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Neuron Cell Degeneration Results from Perturbed Mitochondria or *Vice Versa*?

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Abstract

Mitochondrial disease has important implications for numerous functions that affect different cells lines and tissues. The mitochondrion is an organelle that draws much attention from researchers, but their study is hampered by changing in number, size, shape, and location among other things. To date, it is not understood if mitochondrial alterations could be considered to be downstream effects or are the root causes of diseases classified as neurodegenerative. It is an unresolved enigma if mitochondrion form, size, location, and number become crucial to the correct functioning of distinct cells lines and tissues, besides the role of reactive oxygen species (ROS) generated during the metabolism of glucose. The unexpected role of melanin to transform radiative energy directly into chemical energy by dissociation of the water molecule marks a milestone in the study of mitochondrial diseases.

Keywords

Neurodegeneration, Energy, Mitochondria, Human Photosynthesis, Hydrogen, Water Dissociation

1. Background

Cells require a constant flow of energy to be able to generate and maintain the highly complex biological order that keeps them alive. It is a deeply rooted concept that the cell's energy is derived from the chemical energy stored in food molecules, mainly sugars which are considered to be the universal fuel for the cell.

The breakdown of glucose in the eukaryotic cell releases energy in the form of ATP (theoretically). This

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process is known to have three steps. Step 1: digestion, which occurs either outside the cell in the intestine, or inside the cell, in an organelle called lysosome. Thereby the large polymeric molecules found in food are broken down into monomeric molecules. In this first step of ATP production, proteins are broken down into amino acids; polysaccharides are converted into monosaccharides; and fats are changed into fatty acids and glycerol. However, such explanations tend to overlook the fact that any change requires energy.

According to the chemiosmotic hypothesis proposed by Dr. Peter Mitchell, whose finding in glycolysis' second step begins in the cytosol and ends in the mitochondrion. In this stage, glycolysis occurs, and converts each molecule of glucose into two smaller molecules of pyruvate. It is important to bear in mind energy expenditure.

Pyruvate is the end product of cytosolic glycolysis and it mainly ends up in mitochondrial oxidation. This metabolite crosses the inner mitochondrial membrane. Each pyruvate molecule is converted into carbon dioxide and two-carbon acetyl groups, which are attached to a coenzyme A (CoA) molecule, forming acetyl CoA. Large amounts of acetyl CoA are also produced by the stepwise oxidative breakdown of fatty acids derived from fats. Chemical reactions described above require available chemical energy to occur.

Theoretically a net total of only two ATP molecules per molecule of glucose are produced in glycolysis. In other words, one molecule of glucose has 100 times more energy than a molecule of ATP. It is difficult to accept that nature evolved based on more complex and inefficient metabolic pathways in order to obtain energy. In terms of energy is not possible deferred payment, so the molecules and enzymes involved in the process of glycolysis also depend on the previously available energy, which should be sufficient not only for their function but also for the cell evolution, synthesis, maintenance, and function properly and in a timely manner. And forcedly the energy level ATP carries is just the right amount for most of biological reactions. In biology, nothing has sense except at light of evolution, and glucose cannot explain origin of life, because synthesis of glucose itself is a process that requires energy, and worst, the cellular machinery necessary to get energy from glucose through oxidative degradation of the molecule requires energy also, and not only to process glucose instead to synthesis and maintenance the complex molecules as coenzyme A.

It is true that a steady supply of ATP is so critical that when any harmful chemical is introduced to the organism that causes serious health effects attacking any of the proteins used in ATP production such as arsenic, in high doses it may kill the organism within minutes. However, this effect shows only the importance of phosphates in the living world [1].

The third step in the oxidative breakdown of food molecules takes place entirely in mitochondria, where the acetyl group enters a series of reactions called the citric acid cycle, being carbon dioxide the final product. In this step, large amounts of electron carrier NADH are generated, and the high-energy electrons pass along an electron-transport chain. The energy is released in the mitochondrial inner membrane, and is used to drive a process that produces ATP and consumes molecular oxygen (O_2), but surprisingly the lung only absorbs 30% of inspired oxygen, being the need for oxygen so important.

The lung cannot absorb more than a third part of the inspired oxygen because the oxygen pressure in the arterial blood is greater than the pressure in the alveolar air, so this cannot achieved by simple diffusion, which is the usual way that pulmonary alveolus transfers oxygen to the blood. Today there is not an accurate biochemical or enzymatic explanation of the difference between the supposedly high oxygen consumption in bioenergetic process and the poor efficiency of lung in regards oxygen absorption, besides that any process that lies behind of these events requires energy indeed.

In accordance with current textbooks, the energy derived from the breakdown of sugars and fats is redistributed as packets of chemical energy for the convenient use elsewhere in the cell. However, every single ATP molecule must be reconstituted at least three times per minute [2]. The energy requirement to perform such reconstitution is enormous, but the total human body content of ATP is barely 150 grams, and it must be constantly recycled at least three times per minute. The ultimate source of energy for this process is food, a concept entirely theoretical; ATP is the carrier and the energy-storage unit, although any energy storage unit whose duration is not beyond 20 seconds cannot properly be called storage unit of energy.

The average daily intake of 2500 food calories translates miraculously into a turnover of a whopping 180 kg (400 lbs.) of ATP (Kornberg, 1989). A concept difficult to accept because energy is neither created nor destroyed; can only be transformed. Therefore, transformation of a mass of 150 grams of ATP in a 180 kg of ATP requires enough available energy, which does not come from nowhere.

It is said that ATP has high energy bonds that make the phosphate groups easily transferable to other compounds, and enables ATP to store energy for 20 seconds at most. If ATP had the sacred role those textbooks de-

scribe, no intracellular organelle would be more than 20 seconds away from a mitochondrion, but natural distribution of mitochondria within the cell does not follow that pattern. Furthermore, the cell nucleus, that neither has mitochondria nor ATP, unavoidably requires energy to work, which has, then; an origin that cannot be explained at light of current bioenergetics pathways.

In spite serious drawbacks, ATP is considered so far the universal energy currency of cell. This idea was generally accepted thanks to the "high energy" phosphate bond ATP has, but the word "high energy" in this case really means "interchangeable easily". It is most comprehensive to think that ATP is used by the cell mainly as phosphate "money". That is, the cell regulates, distributes, and optimizes metabolism of phosphate through adenosine triphosphate, and high-energy bond just means that phosphate group is easily interchangeable from one molecule to another.

Mitochondria, theoretically, generates energy as electrons are passed from donors at lower to acceptors at higher redox potential through various proteins complexes. In accordance with Mitchell's Chemiosmotic Theory, along above process, protons are pumped from the matrix outward, generating a potential difference across the inner membrane. Thereafter, and theoretically also, the resulting potential energy is transferred to ATP or dissipated as heat as protons leak back toward the matrix. The concept of heat generation is usually interpreted as energy that is wasted as heat cannot be used in a manner sufficiently accurate for the purposes that the highly complex cell's metabolic processes require.

Although most electrons are eventually passed to molecular oxygen, small portions are leaked during transport, resulting in one-electron reduction of oxygen to superoxide, which subsequently is converted to radical species too. Paradoxically, although generated ROS are so destructive, is slightly conceivable that these radicals also could serve to metabolic purposes such as induction of mitochondrial uncoupling and cell signaling.

The electron transport has not a linear progression along a single pathway, as one might think. In reality, electrons, traveling at speed-light, enter to the so-called electron-transport system (ETS) or branched electron-transport chain (ETC) at least in four separate sites that are convergent, in that all eventuate in the reduction of coenzyme Q.

The various molecules involved subsequent in the forming of different enzymatic complexes are intricate structures immersed in water, and therefore require energy at least for two things: to keep the form and perform their function, though in different sources of information not mentioned a word about it.

Furthermore, the complex V (F0-ATPase) is capable of "coupling"—theoretically—proton flow to conversion of ADP to ATP in an intricate manner that still remains incompletely understood [3], it is said that Peter Mitchell's theory was based on the operation of water mills, which were numerous in the region where he lived. Moreover, substrates for the TCA cycle enter the mitochondrial matrix through pyruvate dehydrogenase, carrier proteins, or one of multiple shuttle mechanisms, however the necessary energy of activation to carry out all these processes, from where?

And worst the metabolism of different substrates results in electron donation to specific complexes or sites, thereby more energy is needed. If we calculate the energy that produce all the processes involved in the whole energy generated at the end, the cell would require something like an International Cell Monetary Fund's to function properly since the cell would be constantly in debt in terms of energy which is evolutionarily and functionally impossible.

Furthermore, in terms of energy, we cannot negotiate; there must be always enough supply of energy to drive the intricate and numerous chemical processes that take place within the cell. Energy has to be in the right place at the right time for each process to occur adequately. Free chemical energy must be available all the time in a very efficient way to drive the myriad chemical reactions that origin what we call life, otherwise, without a source of reliable, steady, and adequate energy; the cell perishes in few minutes because the entropy increases rapidly with potentially fatal consequences.

For the analysis of intracellular processes must always keep in mind that the first scientific article on a metabolic process dating back to the 17th century. We can, however, not fully understand metabolism if we only study the individual parts of the network of reactions. Metabolic processes are constantly taking place in our body no matter whether we eat, sleep or exercise. Supposedly food is broken down to generate energy and to synthesize building blocks needed to maintain our body's cells. Gathering all knowledge on metabolism to build an accurate model and keeping track of new discoveries constitutes a formidable challenge. Notwithstanding the challenge, various initiatives have already resulted in more than ten human metabolic pathway databases. One would expect these databases to contain largely the same information, but the contrary is true; and the differ-

ences are extensive.

That's one of the main reasons why ≈199 of the seven thousand chemical reactions described that occur within the cell are described in uniform way at the different sources of information, and the remaining 6801 reactions differ according to the source [4]. The tricarboxylic acid (TCA) cycle that plays supposedly a key role in generating energy; described for the first time in 1937 by Hans Krebs, even for this well-studied process there is considerable disagreement between databases.

The different sources of information, all they have in common that are based in the ancient y entirely theoretical concept that energy comes from food, glucose, and therefore ATP. But chances are filed here the problem of the prevailing confusion in the great majority of intracellular biochemical reactions described to date is that Cellular Biology so far relies too heavily in glucose as source of energy.

And studies are further complicated because involved enzymes do not work in the same way once they are removed from the cell. Proper temperature regulation is vital to maintaining metabolic reactions, if cell has lower temperature the enzyme and the substrate are moving so slowly that collide weakly, but as the temperature increases, the enzyme and substrate gain more kinetic energy. This fact is not easy to explain since useful random energy does not exist. In an excessive kinetic energy medium the enzyme and its substrate rarely would join. Therefore the reaction cannot be accelerated, nor speed up randomly. Mitochondrion is no exception. There are extraordinary difficulties implied in experimentation with isolated mitochondria, in other words, we cannot expect that what happens *in vitro* reflects exactly to the complex metabolic reactions *in vivo*. Interestingly the amount of melanin correlates inversely with the number of mitochondria, the difference in the number of mitochondria between a person with white skin and dark skin does get up to 83% difference.

This explains why the Mitchell's Chemiosmotic Theory still remains hypothetical after more than 50 years of being postulated. It is conceivable that if the mitochondria were the main energy producer of the cell, and according to cell biology, chemical energy available is essential for intracellular organelles all and bio-molecules can carry out their function, then it should be possible that the mitochondria could operate in isolation, which does not happen in reality. Therefore we can assume that the energy required by mitochondria to properly working probably does not come from the mitochondria itself, and may come from some other unknown or unsuspected process as the intrinsic property of melanin to dissociate the water molecule.

Thereby, when the mitochondria has morphological or functional alterations, the doubt is which came first: the mitochondria was the primary site of damage or instead the cell as a whole is first altered and secondarily the mitochondria cannot perform his duties as retain the adequate shape, size, location, and number despite having four billion years of evolution, which means that both functions known as very close to perfection.

According to our work, the chemical free energy available is the key player in cell biology; we can say that chemical energy level is first and then everything else, *i.e.* to the organization of the carbon chains of the body, this takes carbon atoms from glucose to structure more than 99% of biomolecules. A system that gains a form of energy, automatically also gains mass, but never in the reverse direction.

The chemical energy producing mechanisms are vital, in every aspect of cell function and even form. Mitochondria do not seem to be indispensable organelle in all animal cells. There are cells and even intracellular organelles that do not require mitochondria to carry out their function; Human erythrocytes and the nucleus of the eukaryotic cell are good examples.

So a cell chronically in debt from the energy point of view could even have evolved. It is a fact that any cell with low levels of energy, *i.e.* cancer cell with low voltage; tend to return in evolutionary terms. The cell is like a black box whose operation is stopped or at least altered very significantly in uncover. Therefore until date is not possible to study and much less to understand a living cell due to any intervention is able to modify significantly intracellular processes.

And the question remains: Where do these cells and organelles (erythrocyte, nucleus) obtain their energy to function?

Therefore, having cells and organelles that are able to function normally, adequately without the presence neither mitochondria nor ATP, several possibilities can be raised: 1) mitochondria are not the unique source of energy; 2) the mitochondria is not a source of energy at all, and if so, then we have a third option; 3) the presence of numerous mitochondria in areas of high energy usage is due that themselves exploit the presence of energy that does not come from them, for instance: in the synapse.

And subtle evidence is that the so-called mitochondrial encephalopathy (MELAS syndrome), whose signs and symptoms do not speak precisely of excess energy despite the excessive number of mitochondria [5].

2. The Unexpected Role of Melanin as a Primary Element in Bio-Energetic Pathways

Biomolecules in a living organism rarely act individually [6], except melanin, which requires only water and light visible and invisible to carry out the unsuspected function of energy transduction. The intrinsic ability of melanin to absorb light energy visible and invisible and transform it into chemical energy through the dissociation of water molecule was identified by our team during an observational study about the three leading causes of blindness in the world, launched in 1990 [7].

Our working hypothesis was then observe and record the tiny blood vessels of the optic nerve in order to find morphological changes able to be registered in digital photography, which could eventually serve as valid indicators of early eye disease and therefore start early treatment, or try to find new ways of treatment or therapies.

The magnifications required for adequate visualization of the minute blood vessels of the optic nerve were accomplished after three months of work, but with these magnifications (**Figures 1-3**) we started to notice the constant presence of melanin in the vicinity of the optic nerve.

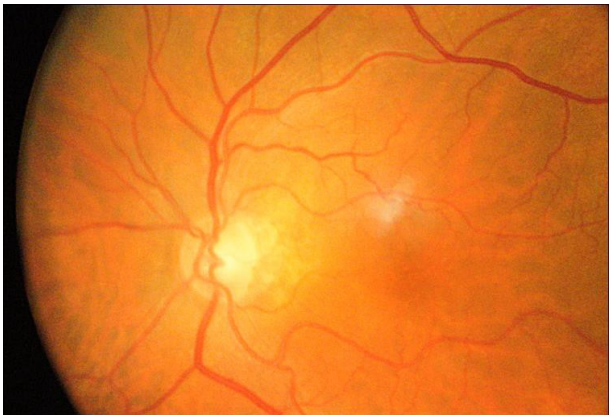


Figure 1. Normal optic nerve photographed with polychromatic light. The optic nerve in the human has a diameter of 1200 microns, the equivalent of 10 human hairs together.

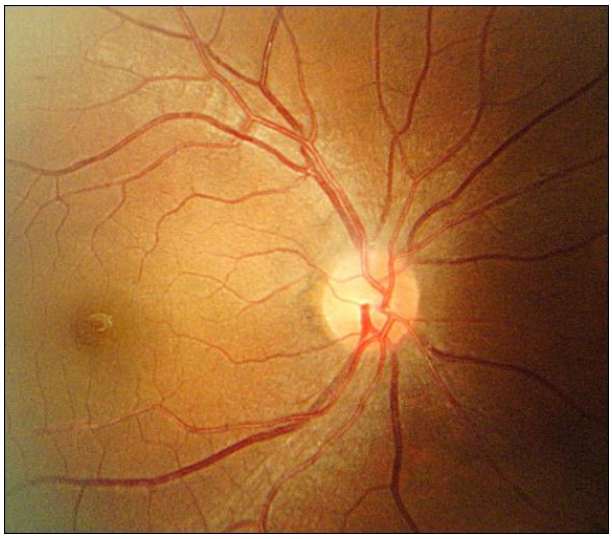


Figure 2. Optic nerve of the right eye in a live patient, showing discrete hyperpigmentation due to melanin presence is in the clock meridian of 10 to 7. The horseshoe-shaped reflection that can be seen to the left of the optic nerve is due to depressed normal fovea and is called foveola.

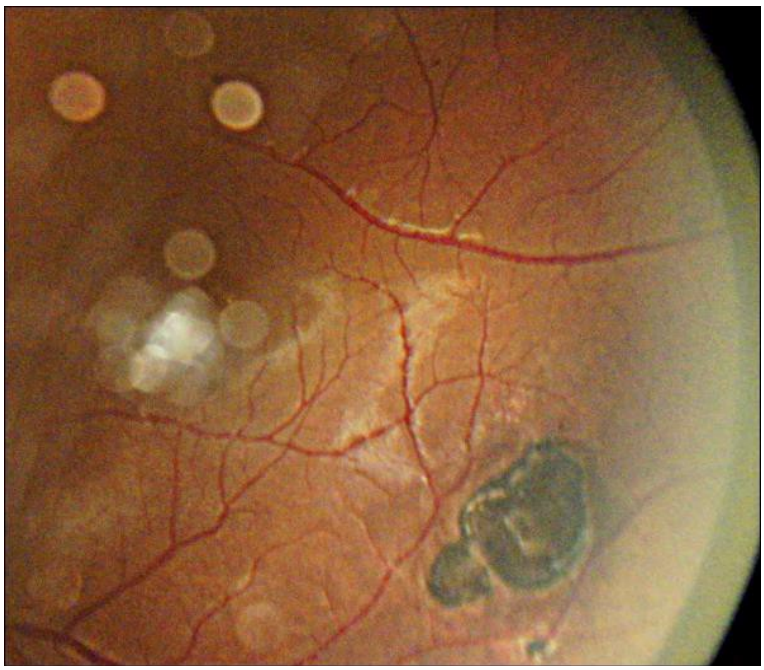


Figure 3. The presence of melanin during the routine ocular fundus exploration is a constant finding. In the nearly six thousand patients examined during our protocol, melanin, regardless of diagnosis, was found in practically all; a fact that caught powerfully our attention. The patient of the photography was asymptomatic in spite to had hyperpigmentation zone about 1 papillary diameter in temporal region of the ocular fundus.

The functions of melanin in the eye was thought so far to be limited to a simple built-in sunscreen, that absorbs excess light entering the eye, allowing the image had better quality [8]. But the fact that all the almost six thousand patients reviewed during the study had melanin led us to think that the function should be something different, why the insistence of nature in place pigments in all patients, regardless of diagnosis who could have.

Searching across the literature trying to find an explanation, we find, on the contrary; data that increased our doubts. For example, the layer of photoreceptors (rods and cones) requires ten times more energy than the cerebral cortex, six times more energy than the heart muscle, and three times more energy than the renal cortex. And according to the existing dogma, any metabolic needs of the tissues are fulfilled by the blood supply (**Figure 4**) *i.e.*, through the blood vessels; but under normal conditions, the layer of rods and cones not normally possesses a single blood vessel, which catapulted the doubt: the energy to the photoreceptors, hence?

Over the twelve years of hard study, we steadily concluded that melanin had a significant effect on the size and number of blood vessels (**Figure 5**), an unpublished fact. Gradually we were able to understand that when there was fewer vessels more melanin and *vice versa*, in other words seem to be an inverse correlation between melanin amount and the blood vessels number.

3. Melanin Is the Human Chlorophyll

Several other minute details observed along those cited above, founded during the twelve years of study, until finally, in February 2012, we were able to decipher the enigma: melanin possess the amazing ability to absorb visible and invisible light and dissipating the absorbed energy through the dissociation of the molecule water, an unsuspected fact which may be represented as follows:

$$2H_2O \rightarrow 2H_2 + O_2$$

This is very similar to the very first reaction in the photosynthesis process of plants and is also represented as follows:

$$2H_2O \rightarrow 2H_2 + O_2$$

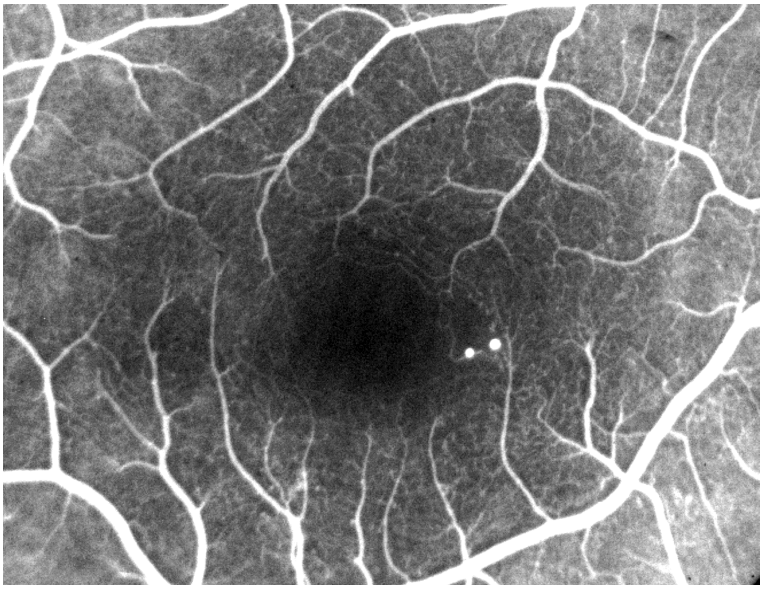


Figure 4. Retinal circulation contrasted with intravenous fluorescein and the central dark zone of the photography, which is called macula; where the normal absence of blood vessels is easily appreciated. The widely accepted source of energy (blood vessels) to this important tissue has not yet a logical explanation. On the right side of the photograph two micro-aneurysms (white rounded dots) are observed.

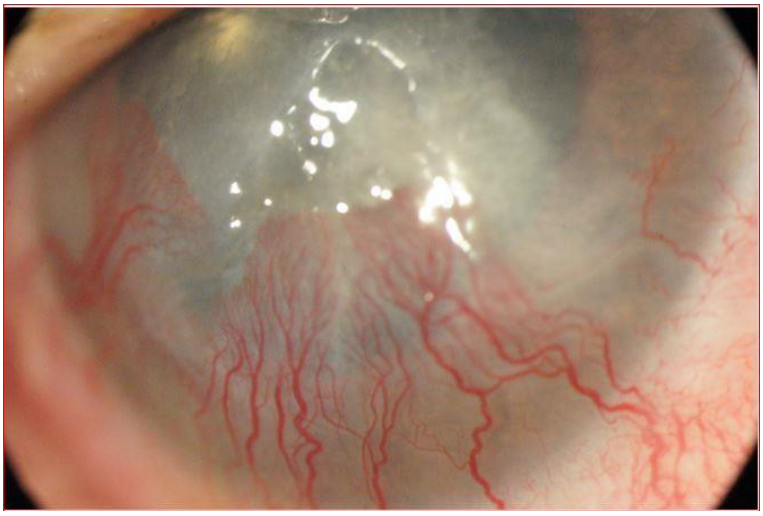


Figure 5. When tissues with normally large amounts of melanin were sick for some reason, then the vessels tend to grow, which is a substantially constant behavior. In the photograph a remarkable blood vessels growth on the surface of the cornea is seen, which is a tissue normally with very little presence of melanin, but a few mm behind is a tissue with 40% more pigment than the skin, and is named iris; so when this highly pigmented tissue goes under disease, the blood vessels then grow (angiogenesis) either on the surface of the cornea, like in this photograph, or over the iris itself (**Figure 6**).

The similarity between both fundamental, primary reactions left us stunned; melanin was nothing less than the equivalent to human chlorophyll. Thereafter we continue to research and in a relatively short time we realized it was more than water dissociation alone, like in chlorophyll, due to water molecule, in plant's leave; is dissociated irreversible, and consequently oxygen is impelled to the atmosphere, but melanin is thousand times more

efficient due to is not only able to dissociate the molecule of water, such as chlorophyll, but also is able to carry out the reverse reaction: could it reform, which is an amazing and unsuspected intrinsic property of melanin.

Then the complete reaction that happens inside melanin is as follows:

$$2H_2O \leftrightarrow 2H_2 + O_2 + 4e^-$$

That is, for every two molecules of re-formed water, 4 high-energy electrons are generated [9]. By other hand, the product of the water molecule dissociation with true value is molecular hydrogen [10], firstly: 98% of the universe is composed by Hydrogen, and secondly: Hydrogen is the quintessential carrier of energy in the entire universe, thus the metabolic reactions inside a eukaryotic cell should not be different from those occurring in the universe.

By other side, oxygen is toxic at any concentration, and both Molecular oxygen and diatomic hydrogen do not mix with water, so they move easily through water following the laws of simple diffusion. Melanin releases chemical energy symmetrically, in all directions; way of increasing energy spheres (**Figure 7**).

The melanin granules are strategically placed in the perinuclear space at every single cell in our body, where the transduced energy emanates from melanin and floods the entire cytoplasm and organelles. This generated energy maintains the shape and functions of the cell, and also Hydrogen is until now the best known antioxidant. Diatomic hydrogen does not combine with water, thus facilitating its diffusion throughout the cell. It is also capable to form high-energy areas, such as in the cell nucleus, which has neither mitochondria nor ATP. The growing fields of energy generated from the melanosomes that characteristically surround the nucleus, together in the same core, provide the energy necessary for many functions of the nucleus.

Melanosomes, which we define as melanin granules surrounded by a lipidic bilayer, similar to the cell membrane surrounding the nucleus almost entirely (**Figure 8**), and the growing spheres of energy tend to coalesce at the center of the core, which forms an area of high energy that fills the huge metabolic requirements thereof.

The mitochondrion is not a self-sustaining organelle on energy terms, it does not produce its own energy, and it really depends on the energy emanating from the melanin. Mitchell's Chemiosmotic Theory came to fill a void in the long-sought explanation of how chemical and mechanical energy is produced, derived and concatenated

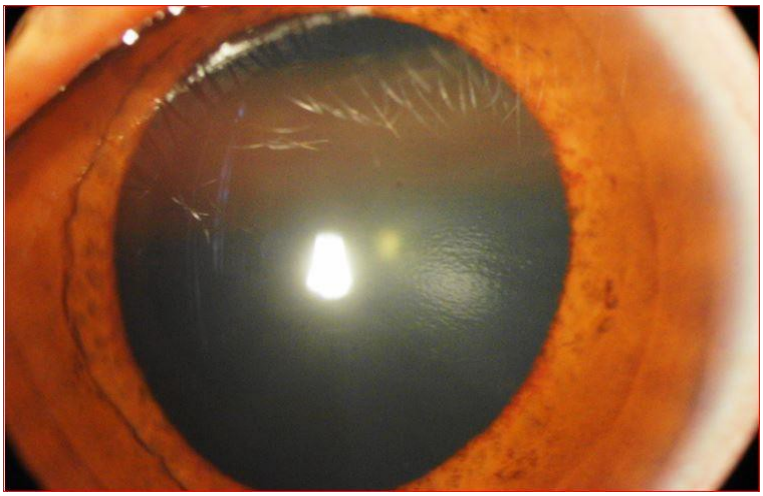


Figure 6. In this photograph of a diabetic patient, the reddish edge of the iris is due to the presence of abnormal new blood vessels (rubeosis iridis). Melanin and blood vessels are antagonistic phenomena. There are more blood vessels if the amount or function of melanin is lower and *vice versa*, which can be observed both in healthy and diseased eyes. In eyes with clear iris, choroidal vessels are quite visible, in contrast with the dark eyes, which are difficult to observe (the choroidal vessels), furthermore the ocular fundus of caucasic people have a reddish coloration; meanwhile in people whit dark skin the color of the fundus is brown. However, it was misunderstood fact and wrong explained as the amount of melanin simply decreasing the visibility of the choroidal blood vessels, but thought that in both cases the choroidal vascular density was very similar.

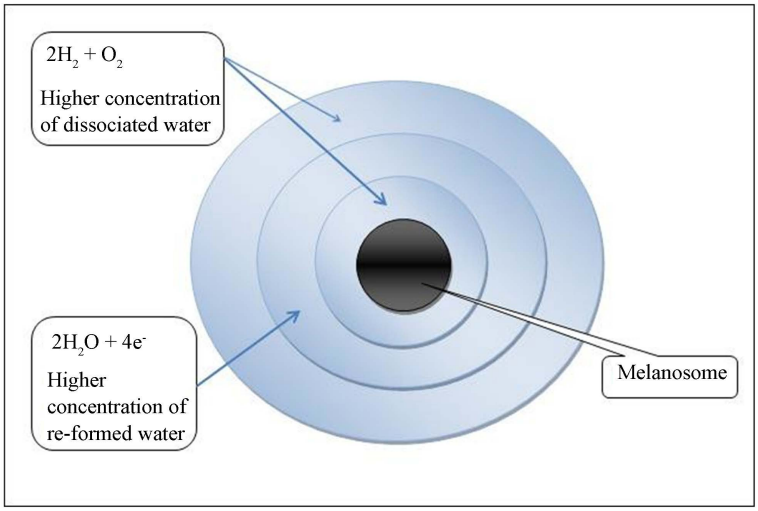


Figure 7. Melanin steadily releases energy in all directions, symmetrically, in a similar pattern as growing spheres. Each sphere represented has significantly different concentration of molecular hydrogen and re-formed water.

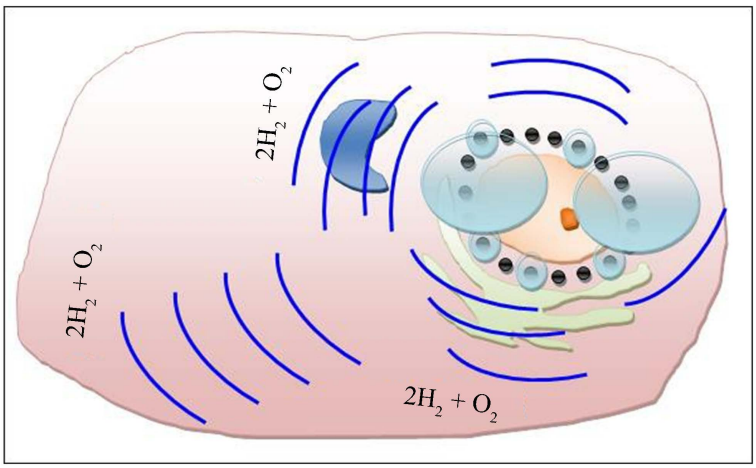


Figure 8. Schematic drawing of a cell where we observed the nucleus, the endoplasmic reticulum and mitochondria. Growing energy spheres (navy blue curved lines) flood the entire cell steadily with free chemical energy.

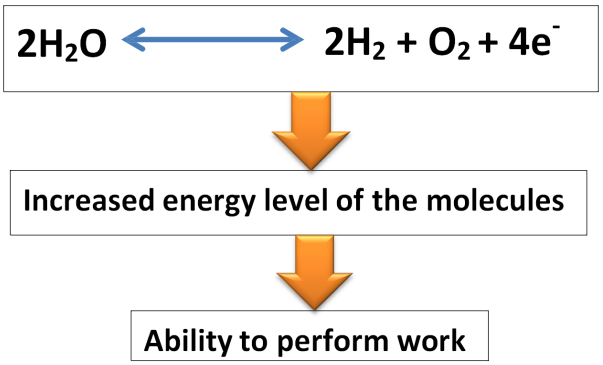
inside the cell. But despite decades of research, it remains entirely theoretical. Interestingly, Mitchell's works did not use mitochondria, but bacteria only.

In our opinion, the mitochondria is not a major part of the cellular bio-energetic pathways (**Scheme 1**), which is a collective error; thereby, our finding of the intrinsic property of melanin to transform light energy into chemical free energy, through water dissociation, mitochondria functions will have to be reconsidered.

Given melanin is characteristically placed around cell nucleus, chemical energy flood even the last cell corner, so energy is distributed constantly, adequately, night and day; a fact quite congruous with the cell biology. Thereby glucose is important as source of carbon chains, this is: of biomass, but energy, defined as everything that produces a change, comes from water, like in plants. Strictly energy comes from sunlight, but sunshine must pass through the water to be used by both eukaryotic and prokaryotic cell. The energy required by any cell organelle for keeping the form and function comes from melanin, and mitochondria are no exception.

4. Mitochondria and Neurodegenerative Diseases

Mitochondrial dysfunction is a hallmark of almost all diseases [11], thereby are physically or functionally



Scheme 1. The chemical free energy emanating from melanin is able to explain the energy requirements of the cell, since the energy level of molecules and atoms rises, enabling them to carry out a job.

altered in many neurodegenerative diseases [12]. This is valid for very rare neurodegenerative disorders as well as extremely common age-related ones such as Alzheimer's disease and Parkinson's disease. But we believe that occurs because Mitochondria is a very sensitive organelle, or at least its alterations seem easier to recognize; more than the fact of being a true causal factor.

In neurodegenerative diseases there are localizable functional impairment and neurodegeneration associate with recognizable syndromes that are theoretically distinct, although in clinical and even neuro-pathological practice substantial overlap exists. These syndromes are categorized (as possible) by whether they initially affect cognition, movement, strength, coordination, sensation, vision, or autonomic.

Neurodegeneration implies a final stage of neuronal loss preceded by a period of neuron dysfunction. But it does not really understand when the disease really begins, and neuronal loss is something that can only be detected more easily than other less obvious but equally important events. Likewise it is thought that mitochondrial abnormalities can cause or effect of numerous diseases.

During the 1980's, were identified several rare disorders as likely arising from mutation of mitochondrial DNA (mtDNA). These disorders typically affected the central nervous system, causing encephalopathy, and muscle, causing weakness. Paradoxically it was shown mitochondrial dysfunction also occurred in neurodegenerative diseases with non-mitochondrial etiologies. For instance, in Huntington's disease is not clear and is only presumed that huntingtin mutation ultimately causes mitochondrial dysfunction in HD.

In neurodegenerative diseases with mitochondrial dysfunction no clear upstream pathology has been elucidated, due to 4 billion years of evolution are quite complex. Therefore questions remains regardless of whether mitochondrial dysfunction is a primary cause of neuro-degeneration, a mediator of neurodegeneration, or an epiphenomenon.

Leber's hereditary optic neuropathy (LHON), MELAS syndrome (mitochondrial encephalopathy, lactic acidosis, and stroke like episodes), the myoclonic epilepsy with ragged red fibers (MERRF) syndrome, the Kearns-Sayre syndrome (KSS), Leigh syndrome (MILS), and the neuropathy, ataxia, and retinitis pigmentosa (NARP) syndrome, are examples of diseases considered to date as Mitochondropaties and can be associated with mitochondrial proliferation, specially LHON, MELAS, MERRF, and KSS.

5. Report of a Case of Kearns-Sayre Syndrome KSS

As an example of the metabolic processes described above, a case of progressive loss of ocular motility, in a young patient is showed. These are rare, sporadic cases; and mitochondrial dysfunction is considered the main cause. Using melanin derivatives as therapeutic tool, the response was remarkable.

This is a male patient 17 years old, short stature, muscle weakness, vision problems, and progressive ophthalmoplegia. When he came to us and had the diagnosis of Kearns-Sayre syndrome (**Figures 9-16**). The patient and relatives are already familiar with our research on human photosynthesis, so once we review it, we recommend pharmacologic enhancement of "human photosynthesis" [13].

The photographs after three months of treatment show a significant improvement (**Figures 17-24**).

Figure 9. Primary position conjugate gaze photographed patient during the first consultation on October 26, 2013.

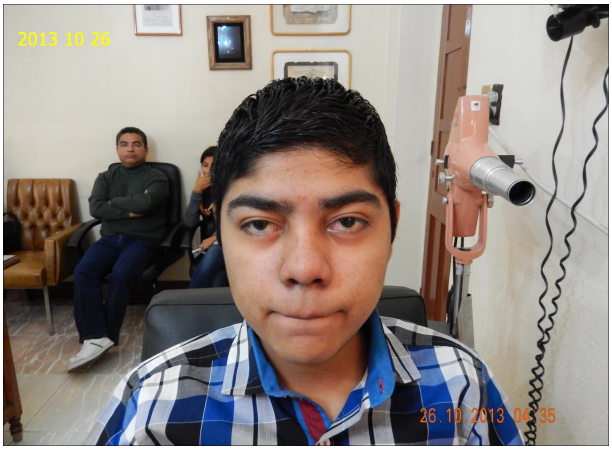


Figure 10. At supra-version or upward conjugate gaze, with no movement at all. Photography was taken at pretreatment consultation.

Figure 11. The dextroversion or conjugate gaze to the right, showing minimum displacement of ocular globes. Photography is pretreatment.

Figure 12. Left-version or conjugate gaze to the left, eye movements are practically absent. The photography was taken during first consultation.

Figure 13. Primary position of conjugate gaze, after a few minutes of hold, the patient tended to close eyelids. Photography is pretreatment.

Figure 14. Infraversion or conjugate gaze down, in the conjugate downward gaze, no rotation of the eyeballs, only a displacement of the eyelids. Photography was taken at pretreatment consultation, at 26 October, 2013.

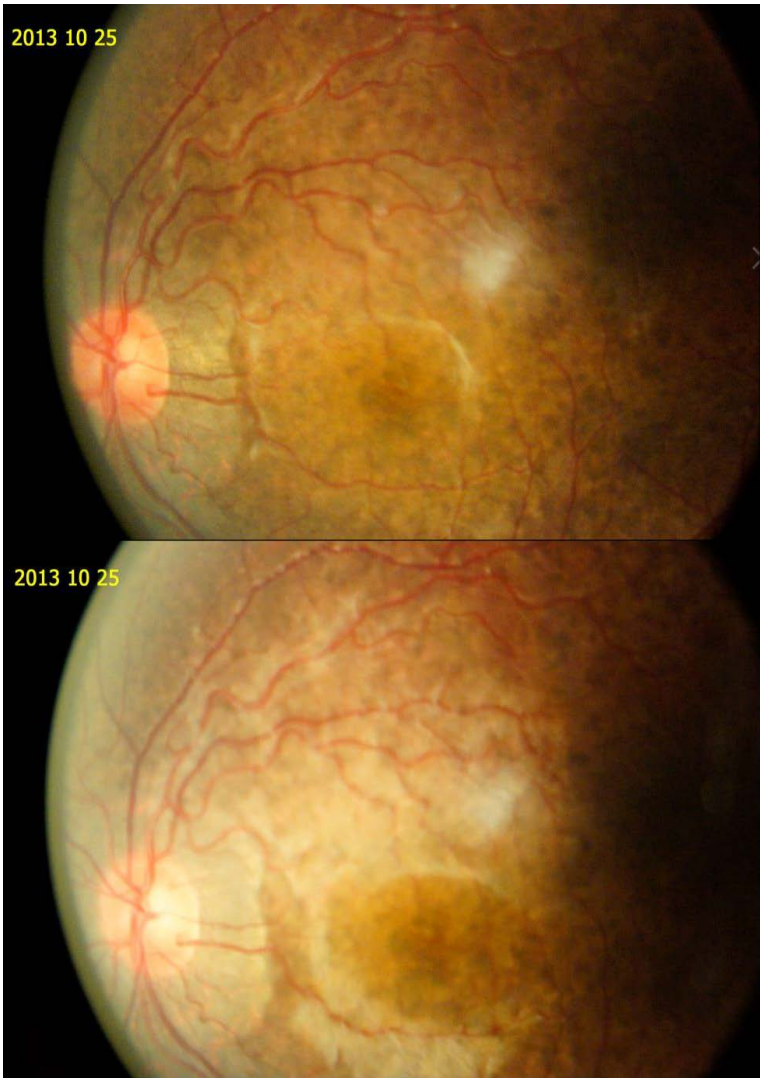


Figure 15. Appearance of the patient´s fundus illuminated with polychromatic (white) light of left eye, the photographs were taken during the first examination of the day October 26, 2013. Note the pigmentary changes, andthe metallic luster of the retina. This patient, around the optic nerve had a large area of surrounding tissue degeneration of the optic nerve.

After nine months of treatment, improvement in ocular motility is still increasing (**Figures 24-27**).

The patient reported improvement in his general condition also, not only in ocular motility problems (**Figure 28**); the family indicated that they no longer had to turn his head to look both sideways.

The patient's therapeutic response to pharmacological enhancement of the dissociation of the water molecule is very encouraging. Our results have been replicated by other researchers and clinicians.

6. Discussion

The observed improvement was expected by us. We have been working in this research for over 24 years, and we have seen the importance in the human body of water dissociation through melanin. This chemical energy, as happens with chemical energy chlorophyll-derivate in plants, is vital to our health.

We believe that mitochondrial alterations are difficult to assess adequately due to both high variability in location and number and secondly the involvement of unsuspected basic cell bioenergetics processes such as the supply of chemical energy through dissociation of the molecule water.

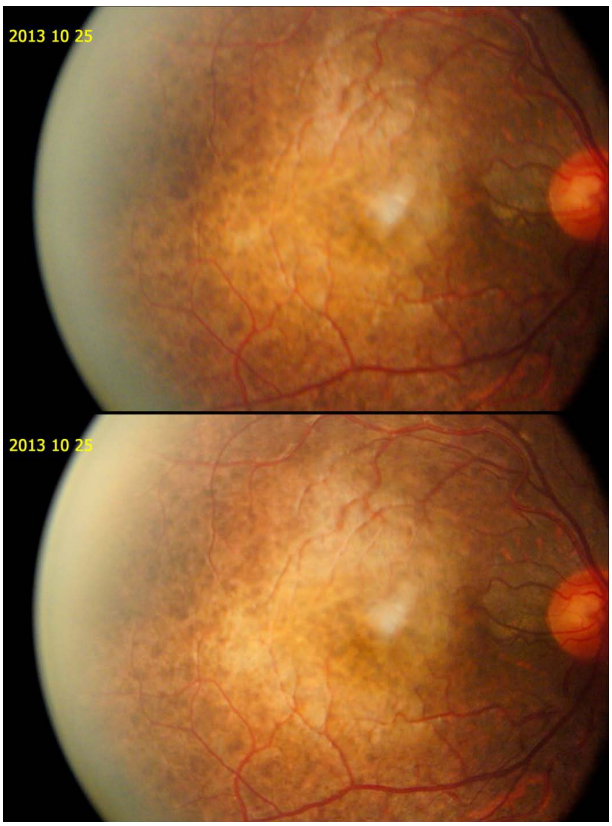


Figure 16. Pictures on the right eye obtained during the first examination, pre-treatment. Lighting is with polychromatic light (white). Also you can see the extensive pigmentary changes, including covering the macular area, the retina in that area has a metallic luster. Dystrophic changes of tissues around the optic nerve are also apparent.

Figure 17. Three months of treatment, primary position of conjugate gaze. The facial expression of the patient and family is different, and the eyelids are held.

The intrinsic property of melanin to dissociate and re-form the water molecule breaks paradigms established for centuries, opposition to this and even anger of researchers in this regard is expected of course, as it has been the case in other transcendental findings, recall Galileo, Magellan, Copernicus and others.

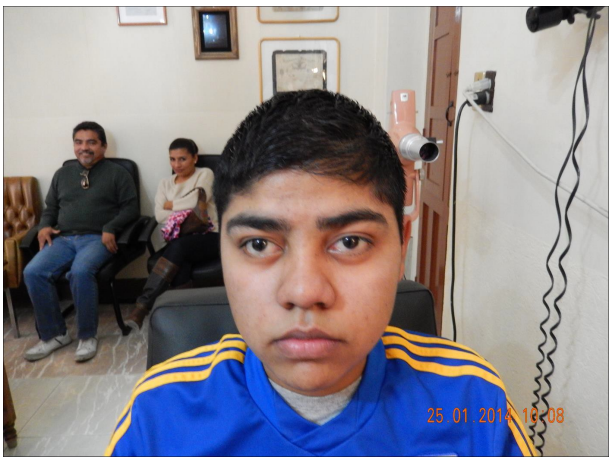


Figure 18. Three months of treatment, supraversion or conjugate upward gaze. Eye movements in upward conjugate gaze are more apparent.

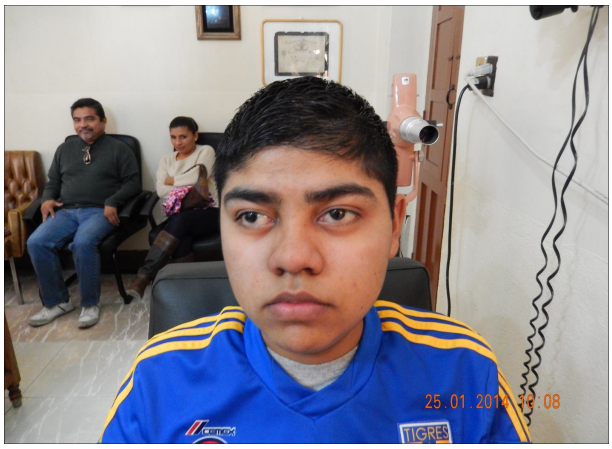


Figure 19. Three months of treatment, dextroversion or conjugated right look. The excursion of the right eyeball is more extensive than pretreatment.

Figure 20. Three months of treatment, levoversion or conjugated left gaze. Looking to the left, ipsilateral eye excursion is better than before treatment.

Figure 21. Three months of treatment, infraversion or conjugated down look. Looking down, there seems to be something more eye movement than before treatment. At least eyelid excursion ismore remarkable.

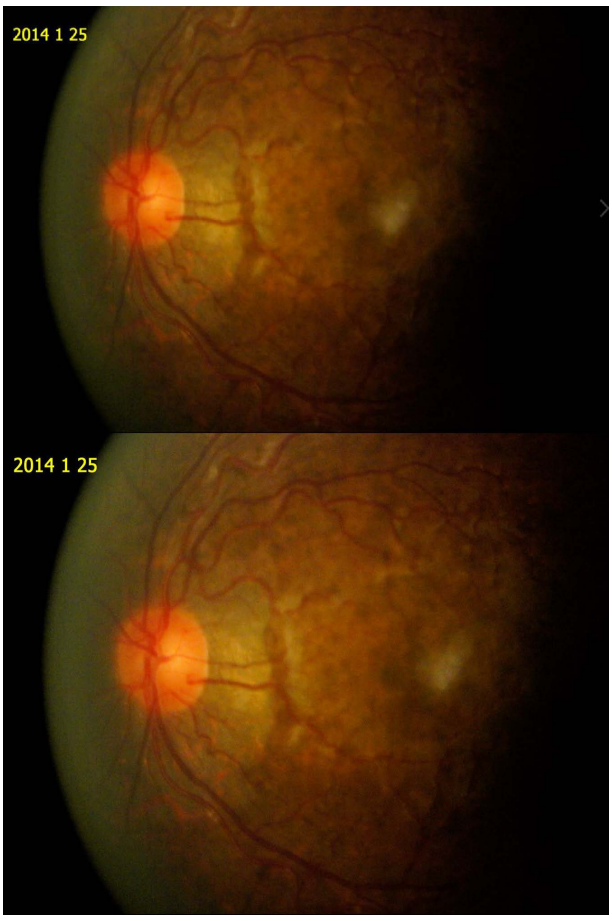


Figure 22. Photographs of the retina and optic nerve of the left side, taken during the second examination. The luster of the retina is decreased, the accumulations of pigment decreased, and the coloring of the disc is different, becoming more orange.

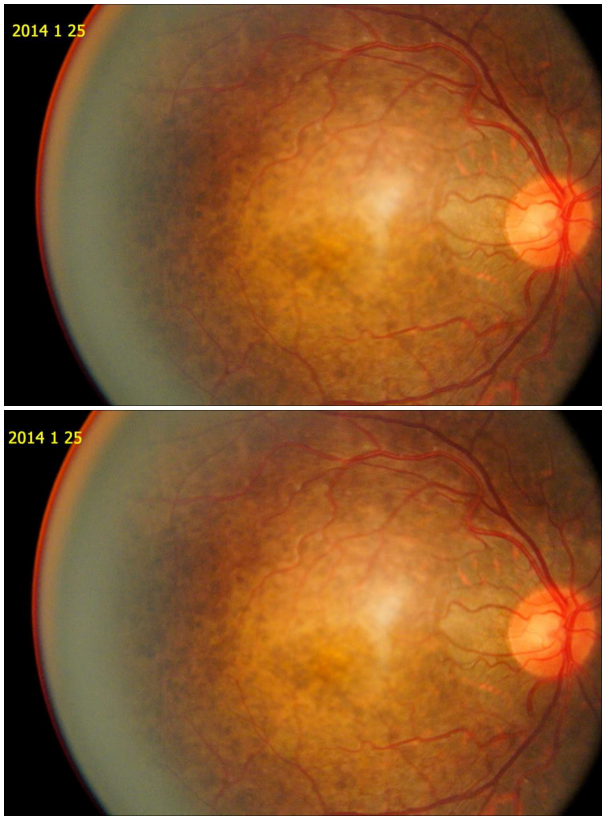


Figure 23. Images of the retina of the right side captured during the second examination, on January 25, 2014. The optic nerve has a normal color (orange), the pigment accumulations have decreased, and the metallic sheen of the retina disappeared.

Figure 24. in the primary position of gaze, there is a marked improvement in eyelid position. This Photography was taken on July 5, 2014. The patient began treatment on October 26, 2013.

It was unthinkable so far to have such an important biological relationship between light, melanin, and water; but this relationship indeed exists, cited in the order of abundance in the universe.

The remarkable beneficial effects of enhancing human photosynthesis in different diseases have been reported in other publications [14]. Initially we thought that the body's ability to transform light energy into chemical

Figure 25. In dextroversion, changes in the displacement of the eyeballs is noticeable better.

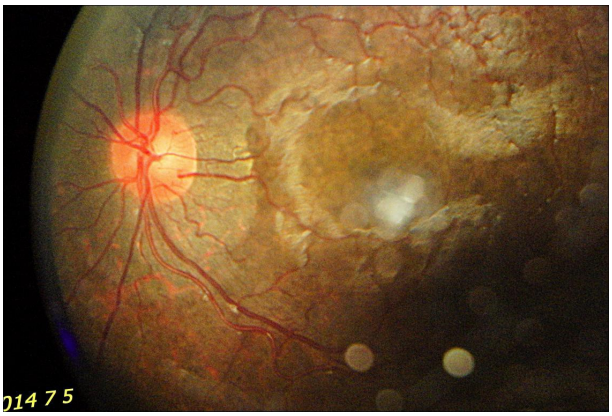


Figure 26. On July 8, 2014, photograph of fundus shows pigment clumping modifications, being now smaller and tending more towards homogeneity. The macular is closer to a normal appearance, also are the retinal and choroidal vessels.

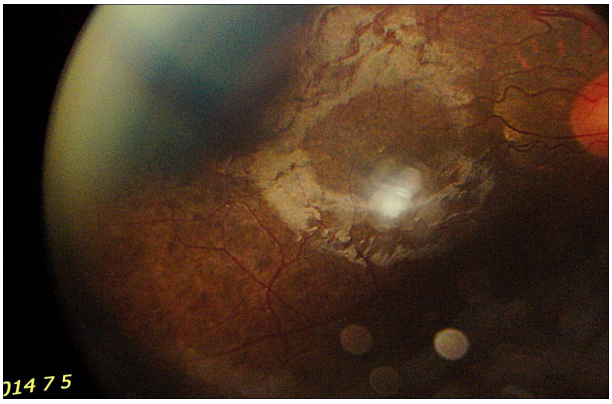


Figure 27. This picture, taken in July 8, 2014, 9 months after beginning treatment, shows a foveal reflex almost normal according to the patient's age, the pigment accumulations have changed their morphology, tending to uniformity, and the optic disc, in this case the right side has a coloration that can be considered normal.

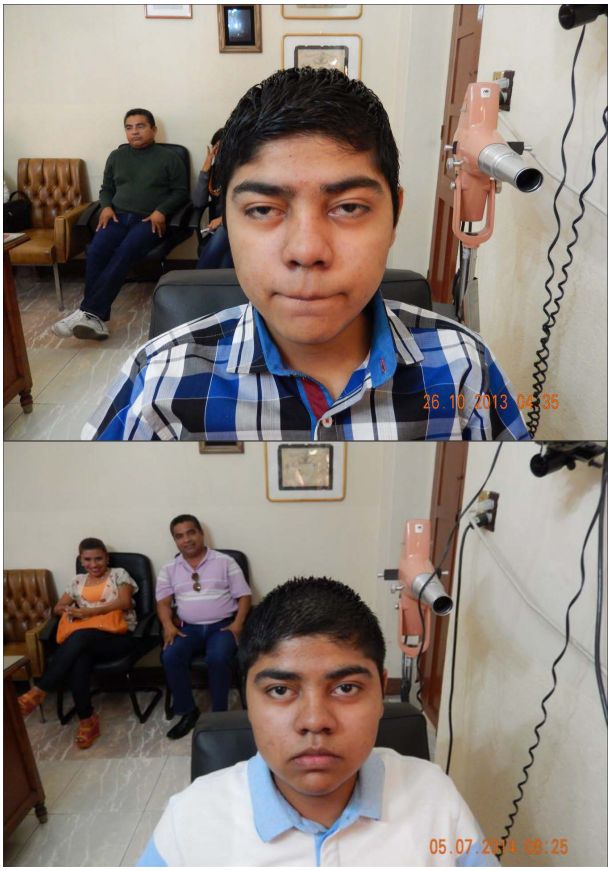


Figure 28. The primary conjugate gaze position is perfect as the eyelid position. This improvement has also an impact in the patient's family as can be noticed in the background. The recovery took place without sophisticated and expensive processes.

energy only happened in the retina, but as we went deeper into the subject, we realized that each and every cell of the body works on the same principle: We are shaped by billions of units (cells) energetically independent.

From our point of view the main cause of KSS is not mitochondrial dysfunction, but the impaired levels of chemical energy available inside the cell, derived from the lack transformation of light energy into chemical energy through the dissociation of the water molecule. This decrease of chemical energy can happen for several reasons: cold weather (like in plants), exposure to toxic agents in the environment such as heavy metals, herbicides, pesticides, contaminated water, sadness, depression, industrialized food; common medicaments; cold weather; etc.

Normally the ability to transform energy through the dissociation of the water molecule begins to decrease at age 26, and is reduced about 10% each decade [15], and after fifties goes into free fall; with which we begin to lose muscle mass, bone mass, lose shape, etc., which together with environmental factors mentioned above, favor the occurrence of many diseases.

One of the most common causes of impaired body's ability to dissociate water molecule is contamination of water sources by chemical compounds from natural or industrial source. In this case, a notable first finding is a significant decrease in water's viscosity and the other properties. Also some compounds present in this water that once enter the body, remain forever inside our organism due to the lack of a metabolic pathway to expel them, being the classic example the perfluorooctane molecule with the empirical formula $C_8HF_{17}O_3S$.

Four billion years of evolution have made our body perfect in practical terms. With the appropriate supply of energy given in natural way or, in this case; by the treatment, our patient's organism knew exactly what have to do to manifest health.

We think that the levels of intracellular chemical energy are essential to the proper functioning of the body for several reasons, including the fact that any chemical reaction that occurs within the cells requires activation energy, *i.e.* free chemical energy available; on the other hand any intracellular chemical reaction depends on the availability of energy.

Glucose is according to our research, the source of carbon chains that our body uses for the synthesis of vital biomolecules. Ninety-nine percent of biomolecules present in our body have carbon chains or at least carbon atoms to a greater or lesser extent that are combined to other elements as hydrogen, oxygen, nitrogen, etc. These resources are mainly to produce biomass for the continual work of the body and replenishment of wasted molecules. If sugars where the main source of energy, diabetic patient would has a very good health, good shape, at least in tissues that have GLUT 1 transporters and does not requires insulin for glucose uptake, e.g. beta cells of pancreas, red blood cells, intestinal mucosa, Central Nervous System, and kidney tubules.

Energy is defined as a force that causes a change and cannot be seen or experimented with our senses in nature. Our body obtains energy from light through the dissociation of water, like plants, but instead of using chlorophyll we use melanin for this purpose.

In our experience, the energy emanating from melanin appears to be critical, and is also present in any known chemical reaction within the cell.

The energy of a cell is constant, endless requirement and has only a narrow range of variation. Melanin is able to maintain a good output of chemical energy through water dissociation that happens day and night, unlike chlorophyll, making our energy supply more effective than that existing in plants leaves.

By raising the levels of this unsuspected photosynthetic process in the human body, *i.e.* by pharmacological means, the body responds as a whole, and begins to function as correctly he has done millions of times, millions of years [16].

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