S_0 + S_1 + S_2$, a *continuous state* holographic cosmology with \hat{M}_4 a standing-wave eternal present created/recreated from a complex $\pm C_4$ advanced/retarded suprastructure of the future-past [26,43,46] has the basic form

$$R_{sym\dot{M}_4}^{S_{N_0}} = \frac{1}{2} \left[R_{retC_4}^{S_{N_1}} + R_{advC_4}^{S_{N_2}} \right] \quad (1)$$

compatible with recent advances in 10(11)D Superstring Theory, now called M-Theory [47]. The continuous state least unit of this complex Noetic Superspace S_N represents the fundamental basis for awareness in a Holographic Conscious Multiverse (HCM) [11,22,25,39,48].

A form of Dirac Spherical Rotation [22,49,50], an integral component of the metric's transformation; provides a symmetry breaking producing the new noetic action principle tantamount to the historic concept of *élan vital*, suggesting a Bohr-type complementarity of mind/body in the quantum brain [32,51] and Cartesian dualism [52] beyond [22-24]. An inherent beat frequency during the continuous state spin exchange compactification dimensional reduction topological transformation introduces the *élan vital* by holophote action through every spacetime point into every atom during the process of continuous dimensional transformation: $D_s \rightarrow D_t \rightarrow D_E$ and $R_U \rightarrow R_Q \rightarrow R_C$ where spatial dimensions D_s are transformed into temporal dimensions D_t and temporal dimensions D_t into energy D_E in a cyclical process of unitarity R_U to R_Q quantum to classical R_C . This process occurs by superluminal Lorentz boosts [38,39,46,53] and represents an additional set of Noetic transformations: Galilean \rightarrow Lorentz/Poincaré \rightarrow Noetic [24,27].

Noetic cosmology postulates a vacuum backcloth comprised of a Dirac polarized hypertiling of G -bumps and EM -holes [36-37]. The noetic action of consciousness $F_{(N)}$ is not a 5th fundamental force but an integration of the electromagnetic and gravitational force at the unitary level where it is confined to the universal sea of consciousness embodying an 11(12)D noetic spacetime metric $S_{(N)}$ [26]. The Schrödinger equations central to quantum theory make correspondence to Newton's second law of motion $F = ma$ which is also the starting point for deriving the noetic formalism. Newton's law of gravitation $F = Gm_1m_2/r^2$ is not chosen because it is not the fundamental form of gravitation and also contains an undesirable constant of dimensionality. Whereas $F = ma$ is dimensionless. Likewise Einstein's gravity is also not chosen.

Substituting Einstein's mass-energy relation $E = mc^2$ into Newton's 2nd law we obtain: $F_{(n)} = E/c^2a$ where $F_{(n)}$ is the noetic force and E becomes the self-organized autopoietic energy [54,55] related to ψ_e of the cosmology of mind defined in the fundamental dualistic relationship of noetic theory [5,10-12,19-21,27,28]:

$$|\Psi_M\rangle = |B|\psi_b\rangle + (|\psi_e\rangle + |\psi_c\rangle) \quad (2)$$

i.e. the mind Ψ_M is not merely quantum brain dynamics $B\psi_b$, but a classical \rightarrow quantum \rightarrow unitary continuum of brain, *élan vital* ψ_e and HD elemental intelligence ψ_c . E is scale invariant through all levels of the CSCU beginning at the highest level in the supralocal Multiverse as a hyperdimensional Wheeler Geon (*ball* of photons of sufficient size to gravitationally self cohere) [56]. At the micro level the Geon becomes synonymous with the de Broglie wave-like mental energy of a conscious entity. The Prion [57], the infectious protein responsible for spongiform encephalopathies (mad cow disease) is designated the

simplest known life form [29], if correct that the prion protein is ‘animated’ by the self-organizing properties of the noetic field (*élan vital*)[29]. The E is a unit comprised of a factor of *Einstein*’s, the physical quantity defined as a ‘mole – Avogadro’s number(10^{23}) of photons’ (noeons).

Next derivation of the noetic equation is generalized for the HCM by taking an axiomatic approach to cosmological scaling [41] (premise that all lengths in the universe are scale invariant). Beginning with the heuristic relation $c \equiv \dot{R}$ or $\dot{R} = L/t = c$ where \dot{R} represents the rate of change of scale in the universe. This corresponds to the Hubble relation for (perceived) Doppler expansion of the universe where $H_0 = \dot{R}/R$ and $a = \dot{R} \times H_0$. Substituting \dot{R}^2/R for a in the original $F_{(n)} = E/c^2 a$, for final substitution we have $F_{(n)} = E/c^2 \times \dot{R}^2/R$. Since $c = \dot{R}$ the c^2 & \dot{R} terms cancel and we are left with:

$$F_{(N)} = E/R \quad (3)$$

the unexpanded fundamental formalism for noetic (Hamiltonian-Lagrange operator) action within the cognitive domain of a conscious entity in the HCM. It should be noted that R is a complex rotational length with standing wave properties and could be derived in terms of angular momentum or spacetime spinors at HD domain levels described by future developments in M-Theory. In fact this noetic formalism takes the precise form of the basic equation for string tension $T_0 = E/L$, where E is energy or mass and L is the length of the string [58].

4. Noetic Effect: Casimir-Like Role of Noetic (Interactionist) Formalism

Science (physics especially) accepts nothing immeasurable as real. Noetic Theory [10-12] integrates Eccles’ Psychon [52] with Pribram’s neural wave equation [31] providing a dualist/interactionist solution to the mind-body problem. Because mind is defined as a physical entity in the Noetic Formalism this putative interaction is open to empirical tests. The principle of interaction between psychon (*élan vital*) and brain is called the *Noetic Effect*. Eccles usage of the term Psychon as the unit of mental experience was not rigorously defined and is expanded here. The Psychon unit is postulated (as required by our view of dualism/interactionism) as quantities of photons¹ giving physicality and work functions to thought processes by the action of the Noetic Effect. This Noetic Effect is defined generally as the mind-body interaction process. The mathematical method used to integrate Eccles’ Psychon with a brain dendron and the existing holonomic theory of Pribram is a variation of the Lagrange operator of least action utilizing not only the well known static Casimir effect [59], but also a duality between it and its dynamical counterpart first described by Schwinger [60]. In this context the Noetic Effect governs energized boundary conditions as described by the fundamental Noetic Field Equation $F_N = E/R$ [11,24].

The thrust of this treatment is to account for the action of spontaneous particle production, in this case bosons (noeons), from zero point energy fluctuations of the quantized vacuum, and from the zero ‘vacuum’ potential (an extended form of the de Broglie-Bohm

¹ The physical unit called the Einstein (E) designated one mole (Avogadro’s number of photons, ie. $1 E \equiv 6.02 \times 10^{23}$ photons; but here is adapted to signify Bosons of the Unified Field which are considered to be spin 4 noeons [65].

concept of a quantum guidance potential) as Psychons. These noeons (rather irradiative scattered Bose potentials arising from the unitary field and confined like quarks to the HD topology of the Dirac spacetime metric) can be constrained in a Gabor-like manner. The Casimir effect was initially developed to account for the force between parallel uncharged capacitance plates. This Casimir force is one example of a general phenomenon in which objects impose boundary conditions on the quantized field². The one we are most interested in is the generalization to parallel interfaces between dielectric media as occurring at the dendron (or water).

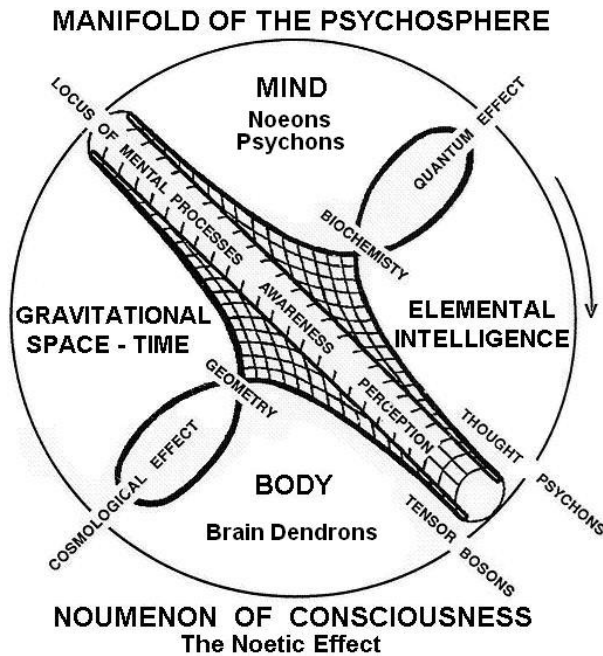


Figure 2. Conceptualization of local, nonlocal & supralocal action of the Noetic Effect. The central tubular domain represents a mental action instant of static Casimir modes; while the Cartesian folium loops represent relativistic energy domains of the dynamic Casimir effect. The regime is described by the fundamental noetic equation of consciousness $F_N = E/R$. The radius R of the outer hypersphere could represent one dendron (bundle of dendrites) acted on by one Eccles' Psychon with energy of one Einstein E (Mole of noeons). This manifold is scale invariant. Since a dendron is macroscopic myriad Planck scale fundamental least units of consciousness make up the multilevel self-organized hysteresis loop (fig. 3) feeding noeons into the psychosphere. This is the primary example of a complex system and the neon is the primary action principle that drives its self-organization.

More recently Schwinger [62-64] proposed a mechanism for the dynamical counterpart of the static Casimir effect based on precise measurements of coherent sonoluminescence, where accelerated dielectric media emit light³. In these experiments, a bubble in water (a hole in a dielectric medium) undergoes contraction and expansion in response to a strong acoustic field. Schwinger's Casimir function formalism utilizes a phase

² But as an extended de Broglie-Bohm piloting potential the noeon is an element of the unitary field and applies to both quantized and unquantized energy regimes.

³ In HCM cosmology inherent continuous state acceleration is part of compactification process [39].

space similar to that of the Gabor function [51] to trap a psychon-noeon bundle and channel it into the previously described quasi states in the quantum holoscape [51] where Bose condensates integrate in the Heisenberg matrix. Fig. 2 provides a conceptual model of the Noetic Effect where the triune action modalities of mind base states (2) interplay.

5. Physical Basis of Qualia

Qualia (plural of *quale*) is ‘the subjective quality of experience [66-67]. Noetic Cosmology provides a physical basis for representing qualia [11,24] allowing immediate application to medicine. In ‘What’s it like to be a bat?’ Nagel [1974] states every experience has a specific subjective nature [67]. Nagel asks, if one removed the viewpoint of the subjective observer; what would be left? He suggests the remaining properties might be those detectable by other humans, the physical processes themselves or states intrinsic to the experience of awareness. This changes the perspective of qualia to the form “there is something it is like to undergo certain physical processes”. “If our idea of the physical ever expands to include mental phenomena, it will have to assign them an objective character”:

Does it make sense...to ask what my experiences are *really* like, as opposed to how they appear to me? This question also lies at the heart of the problem of other minds...If one understood how subjective experience could have an objective nature, one would understand the existence of subjects other than oneself [67].

These are questions an integrative Noetic Science can answer. Standard definitions of qualia are inadequate philosophical constructs describing only subjective character. In the physical sense Noetic Field Theory (NFT) introduces components describing qualia objectively - i.e. distinguishing the subjective phenomenology from the physical noumenon or *thing in itself*. Comprehensively defining qualia demands a threefold basis [11,24]:

Type I. The Subjective - The *what it feels like* basis of awareness. Phenomenological states or qualia of experience. (Current qualia definition Q-1)

Type II. The Objective - Physical basis of qualia that could be stored artificially or transferred to another entity thereby breaking the 1st person 3rd person barrier. These (Q-2) are the noumenal elements of qualia upon which the phenomenology is based.

Type III. The Universal - Living systems represent a substrate of the conscious universe, acting as a holographic ‘blank slate’ or carrier of the noetic field which modulate Q-II elements into the Q-I of experience by a form of super-radiance or hyper-holographic evanescence of the noetic field [24].

The three forms of qualia are considered physically real by NFT because the noetic field of HCM cosmology on which the noetic model is based is physically real. See [11,24].

A standard image requires a screen or other reflective surface to be resolved; but if the foci of two parabolic mirrors (Casimir-like domain walls in the noetic model) are made to coincide, the two images superpose into a real 3D image that does not need a screen [24].

The holophote action of *élan vital* energetics arises from the harmonic oscillation of S_N least unit boundary conditions tiling the spacetime backcloth and pervading all self-organized living systems. The inherent beat frequency of this continuous action produces the

Q-III carrier wave that is an *empty slate* modulating cognitive data of Q-II physical parameters into Q-I phenomenological states of awareness as a superposition of the two (Q-III and Q-II). This modulation of qualia occurs the HD QED cavities of the cognitive domain⁴ [29,54]. The QED cavities are a close-packed tiling of least unit noetic hyperspheres; the dynamic/static [10,12] Casimir surfaces of which are able to reflect *quaneme* subelements⁵. While the best reflectors of EM waves are polished metal mirrors, charged boundary conditions also reflect EM waves in the same way radio signals bounce off the ionized gases of the Kennelly-Heaviside layers in the Earth's ionosphere. This reflective 'sheath' enclosing the cognitive domain is charged by Noeon radiation (exchange particle of the unitary noetic field) [10,12] the phases of which are 'regulated' in complex HD space (least units HCM cosmology).

How does noetic theory describe more complex qualia than simple qualia of a light pencil? The Q-II qualia of a light pencil is assumed to be *the* pencil of light itself [11,24]. Light quanta are microscopic in contrast to the macroscopic sphere of awareness. It thus seems theoretically reasonable to assume that scale invariant properties of the HCM least unit of awareness would apply. Without this physical basis for qualia or the *élan vital*, which it is based on, there is no noetic effect. These are the twin pillars of NFT.

6. Catastrophe Theory and the Noetic Formalism

The structural-phenomenology of Double-Cusp Catastrophe (DCC) Theory in $\geq 9D$ appears homeomorphic to the Riemannian manifold of both 10(11) dimensional M-Theory and the topological geometry of the continuous state spin exchange dimensional reduction compactification process inherent in the action of the corresponding scale invariant least unit of noetic superspace. In this general framework the double-cusp *equilibrium surface* is analyzed in terms of a hierarchy of Ising-like *jumps in state* [35] providing a framework for expanding the basis of allopathic medicine and psychology. One can say FAPP that the noetic least-unit tiling [22] of the Planck backcloth is a complex HD catastrophe manifold mediated by the unitary noetic field.

When applied in concert with the fundamental noetic equation of consciousness [15,25,29] and the model of interactive computing [40] double-cusp catastrophe theory provides a mathematical basis for the new noetic basis for medicine and psychology. The processes of metabolic homeostasis and intentional action are modulated by the ubiquitous flux of the unitary noetic field as described by the $F_{(N)}$ formalism.

Equation (4) is a standard equation for the equilibrium surface of the DCC [68] as modeled in (Fig. 2); where $B \pm Q$ is the state variable and μ_d and ν_d are the control parameters.

$$(B + Q)^3 + (B + Q)\mu_d + \nu_d = 0 \quad (4)$$

The position of the two cusps is found at $\mu_d = 0$ and $\nu_d = 0$.

⁴ Cognitive domain or entities psychosphere which exists in both spacetime and biochemistry.

⁵ Like phonemes (fundamental sound elements for audible languages) metaphorically there are qualia-nemes or *quanemes* for awareness based on the physical modulation of Q-II states by the geometric structural-phenomenology of the Q-III carrier base inherent in living systems [11,24].

If fig. 4a is considered as a present moment; 4b is a flag of temporal permutations as the noetic catastrophe cycle evolves in time from future to past and higher to lower dimensions in the same manner as the CSCU cosmology for the spaces: $R^{12} \supseteq \dots R^4 \supseteq R^3 \supseteq R^2 \supseteq R^1 \supseteq R^0$.

Noetic Action on the Equilibrium Plane of a Double-Cusp Catastrophe

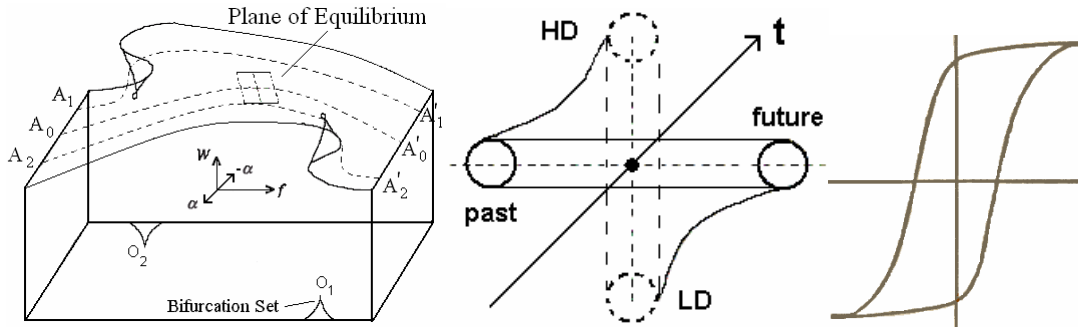


Figure 3. In 2a, the DCC is illustrated showing cusps at each end of the plane of equilibrium. The DCC is said to occur in ≥ 9 dimensions and thought to be the catastrophe form most compatible with NFT symmetry. The plane of equilibrium is a topological manifold tiled of noetic *least units*. The equilibrium manifold undergoes a ‘conscious’ quantum computation best described by interactive computation (Wegner, 1998; Milner, 1993). Fig. 2b graphically illustrates the fundamental scale invariant noetic equation $F_{(N)} = E / R$ of conscious action. Any internal or external stress or change in E is a nonlinear dynamic process producing stability or instability in the boundary conditions of R ; an instability in $E \rightarrow$ stress \rightarrow displacement \rightarrow catastrophe \rightarrow jump...whereas stable flux is homeostatic. 2b like noetic HCM cosmology is also a form of hysteresis loop generalized in 2c [15,69].

This brief summary is only a primitive slice introducing the anticipated new field of integrative Noetic Science revolutionizing medicine and psychology and implementing myriad *conscious* technologies like sensory bypass prosthesis or E -wave (eternity-wave) accelerated healing for example. Experimental work is underway to isolate and utilize the noetic field for these tasks.

6.1 New Computational Basis Required for Action of the Noetic Effect

While biological mechanism [8,9] (physics and chemistry provide sufficient explanation for living-systems with no additional life principle required) provides an underlying skeleton for the mechanical aspects of self-organization, noetic computation is not Turing but *Interactive* [40]. This suggests that at certain HD loci higher level “Interactive programming” may mediate or overwrite (by conscious or subconscious qualia parameters of the entities noetic field) built in natural mechanical aspects of classical Turing algorithms. This Noetic Processing is governed by the fundamental equation of Consciousness $F_N = E / R$.

Cyclotron resonance of qualia states may maintain homeostasis of the noetic field or induce electromotive force (The Noetic Effect) on brain dendrons, or proteins leading to conformational change.

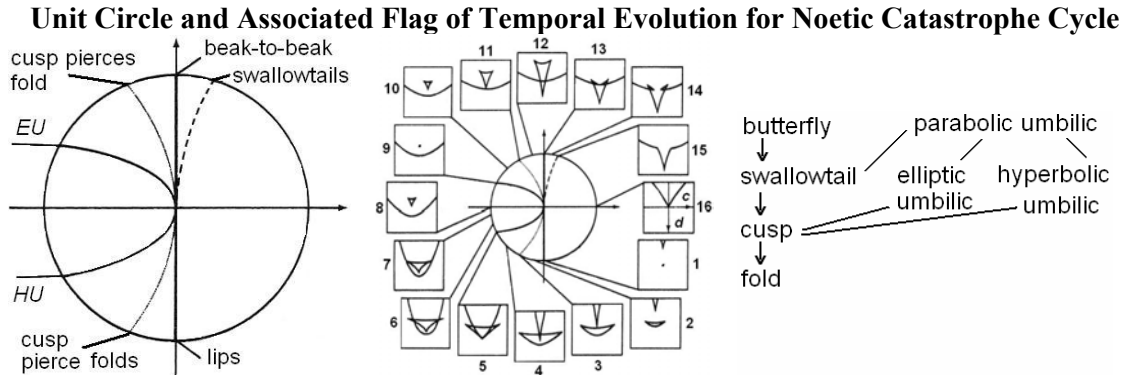


Figure 4. 4a represents a plane of the unit circle with corresponding cross sections in 4b: Section 16 for example shows a cusp. A single point in 1 grows to the ‘lips’ in 2. In 3 to 4 the original cusp 16 penetrates the mouth becoming a hyperbolic umbilic point at 5, turning into an elliptic umbilic at 6, shrinking to a point in 9. Growing again in 10 to pierce the fold line in 11 and through it in 12. A ‘beak-to-beak singularity in 13 breaks in 14, collapsing to a swallowtail 15. The seven fundamental catastrophes contain ‘subcatastrophes according to the diagram in 4c.

7. Potential Alzheimer's Vaccines, Status 2005

Three types of Alzheimer's vaccine are under development - 1. Amyloid, 2. Gene & 3. ADDL:

A) Amyloid Vaccine. 2002 trials on 300 participants for a vaccine to stimulate the immune system to fight plaque building β -amyloid were stopped because 18 patients developed brain inflammation. Trials are expected to restart in 2005. Follow up studies continue to monitor the group. Findings reported in May 2005 *Neurology* have found that 20% developed antibodies to the plaque causing β -amyloid protein.

B) DNA (Gene) Based Vaccination. Recently, researchers at UT Southwestern Medical Center, Dallas, found a gene-based vaccine which avoids stimulating the body's own immune cytotoxic T cells. Stimulation of cytotoxic T cells can lead to a number of unwanted side effects including encephalitis. By contrast, the gene vaccine appears to have increased the level of antibodies in mice without negative effects. Human clinical trials are expected in ~2006.

C) ADDL Research Provides Best Vaccine Hope. Binding of ADDLs to neurons is thought to disrupt normal electrical flow resulting in memory deficits. Researchers G. Krafft and W. Klein discovered huge quantities of ADDLs in post-mortem brains of AD sufferers. By contrast, relatively few ADDLs are found in brains of people without AD. Experiments discovered neurons of mice function normally once ADDLs are removed. Merck Pharmaceutical has allocated 96 million research dollars. An ADDL vaccine seems to provide the most hope for complete prevention of AD. More research is required before clinical trials can be scheduled [70].

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