International Journal of Materials Chemistry and Physics
Vol. 2, No. 2, 2016, pp. 84-87
http://www.aiscience.org/journal/ijmcp

Demonstration of Biomagnetic Responses of Paired Human Hair Follicles Using Nano-sized Iron Particles Solutions: Inhibition of Diamagnetic Crystallization

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Abstract

Introduction: In previous studies a solution of nano-sized iron particles mixed with Prussian Blue Stain (PBSFe2000) in the presence of a human hair, was used to demonstrate the inherent electromagnetic forces emanating from the hair follicles. Further studies also showed that the magnetic activity of both inanimate (magnet fragment) and the human hair follicle triggered either ferro or ferric cyanide crystalllization in a single open slide preparation (SSP). Methods: Single or pairs of freshly plucked human hairs from the forearm of the authors were placed on a clean glass slide. The paired hairs were arranged with the follicles facing each other. The SSP is an open air technique where one drop of either PBSFe2 (diamagnetic) or PBSFe3 (paramagnetic) was placed to cover the single or paired hair follicles. The solution was then allowed to evaporate and images recorded. Results: When hair follicles were placed in close proximity and covered with the diamagnetic solution there was an absence of crystals formation surrounding each follicle. Conversely when hair follicles were placed in close proximity and covered with the paramagnetic solution, both hairs showed a normal crystallization pattern seen in each follicle. Conclusion: When two hair follicles were placed opposite one another but in close proximity the diamagnetic PBSFe2 solution showed inhibition of crystallization in the proximity of the follicles similar to that seen when the same solution was applied to the single pattern as seen in a single individual hair SSPs. No changes in crystallization patterns were observed between single and paired follicles with the paramagnetic PBSFe3.

Keywords

Biomagnetism, Hair Follicles, Crystallization, Nano-sized Iron Particles, Diamagnetism, Paramagnetism, Opposing Bioelectromagnetism, Atracting Bioelectromagnetism

Received: January 26, 2016 / Accepted: February 7, 2016 / Published online: February 24, 2016

1. Introduction

Evaporation of crystal containing solution consists of two stages:

Nucleation and secondary crystallization. In previous experiments we have shown that when a drop of the PBSFe2000 solution (dissolved ferrocyanide crystals + iron nanoparticles) is placed on a clean glass slide (undisturbed and allowed to evaporate), there is a homogeneous microscopic distribution of ferrocyanide crystals across the slide [1] When a similar drop is exposed to external magnetic forces from a living tissue, i.e., hair follicle or inanimate magnet, there is layered crystal formations which are repelled from the vicinity of the hair follicle and the magnet. We have previously reported electromagnetic energy emanating from animal hairs and plants [2, 3 & 4]. The development of the single slide preparation technique (SSP) has allowed us to

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visualize nano-sized iron particles crystals architecture ensuing from evaporation. In the present study, we are presenting evidence showing that paired follicles facing each other, in close proximity, and placed in a SSP diamagnetic solution environment, show inhibitory action on crystallization compared to the response to a single follicle in the same environment. Conversely when follicle pairs are placed in a paramagnetic environment the follicles retain their intrinsic effect on crystallization as each follicle attracts the paramagnetic crystals.

2. Materials and Methods

Preparation of the Prussian Blue and Iron particles solution:

A fine iron particle solution was prepared by mixing several grams of powdered iron filings (Edmond Scientific, Co., Tonawanda, NY) in 200 cc of deionized water (resistivity, 18.2 MΩ.cm). After standing for several hours the supernatant was carefully decanted for sizing of the iron nano-sized iron particles. The particle size and distribution of the nanoparticles from the supernatant was determined using dynamic light scattering (DLS). The zeta potential, a measure of particle electrical stability was determined using phase analysis light scattering by a Zeta potential analyzer (ZetaPALS, Brookhaven Instruments, Holtsville, NY). For sizing, 1.5 ml of the solution in de-ionized water was scanned at 25°C and the values obtained in nanometers (nm).

- PBS Fe2 2K solution:

Using deionized water as the solvent, we mixed 2 (two) parts of the iron particles in solution (mean particle diameter 2000 nm), with 1 (one) part of potassium ferrocyanide ($K_4Fe_2CN_6$) and 1 (one) part of 2.5% hydrochloric acid (HCl). Initially, the fresh solution is a pale yellow color that slowly (within 24 hours) begins to turn blue. Since it contains 2 parts of iron nanoparticles (4K) this solution was dubbed PBS Fe2 2K.

- PBS Fe3 2K solution

Using deionized water as the solvent, we mixed 2 (two) parts of the iron particles in solution (mean particle diameter 2000 nm), with 1 (one) part of potassium ferricyanide ($K_4Fe_3CN_6$) and 1 (one) part of 2.5% hydrochloric acid (HCl). Since it contains 2 parts of iron nanoparticles this solution was dubbed PBS Fe3 4K.

The Single Slide Preparation (SSP):

Freshly plucked human hair pairs from the forearm were placed on a single clean slide (size 25 x 75 x1mm), The single slide preparation (SSP) is an open air technique where one or two drops of either PBS Fe2 2Kor PBS Fe3 2K were placed in such way to cover the hair follicle. The solution was then allowed to evaporate. Control SSPs (n=4) were obtained without electromagnetic forces (EMFs) present (Fig 1).

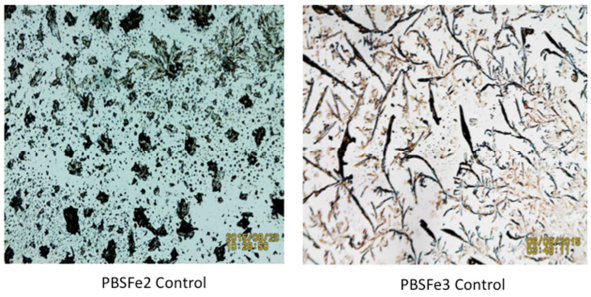

Figure 1. Control evaporation experiments of diamagnetic PBS Fe2 2K and paramagnetic PBS Fe3 2K solutions. Both show randomly distributed small crystals incorporating aggregated iron particles (black areas).

- Diamagnetic SSPs and human hair:

Individual human hairs were mounted in SSP (n=5), one drop of PBS Fe2 2K (diamagnetic solution) was placed covering the follicle and allowed to evaporate (Fig 2 panel "A"). Individual hairs (n=5) were also mounted in SSPs and a drop of PBS Fe3 2K was also allowed to evaporate (Fig 2 panel "B"). In both instances the individual hairs attracted iron laden crystals around the follicles. Inhibition of crystal formation from the follicle in the diamagnetic SSP and attraction of crystals in the paramagnetic SSP.

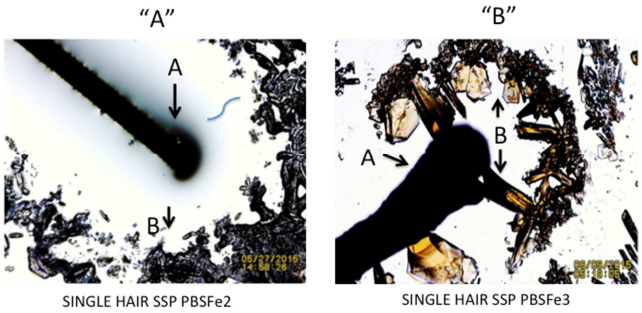

Figure 2. Panels showing individual human hair SSP crystallization patterns: "A" = PBS Fe2 2K and "B" = PBS Fe3 2K (Paramagnetic). In both panels A= Hair follicle B= Crystals. Please notice the difference as follows: In the diamagnetic SSP panel "A" there is crystal accretion and repulsion circumventing the hair (curved line) by the EMF from hair follicle. In contrast, in the paramagnetic panel "B" the EMF from the follicle is seen attracting the crystals.

Human Hairs Fronting:

Human hairs facing each other at a linear distance of approximately four times the diameter of the distal part of the follicle (n=10) were sequentially placed in a SSP. One or two drops of the PBS Fe2 2K were aimed at covering the hair follicle, then allowed to evaporate (Fig 3).

- Paramagnetic SSPs and human hair:

Using the same technique, human hairs (n=10) were also fronted and placed in SSPs with one or two drops of the PBS Fe3 2K covering the hair follicle, then allowed to evaporate. (Fig 4)

During all stages of evaporation the crystal formation and distribution were videotaped and still microphotographs obtained. Images were obtained before and after evaporation in the normal mode X4 magnification with a video-microscope (Celestron LCD Digital Microscope II model #44341 Torrance California USA).

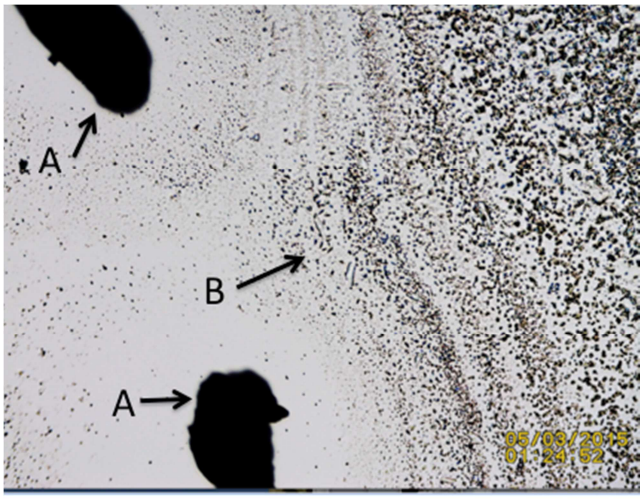

Figure 3. Fronting human hairs in PBSFe2 2K (diamagnetic solution) after evaporation. Showing A= Hair Follicles B= PBSFe2 2K crystals. Compare the absence of crystal formation surrounding the follicles.

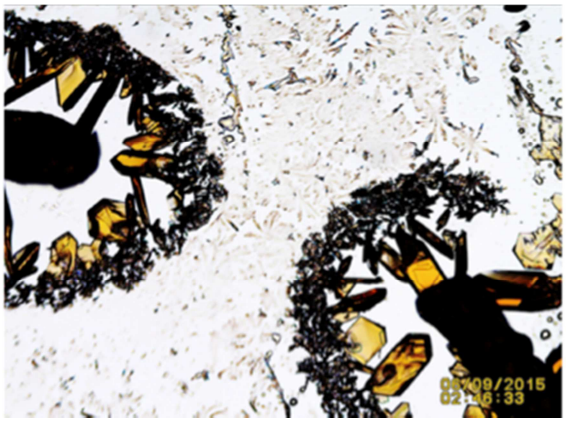

Figure 4. Paired human hair follicles facing each other in a paramagnetic nano-sized Iron particles solution (PBS FE3 2K) Both follicles show similar attraction of ferricyanide yellow crystals and incorporated iron particles. Compare with panel "B" on Figure 2 where a single hair was mounted.

3. Results

The control SSPs (absence of EMFs) with either the diamagnetic (PBS Fe2 2K) or paramagnetic (PBS Fe3 2K) solutions, when allowed to evaporate, showed small crystal clusters with incorporated iron particles dark areas as well as iron particle aggregates randomly distributed throughout the field (Figure 1).

When a single hair was placed in the SSP with application of diamagnetic PBS FE2 2K solution over the follicle area, crystallization followed the evaporation line but did not reach the follicle itself even as the liquid completely dried (Figure 2 "A"). On the other hand, the SSP with the follicle exposed to a paramagnetic PBS Fe3 2K solution crystal/iron particle accretions were observed which directly contacted the follicle (Figure 2 "B").

- Paired fronted human hairs

When two human hair follicles were placed on a slide facing each other, and covered with the diamagnetic PBS Fe2 2K solution there were no crystal formation surrounding the follicles observed after evaporation. Morevover the scattered iron particle aggregates showed a gradient with greater density at a distance from the pair and much lower density between the paired follicles (Figure 3).

In the SSP with paramagnetic PBS Fe3 2K solution applied to the paired follicles, there were no differences in crystallization when compared to the single slide paramagnetic SSP Fe3 2K (Figure 4).

4. Discussion

It has been established that some materials exhibit a magnetization (attraction), which is proportional to the applied magnetic field in which the material is placed. These materials are said to be paramagnetic and follow Curie's law, conversely diamagnetic materials create an induced magnetic field in a direction opposite to an externally applied magnetic field and are therefore repelled by the applied magnetic field [5,6]. In a recently published report, using the SSP methodology we demonstrated that human hair follicles and magnets which share inherent EMFs can induce specific forms of crystallization when the diamagnetic PBS Fe2 4K solution are applied [7]. These responses were based on the interaction of the EMFs with the diamagnetic properties of the ferrocynaide crystals and the iron aggregate particles in the PBS Fe2 solution. Figure 2 ("Panel A") is a confirmation of the previous demonstration and contrasts dramatically with the responses we observed when two follicles facing each other were placed on an SSP and immersed in the diamagnetic PBSFe2 2K solution. In this instance, no crystallization was observed but there was a gradient of small iron particle aggregates with a greater density at right angles to the alignment of the paired follicles. It is interesting to note that the definition of diamagnetism includes, "a property of certain materials of being repelled by both poles of a magnet, thus taking a position at right angles to the magnets lines of force [9]." In this case the paired follicles have their EMF in a direction aligned with the follicles and the gradient of iron particles is aligned perpendicularly (at a right angle) to the lines of force that the follicles generate. In other words, the definition of diamagnetism is a descriptive term, which indicates that a substance contains no unpaired electrons and

thus is not attracted to a magnetic field. In contrast "Paramagnetism refers to the magnetic state of an atom with one or more unpaired electrons. The unpaired electrons are attracted by a magnetic field due to the electrons' magnetic dipole moments" [10, 11].

We hypothesize that the iron particle gradient and the inhibition of crystallization by the paired follicles in a diamagnetic environment is due to the interaction between the diamagnetic forces from the ferrocyanide crystals in the PBBS Fe2 2K solution and the induced magnetic field in the direction opposite to the hair follicles. Although the exact nature of this interaction requires further research and elucidation, this hypothesis conforms to the established definition of "biomagnetism." as:

- The magnetic field created by a living organism
- The effect of an external magnetic field on living organisms and
- The scientific study of these phenomena.

Limitations

Our experiments of the paired and single hairs magnetic waves interference are limited to forearm hsir samples from the author (male 73+ years old).

5. Conclusions

Using Nano-sized iron particles (average diameter 2000 nm) in a Prussian Blue Solution stain for iron, we have documented the inherent magnetic waves from the single human hair causes attraction of iron laden layered crystals. In this study we demonstrated that when paired hair follicles, facing each other, in a SSP with applied diamagnetic PBS Fe2 2K solution showed inhibition of crystallization readily demonstrate in a single follicle SSP exposed to the same diamagnetic solution. On the other hand, when paired hair follicles in an SSP with a paramagnetic PBS Fe3 2K solution they retain their individual characteristics as when mounted singly in an SSP in a paramagnetic solution. The interaction between diamagnetic activity of the ferrocyanide substance of the PBS Fe2 2K solution and the paired follicles is hypothesized as the basis for crystallization inhibition.

The present findings corroborate the presence of Biomagnetism in human tissue. The human hair influence on established magnetic diamagnetic and paramagnetic susceptibilities [9, 10] provides further evidence as to the presence of Biomagnetism in the living human hair follicle.

Abbreviations

EMFs = Electromagnetic Forces

PBS = Prussian Blue Stain

PBS Fe2 2K = Ferrocyanide (diamagnetic) and Prussian Blue Stain mixed with nano-sized iron particles (2000 nanometers in diameter)

PBS Fe3 2K = Ferricyanide (paramagnetic) and Prussian Blue Stain mixed with nanosized iron particles

SSP = Single slide preparation. Drops of solution on a clean 25x75x1mm slide and allowed to evaporate.

2K= Iron nanoparticle mean diameter of 2000 nanometers.

Authors Contributions

AAE and BJS contributed equally to this work.

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