Appendix

DIALOGUES CONCERNING A THIRD NEW SCIENCE

Roger Y. Gouin

THE STAGE: *After being forgiven at last by the Pope in 1993, Galileo asked his friends Sagredo, Salviati and Simplicio to go back to Earth to find out what made the Pope change his mind 400 years after their discussion on the two sciences that Galileo instigated then.* [**1**] *They had no difficulty seeing to their dismay how distorted these sciences in fact became at the hand of Scholars, with so much mathematics and so little physical feelings. They went especially to find the facts and theories of the 20th century since they appeared to be behind the pardon by the Pope, and to see whether any new science was hopefully in the works to repair the damage done to the older ones. After 10 years of search and new learning, they finally fell upon a small book that reminded them a lot about their dear Academician and his old ways. Following the line of their Academician's work, that book was running square against what they saw at the house of Scholars. A lot of hope was coming from it for the future of Science and Humanity, as the science of Life it addressed could not be envisioned at all the first time they were on Earth. Simplicio however was puzzled after going over the book.*

1. Simpl.: *So we are nothing more than self-aware computers; this part of the book does not sound right…*

Sagr.: "Self aware computers" may be an image drawn from that work, but it is an incorrect inference, as there are a lot of connotations in this 3-word bit. We are not computers because computers are MACHINES, made out of **separated things** in the language of the Scholars, thus dead things, like our beloved boats in Venice, sorry to say. We are not golems, i.e. without soul. We are **whole physical entities**, SCQSs as the disciple of our Academician identified systems like our minds, [**2**] entities unlike anything that can be found in the world outside us, and certainly not in the world of this technology we see all around. (Such appears to result from the first two sciences we envisioned back then after being left at the hand of Scholars.) We are the **jewel of Nature**; and through our minds we hold the key to its future. The Scholars who call themselves "computer scientists" have in effect put out a propaganda since the 1950s about Humans being machines through their beloved Turing, the inventor of the theoretical concept of these machines. His "Human vs. Computer Test" was designed so that these machines **could have a chance at being as "intelligent" as Humans or better**. Of course they did not stand a chance when it came to dealing with Human behavior, and everything that comes with it, including its genius at designing these computers.

2. Simpl.: *Now I feel better. The next problem I have is that the Author is describing space as "curved." This can only be a mathematical description, since space is mani-*

festly flat as I consciously see it, and my common sense tells me so too. Isn't that what present physicists say also?

Sagr.: This appears indeed to be a widespread misconception held by students of the physical sciences these days. Einstein's theory is however not a mathematical description of "flat world properties," it is a physical description of a world truly curved in more than 3 dimensions. The leaders of physics, such as John Wheeler, have reiterated this thrust of Einstein's theory.[**3**] Other theories have been proposed, such as the theory of **gravitons** by Feynman, where particles carry the gravitation "field" in a *flat space*, but this is only an attempt at making Einstein's view mathematically easier to handle. **Quantum theory still uses a flat space** also, and that theory has problems resulting from such a stance. In a similar fashion, in the times of our dear Academician, people believed we were on a **flat earth**. This concept had to wait until this century, when pictures of Earth were finally obtained from space, for some people to accept at last that we were on a round world! The same appears to be happening with Einstein's original conscious experience (now almost one century old). People simply cannot **imagine** anything else but a flat space, and this includes many Scholars of the present period in science.

It is true though that this question has not yet been put to rest through experiments. This is indeed **the last experimental proof that has not yet been given about Einstein's theory**. Recent experiments may hopefully give this proof shortly at last.[**4**]

2. Simpl.: *I won't believe this until I see pictures of the effects that these experiments describe. "Curved beams" are too weird to conceive... Speaking of a weird aspect of our world, Salviati, please define again a "cellular automata" for me, will you? A key concept of this new science we are seeing starting around us, no doubt...*

Salv.: From what I learned in class,[**5**] cellular automata are **discrete** classic dynamical systems with a behavior completely specified in terms of a **local relation**. Space is represented by a **uniform grid**, with each **cell of the grid** containing a few bits of data. Time advances in **discrete steps for the entire grid**, and the laws of the "universe" are expressed in a **small look-up table**, through which, at each step, each cell computes its **new state** from that of its **nearest neighbors**. Thus, the laws of the system are local and uniform. The peculiar thing about them, as I have been told, is that they are able to perform a computation as any computer…

3. Simpl.: *How can there be such an abstract-sounding thing in reality, especially across a "double layer of space" as the book says?* [**7**]

Sagr.: Let's consider biomolecules arranged on a cylinder in a **triangular grid**, and assume these molecules able to exist in two different atomic configurations (conformations), α and β corresponding to a dual electron state somewhere in each of the molecules. The two states differ only by the position of one electron in each molecule, with the

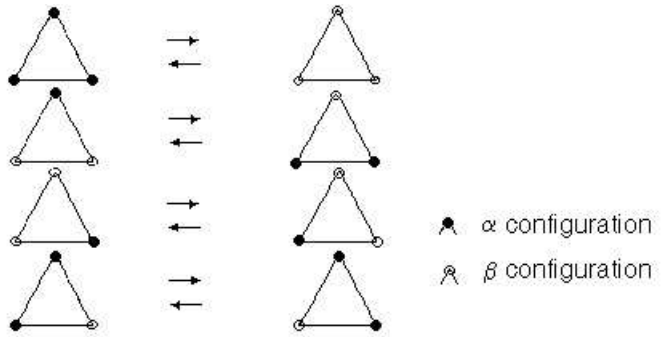

Fig. 1 – Two-neighbor reversible update rules

atomic configuration being only slightly different between configurations. This is essentially the arrangement of a microtubule (MT) found in biological cells.

With **nearest-neighbor only** considered in the molecular interactions, the component molecules switch their **conformational state** in 8 different ways according to Fig. 1. This is the "small look-up table" mentioned in the automata definition. *Energetically,* these configurations can be split in two sets of four as shown on the left of Fig. 2.

Instead of affecting the entire grid as the definition puts, the time advances by rows on the grid, and this by waves of atomic vibrations (like sound) that quantum mechanics calls "phonons."

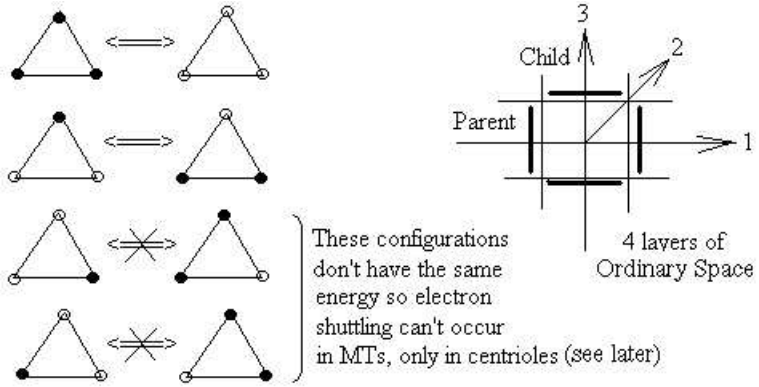

Fig. 2 – Complementary logic configurations

Moving thousands of atoms, even just slightly, to effect the conformation switches would be energetically a Herculean task. In order to minimize the energy required for these switches, they would be feasible only if a parallel layer in ordinary space was created **around the cylinder** containing complementary states (Fig. 3). Then the electrons would only need to shuttle between complementary **molecular states** across the layers of space.

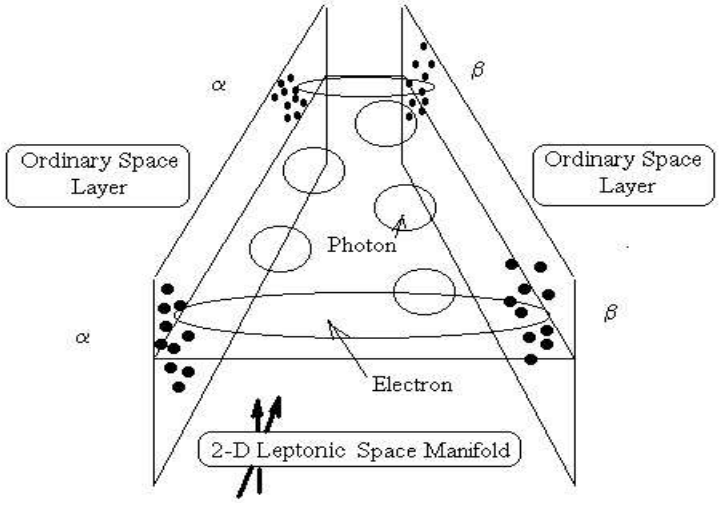

Fig. 3 – Split of ordinary space in 2 layers

We have of course no data on energy requirements, but at least a **ground state** for the quantum process of the shuttling electrons must be then reached. Transition quanta

(photons) are an essential part of the non-local quantum dynamical system creating the new "leptonic" space in-between the layers of ordinary space.

This can occur of course only within the set of configurations of nearest-neighbors **having the same energy** (Fig. 2). MTs have only half of the set at the same energy, being simple tubes. **But in order to generate an automata we need all configurations to be available, and thus at the same energy**.

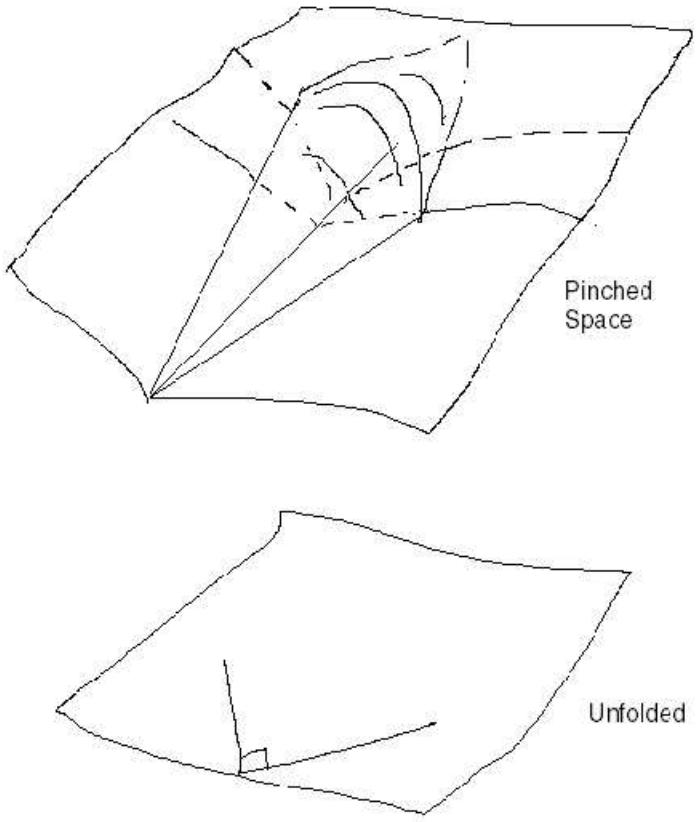

Fig. 4 – An ordinary space squeeze

Now, if ordinary space could be warped in a conical fashion (when taking a 2D sheet view of ordinary space - Fig. 4), we would obtain a *superposition of 4 layers of space at right angles* in leptonic space (Fig. 2 – right side), giving us the entire set **at the same energy**: The leptonic space manifold of one double layer being in dimension 1 and the other in dimension 3 makes their common 3rd dimension (dimension 2) also part of ordinary space, in effect "pinching" ordinary space along the length of the cylindrical structure in the direction of that 3rd dimension(Fig. 4).

Salv.: If we consider an arrangement more sophisticated than MTs, such as a cylinder lined up with MTs, we may be able to reach the other states in that manner, and thus have an automata dynamics.

I can in fact see the **duplication** of the cylindrical structure through this warp of space, as such duplications have been observed through the electron microscope since the late 1970s for struc-

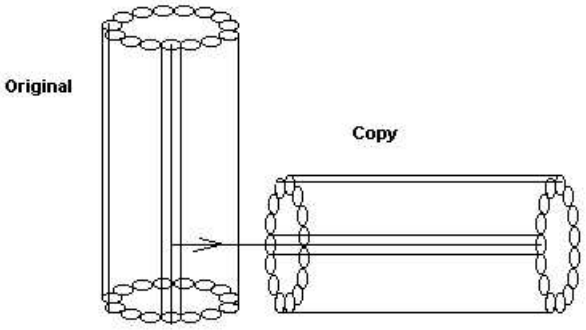

Fig. 5 – Making a copy seen from ordinary space

tures called "**centrioles**." [**8**]

New molecules are attracted from the medium in the cell by the dynamics of the initial structure, and are connected to the growing structure via their own leptonic spaces, thereby building a cloned shadow cylindrical structure *at right angle from the initial one in ordinary space* (Fig. 5). The striking one-sided aspect of the duplicated structure vs. the original confirms the spatial cone formation you just envisioned.

Sagr.: Yes, this construction across ordinary space then acts as a "zipper" on that space, starting at one end of the structure, "attaching" two ordinary space locations along the length of the original structure in dimension 2 of the leptonic space manifold, which then becomes a 3D manifold instead of 2D. The duplication goes layer by layer of molecules outward from the apex of the cone, guided by the location of the previous expansion of the leptonic space manifold in its new dimension. The non-local aspect of the connection in ordinary space between the two space manifolds in leptonic dimension 2 can be seen from ordinary space via a geometric development into two orthogonal structures (a flattened cone – see Fig. 4 bottom).

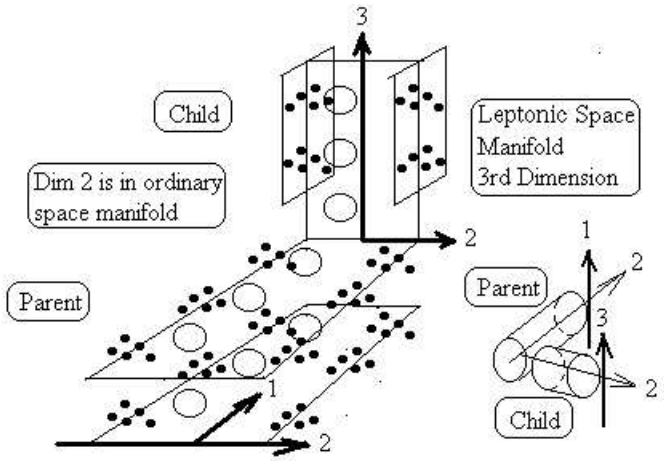

Fig. 6 – New dim 2 in leptonic space manifold

One centriole of the parent-child pair has then its leptonic space in dimension 1 while the other centriole has it in dimension 3 as a result of the construction of the child from the parent (Fig. 6).

The two centrioles must then have a complementary configuration of molecular conformations. They line up ordinary space at right angle through dimension 2 of the leptonic space manifold, while being superposed through that manifold (Figs. 4, 5 and right side of Fig. 2).

Salv.: Indeed, we know here from quantum mechanics that if we have the mere **possibility** of a **dual state in space** (dual layer), this allows a dynamical **entanglement** (coupling) between wave functions of the electronic evolution within spatially separated structures. These structures are then **coupled** through their evolution in leptonic space.

Of course QM to date does not consider different states for space since space is a mere **arena** for physical evolutions in that theory, but Nature appears to have a different idea on this matter. In that respect, existing experimental hints about the existence of these local spatial split and attendant warp phenomena can be found from at least two sources:

(1) From the late 1970s data on *unexplained large inertia* observed where the structures are located in a cell ("centrosome" of a cell) [**9**] hinting at a local spatial warp, and

(2) From the "mitotic spindle" shape, observed within the phenomenon of "mitosis" now for over a century in Scholar's Biology.[**8**] *This spindle shape could be the indication of a "field" of forces similar to the e-m field but coming from a quantum effect-originated curved space unrelated to gravitation.* The **membrane of the cell nucleus** in-between the centrosomes would influence the new "field" by also sustaining a set of leptonic space manifolds. **Such a field would only be felt by the molecules susceptible to participate in the overall dynamics of the system**, and so *we would be in presence of forces of a very different kind from the ones we considered in our Mechanics back 400 years ago, even with electromagnetism and strong forces added to it. We are indeed in front of* ***a brand new science****.*

Simpl.: We should not include the well-known "head spinning" experience when subject to a sudden stop of body rotation as an experimental evidence, but it may come also in part from the inertia of the system above since centrioles are free to rotate in the medium while they get their data from the fixed MT structures in the cell.

Anyway, so far I don't yet see how the above arrangement could sustain the evolution of a cellular automata per the definition you gave me earlier.

Sagr.: Indeed we have met only one condition for cellular automata: The electrons in the two perpendicular centrioles (in ordinary space), and superposed through leptonic space, can shuttle within dimensions 1 and 3 of this last space across the 4 layers of ordinary space in effect provided by the two centrioles. We have then a **complete set of rules** per Fig. 1 for effecting a cellular automata within one cylindrical leptonic space manifold lined up with a quadruple layer of ordinary space.

However, in a **symmetrical grid**, as we have assumed so far, the automata evolution would have both forward and backward **computational fronts** following the phonon wave fronts, **thereby giving no computation at all, one canceling the other**.

Salv.: Yes, there we reach a key problem that Feynman faced also. He thought of spin waves as possibly sustaining a computation through a one-dimensional sort of automata in a spin chain.[**10**] But he could not get away from the fact that both directions in the spin chain he considered were allowed, **making the time to complete the potential computation undetermined**. His idea is however at the origin of the "quantum computers" of today's thinking by Scholars. This thinking uses only **interfering realities** through the present quantum theory formalism, and fails to consider **non-commuting variables** in the quantum evolution internal to a given system. In other words, their quantum systems are "black boxes" with no internal separation and connection methods between structures. We need to consider such in order to have a **deterministic** computation as classical automata sustain.

Simpl.: The only systems considered in their "quantum computation" are all sorts of "gates," each performing a simple logic; but these gates **need to be connected classically** in order to have a complete set of elements to perform a true computation as Turing defined. They have got to miss most of the advantages of a multiple-reality world.

Salv.: Hopefully, through his "relative states" formulation of quantum mechanics, **Everett** did think about a deterministic world **where everything is a quantum system**, **including the observers of the system**. [**11**] Then, in effect, he saw that a quantum system could have an **internal structure**. The "observations" of a system were merely a **specific connection between subsystems**, among which **the observer** was included. Then, as Heisenberg pointed out (via his **Uncertainty Principle**), there could be two kinds of such connections: the kind via **commuting variables**, and the kind via **non-commuting variables**.[1] We are then led to **interfering** and **non-interfering** realities within the many-realities aspect of **composite quantum systems**, as in effect Everett considered.

Sagr.: Indeed, this is a fundamental discovery, which has nothing to do with mathematics! Let's address now at last why we have a **deterministic computation**. This is because **centrioles** are not cylinders, but quasi-cylinders… They are an **asymmetrical** arrangement of **slats** containing MTs (Fig. 7), with each slat being a **quantum subsystem** that can **observe** its neighbors! With this centriolar arrangement, Nature has indeed solved the 2-way computation problem of Feynman by allowing **only one direction** for the evolution through its asymmetrical slat construction.

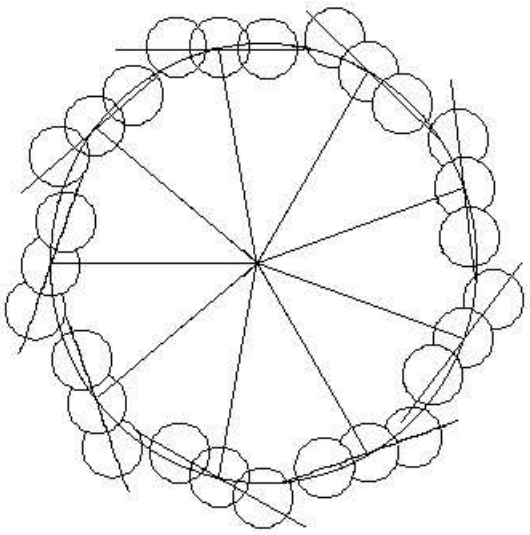

Fig. 7 – Section of a centriole

The **skewed slat** construction in Fig. 7 forces a given centriole to sustain only a forward **OR** a backward computational front. This is because each slat can **observe** (Fig. 8b), as an **Everett (Quantum) Observer,** only the photon pulses emitted in dimension 2 (in ordinary space) by the corresponding slats on both centrioles **from the previous step of the automata evolution**. With each observed centriole slat being in its own dimension (1 or 3), we have then a **one-way** non-local coherent evolution through a *sequence of observations* in a ratchet fashion on both centrioles (Fig. 8a).

[1] Here, as Simplicio did, the reader must read a basic quantum mechanics book such as Sakurai, J. J., 1994, *Modern Quantum Mechanics*, revised edition, Addison-Wesley

Simpl.: But how could Nature have come up with such a complex structure without the Hand of God?

Sagr.: The critical **asymmetry** in the slats arrangement has to be the result of the **collective quantum mechanical evolution** of vibration quanta (or **phonons**) started while they were originally produced by DNA. The phonons are coherent as a result of the atomic nuclei of the molecules supporting them being the connection of ordinary space with a leptonic space manifold generated by the electronic evolution.

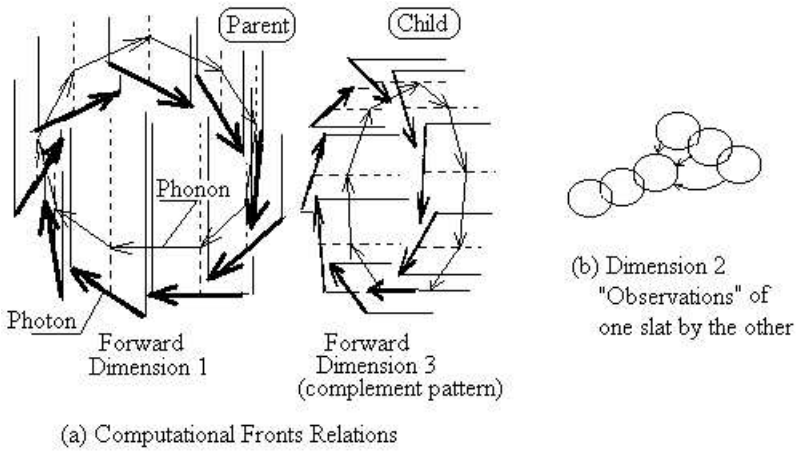

Fig. 8 – Computational relations in a centriolar pair

Phonon exchanges between slats would then occur because :

(1) One-way **ballistic-mode** propagation is available through an asymmetrical arrangement (the phonons have nowhere to go in the other way - Fig. 8a), allowing a stable larger evolution. A two-way evolution would just create resonances destroying the system. The need for an asymmetry explains then the observed **odd number** of slats (9 each).

(2) The leptonic spaces of the slats must be produced all with dimensions 1-2 **or** with dimensions 2-3 by the DNA, thereby allowing a **common** 2-D leptonic manifold between the slats out of the original set of individual slat leptonic manifolds. The mechanics of spaces is crucial here, something that is utterly foreign to our Mechanics of old! **The resulting stable larger leptonic space manifold in turn prevents the structure from falling apart** (even though it is seen as made out of **disjointed** parts in ordinary space). The assembly of the slats into a quasi-cylinder out of the DNA must thus occur as soon as they are produced near each other.

Simpl.: I have to say that this self-assembly could be seen as (1) an example of Life originating from quantum evolutions searching for larger collective dynamic patterns, since such patterns demand less energy, and (2) a beautiful example of a set of monadic spaces finding a possible stable and larger arrangement for their collective (non-local and unseparable) evolution, with their search including a modification to ordinary space!

Salv.: Indeed. The process happening in cosmic **spatial sink-source systems** [**12**] appears to be of the same kind: Monadic elements of space and matter rearrange them-

selves there also to find possible stable arrangements as large as possible, thereby defining all the necessary **asymmetries** found in elementary particles as well as the needed **constants of Nature** to accomplish their collective energetic goal.

Sagr.: This is also the case of **tensegrity structures** [**13**] we see in biological cells made out of MTs and **integrin** filaments defining the shape of a cell. [**14**] While the present Scholars are imagining a magical "spontaneous creation" of such minimal structures (as D'Arcy Thompson saw earlier this century in general for the whole body [**15**]), very much as our old alchemists were doing hundreds of years ago, the distributed quantum computation within the cell centrioles and the cell membrane receptors is in fact getting the DNA to produce the elements while directing the construction in coordination with the organism as a whole. The very existence of such structures defining the *form of the organism* is a direct hint at the hidden fundamentally quantum origin of the organizational capabilities of Life.

But let's go back to our centrioles to complete the picture. When we tack the electronic evolution described earlier onto the evolution of the phonons, we obtain a pure mechanical/electronic forward (**OR** backward) evolution on both centrioles. Since complementary biomolecular patterns exist on these two centrioles, the combined evolution on their **superposed surfaces** in leptonic space can exist in only one direction of propagation, and thus must be a **deterministic** *two-dimensional quantum computation*, something that Feynman was looking for.

Also, due to the slats construction out of three small cylinders, each slat can **observe** the previous one on the cylinder in more than one direction (Fig. 8b). Since each cylinder strip holds **non-commuting variables**, according to the analysis of our Academician's disciple following the line of Everett's view (App. B of [**6**], phase 2), the evolution of the automata ends up **branching in as many realities as the automata patterns computation can have choices in its evolution**. Each reality follows its own evolution path, **non-interfering** with the others on the surface of the centrioles in leptonic space. The two centrioles support a single **composite quantum system** which is evolving in a **deterministic** computational manner. The system is composite since the slats act separately as subsystems through their observation of non-interfering realities from the previous slat choice in the overall evolution of the automata. Their only evolutional connection with other slats are via photon pulses from the previous ones, which are quanta going **in a specific direction** as a result of **internal observations** within the **quantum spatial structure** as I described earlier.

Salv.: We can only conclude then that quantum theory conceived by the Scholars cannot consider composite quantum systems, being only able to formalize **interfering realities** through their statistical formalism of **classical** observations. Everett's interpretation of the Schroedinger equation characteristics identifies the possibility of such a composite feature, but on the other hand, **fails to clearly point out it is a generic composite quantum system feature**. Our Academician's disciple fills up that gap (Appendix B of

[**6**], phase 1). This allows a **self-contained** quantum evolution between systems, entirely away from the classical world with its separated elements character.

Since we are dealing with an exponential branching of realities, we have not only a 2-dimensional computation (a **non-local cellular automata**), but also a **quasi-infinite number of them happening in parallel**. This feature must lead to all sorts of effects unavailable in the classical world as we saw it 400 years ago, i.e. features behind **the stuff of Life**.

4. Simpl.: *When it comes to features of Life in general, why does embryo development need more than the classical morphogens envisioned by the Scholars?*

Sagr.: The immediate answer is: "**Diffusion is not a precise enough phenomenon to account for embryo development**." Under the leadership of Lewis Wolpert [**16**], the embryology of the Scholars is seeing the development of living organisms as a chemical clockwork process classically programmed through the genes (using a conveniently unidentified physical process) to direct the cells differentiation implemented through series of macromolecular reactions ("**pathways"**), in effect a **classical computational process** as understood by the Scholars' computer science. A key problem in such a subject is how the **unfolding** in real time of a body 3-D shape is **directed** through the organism development; this is certainly at first sight a **non-local** process since it has a definite sequence; and many parallel subprocesses operating, no doubt under an overall control.

The key hypothesis in this field is the existence of **morphogens** doing the directing from data in the genes (**homeobox** genes – [**17**]) providing a **positioning system** ([**16**, **18**]) for defining the kinds of cells in the embryo that are differentiated, at least in the early stages when differentiation and oocyte partitioning has not yet occurred.

However, (1) what is seen in the initial division of a tiny vinegar-loving fly, the **Drosophila Melanogaster**, into segments [**19**] may not come from a diffusion process (i.e. **statistical mechanics**). It appears more like a **quantum wave function collapse** across the oocyte. (2) Experiments have yet to show how the genes of a cell modify their **program** according to the concentration of so-called morphogens at their location! What is known is that certain molecules **present** around a cell can trigger or inhibit the production of other gene products. What is not known is how such external molecules could affect, **via their presence**, the internals of the cell nucleus through two isolation membranes.

There is no indication on how the cells that are part of the choreography described in the Scholars' literature can change or trigger an **ongoing program** among many different programs available through the DNA, and somehow run by it (or by an associated system in the cell nucleus), and this **in synchronism with other cells**. For such a program to run in parallel across cells, some kind of **physical support for a synchronization** must at least be present between these cells, at least all the cells involved in one function, and maybe one organ. What is this non-local clocking mechanism in real time – not in number of cell divisions time since synchronism would then be quite imprecise and variable?

Also, molecules such as "**Sonic HedgeHog**" (a gene product with a weird name) have been found as the closest thing to morphogens (see for example [**20**]). But they appear in the development process more like **initiating a cascade of local cell-signaling responses**, or as inhibitors of other programs to implement a small part of the 3D blueprint that would be in the genes. They would also appear at specific stages in which **their presence** (not their concentration) is in effect **directed** by other molecules via **signal pathways** for their **activation** as the chemists describe, with no attempt of course at getting into the physics part of the things (i.e. their physical movements).

Recent observations [**21**] have shown that Hedgehog and other such products, that supposedly **regulate** growth and **decide** on cell fate, are in fact being transported in the embryo via **cytonemes**, very thin threads of cytoplasm thrown by individual cells from one side of the embryo to the other by using transport vesicles going along MTs to send **chemical messages** from the source cells. The formation of such cytonemes is a big mystery, but they were produced in vitro by the mere **presence** of target cells nearby. So there must definitely be a **quantum entanglement** here that needs study.

In another example in the same referenced article, egg rotations have been observed as being directed by **MTs transporting a protein in vesicles from one side of the egg to the other**, and this protein "turns on a host of genes." In the article it is advanced that "*developing embryos may actively ship key signaling molecules from place to place, instead of relying on diffusion to carry the messages*," and the processes observed "*may show the way to solve the long standing mystery of how signaling molecules orchestrate development so precisely*."

Simpl.: Apparently **it has then been known for quite some time** in Scholars' biology that diffusion is not a precise enough phenomenon to account for embryo development. Theoretical Scholars there seem to have missed (or chose to miss) that fact. So the **regulation and decisions on embryo development are not based on chemical processes after all, but on unknown physical processes directing chemical processes.**

5. Salv.: *We need now to go over the features of mitosis that are explained through "leptonic" space as you so brilliantly introduced earlier.*

Sagr.: The observed starting point of mitosis [**22**] is when the pair of centrioles in the cell breaks up. Each centriole subsequently replicates itself into another centriole perpendicular to the axis of the original one.

The separation between the parent and the child centrioles at the start of mitosis (Fig. 9 - step 2) occurs as a result of the evolution of the structures in leptonic space. Their photon exchanges are stopped through an **external agent** coming into their common leptonic dimension. This common dimension lays in ordinary space as we have seen earlier (dimension 2 in Fig. 9).

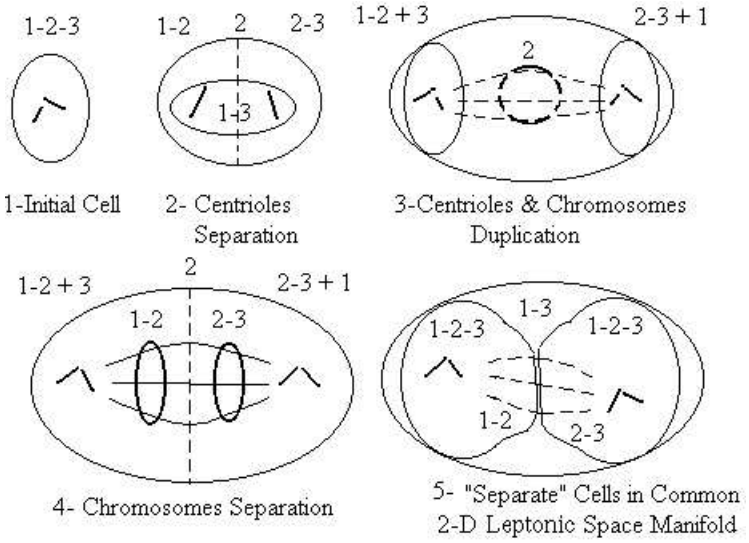

Fig. 9 – Cell leptonic space manifold connections

Salv.: This stop in exchanges appears to be the key to the relation between the DNA replication and the MT replication process timings, something that must have come from the original symbiosis between the systems. The messaging between the two systems appears to be obtained through the production of the **cyclin-dependent kinase 2-cyclin E** (Cdk2-E) complex by the nucleus [**23**], a large molecule that would be **attracted by the quanta exchanged between the two centrioles** in the leptonic space common dimension (in ordinary space) and would block it. Cdk2-E is shown in the referenced article as being localized in **very specific areas of the cell**. This can happen only by this molecule following **unobservable leptonic space tracks** laid out between the nucleus and the centrioles through the MT system evolution and the centriolar program.

Sagr.: With one of its quanta exchange dimensions eliminated, the 3-D leptonic space manifold (identified with the centriole pair) **splits into two 2-D manifolds**, thereby **disconnecting** the two structures within ordinary space (their dimension 2). Then they merely drift apart, but are still connected through their leptonic space dimensions 1-3, which remain intact.

Subsequently, new child centrioles are built out of the "separated" centrioles, and the resulting new pairs have each a **rebuilt 3-D leptonic space manifold**. Since being kept connected via leptonic space 1-3, **the two pairs are still quantum coherent with each other in their evolution**. They are then able to exchange photons through leptonic dimension 2 as they have it again in common with ordinary space when their common program reaches the stage of producing these photons –via patterns in their automata. (Fig. 10)

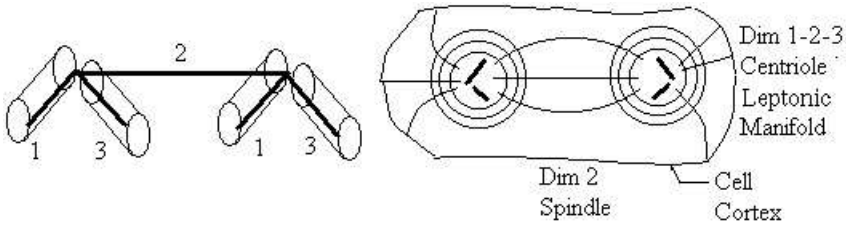

Fig. 10 – Mitotic spindle construction pulses in dim 2

Such 1-D (curved) quantum coherent photon exchanges **inflate** their individual 3-D leptonic space manifold. This inflation in turn sends the two pairs of centrioles at opposite locations in the cell.

Simpl.: Such an obvious motion of "asters" (centrosomes) in cells has never been explained before, even though it is prominently displayed in the Scholars' basic teaching!

Sagr.: Then polymerization of MT's occurs **between the centriole pairs**, induced by quanta exchanges between the pairs. They form the well-known mitotic **spindle** (Fig. 9 - step 3 and Fig. 10). These MTs support different sets of leptonic dimensions (1-2 or 2-3) according to which centriole pair emits the photons.

Salv.: The separation of the cell into two cells after the completion of chromosomes duplication is described in the Scholars' literature (see for example [**24**]) as being effected through MTs polymerizing in-between the centrioles, and between them and the cell cortex. This is conceived as a **Newtonian pulling force** generated by a **treadmill effect** of the MTs, helped with dynein **motors** attached to them (quite mechanistic, indeed in the way we thought 400 years ago!). But the evolution of the MTs is observed to occur **in concert** with all the components of the cell, including the nucleus components, which replicate in their own way, helped by the MTs segregating somehow the replicated chromosomes. This is quite a miracle for so many separated entities!

Simpl.: I shall note here that the **coordinating agent** for this **non-local** so-called **pulling apart process** (which can only be seen indeed as miraculous when considering all the other coordinated events happening in the nuclear material) cannot be found described in the Scholars' literature, and **is not even pointed out to students like me as a theoretical void!** Such a non-scientific attitude appears very common in Scholars' biology these days. That's probably why the present Pope forgave our Academician, thinking he must have been acting that way too deep down…

Sagr.: Let's then now turn to our earlier **multi-dimensional picture** of the system. MTs are mostly produced in the period starting before the pulling apart process begins, and ending with the start of the cell splitting into two cells. [**22**] This indicates to me that the dual layer of ordinary space, with its associated leptonic space manifold, **connects the entire cell** up to and including the molecules of the cell cortex (outer membrane), and this through MTs that go from the centrosome to that cortex (Fig. 9 - steps 3 and 4, and Fig. 10).

The chromosomes in the nucleus of the cell include molecular complexes called **kinetochores**. Their replication must end up with 2-D leptonic space manifolds in separate dimensions 1-2 and 2-3, **probably through principles similar to the ones of centrioles replication**.

Such kinetochore manifolds would be included in the corresponding MT system manifolds through the photon exchanges between centriole pairs (according to the extent of their leptonic dimensions), and thus attach the chromosomes they hold to the corresponding threads of the spindle (Fig. 9 - step 4).

Then, as it happened for the separation of centrioles, the photon exchange between centriole pairs ends, forcing dimension 2 of the centriole pairs leptonic space **to recede** between them.

What makes the photon exchange end here? From many reports this looks to be effected by the kinetochores, as **they must all attach in order to stop all the photon exchanges in leptonic space dimension 2**, thereby breaking at last the 3-D leptonic space manifold of the cell into two 2-D manifolds.

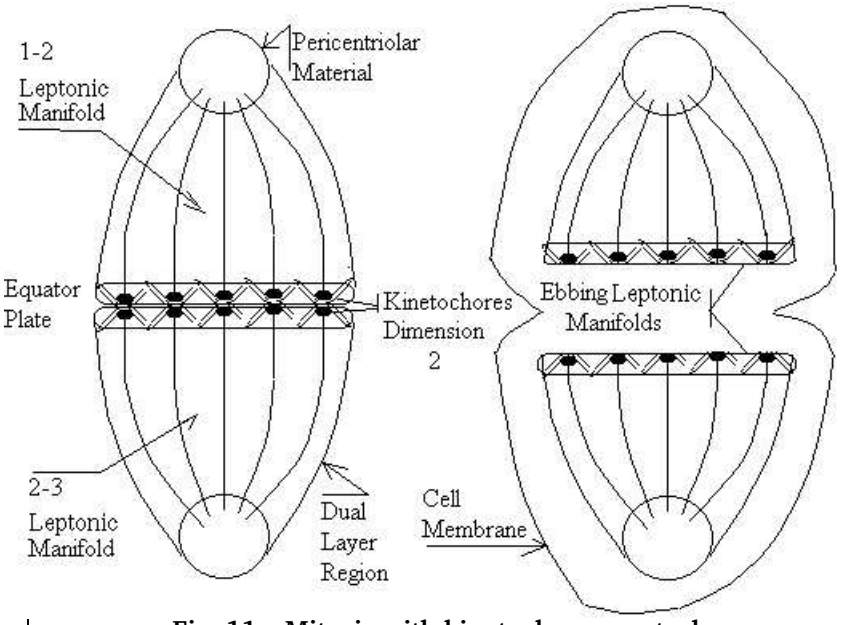

Fig. 11 – Mitosis with kinetochores control

Simpl.: Note that such a spatial process would be much simpler than any based on chemistry, and thus much more likely when taking the standpoint of Evolution. This goes on top of the precision required of the process, a precision unattainable via the stochastic phenomena of chemistry.

Sagr.: The subsequent **receding leptonic space** then segregates and pulls apart the two sets of chromosomes, as well as the other parts of the cell that were duplicated in parallel with the nuclear material. Since the cell membrane itself is connected to leptonic space via its receptors, the **ebbing process of this space** ultimately results with a separation into two cells (Fig. 9 - step 5 and Fig. 11).

Simpl.: But the above **matching process** between kinetochores and quanta exchange paths would require the number of these quanta paths connecting the two centrioles (not the number of spindle threads) to equal the number of kinetochores. What physical process could result in such a quantified and precise function? My thought there is that the required number of photon pulses generated across two pairs of centrioles forming the spindle must come from the characteristics of the computational program occurring through the electronic shuttling inside the centriole pair leptonic space.

Sagr.: Let me restate the problem. Through the split of the leptonic space manifold into two 2-D manifolds in different dimensions at step 2 of mitosis, the computation on the centrioles is stopped (from the DNA signal molecule, as we have seen); and this with the electronic states frozen at the instant of separation since only one leptonic dimension is available for the electron shuttling. In order for the computation to restart, the centrioles must drift apart far enough such that the dual layer of ordinary space is limited to the neighborhood of each centriole, thereby allowing a sufficient localization of photons in dimension 2 to start a new child construction.

The computations on the two centrioles then become separate in their evolution, even though they are coherent evolutions by themselves. They just have now to exchange quanta through conduits provided by MTs (the observed spindle) in order to have a common computation. They are realizing then a **composite quantum system** between themselves.

Salv.: Ok, now I get it. A computational output occurs when electrons simultaneously shuttle in dimension 1 and dimension 3 at the same corresponding location along a slat on both centrioles, thereby emitting photon pulses in dimension 2 common with ordinary space. Such pulses have a circular polarization in leptonic space dimensions 1-3 and thus do not interact with ordinary space contents (water, etc.). They are thus unobservable. They attract biomolecules because they **connect** with them through their leptonic space in the process of extending a space manifold.

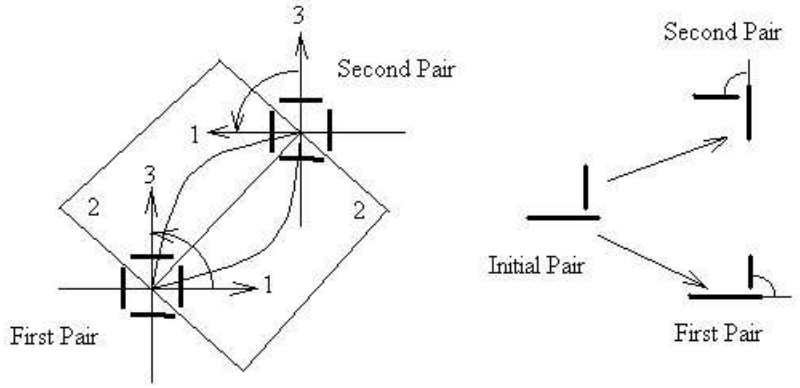

Fig. 12 – Quanta exchanges forming spindle

They contain a **set of photon realities** by being simultaneously emitted from a set of **computation realities** from the **entire length of the slats**, forming a parallel train of photons along dimension 2 superposed with each other. (Fig. 12)

The other pair of centrioles being coherent with the first one will emit at the same instant a corresponding pulse. But the centrioles in that second pair result from the initial pair that split up. A 90 degree rotation was made to create a complement pattern in dimension 3 during the original pair build-up. Another rotation was made for the construction of the present pairs so the initial pattern is again in dimension 1 but rotated 180 degrees (Fig. 12).

Then the present second pair has its automata computation running in the opposite direction in dimension 1 from the first pair, thereby emitting the photon pulse in the opposite direction from the pulse emitted by that pair, and thus towards it.

Dimension 2 of the leptonic space between the two pairs is **a curve in 3-D through ordinary space**. The pulses generate two **complementary spindle threads** between the pairs of centrioles, one thread having its leptonic space in dimensions 1-2 and the other in 2-3 according to the dimensions of the source that emitted the photons. The attracted biomolecules sense ("observe") the photon pulses polarization in leptonic space through their own electron shuttling orientation, and thus "get into it," as any **quantum observer (per Everett's analysis)**.

The **spatial separation between threads at the equator of the spindle** is created by the presence of the nucleus kinetochores creating a dual layer in the ordinary space manifold as described earlier (Fig. 11), and the process has no other outcome but having the kinetochores matching the quanta paths. The set of duplicated kinetochores have their leptonic manifolds in dimension 3 if the originals have theirs in dimension 1, thus, together, they form a 3D leptonic manifold in two submanifolds connected in dimension 2 at the kinetochores themselves. The kinetochores are then **selectively** attracted by the photons on their way to the other centriole pair according to their leptonic space manifold orientation.

When the photon pulses meet the corresponding slats in the other centrioles pair, they do it in the same way they were emitted (thinking in more than 3D is here important!): At that point, each pair of centrioles in effect receives back ("observes") its own photon pulse (**undistinguishable** set of monadic spaces) as if it was reflected in a mirror. The computation then runs as if a time reversal occurred until a new set of photon pulses is generated by the computation. **Therefore the computation must generate a fixed, even number of quanta paths (threads) through processing its automata pattern program generating the same pulses again and again until this cycle is stopped by the kinetochores as we have seen earlier**, allowing the computational process at that time to go further in its evolution. Other programs with a different number of quantum paths would have been discarded by Evolution. And conversely, a defect in the program defining this number will lead to very serious development or maintenance problems.

Simpl.: Experiments with mitosis without chromosomal material showed the spindle then reduced to straight parallel lines between centrioles. (p. 229 of [**8**]), with no cell separation ever happening.

Salv.: As a result of the above analysis, I can infer that, when alone in a cell, a pair of centrioles generates MTs either all with leptonic dimensions 1-2 or all with dimensions 2-3, depending on whether the pair was the **first** or the **second** one in the mitosis they come from. In other words, the 3-D leptonic space manifold of the cell is basically a 2-D

layer **lining up** the ordinary 3-D space of the cell, except for the centrioles area which has a stub in a third dimension (here again thinking in more than 3D is important).

The leptonic space of the cell will be fully 3-D only during mitosis when the spindle threads intermix to pick up the chromosomes as seen earlier.

Sagr.: In the picture drawn above, the MTs generated by the centrioles cannot perform a computation since only two complementary conformational configurations through either leptonic dimension 1 or 3 is available (see the left side of Fig. 2). The electrons have then a fixed dual state to shuttle between in leptonic space. These states correspond to molecular conformations forming a fixed 3-D pattern in ordinary space. This pattern is dynamic as it propagates through the **phonons waves**, except that no computation is performed here. This non-local dynamic pattern of conformations propagating in waves can be seen as at the physical origin of the synchronized motions observed for dynein and kinesin **motors** used in intra-cellular transports along MTs.

These **dynamic patterns** have other functions: They can be modified either by **multiple reality photon pulses from the centriole pair** or from **(classical) ion translation in the cytoplasm**. They are therefore the **memory** of the cell quantum system as well as its input/output versus the outside classical reality, something that Descartes would have been very interested in indeed!

Simpl.: Let me add one aspect I get from all this: In step 5 of mitosis, once the cells are separated in ordinary space, quanta exchanges can exist through the cells MTs, membrane and extracellular matrix, allowing their centrioles to continue evolving with some input from their neighbors, but **provided they remain in sufficient contact** so that a leptonic space manifold is maintained. However, a common computation can no longer be sustained as it happened in mitosis. Input from neighbors may allow **synchronizing their replications**, among other things, through quanta exchanges with the kinetochores of their own nucleus so that their DNA programs can remain synchronized. If they don't we are bound to see some cancer developing, marking the onset of a **separated entity** within the organism…

6. Salv.: *Now that we have the geometrical principles of cell division, let's describe more precisely the geometry leading to synapses to complete the picture.*

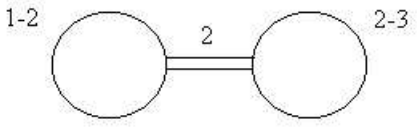

Fig. 13 – Neurons leptonic space connections

Sagr.: In order for two **spatially separate** centriole pairs in glial cells to have a common quantum computation, a 3-D leptonic space manifold common to the neurons and glial cells is needed in order to allow exchanges of their quanta. However, in the physical picture of mitosis outlined earlier, neurons, **as any cell in the organism**, have their MTs leptonic space in either dimensions 1-2 or 2-3, per our earlier discussion. Therefore a connection

with ordinary space in dimension 2 must complement the neurons leptonic manifold dimensions 1-2 and 2-3. The need for such a 3-D manifold connection then gives a physical reason for neural synapses (Fig. 13), as **the MTs within the neurons would be then able to provide the quanta exchanges paths between glial cells centrioles pairs as they were providing in mitosis within a single cell.**

Simpl.: Indeed, this is the confirmation of the lengthy geometrical analysis Salviati went through earlier!

Sagr.: In that picture, each pair of centrioles in a glial cell emits a photon pulse in dimensions 1-2 or 2-3 through the synapse of the nearest neuron (Fig. 14b), maybe using neurons cytoplasm elements such as vesicles **coated** with the supramolecular structure **clathrin**, which is known to enclose **cell membrane receptors**.

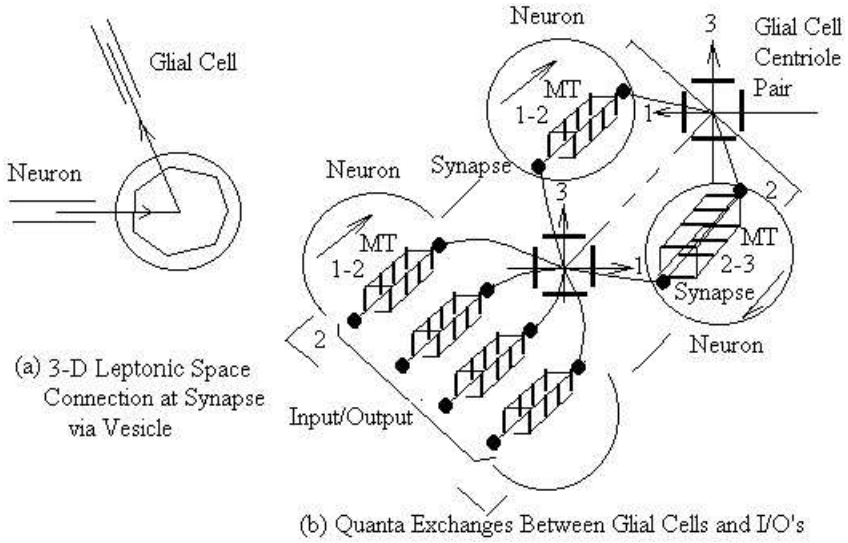

Fig. 14 – Relationships between neurons and glial cells

Such vesicles would then be involved not only in releasing neurotransmitters in the synapse cleft for subsequent classical ion pulses, as the Scholars look at, but more importantly act as a **photon pulses redirector between leptonic space submanifolds**.

They would, by themselves, effect a 3-D connection with leptonic space **as centriole pairs do**. This function there would come from the **cell membrane receptors** put in a quasi-spherical arrangement inside the clathrin "**triskelion" structures** forming the vesicle clathrin coat. Their sharp geometrical features hints at their function: Such receptors would sustain a quasi-spherical dual layer of ordinary space through polyhedral "crimps" in ordinary space centered at the vesicles, thereby creating an orthogonal 3-D leptonic space connection (Fig. 14a).

The glial cells then modify the synaptic connections (which would occur initially at random via DNA) as their computation calls for, and this through developing the required MTs in the neurons via their clathrin-coated vesicles. (The MT patterns in turn **direct actin for the needed growth cones**.) These vesicles would in a sense provide the pulling strings of the puppet master, as the book from our Academician's disciple identifies.

7. Simpl.: *I missed the point of "contextual" motions mentioned in the book…*

Salv.: Macro-molecules have been reported as moving apparently **contextually**, i.e. **non-randomly to a certain long-range destination that looks to be appropriate for their use**. In one case, a **single** molecule just made by a gene is **seen** heading out of the nucleus for use within the cytoplasm of the cell. [**25**] With only very small portholes in the nuclear membrane compared to the size of the membrane, how does it find its way out, and why would it go out in the first place? The corresponding report says nothing on that matter. (It does not even ask the question!) In two other cases ([**19**] among many others) a molecular complex produced by the nucleus is found to locate itself around a specific component of the cell, with very little spreading around as expected if diffusion was the means to reach its destination. There again the question is not even asked…

A more recent article [**26**] shows at last that indeed there is a supramolecule that does the transporting in and out of the nucleus **for some types of cargo**, namely "importin" (how about that for an inventive name!). The structure of that molecule has just been studied, showing its extraordinary **flexibility in conformations**. So, again, a leptonic spatial function has to be present to allow it to go in and out of the nuclear membrane **depending on its cargo**. And again there, Scholars' attention is directed at accumulating data, not into finding the physical function that would give the secret of its motion so we could act on it, same as for the question of viruses (even though there this is an obviously **very pressing issue**!). All these questions are about how the leptonic space of a specific molecule relates to the space sustained by the nuclear membrane. Physicists are apparently not interested.

8. Simpl.: *Also, DNA can duplicate itself together with its cell without need for an external helping system. How can it do that?*

Sagr.: DNA duplicates itself in a stochastic environment (such as the ones in PCR procedures). The biochemistry books we looked at describe how this happens. [**24**] The key mystery is how the duplication can involve an entire cell (which is of course a non-stochastic duplication!). The study of **mitosis** shows the construction of leptonic space manifolds covering a whole cell, manifolds that split due to their **complementary dimensional arrangement**. The theoretical answer for these kinds of single cells may be that **chromatin** lining DNA must sustain by itself complementary leptonic space manifolds, and this since chromatin is otherwise part of mitosis. A structural analysis of chromatin should be done to confirm the leptonic space hypothesis for them. The fact that primitive cells do not have a nucleus tells us that some other structures are doing the overall control of the cell (an even more basic **spatial physical process**, no doubt).

The existence of leptonic space manifolds being sustained by rather simple supramolecules such as chromatin and tubulin (together with the **nuclear membrane** and the **cell cortex receptors**) would explain the **quantum origin of Life**, being then a very commonly occurring phenomenon in diversified molecules **based on the carbon element**

that permits all sorts of **spatially coordinated functions**. We can't say much more without a systematic study of the key supramolecules found in Life in the light of potential leptonic spaces.

9. Simpl.: *Let's then summarize the higher dimensional aspects of space as we see them now, so they finally make sense to me.*

Sagr.: The physical knowledge found with the Scholars of this period in the history of this planet is obviously missing the **higher dimensionality of reality** by ignoring the manipulation of ordinary space by Life's quantum dynamics. It is hard to believe such a feature is being missed, especially after Einstein's discovery that space was being manipulated **in higher dimensions** by the mere presence of its content (gravitation). But on the other hand, look at what they were missing back in the days of our Academician!

Salv.: The detail work of our Academician's disciple ([**6**]) describes a spatial dynamics occurring at a supramolecular scale by using the Scholars' quantum mechanical formalism, with the extra assumption that **space is a quantum entity**, and thus can have other states than a ground state with its normal single layer as we see it everyday. The small set of articles presented in his little book is just a meager summary of what he found.

Starting from a description of an electronic evolution dependent as a whole on the *conformational states* (α and β) of a polymer of large molecules commonly found in Life, the resulting supramolecular structure would have to be able to exist with different such conformational states in two parallel space layers connected via semi-free electrons (part of the individual molecules of the polymer) shuttling between these layers of ordinary space. This electron dynamics effects then a new space called a "leptonic" space in other dimensions than the normal General Relativity curved 3D. If the **mere possibility** of such a space exists, a **standard** QM analysis informs us that ordinary space needs to be locally "squeezed" in order to produce a complete evolution of the quanta making up the structures and their shuttling electrons.

This semi-formal approach could be then generalized to any structure made out of individual identical molecules, which could exist in more than one conformational state while containing **semi-free electrons**. Space in areas containing such molecular arrangements would be lined up with leptonic space manifolds oriented differently in different dimensions, forcing a new dynamics in ordinary space (outside the one coming from gravitational forces). **This dynamics would be specific to given molecular arrangements**, and would be observed by Scholar biochemists as "tracks," "accumulation points/patterns" and otherwise **unexplained directed motions of proteins and other molecules**. It would then give the true physical origin of **embryo initial oocyte compartmentalization**, as well as **subsequent cell divisions and motion within the organism**.

This kind of dynamics would explain the *precise* choreography observed in the evolution of cells, as well as the evolution of the matrix in-between cells (extracellular matrix), not to mention the **holistic aspect of living entities**. Life in that sense would be the tool of matter to mold space for its needs, needs which are to obtain an organized and meaningful universe, as our Academician's disciple foresees.

Simpl.: Experimentally, [**27**] an atom with two states of its orbital electrons has been observed with these states coexisting in separate locations (up to 80 nanometers in distance) in what was perceived by Scholars as ordinary space. They have been called "Schroedinger Cat states" in reference to the 1935 paper by Schroedinger where a cat was imagined being *both dead and alive at the same time*, [**28**] something Schroedinger saw then as a hint that quantum mechanics may be far from complete in describing reality. **Were the above two atomic states two "shadows" of the same quantum structure seen through a warp of space in higher dimensions (as General Relativity considers)?** The answer seems to have been given here with the centriolar evolution.

Sagr.: Yes. The second (more important) question raised by this Schroedinger Cat Ion experiment is **whether quantum coherence (unseparability of the evolution) in a single atom could be extended to much larger scales, beyond a supramolecular structure, and even to macroscopic sizes**. The answer here is also simple:

Quantum "decoherence" occurs in our world as a result of the presence of atomic nuclei in ordinary space (they are the source of the disorder called "entropy" in thermodynamics). Thus, if a space could be maintained **without nuclei present** (with only leptons), coherence (i.e. non-separability) of the evolution could be maintained **at any size** as long as this space existed.

Even though atoms lining up the connection of ordinary space with this new "leptonic" space would be subject to random thermal evolution at their location in ordinary space, the overall *conformational state* of the molecule they belong to would only have to follow the evolution of the semi-free electrons generating the space layers "between" the conformational states, itself a quantum coherent evolution outside ordinary space.

Then the full evolution of the molecular conformations can occur along the supramolecular structure, per the detail work of our Academician's disciple (App. B of [**6**], phase 2), and this in a "non-local quantum cellular automata" fashion at the level of molecular conformations. The geometrical arrangement in slats of the structure *dictated by its phonon evolution* would allow only one direction for the evolution of molecular conformations, and thus would permit a ***deterministic quantum computation*** to take effect through this last evolution. The supramolecular structure would then be a true *quantum data processor* (with data being in some extended form, such as patterns).

The structures that cannot warp space due to their smaller size ("microtubules") would act as memory systems via their *persistent conformational states*.

Simpl.: Indeed! We saw in class these microtubules creeping like tiny serpents on top of a glass as a result of their internal dynamics. These really freaked me out…

Salv.: Neurons (unlike the ones misdiagnosed in Scholars' biological outlooks) would then contain the "memory-mapped" I/O system for a *self-constructing network of* **interacting processors** *located in glial cells*. This would be a historical case of mistaken identity!

Sagr.: Needless to say, the phenomenon discussed here would provide also a much more basic (if not practical) way to engineer true quantum computers at large scales than the nuclear spin and other methods presently envisioned by Scholars outside living materials. Let's hope we won't have to wait for another 400 years to see the applications… Let's go back and report our findings to our dear Academician!

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