Entropy and the syntropy of life

Introduction

The purpose of this essay is to outline the relevance of understanding the **entropy forces** in relation to cell decay and how this decay can be minimised through the entrainment of **syntropy** forces.

There are two forces that influence cell health, **entropy and syntropy**. Perhaps there is no better way to understand **entropy** than to grasp the **second law of thermodynamics**, and vice versa. This law states that the entropy of an isolated system that is not in equilibrium will increase towards decay (death) as time progresses, unless equilibrium is achieved through the opposite and life affirming force of **syntropy**. In terms of the human body, entropy drives aging and disease, while syntropy slows down aging and prevents disease.

Therefore, life extension or longevity is a matter of diet and lifestyle choices between **entropy** forces or **syntropy** forces. In both cases they are characterised as energy forces at a cellular level. **Syntropy** is at its fullest effect when the cell charge is -50mV or higher and entropy is at its fullest effect when the cell polarity charges to positive (+) and this is the state of decay and disease.

This *dance* between entropy and syntropy can be defined as the *yin and yang* of **life-force energy**. The idea that all living things have an unknown life-force energy has been discussed in science since the early 20th Century. That is, there is more to life than chemistry, physics and biology. **Einstein** once said: *A human being is part of the whole universe, a part limited in time and space. We experience ourselves, our thoughts and feelings as something separate from the rest. A kind of optical delusion of consciousness. This delusion is a kind of prison for us, restricting us to our personal desires and to affection for a few persons nearest to us. Our task must be to free ourselves from the prison by widening our circle of compassion to embrace all living creatures and the whole of nature in its beauty. The true value of a human being is determined by the measure and the sense in which they have obtained liberation from the self. We shall require a substantially new manner of thinking if humanity is to survive. (**Albert Einstein**, 1954)*

*The most beautiful and most profound experience is the sensation of the mystical. It is the sower of all true science. He to whom this emotion is a stranger, who can no longer wonder and stand rapt in awe, is as good as dead. To know that what is impenetrable to us really exists, manifesting itself as the highest wisdom and the most radiant beauty which our dull faculties can comprehend only in their primitive forms - this knowledge, this feeling is at the center of true religiousness. (**Albert Einstein** - The Merging of Spirit and Science)*

Rudolf Steiner also had ideas ab out life-forces energy*: It is possibly not helpful to our inner life to ponder a great deal on how the external world is reflected in our soul. By doing so, we do not get beyond a shadowy picture of the world of mental images in ourselves. In the very traits of his temperament, which have a considerable effect on his life of soul, a person bears within him qualities and impulses that have an obvious connection with those of his physical ancestors.*

Both Einstein and Steiner conceived the idea that life contained traits (memory) of past lives (ancestors). That is, a life-force energy in a living thing is an accumulation of energy forces passed on by reproduction over time. However, this **life-force** also contains the history of the ancestral environment and life experiences.

Therefore, in this essay it is worth exploring these ideas further in the context of modern scientific thinking and ideas that would sit more in the fields of quantum physics, spirituality, or energy science. Certainly, we should think about life-force energies and be open to this idea as an explanation about consciousness and spirituality. It is this present world that we must embrace if we want to know ourselves and of the universe, and the place we play in the universe. For example, is your life-force energy the driver of your experiences and therefore the *mark* you leave on Earth.

Background theories on entropy

Research concerning the relationship between the thermodynamic quantity entropy and the evolution of life began around the turn of the 20th century. This research was primarily focused on the **chemical and physical aspects of entropy**. This led to ideas about cell charge being explained purely in chemical terms based on the charge of cations and anions, and charge separation.

The mechanist view of life, the view taken by physiologists, holds that all phenomena, no matter how complex, can ultimately be described in terms of physical and chemical laws. In contrast, vitalism is the view that some ***vital force*** (life force energy) beyond physics and chemistry is required to explain life. The mechanist view has predominated in the twentieth century because virtually all information gathered from observation and experiment has agreed with physical and chemical laws or beliefs. That is, you would not expect a physiologist to measure energy forces, because such forces are not part of their belief system.

In 1910, American historian Henry Adams printed and distributed to university libraries and history professors the small volume *A Letter to American Teachers of History* proposing a theory of history based on the second law of thermodynamics and on the principle of entropy.

The 1944 book *What is Life?* by Nobel-laureate physicist Erwin Schrödinger stimulated further research in the field. In his book, Schrödinger originally stated **that life feeds on negative entropy**, or negentropy (now known as **syntropy**), however in a later edition he corrected himself in response to complaints and stated that the **true source is free energy**. This free energy could now be viewed as a **life-force energy**.

More recent work has restricted the discussion to Gibbs free energy because biological processes on Earth normally occur at a constant temperature and pressure, such as in the atmosphere or at the bottom of the ocean, but not across both over short periods of time for individual organisms.

Ideas about the relationship between entropy and living organisms have inspired hypotheses and speculations in many contexts, including psychology, information theory, the origin of life, and the possibility of extraterrestrial life.

In 1863, Rudolf Clausius published his noted memoir *On the Concentration of Rays of Heat and Light, and on the Limits of Its Action*, wherein he outlined a preliminary relationship, based on his own work and that of William Thomson (Lord Kelvin), between living processes and his newly developed concept of entropy. Building on this, one of the first to speculate on a possible thermodynamic perspective of organic evolution was the Austrian physicist Ludwig Boltzmann. In 1875, building on the works of Clausius and Kelvin, Boltzmann reasoned: *the general struggle for existence of animate beings is not a struggle for raw materials, ie. organisms, are air, water and soil, all abundantly available, nor for energy which exists in plenty in a body in the form of heat, but a struggle for syntropy, which becomes partly available through the transition of energy from the hot sun to the cold earth.* However, **syntropy in all forms requires effort or expenditure of energy** to create the opportunities to entrain this energy.

In 1876, American civil engineer Richard Sears McCulloh, in his *Treatise on the Mechanical Theory of Heat and its Application to the Steam-Engine*, which was an early thermodynamics textbook, states, after speaking about the laws of the physical world, *that there are none that are established on a firmer basis than the two general propositions of Joule and Carnot*; *which constitute the fundamental laws of this subject*. McCulloh then declares that *the applications of these two laws, ie. what are currently known as the first law of thermodynamics and the second law of thermodynamics, are innumerable.*

These ideas have led generally to how physical phenomena are connected with thermal changes and relations, and that they are dependent upon these *great truths*. Also, the mechanical theory of heat has been freely adopted, and consequently whole branches of physical science have gone down this pathway.

McCulloh gives a view of what he calls the *more interesting examples* of the application of these laws in extent and utility. His first example is physiology, wherein he states that *the body of an animal, not less than a steamer, or a locomotive, is truly a heat engine, and the consumption of food in the one is precisely analogous to the burning of fuel in the other; in both, the chemical process is the same: that called combustion*. He then incorporates a discussion of Antoine Lavoisier's theory of respiration with cycles of digestion, excretion, and perspiration, but then contradicts Lavoisier with recent findings, such as internal heat generated by friction, according to the new theory of heat, which, according to McCulloh, states that the *heat of the body generally and uniformly is diffused instead of being concentrated in the chest*. McCulloh then

gives an example of the second law, where he states that friction, especially in the smaller blood vessels, must develop heat. Undoubtedly, some fraction of the heat generated by animals is produced in this way. He then asks: *but whence the expenditure of energy causing that friction, and which must be itself accounted for*?

To answer this question he turns to the mechanical theory of heat and goes on to loosely outline how the heart is what he calls a *force-pump*, which receives blood and sends it to every part of the body, as discovered by William Harvey, and which *acts like the piston of an engine and is dependent upon and consequently due to the cycle of nutrition and excretion which sustains physical or organic life*. It is likely that McCulloh modeled parts of this argument on that of the famous Carnot cycle. In conclusion, he summarizes his first and second law argument as such: *Everything physical being subject to the law of conservation of energy, it follows that no physiological action can take place except with expenditure of energy derived from food; also, that an animal performing mechanical work must from the same quantity of food generate less heat than one abstaining from exertion, the difference being precisely the heat equivalent to that of work*.

In recent years, the thermodynamic interpretation of evolution in relation to entropy has begun to utilise the concept of the *Gibbs free energy, rather than entropy*. This is because biological processes on Earth take place at roughly constant temperature and pressure, a situation in which the Gibbs free energy is an especially useful way to express the second law of thermodynamics.

The minimisation of the Gibbs free energy is a form of the principle of minimum energy, which follows from the entropy maximisation principle for closed systems. Moreover, the Gibbs free energy equation, in modified form, can be utilised for open systems when chemical potential terms are included in the energy balance equation. In a popular 1982 textbook, *Principles of Biochemistry*, noted American biochemist Albert Lehninger argued that the order produced within cells as they grow and divide is more than compensated for by the disorder they create in their surroundings in the course of growth and division. In short, according to Lehninger, *Living organisms preserve their internal order by taking from their surroundings free energy, in the form of nutrients or sunlight, and returning to their surroundings an equal amount of energy as heat and entropy*.

Similarly, according to the chemist John Avery, from his 2003 book *Information Theory and Evolution*, we find a presentation in which the phenomenon of life, including its origin and evolution, as well as human cultural evolution, has its basis in the background of thermodynamics, statistical mechanics, and information theory. The (apparent) paradox between the 2nd law of thermodynamics and the high degree of order and complexity produced by living systems, according to Avery, has its resolution *in the information content of the Gibbs free energy that enters the biosphere from outside sources*. Assuming evolution drives organisms towards higher information content, it is postulated by Gregory Chaitin that life has

properties of high mutual information, and by Tamvakis that life can be quantified using mutual information density metrics, a generalisation of the concept of biodiversity.

In a study titled *Natural selection for least action* published in the *Proceedings of the Royal Society A.*, Ville Kaila and Arto Annila of the University of Helsinki describe how the process of natural selection responsible for such local increase in order may be mathematically derived directly from the expression of the 2nd law equation for connected non-equilibrium open systems. The 2nd law of thermodynamics can be written as an equation of motion to describe evolution, showing how natural selection and the principle of least action can be connected by expressing natural selection in terms of chemical thermodynamics. In this view, evolution explores possible paths to level differences in energy densities and so increase entropy most rapidly. Thus, an organism serves as an energy transfer mechanism, and beneficial mutations allow successive organisms to transfer more energy within their environment.

In 1964, James Lovelock was among a group of scientists requested by NASA to make a theoretical life-detection system to look for life on Mars during the upcoming space mission. When thinking about this problem, Lovelock wondered *how we can be sure that Martian life, if any, will reveal itself to tests based on Earth's lifestyle*? To Lovelock, the basic question was *What is life, and how should it be recognised*? When speaking about this issue with some of his colleagues at the Jet Propulsion Laboratory, he was asked what he would do to look for life on Mars. To this, Lovelock replied, *I would look for an entropy reduction, since this must be a general characteristic of life*.

In 2013, Azua-Bustos and Vega argued that, disregarding the types of lifeforms that might be envisioned both on Earth and elsewhere in the Universe, all should share in common the attribute of **decreasing their internal entropy at the expense of free energy obtained from their surroundings**. As entropy allows the quantification of the degree of disorder in a system, any envisioned lifeform must have a higher degree of order than its immediate supporting environment. These authors showed that by using fractal mathematics analysis alone, they could readily quantify the degree of structural complexity difference (and thus entropy) of living processes as distinct entities separate from their similar abiotic surroundings.

It was inevitable that the notion of *entropy as a disorder* has been transferred from **thermodynamics to psychology** by Polish psychiatrist Antoni Kępiński, who admitted being inspired by Erwin Schrödinger. In his theoretical framework devised to explain mental disorders (the information metabolism theory), the difference between living organisms and other systems was explained as the ability to maintain order. Contrary to inanimate matter, organisms maintain the particular order of their bodily structures and inner worlds which they impose onto their surroundings and pass through reproduction to the next generations.

The life of an organism or the species ceases as soon as it loses syntropy. Maintenance of that syntropy order requires continual exchange of information between the organism and its surroundings. In higher organisms, information is acquired mainly through sensory

receptors and metabolised in the nervous system. The result is action or some form of motion, for example locomotion, speech, internal motion of organs, secretion of hormones, etc. The reactions of one organism become an informational signal to other organisms. Information metabolism, which allows living systems to maintain the order, is possible only if a hierarchy of value exists, as the signals coming to the organism must be structured. In humans that hierarchy has three levels, i.e. biological, emotional, and sociocultural. Kępiński explained how various mental disorders are caused by distortions of that hierarchy, and that the return to mental health is possible through restoration of syntropy forces.

This idea was continued by Struzik, who proposed that Kępiński's information metabolism theory may be seen as an extension of Léon Brillouin's negentropy principle of information. In 2011, the notion of *psychological entropy* was reintroduced to psychologists by Hirsh et al. Similarly to Kępiński, these authors noted that uncertainty management is a critical ability for any organism. Uncertainty, arising due to the conflict between competing perceptual and behavioral affordances, is experienced subjectively as anxiety. Hirsh and his collaborators proposed that both the perceptual and behavioral domains may be conceptualized as probability distributions and that the amount of uncertainty associated with a given perceptual or behavioral experience can be quantified in terms of Claude Shannon's entropy formula.

Entropy is well defined for equilibrium systems, so objections to the extension of the second law and of entropy to biological systems, especially as it pertains to its use to support or discredit the theory of evolution, have been stated. Living systems and indeed many other systems and processes in the universe operate far from equilibrium, whereas the second law succinctly states that isolated systems evolve toward thermodynamic equilibrium, ie. the state of maximum entropy.

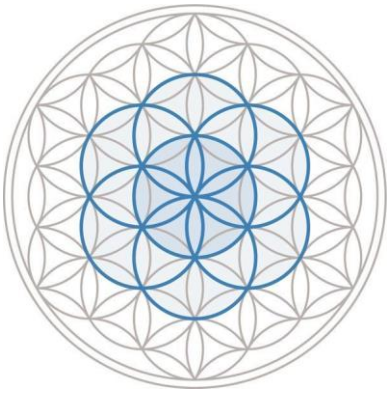
However, entropy is well defined much more broadly based on the probabilities of a system's states, whether or not the system is a dynamic one (for which equilibrium could be relevant). Even in those physical systems where equilibrium could be relevant:

- living systems cannot persist in isolation, and
- the second principle of thermodynamics does not require that free energy be transformed into entropy. Living organisms absorb energy from sunlight or from energy-rich chemical compounds and finally return part of such energy to the environment as syntropy (generally in the form of heat and free-energy compounds such as water and carbon dioxide).

The geometry of life

The leading question here is: who does the **life-force energy of a cell get its unique form** for every life form (eg. species of plants)? The key to the answer to this question is the *sacred* geometry embedded in the DNA of the cell. It is this geometry that enables life-force (eg. gene) expression of the past genome (ancestral experiences), life cycles (includes cycles within cycles of a life). Therefore, the geometry of any lifeform could be described as an embedded syntropy force, and **when this force is kept in a harmonic state than entropy is reduced**.

A classic example of sacred geometry is the tree of life. The structure is a geometrical shape consisting of overlapping circles, which are spaced out in **six-fold symmetry to give it the look of a flower**. As is seen from the image below, the flower reflects perfection and harmony. Taken to be a shape known to all religions of the world and is known by Pagans as ***sacred geometry*** as it depicts the fundamental forms of space and time. The **flower of life** is a concept that explains the patterns for the formation of the Earth and subsequently, all life forms.



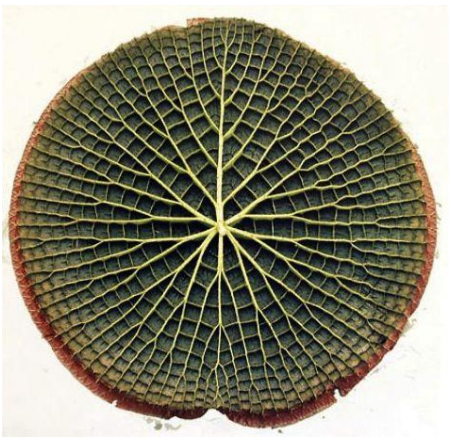
A crucial implication of this shape is its display of how all beings are interconnected. It is the ultimate registry with all information of living beings as it sustains a record of all information that is required for this life form is emerge and function. It is also considered the **primal natural element** from which the other four (fire, water, earth, and air) evolved. It has a hexagonal pattern, where the centre of every circle lies on the circumference of six other surrounding circles of the same diameter. Looking at it as numbers, there are in all 19 complete circles encircled by one big circle on the outside.

In the early stages of Earth formation, crystals grew. At the time when the entire Earth was so hot, water was mainly in a gaseous form, and the only active fluid was molten minerals. The only possible primal expression for plant like growth patterns (geometry) that could have emerged from this primordial soup were soft formations of glasslike material. As Rudolf Steiner said in 1923, *the **quartz** was actually as soft as wax* (or gel). At this stage, the Earth as hot as a glassblower's kiln where glowing hot protuberances grew out the heat of the Earth. In Steiner's view of this prehistorical era, the *alkaline element itself condensed and evaporated in a kind of rain cycle*. There would have been primal water present in the Earth's mantle at this stage regardless of such incredible temperatures. However, the only thing malleable enough to shape into growth forms was **silicon paired with its oxygen**.

It is for this reason that Steiner recommends **quartz silica and silicic acid** within biodynamics (ie. as a primal plant growth stater). Its evolutionary significance as a precursor to plant growth belongs to a time before the Moon. However, regardless of the moon cycle implications in plant growth cycles, it is silica that brings this *primitive plant archetype* back into play for plant growth. In plants, hydrated silicon tends to harden into opaline deposits which serve a number of roles. The significance of silicon in agriculture these days has gained some serious attention. Around the blisteringly hot hexagonal quartz crystals emerging was what Steiner claims was an *albuminous atmosphere*. In Steiner's mind, when we crush quartz and place it in in the soil or compost, this would be a kind *of gestural recapitulation of a much earlier epoch*.

The geometry of life is more obvious in plants, including the Fibonacci, spirals, and fractals





Healthy plants (ie. high syntropy and low entropy forces) have cells that are full of structured (negative charge) or -mV water, and they have access to the full array of nutrients from the soil (ie. nutrient dense). Also, the soil that they grow in has a high carbon content (eg. greater than 5% of volume in the topsoil) and a microbial balance (ie. high diversity and abundance of microbes). The DNA of a plant can be fully expressed when the environmental conditions of the plant are organic (chemical free), and in harmony with the frequencies and wave energies of nature. When these conditions exist, photosynthesis will be maximised to obtain sunlight energy, produce carbohydrates and disperse much of these carbohydrates to the soil to feed microbes. When this **energy cycle** is at its fullest potential then the fruit of plants will be fully formed, large in abundance and size, nutrient dense, delicious taste, low insect attack, no disease and have a high life-force energy.

Research suggests that much of the cell biology may be governed by a single unifying mechanism, ie. phase transition. The term phase transition (or phase change) is most commonly used to describe **transitions between solid, liquid, and gaseous states of matter**, as well as plasma in rare cases. A phase of a thermodynamic system and the states of matter have uniform physical properties. This can include the transition of the crystalline structure of water from a pentagonal (de-structured or entropy) to a hexagonal (structured or syntropy) form. This process occurs in all living forms where de-structured water is consumed, and the water has to be transitioned to a structured form for cell life to function. This transition requires energy, and in the case of humans 50% of body energy can be required in this transition process per day. Therefore, the consumption of structured water with a negative charge (-mV) will **increase cell syntropy**. This is why the Phi'on developed a unique and patented MEA water devices (www.meawater.com.au) to put as **permanent negative (-mV) charge** into de-structured water (all urban water) and thereby provide life-affirming support to all life-forms. For example, plants that receive MEA water are able to maximise **syntropy forces in plant growth.**

The grape bunch on the left was watered with MEA water and in the first fruiting season after receiving MEA structured water the grape vine produced bunches of grapes with 240- 375 grapes in a bunch. The vegetable plant on the right (B. Romanesco) was watered with MEA water and resisted insect attack, heavy frost and produced a large and delicious food.

Structured water is absolutely central to every function of the cell, including muscle contraction, cells dividing, or nerves conducting, etc. Water is the carrier or conveyor of information for the molecules of life, eg. proteins and DNA, and everything the cell does (eg. regulation and healing). The water in cells is not like the *urban* water in a glass. Cell water is ordered or structured like a crystal (ie. like ice), and it excludes toxic or unnatural particles and solutes to achieve purity and balance (ie. syntropy).

The emergence of ideas about the influence of DNA on entropy

In the 1944 book *What is Life?*, Austrian physicist Erwin **Schrödinger**, who in 1933 had won the Nobel Prize in Physics, theorised that life, *contrary to the general tendency dictated by the second law of thermodynamics, which states that the **entropy** (decay) of an isolated system tends to increase*, *decreases or keeps constant its entropy by feeding on **syntropy***. The problem of organisation in living systems increasing despite the second law is known as the Schrödinger paradox. In his note to Chapter 6 of *What is Life*, however, Schrödinger remarks on his usage of the term negative entropy (*syntropy*): *Let me say first, that if I had been catering for them [physicists] alone I should have let the discussion turn on free energy instead. It is the more familiar notion in this context. But this highly technical term seemed linguistically too near to energy for making the average reader alive to the contrast between the two things*.

Schrödinger argues the ***dance between entropy and syntropy*** is what differentiates life from other forms of the organisation of matter. In this direction, although life's dynamics may be argued to go against the tendency of the 2nd law, life does not in any way conflict with or invalidate this law, because the principle that entropy can only increase or remain constant applies only to a closed system which is adiabatically isolated, meaning no heat can enter or leave, and the physical and chemical processes which make life possible do not occur in adiabatic isolation, ie. living systems are open systems. Whenever a system can exchange either heat or matter with its environment, the **entropy decrease** of that system is entirely compatible with the 2nd Law of Thermodynamics. For example, Phi'on has proven that water from an MEA water device can increase in -mv charge (eg. from -500mV to 1,400mV) over time (often with 6 weeks) and this change direction is an example of **entropy decrease**.

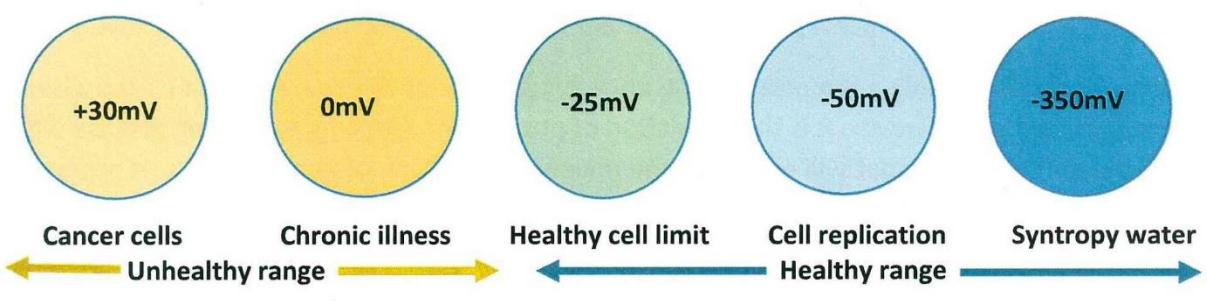
Schrödinger asked the question: *How does the living organism avoid decay?* The obvious answer is, *by eating, drinking, breathing and (in the case of plants) assimilating*. While energy from nutrients is necessary to sustain an organism's order, Schrödinger also presciently postulated the existence of other molecules equally necessary for creating the order observed in living organisms: *An organism's astonishing gift of concentrating a stream of order (coherence) on itself and thus escaping the decay into atomic chaos – of drinking orderliness from a suitable environment – seems to be connected with the presence of the aperiodic solids.*. We now know that this *aperiodic* crystal is DNA, and that its irregular arrangement is a form of information. *The DNA in the cell nucleus contains the master copy of the software, in duplicate. This software seems to control by specifying an algorithm, or set of instructions, for creating and maintaining the entire organism containing the cell*.

DNA and other macromolecules determine an organism's life cycle: birth, growth, maturity, decline, and death. Nutrition is necessary but not sufficient to account for growth in size, as genetics is the governing factor. At some point, virtually all organisms normally decline and die even while remaining in environments that contain sufficient nutrients to sustain life. The controlling factor must be internal and not nutrients or sunlight acting as causal exogenous variables. **Organisms inherit the ability to create unique and complex biological structures**; it is unlikely for those capabilities to be reinvented or to be taught to each generation. Therefore, **DNA must be operative as the prime cause in this characteristic** as well. When we apply Boltzmann's perspective of the 2nd law, the change of state from a more probable, less ordered, and higher entropy arrangement to one of less probability, **more order, and lower entropy** (as is seen in biological ordering) calls for a function like that known of DNA. DNA's apparent information-processing function provides a resolution of the Schrödinger paradox posed by life and the entropy requirement of the second law of thermodynamics.

Cell charge and its link to entropy

The discussion in the previous sessions outlines how the **life-force energy we entrain from our ancestors** is a factor in our rate of entropy (decay) and therefore life survival is this constant challenge of entrainment of syntropy forces from our environment to overcome inherent entropy we constantly entrain from our diet (loss of nutrients) and lifestyle (exposure to toxic compounds) . A critical factor in syntropy entrainment to cells of body organs and systems is the **consciousness of water and its innate ability to receive, store and transmit information as an energetic form of syntropy**.

This process of the interaction between entropy and syntropy can be expressed as follows:



The human body strives through regulation and healing process to sustain a high cell negative charge. It does this by using cell energy to change any positive (+) charge forces affecting the cell to a negative charge (-). However, any onslaught of positive charge forces (eg. trauma, poor diet and lifestyle) can overwhelm syntropy to the detriment of cell charge.

The obvious question is what is syntropy and how can you entrain maximum syntropy to cells? Syntropy is an energic forces that sustains a high negative charge at an inner cellular level. That is, syntropy carries a high negative charge to the cell. The primary syntropy forces can be entrained by:

- Drinking structured (negative charge) water (MEA water devices www.meawater.com)
- Eating fresh, organic food (the water in fresh food: less than 60 hours after harvest) has a negative charge and retains its life-force energy
- Ensuring regular contact with sunlight over the full spectrum of light (ie. ROYGBIV photons of light enhance cell negative charge)
- Ensuring regular physical contact with nature on a regular basis (including bushwalking and swimming in the ocean)
- Embracing the emotions of love, joy and hope and avoiding the + charged emotions of grief, resentment, anger, etc.
- Tuning into classical music frequencies (eg. Mozart in the 432 Hz or download Spotify 432 Hz or healing frequencies from YouTube)

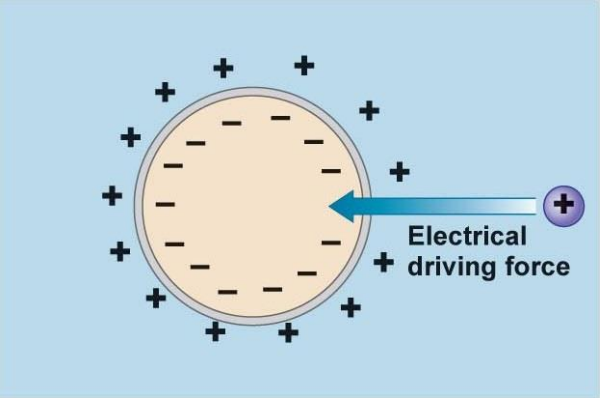
Cell can only sustain a high level of coherence or harmony for proper regulation and healing when the syntropy forces in your life dominate your entropy forces, every day

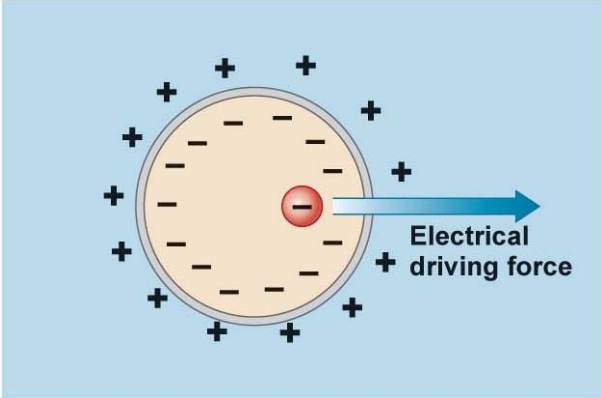
Flaws in the current theories of cell charge and heart function

Often the theories on cell charge promulgated by public science are confined by thinking about the charge of cations and anions and their magnetic attraction within and outside of the cell membrane. However, inside the cell, the water is in structured, gel form and produces a **large negative charge** when the cell is dominated by the entrainment of syntropy forces. There is also the net negative charge in the structured water due to the increased presence of oxygen (-mV) that dominates the positive (+mV) charge of the hydrogen.

However, it is considered by most scientists that cells (usually if not always) have a negative surface charge due to the **phospholipid bilayer composition** but cells (usually, at rest) have a negative membrane potential, ie. **negative charges accumulate on the inner**/intracellular/cytoplasmic side of the membrane and **positive charges accumulate on the outer**/extracellular side of the membrane. The excess negative charges inside the cell are **electrically attracted to the excess positive charges outside the cell**, and vice versa. Therefore, these excess ions collect along a thin shell on the inner and outer surfaces of the plasma membrane, whereas the bulk of the intracellular and extracellular fluid is electrically

neutral. However, this conventional science conclusion about the neutrality of charge for the intracellular fluid is clearly flawed.





Molecular malaise in cell biology

An understanding about cell entropy or decay occurs requires an understanding about cell function, including charge. The **living state** of a cell is not a static configuration of structures, but a **dynamic process** in which structures are constantly changing, constantly being broken down and reformed. Consequently, no matter how perfectly preserved, a fixed, frozen section of a cell, like a good photograph of a person, can give no more than an instantaneous snapshot of its life-process at a moment in time. It then follows that while we have no difficulty in telling the differences in people from photographs over their life, there are considerable issues in sorting out actual structures from artefacts of preservation in the case of the cell, especially if we have no idea what the **cell is like in real life**.

While the living cell is primarily an assembly of water, proteins and associated potassium ions, and that the states of water as well as proteins in the living cell are very different from those of bulk water and isolated proteins, this chemical description says nothing about the **electrical state of the cell** in time or space. Also, the electrical sate can be more than just electrons, charge and current, there is also the yet undefined, universal **life-force energy** that is unique to the body of cells. For example, every person has the genome of many extinct human species that have not been sequenced**. We carry the *life-force* experiences (memory) of a long line of humans in our own genome and this is why every person, and every cell in their body is unique**.

Many scientists, like Gilbert Ling, have not been afraid to ask big questions, such as posed by the celebrated quantum physicist Erwin Schrödinger sixty years ago: "*What is life?*" It is indeed a mistake to call such scientists 'mavericks' and 'dissenters', because there is nothing arbitrary about their refusal to accept the conventional theory that's riddled with holes and falsehoods; and no coincidence that they are converging on a more accurate view of what life is.

Gilbert Ling's thesis is so important, and so original, that his books (eg. ***Life at the Cell and Below-Cell level***) should be read and understood by every cell scientist. However, to answer the

big cell questions requires an understanding of both physical and biological sciences to a degree that is beyond most scientists.

The subtitle of his book mentioned above is *The Hidden History of a Fundamental Revolution in Biology* and this may explain why Ling has gone to such lengths to document his own work and the contribution of others with abundant notes and references

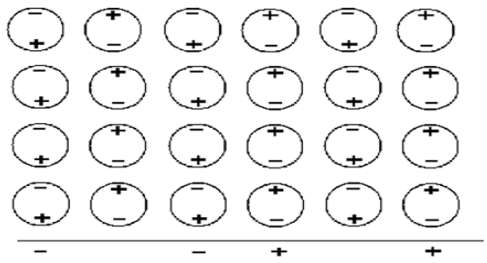
Debunking the membrane theory of cell biology

In case you are wondering about Ling's credentials, he and Chinese physicist C.N. Yang were co-winners of the Chinese national Boxer fellowship that enabled them both to go to study in the United States. Yang won the Nobel Prize in Physics in 1957, while Ling soon found himself at odds with the most fundamental theory in cell biology: that the cell membrane is what keeps the cell intact, by pumping sodium out in exchange for potassium. This is why the cell has a high concentration of potassium and low concentration of sodium, precisely the opposite of the fluid outside, and acting as gate-keeper for glucose and other metabolites. Also, the membrane has numerous receptors that are involved in ***signal transduction*** (communication).

Ling's thorough knowledge of physical chemistry and statistical mechanics enabled him to **debunk the conventional membrane theory** with meticulous experiments, based on which he developed several theories that fit the observations much better than the cell membrane theory.

Cell water is organised in multiple layers on an extended protein matrix

The first idea to grasp is that the 70% or so by weight of water associated with the cell (cell water in a 6-sided crystalline structure) is not like water in bulk. Instead, the water molecules are aligned in ordered layers over a matrix of extended proteins in the ***protoplasm*** (see image below) as ***multiple layers of water molecules aligned over a hydrophilic surface.***



Most people nowadays accept that water molecules immediately next to the hydrophilic (*water loving*) surface of proteins are *bound* in some way to the surface, so their motion is much more restricted than it would be in bulk (*ordinary of non-cell*) water, but few believe this applies to more than one to several layers of water molecules. Ling, however, believes that practically all the cell water is restricted in motion and arranged in *polarized multilayers*.

This organised water has unusual properties, among which, its ability to partially exclude molecules and ions with large hydration shells, which include the sodium ion, Na^+. That is essentially why the cytoplasm, even without its cell membrane will bind the smaller potassium ion, K^+ in preference to Na^+, and the latter need not be pumped out of the cell by an energy consuming mechanism.

In fact, the bulk of potassium does not exist in free solution in the cytoplasmic matrix. It is associated with **fixed negative charges** on the carboxylic acid side chains of the proteins. That is the earliest of Ling's theories, which explains why K^+ is not freely diffusible even in a muscle cell that lacks an intact cell membrane, and externally applied Na^+ is still excluded from the cell.

In an astonishing, apparent confirmation of Ling's *polarized multilayers* hypothesis, Prof. Gerald Pollack and colleagues in Washington University, Seattle, USA, used a suspension of 0.5 to 2 micron diameter microspheres that can be seen under the microscope, and showed up massive ***exclusion zones*** (*or what Pollack calls EZ water*) clear of all or almost all microspheres extending millions of layers of water molecules from the hydrophilic surfaces of gels. Perhaps other explanations are possible, but they are not yet convincing. Pollack was inspired by Ling to write, *Biology of Least Action*. More recently, Pollack is saying *EZ also has a central role when it comes to weather. The atmosphere is full of tiny droplets called aerosol droplets which makeup atmospheric humidity. We found that EZ water envelops each droplet while hydronium ions occupy the droplets interior which explains why rain droplets float on water. Droplets also condense to form clouds because of the* ***unlike charges that lie in between the droplets***.

However, water production in clouds is enabled by microbes. That is, water in the universe has a microbial environment, and on Earth the microbe's cycle from the ocean and land into the clouds. When **Sands**, a researcher in the 1970's showed that a leaf-dwelling bacterium called ***Pseudomonas syringae*** is a catalyst for ice formation even in relatively warm conditions. Why *P. syringae* evolved these instant-freeze powers is not clear, however it might have been a way to get into a plant's tissues through the spiky ice crystals piercing leaves and ripping open cells, to get to the nutrients inside. If bacteria are influencing our weather, even if only in a particular cast of clouds, could they be a key component in self-contained rain factories? Soon after Sands found *P. syringae* hiding out in the clouds, he proposed a **feedback loop**, ie. leaf-dwelling microorganisms are lofted into the atmosphere, where they seed ice crystals and make rain, thereby securing their own dispersal and ensuring a good drenching for their plant hosts. Also, ***Aerobacter aerogenes*** (found naturally in soil, fresh water, vegetables and human and animal feces*)* is a gram-negative, rod bacteria that helps to hygroscopically coalesce and nucleate cloud droplets into rain, as a natural process.

Whether microbes evolved this ability to quickly freeze water at relatively high temperatures in order to rip open and feed on host plants, or as a defence against ice forming inside their own cells, it's perfectly plausible to think that it might have been co-opted as a way to reach pastures new. The atmosphere is like a giant freeway system, but it is also a lethal place to be, so it is possible that they evolved their ice-nucleating ability to get themselves down again,"

says Christner. Maybe the *P. syringae* that Sands pulled out of the clouds above Montana were instigating the instant freeze that would bring them back down to Earth.

There is little doubt that water and microbes form a **syntropy force** that sustains the integrity of land ecosystems and the cycling is a feedback loop to the ecosystem. However, in this relationship consideration has to be given to **Dimethylsulfoxide (DMSO)** that in a plant is held within the **negative charged**, structured water of the plant. When it is taken from the plant it freezes at 18.3^0 C, and it is worth considering the role of DMSO as a critical part of the cycle and feedback loop. Dimethylsulfoxide (DMSO) is a ubiquitous, albeit poorly understood, component of the marine sulfur cycle. Conventionally, the accepted formation pathways are the photo- chemical and microbial oxidation of dimethylsulfide (DMS). In natural environments DMSO is formed abiotically from photooxidation of DMS in surface waters and the atmosphere. It is likely that **DMSO is an essential in pathways to syntropy forces** for ecosystem stability and preventing entropy. For example, ongoing ocean acidification, caused by continuous anthropogenic CO^2 emissions, seems to decrease the concentrations of dimethylsulfide (DMS) and its precursor dimethylsulfoniopropionate (DMSP) in the surface oceans.

Humans consume DMSO from fresh vegetables and fruit, and it is also a compound in breast milk. In this respect, **DMSO** is likely a natural ingredient to immune function, **and limiting cell entropy**. This is why human **cell function and maximising syntropy forces to limit cell entropy** needs to be considered with the context of the total human environment and therefore sustaining the integrity of the Earth's natural environment and its processes.

The electronic cell

A major difficulty for conventional biochemists is that the proteins they know are never extended in solution, but folded up, almost always, in globular conformation and there is no evidence whatsoever that when such isolated proteins are in solution, they preferentially bind K^+ over Na^+.

Ling's answer is that purified isolated proteins are not at all what they are like within the cell. Instead, within the cell, most, if not all proteins are extended so that the peptide bonds along their polypeptide chains are free to interact with the multiple layers of polarized water molecules, and their carboxylic side chains similarly are free to bind preferentially K^+ over Na^+. One reason may be the ubiquitous presence of ATP in the living cell.

Ling's most original idea is that ATP (adenosine triphosphate) is the universal intermediate in all energy transformation processes. This includes muscle contraction, protein synthesis, DNA synthesis, transport, etc. It was once erroneously regarded as the *high energy* intermediate, on account of its *high energy* phosphate bonds, which turned out not to be the case. Living protoplasm is full of ATP, which is bound to proteins at certain *cardinal sites*, according to Ling. These ATP-bound sites then induce changes in the **electron density**, ultimately of the entire polypeptide chain, including the side chains.

In the absence of ATP, proteins do tend to adopt secondary structures, ie. alpha helix or a beta pleated sheet, due to hydrogen bonding between peptide bonds in the same chain, which gives them a folded-up conformation where they do not interact maximally with water. However, when ATP is bound to the cardinal site, it tends to withdraw electrons away from the protein chain, thereby inducing the hydrogen bonds to open up, unfolding the chain and enabling it to interact with water. This, Ling says, is the *resting* living state of the protoplasm, a **low entropy** (ie. high syntropy) state that is highly organised, possessing what Schrödinger referred to as negative entropy or **syntropy**.

It may be a misnomer to call the ATP-bound state of the protoplasm a resting state, as it is also full of 'stored energy' ready to be released when ATP is hydrolysed to ADP. It so happens that ADP has a much lower tendency to bind to protein, so it comes off the cardinal site, and the protein naturally reverts to its folded state, an abrupt mechanical process that releases a lot of energy. It is a thermodynamically downhill or entropy-driven process because it produces disorder among the bound water molecules.

There could be other sites that bind molecules or ligands that have an **electron-d*onating* tendency**, in which case, an extended protein chain will abruptly adopt the folded up conformation, and at the same time, lose its ability to selectively bind K^+, or even reverse its preference for binding Na^+ over K^+. The increase in electron density of the side-chain carboxylic groups favours the formation of ionic bonds, providing sufficiently strong attraction for the electropositive Na^+ for it to give up its hydration shell.

No elaborate pumps or gates are needed to account for the high concentration of potassium and low concentration of sodium inside the cell, opposite to the situation in the extracellular medium. According to Ling, the abrupt transitions of state are what powers living activities. The living cell is an exquisite **electronic machine**, where everything is done with the greatest of ease and the least bother, depending on the **electron density** in specific protein chains.

Cell membrane and membrane potential demystified

According to Ling, cell membranes do exist, but they are not the barriers to diffusion into and out of the cell, which, for far too long, has been regarded little more than a *bag of enzymes* in free solution that would instantly disintegrate were the membrane to disappear. Rather, the **cell membrane is more like the skin of an apple which itself constitutes a phase similar to the bulk phase it encloses**: the major constituents of membranes are also proteins that behave in a similar way as proteins in the cytoplasm. They too, preferentially bind K^+ over Na^+ in the resting state. Membrane potentials are local surface potentials, while action potentials simply reflect the changes of state that involves a release of bound water and the temporary exchange of Na^+ for K^+ bound to the carboxylic acid groups in the protein side chains.

The living state is flexible and liquid crystalline

The picture of what Ling has referred to as the 'resting' living state with ATP and lots of associated water is very much like the liquid crystalline state that I and my colleagues have

discovered in cells and organisms (see Dr. Mae-Wan Ho book, *The Rainbow and The Worm, The Physics of Organisms*), which is another reason why Ling may be correct. The living state, as opposed to the state of death, in which ATP is exhausted, and *rigor mortis* sets in, is maximally **hydrated by polarized layers of bound water, and hence flexible and full of energy**. This idea of the truly living cell is beautifully brought to life in the inspired portraits produced by Ludwig Edelmann (see *What's the cell really like*?).

Flaws in blood science

Similar flaws in science exist about blood, as a bodily fluid. Contrary to existing science, it is likely that blood (82% water) carries a net negative charge due to its vortex action that creates and holds the negative charge in its circulating motion around the body's cells. This vortex action is created by the heart's 4 chambers, the beating heart cell rhythm and the elasticity (pulsing vibration) of the arteries, veins and capillaries. That is, the **heart is not a pump but a *vortexer***.

In 1932, Bremer of Harvard filmed the blood in the early embryo circulating in self-propelled mode in spiraling streams before the heart was functioning. Amazingly, he was so impressed with the spiraling nature of the blood flow pattern that he failed to realize that the phenomena before him had demolished the pressure propulsion principle. Earlier in 1920, Steiner, of the Goetheanum in Switzerland had pointed out in lectures to medical doctors that the heart was not a pump forcing inert blood to move with pressure but that the blood was propelled with its own biological momentum, as can be seen in the embryo, and boosts itself with induced momenta (vibrational entrainment) from the heart. He also stated that the pressure does not cause the blood to circulate but is caused by interrupting the circulation.

The fact that the heart by itself is incapable of sustaining the circulation of the blood was known to physicians of antiquity. They looked for auxiliary forces of blood movement in various types of *etherisation* and *pneumatisation* or *ensoulement* of the blood on its passage through the heart and lungs. With the dawn of modern science and over the past 300 years, such concepts became untenable. The mechanistic concept of the heart as a hydraulic pump prevailed and became firmly established around the middle of the nineteenth century.

The heart, an organ weighing about 1.05 kg, is supposed to *pump* some 8,000 litres of blood per day at rest and much more during activity, without fatigue. In terms of mechanical work this represents the lifting of approximately 45.35 kg to 1.6km high. In terms of capillary flow, the heart is performing an even more prodigious task of *forcing* the blood with a viscosity 5 times greater than that of water through millions of capillaries with diameters often smaller than the red blood cells themselves, over about 100,000 km per day. Clearly, such ideas that the heart is a pump go beyond reason and imagination. Due to the complexity of the variables involved, it has been impossible to calculate the true peripheral resistance if the heart was a pump, even of a single organ, let alone of the entire peripheral circulation. Also, the concept of a centralised

pressure source (the heart) generating excessive pressure at its source, so that sufficient pressure remains at the remote capillaries, is not an elegant or realistic idea.

When the heart begins to function, it enhances the blood's momentum with spiraling impulses. The arteries serve a subsidiary mimicable heart function by providing spiraling (vortexing) boosts to the circulating blood. In so doing the arteries dilate to receive the incoming blood and contract to deliver an impulse to increase the blood's momentum. This is why the elasticity of the blood delivery systems is critical to proper blood flow.

Our understanding and therapy of the key areas of cardiovascular pathophysiology, such as septic shock, hypertension and myocardial ischemia are far from complete. The impact of spending billions of dollars on cardiovascular research using an erroneous premise is flawed. In relation to this, the efforts to construct a satisfactory artificial heart have yet to bear fruit. Within the confines of contemporary biological and medical thinking, the propulsive force of the blood remains a mystery. If the heart really does not furnish the blood with the total motive force, where is the source of the auxiliary force and what is its nature? The answer to those questions will foster a new level of understanding of the phenomena of life in the biological sciences and enable physicians to rediscover the human being which, all too often, many feel they have lost.

Consequently, there are times when we have to push aside scientific ideas that generally concerns us most in our conscious life, namely the content of our thoughts, and learn instead to make conscious use of the *element of will* in our thinking and express the counter case. This can then lead us to creative thinking, initiative and innovation.

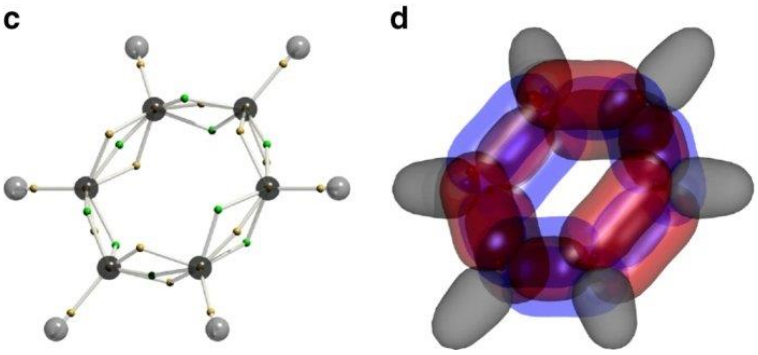
The changing world of molecular energy structures

Knowledge never stands still on any area of science, and less still at a molecular level. for example, the atomic structure of benzene is understood. It has a ring consisting of six carbon atoms, and six hydrogen atoms, one attached to each of the carbon atoms. However, it gets problematic when we consider the molecule's 42 electrons. Researchers at the University of NSW, Sydney have finally revealed the complex electronic structure of benzene.

This not only settles a debate that has been raging since the 1930s, this step has important implications for the future development of opto-electronic materials, many of which are built on benzenes.

This research developed mathematical functions that describes benzene's electrons is 126-dimensional, or a function of 126 coordinates, three for each of the 42 electrons. However, the electrons are not independent, so they cannot be broken this down into 42 independent three-dimensional functions. Therefore, mathematically describing the electronic structure of benzene needs to take 126 dimensions into account. Currently, there are two schools of thought: that benzene follows valence bond theory, with localised electrons; or molecular orbital theory, with de-localised electrons. However, the interpretation of electronic structure

in terms of orbitals ignores that the wavefunction is antisymmetric upon interchange of *like spins*. Furthermore, molecular orbitals do not provide an intuitive description of electron correlation.



Voronoi site showing electron spins (left), and cross sections of the site (right). (Liu et al. Nature Communications, 2020)

The research team's work was based on a technique they recently developed. It's called dynamic Voronoi Metropolis sampling, and it uses an algorithmic approach to visualise the wavefunctions of a multiple-electron system. This separates the electron dimensions into separate tiles in a Voronoi diagram, with each of the tiles corresponding to electron coordinates, allowing the team to map the wavefunction of all 126 dimensions. The researchers found the electrons with *up-spin double-bonded*, where those with down-spin single-bonded, and vice versa. However, that is not the current scientific idea about benzene. The effect of this is that the electrons avoid each other when it is advantageous to do so, reducing the energy of the molecule, and making it more stable.

Essentially, this unites chemical thought, by showing how the two prevailing views to describe benzene come together. They also show how to inspect what is called **electron correlation**, or how the electrons avoid each other. This is almost always ignored qualitatively, and only invoked for calculations where only the energy is used, not the **electronic or light energy behaviour in molecular communication**.

For example, the exchange of information between electrons and ions has been a mainstay in a variety of biochemical applications for decades. Small molecules, however, represent a much wider *repertoire* for biological information transfer, or *molecular communication*.

Redox biomolecules have significant roles in a wide array of cellular functions and present a means for electronically interceding with both native cell pathways and redox-sensitive engineered construct. Electronic interrogation of biological systems with redox molecules has allowed for detection of changes in cell metabolic activity, redox state, toxicity and other parameters. Electronic signals translated through redox molecules show controlled glucose consumption and regulation of enzymatic activity.

It is now known that varied **electrode potential modulates oxidation (charge) and cell fluorescence** (ie. *the emission of light by a substance that has absorbed light or other*

electromagnetic radiation). Applied potentials between the reduction and oxidation peaks (∼+0.1 and +0.25 V) resulted in proportionally more negative cell charge and increasing fluorescence. Based on these results, it can be confirmed that +0.5 V is oxidizing potential and −0.3 V as the reducing potential. Also, oxidized *in situ* by a constant oxidizing potential could **amplify gene expression**. A heat map depicts the **cell fluorescence** due to varied durations of applied +0.5 V. Low charge (closer to zero) resulted in low cell fluorescence compared to charges between zero (0) and ∼−0.27 C, produced initial increases in fluorescence, followed by decreases.

Experiments like the ones described above demonstrate that cells are operating at full potential when they have a negative charge (ie. high oxygen levels or high + ORP) and in this state the cells emit light protons (fluorescence). This also confirms that cell absorb light photons. It is the combination of cell negative charge and light absorption that cells achieve a potential to communicate, electrically. In this respect, the human body is a collection of cells in 250 organs and systems that operate as an integrated, human entity.

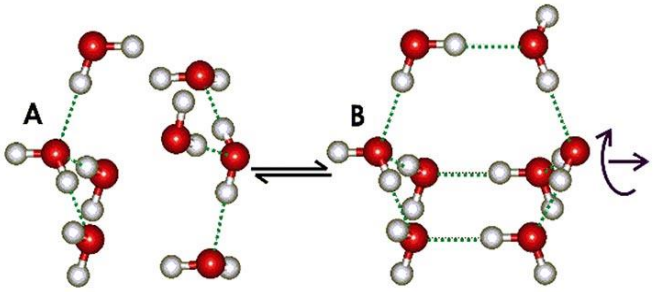
However, the human body is more than the sum of the cells and their charge: there is ***a life-force energy*** that enables systematic thinking, and through training can achieve imaginative knowledge or supersensible perception that we know are clairvoyance and the practices of dowsing or divining (ie. divination). Undoubtedly, this human capability is part of our **gene expression** and a long line of capacity experienced by our ancestors.

The nature of water

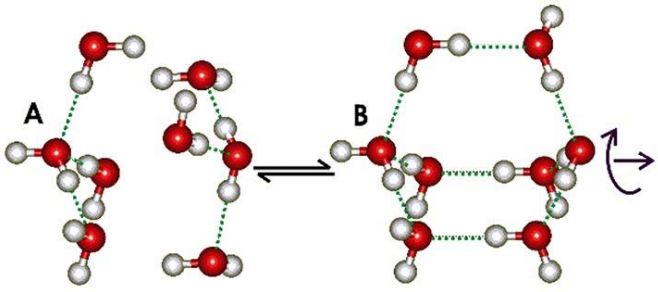
The nature of cell water is likely to be the defining knowledge that furthers research into the understanding of cell function. Water is not plain H_2O, it occurs in nature in many forms and the form of water in cells is different to the water in a pristine flowing stream and also different from the bulk water in tans, reservoirs and pipes. Water has an awareness of its environment that puts it at the **top of the tree in terms of universal consciousness**. It is the nature or state of cell water that ultimately determines cell entropy or syntropy sates. The choices we make in life in terms of the state of water we drink, the diet and lifestyle we choose determines our cell state (ie. entropy or syntropy) and therefore our rate of aging or decay, and disease conditions. Cell water is entraining your internal and external living environment every split second and signaling to other cells the necessary regulation and healing to achieve wellness.

Water possesses many properties that seem strange, or anomalous. Some of these, such as its high melting and boiling points can be simply explained as due to water's hydrogen bonded clustering. Since about 2000, a broad range of evidence has accumulated concerning a **two-state structuring within liquid water**, which can explain many of the remaining anomalies. This theory involves the presence in liquid water, of clusters with a lower density comparable with that of ice. The water molecules in such clusters flicker between partners as their hydrogen bonds are constantly making and breaking. Over a long timescale they appear as favoured arrangements. These low-density water clusters do not consist of ice-like crystals, due to their

lack of long-range order, but they do contain water molecules linked by hydrogen bonds in an expanded, 4-coordinated tetrahedral arrangement. At the smallest scale, the water may be thought of as an equilibrium between two water tetramers (see image below of e*quilibrium between two water tetramers*): structure A, held closely by non-bonded interactions, forming a more dense structure, and structure B, with molecules held further away and linked by hydrogen bonds to form a less dense structure There is little difference in energy between the structures A and B, so the equilibrium is easily affected by the presence of solutes and surfaces. An increase in temperature or pressure will shift the equilibrium to the left.



Although the natural structuring in water at ordinary temperatures tends towards the collapsed *structure A*, the low density *structure B* can grow to form larger non-crystalline clusters based on dodecahedral (12-sided) water cluster cores, similar to those found in the crystalline *clathrate hydrates*; as for example, the extensive icosahedral $(H_2O)_{280}$ aggregate built up from tetrahedrally hydrogen-bonded water molecules surrounding a dodecahedron made up of 20 water molecules, the basic clathrate cage (see image below of e*xtensive icosahedral $(H_2O)_{280}$ structure of water built up from tetrahedrally hydrogen-bonded water molecules*).



Intracellular water contains lower density water with more potassium ions

The differences in intracellular and extracellular environments of cells is primarily due to the extensive surface area and high intracellular concentration of solutes that promote the low-density clustering of water and restricted diffusion inside cells. The extensive surface of cellular membranes (eg. each liver cell contains ~100 000 mm^2 membrane surface area) favours the formation of low-density water inside cells, as the membrane lipids contain hydrophilic head groups that encourage this organization of the associated interfacial water. Other surfaces attract the water, so stretching the hydrogen-bonded water contained by the confined spaces within the cells.

The difference in ionic concentrations is particularly evident in sodium (Na^+; intracellular, 10 mM; extracellular, 150 mM) and potassium (K^+; intracellular, 159 mM; extracellular, 4 mM). Na^+ ions create more broken hydrogen bonding and prefer a high aqueous density, whereas K^+ ions prefer a low-density aqueous environment, as proven by **Philippa Wiggins**. The differences in intracellular and extracellular distributions of potassium and sodium are due to differences in the affinity of these ions for water. The interactions between water and Na^+ are stronger than those between water molecules, which are in turn stronger than those between water and K^+ ions, all due to the differences in *surface charge density* of the ions - that of the smaller Na^+ ion being nearly twice that of K^+ ions. Ca^{2+}, with an intracellular concentration 0.1 mM and an extracellular concentration of 2.5 mM, has a surface charge density more than twice that of Na^+, and has even stronger destructive effects on low-density hydrogen-bonding than Na^+ ions.

Other studies confirm the preference of K^+ ions for low-density water over Na^+ ions. The ions partition according to their preferred aqueous environment; in particular, the K^+ ions are preferred within the intracellular environment and naturally accumulate inside the cells at the expense of Na^+ ions. This process occurs simply as a result of the water structuring without the help of putative ion-pumps in the cell membrane.

Besides, membrane ion-pumps cannot produce these large differences in ionic composition, simply because the (ATP) energy required far exceeds the energy available to the cell. Also, many studies, as for example, the extensive series carried out by Gilbert Ling, have shown that cells do not need an intact membrane or active energy (ATP) production to maintain the ionic concentration gradients.

Ultimately, the purpose of a cell membrane is to delineate the definition between an individual's life-force energy and its infinitely unique resonance frequency or wave energy. The harmonic-construction details get communicated both ways while being able to reproduce the whole of *universal life-force*. The membrane describes what is relative to inside membrane boundaries as compared with what is outside, in 3D and multi-dimensionally. As a multi-dimensional system, the membrane interfaces, with life-force resonance, to send, receive and store energy. The membrane may be considered thin, however in reality a membrane reaches

out in 3D and multi-dimensionally to be the interface between the *sacred* or unique individual and the infinity of other unique humans.

The effect of intracellular protein on water structuring

The degree to which the density of cell water is lowered is determined by the solutes and the state of motion of protein. Water has conflicting effects in the mixed environments around proteins due to the variety of amino acids making up their surfaces. Weak interactions between the protein and surface water molecules allow greater protein flexibility. Strong interactions endow the protein with greater stability and solubility.

There is generally an ordered structure in the layer of water molecules immediately surrounding the protein, with both hydrophobic clathrate-like and hydrogen bonded water molecules each helping the other to optimize water's hydrogen bonding network. Protein carboxylate groups are generally surrounded by strongly hydrogen-bonded water whereas the water surrounding the basic groups arginine, histidine and lysine tends towards a more-open clathrate structuring. The formation of partial clathrate cages over hydrophobic areas maximizes non-bonded interactions between the water and the protein without loss of hydrogen bonds between the water molecules whereas carboxylate groups usually only fit a collapsed water structure creating a reactive fluid zone.

The rotation of the proteins will cause changes in the water structuring outside this closest hydration shell. At the breaking surface, hydrogen bonds are ruptured, creating a zone of higher density water. Protein rotation thus creates a surrounding high-density water zone with many broken hydrogen bonds.

The importance of biology in cell function (entropy or syntropy states)

Earlier in this essay was the discussion about the complex line of the human genome captured in our cells and manifesting as a life-force energy. We also born with and carry with use the **genome of microbes**, and this genome is another layer of genetic expression in human life.

A microbe (or bacterium) is the simplest organism that exists, even though it is by far the oldest, with a **direct lineage going right back to the beginning of life on earth some 3.8 billion years ago**. This is a long time of environmental experiences to influence human life.

Plants and animals are referred to as *eukaryotes*, meaning organisms whose cells have a *true* nucleus, while the bacteria, which have no nucleus, are referred to as *prokaryotes*. This is indicative of their primitive status as *proto-cells*, or forerunners to eukaryotes.

Much of the prejudice against bacteria stems from their small size and the tough cell wall, which make them difficult to study. The much larger plant and animal cells show up many **organelles inside such as mitochondria** (where food is oxidised to provide energy), lysosomes and peroxisomes (where macromolecules are degraded back into building blocks), and many membrane-bound compartments as well as a cytoskeleton of fibrous proteins that fill the cytoplasm. However, a typical electron micrograph of a bacterium on the same scale would reveal an amorphous blob inside.

Bacteria are stunningly efficient, as is clear from the speed with which they can multiply, ie. doubling every 20 minutes or so in the laboratory, and it makes much more sense to suppose that, even without a membrane, the molecules required for a particular activity are grouped together in what can be called *functional compartments*.

When bacteria are sufficiently magnified (ie. about one million times) with a powerful enough electron microscopy, an astonishing amount of sub-cellular organisation becomes evident; and it is possible to see several well-defined compartments immediately.

Inside the outer cell wall layers, referred to as the *capsule*, an *E. coli* cell is further enclosed by two membranes with a space in between, ie. the periplasmic compartment, where nutrients and wastes are captured and sorted, and where a cell-shape controlling network of poly-sugars and peptides, the peptidoglycan, is located. At the centre of the cell is the densely packed DNA strands of the bacterial genome, folded into a compact body, a *nucleoid*, forming a loosely defined compartment devoted to storage and use of genetic information. In between the nucleoid and the inner membrane is the cytoplasm, filled with ribosomes (organelles for protein synthesis) and multi-enzyme or multi-protein complexes performing a variety of functions. The most obvious multi-protein complex, connected to the inner membrane, is the flagellar motor that turns a long, helical flagellum to propel the bacterium through its aqueous environment. Chaperonins and proteasomes are respectively responsible for folding new proteins and disposing of used, obsolete ones. DNA polymerase complexes attached to the DNA strands are responsible for replicating the genetic information. The pyruvate dehydrogenase complex links three sequential reactions together, delivering the metabolites from one reaction to another via a flexible arm of the protein.

However, where is the cytoskeleton? **Frank Mayer** has found by using antibody-staining techniques, evidence of abundant fibrous proteins that form a web-like structure just inside the inner membrane, to which the ribosomes, ie. organelles for synthesising proteins, are attached.

Therefore, there is no doubt that the bacterial cell is just as highly organised as cells of *higher* organisms and could equally influence the *life-force energy of human cells*. Consequently, the **entropy or syntropy** state of cells in the human body is decided by many condition states that includes the human biological state. A primary condition would be the microbial balancing in the gut and consequently, the capacity for **immune responses to constant changes to the states of entropy.**

Conclusion

In the process of a person's life, from infancy to old age, our bodies undergo various integrated system changes all using the same DNA. Living cells are dissipative, open, and far-from-equilibrium systems that **lower the entropy** utilising an influx of energy and molecular material in a multi-compartment structure with specific functional characteristics. **Entropy reduction by syntropy forces was discussed by Schrödinger (1967)** and it relies on both **energy supply to create a metastable non-equilibrium state** and **electrical**, pressure and chemical potential gradients across semi-permeable membranes. **Electric potential** differences also assist in the process. As an open system, a cell operates cyclically exchanging material and heat with the

environment. High-energy molecules are absorbed through pores in the membrane and their energy used to synthesise components of the cell and maintain ambient temperature. Heat is dissipated and **waste products excreted so that excess entropy in the environment is balanced by structure, and information-production lowering the entropy inside the cell**. This, of course, leads to a **net entropy change** in the cell.

Most people know how to increase entropy (ie. decay) in their body cells, through neglect of diet and lifestyle. However, when people choose to **reduce entropy by embracing syntropy** then this requires effort on a continuous basis. This can include:

- Drinking structured (-mV) water
- Accessing more sunlight on a regular basis throughout the day
- Maintaining mobility and muscle movement
- Growing or selecting fresh (living) and organic food and where necessary cooking this food in a manner that does not destroy the nutrients (eg. slow cooking meat in water and saving the broth for the collagen)
- Maintaining regular contact with the natural world as recreation and leisure
- Listening regularly to harmonic music (eg. Mozart 432 Hz)
- Embracing love, joy and hope (negative charge) and avoiding grief, resentment, anger, and hate (the positive charge emotions)

The Earth is full of syntropy. The negative charge of syntropy rains down on us everyday and we just need to be aware of its presence in nature. It would be valuable to take some advice from María Sabina, Mexican healer, and poet:

Heal yourself with the light of the sun and the rays of the moon. With the sound of the river and the waterfall. With the swaying of the sea and the fluttering of birds. Heal yourself with mint, neem, and eucalyptus. Sweeten with lavender, rosemary, and chamomile. Hug yourself with the cocoa bean and a hint of cinnamon. Put love in tea instead of sugar and drink it looking at the stars. Heal yourself with the kisses that the wind gives you and the hugs of the rain. Stand strong with your bare feet on the ground and with everything that comes from it. Be smarter every day by listening to your intuition, looking at the world with your forehead. Jump, dance, sing, so that you live happier. Heal yourself, with beautiful love, and always remember, you are the medicine.