
DIPOLE NEUROLOGY

(draft 2)

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NEW DIRECTIONS AND SIMPLIFICATION FOR THE COMPLEX BRAIN

1. WHAT IS THIS DIPOLE NEUROLOGY ?

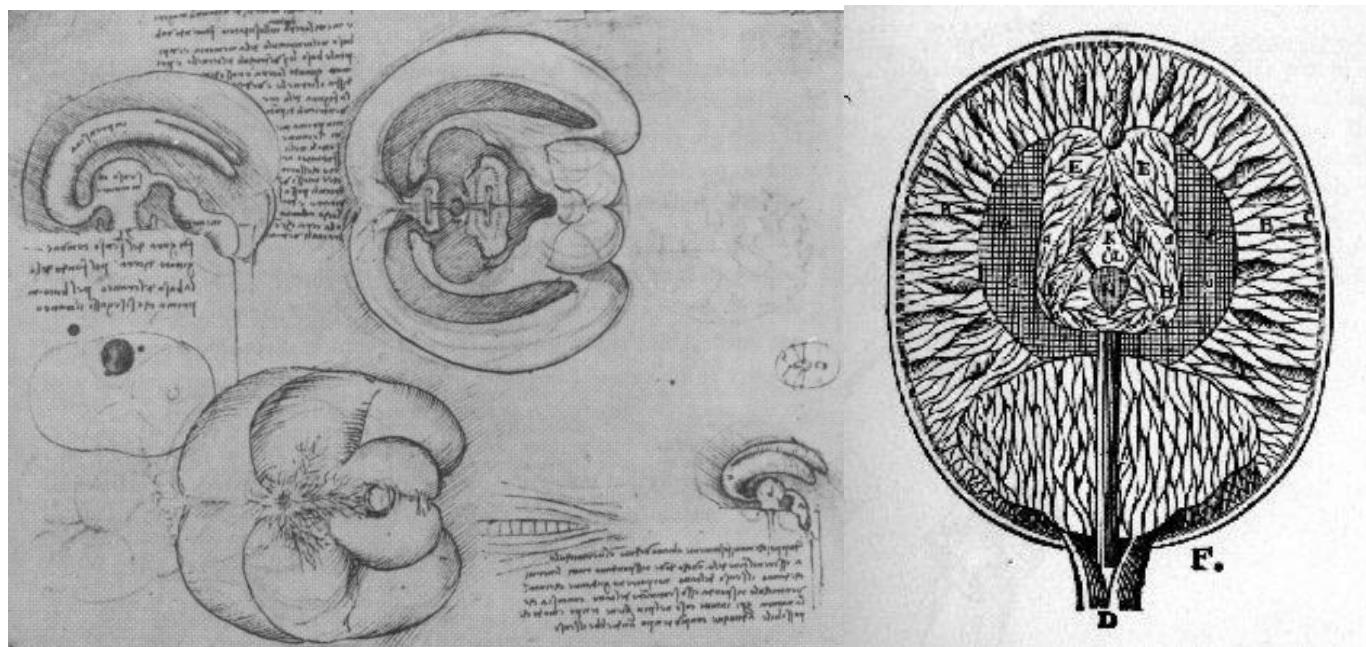
Dipole neurology, the concept of electromagnetic reversal as a key to brain structure, started off as personal experience and an idea which has now been pursued. The subject of this project is about seeing the structure of the brain in the context of the system which it is. This system exists already in design and scientific philosophy as “tensegrity”, a push / pull between opposite kinds of forces. Medical science is unable to, or having difficulty in recognising that as a whole brain decoding tool because it is very simple, and is then hard to falsify in the face of human complexity. There are increasing amounts of fragmented data which arise daily to hide this system and demand our pre-occupation elsewhere. The opening part of this section is dedicated to reasoning why this is. So far tensegrity has not been applied beyond simple structures. I believe the tensegrity system is the key to what complexity is, and that it is the system which codifies DNA and so will unravel DNA. Before it is possible to get to that stage, complex tensegrity systems need to be fully understood. The brain itself is the best place to begin, so read on. I am satisfied that this method does represent the global answer, and the next goal is to take a similar approach to human systems, which will then allow the wider context to give meaning to what DNA does and why.

All 4 sections here are heavily referenced where necessary. The parts relating to human systems and genetics have been taken out, to keep this project dedicated to one system. The original unreferenced draft one has been fleshed out from 20 to 150 pages due to scientific reading, which was a test for the original idea. Would reading existing knowledge reveal the system, or feel like an uphill effort to re-fabricate the proposition.

What this project is not, is any kind of definite approach to the subject of the brain. It is an application of an almost eastern style system to figure out the brain structure. This is an independent exercise in using tensegrity as a decoding template. It is a creative global approach which relies on scientific data, but only to a degree, the method of re-iteration. Since the idea is to take a dual approach through the whole brain, it is obviously not possible to be so rigorous, in every part. There may very well be errors due to some ideas being added later on with only one or two periods of rest and re-reading. This is to be expected with the very nature of creative thinking. Most of the stuff in here has been re-done again and again. Each time this happened, the interaction with science led to hidden secrets, new meaning for the obvious and a vindication that the method used here is the right way to go.

2 INTRODUCTION TO SYSTEMS INVESTIGATIONS

Tensegrity systems are based on opposition within structure. For myself this has proven to be the predominant system to begin describing the brain. The premise of this project is so simple, the question arises, why this very basic tensegrity model, has never been applied to the massively complex models of neurobiology. Current biological sciences result from precise investigations, and not an artistic fascination with the neural symmetry, patterns, shapes and products of the brain. This already occurred previously, and was tackled by artists and philosophers of the day. Looking back in the roots of neurological history, the question of symmetry was initially discussed at great length. The medical illustrations of the time also reveal an intense relationship by the artists with the shape and pattern of these structures.



LEFT : Leonardo Da Vinci, made contributions to neurophysiology by taking a creative approach based on simplicity, vision and experience. RIGHT : Descartes sought to decipher the brain by it's symmetry.

2.1 CURRENT STATE OF AFFAIRS

An invisible electromagnetic field, a simple tensegrity, don't really grab attention these days. There has been an explosion of medical complexity in neuropharmacology, neurochemistry and many sub disciplines, which does not reflect in any way the obvious visual and cognitive reverse symmetry apparent in neuroscience and neuropsychology. Yet all that data, is from and within the same brain. It is one organ, which has been broken down to reverse and detract from that, making even the basic proposal of what it really is seem eventually ridiculous. Negative labels are created for lateralization theories. The best research I could find where there is dawning realisation of tensegrity within the brain (256,257,258,259) is cited for ridicule on a “this is the wrong way to do things” website for other neuroscientists.

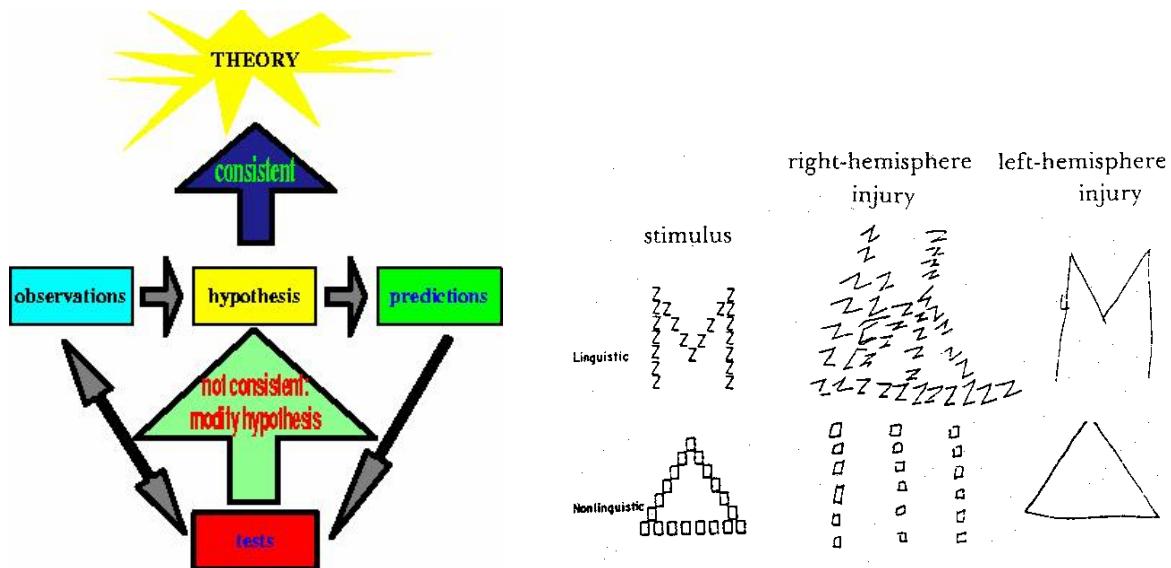
The complex dipole system could be a map from which to plan brain investigations, requiring understanding of the whole system. Fragmentation is getting in the way.

“In addition to becoming too specialized, science has become too dense. The National Institutes of Health’s PubMed database alone lists more than 40,000 papers pertaining to Alzheimer’s. Regardless of the scientific field – medicine, nuclear physics, mathematics, whatever – PhD students typically take a year just to read what others have done before them, and even then they are usually just scratching the surface.” Wired article on decoding complexity September 2004

2.1.2 IS IT INEVITABLE SCIENCE WILL MISREPRESENT THE BRAIN ?

Currently, we are looking at life with hierarchies and industrial organizations, so the scientific results and methods reflect convergence itself. The scientific method is itself a loop which needs ideas, but then demands repetition until a point of linearity. Throw just one of these loops into something as complex as life, and it will keep burrowing away, throwing up information, which demands more checking to deal with the questions brought up. The increasing refinement invents its own language as new terms are defined, and the initial idea often rejected while a snake of industry replaces it. Throw in an industry of workers adhering to the method, and the result is what we have today. Very similar to a biblical tale “the confusion of tongues” or babel, which described a massive religious building project to build a tower to heaven. At the time failure was ascribed to mystical powers which made people involved in the project speak in different languages. Now faced with a similarly endless task, it’s easy to see what happened.

In following sections one offhand idea put forward is that language is not a specifically weird thing to arise in humans, but the natural consequence of converging low frequencies within the left side of a brain dipole. The left brain is the self organizer of knowledge, language and logic. I would put a good bet that the majority of employed scientists are dominated by a larger majority of left hemisphere dominant thinkers than right. This would explain why the results of science are similar to this selective focus of the left brain, which has to operate on selective reinforcement. The left hemisphere works towards detail while becoming blind to global features. (*see section 1.5.2 NEUROLOGY REALISES THE SPLIT PERSONALITY*) The results of neuroscience are like a map which show lots of fragmented details, with no overall structure. The structure of the brain is then obfuscated.



LEFT : Scientific method heavily biased towards closing the loop. Its biased to give concept a raw deal. RIGHT : Ok I’m now pushing the point, but I think scientific results produce a lot of fragmented details that could be cheekily named “right hemisphere injury”.

2.2 TENSEGRITY AS A DECODING TOOL

The scientific agenda, needs new directions, and allows for theory in an encoded sense, but then gets back to its own unbalanced way of doing things. If a theory is not easily falsified then it is of no use, even if it’s intrinsic. This is fair enough when trying to be definite, but it does not mean that something which is clear and can not be falsified is not there, and should be rejected. Falsification, the mainstay of scientific education, destroys complex systems by default, while building a wall of industry, attention and data which works against the possibility that these systems would be revealed. Unlike the tower of babel, we all have an intrinsic need for medical research so we enter into endless subscription, which is the current aspect of the see / saw nature of human discovery. If neuroscience accepts tensegrity for every level within the brain, then amongst many other things, (*like a simplification of most*

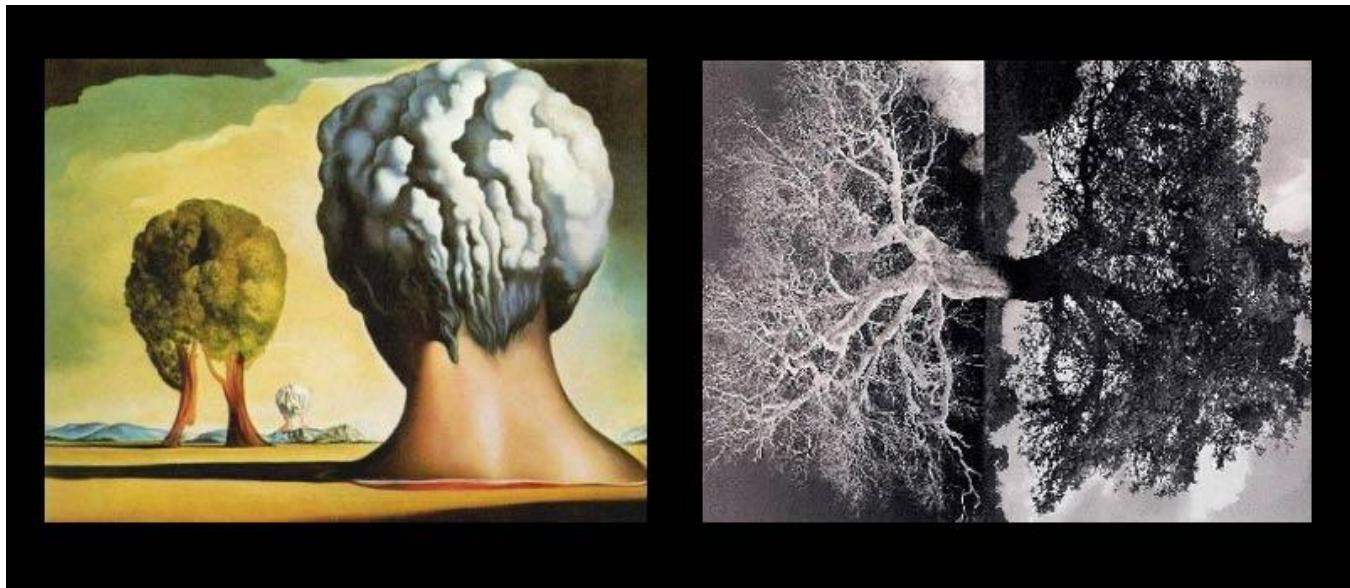
cortical chemistry and complex illness) it would become clearer why the distribution and function of serotonin and glutamate receptors are so unclear, and why the distribution of Gaba and dopamine receptors are. (2,3) They are both reverse parts of the same hybrid digital / analogue system, pushing and pulling against each other, evolving by trading pieces, but mainly sticking within their respective hemispheres, because evolution favours a tensegrity system.

'Pluralitas non est ponenda sine necessitas.' (Plurality should not be posited without necessity.)

This well known phrase referred to as occam's razor is essential to retain when figuring out complexity. It is possible to take tensegrity as a reference, like occam's razor, to make sense of these many medical languages. This project takes that through thousands of papers to attempt to bring neurological sciences fragmentation together.

The final two sections of this project, build a dipole from secondary evidence in neurons. Medical databases are overflowing with journals which contain many dead ends from logical investigations within research systems to find definite mechanisms. These leave branching lines of evidence which create huge databases of impressive detail, regarding neurochemicals. The pieces of the puzzle are just lying ready to be put together to show that which is not visible. In these following sections this evidence will be dropped into the dipole framework, demanding no more than they have some sort of value, such as their polarization, binding properties, and physical position within the neurology. This will be related to the electromagnetic structures discussed in sections one and two. From this evidence is revealed a breathtaking simplicity which runs through every major level of the brain.

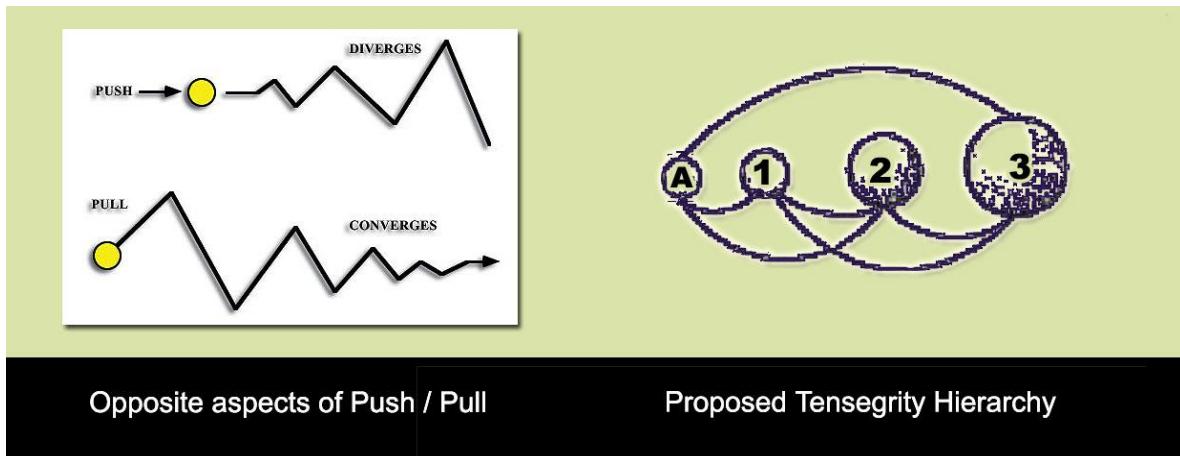
The next section describes more about tensegrity itself. This requires looking at the brain. Just looking at the brain. Seeing the symmetry, then seeing the behavioural and cognitive reversals, then holding that in mind when looking through everything else, within it.



RIGHT : Salvador dali represents the brain as a tree. LEFT: He was not far from the truth. The left hemisphere represents the roots and the right hemisphere the branches.

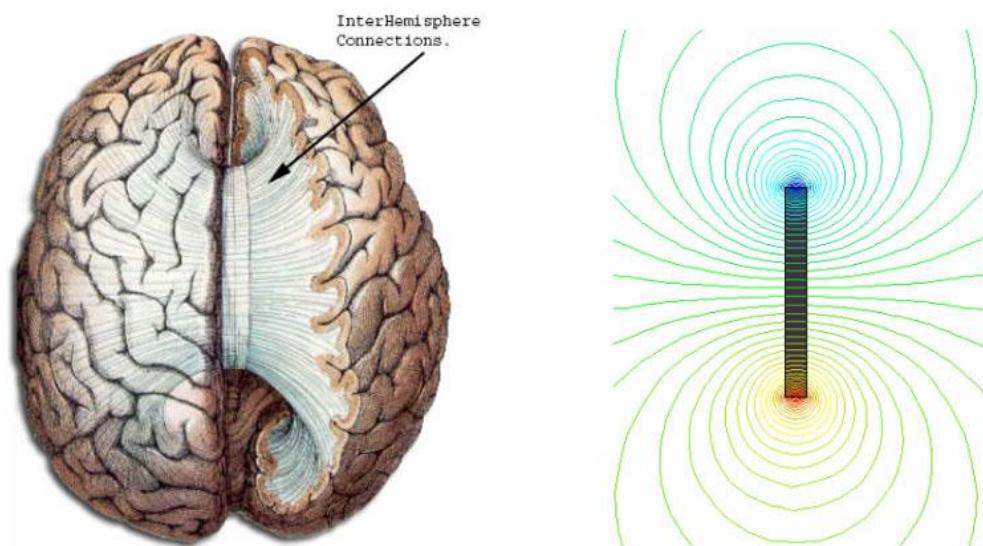
3 TENSEGRITY

Many levels of functional and inter-related complexity emerge at a homeostatic midpoint. The system itself becomes visible as representing reverse flip sides of itself at this midpoint. When the search is on its possible to uncover the process at many levels. This discovery of Convergent and Divergent process within complex systems is recent and not to be confused with black and white Theological or Taoist concepts, but best described by Buckminster Fuller as a “Tensegrity”. A balance between equal push / pull forces. This word “tensegrity” is favoured and being re-used elsewhere, because the word tensegrity describes the push / pull of the system as a priority. This encourages the middle view.



This illustration by Dr Timothy Wilken showing the different aspects of a Synergistic system asks us first to visualize a ball being pushed on a smooth table. The ball would roll with unpredictable side to side divergence. If the ball is attached to a string and pulled it is always predictable and controllable. It converges to the direction of the strings pulling point.. It is the stacking repetition of the tensegrity system at increasing levels of scale which describe biological complexity. LEFT : It's proposed that the brain system has several levels of tensegrity which stack upon each other at bigger levels of scales. This will be discussed in the section "hierarchy of magnitudes".

Successful Synergistic systems like the brain operate on a push / pull relationship between the two hemispheres. The left hemisphere is the side which pulls and the right hemisphere the side which pushes. For the dipole in this section, this synergy takes place in the cortex through the inter-hemisphere connections of the Corpus Callosum.



ABOVE :The visual premise of the dipole. Axon lines and midline are clearly similar to a dipole field. (Both are standard images)

3.2 EXAMPLES OF SYSTEMS WITH TENSEGRITY FEATURES

LEVEL	CONVERGENT	MIDPOINT	DIVERGENT
Quantum Physics	Particle	Superposition	Wave
Genetics	Inheritance	Crossover	Variation
Neurology	Left brain	Callosum	Right brain
Systems Theory	Order	Stasis	Chaos
Time	Past	Present	Future

The table above explains levels of opposition which appear in emergent systems. Convergent aspects are fixed and definite. Divergent are vague and continuous. Midpoint aspects represent the interchange point of exchange and communication.

1. Last century was dominated by puzzled physicists who couldn't place completely definite aspects on small particles. After the industry of the previous 100 years dominated by classical frameworks, confidence was high that physics could clearly define reality. Then it was found that small scale quantum matter could have both particle and wave properties depending on the methodology used to evaluate. This gives the idea that physics (at that time) attracted left hemisphere dominated thinkers, who in retrospect were grappling with the limits and desires of their own logical neural structure. The physicists of the day were upset that a truthful picture of reality could not be encoded in absolute definites. Thinkers in this field today tend to subscribe towards codifying these dual aspects of reality. (224)
2. Genetics which represents a library of what is required for life to repeat and evolve updates its library at the point of sexual crossover, where a 50/50 mixing of genes between two people take place.
3. Neurology of the hemispheres falls into the aspects of a push / pull system. The next section will be devoted to this subject. When looking at these tables a left hemisphered thinker should immediately feel an affinity with the words in the Convergent column and a right hemisphered thinker with the words in the Divergent column.
4. Systems theories define opposing ends of complex systems with definitions of order and chaos which can be defined by points of attraction. Tensegrity was in itself a simplified precursor to modern systems theory. As will be illustrated later resonant feedback within lower level pyramidal neurons and cyclic motion within higher order dendrites, can be lateralized to left and right hemispheres respectively to form the basis of whole brain simplification.
5. Time which could be defined neurologically as the relative progression of perceived events is spun into trees, our geology, history and reality by cyclic motion. Time itself fall into the definitions of convergent / divergent. The implications of this will be discussed in terms of neurological hippocampus function and how the brain creates perceptions of time within the limbic region.

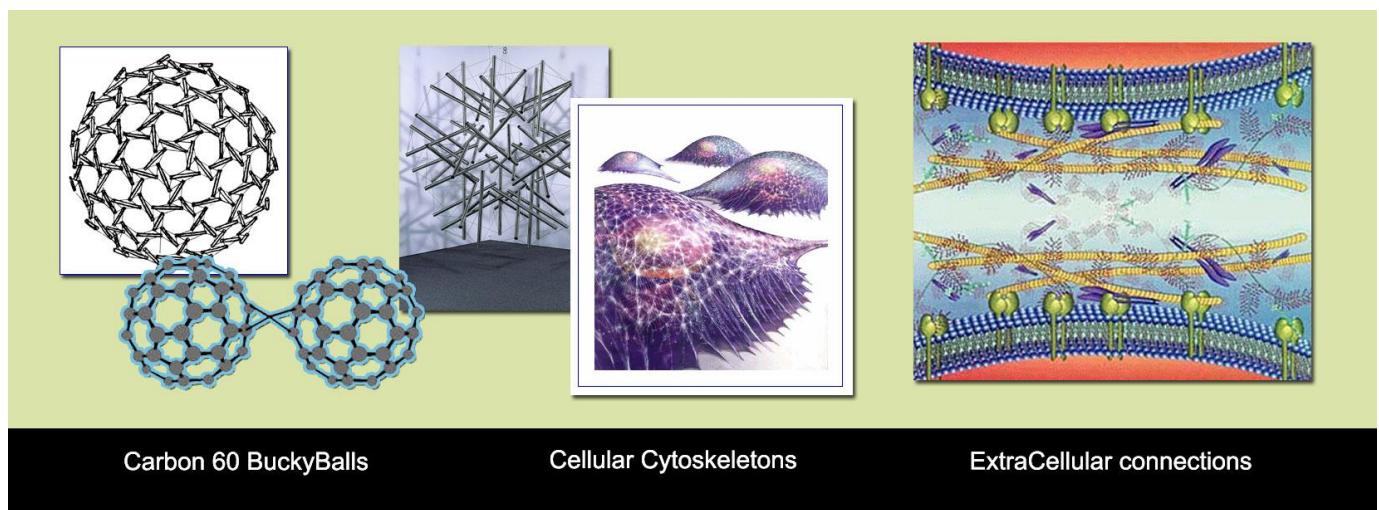
3.3 TENSEGRITY WITHIN BIOLOGICAL SYSTEMS

A following section “Hierarchy of magnitudes” deals with proposing several new levels of tensgrity within the brain. For just now science has allowed tensegrity to describe cell structure at the cellular level. (11, 32, 33)

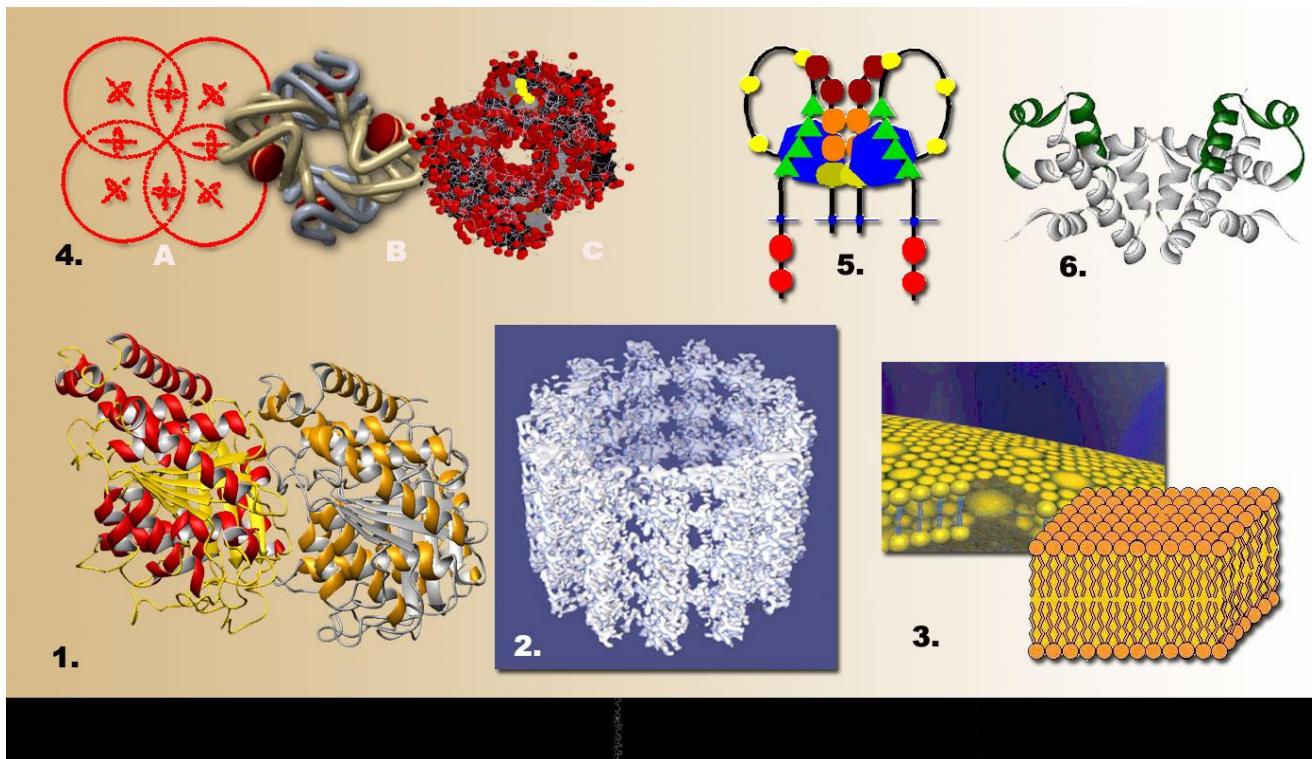
“cells respond to mechanical forces and to changes in cell shape or cytoskeletal structure by altering these same chemical activities chemistry at the molecular level and to translate this description of the cell into mathematical terms.” (11)

Tensegrity alters cell functions :

“neurotransmitter release from motor nerve terminals can be detected within 10-20 msec after cell surface integrins are mechanically stressed . Direct mechanical stress transfer across these CSK linkages also may explain the coupling between cell and nuclear shape that is observed in spreading and retracting cells ; why nuclear pores expand and nuclear transport rates increase when cells physically extend; and how changes in the distribution of mechanical stresses transmitted across integrins might redirect the axis of cell division, a process that is critical for morphogenesis of plants as well as animals. This type of "mechanical signalling" (i.e., structural coupling) could serve to coordinate, complement, and constrain slower diffusion-based chemical signalling pathways and, thus, explain in part how mechanical distortion of ECM caused by gravity, hemodynamic forces, or cell tension can change cell shape, alter nuclear functions, and switch cells between different genetic programs.” (9)



Man made Tensegrity structures set against their counterparts in nature. LEFT : The well known buckyball, represents an optimum figure of shape and structure. MIDDLE : Two examples showing how tensegrity from art applies to cellular skeleton structure. RIGHT : Closer view of the cellular skeleton tension rods.



Not everything symmetrical has tensegrity. There has to be a structural reversal or “chiral” aspect driving the tensegrity. The above diagram has examples to show highlight which have tensegrity.

(1.) Tubulin Protein is a paired Dimer protein. Even though these two proteins couple through opposite charges they do not have tensegrity, because there is not structural reversal. **(2.)** Microtubules formed from Tubulin have been proposed to be dipoles. (7,8) Microtubules cannot be considered to have tensegrity until they form the basis of a larger tensegrity system. See section “hierarchies of magnitude”. **(3.)** Cell layers formed from polarized lipids have reverse symmetry. This occurs because their water loving heads move away from each other and the water rejecting tails move towards each other. They do not have tensegrity because reversal occurs entirely due to the external environment. **(4.)** (A) Iron Quad structure first in atomic form does not appear to have a tensegrity at atomic level, but there is symmetry and very tight structure. As iron progresses in scale it reveals self similarity and structural reversal. Iron prevails through living systems due to ferromagnetic domain ordering. (*see section Introduction to dipoles*) At increasing scales : (B) Hemoglobin Protein double heterodyne (C) Red blood cell which has become toroidal. A classic dipole system quality. (*see section introduction to dipoles*). **(5, 6)** Semaphorin Heterodimers (twinned paris) play a big part in neurodevelopment. They can both push and pull growing axons towards neuron layers. Their reversing charge qualities and reverse structure would indicate these are coupled tensegrity units. (56, 61, 63, 64)

4. INTRODUCTION TO DIPOLES

What is a Dipole ?

From Wikipedia, The Free encyclopedia (115)

“ A dipole is a pair of electric charges or magnetic poles of equal magnitude but opposite polarity (opposite electronic charges), separated by some (usually small) distance. Dipoles can be characterized by their dipole moment, a vector quantity with a magnitude equal to the product of the charge or magnetic strength of one of the poles and the distance separating the two poles. The direction of the dipole moment corresponds to the direction from the negative to the positive charge or from the south to the north pole. (Because of the absence of magnetic monopoles, magnetic dipoles are actually created by current loops or by quantum-mechanical spin.) ”

Strictly speaking a dipole contains only two point charges (or magnetic poles), however various arrangements of multiple charges or currents have dipole moments and may be treated as an effective dipole. For the case of magnetic dipoles (where single magnetic monopoles do not exist naturally), the simplest dipole is a single ring of current, which will make a dipole field. **Other more complicated systems can be approximated as dipole systems mathematically, especially if the net charge is zero, but the positive and negative charges are not distributed symmetrically and the dipole field structure is the dominant one.** ”

The last statement highlighted in bold is the most important when considering a paradigm for the brain. To begin understanding a complex system which is a Dipole, a good example is our planet. Obviously it looks nothing like a brain. Primarily because the brain has a much more complicated structure, evolved from creature roots, is sealed within the skull and derives from the incredible complexity of genetics.

Some of this will be discussed in the section “spherical evolution”. Then later the brain will be proposed initially to be a linear quadrapole interacting within a dipole. The correct term might be a linear multipole. Initially for beginning it is a good idea to look into the operation of basic dipoles such as our planet.

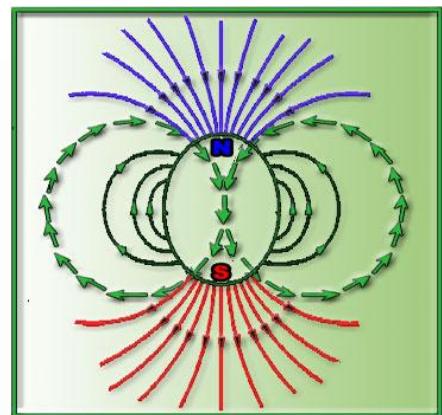
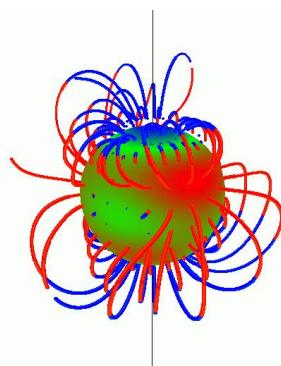
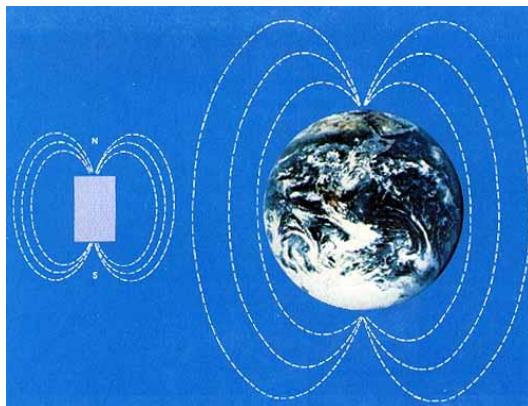
4.1 GENERATION OF EARTHS DIPOLE MAGNETISM

From HyperPhysics (116)

“ The earth's magnetic field is similar to that of a bar magnet tilted 11 degrees from the spin axis of the earth. The problem with that picture is that the Curie temperature of iron is about 770 C . The earth's core is hotter than that and therefore not magnetic. (paramagnetic) So how did the earth get its magnetic field?

Magnetic fields surround electric currents, so we surmise that circulating electric currents in the Earth's molten metallic core are the origin of the magnetic field. A current loop gives a field similar to that of the earth. The earth's magnetic field is attributed to a dynamo effect of circulating electric current, but it is not constant in direction. Although the details of the dynamo effect are not known in detail, the rotation of the Earth plays a part in generating the currents which are presumed to be the source of the magnetic field. . ”

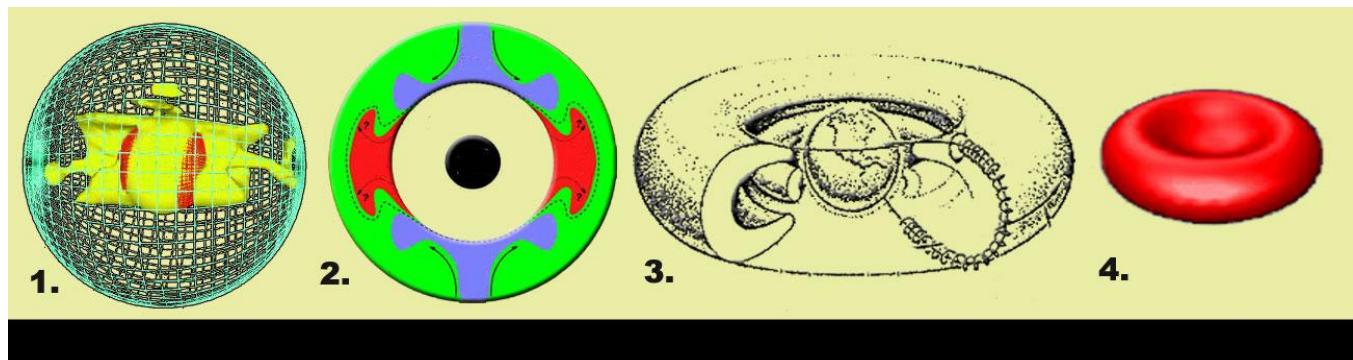
What this tells us is a Dipole field can be generated by movements of different states of iron in paramagnetic form. What kind of field would be generated if paramagnetic iron is moving against an outer crust of magnetite ? The earth does have an outer crust of magnetite. As will be shown in more detail later in this “Dipole neurology”. The brain has an alternating field paramagnetic blood circulation which flows against itself, and also next to a steady magnetite (iron oxide) outer structure. Blood / magnetite is suggested to be a superstructural system. Neurotransmission itself keys in direct energy from metals like sodium in Na K ATPase (*cellular ion pumps*) (2) Sodium itself is capable of a Dipole state. Recent experiments which try to re-create the earths dynamo generate dipole fields from spherical sodium currents. (117) These are highly unstable. The brain uses both sodium and chlorine for it's extracellular currents, which are lateralized in the right and left hemisphere respectively. (2)



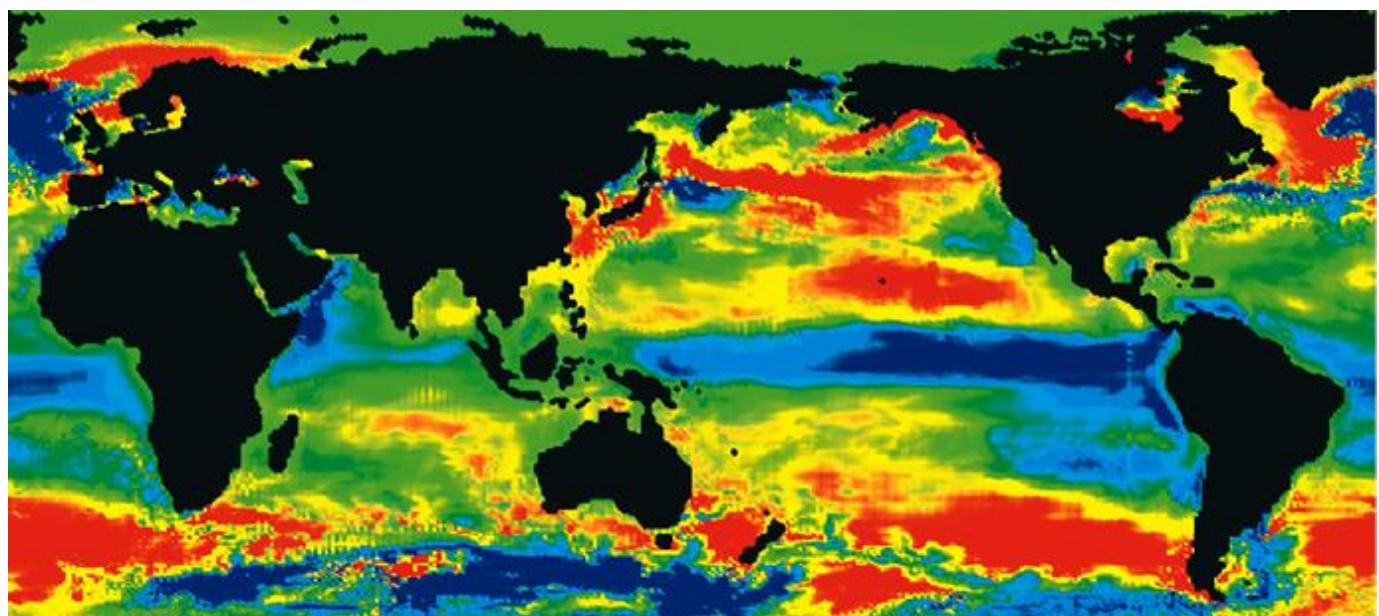
LEFT : the rectangle represents a simple ferromagnetic iron bar magnet with a North and South pole.. Most of us are familiar with this. The magnet attracts to varying degrees other magnets at their opposite poles. (like poles repel each other) The earth is also a ferromagnetic dipole, with a North and south pole. MIDDLE : The unstable dipole field from a ball filled with liquid sodium. RIGHT : image shows the basic lines illustrating the magnetic field. These are broadly similar in all dipole systems. The circular feedback round the central axis forms a tube or toroid, while the field lines at the north and south poles have branching structure. As will be shown the brain dipole has these two features of toroids and branching. at many levels. These kinds of shapes exist at all scales and are represented in the structures of many natural complex systems with different ratios of toroid to branching depending on the system itself. .

2.2 TOROIDS WITHIN AND OUTSIDE Dipoles

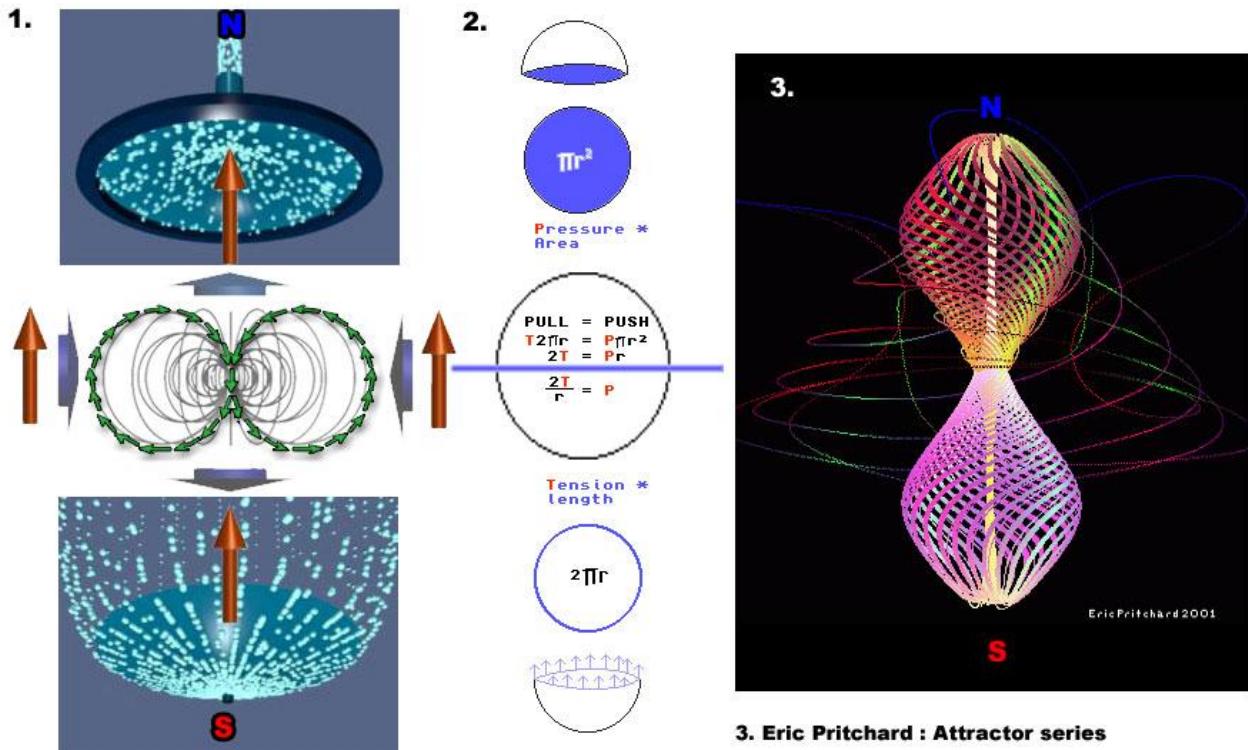
The toroid is a feature which occurs within many complex systems, but is not always visible.



1. The formation of energy zones within the toroidal space inside our planet. These computer simulations of the earths Mantle layer indicate increased liquefaction of matter round the central line. 2. This graphic by geophysicists studying the earths internal system, shows the hot system in the middle balances against the cold plates at the poles. Internally the middle zone has the profile of toroid formation seen also outside the earth in figure 3. In this the Earths ionized atmosphere consists of several toroidal layers. A representation of the inner iron core produces this Classic Donut. 4. Iron embedded in the centre of a Haemoglobin Protein creates the same donut.



Back on the planet, the effect of northward flow of energy can be clearly seen. This depiction of the amount of carbon flux between the oceans and the atmosphere (peak heights) and amount of biological activity (color). (121) highlights the result of Northward flowing energy on the earth itself. Land distribution is mainly pulled towards the north while southward are the oceans which transduce carbon flux as the energy source.



3. Eric Pritchard : Attractor series

1. Adapted from <http://evangelion.mit.edu/802TEAL3D/visualizations/guidetour/Tour.htm>2. Adapted from <http://myweb.lsbu.ac.uk/~dirt/museum/surfactant.html>

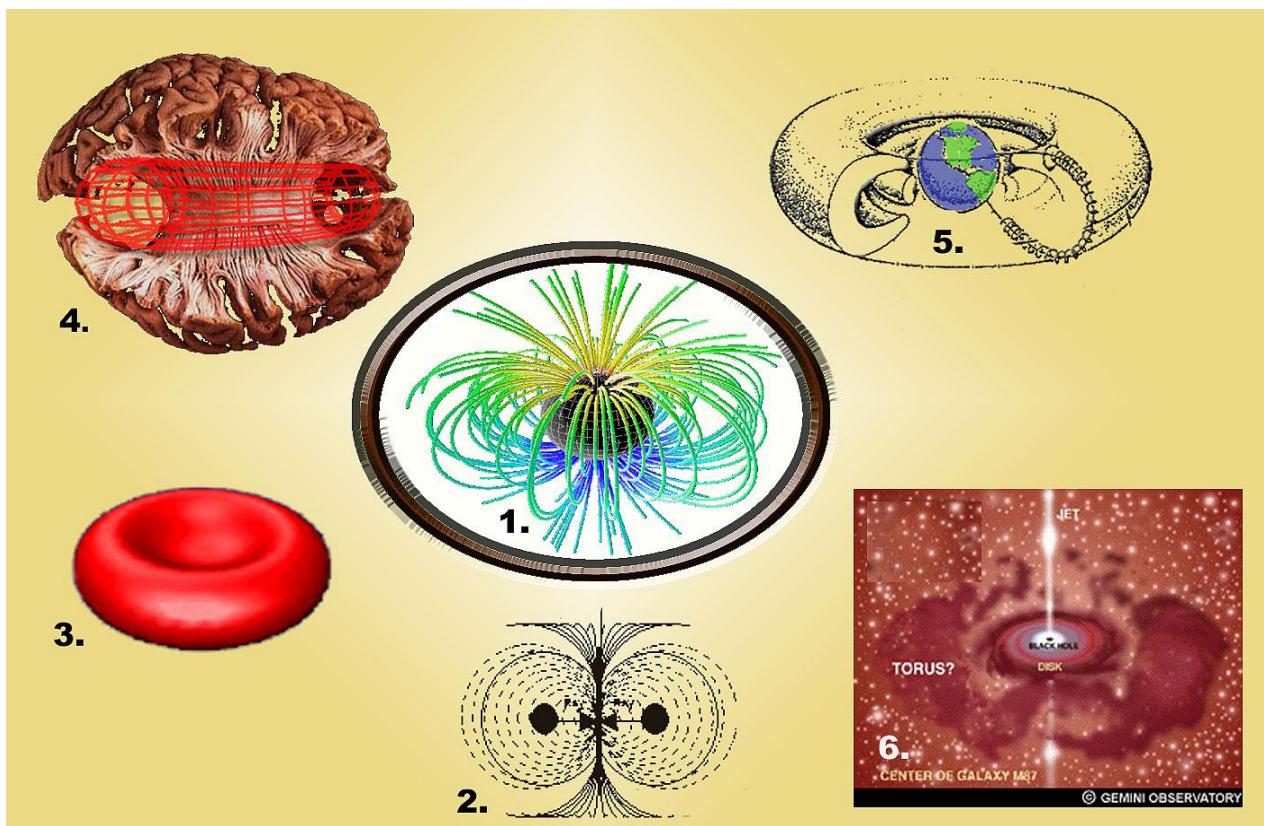
(1.) This image uses liquids to explains how flow differs between north and south poles. At the south “divergent” flow transduces the energy of that particular system, which flows to the north where the energy is stored, through geological process within land itself. As pointed out previously, most of the action takes place in the middle toroidal area, where the flow of electromagnetic energy is acted upon.

If we look at the arrow circles on the left side of this toroid, the field on that toroid is perpendicular to the outwardly pointing normal to that face, and Faraday would have said that the field on that toroid transmits a pressure perpendicular to itself. In this case, this is a push to the right, indicated by the arrows. Similarly, if we look at the circles on the right side of this toroid, the field on that face is perpendicular to the outwardly pointing normal to that face, and Faraday would again have said that the field on the left side of the toroid transmits a pressure perpendicular to itself. In this case, this is a push to the left, indicated by arrows. If the electric or magnetic field is homogeneous, this total electromagnetic force transmitted to the interior of the toroid in the left-right direction is a push to the left and an equal but opposite push to the right, and the transmitted force adds up to zero.

Similarly, if we look at the top arrow in the middle of the toroid in Figure 1, the field on that direction is parallel to the outwardly pointing normal to that face, and Faraday would have said that the field on that face transmits a tension along itself across that face. In this case, this is an upward pull, just as if we had attached a string under tension to that face, pulling upward. Similarly, if we look at the bottom arrow underneath the toroid, the field on that area is anti-parallel to the outwardly pointing normal to this area, and Faraday would again have said that the field on that area transmits a tension along itself. In this case, this is a downward pull, just as if we had attached a string to that toroid area, pulling downward. Note that this is a pull parallel to the outwardly pointing surface normal, whether the field is into the surface or out of the surface, since the pressures or tensions are proportional to the squares of the field magnitudes. If the electric or magnetic field is homogeneous, this total electromagnetic force transmitted to the interior of the toroid in the up-down direction is a pull upward plus an equal and opposite pull downward, and adds up to zero. This kind of push pull system is described as a tensegrity system. (122 adapted)

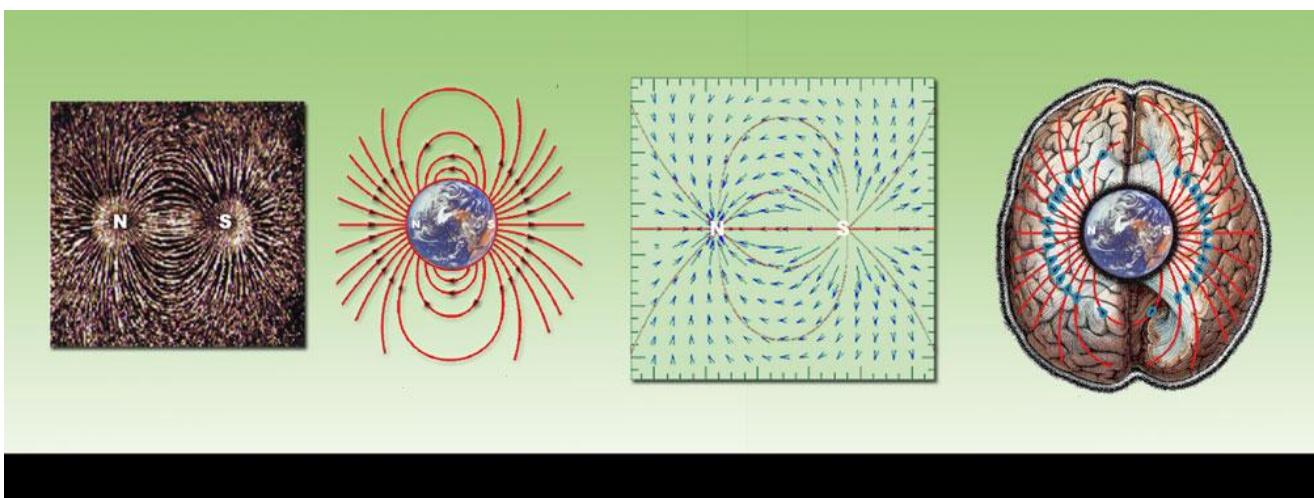
2. Geometrical proof of tensegrity in a sphere without reference to electromagnetism. Outside tension (push) versus inside pressure (pull). Once again they are opposite and cancel each other out.

3. This is an artists impression of a tensegrity system, with more focus in the “spin” interaction between “attractors” and “repellers”. Mathematical models from fractals and dielectric breakdowns exist to explain the branching structures prominent at the poles of dipole systems. What exists to explain the tensegrity in electromagnetic systems is thin on the ground. Current thinking relies heavily on attractors. Toroids themselves are described as convergent attractors. (134) The toroid would best be described as a tensegrity. It both attracts and repels.



Dipoles structure appears in every one of these complex systems

DIPOLES AT INCREASING ORDERS OF MAGNITUDE : A tour round dipoles at every scale. (1 in figure above) A classic dipole taken from an electromagnetic simulator. This reveals the poles and the toroidal midline. (2 in figure above) Dipole structure of iron atomic elements. Notice the toroids and poles which are branch like. (3 in figure above) The blood cell is protein structured round iron. No surprise it represents a toroid due to all the magnetic substance being in the centre, in a similar way to the ionosphere of the earth. (5 in figure above) The brain itself. with superferromagnetic iron surrounding it, and paramagnetic blood through it. The polar branching and midline toroid are visible. Toroidal aspect is looked at properly in section 2 (1). (5 in figure above) New evidence that galaxies have dipole structures.



DIPOLE APPLICATION TO BRAIN SYSTEMS : From left to right. The bar magnet when put in proximity of iron fillings, reveals the magnetic of “flux” lines. Both North and South poles appear symmetrical. Next magnetic lines of our planet. Next : This grid of arrows indicate the direction of ion flow. Notice the difference. This is the hidden reversal within dipoles. North pulls and south pushes. RIGHT : Flux lines from previous example, overlay and match the axons fibres of the brain.

5 THE SPLIT BRAIN AS A CONVERGENT / DIVERGENT SYSTEM

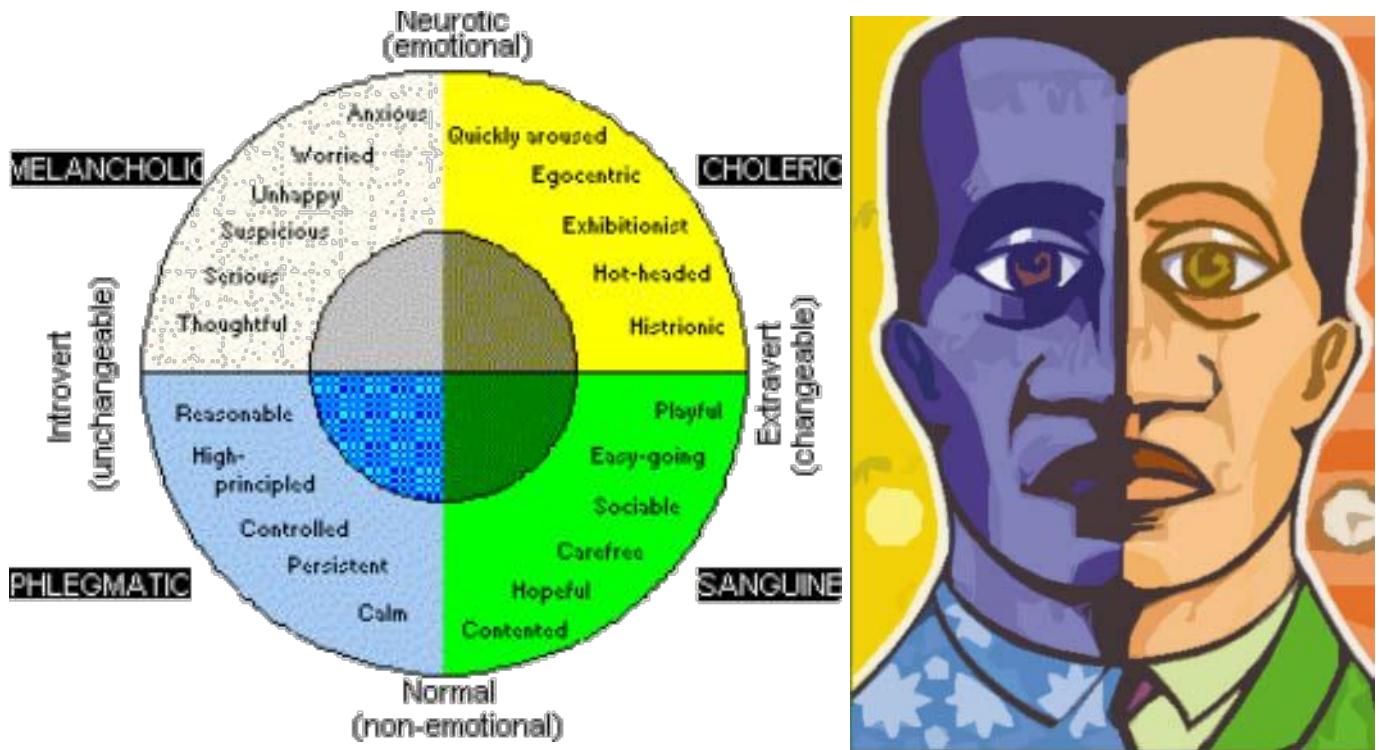
When reviewing the research in the area such as Neurobehavioral, Neural mapping and Neurobiology there is a definite quality to each hemisphere which could best be described as Convergent process in the left hemisphere and Divergent process in the right

This paper sets out a different route to explain Neural Dichotomy based on a system theory that the whole brain volume itself is an electrochemical Dipole by :

1. Discussing what research has found out about lateralized behaviour so far, and propose they fit the definitions of a push pull system.
2. Showing similarities of the brains whole volume structure with modern physical electromagnetic models.
3. A look at structural aspects and current theories.
4. Exploring ideas for how the brain could generate a dipole field from a magnetite ferrofluid layer.

5.1 DICHOTIC NEUROPSYCHOLOGY

. Many academic theories and models exist to categorise dichotomies (contradicting opposites) in human process and behaviour. A simplified model by the renowned Hans Esenky was four pole consisting of introversion, extraversion, emotionally stable and emotionally unstable.



An even more basic method is used here. The reasons will be apparent later. Neurology based personality factors will be initially classed either convergent or divergent, if they can be.

Bias Factor	Convergent	Divergent
Hormone effect on brain structure (pre-natal)	Male brain processing (Grey matter and neuron soma biased)	Female brain processing (white matter and neuron dendrite biased)
Hormones (circulating)	Testosterone (DHT)	Estrogen (Progesterone)
Co-Transmitter profile	Dopamine biased	Serotonin biased
Pre-frontal Lateralization (thinking style)	Left lateralized (gaba)	Right lateralized (glutamate)

Initial research in this series of reviews finds that neurotransmitter receptors : major (gaba, glutamate) and minor (dopamine, serotonin) are convergent / divergent systems lateralized in the left and right hemispheres respectively. (2,3) Hormones appear to be lateralized in the opposite hemisphere expected. (*L laterality of sex hormones is a current work in progress*) For that reason it will just be proposed that hormones have either convergent or divergent results.

5.2 NEUROLOGY REALISES THE SPLIT PERSONALITY

In 1970's Roger Sperry a Neurosurgeon treating epilepsy had to perform an operation which involved cutting the connections between the two sides of the brain. A Cerebral Calossal Commissurotomy and also a WADA Procedure (*closing of blood flow to one brain hemisphere*). Previously unseen and completely opposite human neurological cognition were observed from the left and right sides of the brain. The left brain was observed to be cool, logical and detached while the right brain was emotional, creative and expressive. The left and right brain behaviours have correlations which match Esenyk's introversion, stability / extraversion, instability components.

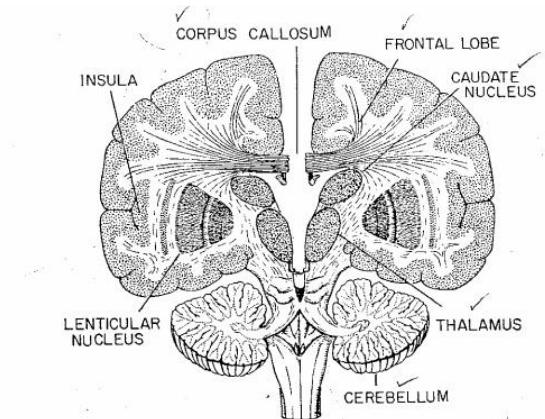
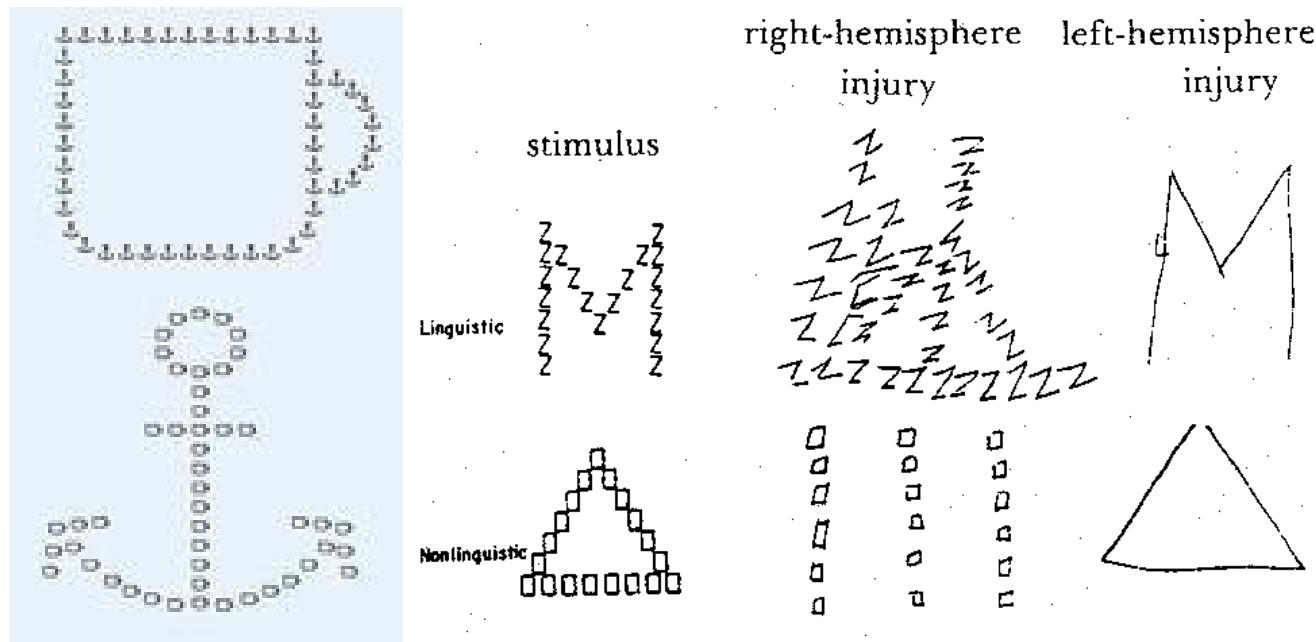


FIG. 2. Cross section of bisected primate brain, schematic.

Left : Looking at the cross section there is no obvious indication of anything which could cause such deep personality differences in each side. Right : Illustration of a Cerebral Calossal Commissurotomy

Epilepsy Patients who lost use of their whole left hemisphere during a WADA suddenly became overawed with negative emotion. A divergent expression of their new chaotic mental state ? The left hemisphere is the side of order and neural structure. Taking it away from a person throws them into sudden cognitive chaos.



LEFT : Navons are used to determine hemisphere dominance. Left hemisphere looks at the anchors which form the cup and right hemisphere looks at the anchor. (230) RIGHT : From roger sperry epilepsy research. When the right hemisphere is damaged patients only drew the components of the navon. When the left hemisphere is damaged patients drew the overall shape of the navon.

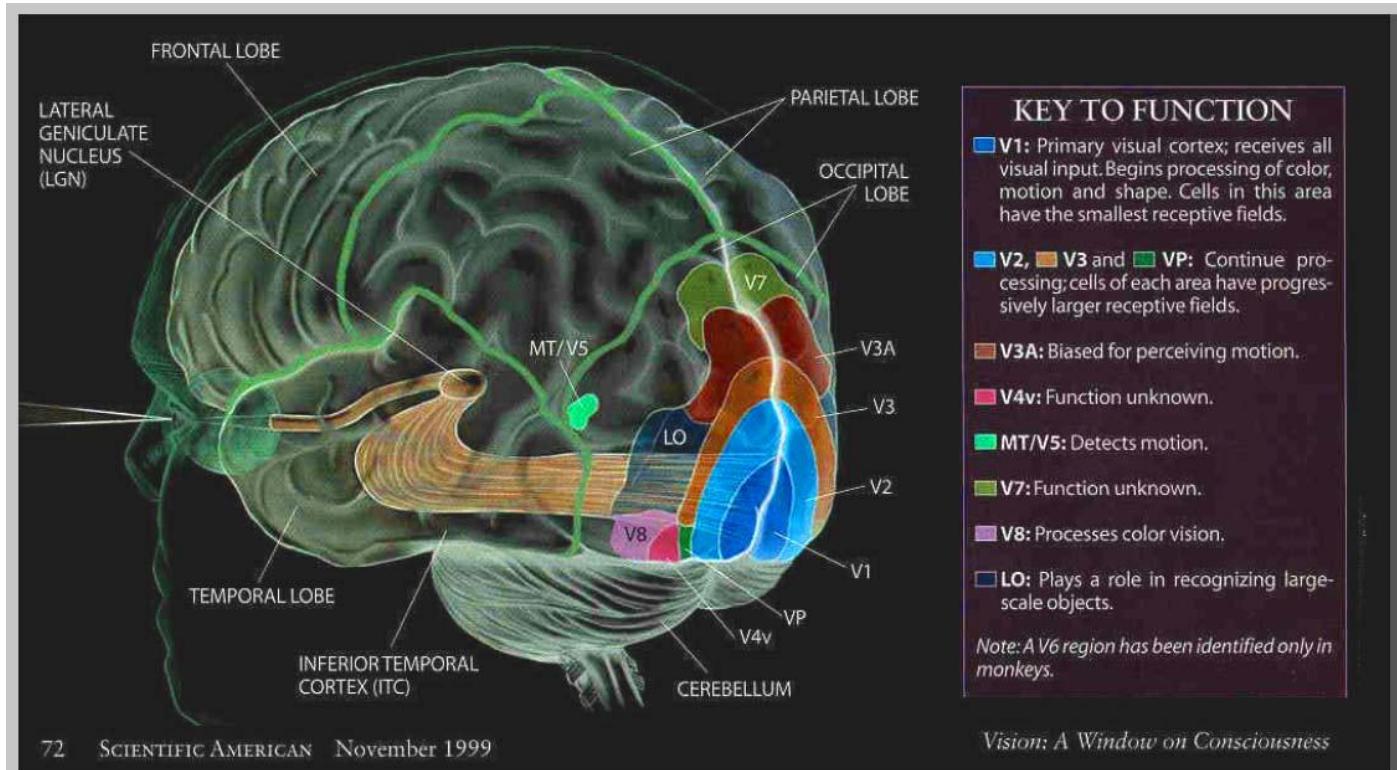


Chaotic attractor patterns emerge within a tank of oil after a steel rod is pulled out. (*simulated image*) As will be shown later left hemisphere has the convergent structure, which would define it as an attractor.

The same WADA procedure shutting down the right hemisphere elicits consolidating type response, dysphoric and denying any loss of faculty by the patient even though 50% of mental processing has been lost. This is typical of the business like left brain. It is self referential. Disconnection of the ever changing needs of the right hemisphere is an opportunity to revert to and state its previous position. Perhaps what remains in the left hemisphere is the encoded pattern of previous experience, and the indexed rhetoric which states clearly what that is. It's this prevalence of the left hemisphere for stating encoded facts that puts its neural dimensions firmly in the past, and in these extremes unaware of change. There is no mental construct in place to recall what would be different about the current situation from its previous state.

6 LATERALIZATION OF SENSES AND MEMORY

6.1 VISUAL LATERALIZATION



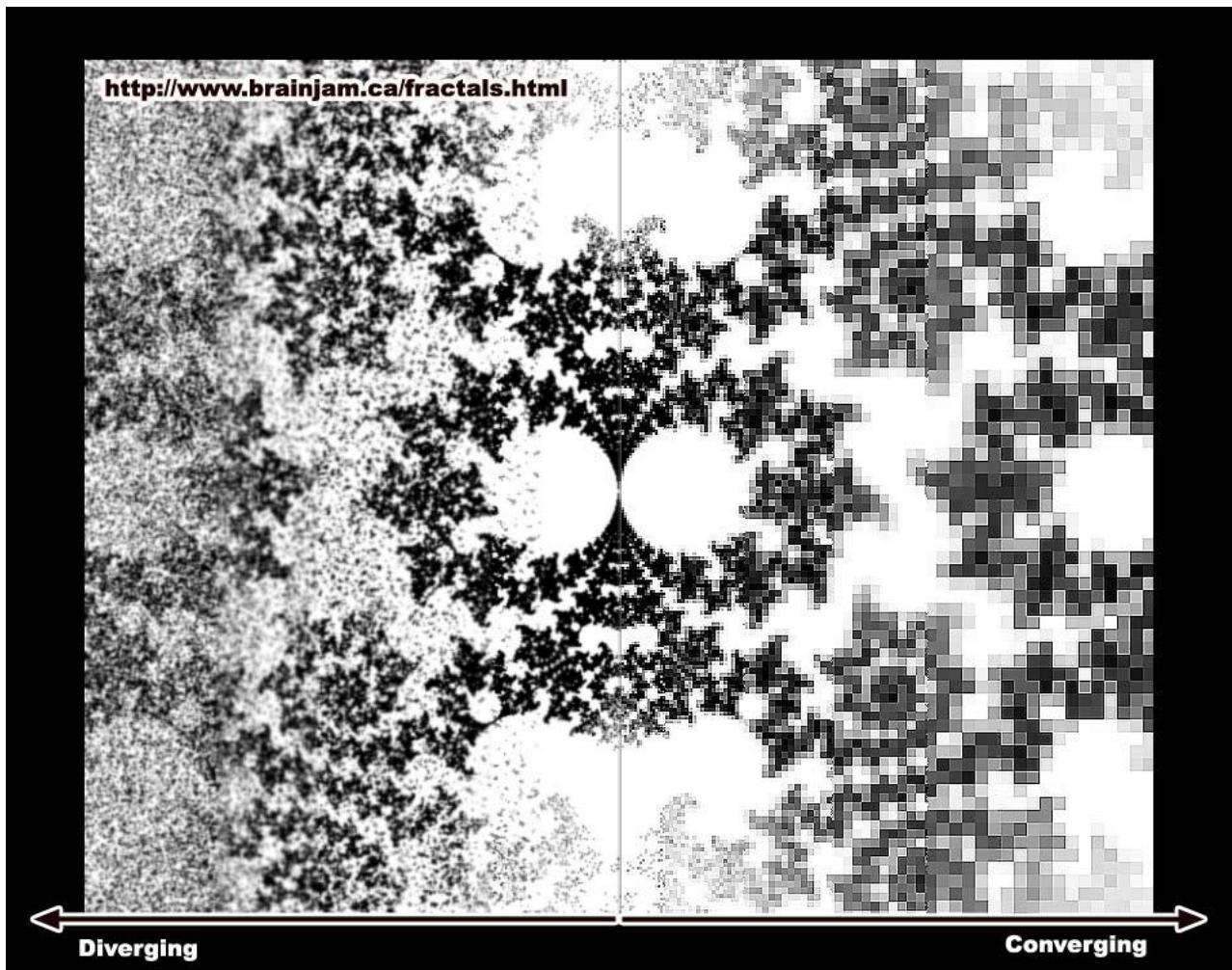
The visual system is an example of the most intense division of labour between hemispheres. The example above is very much simplified. Decoding the visual system has been taken a great deal of work. For the scale of research there has not been a great deal published on the obvious lateral differences compared to other regions such as audio processing.

One reason is due to division of labour itself. The other is of increased lateralization heading outwards towards the planum temporale. (auditory regions) The reasons for this are dealt with in the follow up to this paper (1).

The connections between the hemispheres are few in comparison to the wiring within each side. Decoding and dealing with visual information requires so much breaking down that layer IV spiny stellate cells take up 3 more layers than usual and unusually cross the corpus callosum. (239) In the pre-frontal areas on the opposite side, it has been found that complicated tasks bring into play more cross hemisphere connections.

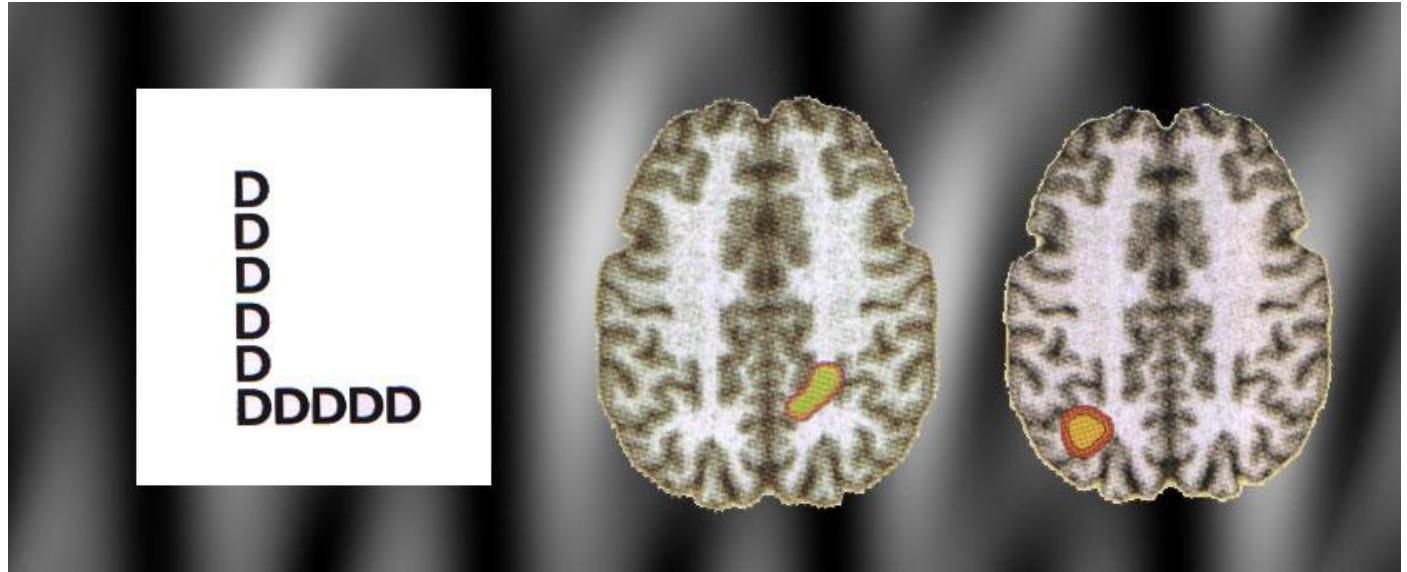
"successful encoding with the hard concurrent task was supported by a subset of the regions recruited for successful encoding with the easy task. The neural processes recruited for successful retrieval also depended on the encoding condition: The left PFC was disproportionately recruited for retrieval of items encoded with the easy task, whereas the right PFC was disproportionately recruited for retrieval of items encoded with the hard task"

This should result in increased heterogeneous structure on either side. This is proposed to be due to inherent crossing over which occurs at the midline of electromagnetic systems. (1)



Symmetrical image treated with opposite kinds of processing, increasing in intensity from the midline out. Diverging would equate to the right side of the brain, and converging the left. At the diverging side noise increases while the image retains shape integrity. At the converging side clarity increases as the image increases the lines themselves.

This kind of processing division has been seen in the visual perceptions of navons. Images which can give reverse results to the same question.



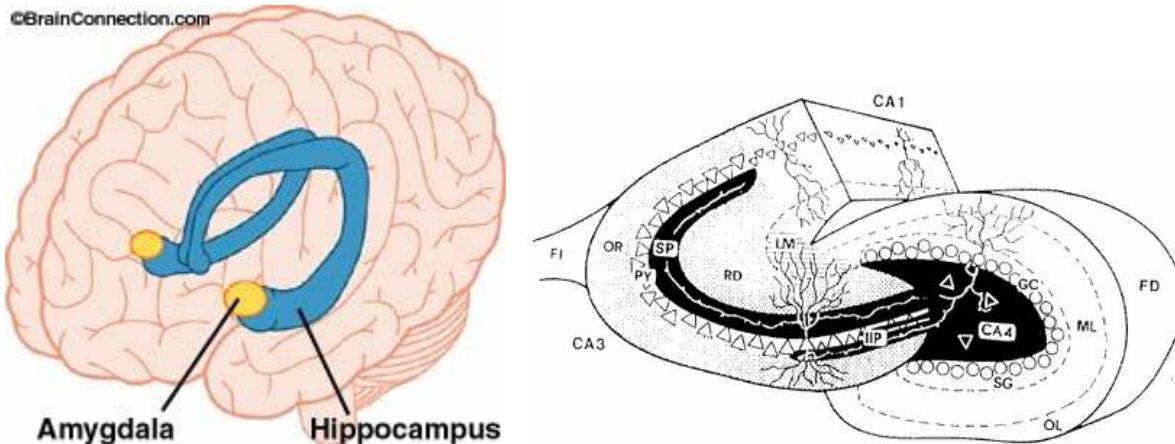
In the example above, the right hemisphere lit up when subjects concentrated on reading “L” and the left hemisphere lit up when concentrating on “D” (227)

“high-level regions known to be crucial for directing the brain's attention—the inferior parietal cortex and its junction with the temporal cortex--fired every time attention switched between local and global features. But they also found flurries of activity at lower levels of the visual cortex--areas known as V2 and V3. These areas on the right side glowed with the effort of seeing the global picture, and the left- side equivalents fired when the demand was to concentrate on local shapes.” (230)

The areas used by the visual system are also farther out from the midline than the main processing regions.

6.2 HIPPOCAMPUS LATERALIZATION OF MEMORY

"The hippocampus is a part of the brain located inside the temporal lobe (humans have two hippocampi, one in each side of the brain). It forms a part of the limbic system and plays a part in memory and navigation. The name derives from its curved shape, which supposedly resembles that of a seahorse (Greek: hippocampus)". (241)



LEFT : Hippocampus is a loop which ends at the emotional amygdala. RIGHT : Cross section of the hippocampus shows the coiling. This is proposed as due to interaction of two magnetic fields. (1)

The same reverse symmetry exists when looking at the hippocampal area as the rest of the brain. hippocampal horns coil inwards in opposite directions in each hemisphere. According to one idea from the dipole model which will be set out later. (1) Electromagnetism tries to fulfil a sphere, which receives maximum frustration at the jaw area. This set up an evolutionary opportunity for cortical layering that has became utilized for long term memory, by two interacting magnetic fields. (1)

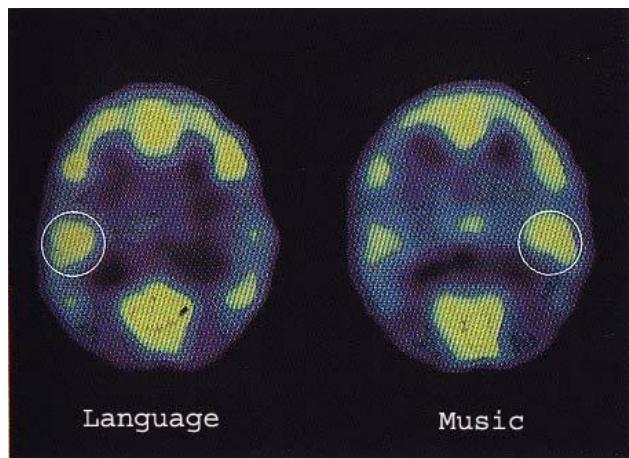
For the purposes if this section it is just enough to point out that the left and right hippocampus split processing between local and global processing respectively.

*"The results suggest separate mechanisms for dealing with spatial reorientation problems, with the right hemisphere taking charge of large-scale geometry of the environment and with both hemispheres taking charge of local, nongeometric cues when available in isolation, but with a predominance of the left hemisphere when competition between geometric (**whole environment**) and nongeometric (**marked features**) information occurs." (232)*

*"(PET) was used to examine the neural substrates of topographical (**whole scene plan view**) memory retrieval in licensed London taxi drivers of many years experience while they recalled complex routes around the city. Compared with baseline and other nontopographical memory tasks, this resulted in activation of a network of brain regions, including the right hippocampus. Recall of famous landmarks (**marked features**) for which subjects had no knowledge of their location within a spatial framework activated similar regions, except for the right hippocampus." (231)*

6.3 HEMISPHERIC DIFFERENCES IN AUDIO PROCESSING

Almost every region of processing has a reverse opposite hemisphere mirror image. What happens in the hearing part of the brain shows this opposite nature quite clearly. Neural context from the ears enters the auditory regions, and once again the reverse differences happen in their mirrored regions.



Left : Hemispheric differences in audio processing Right: Music allows many people to “sound off” in parallel.

With language in the left hemisphere and music in the right. (227) For language sound is compressed, channelled and indexed in sequenced last in first out. Language develops in a hierarchical manner.

“Perhaps the most cited hemispheric difference that might be related to the various microanatomical asymmetries is the better ability of the left hemisphere to process temporal (time based) information. The suggestion of a temporal processing asymmetry has been documented in visual, auditory and tactile tasks [35,36]. Language, which typically relies on a serial stream of auditory information, might require such specialized abilities because timing appears to play such an important role in language comprehension.” (66)

Music would require a more divergent network to layer 3 dimensional pictures of a whole harmonically moving soundscape. The right brain is the side of spatial, fuzzy whole pictures. The auditory hemispheres more than any other region, don't just process local or global features in an opposite manner, they prefer to process totally opposite kinds of information. The right hemisphere does contribute it's musical abilities towards language processing.

“even in highly lateralized subjects, some aspects of linguistic function, such as processing the prosaic, emotional, and melodic aspects of language, are thought to be performed by the non-dominant hemisphere. Rather than processing the literal meanings of words, the right hemisphere is thought to interpret the figurative meanings in language, conveyed by humor, metaphor, as well as hesitations and tone of voice.” (72)

The reasons for the differences in processing are in neuron structures. Most research in the auditory regions is concerned with the language hemisphere. This studies the columns where grey matter neurons reside.

“the presence of a greater number of differently tuned macrocolumnar systems in the left posterior language cortex would allow for more distinctly tuned systems, which could analyze the incoming information on a finer scale than on the right side.” (66)

“The separation of connectivity in both column types could be an important advantage of the left hemisphere for extracting crucial temporal information from the incoming stream of auditory inputs and, thus, analyzing these inputs under different conditions than the right hemisphere”. (66)

6.4 TABLE SUMMARY OF REVIEW OF BRAIN REGIONS

LEFT HEMISPHERE / CONVERGENT	RIGHT HEMISPHERE / DIVERGENT
Left Hippocampus	Right hippocampus
Landmark information (232)	Whole scene information (231, 232)
V2, V3 Left visual cortex	V2, V3 Left visual cortex
Local shapes (230)	Global picture (230)
Left hemisphere	Right frontal lobe
Perceives vocal expression (234) Processes analytically (227)	Perceives facial expression (234) Processes conceptually (227)
Left auditory cortex	Right auditory cortex
Language (227)	Music (227)

WHAT IS THE QUESTION THAT NEEDS ANSWERED ?

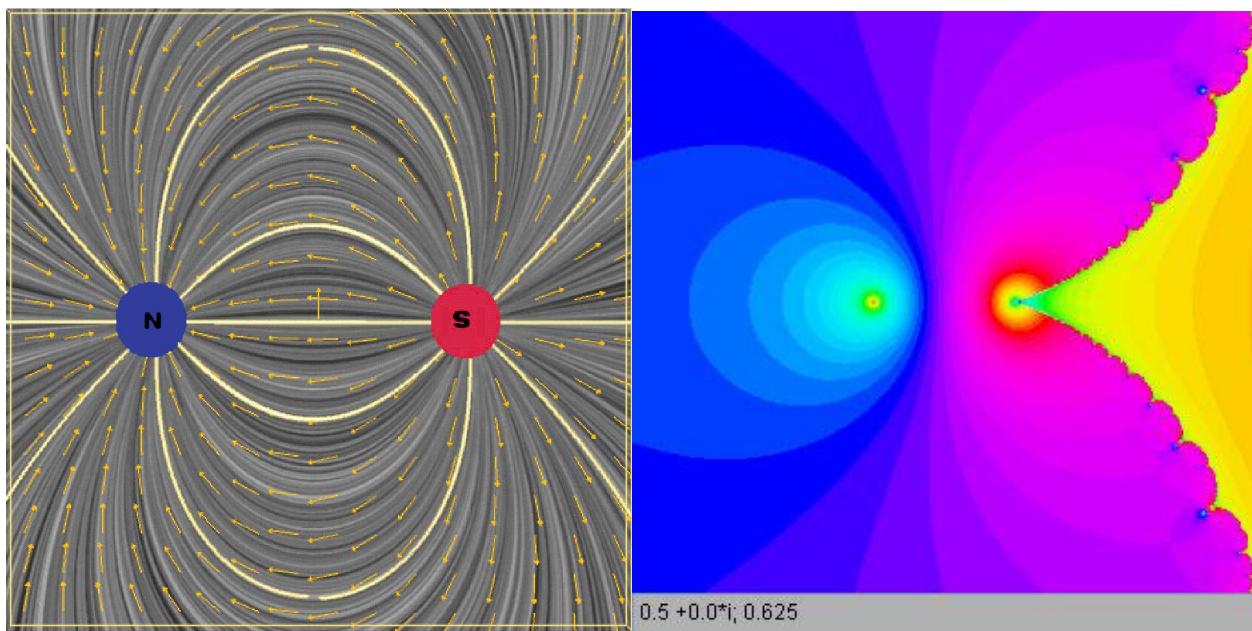
Having briefly sketched out some of the aspects which hopefully illustrate the hemispheres as convergent / divergent the **big question is why**. An entire scientific journal has been published for over a decade and a university dept in Melbourne is dedicated to the subject of lateralization. The subject of why and how appears like a mystery. The next chapter begins by introducing field reversals from electromagnetism and looking for reversals in brain structure itself.

7 DIPOLES AND BRAIN STRUCTURE

7.1 DIPOLE MAGNETISM IS PUSH / PULL IN NATURE

To understand the complex system dominated by polar opposites it's helpful to look at the simple one and see if the features of the simple system match the main features of the complex one.

With the iron dipole bar magnet iron filings jump round each pole forcefully. These give the impression of a mirror image in force taking place. When the underlying physics of attraction and push pull relationships are investigated then the North Pole of the magnet is doing all the pulling, or is the South Pole doing all the pushing starting with the expended flow from the North ? Neither begins the process. With the magnet experiment like the brain we cannot see it is a convergent / divergent electromagnetic system. These aspects of the system are hidden until a current is induced and we can see the movement of the field lines in motion. This is similar to what happened in neurological history. Early neurological dissections noticed the mirror image hemispheres and philosophers like Descartes commented on it. It wasn't until Roger Sperry performed Commissurotomy in the 1970's that the hemispheres were seen in motion separately.



North and south poles showing the flow of electromagnetic energy. South pushes out and north pulls in. RIGHT : A mathematical tangent plot for reverse tangents (tangents define dipole fields mathematically.) (1)

7.1.1 DIPOLE ENDS OF FIELD HAVE OPPOSITE EFFECTS ON BIOLOGICAL SYSTEM.

Modern physics does now teach these differences in magnetism. The unrecognised founders who spent their life researching this were largely ignored by science. Their lives work and books, are well recognised thanks to internet. According to the researches of Albert Roy Davis and Walter Rawls a magnet has two effects on the living system, "two pole effect" (226) each reverse opposite and supplied by the two forms of energy from each pole.

"North Pole energies cause mass to contract and condense, rotating in a CCW direction, while South Pole energies cause mass to expand and dissipate, rotating in a CW direction. Also, North Pole energies have alkaline properties while South Pole energy is acid. North pole energies tend to collect fluids while South Pole energies dissipate fluids. North Pole energy is referred to as negative because it reduces or attracts, while South Pole energy is referred to as positive because it expands and dissipates. "(226)

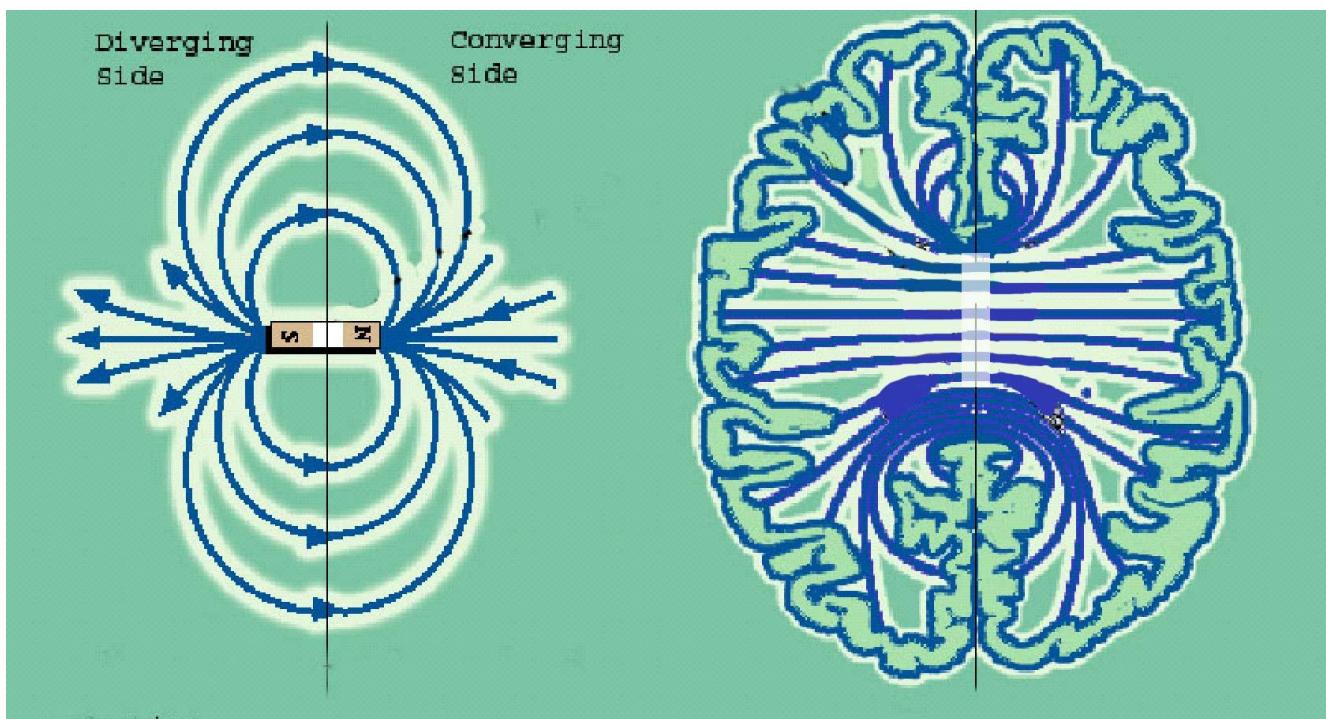
Experiments involved growing plants and incubating bird's eggs at each end of large magnets. Birds hatched at the North Pole grew to be more efficient and reliable in flight patterns. Birds hatched at the South Pole were sporadic and expended greater energies. Would North pole born chick be a left brain dominant bird : Efficient reliable,

always hitting landmarks. Would the south pole born chick be a right brain dominant bird : sporadic and expended greater energies as it wastes energy trying to navigate through scenic snapshots with a great deal of room for error.

This planet wide reverse energy could relate to studies on behaviours within human North, South and equatorial populations. Apart from that it's not suggested here that the earth's poles are presently related directly to the brain. The point is to make clear the nature of the two opposite types of energy which exist due to magnetism

7.2 BRAIN IS A DIPOLE

The brain is a complex DNA built dipole. Hopefully these four papers will make this clear. To begin with a diagram to show how brain wiring is very much like magnetic field lines.



Left. A bar magnet, illustrating the flow of energy. The white gap in the middle is a "bloch" wall. A point where the magnetic field reverses. Right. A top down diagram of brain connectivity from a medical textbook. The white rectangle is the corpus callosum. This has all the features of a bloch wall (1).

How many similar features can you spot between the two systems ? The south pole of the magnet would equate to the right side of the brain. The field lines are similar, but the brain sealed in a skull alters them. The longitudinal midline, breaks through the lines. Looking at this view gives the same problem facing neurologists. There is no evidence that one side has a different structure. The issues only arise, when considering how the previously discussed divergent / convergent hemispheres match the qualities of the reverse opposite magnetic energies.

7.3 NEUROLOGICAL CORRELATES OF MAGNETIC FIELD REVERSAL

The first place to look for a dipole field reversal is neurons themselves. This has already been covered for neuron chemistry. (2, 3) Here evidence will be looked at for differences in neuronal structures between hemispheres. The biggest difference is that, overall for the whole brain, there is more gray matter relative to white matter in the left hemisphere than in the right. (69) This would support some level of field reversal. Neuron bodies themselves could be described as a computation of converging inputs, as well as spreading this information throughout the network. Axons are purely to spread and connect information. Approx 90% of cortical axons interconnect regions within each hemisphere (229)

“Lateral thinking” would be helped.., by the neural arrangement in the right brain – the sideways extension of axons even makes the phrase literal rather than figurative. The left brain by contrast is more densely woven. The closely packed, tightly connected neurons are better equipped to do intense, detailed work that depends on close and quick c-operation between similarly dedicated brain cells” (227)

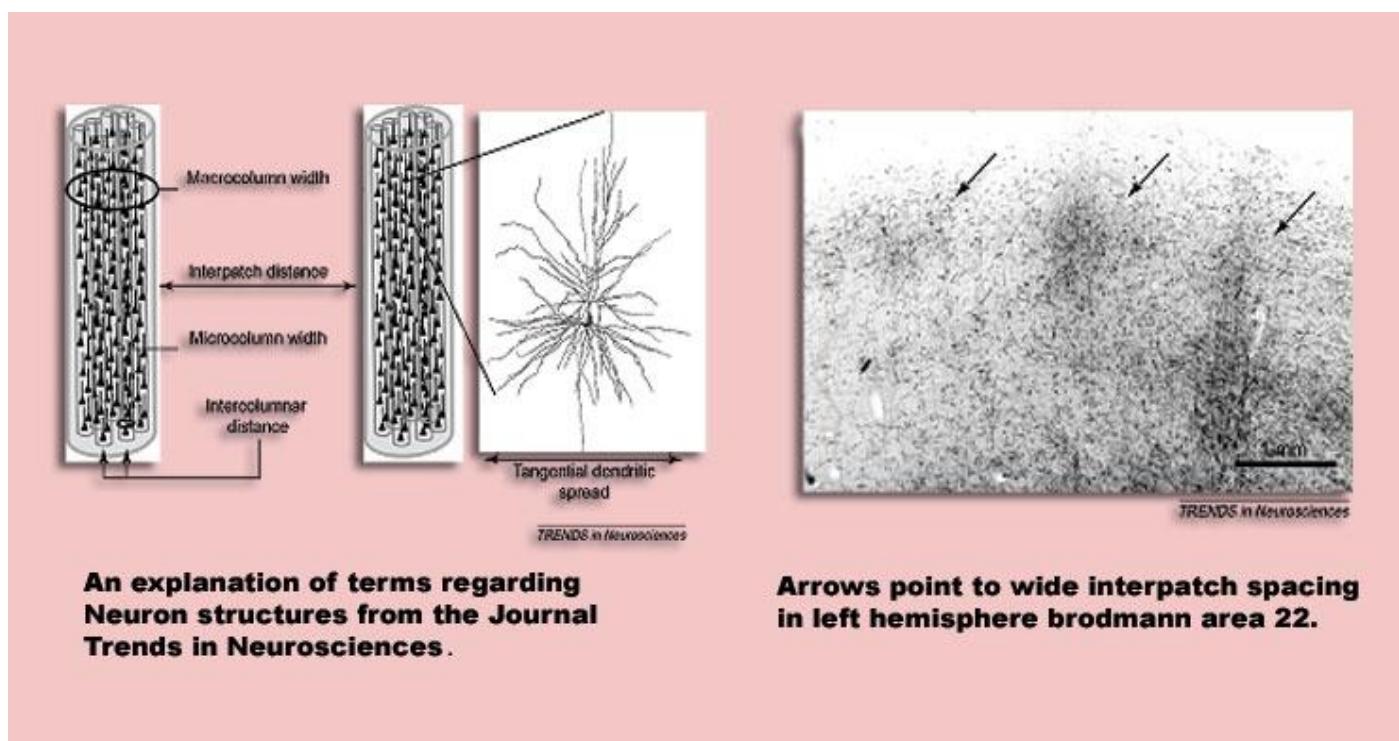
7.4 CORTICAL COLUMNS

Detailed analysis of differences between hemisphere networks requires knowing the intrinsic structures to each side. Neurons in grey matter point outwardly to the brain surface in straight columns. This is called a laminar, mini or microcolumn (42) Microcolumns appear in grey matter as “patches” within different layers. As do macrocolumns which are aggregations of up to 80 microcolumns (66) (see digram below for images of terms)

The left hemisphere has a greater number of “selectively” interconnected macrocolumns than the right. (66) Also the spacing of the interconnected clusters (interpatch) of neurons is significantly larger in the left, even though the clusters themselves have the same size in both hemispheres. (66) Pyramidal cells are larger and greater in number in those left hemisphere regions studied. (66) As are their higher order dendrites. (72)

“Individual pyramidal cells in each hemisphere contact a different number of adjacent cell columns. In the left hemisphere, this asymmetry results in a smaller number of interconnected columns than in the right, and it has been suggested that this might indicate a more elaborate and less redundant pattern of local processing architecture in the left hemisphere. This, in turn, might give rise to an improved separation of the local processing streams.....The separation of connectivity in both column types could be an important advantage of the left hemisphere for extracting crucial temporal information from the incoming stream of auditory inputs and, thus, analyzing these inputs under different conditions than the right hemisphere.” (66)

The reverse for this is true in the right. The reason would be that lower order dendrites from spiny stellate cells, which link together information within sensory areas, (195) are longer in the right hemisphere. (72)



Research in lateralization of neuron structures, is focussed on the audio and language areas for obvious medical reasons. The general view is that language is held up as prize of human achievement and a genetically selected for specially evolved brain regions. The argument has also been made that language is innate to many kinds of mammals, and these defy any kind of evolutionary specialization.

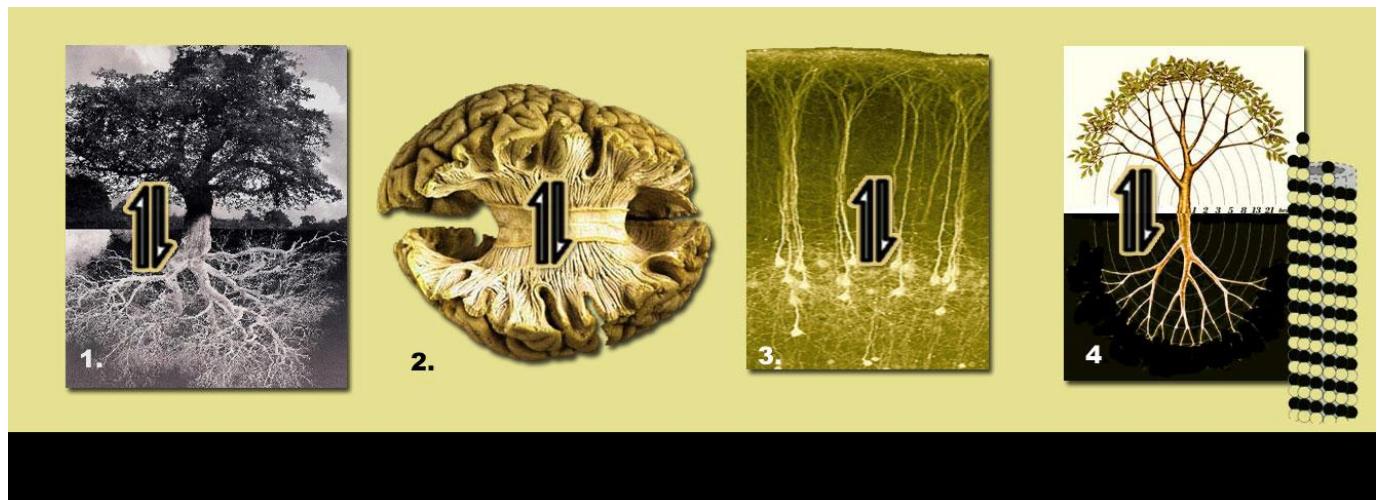
"This evolutionary expansion is believed to be important to the emergence of human language and other high-order cognitive functions, yet its genetic basis remains unknown..... A German border collie has surprised scientists with his 200-word vocabulary and uncanny knack for learning new words, shedding light on the evolution of language. 9-year-old Rico knows the names of each toy in his hundred-strong collection and can retrieve items called out to him with over 90% accuracyref1, ref2. He can also learn and remember the names of unfamiliar toys after just one encounter, putting him on a par with a 3-year-old child. But canines' ability to comprehend speech can only have manifested itself after they were domesticated, some 15,000 years ago, and human speech is thought to have evolved 100,000 to 200,000 years ago : the ability to match novel words and items has evolved twice, first in humans and then in dogs." (214)

Is language processing evolved, or intrinsically a representation of a convergent network processing audio information ? In spite of these arguments Looking at these neuroscience investigation of hemisphere differences, shows there are greater densities of neuron cluster in left hemisphere microcolumn. Interpatch distances between those functional macrocolumns exist in relation to their mirrored regions on the right. The scant evidence appears conclusive. Tangential grey matter structure exists in the right hemisphere, and focussed clustered structures in the left. The clear evidence for the left hemisphere, correlates with the results for the neurotransmitters, (2,3) in which clearer evidence exists within the left hemisphere than the right. That is to say that the digital left hemisphere favours description in clearer terms than the analogue right. (3)

8 THE CONCEPT OF “AXIALLY ALIGNED HIERARCHIES OF MAGNITUDE”

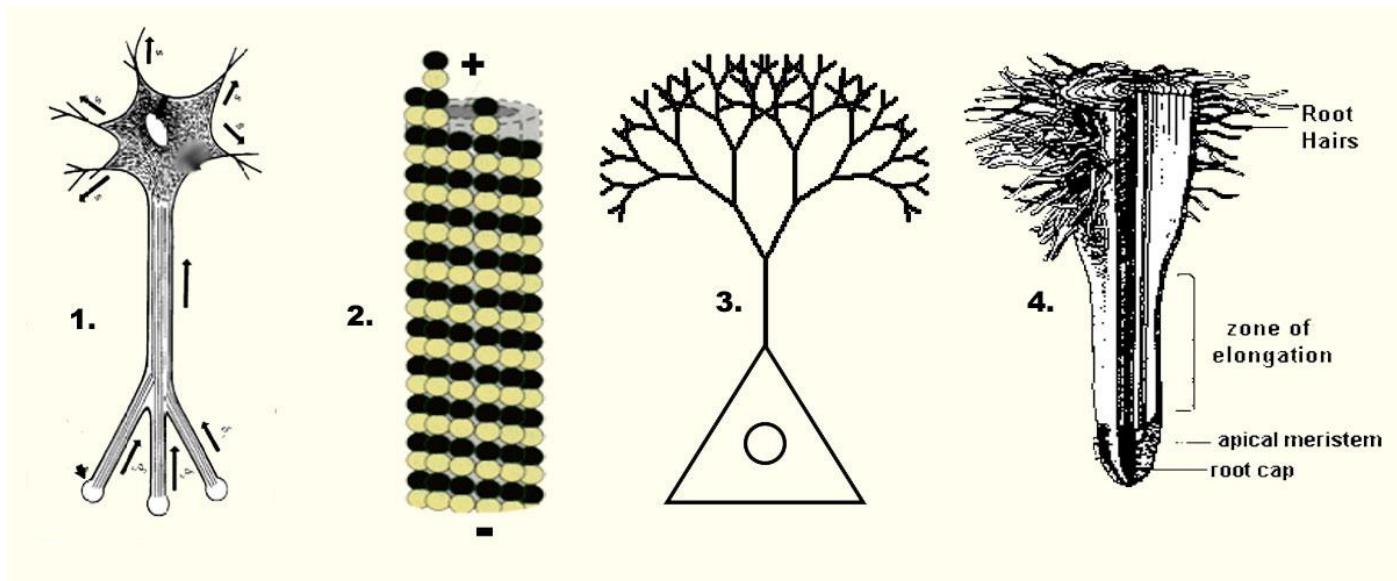
The concept of “axially aligned levels” as the basis of whole system integration, arose while looking through all the brain levels. Ions, microtubules, neurons, cortical columns and the whole brain have a similar tree type tensegrity. Each of these levels is aligned in space and responsive in time to the polarization and mechanical energy of the bigger components as the hierarchy of scale of increases.

For example a single laminar column is under a two way anisotropic influence. (directionally dependent growth) A top down “Hierarchy of influence” balances against the demands of the bottom layers which are laden with larger neuron heavy thalamic grounded connections. (42) The top cortical layer is almost completely dedicated to intercortical connection. The middle ground is occupied by inhibitory neurons, providing tension or pull. Upper layer dendrites can send signals downwards to the distal inputs (top peak) of the pyramid cell. The higher up the columns the dendrite signals are located, the greater the amplification by calcium wave propagation, resulting in an increased signal level to the lower layer Pyramid neurons. (44) The column has the structural and visual features of a tensegrity system. (see 3 in figure below)



The tree (fig 1) is a reminder of the basic analogy behind whole brain structure. Roots in the tree look similar to their branches. Looked at in action, their function is to pull nutrition and keep firm ground while branches serve to interact with the environment through energy transformation and spreading of seeds. Brain (fig 2) has the right hemisphere top as an analogy to the branches of the tree. The left hemisphere is the roots. Processing of reality is

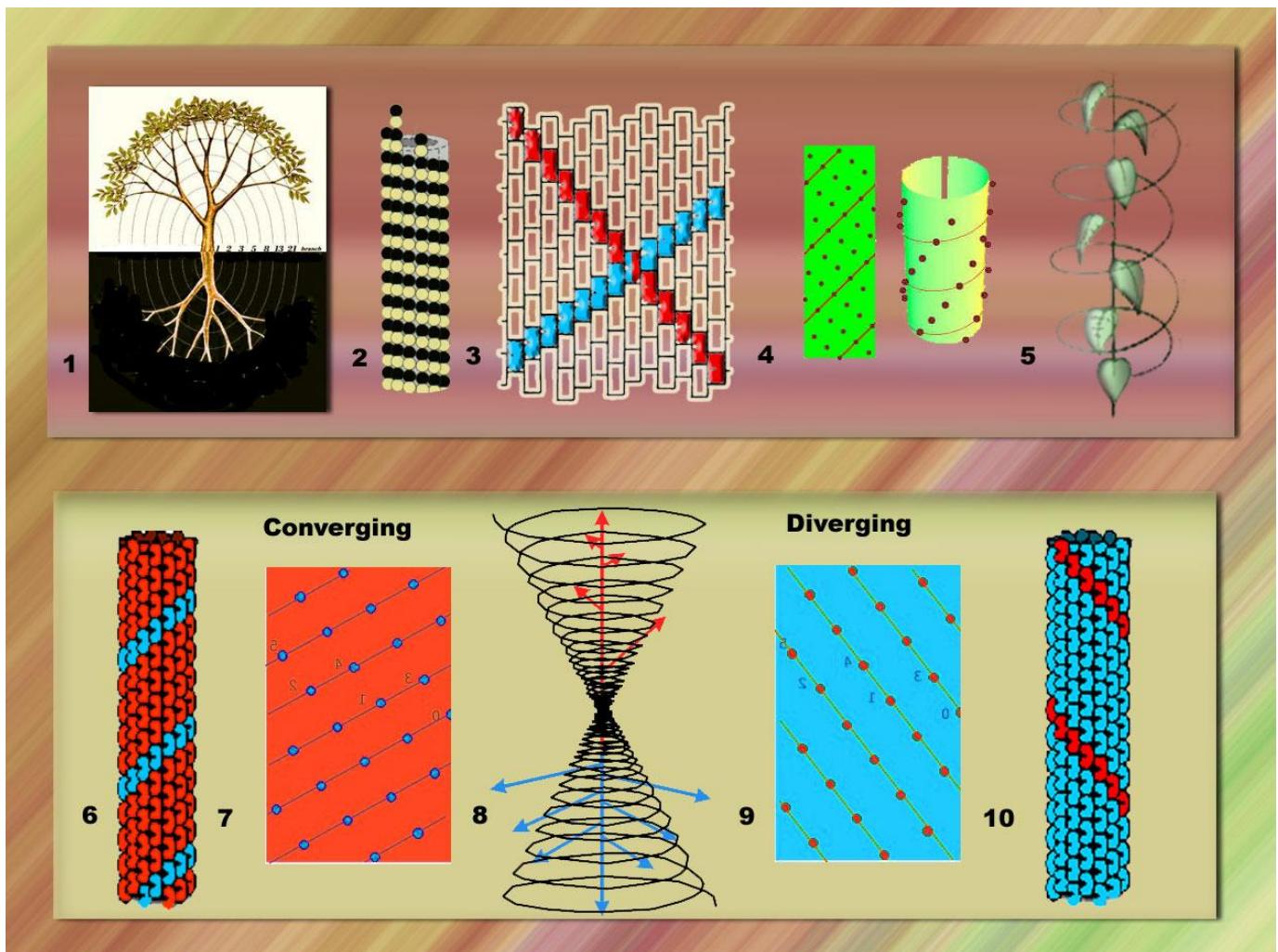
rooted in detailed points. Cortical columns (*fig 3*) seem to have a self similar push pull relationship both to the tree, and the left / right hemispheres to which they are aligned axially. Microtubules (*fig 4.*) Are the actual building block of cellular structure. Their structure contains the Mathematical Fibonacci series required for fractal properties. Microtubules have unique dielectric (Charge carrying) properties. (7, 8) The protein subunits of the microtubule themselves (*fig 4.*) have been well studied as dipoles capable of the quantum coherence (communicative properties) required to play a part in an integrated whole brain structure (7). Microtubules within cells themselves have the intra-cellular tensegrity (structural flexibility) required of the cortical column cell axon units in both the respect of mechanical structure and alignment due to charge. (9,11,33)



(1.) A closer look at the structural make of the basic unit of a cortical column. The lines inside are drawn to illustrate microtubules, and the arrows the direction of microtubule growth. (2.) The microtubule itself showing it's negative start point and it's growing "plus" end. (3.) An icon to represent the pyramidal / dendrite unit. (4.) Dendrites and branching are well covered in available texts. To examine the structure of the pyramidal neuron means will mean getting ideas by having a good look at more accessible root structures.

The section "DIPOLE AS STRUCTURAL AID TO BINDING" following the next, will propose that overall reversal for the hemispheres is present. Firstly the most obvious. Because direction of growth from each side of the callosum is in opposite directions. Microtubule plus ends will be too. Each hemisphere favours neuron architecture which are reverse in receptors, chemistry, (2, 3) electrical charge (1) and as covered here structure.

8.1 NUMBERING DETAILS OF NEURON STRUCTURAL COMPONENTS



Fractals are the mathematical descriptions which describe trees. In particular the fibonnaci sequence 1, 1, 2, 3, 5, 8, 13, 21 etc. The bifurcation or branching points of the tree occur at these numbers. (**1 in figure above**) Microtubules (**2 in figure above**) contain the fibonnaci numbers.

"The microtubule lattice features a series of helical winding patterns which repeat on longitudinal protofilaments at 3, 5, 8, 13, 21 and higher numbers of subunit dimers (tubulins). These particular winding patterns (whose repeat intervals match the Fibonacci series) define attachment sites of the microtubule-associated proteins (MAPs)" (176)

Not how the microtubule (**2 in figure above**) is adding units at the top end. This is the positive end. The direction the microtubule grows. They can grow to the length of axons. Because the microtubule is built from 13 columns, 4 repeating patterns exist for microtubules using the fibonnaci numbers 3, 5, 8, 13 because they can repeat themselves within the pattern. Beginning at the top of a section of flattened microtubule. (**3 in figure above**) This is a diverging spiral because it winds in the same direction and is also a deeper spiral which winds ahead of the direction of the microtubule growth.

The first pattern (red) finishes at the opposite edge 8 blocks down the microtubule before the pattern would repeat again. (**10 in figure above**) By starting at the opposite side from the red line (**3 in figure above**) The blue line finishes at the opposite edge 5 blocks down the microtubule before the pattern would repeat again. (**6 in figure above**) This is a converging spiral because it winds against the direction of growth. Compare the winding pattern with the microtubule (**2 in figure above**) Notice how the spiral winds in the opposite direction.

These 5+8 winding patterns are very important for describing tree structures. They appear throughout nature. The winding patterns determine the points for roots, branches or leaves to grow in plants and trees. (**4 and 5 in figure above**)

Microtubules contain these patterns and they have been found to be the point of attachment for Microtubule associated proteins (MAP) which link with other microtubules. (176) It would be predicted that these contain the geometrical numbers which build the tree like structures of neurons.



ABOVE : Examples of rooting structures maximised towards their limit.

The convergent patterns (blue line) (**8 in 2nd figure above**) wind more acutely as an angle (**7 in 2nd figure above**) and also against the direction of growth. They would accumulate at the negative end or beginning of the microtubule. Networks of these would create the root structures of the soma, because they are forced to compress as they wind round each other.

The divergent patterns (red line) (**8 in 2nd figure above**) wind less acutely (**9 in 2nd figure above**) and are ahead of the direction of growth. Their winding out limit only restricted by space and resources. This is why dendrite branching is usually an order of magnitude greater than the number of neurons.

If the above is taken as true, putting this with the previous section regarding left laterality of neuron bodies and right laterality of dendrites would give a structural model where the left side of the brain is higher in “5” pattern convergent microtubules and the right side in “8” pattern divergent microtubules, which provides a structural case for a lateralised reverse brain symmetry.

8.2 DIPOLE AS A STRUCTURAL GUIDE TO BINDING

The test of this Dipole model is whether it accommodates every aspect of previous and current neuroscience that gets put through it.. The binding problem is the current Neuroscience agenda. (6) which has developed to discuss how attention binds specific association regions. Whole perceptual binding is still the goal. Currently Walter Freeman leads the way with “wave packets” which extend over much wider areas. (242)

“Domains of cooperative neural activity called ‘wave packets’ have been discovered in the visual, auditory, and somatomotor cortices of rabbits that were trained to discriminate conditioned stimuli in these modalities. Each domain forms by a first order state transition, which strongly resembles a phase transition from vapor to liquid. In this view, raw sense data injected into cortex by sensory axons drive cortical action potentials in swarms like water molecules in steam. The increased activity destabilizes the cortex. Within 3 to 7 milliseconds of transition onset, the activity binds together into a state resembling a scintillating rain drop, which lasts ~ 80 to 100 milliseconds, then dissolves. Wave packets form at rates of 2 to 7/second in all sensory areas, overlapping in space and time.” (242)

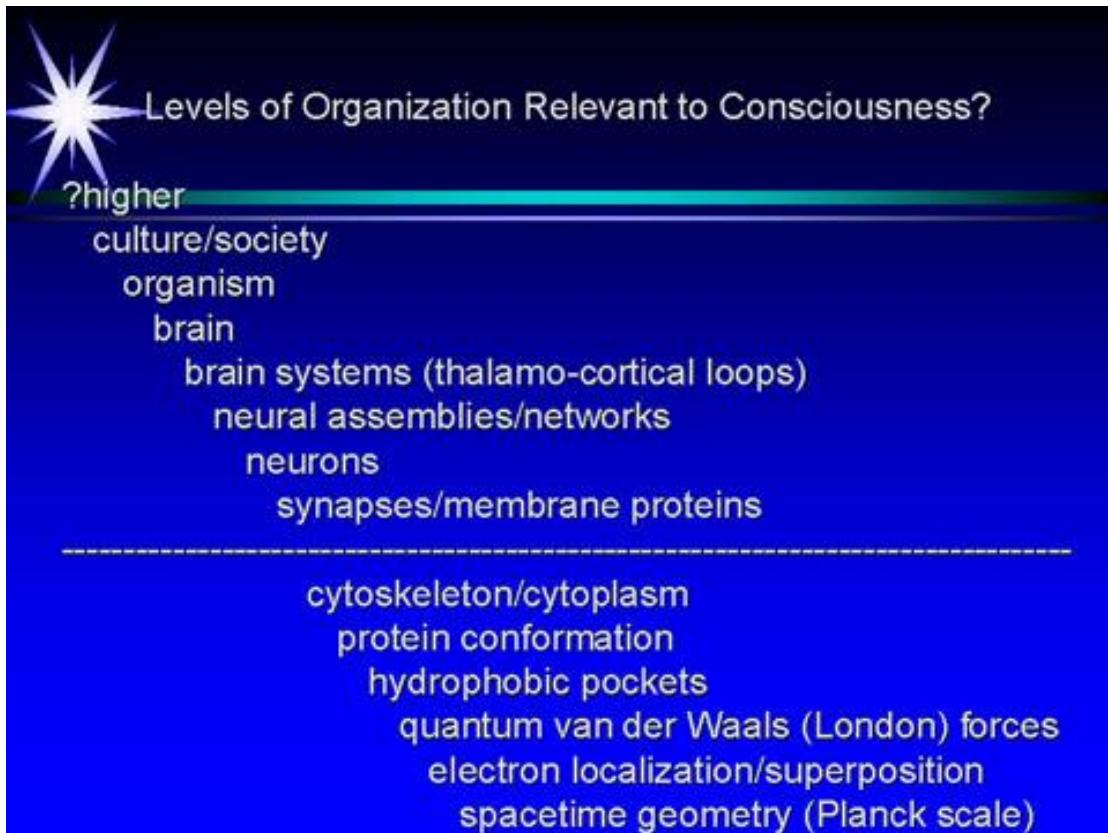
In regard to what areas are bound.

“Four sets of data from epidural electrode arrays have shown that the spatial AM patterns of gamma oscillations relating to perception contain information that is spatially distributed and graded, and not localizable to point sources. : Olfactory bulb in rabbit, Sensory neocortices in rabbit, Auditory cortex of Mongolian gerbil, Multiple sensory and limbic cortices of cat Analysis of scalp EEG by others indicates they are global.” (244)*

Freemans work focuses on how the cortex is poised for chaotic activity, and this settles into cognition when receiving thalamic input. These top down studies of binding such as “Neurodynamics” argues that the whole brain field is in a state of “self organized criticality” Consciousness is finely tuned to amplify and respond to sensory input efficiently and dynamically. (22, 42) The sensory input becomes an attractor spreading throughout the cortical network in a search for similar patterns. Structurally this is consistent with the inner / outer isotrope structures proposed in paper 2. (1) That the inner isotrope (limbic system) is a linear quadrupole which is tightly structured, in contrast to the outer cortical dipole.

Also in this area from the small scale up Hameroff presents his well known approaches to solve binding. A difficult process of trying to move quantum scale interactions up through many layers of increasing complexity. (7,8).

Hameroff’s team sets down 16 levels of distinction within the brain. (7)



Hameroff / Penrose definitions for levels of consciousness. The line denotes how far their current models take them.

Levels 1 to 2 are basic atomic qualities.

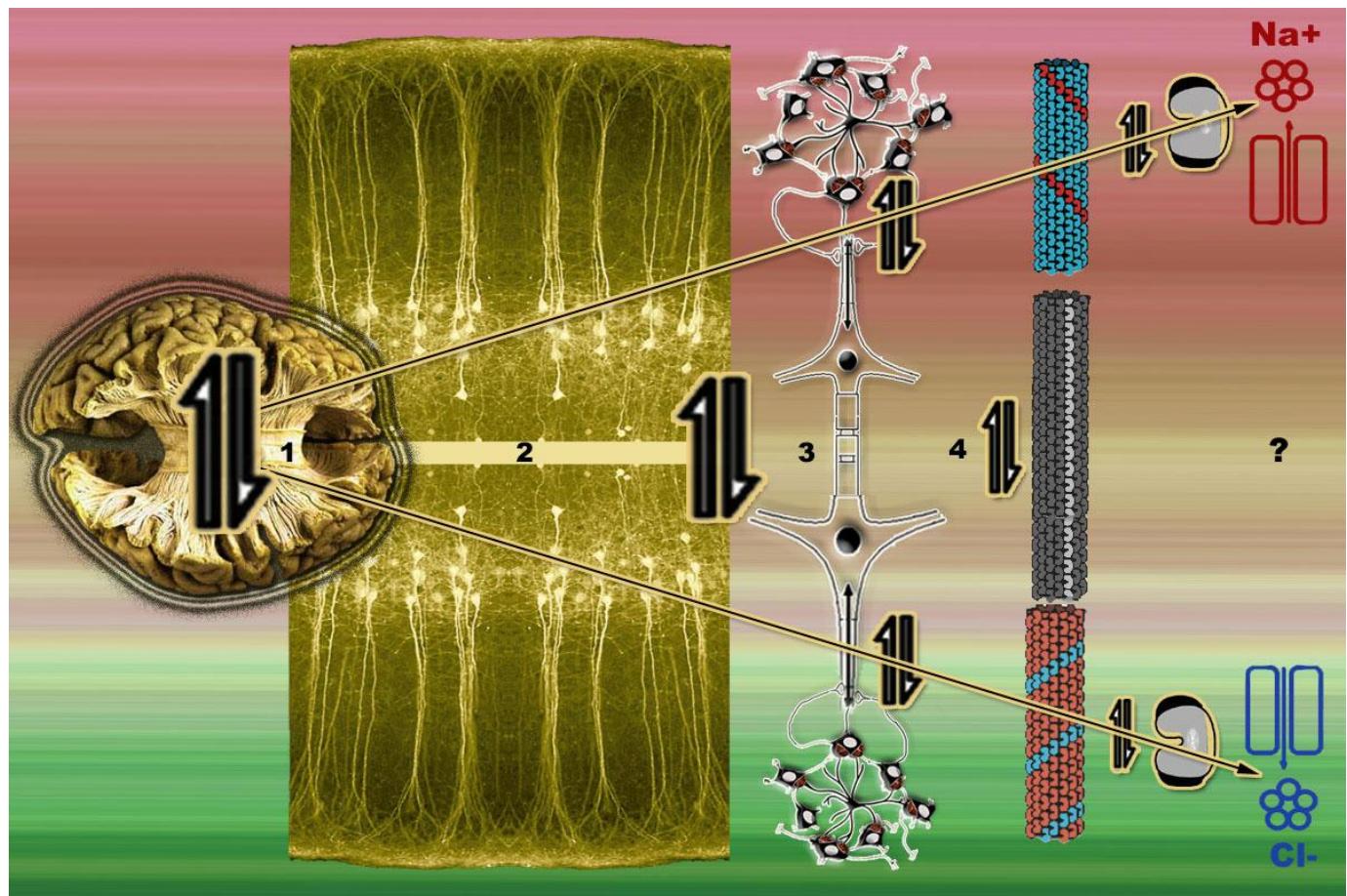
Levels 3 to 5 correlate with Small / Large Molecule level

Levels 6 to 8 correlate with Cellular system level

Levels 9 to 11 correlate with Whole organ level

Levels 12 to 13 beyond the scope of this research.

The diagram below is an attempt to highlight the concept of axial alignment as a framework to integrate binding as looked at from a dipole model. Each of the levels above is geometrically aligned to be in tune with their bigger systems just by geometrical position, and structure. An analogy would be how the moon is aligned to planets, aligned to stars, aligned to the spiral galaxy. Aligned within a hierarchy of magnitude.



(1 in figure above) The whole organ itself is a dipole which has a push / pull relationship between the hemispheres. The right hemisphere is mainly push or excitatory, and the left hemisphere mainly pull or inhibitory. The all enveloping overarching magnetic field illustrated arises from the outer magnetite layer. (**more about this in the following section**) This represents levels 11 down to 10. (For the sake of simplicity this just deals with the cortical / cortical system. Thalamo cortical system are another inner encapsulated quadrapole or isotrope. (1))

(2 in figure above) This represents level 9 which are cortical areas of processing. The image zooms into illustrate cortical columns for each hemisphere. (pyramidal neurons are lit) The line in the middle represents the corpus callosum. The section of the cortical area we are looking at could be angled right or leftwards off the central horizontal axis of the whole brain unit. **(1 in figure above)**

(3 in figure above) This represents level 8 and 7 which are single neurons. The pyramidal neuron and the dendrite astrocytes as proposed previously are to be considered a single push / pull unit. The pyramidal neuron representing the pull component, and the dendrite / astrocyte push. Remember from the previous section how pyramidal neurons are bigger in the left hemisphere (**bottom half**) and Astrocyte/ dendrites greater in the right hemisphere (**top half**). This fulfils the requirements for a structural tensegrity. These units are aligned geometrically to their cortical columns.

(4 in figure above) This represents level 6 to 3 These are single cytoskeleton “girders”. Within the Neuron cells themselves cell structure and shape changes can be triggered by external forces. This is Tensegrity occurring at the level of the Cellular structure (11,32,33). These majority of these girders will also be aligned in the direction of

ther neuron they are within. The divergent microtubule pattern is selected as the most prominent pattern for the right hemisphere (**top half of diagram**) because increased dendritic branches and axons in this hemisphere will demand that. The reverse applies for the bottom half of the diagram where pyramidal and neuron bodies are larger. The middle (grey) microtubule represents the long axons of the transcallosal bridge. These also have quantum conduction potential. (176) As does the corpus callosum itself. (1) The subunit dipoles of the microtubule (**peanut style things**) are themselves dipoles aligned by angle to the bigger microtubule.

(? In figure above) This represents level 7 to 2. These are the ionotropic sodium (**red**) and chlorine (**blue**) membrane channels which bring these extracellular ions into the neurons themselves. Glutamate and Gaba which are lateralized in the right and left hemispheres respectively. (2) The membrane channels are aligned in the receptors which mainly point ions into the postsynaptic cleft from the direction of the neuronal assemblies. Even the ions themselves become aligned, and represent the overall charge qualities of the dipole. The gating of sodium and chlorine is part of the overall aligned and lateralized structure. This represents the extracellular dipole field. (**more about how that is generated in the next section**)

The question mark arises because it is beyond the scope of this research to provide an intracellular middle bridge as in previous levels. Hameroff is the main proponent of dipole processes within cellular structures of microtubules. If embedded electrochemical trees are the structure of system binding then this might explain why microtubules have been proposed as a dominant factor in sub level processing. (7,8) Hameroffs experiment demonstrated coherence within extra cellular fluids..

In human brain imaging (one axial slice is presented) Zizi et al (2000) found sites of maximal IMQC quantum coherence appearing in periventricular gray, and frontal, pre-motor/parietal, and occipital cortex. A measure of the durations of the quantum processes were 24.2 msec in the white matter region, 26.0 msec in the gray matter region, and 293.8 msec in the ventricular region (177)

The higher readings for grey matter are due to an increase in fluids.

C226 “The extracellular interstitial fluid of the brain is thought to have a volume in the range of 15 to 20%. The space is greater in gray matter than in white matter, the former having a higher water content than the latter.”

Does the extracellular dipole model link to aspects of the hameroff theory ? Coherence potential is high in CSF which is similar to extracellular fluid. (177) When chlorine and sodium enter neurons they are going to affect microtubule polarity. The two models end up in the same place from bottom down and top up. Dipole neurology uses a top down method looking at shape, and system and reaches its conclusions in neurons. Orch Or begins at subatomic level and also reaches its limits in neurons. The four patterns hammerof provides for microtubules (176) give the possibility to describe the hierarchy of the whole dipole using structural components.

The emergent feature within hierarchies of structures are built from layers of spin systems : microtubules, dendrites, cortical columns, and entire areas of cortical magnetic domains. (this spin is also in 1) This accommodates the results of freeman. Who placed his work within the dipole framework.

“A common approach to derive the behavioral correlates of gamma activity is to localize the ‘hot spots’ with high amplitude, fit them with an equivalent dipole, and find the phase relations between spots to infer causal relations” (244)...

Just joking freeman refers to the EEG electrode.

8.3 EXAMPLE OF A HIERARCHY OF ALIGNED MAGNTITUDE.

Upon firing, the intracellular ion content is altered as ions are brought into the cell, with a vector determined by the receptors of which the majority are aligned to the vector of the neuron.

Within the neuron, the Microtubule associated proteins (MAP) have the straight, circular or winding pattern for attachment structures set out in the previous section, statistically related because they have their position within the dipole. Hameroff talks about water spin twisting within neurons. (247) The ions within dendrites would also be affected by the structure of the intracellular connections.

These microtubules themselves are aligned to the dendritic tree.

Freeman says EEG originates from dendrites with “axial symmetry” (244) this concurs this proposal at cellular system level. The dendrites are aligned to cortical columns, these are aligned to the cortical domains, where freeman’s phase cones occur at whole organ level. It is not clear whether these are cones are aligned to dendrites.

In fact cones and axial winding represent different aspects of the winding. (1) The cone is the whole shape, and the axial winding the structure of the shape.

Freeman tries to correlate the wave packets to blood flow. (244) This would fit the dipole. Blood flow structure itself has the overarching conical winding structure. (1)

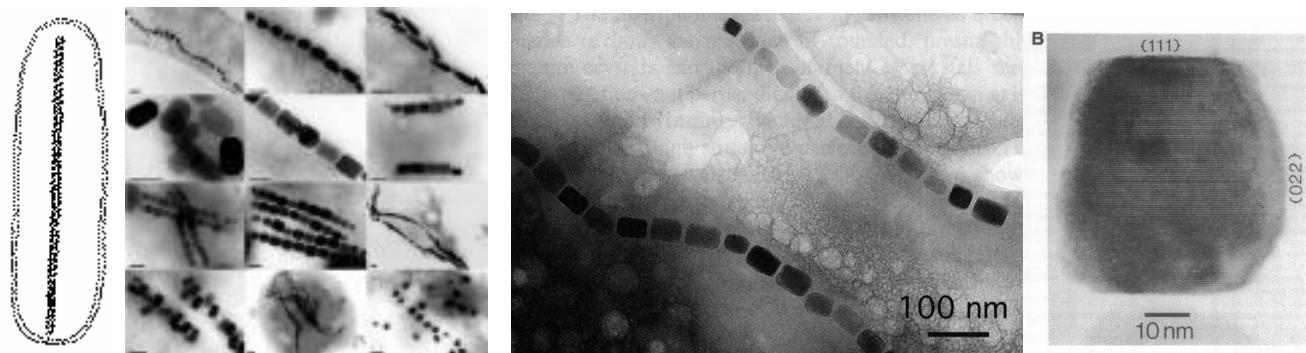
There are of course loads of exceptions to this alignment. A horizontal interneuron, inhibiting a vertical pyramidal cell. Microtubules which do not have the appropriate winding pattern to the orientation of their neuron. Phase cones being pulled away from the direction of the cortical column and so on. This could be explained by structures of interneurons being determined by a 3 step MAP pattern illustrated by hammerof. (176) Initial attempts within a 3d modeller by myself, determined this could build a Spherical cell structure, and that the 4 microtubule patterns can describe every possible neuron, axon, dendrite structure within a dipole.

The whole idea behind a hierarchy of alignment, is that the whole brain structure is a statistical attractor. There are going to be trillions of cases of things happening out of alignment. These will be not statistically greater than the number involved in representing the overall structure.

The next section discusses magnetite and how the electromagnetic field could be generated as a salt water battery driven by blood. That reworks the ideas here, to propose that the outer brain layer has a ferrofluid magnetic recorder for short term memory, driven by input from the thalamo cortical system.

9 BIOGENIC MAGNETITE

*"Magnetite is the most magnetic of all the minerals on Earth, and these magnetic properties led to lodestone being used as an early form of magnetic compass..... Crystals of magnetite have been found in some bacteria (e.g., *Aquaspirillum magnetotacticum*) and in the brains of bees, of some birds (e.g., the pigeon), and of humans. These crystals are thought to be involved in magnetoreception, the ability to sense the polarity or the inclination of the earth's magnetic field, and to be involved in navigation field"* (143)

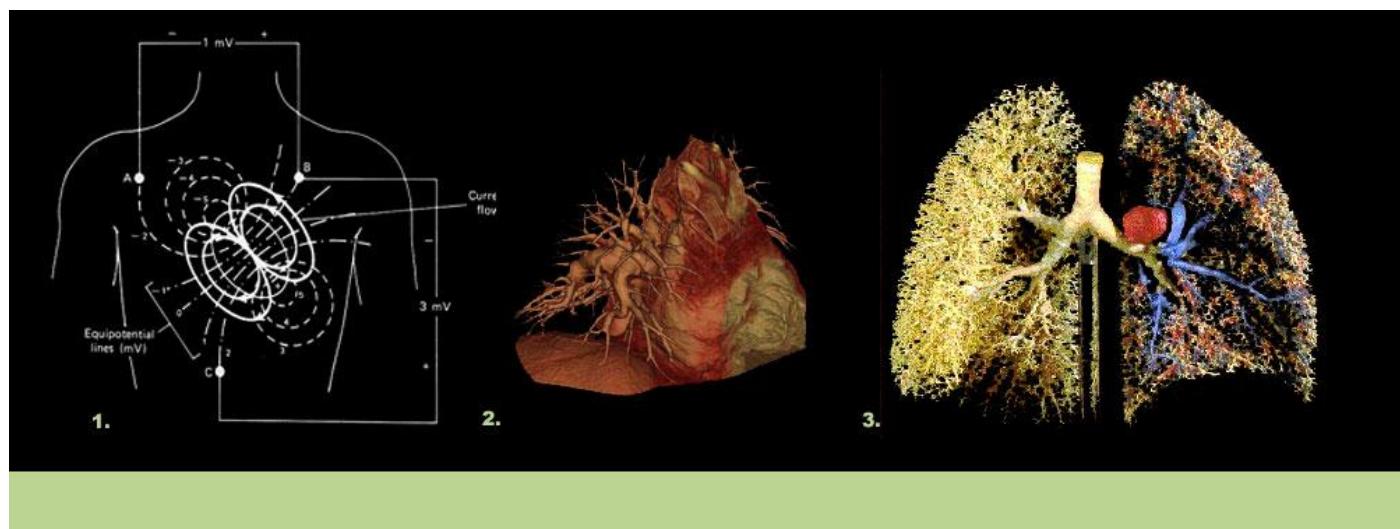


Various forms of magnetite within nature. : LEFT : All these examples were found within bacteria.
MIDDLE : the crystals form chains. RIGHT : Crystal from human hippocampus.

9.1 BASIC COMPONENTS OF ELECTROMAGNETISM

Previous aspects of Metal Electrochemistry in the brain system, such as Sodium potassium pumps, Calcium have been well covered. Exploring the role of the other elements Iron, Copper, Manganese, Zinc, Rhodium, Iridium, Magnetite, Selenium in brain illnesses such as schizophrenia (135) is a relatively new area called "MetalloNeurochemistry". (136)

In particular magnetite is being investigated for epilepsy and alzheimers. (248, 249) Before looking at magnetite, properties and what it is in the brain for, Magnetite has also been discovered in the body.



(1 in diagram, above) The heart generates a dipole field. (2 in diagram above) Fractal structure of heart vessels. Is this due to the presence of magnetite (3 in figure above) Fractilization of lung tissue. Magnetite is present also.

Magnetite has been found in Lung (141, 167) liver (141, 140) heart and spleen (140) with heart having higher concentrations than liver and spleen. (140) Magnetite in lungs was found to be distributed in clusters (141)

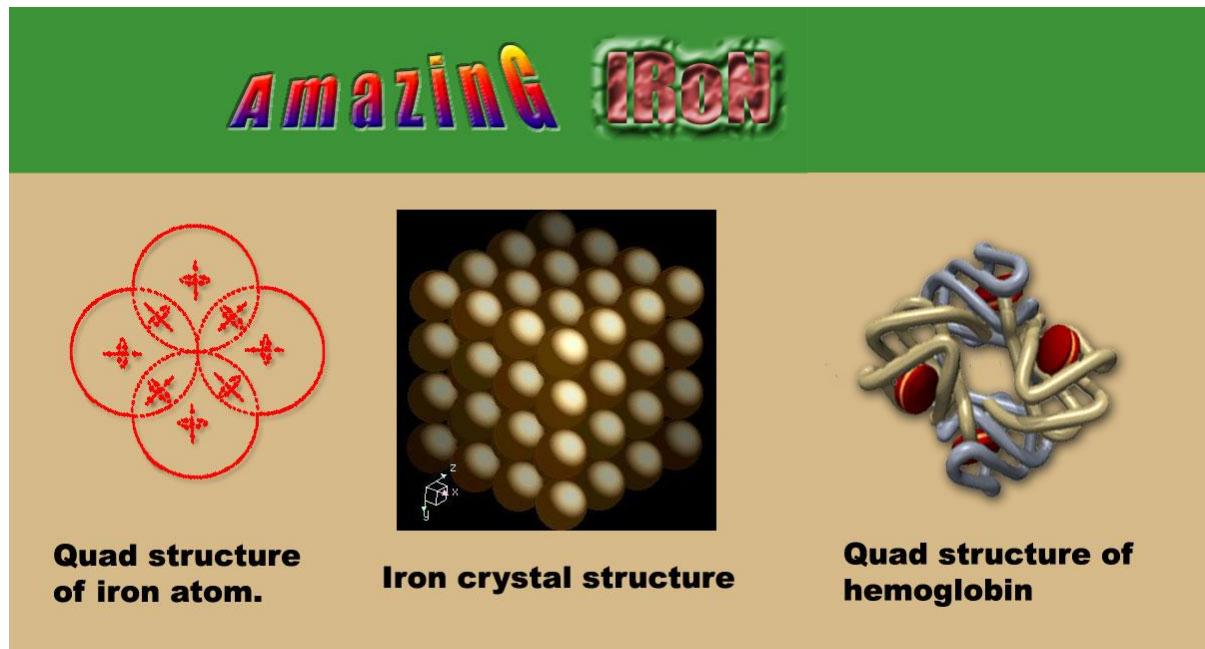
Heart cells are the most studied so far. Conditions of elevated iron in the heart, find that the heart produces transporters (divalent metal transporter 1 (DMT1).) to take iron from blood. (155) These transporters were not interested in taking iron from transferrin, which is the bodys normal cell delivery method, but modulated themselves for Non-transferrin-bound iron. (NTBI) (155, 156) The Uptake from that was greater for Fe²⁺ than Fe³⁺ in heart cells. (156) Ferritin, which is an iron storage protein implicated as precursor of magnetite in magnetotactic bacteria (*The most studied to uncover the process if magnetite bio-mineralization*) contains hydrated iron oxide (Fe₂O₃ • nH₂O) in its core. (148) Is ferritin the precursor of magnetite in heart and brain ? The following section takes a look at all the biochemical players so far, to try and see what the evidence has brought up so far.

9.2 LOOKING AT KNOWN PLAYERS SO FAR

To figure out how magnetite arises within the brain, means looking at every available kind of iron / protein. Non-heme (blood) iron is abundantly present in the brain in three different forms: (166)

"low molecular weight" complexes

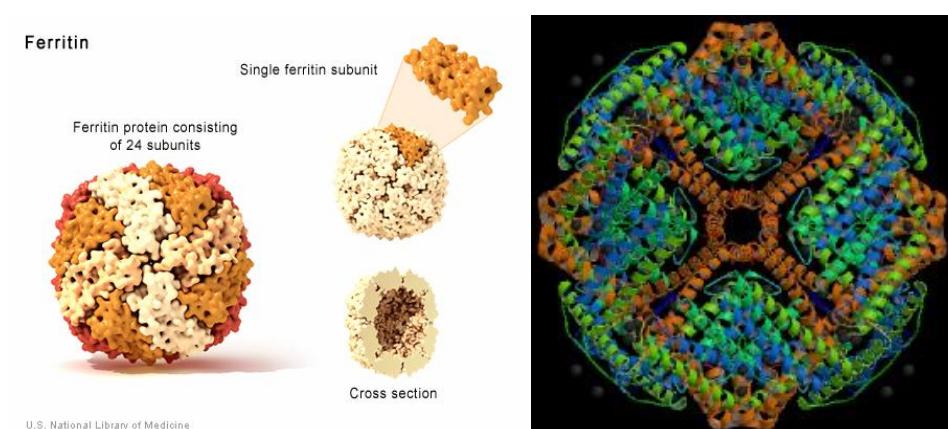
Free iron itself, which is quite toxic and is immediately bound to an enzyme, transport or storage. Atomic structure tends towards quad and cubic crystals. The properties appear to repeat and resonate through biological structures which develop from them. (*see introduction to dipoles*)



"medium molecular weight complexes" : Transferrin, Apoferritin

metalloproteins such as transferrin are available for transport throughout the body. When transferrin reaches a cell requiring iron, the iron is complexed onto a protein, apoferritin, for sequestration within the cell. (163) apoferritin (*a colorless protein closely related to transferrin;*) complexes combine to form a micelle (*In chemistry, a micelle a particular grouping of molecules. See figure below right*) from the next group up which is called ferritin.

"high molecular weight" complexes : Ferritin, Hemosiderin and siderosomes



ABOVE : Ferritin protein showing core where iron is stored. RIGHT : ferritin micelle has a quad structure.

Ferritin : Ferritin-bound iron is the main storage form of iron and is present predominantly in the extrapyramidal nuclei (*Motor system*) where its amounts normally increase as a function of age. (166) Ferritin can store about 4500 iron ions in a hollow shell made of 24 identical subunits (169)

If a large amount of iron is made available to a cell it will produce a large number of ferritin micelles. Such large aggregates of micelles are referred to as Hemosiderin. (162, 163) These have a larger cluster size and are water-insoluble. (168)

Hemosiderin : The presence of hemosiderin in small amounts within iron rich tissues such as the spleen, liver, bone marrow is considered normal. Large aggregations of hemosiderin or its presence in tissues such as the lung or subcutaneous connective tissue suggest a pathological condition." (163)

Hemosiderin was found to be produced by the choroids plexus, (*see Ventricles diagram below*) as far back as 1954. There was debate as to whether it was a waste product.

"The presence of a blood breakdown product such as hemosideran in an organ such as the choroids plexus, which, though highly vascular, is not co concerned to be concerned with blood destruction or as a part of the reticulo-endothelial system, has yet to be explained. Since hemosideran is considered to be formed within the cytoplasm of a cell, it would not seem to indicate phagocytosis on the part of these cells." (160)

Hemosiderin is a blood breakdown product. (163) A degradation product of ferritin, (168) or Light ferritin (146) It could be a latter stage of iron storage when iron-ferritin is full (146)

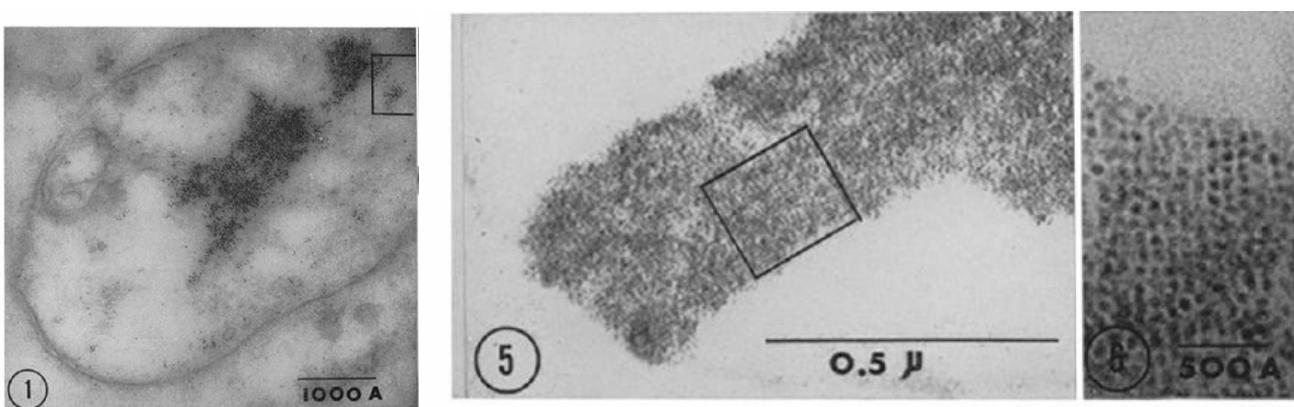
Heme (blood products) is metabolized to iron-free derivatives by the enzyme heme oxygenase followed by an acceleration of ferritin biosynthesis to sequester the iron. (146) Loading of the heart with Non transferrin bound iron (NTBI) doubles both the number of ferritin units and the hemosiderin granules (166)

9.3 THE CANDIDATES FOR BIOMINERALIZATION

Ferritin, the iron storage nonheme-protein contains hydrated iron oxide ($Fe_{203} \cdot nH_2O$) in its core. It is suggested that this hydrated oxide in ferritin would be the precursor of magnetite in both magnetotactic bacteria and the chitons." (148)

At the introduction ferritin was considered as a precursor to magnetite. The problem is that distribution of ferritin is not correlated to the distribution of magnetite in the human brain (148) Also magnetite formed from ferritin is too small and spherical. (171)

9.3.1 SIDEROSOMES



Siderosome in cell of proximal convoluted tubule from rat treated with hemoglobin. The aggregated dense particles represent iron micelles of a hemosiderin deposit and have a mean diameter of about 60 Å.

In some hemosiderin deposits the dense particles forms lattices (siderosomes) similar to those present in sections of crystalline ferritin. (163) Such ordered arrangement of dense particles was encountered inside as well as outside of the cytoplasmic organelles. They may be derived from mitochondria. (162) New research suggests that “illum Aquaspirillum **magnetotacticum**, forms magnetite from **siderosomes**” (164)

If siderosomes are the precursor to magnetite would they occur in CSF? Magnetite formation occurs only in a narrow range of low oxygen concentration. (147) CSF oxygen levels are low and are dependent on blood levels. (250) The CSF slow 5 hour rate turnover makes it the ideal environment for slower oxygen perfusion.

“Magnetite formation occurred only in a narrow range of low oxygen concentration, i.e., 2 to 7 microM O₂ at 30 degrees C. Magnetic cells stored up to 2% iron as magnetite crystals in intracytoplasmic vesicles. This extraordinary uptake of iron was coupled tightly to the biomineralization of up to 60 magnetite crystals with diameters of 42 to 45 nm” (147)

9.4 CEREBROSPINAL FLUID

Iron is essential for the development and functioning of the brain. Influx of iron into brain is by transferrin regulated receptor-mediated transport (154) Iron and transferrin is found in oligodendrocytes in high density and is required for myelin production. Transferrin is produced in the choroid plexus in concentrations equal to that found in liver. (157)

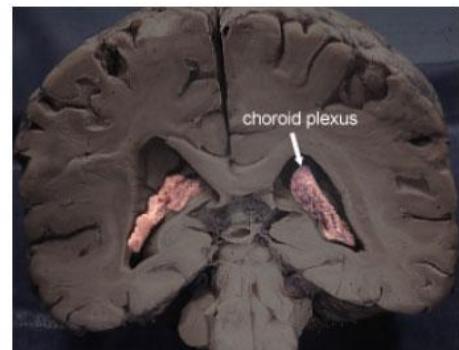
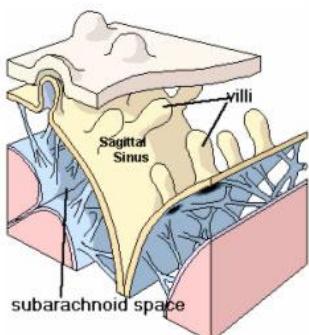
“Iron is an important constituent in brain and, in certain regions, e.g., the basal nuclei, reaches concentrations equivalent to those in liver. It has a role in electron transfer and is a cofactor for certain enzymes, including those involved in catecholamine (Neurotransmitter) and myelin (White matter). Synthesis. Iron in CSF is likely to be representative of that in interstitial fluid of brain. Transferrin in CSF is fully saturated, and the excess iron may be loosely bound as Fe(II).” (154)

“Tf transport through the brain barriers is restricted, Fe is probably released into the brain extracellular compartment as non-Tf-bound iron (NTBI).” “NTBI is present extracellularly in CSF and probably in brain interstitium.” (145)

Transferrin bound iron is taken up by white matter. Transferrin binding protein (TfBP) is seen in the choroid plexus and Bergmann glial cells of the cerebellum. (142)

“The selective vulnerability of the cerebellum may be influenced by the abundance of microglia and presence of Bergmann glia in the cerebellar molecular layer. Microglia synthesize ferritin, and most hemosiderin formation occurs in microglia....Bergmann glia are a source of ferritin repressor protein (whose dissociation by heme or iron leads to increased ferritin production) Anatomically, the restriction of damage to vermis and paravermis likely reflects their close anatomical relationship to the roof of the 4th ventricle and compartmentalization of CSF flow within the meninges, consistently increasing exposure of these cerebellar surfaces to materials circulating in the CSF.....“the vulnerability of cranial nerve VIII likely results from its course through the pontine cistern, which not only contains a large pool of CSF but also has a greater flow of CSF (1), potentially delivering a larger amount of iron and heme. More importantly, the VIIIth nerve has a long glial segment (the portion of the nerve surrounded by CNS glia) exposed to CSF, resulting in a greater length of hemosiderin deposition and, thus, a greater chance of axonal damage” (146)

This gives a great deal of information. That the cerebellum produces hemosiderin, and this flows within the CSF which should result in CSF deposits within the meninges. Also the presence of Heme and NTBI iron in the CSF stimulate ferritin synthesis. (146) Cerebellar surfaces situated next to meninges and the roof of the 4th ventricle are increasingly exposed to CSF. (154) The processes of Bergmann glia of the cerebellum come into direct contact with the fluids of the subarachnoid space. (146) Efflux of iron is by bulk outflow of CSF through arachnoid villi (*microscopic projections of pia-arachnoid mater that extend into venous channels providing CSF-vascular interfaces*. (213)) and choroid plexus. (154)



LEFT : Arachnoid vili are a drain filter before fluid re-enters the venous return. MIDDLE : Photo of real arachnoid space.
RIGHT : Choroid plexus within lateral ventricles.

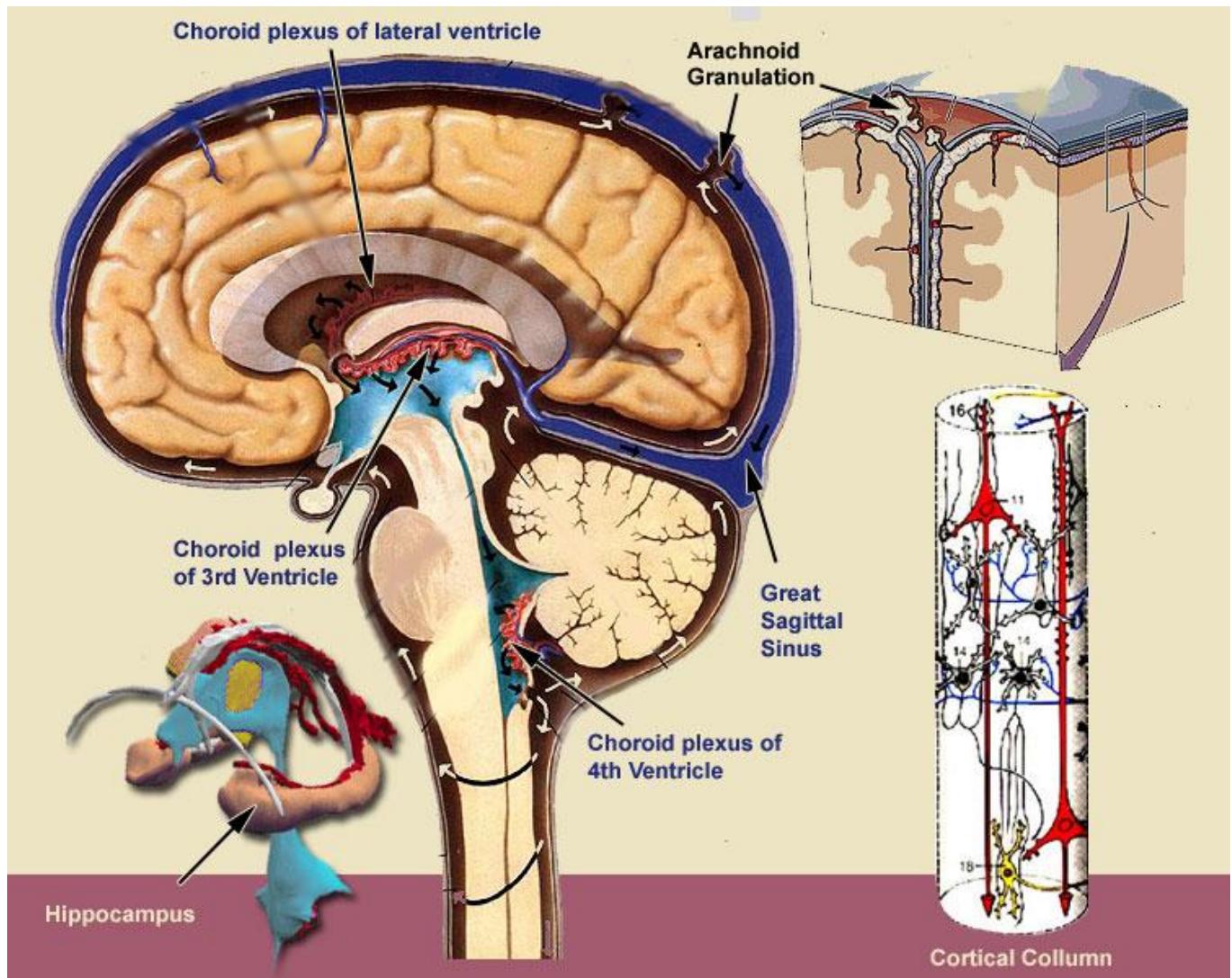
Hemosiderin Granules have been found in the Choroid Plexus as far back as 1959.

"The presence of a blood breakdown product such as hemosideran in an organ such as the choroids plexus, which, though highly vascular, is not co considered to be concerned with blood destruction or as a part of the reticulo-endothelial system, has yet to be explained. Since hemosideran is considered to be formed within the cytoplasm of a cell, it would not seem to indicate phagocytosis on the part of these cells. At very least, the presence of such a waste product emphasizes that an attitude of caution is appropriate in interpreting the still controversial and incompletely understood role of the choroid plexus". (160)

and the meninges

"The larger ones (Hemosiderin Granules) appeared "frothy," with many and variously sized clear vacuolar spaces in them. Most of the bodies were irregularly round or elliptical in shape and in appearance seemed almost identical to similar bodies seen in phagocytic cells found in the subarachnoid space by Schultz (22)." (160)

9.5 CEREBROSPINAL FLUID SYSTEM



A clear tour of the choroids plexus / CSF system. Follow the arrows from the central 3rd ventricle. Note how the choroids plexus winds round the hippocampus which has high levels of magnetite. (252, 253, 254) Also as previously mentioned the choroid plexus of the 4th ventricle next to the cerebellum. Cerebellum also has magnetite present. (24, 55) CSF flows up from the cerebellum, round the base and over the top of the brain. CSF products drain through the arachnoid villi which are microscopic, up to ten microns (254) and then through the bigger arachnoid granulations. Magnetic aggregations in hippocampus were up to 10 micron clusters. (250) Presumably the villi are to keep these larger materials from re-entering the blood. The diagram above also shows a cortical column as a link to the following sections, which look into what happens next, in the meninges arachnoid pia layer.

"there are five million magnetite crystals per gram in the human brain (1). Interestingly, The meninges, (the membrane that envelops the brain), has twenty times that number. These 'biomagnetite' crystals demonstrate two interesting features. The first is that their shapes do not occur in nature, suggesting that they were formed in the tissue, rather than being absorbed from outside. " 153

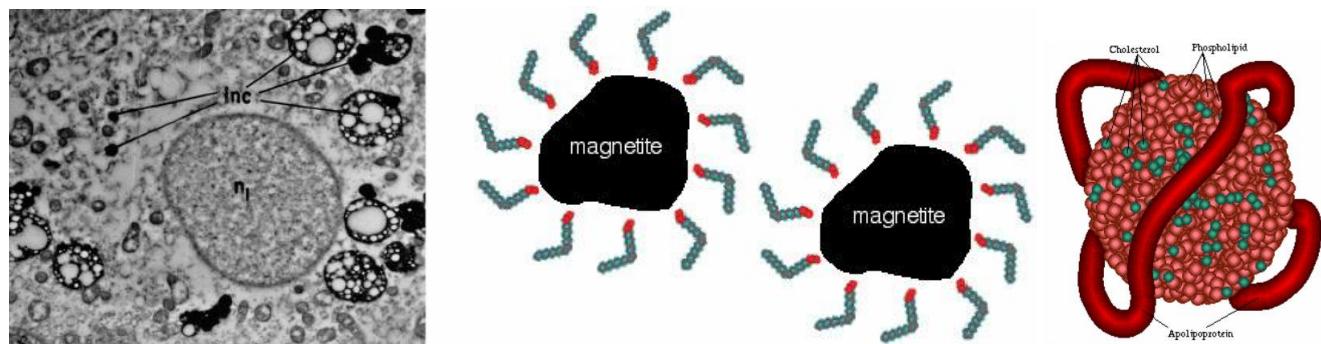
9.6 LIPIDS

As mentioned previously Hemosiderin granules were found within a frothy fluid. Hemosiderin, is a paramagnetic iron-protein, (159) within lipids it would be a magnetic fluid.

"Large numbers of inclusion bodies ranging in size from 0.5 to 5 Microns in diameter were found dispersed in the cytoplasm of the choroidal cells. The larger ones appeared "frothy," with many and variously sized clear vacuolar spaces in the At first these frothy inclusions, as well as the homogenously dense bodies, were thought to represent lipid-like materials. When, however, formalin-fixed, paraffinembedded material was also examined in the light microscope, brownish colored granules which had not been dissolved out by the fat solvents during embedding were also revealed. Comparison of the granules in the formalin-fixed and in the osmiumfixed material showed the granules to be only slightly osmophilic, most of the coloration being due to the color of the pigment. Subsequent examination of histochemically stained sections showed the lipofuchsin-stained tissue to be negative while the Prussian blue preparation was positive, thus identifying these bodies as hemosideran granules and confirming work done many years ago " (160)

A neurological basis for a magnetic field

"The reason for these special magnetic properties is based on the fact, that the small particles suspended in a ferrofluid can be treated as small permanent magnets. These magnets are thermally agitated and thus the fluid can be treated as a paramagnet, showing the typical magnetization behaviour of paramagnets - i.e. the magnetization as function of an applied field follows the Langevin law. The important difference to paramagnetic salt solutions is the fact that the increase of magnetization with field at low field strength - the initial susceptibility χ - is approximately 4 orders of magnitude larger in a ferrofluid. Therefore the fluids are called superparamagnetic" (179)



RIGHT : Pictures of the oily Hemosiderin found in choroid plexus (160). MIDDLE : Magnetite and lipids have already been put to use as a ferrofluid in engineering. Diagram shows how lipids form micelles round magnetite. LEFT : A CSF lipoprotein carrying cholesterol and phospholipids.

Lipids are used in the optimum requirements for a ferrofluid

"Therefore, one method of preventing agglomeration due to van der Waals and magnetic forces is to keep the particles well separated. This separation can be accomplished by adding a surfactant to the liquid medium. The surfactants can generate either steric or electrostatic repulsions between the magnetic particles the particles of magnetite must remain small in order to remain suspended in the liquid medium. To keep them small, magnetic and van der Waals interactions must be overcome to prevent the particles from agglomerating. Thermal motion of magnetite particles smaller than ~10 nm in diameter is sufficient to prevent agglomeration due to magnetic interactions." (187)

9.7 CSF FREE LIPIDS

The candidates to play a role for a ferrofluid in CSF would be lipids. There are many lipids in the CSF. Some of these are transported by Albumin, a protein that is produced in the choroids plexus. Albumin represents 3.5mg of CSF and (214) transports fatty acids ("free" fatty acids). (222)

"Human cerebrospinal fluid is an ultrafiltrate of plasma that is largely produced by the choroid plexus. It consists of a mixture of anorganic salts, various sugars, lipids and proteins from the surrounding brain tissues. The predominant proteins in cerebrospinal fluid are isoforms of serum albumin, transferrin and immunoglobulins, representing more than 70% of the total protein amount".

The lipids in CSF = 1.2 mg. (in approx 125 ml CSF) (202,202b) This breaks down into (microg/L) : arachidonic 26.14, docosahexaenoic 60.74, linoleic 105.07, myristic 160.38, oleic 10.13, and palmitic 638.34.

(These are all used for membrane phospholipds phosphatidylethanolamine (PE), phosphatidylinositol (PI), phosphatidylcholine (PC)) (199)

Palmitic acids is the greatest quantity in the CSF lipids. This is being suggested for the smaller Hemosiderin granules. Magnetite crystals over 25nm. *(most of the magnetite crystals found in the brain were greater than 25nm (151))* The Hemosiderin ferrofluid may be the precursor to the crystals.

Magnetite lipids have already been developed for medical use such as drug delivery, long before they were discovered in the brain. Medical engineers created "magnetite cationic liposomes" (MCLs), which are cationic liposomes containing 10-nm magnetite nanoparticles. These generate heat under an alternating magnetic field (AMF) by hysteresis loss. *(A model will be proposed in the following section to show that a hysteresis loop can be created in the magnetite pia layer, due to magnetic shifts occurring as blood loses oxygen to become paramagnetic.)*

In these engineering experiments albumin secretion by liver cells increased in response to the presence of the magnetite.

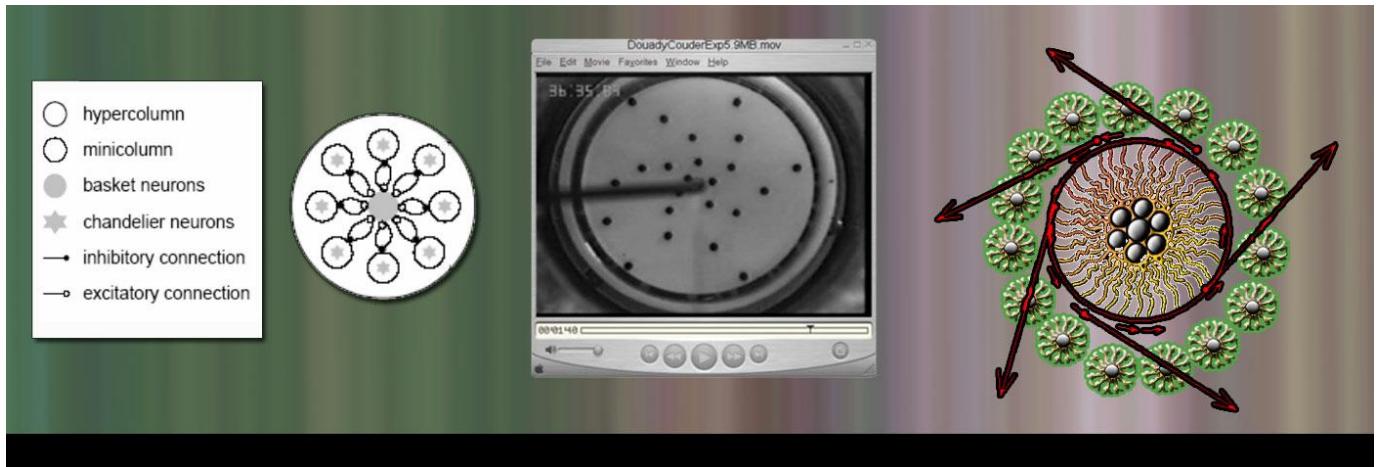
"Albumin secretion by hepatocytes (liver cells) was about three times higher than that of the control co-culture system without magnetic force." (210)

In the brain albumin is produced by the choroid plexus. Would this increase in response to the brains own magnetic forces ?

Albumin itself has been used by medical engineers as a sealant for magnetite. When it was discovered that this protein solution dispersed in oil, and then heated produced solid, spheroid albumin protein particles. The substance called polyacrolein contains magnetite cores less than 25nm. These were produced for drug delivery. (220, 221)

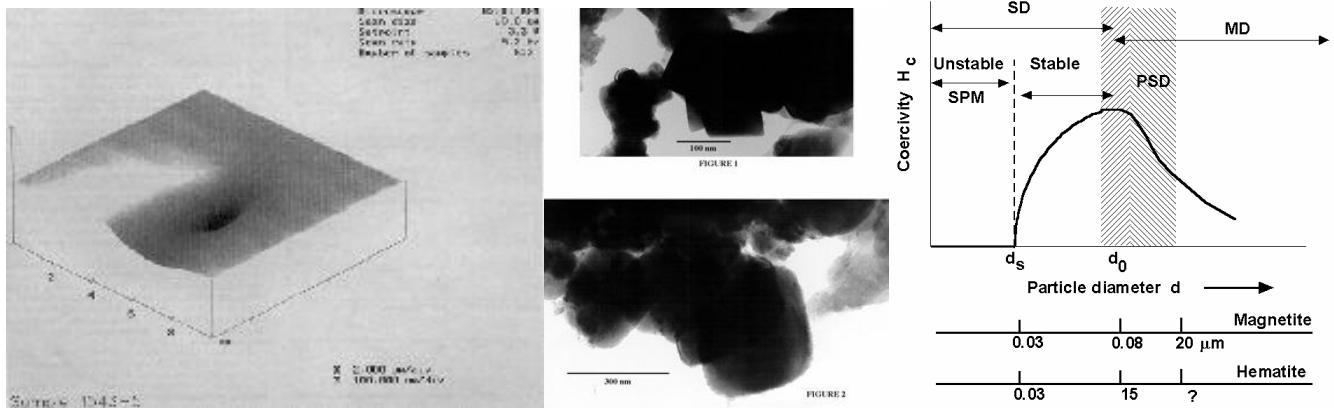
The number of approx 40,000,000 cortical magnetite clusters lies between current estimates for the number of cortical minicolumns and hypercolumns 200,000 and 200,000,000 respectively. (255)

Here the proposition will be a Ferrofluid cluster where the small magnetite crystals arises within lipid mixed deposits of hemosiderin and the larger crystals from siderosomes.



RIGHT : Graphic defining the Macro or Hypercolumn visually. (255) The hypercolumn represents everything contained within the whole unit. Macrocolumn diameter is estimated at 200-700 μm , (60-80 minicolumns) Minicolumn diameter 40-50 μm . (100 neurons per minicolumn) (66) MIDDLE : Ferrofluids tend to space themselves out, moving with spin force. RIGHT : Visual representation for a ferrofluid cluster. The magnetic material larger than 30nm aggregates together in the centre, producing spin force, which could space the remaining smaller lipid surrounded particles out to fill the diameter of the minicolumnms 40-50 μm .

10 MAGNETITE WORKING WITHIN THE BRAIN



LEFT : Magnetic Force Microscope image of an alzheimers, brain plaque showing a dipole-like magnetic response, indicating the presence of magnetic material. MIDDLE : Transmission electron micrographs of biogenic magnetite particles extracted from a human hippocampus LEFT : What a coincidence. Biomineralized magnetite falls into the range for stable single domain (SD) units. 30-80 nm. (SPM: superparamagnetic SD: single domain PSD: pseudo-single domain MD: multidomain)

10.1 COMMENTS ON MAGNETITE BY RESEARCHERS

Magnetite is obviously very powerful:

"the mechanical energy present in a single 0.1 um magnetite crystal exposed to a 60 Hz, 0.1 mT magnetic field is many times the thermal background noise Such particles, if adsorbed on cell surfaces or ingested by the cells, could conceivably transfer this energy to contiguous cell structures such as mechanically-activated ion channels (which operate with a gating force close to the thermal noise limit and thereby alter cytoplasmic ion concentrations sufficiently to produce the observed bioeffects." (154)

"A simple calculation shows that magnetosomes moving in response to earth-strength ELF fields are capable of opening trans-membrane ion channels, in a fashion similar to those predicted by ionic resonance models. Hence, the presence of trace levels of biogenic magnetite in virtually all human tissues examined suggests that similar biophysical processes may explain a variety of weak field ELF bioeffects." (150)

"Magnetite is an excellent absorber of microwave radiation at frequencies between 0.5 and 10.0 GHz through the process of ferromagnetic resonance, where the magnetic vector of the incident field causes precession of Bohr magnetons around the internal demagnetizing field of the crystal. Energy absorbed by this process is first transduced into acoustic vibrations at the microwave carrier frequency within the crystal lattice via the magnetoacoustic effect; then, the energy should be dissipated in cellular structures in close proximity to the magnetite crystals" (149)

"The shift in coercivity distributions, as measured by isothermal (an isothermal process is a thermodynamic process in which the temperature of the system stays constant) remanent magnetizations IRM (Magnetization acquired instantaneously in an external field) acquisition and its demagnetization, and the relatively slow tendency to acquire an anhysteretic remanent magnetization (Magnetization acquired by the combined effects of a large alternating field and a small DC field) ARM suggest that the particles in situ are in small interacting clumps. Comparison with bacterial control samples suggests between 50 and 100 particles per clump." (151)

So what is it for ? Is magnetite a waste product. ? Why does it remain in the brain, if all it does is accumulate, to then disintegrate us, as we get older. Magnetic resonance if utilised by biology is a very powerful force. Ferromagnetic crystals interact more than a million times more strongly with magnetic or electrical fields than do diamagnetic or paramagnetic materials. (152)

A researcher in spain MA banaclocha has proposed that the electromagnetic field itself could be where our short term memory is located. Short term working memory does not seem to be encoded by the hippocampus. There is evidence against human hippocampal involvement in working memory maintenance of familiar stimuli. (192) visuo spatial and verbal components. (193) The latter two are encoded by hippocampus for long term memory.

(refer section 1) Where is short term memory ? It is held in the cortex, but not by slow acting g-protein (intracellular messaging) long term potentiation.

(125) Before the discovery of magnetite, J McFadden suggested the outer cortical layer is where consciousness was held by an electromagnetic interaction with itself. (126) John Joe Macfadden describes this extracellular field :

"The human (and animal) brain therefore contains a highly structured (in time and space) endogenous extracellular em field, with a magnitude of up to several tens of volts per metre. Although these extracellular fields are relatively weak, at the low frequencies characteristic of brain waves, cell membranes are much more resistive than either the cytoplasm or extracellular fluid. Consequently, within brain tissue, most of the potential drop occurs across cell membranes. In general, transmembrane fields are approximately 3,000 times the field in the surrounding tissue (Valberg et al., 1997) but may be even higher in elongated cells orientated along the field. Consequently, endogenous em fields of tens of volts per metre are capable of generating fields of several tens of thousands of volts per metre, translating to up to several millivolts, across the 5 nm neuronal cell membrane."

He proposes that these EEG fields interact at an extracellular collective level.

"Although weak, the existence of evoked potentials demonstrates that both sensory stimuli and motor activity are associated with temporally organised perturbations to the brain's em field. Walter Freeman's classic experiments (Freeman, 1991; Freeman and Schneider, 1982) measuring EEG activity within the olfactory bulb of rabbits and cats demonstrated bursts of EEG activity in response to sensory stimuli with average amplitude of about 100 microvolts across recording electrodes that were spaced at 0.5 mm and thereby corresponding to field gradients of 0.2 V/m. Interestingly, in these experiments information concerning the identity of a particular odour was not carried by the temporal shape of any particular EEG wave but by the spatial pattern of EEG amplitude (the contour plot) across the entire surface of the olfactory bulb".

Magnetite is the prime candidate for the sought after overarching coupling ?

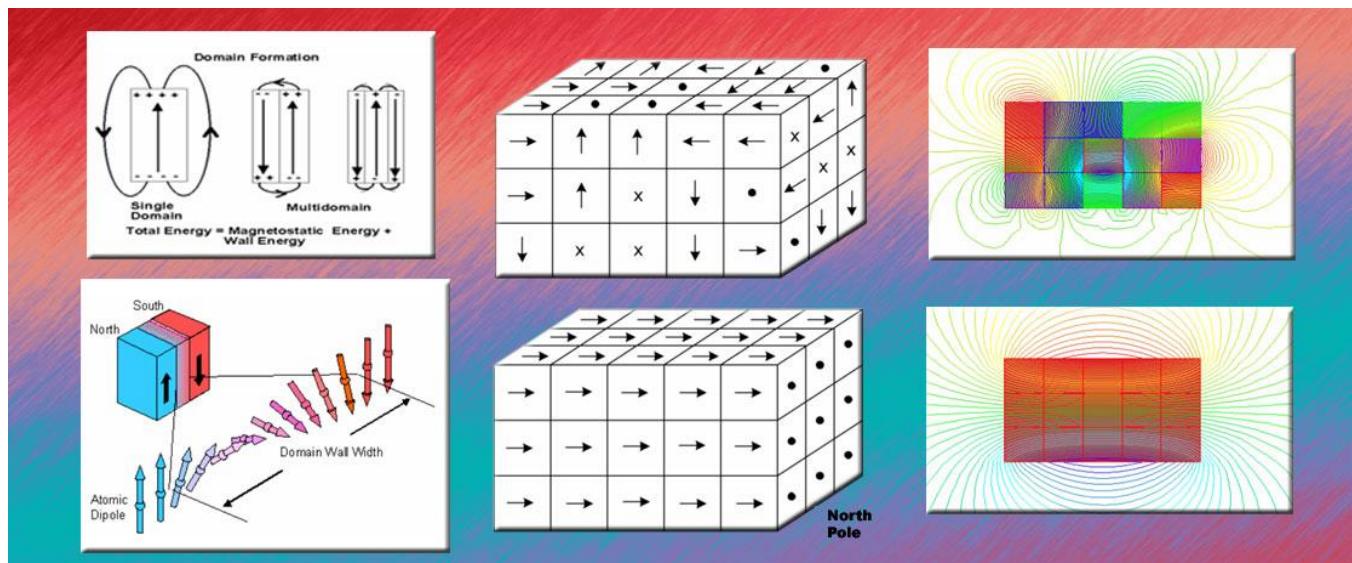
"The crystals (cortical magnetite) appear to be oriented so as to maximize their magnetic moment, which tends to give groups of these crystals the capacity to act as a system." (153)

*"There was remarkable consistency in the IRM *(isothermal remanent magnetizations, isothermal process is a thermodynamic process in which the temperature of the system stays constant; ΔT = 0.) measurements of both the brain tissue and the meninges. There was little difference in IRM from one area of cerebral cortex to another or in the cerebral versus the cerebellar cortex." (54)*

Meaning that the magnetic properties of magnetite are similiar throughout the brain.

10.2 MAGNETIC DOMAINS

How could a magnetic layer operate as a system for the brain ? Preceding this requires looking at what happens when a whole lot of magnetic domains get together to understand what would happen with a ferrofluid surrounding the brain.

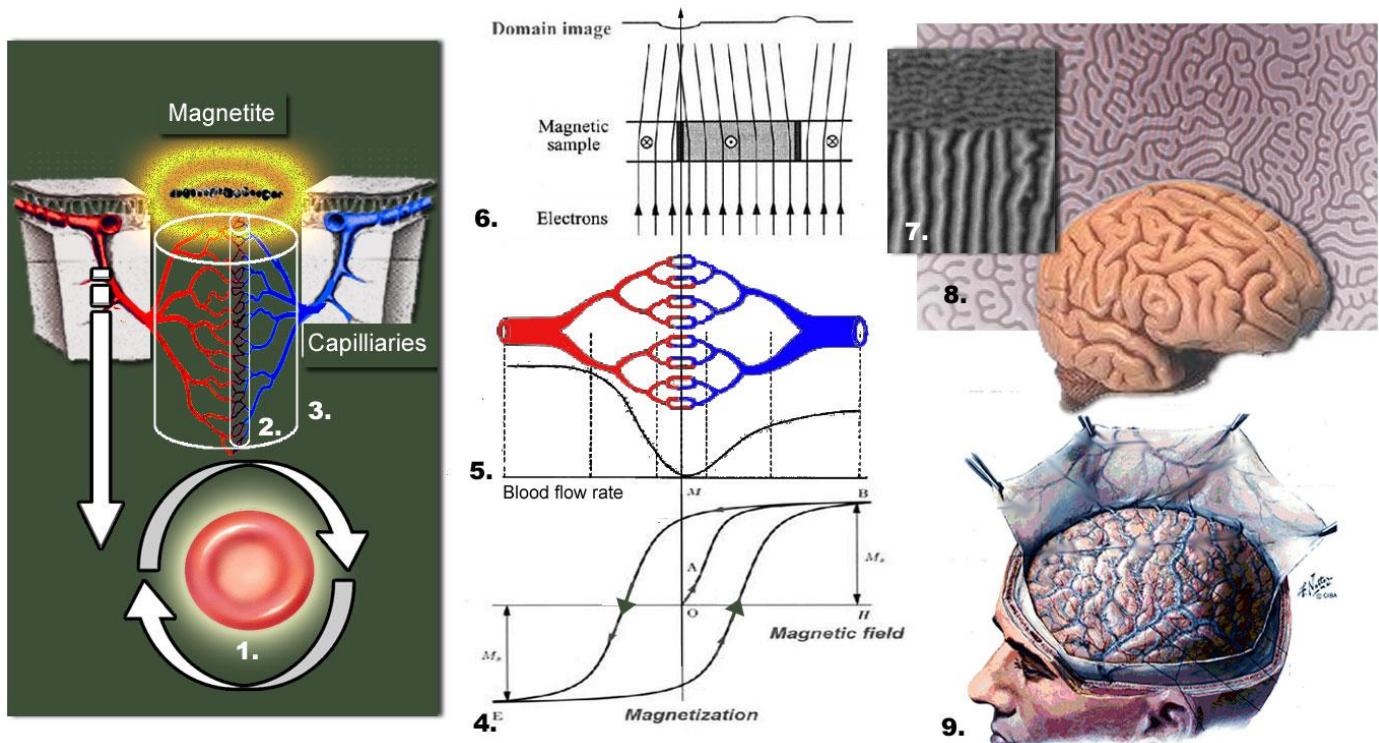


Bottom Left : Within any two pole magnet there is an area where the magnetic field reverses. This is a domain or "bloch" wall. These are usually in the midline. In our earth this would correspond to the equator. Understanding domain walls is useful to know for paper 2, which explores the idea that the corpus callosum itself has domain wall structure.

The diagrams above from Rick Hoadley help understand what would happen with a ferrofluid surrounding (*or making*) the brain. A Domain is the smallest known permanent magnet. (*About 6000 domains would occupy an area the size of the head of a common pin*) Each domain has a single magnetic vector loop. (*top left in diagram above*) If the magnetite crystals get too big above 150 nm they become capable of splitting to multi-domain crystals. (*top left in diagram above*) From the previous results it seems that human biomineralization selects for single domain. If a lot of single domain crystals suddenly arise from hemosiderin or siderosomes, surrounding a brain, they will be orientated randomly, with each of their domains pointing in different directions. (*Top middle and top right in diagram above*) These are unmagnetized ferromagnetic materials, the domains are randomly oriented and neutralize each other or cancel each other out. However, the single domain magnetic fields are still present within the domains. (*Note : The diagram shows a block of magnetic domains, the principle is similiar for a ferrofluid.*) For all the single domains to become unified, and posses a typical north / south pole, The application of an external magnetic field such as the earths own magnetic field, would be required to cause the magnetism in the domains to become aligned so that their magnetic moments are added to each other and lined up with the applied field. (*Bottom middle and right in diagram above*) Research into human subjects find that the magnetic layer does not posses the magnetic signature of the earth. (55) Does magnetite remain random ? The next section proposes that the solution to this missing field comes from a loop of magnetic changes in our blood, which resets the domains, while the information which is written to the field is from EEG itself.

10.3 PROPOSED MODEL FOR BRAIN BLOOD POLARIZATION

The outer brain has the very striking appearance of a divided walnut. This section uses physics, biology and visual thinking to present some ideas on the possible mechanics which produce this, while considering how this has implications for current theories on memory.



At this point, the ideas from Banaclocha and MacFadden, regarding memory and EEG, can be fused with one of the first ideas from draft one of this project. That is a whole brain dipole from blood flow itself.

(1 in diagram above) Blood is highly susceptible to interact and even spin with magnetic fields. (127) (*This is consistent with visual evidence for spin in the whole cortical artery network. (1)*) The Blood flow in the capillaries changes from diamagnetic to paramagnetic at the point red blood cells give up oxygen. This is signaled by blood changing from red to blue. What is being proposed by the cyclic blood flow, (*which prolongs its time period in favour of periods while blood is paramagnetic, 5 in fig above*) is a hysteresis loop. (*Hysteresis, is a loss of energy in a material during cyclic excitation. These kinds of cycles are used in tape recorders.*) Note large cylinder (3 in diagram above) and small cylinder (2 in diagram above) represent macro and minicolumns respectively.

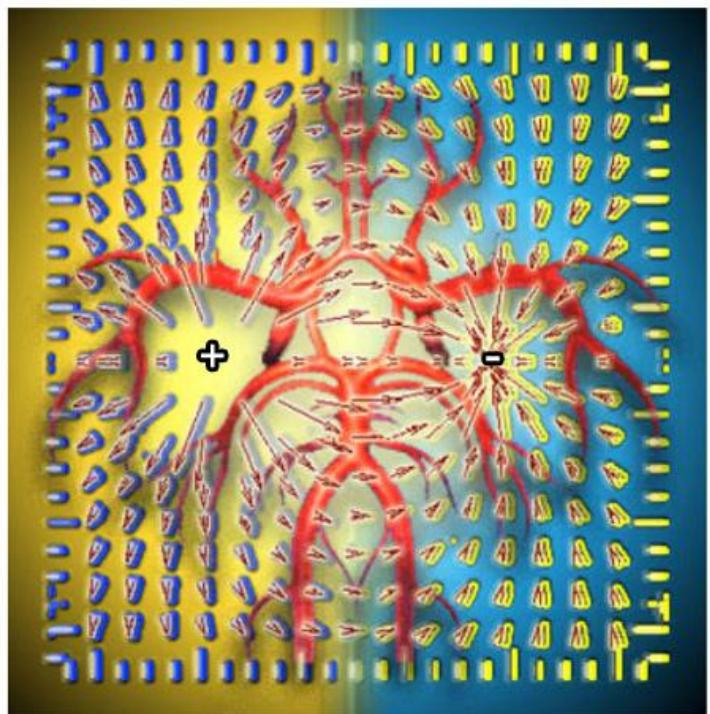
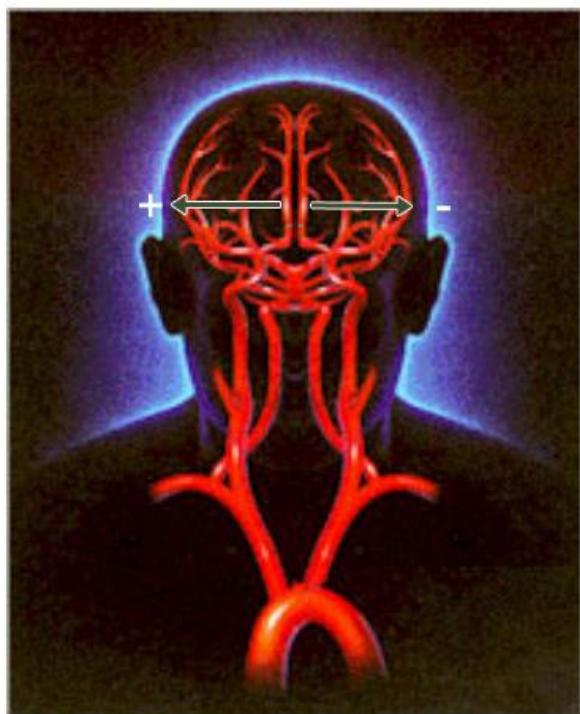
Moving right to the middle of the figure above diagram 5 which represents blood flow rate through varying diameter of blood vessels, is placed between a pre-existing scientific diagram (4 and 6) that describes the hysteresis loop which writes to a magnetic tape (*top half is diagram 6*). This has been done to illustrate a correlation which required no adjustment of either diagram. The loss of magnetic energy comes from the decrease in pressure of diamagnetic red blood. In the midpoint where the blood is in the capillaries giving up oxygen, it becomes starts to become paramagnetic. (*This is not quite as sudden as the diagram indicates.*) As the paramagnetic oxygen blue, picks up pressure it increases the magnetic field while it is passing by the meninges ferrofluid, as it leaves the cortical area. The loop is created as the red blood coming in is also dropping the magnetic field. (*note that arrows for the magnetic field, point downward to the left of diagram 4*) This loop is continuously flowing by and resetting, the magnetite layer. At the same time neurons are firing, creating ionic changes in the extracellular fluid, which register as EEG and provide a direct current (DC) to the cortical ferrofluid.

For the middle of the diagram, this collage of vessels and domain stripes should be viewed as a side on view analogy for cortical columns. The scientific diagram (4 and 6) describes the production of Magnetic stripe domains by means of an alternating magnetic field in thin film ferromagnetic strips. (124) This is the kind of loop which

produces the perpendicular anisotropic (*upwards direction*) domain ordering, seen at both the surface of the brain and the cortical columns themselves. (*Note the domain image at top of figure 6, then compare it with its photograph, figure 7*) For the neural equivalents of the domain image in figure 6 the magnetic sample would be the brain magnetite layer, and the electrons from the electrical flow of neurotransmission through the cortical columns as represented by EEG. The ferromagnetic strip retains information, when the electrical activity that imprinted it has subsided. (*Our working memory, equivalent would be sitting back doing less and reflecting.*) When looking at images of stripe domains (7) and from top (8), (*which are photographs of thin ferromagnetic strips, written to by an alternating magnetic field*) Writers have commented on the similarity to cortical folds. (118, 120) .

Using this magnetite / blood theory predicts the Vein return system would have the highest magnetic field. This could explaining why in comparison to the arteries, there is an increasingly fractalised structure which is precisely aligned to the cortical domains themselves, (fig 9) and why the central sinus into which these veins converge is toroidal. Exploration of dipole shapes within the brain is included in another paper in this series. (1-1)

For the final pieces in the puzzle, a good candidate to couple neurons to blood flow itself is the recent discovery of nitric oxide. Nitric oxide is paramagnetic vasodilator (*a substance that increases blood flow*) which is released by all of the neurons involved in consciousness. (174) This would be to be the key player in coupling neuronal activity to blood flow. (175) Also of note is that palmitic acid which represents the largest quantity of CSF lipids within the proposed ferrofluid, modulates brain capillary proteins (203) and the glucose transporter in brain capillaries as well. (223) Any modulation to brain capillaries width and glucose transport also modulates major factors in the focal area of it's own hysteresis loop.



LEFT : Blood flows against itself in opposite directions. When currents flow against themselves within a magnetic field polarization increases towards the poles. RIGHT: This would translate to a greater positive ion charge in the right hemisphere and negative in the left. This correlates with the lateralization of extracellular sodium and chlorine from glutamate and Gaba neurons in the right and left hemisphere respectively. (2)

10.4 ALZHEIMERS DISEASE CORRELATES WITH THE COMPONENTS OF HYSTERESIS MEMORY THEORY.

The Severity of Alzheimers disease correlates to increased levels of magnetite. (191 L) Many other of the biochemical players for the ferrofluid memory model correlate to Alzheimers.

As mentioned previously the albumin component of CSF stimulates, oleic acid. Oleic acid reversibly opens the blood-brain barrier. (219) This correlates with alzheimers.

“BBB permeability is increased in the cerebral cortex of 10-month-old Tg2576 mice preceding Alzheimer disease pathology presentation. Furthermore, when compared with their nontransgenic littermates, 4-month-old Tg2576 mice exhibit compromised BBB integrity in some areas of the cerebral cortex. An age-related increase in albumin uptake by the brains of Tg2576 mice, compared with nontransgenic mice, was also observed.” (185)

This could contribute towards the increase in Albumin-bound polyacrolein in alzheimers plaques. (186)

10.4.1 LIPIDS, DISEASE AND MEMORY

Increased lipid peroxidation precedes amyloid plaque formation in an animal model of Alzheimers. (188)

Strong magnetic fields peroxidise brain lipids. Rats given monthly exposure to an impulse magnetic field activated initial, intermediate and final stages of lipid peroxidation. (187) magnetite nanoparticles themselves, generate heat under an alternating magnetic field. (210) Docosahexaenoic acid, (DHA) one of the Lipids present in CSF alleviates memory problems due to alzheimers.

“DHA administered for 12 wk significantly reduced the increase in the number of reference and working memory errors in the Abeta-infused rats, and increased both the cortico-hippocampal level of DHA and the molar ratio of DHA/arachidonic acid, suggesting an amelioration of the impaired spatial cognition learning ability. Furthermore, DHA suppressed the increases in the levels of lipid peroxide and reactive oxygen species in the cerebral cortex and the hippocampus of Abeta-infused rats, suggesting that DHA increases antioxidative defenses. DHA is thus a possible therapeutic agent for ameliorating learning deficiencies due to Alzheimer's disease.” (191)

In alzheimers acrolein (*remember that polyacrolein was also produced by engineers to contain magnetite*) is implicated in the beginning stages of the amyloid plaques. (186) Acrolein is a product of lipid peroxidation, which inhibits glucose and glutamate uptake. (195) These polyacrolein-albumin mixtures correlate with real amyloid plaque components.

As mentioned previously in the brain albumin is produced by the choroid plexus. Albumin producing cells were found to increase threefold in the presence of magnetite. (210) The first choroid plexus is the starting place for both albumin and heavy magnetite production. (251, 252, 253) The hippocampus atrophies early in alzheimers. (197)

The Biggest quantity lipid in CSF which would be the prime candidate for the ferrofluid is palmitic acid, which is transported by albumin (213) and high in alzheimers. (198) If this increase were due to brain injury, all brain lipids would be increased (216)

10.4.2 CSF LIPOPROTEIN apoE IN ALZHEIMERS

The apoE-enriched (High density lipoprotein) HDL is the predominant lipoprotein in CSF (207, 208) **CSF apoE is synthesized and secreted mainly by astrocytes (207)** In human CSF, the lipoproteins were primarily spherical (approximately 140 Å), and contain cholesterol, diacylglycerol and mainly phospholipid (206, 207) **Apolipoprotein (apo) E**, is one of the main apolipoproteins in the central nervous system, may play an important role in lipid metabolism; (207)

“Apolipoprotein E (apoE) is a protein (Mr = 35,000) that functions in the CNS. This conclusion is supported by the abundance of apoE mRNA in the brain (Elshourbagy et al., 1985), the presence of immunoreactive apoE in subsets of brain glial cells (Boyles et al., 1985), and the finding of apoE in CSF lipoproteins (Pitas et al., 1987). Several studies suggest that apoE

contributes to neural homeostasis. ApoE may help to repair and maintain neuronal integrity after lesion-induced damage (Poirier et al., 1993), acute head injury (Chen et al., 1997), stroke (Slooter et al., 1997), and during aging (Masliah et al., 1995a). ApoE is present in extracellular insoluble amyloid plaques and intracellular neurofibrillary tangles that are characteristic of Alzheimer's disease (Namba et al., 1991). (207)

Non alzheimers subjects, with particular variations of the genes connected to alzheimers (epsilon 4) apolipoprotein E resulted in similar short term memory problems to alzheimers but with no disease manifestation. (194)

Also in a separate study, memory tests in early onset alzheimers patients found that they performed worse in tasks involving the cerebellar and occipital regions. (195)

This may be because defective apoE could originate from the cerebellum. And this converges with the previous observation that the ventricles would be the spot for magnetite production, and the cerebellum is deeply intertwined with the 4th ventricle.

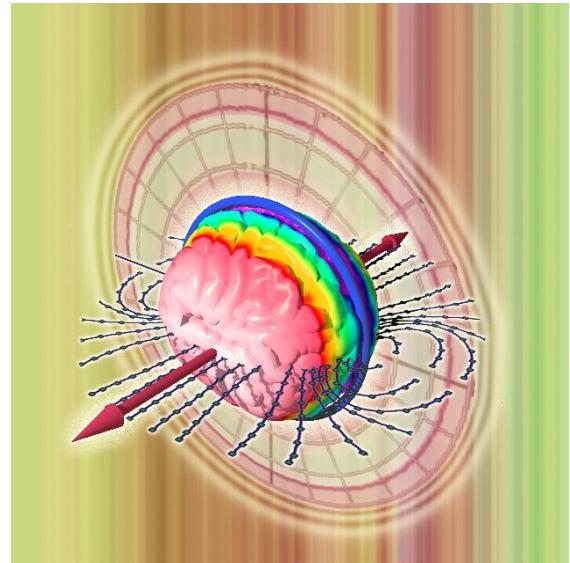
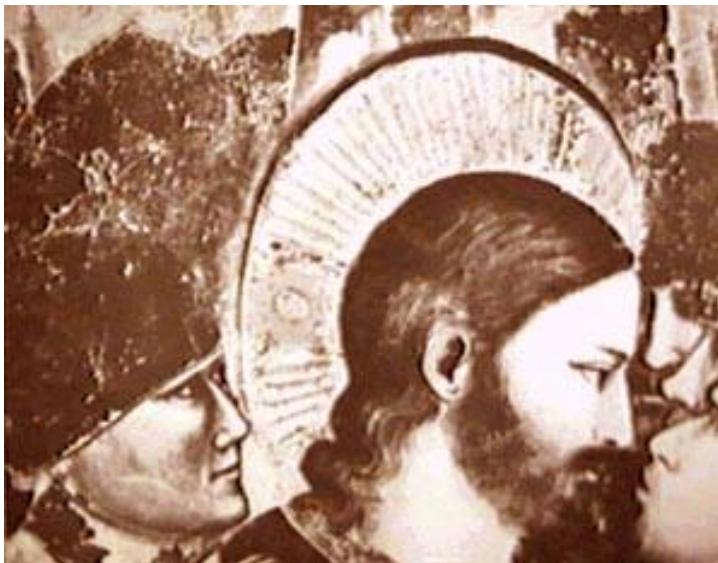
"In wild-type mice, the highest overall levels of apoE mRNA were found in astrocytes in the glomerular layer of olfactory bulbs and in Bergmann glia in the cerebellum. " (218)

And make it's way round the CSF towards the meninges affecting the occipital lobe first.

"The curiously consistent localization of cerebellar cortical damage in chronic alcoholism is re-evaluated in the light of selective damage, with a similar topography in the cerebellar vermal region, in superficial siderosis in man and in experimental animals exposed to certain toxic substances. Attention is drawn to the capacity for Purkinje cell dendrites and Bergmann glia to extract materials from the CSF, and to the close anatomical relationships of the susceptible lobules I-II, IX and X to the roof of the IVth ventricle and to the cistern of the great cerebral veins. This restriction of damage to vermis and paravermis may reflect some compartmentalization of CSF flow within leptomeninges, consistently increasing exposure of these cerebellar surfaces to materials circulating in the CSF. In other circumstances when this pattern of damage is encountered it raises the question as to whether other environmental agents, gaining access to the CSF, may be similarly distributed." (217)

11. THE MAGNETIC PERSONALITY

The section following this is going to explore more specifically what electromagnetism reveals about brain structure at the brain midline. Taking this into account with all the previous ideas about magnetite distribution, gives amazingly specific correlations with visual descriptions of religion, psychic ability and eastern medicine.



RIGHT : Religious art is full of references to discs or auras. Religious states are neurologically tied to temporal brain regions, (*below ears*) which are the most prone to epilepsy. These can spike out the strongest peaks in the electromagnetic field. LEFT : A specific look at brain electromagnetism from the next section "exploration visual evidence"

"Electrosensitivity" is a state which can describe specific sensitivity to electromagnetic field, in terms of, unreal charges, ionised air, electrical tingling, magnetic transfixation and the visual perceptions of rings or energy round the heads of specific people. In psychics whose brains could be said to be overactive, this would correlate with increased thermal radiation from an overactive magnetite field, and induced lipid peroxidation round the meninges, and the midline longitudinal fissure. (2)



The seven major psychic centres

Crown chakra

Christ chakra

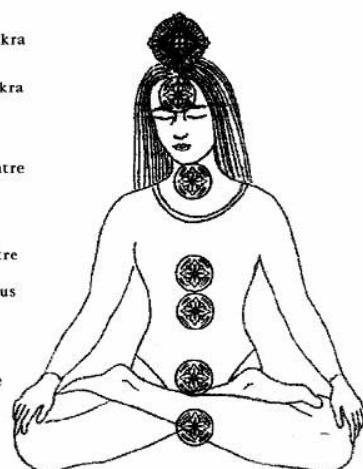
Throat centre

Heart centre

Solar plexus centre

Sex centre

Base of spine centre



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RIGHT : This image describes well, albeit in a dramatic manner what can be seen, but only if a person is electrosensitive. LEFT : What has come up in this research regarding the midpoint for the electromagnetic field concurs with that from eastern medicine. When the eyes are closed thalamic input is reduced. The brain midline becomes more active than the hemispheres. (1)

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