Biological Sciences

Human Blood Magnetic Profiles Interactions: Role in Mosquito Feeding

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Background: In a recent unpublished research paper under review, it was demonstrated that insects (mosquitoes) maintain electromagnetic magnetic profiles (EMFs) and are piezoelectric. Also proposed in the same report was that EMFs are present during host finding and under skin blind blood feeding by detecting blood vessels. The purpose of this report is to demonstrate that the human blood also maintains intrinsic piezoelectric properties, thus also proposed to play a role in guiding the mosquitos' blind feeding maneuvers.

Materials and Methods: By utilizing a standard small sterile needle, two small drops of fresh blood from the author's distal finger were placed in the center of a 25x75x1mm clean glass slide. The blood was then "sandwiched" (SDW) by covering the first slide with a similar one. One intact freshly plucked abdominal periumbilical hair was placed in the center of the top slide n=4. Immediately, via a small pipette, two drops of distilled water were carefully aimed and delivered covering the follicle and adjacent distal hair. The SDW was then examined with an optical video microscope. Still pictures and video-recordings were done of the follicle while the depth of focus point was slowly changed in and outwards from the focused follicle. Images were then photographed and interpreted. Control experiments were done with hairs mounted on distilled water SDWs.

Results: Several patterns representing different magnetic profiles were observed. Depending on the focus depth, the images changed as to reflect changing magnetic profiles detected in separate layers on the slide containing the hair. They ranged from zero profile while focusing on the follicle, to a cyclotron resonance pattern, to linear Lorentz Forces, as well as linear distortions caused by the Hall effect. The control experiments (zero blood drops in SDW) were void of any magnetic profiles.

Conclusions: In this report we are demonstrating in a glass slide assembly the magnetic profiles from the interactions between blood, hair and/or mosquito proboscis This was possible because the hair, proboscis and blood maintain magnetic profiles and are piezoelectric, i.e. convert EM oscillations to mechanical vibrations and vice versa.

Implications: It was demonstrated the presence of reciprocal electromagnetic interactions between tissues maintaining piezoelectric characteristics, thus supporting the hypothesis of biomagnetism as a factor in insects such as mosquitoes during the blood feeding process.

Blood Piezoelectric Profile | Mosquito Proboscis | Cyclotron Resonance | Hall Effect | Lorentz Forces.

Introduction

Mosquitoes seek blood for their reproduction and survival. The process of blood feeding has been documented as taking place under the skin [1]. A specialized mouthpart, namely the proboscis enters the host's body and blindly seeks and cannulates small blood vessels. Notably this blood drawing suction leaves no apparent hematoma on the host's puncture site area. On occasions a localized allergic reaction occurs [2]. In a previous unpublished paper (under review) the proboscis was documented to exhibit piezoelectric properties and hypothesized to use a sonar type reciprocal signaling mechanism in order to find the blood source. The blood, on the other hand has also been described as to also possess piezoelectric characteristics [3,4,5]. Piezoelectric meaning i.e. converts electromagnetic oscillations to mechanical vibrations and vice versa. In this report we are introducing a novel simple glass slide technique not previously described demonstrating that the human blood also exhibits a wide range of biomagnetism (Figs 1,2).

Materials and Methods

By utilizing a standard small sterile needle, two small drops of fresh blood from the author's distal finger pad were placed in the center of a 25x75x1mm clean glass slide (Globe Scientific # 1301). A second similar slide was placed on top, thus trapping the blood in a sandwich like structure (SDW). As the interstitial blood equilibrated, a continuous flow of red blood cells ensued as documented in video recordings.

One intact freshly plucked abdominal periumbilical hair was placed in the center of the top slide n=4. Immediately, via a small pipette, two drops of distilled water were carefully aimed and delivered covering the follicle and adjacent distal hair. The SDW was then examined with a Video-Photographic Equipment Celestron LCD Digital Microscope II Model # 44341, Torrance California and downloaded into an Apple MacBook Pro system. Still pictures and video-recordings were done of the follicle and adjacent tissue while the depth of focus point was slowly changed in and outwards from the focused follicle. Images were then photographed and interpreted. Control experiments were done with hairs mounted on top of distilled water SDWs (Fig 3). An *ex vivo* female mosquito proboscis was also prepared on top of a human blood SDW.

Results

A review of the data showed that when human blood was trapped in a SDW and exposed through a glass barrier [6] to a mosquito proboscis or a freshly plucked human peri-umbilical abdominal hair or inanimate wood fragment (ie: toothpick); magnetic profiles were seen such as cyclotron resonance (Fig 1) and Lorentz forces signaling (Fig 2). Of interest, was the rotation of the Lorentz forces around the follicle caused by blood movement seen as the blood equilibrated in the SDW. (Refer to the ancillary video recording # 0339). Conversely, when the blood had settle in the SDW and the experiments repeated, motionless Lorentz forces were seen around the hair. Controls experiments were done in the absence of blood in the SDW, the magnetic profile signals disappeared (Fig 3).

Conflict of interest: No conflicts declared
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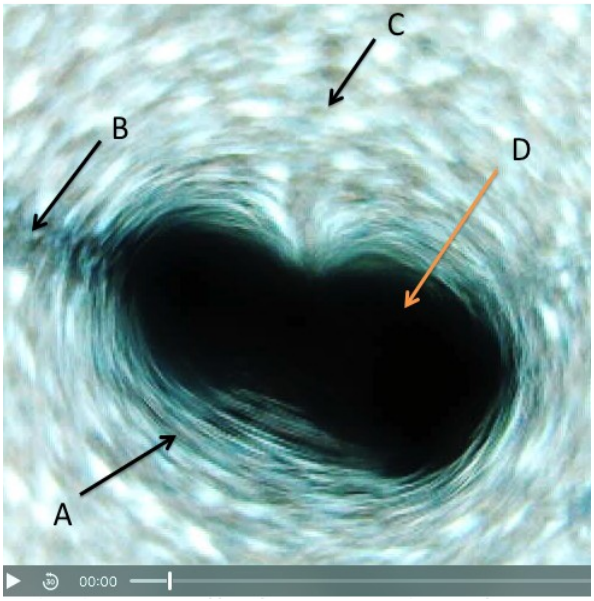

Figure 1. Demonstration of human blood magnetic properties. Microphotograph of a still video frame of fresh moving (expanding field) human blood immediately after SDW was prepared. Seen on top slide is a human hair follicle and shaft covered by distilled water. This image shows circumferential lines as a product cyclotron resonance, which is caused by curving or charges in a magnetic field as the electrical field changes polarity across the conductive bodies. A= Circumferential lines B= Hair shaft C= Sandwiched moving blood smear D= Hair follicle.

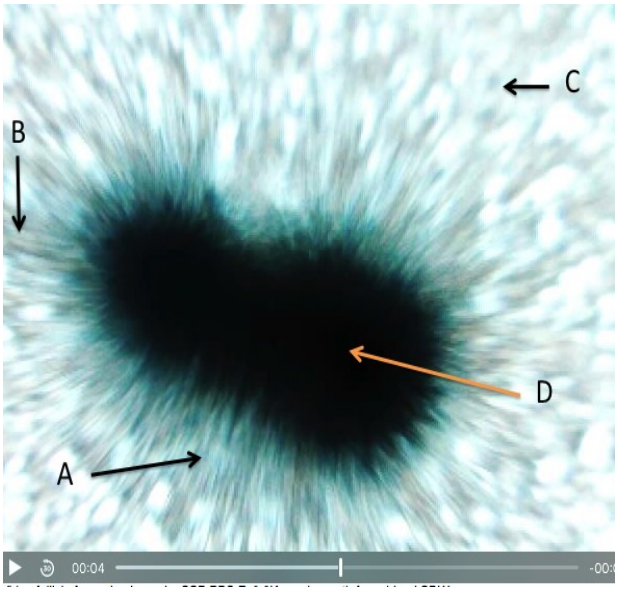

Figure 2. Focusing knob moved inwards. Microphotograph of video frame of hair follicle and shaft on top of blood SDW. Both hair and blood maintain magnetic profiles and are piezoelectric ie: convert oscillations to mechanical vibrations and vice versa. A= Linear extensions viewed represent Lorentz forces as a result of the Hall effect. B= Hair shaft. C= Out of focus blood in SDW. D= Hair follicle. (Please see supplemental video recordings showing movement of the Lorentz forces as the blood settles in the SDW: http://www.jnsci.org/files/video/e186/S1.htm).

Additional comment: Notably, when the distal section of a female mosquito proboscis was exposed to a blood SDW, the piezoelectric effect ensued. (Fig 4). It can then inferred from the findings, that there is a two way communication (due to the piezoelectric effect) between the mosquito proboscis and human blood.

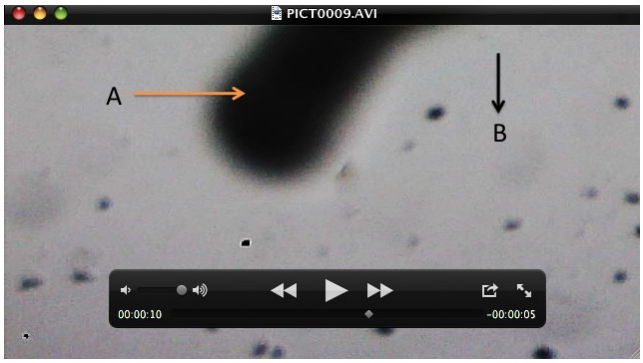

Figure 3. Control: Microphotograph of video frame. Hair follicle placed on top of water laden SDW. There were no magnetic profiles detected as focusing knob was moved away from the horizontal plane. A= Out of focus hair follicle B= Distilled water inside SDW.

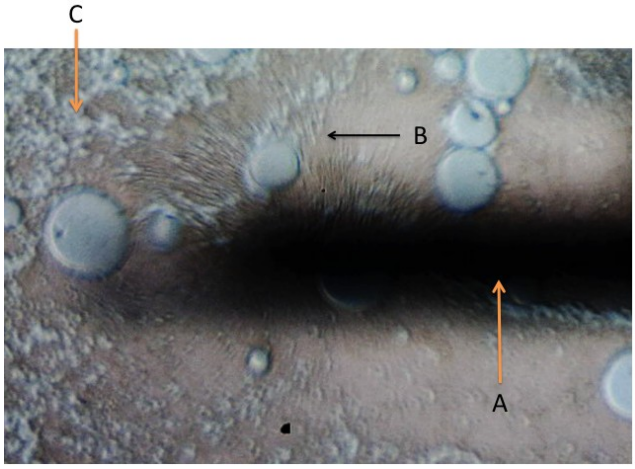

Figure 4. Un-retouched microphotograph. Slide showing mosquito proboscis/human blood piezoelectric interaction. Dried blood in SDW with distal *ex vivo* mosquito proboscis on top slide (covered by distilled water) showing the cyclotron resonance curved magnetic signature. A= Mosquito proboscis B= Magnetic profile (Cyclotron Resonance) C= Static dry human blood in SDW. X4 Magnification.

Discussion and Implications

Living body parts and inanimate objects whether hair, blood or mosquito's proboscis maintain magnetic profiles and are piezoelectric, i.e. convert electromagnetic (EM) oscillations to mechanical vibrations and vice versa. In previous research we have demonstrated the phenomenon of bioelectromagnetic forces penetrating glass barriers. The images herein presented show linear extensions represent Lorentz forces transmitted through a a one (1) mm glass barrier, this as a result of the Hall effect [7]. There is a cross sectional EMF induced secondary to the electromagnetic field of the light emitted by the microscope, which is oriented at right angles to the planes of blood and hair. The Hall effect accounts for the accumulation of charge at the edges. The image that shows circumferential lines is a product of cyclotron resonance [8,9], which is caused by the curving of charges in a magnetic field as the electrical field changes polarity across the conductive bodies. The experiments herein presented are in support that piezoelectric interactions occur between living tissues, such as the mosquito's proboscis and blood.

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Glossary

Cyclotron resonance: Cyclotron resonance describes the interaction of external forces with charged particles experiencing a magnetic field, thus already moving on a circular path. (Quote from Wikipedia).

Depth of focus: The distance between the two extreme axial points behind a lens at which an image is judged to be in focus.

Electromagneric Field: An electromagnetic field (also EM field) is a physical field produced by electrically charged objects. It affects the behavior of charged objects in the vicinity of the field. The electromagnetic field extends indefinitely throughout space and describes the electromagnetic interaction. (Quote from Wikipedia).

Hall effect: The Hall effect is the production of a voltage difference (the Hall voltage) across an electrical conductor, transverse to an electric current in the conductor and a magnetic field perpendicular to the current. It was discovered by Edwin Hall in 1879.

Lorentz force: The total force exerted on a charged particle by electric and magnetic fields. All charged particles encounter a force from an electric field, oriented in the direction of the field (or the opposite direction, depending on the sign of the charge),

Piezoelectric Effect: Is the ability of certain materials to generate an electric charge

1. Kong XQ, Wu CW. Mosquito proboscis: an elegant biomicroelectromechanical system. Phys Rev E Stat Nonlin Soft Matter Phys 2010 Jul;82 (1 Pt 1):011910.
2. A.N. Beckett, W. Sun, F.E.R. Simons, Y. Ma, Z. Peng. Role of recombinant mosquito salivary allergens in the diagnosis of individuals with allergic reactions to mosquito bites. Journal of Allergy and Clinical Immunology. Volume 113, Issue 2, Supplement, February 2004, Pages S74
3. Hye Jin Kim Jinsik Kim1, Omid Zandieh, Myung-Sic Chae, , Jeong Hoon Lee, Jung Ho Park, Seonghwan Kim, Kyo Seon Hwang. Piezoelectric layer embedded-microdiaphragm sensors for the determination of blood viscosity and density Appl. Phys. Lett. 2014 **105**, 153504
4. Tiutrin II, Pchelintseva OIu, Shpisman MN, Shipakov VE, Parshin AN. [Piezoelectric vibration blood coagulography as a method for assessing the functional state of the hemostatic system]. Med Tekh. 1993 Sep-Oct;(5):11-4.
5. Cheng TJ1, Chang HC, Lin TM. A piezoelectric quartz crystal sensor for the determination of coagulation time in plasma and whole blood.Biosens Bioelectron. 1998 Feb 1;13(2):147-56.
6. Embi, AA, Scherlag BJ. Demonstration of Human Hair Follicle Biomagnetic Penetration Through Glass Barriers International Journal of materials Chemistry and Physics. 2016
7. Jairo Sinova, Dimitrie Culcer, Q. Niu, N. A. Sinitsyn, T. Jungwirth, and A. H. MacDonald. Universal Intrinsic Spin Hall Effect Phys. Rev. Lett. March 2004 92, 126603
8. V. V. Lednev· Possible mechanism for the influence of weak magnetic fields on biological systems. Bioelectromagnetics 1991 Volume 12, Issue 2, pages 71–75,
9. Abraham R. Liboff. Geomagnetic Cyclotron Resonance in Living Cells. Journal of Biological Physics. 1985 Vol. 13, Issue 4, pp: 99-102.