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Oxygen for Fetus does not come from the atmosphere, but from Amniotic fluid

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1. Abstract

To date, the physiology of the fetus in development is interpreted arising as is the oxygen present in the fetus and in the amniotic fluid coming from the atmosphere. However, since oxygen in the atmosphere was characterized in the mid-18th century, it was also found to be relatively scarce. Later, in the middle and end of the 19th century, when the study of the biochemistry of the human body was deepened, it was found that the levels of oxygen inside the cells of the human body were almost five times higher than the levels of oxygen in the atmosphere.

What originated a heated controversy about the origin of oxygen inside the human body, and that to date said controversy is close to turning 200 years old. The controversy is since the physicochemical properties of both oxygen and the cells that make up the alveolar wall of the lung mean that these elements tend to reject each other. Therefore, the prevailing Kroch model, which is supposed to explain the diffusion of atmospheric oxygen through the lung to reach the bloodstream, is wrong, which was to be expected, since it is a very convoluted mathematical model that does not even allow its experimental contrasting.

Circumstantially, we found the answer to this controversy during an observational, descriptive study about the morphological characteristics of the optic nerve and its possible correlation with the three main causes of blindness in the world: macular degeneration, diabetic retinopathy, and glaucoma. The study lasted 12 years (1990-2002) and included fundus photographs of nearly 6,000 patients. And the conclusion was surprising: The human body has molecules capable of transforming sunlight into chemical energy through the dissociation of the water molecule, like plants.

Here is the origin of oxygen inside the cells of the human body. We can conclude that our body does not take oxygen from the air that surrounds it, but from the water that each and every one of the cells that make up us contain, such as plants.

2. Keywords:
Oxygen, hydrogen, water, energy, respiration.

3. Introduction

Oxygen is the element of highest electronegativity after fluorine, and even molecular oxygen is still a highly reactive and therefore, toxic molecule [1]. Currently, tissue oxygen tension is defined as a measure of the oxygen partial pressure in the interstitial (extravascular) space reflecting the balance between oxygen supply and demand [2], but we must not forget that oxygen is insoluble in water, so this interpretation is biased.

Oxygen tension in cellular microenvironment can strongly influence cellular processes [3], which leaves no room for doubt, but the microenvironment refers to the interior of the cell, and this is very difficult to measure, which is why current theories are based on measuring oxygen in the atmosphere and in body fluids, but not inside the cell, all of which is riddled with errors, starting with the fact that the oxygen present inside the body comes from the dissociation of the water molecule, like plants, and the molecule that allows this reaction is found mainly in the perinuclear space [4].

During evolution, organisms developed numerous strategies to cope with the potentially toxic effects of oxygen, such as antioxidant systems and enzymes. Exposure to oxygen in tissues is therefore highly regulated (supposedly) by the level of vascularization [5]. However, if the oxygen in the air around us cannot pass through the lung tissue and reach the bloodstream, then the oxygen present in the blood does not come from the atmosphere, but from the dissociation of water, and in the blood, hemoglobin can do it perfectly, given its 99% similarity to the chlorophyll molecule.

Mammalian tissues, allegedly; have highly specific oxygen tensions which can range from 16% oxygen in alveolar air [6] down to almost anoxic calculated (this is: hypothetical) oxygen tension in the bone marrow hematopoietic compartment. However, Oxygen cannot pass through alveolar tissues and reach the blood stream [7], and on the other hand, the theories that defend the supposed passage of oxygen from the atmosphere to the interior of the organism by means of the simple diffusion mechanism, after almost 200 years have not been able to be corroborated, nor even contrasted.

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Adult stem cells, such as mesenchymal stem cells, neural stem cells, and hematopoietic stem cells, maintain their stem cell state in niches of hypothetical very low oxygen tensions [8]. Changes in the oxygen microenvironment particularly affect mitochondria, also designated as the "main sink of oxygen" [9]. Our research has allowed us to understand that mitochondria are not the cell's energy source but are in charge of complementing the accurate regulation of temperature at which countless biologically important reactions take place [10]. One proof is that in light-skinned people, who live in cold places with little light, the number of mitochondria is up to 83% higher than in dark-skinned people, who live on the equator.

Oxygen, with its high standard redox potential, supposedly is the final electron acceptor in the mitochondrial electron transport chain for the generation of adenosine triphosphate (ATP) via oxidative phosphorylation, an entirely theoretical pathway [11]. It´s so, that electron paramagnetic resonance (EPR) measurement showed a trend to lower levels of intracellular ROS in human amniotic mesenchymal stromal cells (hAMSCs) incubated at higher oxygen tension (20%), against even with the expectations of the researchers [12].

Different cells of the body are exposed to significant different oxygen tensions. Adult stem cells, such as mesenchymal stem cells, neural stem cells, and hematopoietic stem cells, seems to maintain their stem cell state in niches of theoretically very low oxygen tensions [13], which is paradoxical at light of experimental results. Common cell culture laboratories are usually set up for cultivation at 20% oxygen, which is the partial pressure of oxygen in the atmosphere (19-21 %), but the oxygen inside the cultivated cells does not come from there, but rather from the dissociation of water that takes place inside the cells, as in plants.

Cells acquire energy through ATP generation via glycolysis, and the metabolic switch from glycolysis to oxidative phosphorylation changes stem cell fate and cell function [14]. Even though this concept is widely disseminated and enjoys general acceptance, it is a misconception, since it is 98% theoretical (Stobbe Miranda, 2012).

Interesting results are reported, which were to be expected since oxygen comes from inside the cells, and not from outside. For instance, the LEAK state [15], reflecting proton permeability of the inner mitochondrial membrane without producing ATP, increased after 4-day incubation, independent of the oxygen tension and the amniotic region, very consistent results with the fact that atmospheric oxygen does not have the importance that has been given to date.

4. Human Amniotic Membrane

It is not entirely known, how the avascular amniotic membrane is provided with nutrients and oxygen, as in the cornea. If oxygen is transferred by diffusion, then, in utero, more oxygen might diffuse to placental amnion compared to reflected amnion (figure 1).

The epithelium of the reflected amnion consists of a single layer of cuboidal cells with central nuclei (like corneal endothelium) whereas epithelial cells of the placental amnion are cylindrical with decentralized apical nuclei [16], meanwhile the umbilical amnion consists of three to four layers of epithelial cells, like corneal epithelium [17].

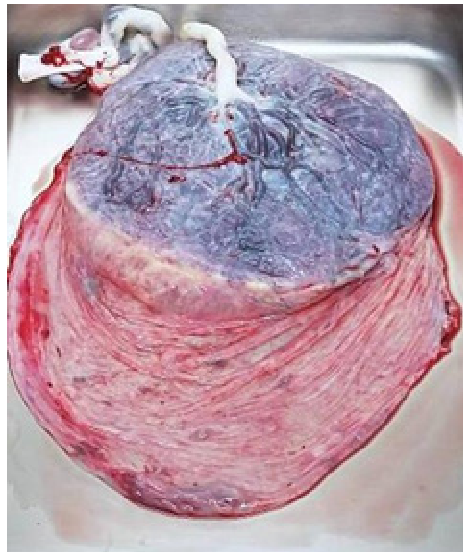

Figure 1: The dark color of placental amnion could be given, among other factors, by a high melanin concentration and other photopigments capable of dissociate the water molecule as hemoglobin, bilirubin, Cytochrome P 450, etc. that explains the high oxygen content of amniotic fluid and are the source of oxygen for the avascular amniotic membrane.

Perinuclear halos (melanin granules?) can be seen in umbilical amnion cells of the lower layers whereas cells of the upper layers show pyknotic nuclei or are non-nuclear [18]. It is not easy to identify melanin granules at microscope. By the way, the epithelial cells of the cornea (figure 2) do not take oxygen from the air that surrounds them but obtain it by dissociating the existing water inside each one of them.

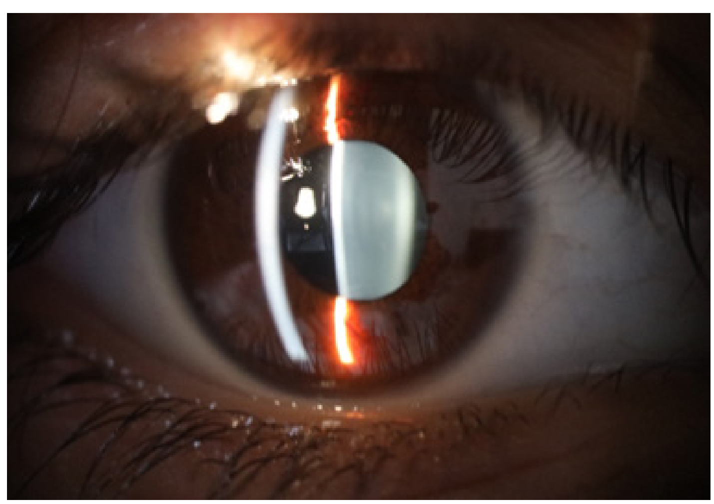

Figure 2: Macrophotograph of OD. In the foreground we have the transparent cornea, only visible by the beam of light that it reflects (parallelepiped), and in the background the anterior chamber, the iris;

in the background we have the lens, with the highest concentration of proteins in the body, and completely transparent and also avascular under normal conditions.

In the case of the cornea, the lens, and even the vitreous body, are avascular structures with high levels of oxygen, but according to the prevailing dogma that oxygen comes from the atmosphere, avascular tissues should be in constant, chronic hypoxia, and it is not like that. In the case of the avascular structures of the human eye, the solution seems simple: the abundant amount of oxygen comes from the dissociation of the water molecule, which takes place inside the melanin molecule. The human eye contains 40% more melanin than the skin.

In relation to the nutrition of avascular human tissues, we have that glucose, the universal precursor of any organic molecule in plants and animals, is also the most hydro-soluble of carbohydrates; so, it can be transported in the amniotic fluid without problems. The oxygen and the energy necessary for the cells to transform glucose into one of its many organic derivatives, is obtained while the oxygen is released from the water; because when dissociating said molecule, oxygen and hydrogen are obtained at the same time. Let's remember that hydrogen is the energy carrier par excellence in the entire universe, so our body cannot be different. So, the energy that is released during the breaking of the water molecule is captured and transported by the hydrogen.

Therefore, the similarities between the different avascular tissues of the human organism allow us to infer that they obtain oxygen and hydrogen, with its precious energy charge, at the same time and in the same way that plants do, this is: dissociating the water molecule.

5. Amniotic Fluid

Amniotic fluid surrounds the embryo and fetus during development and has a myriad of functions. it serves as a reservoir of fluid and nutrients for the fetus containing: proteins, electrolytes, immunoglobulins, and vitamins from the mother or perhaps some molecules are synthesized in situ (in the amnios fluid itself). It provides the necessary fluid, space, and growth factors to allow normal development and growth of fetal organs such as the musculoskeletal system, gastrointestinal system, and pulmonary system [19].

During the embryonic period, amniotic fluid derives from both fetal and maternal factors such as water from maternal serum (?), coelomic fluid, and fluid from the amniotic cavity; however, during late gestation, amniotic fluid is largely produced by fetal urine and lung secretions [20]. The coelomic fluid is essentially an extension of the placenta, providing the embryo with nutrients until the amniotic cavity becomes large enough to take over later in development [21]. Once the coelomic fluid begins to disappear, the amniotic cavity takes over. In the early stages of gestation, the water in amniotic fluid is derived mostly from maternal serum; however, at 10 weeks, the fetus begins to produce urine which is secreted into the amniotic sac. During late gestation (the second and third trimesters), as the amniotic fluid expands, fetal urine becomes the largest source of the amniotic fluid [22]. It is probably that during early stages of gestation and along the pregnancy, the embryo cells provide water and nutrients, because the hypothetical maternal serum source of water cannot be fully explained.

Lung secretions, gastrointestinal secretions, and excretions from the umbilical cord and placental surface contribute to the composition of amniotic fluid as well; however, lung secretions alone make up as much as one-third of amniotic fluid [23]. Atmospheric oxygen cannot pass through the alveolar walls of the lung and reach the bloodstream, and in the same way, the oxygen that is generated inside the cells through the dissociation of the water molecule, as in plants, cannot pass through an aqueous medium, since it repels it, reach the bloodstream, reach the lungs, and be expelled through respiratory movements.

The subtle but efficient barriers to the entry of atmospheric oxygen are the same for the exit of intracellularly generated O_2. Therefore, Nature attaches a carbon atom, which probably comes from the metabolism of food to each molecular oxygen forming a CO_2 molecule, which is 25 times more water soluble than molecular oxygen. This allows CO_2 to cross the cellular and interstitial aqueous media and is then able to enter the bloodstream which transports it to the lungs, where it is expelled into the atmosphere.

Despite the greater solubility of CO_2 compared to oxygen and other gases, the speed of the reaction is not enough to expel all the CO_2 that is continuously formed inside our body. So, nature developed a molecule that is widely used in the animal and plant kingdoms to adjust the speed of the reaction to the needs of organisms.

Carbonic anhydrase (CA, carbonate dehydratase) is an enzyme that belongs to a family of metalloenzymes (enzymes that contain one or more metal atoms as a functional component of the enzyme) and that catalyze the rapid conversion of carbon dioxide carbon and water to bicarbonate and protons, a reaction that occurs more slowly in the absence of the catalyst. Carbonic anhydrase significantly increases the reaction rate, where typical catalytic rates for different forms of this enzyme have values that alternate between 104 and 106 reactions per second [24]. The activity of the carbonic anhydrase enzyme is not free, it requires energy to be carried out, like any other enzyme. And an enzyme with the highest known pKa also means a huge expenditure of energy, which does not come from glucose, but from the dissociation of water, since the energy that is released when breaking the water molecule is trapped by molecular hydrogen. which besides oxygen, also is released from the same reaction. Let's keep in mind that hydrogen is the energy carrier par excellence in the entire universe, therefore our body cannot be different. The active site of most carbonic anhydrases contains a zinc (Zn) ion.

Given that the high levels of oxygen that we have inside the organism come from the dissociation of the water molecule that is carried out intracellularly, especially in the perinuclear space where the melanin

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granules are located, it is not surprising the presence of carbonic anhydrase even inside cells, even in mitochondria; where it is constantly solubilizing the CO_2 that is continuously formed and diffuses into the cytoplasm, then into the interstitial fluid, from there it passes into the blood and finally reaches the lung tissues where the same carbonic anhydrase converts it back into gas to be able to be expelled into the air contained in the alveolus, where it goes from a concentration of 0.004% in inspiration to 4.0% in expiration.

Therefore, gas exchange in the lungs only takes place in relation to CO_2 and not to oxygen. And this is so from gestation. This explains why the respiratory movements of the fetus and the embryo are like those of fish (2 to 4 per minute), since the water in the amniotic fluid is several times more efficient than air to transport CO_2. So, in a lung filled with water, the respiratory rate is very low because water can dissolve a large amount of CO_2 in the form of bicarbonate, compared to atmospheric air, which can only transport very limited amounts of CO_2.

More than 15 isoenzymes of CAs are found in cellular secretions, cytosol, mitochondria or bound to the cellular membrane. CAs have broad biological functions, including the regulation of pH, removal of metabolic waste, transportation of ions across cell membrane, gluconeogenesis, lipogenesis, urea genesis and calcification [25]; therefore, in the fetus the expulsion of CO_2 into the amniotic fluid is directly from the cells, and gradually happens through the intestine, the non-keratinized skin, and partially through the lung. But as the systems develop and integrate, the tendency is to eliminate CO_2 through the lungs is favored and less and less through the intestines and other tissues. The elimination of CO2 by the skin, once it is keratinized, is no longer significant.

As it expected, the distribution of the enzyme in the human fetal lung differed clearly from that in the adult human lung, where little or no enzyme has been found in the airway epithelium [26]. The CA enzyme can be detected at 11 weeks' gestation. The CAIII level rises gradually up to 25 weeks, and there is then a more dramatic increase to reach approximately half adult level at birth [27]. Red blood cells also express carbonic anhydrase [28] (Figure 3).

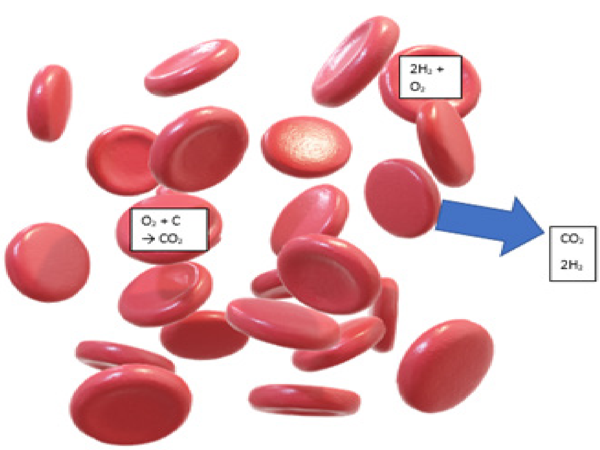

Figure 3: Hemoglobin irreversibly dissociates the water molecule, which was to be expected given its close resemblance to chlorophyll. But the oxygen that is generated does not diffuse into the water, so a carbon atom (coming from nutrients metabolism) is added to form CO_2, which can be carried outside the erythrocyte.

Molecular hydrogen that is generated inside hemoglobin easily diffuses out of the red cell. As it passes through the cytoplasm, molecular hydrogen is captured by the different chemical reactions that constantly take place inside the erythrocyte and that require the energy transported by hydrogen, and the H_2 molecules that reach the blood plasma drive plasmatic processes that also require energy, since it is known that the numerous organic molecules that are transported by the plasma are transformed during their journey and permanence in the blood plasma.

And like any chemical reaction requires energy, the mystery of plasmatic metabolism seems to be becoming clearer.

Homeostasis of body fluids is important in the growing fetus. In addition to the constant circulation of amniotic fluid through inhalation and exhalation, there must be a highly precise balance between fluid formation and elimination. Respiration, swallowing, and urination are the main routes of exchange between the fetus and amniotic fluid to maintain the fluid balance. The two largest contributors to elimination are fetal swallowing and the intramembranous pathway. Though there are many mechanisms for eliminating amniotic fluid, the greatest contributor to amniotic fluid elimination is through fetal swallowing, seen as early as 11 weeks [29]. The recycling of the amniotic fluid that the embryo swallows is carried out when it is reabsorbed in the intestine and taken inside the cells, where the water is dissociated again, thus starting a new cycle.

Eukaryotic cells possess the molecular machinery to dissociate and re-form the water molecule. The part of the reaction that requires the most energy is the dissociation, this is: from liquid water to gas ($2H_2$ and O_2) since it is highly endergonic. The water reforming process is relatively cheap because it requires little energy, that is, it is an exergonic process. Therefore we can infer that it happens easily and apparently dominates, for which the presence of liquid water in the uterus, during pregnancy, is guaranteed and regulated.

To finish this work, I would like to refer to the fact that the lines of force that are generated during the dissociation of water can be detected by means of nuclear magnetic resonance, overall in the Central Nervous System (CNS).

Next, we will give an example (figure 4 to 7).

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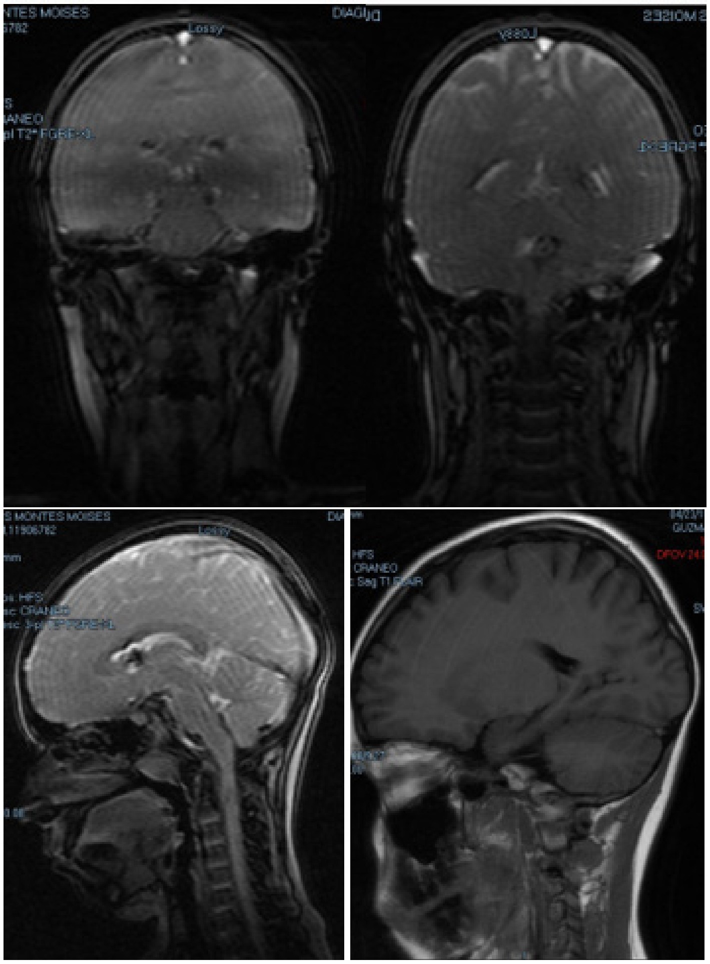

Figure 4: The oxygen source of the central nervous system is not the atmosphere, but the substantia nigra and the locus coeruleus, so the lines of force that are observed in some MRI studies of the brain are visible in some patients, and appear to come from these. cranial structures.

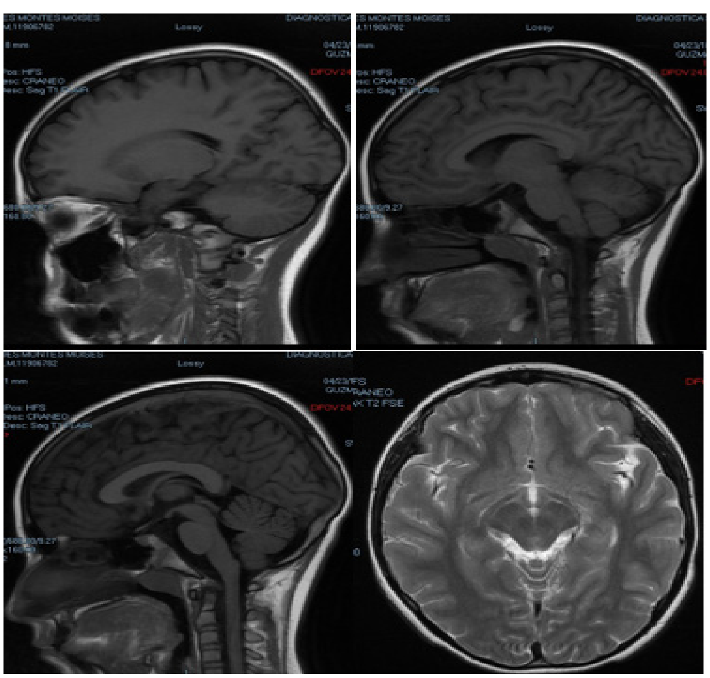

Figure 5: There are MRI images that do not show said fields or lines of force, probably because they do not capture the diffusion of molecular hydrogen that spreads from the area of greatest concentration (Substantia nigra and locus coeruleus) to the areas of lower concentration, that is, towards the cerebral cortex, especially frontal.

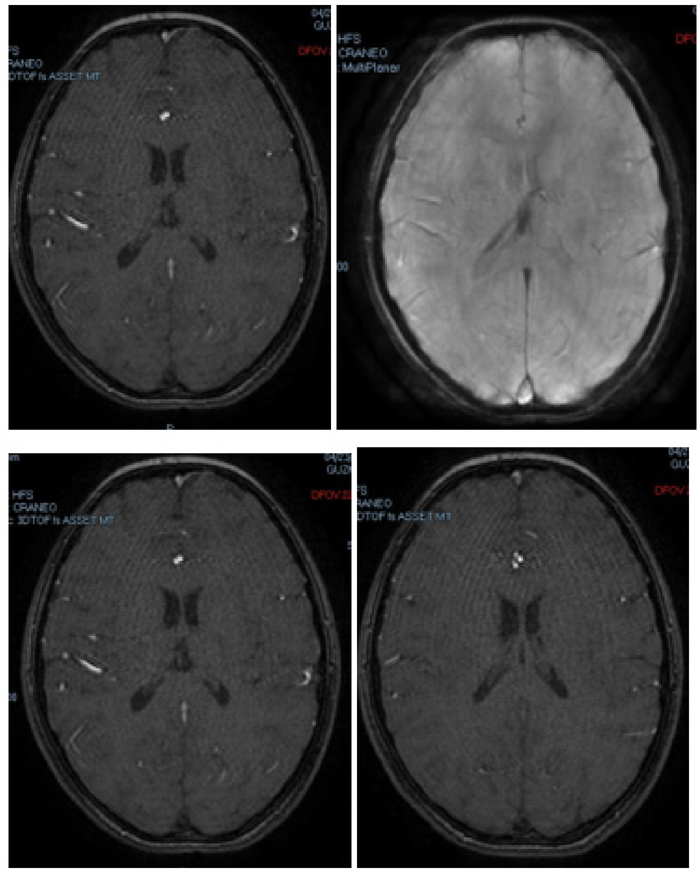

Figure 6: Images of these MRI slices clearly show the lines of force that appear to originate from the midbrain and move toward the periphery of the CNS.

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Figure 7: The application of contrast media does not reinforce these lines of force, and on the contrary they seem to vanish. All images are of the same patient.

6. Conclusion

Our discovery of the unsuspected capacity of the human body to take or extract oxygen from the water that the cells contain inside, through various molecules, in a similar way to plants, opens a new field of study, reflection, investigation and analysis in the field of gynecology and obstetrics.

This work intends to be the initial seed of a new era in the study of the phenomena that occur during the formation of the fetus or embryo, as well as the possibility of developing new treatments in this regard.

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