



Science

TRANSFER OF HUMAN HAIR EXOCUTICLES ONTO GLASS BY LIQUID CATALASE AND WHOLE BLOOD (REPORTING BLOOD CLUMPING FORMATION WHEN CONTACT WITH KERATIN AS POSSIBLE FACTOR IN ATHEROSCLEROSIS)

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Abstract

The genesis of cardiovascular diseases, namely intra-arterial plaques formation leading to heart attacks, strokes and other vascular complication remains unanswered. To date there is accumulated evidence attributing antioxidant activity (toxic materials) of biochemical events in the human body as probable cause for the illness. Experts in the area of cardiovascular diseases have identified a lack of standardization in disease management; therefore, clinical trials comparing antioxidant agents (such as catalase) have been difficult to compare. Experts are also calling for new knowledge in relation to blood antioxidants physiology. Keratin is a chemical present in cellular structures in the body, also present in the human hair root and shaft. This manuscript presents a new finding, which is documentation of a binding capacity of catalase with keratin. Red blood cell are the main carriers of the catalase present in the circulatory system; in this manuscript experiments are introduced in support of a hypothesis adding one additional factor in the genesis of atherosclerosis; which is the protein enzyme catalase ever present in erythrocytes reacting with the keratin present in human arteries via an unknown mechanism.

Keywords: Blood Catalase; Hair Cuticles; Image Transfer Technique; Vascular Diseases; Keratin Catalase Binding; Keratin Coronary Artery Disease; Keratin and Blood Clumping.

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1. Introduction

The purpose of this manuscript is twofold: First to introduce a new property of catalase by demonstrating the transfer of human hair shafts onto a glass slide. Second: To introduce a hypothesis inferring the binding of blood catalase with the keratin present in human arteries. In demonstrating the aforementioned property, two different fluids were used, the first being a

solution of diluted catalase powder in distilled water, the second were human whole blood drops; both applied to the human skin. It had been established that when a human hair is sandwiched between two glass slides containing drops of Prussian Blue Stain (PBS), adhesion failure of imbricate pattern cuticles segments occurred and observed separated from the hair shaft (Fig 1). Details of the images were viewed and recorded using a video-microscope (1). At the time, it was hypothesized that an electromagnetic mechanism between the diamagnetic Ferrocyanide (present in Prussian Blue) and the sulfur and cystine present in the cuticle's keratin could be the cause for the adhesion failure. In this manuscript experiments are introduced in supporting an additional cause for **atherosclerosis** to be the protein enzyme catalase (**present in whole blood**) reacting with **keratin (present in arteries)**. Via an unknown mechanism, this newly reported phenomenon could gradually contribute towards an intra-arterial plaque building process.

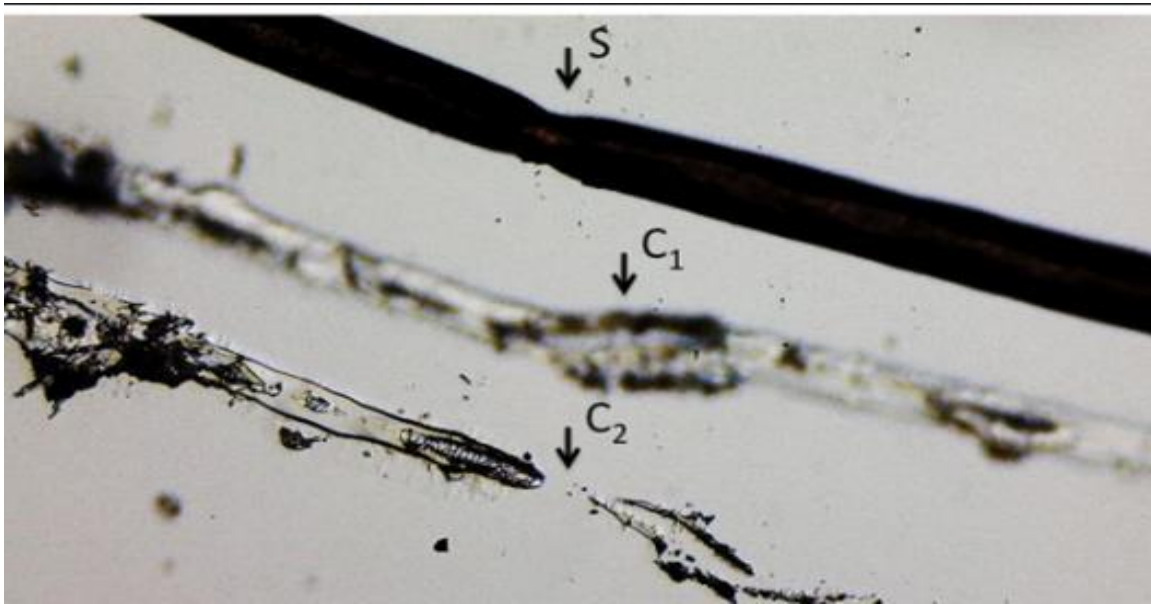


Figure 1: Human hair sandwiched between two glass slides showing hair cuticles detachments triggered by Potassium Ferrocyanide crystals in solution. Cuticles detached in two planes (C₁, C₂). Reproduced from: Embi AA. Adhesion Failure of External Hair Cuticles Caused by Prussian Blue: Possible Electrochemical Roles of Sulfur and Cystine. J Nat Sci, 2(6):e194, 2016.

2. Materials and Methods

A slide assembly was made by placing and securing with small strips of tape a cover slip (0.017 mm thickness) on top of a glass slide (25x75x1mm). A flat area of the author's forearm was used for the placement of the assembly.

2.1. Recording Equipment

After evaporation, images were viewed and recorded in the normal mode (no filters) x10 and x40 magnifications. (Fig 2). Equipment used was a video-microscope (Celestron LCD Digital Microscope II model #44341, Torrance, California, USA). All pictures downloaded and labeled by using an Apple Inc. iPhoto 8.1.2, App.

2.2. Liquid Catalase Solution Approach

One gram of white powder catalase (20,000 Units/G) was diluted in 3 ml of distilled water. The solution was rubbed onto a small section of the forearm; the slide assembly was gently placed on top, and secured by small strips of tape anchoring both sides of the slide to the arm. The preparation was held in place for 3-4 hours, and viewed in the video-microscope as shown in Figures 2 & 3 below.



Figure 2: Forearm hair shaft microphotograph. A= Showing details of exocuticles. B= Detached skin keratin flake. Image imprinted onto a coverslip placed on the skin that was covered by liquid diluted catalase.

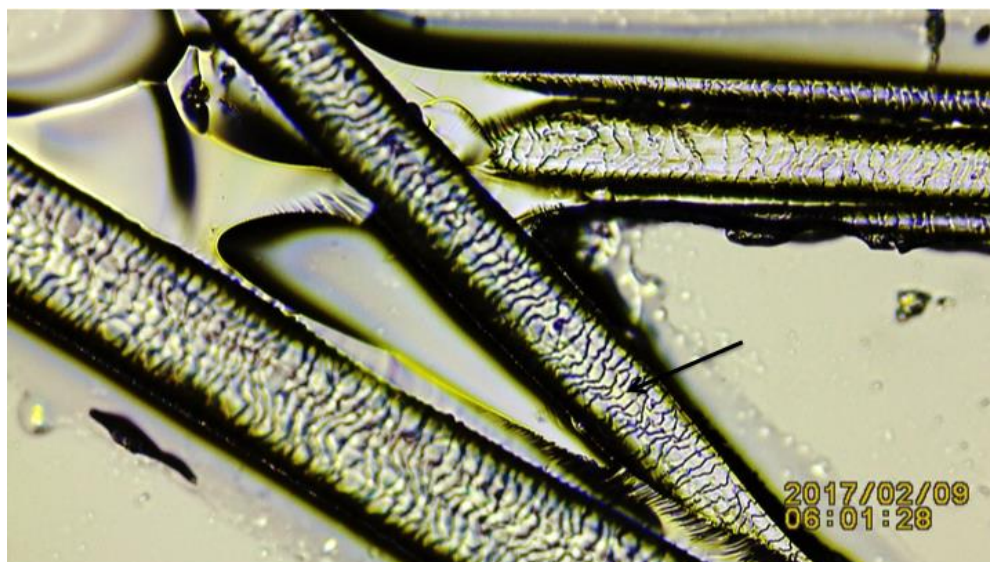


Figure 3: Forearm hair shafts showing details of the outer layer of cuticles. Image imprinted onto a coverslip placed on the skin that was covered by liquid diluted catalase. Black arrow pointing at hair cuticles images.

2.3. Provocative Maneuver to Confirm the Image Transfers

Under video recording mode the exposed images were physically scraped by **tweezers**. This maneuver was documented in a video-recording link shown in the figure caption of (Fig. 4 below).



Figure 4: Different experiment n=2 from Fig 1. This microphotograph of a frame from a video-recording shows the scattered imprinted images that was caused by scraping the glass with tweezers' strokes. Notice the absence of hair shafts proper, only the cuticles images were disturbed. For details please link to: <https://youtu.be/JIy0DZ4wPfE> or scan QRCode:



2.4. Human Whole Blood Drops Approach

A finger tip distal area was punctured via a sterile lancet (One Touch Delica), the finger was milked and 3 to four drops of blood were placed on a flat area of the opposite forearm. A coverslip (0.017 mm in thickness) was firmly held on the blood drops. Slight pressure was applied for 30 seconds; then the coverslip was vertically removed and the dry area of the coverslip placed on a glass slide (25x75x1mm) to allow for viewing. While on the microscope platform, the blood on the coverslip was allowed to evaporate and video images recorded. (Figs 4 & 5) below shows hair cuticles as well as red blood cells adhered to the coverslip.

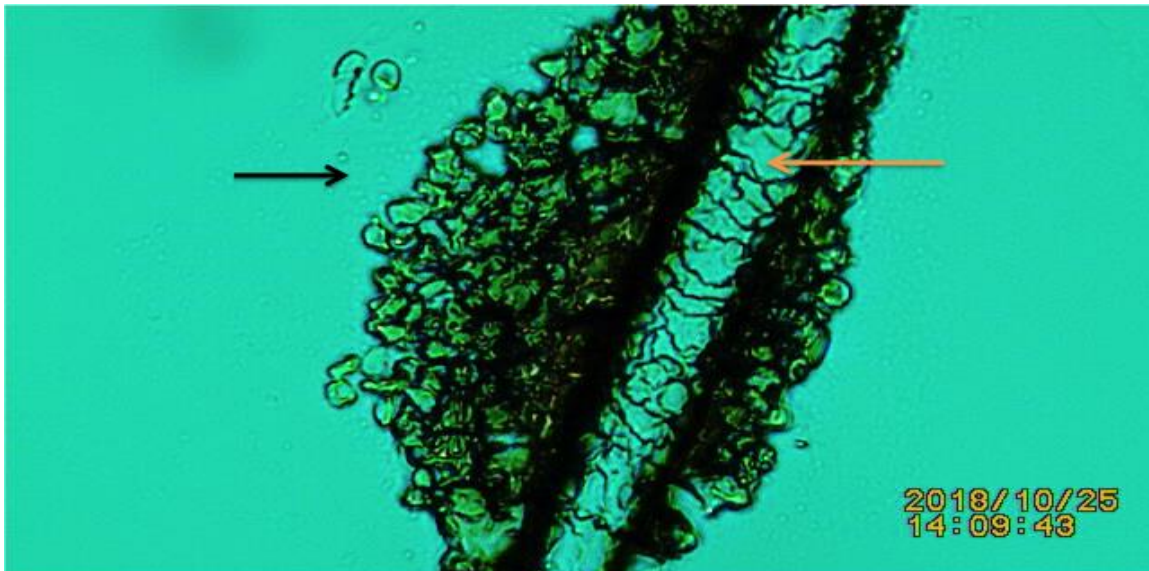


Figure 4: Microphotograph showing image of hair shaft transferred onto a glass slide (coverslip 0.017 mm in thickness). Black arrow pointing at clump of red blood cells. Orange arrow pointing at hair shaft outer cuticles.

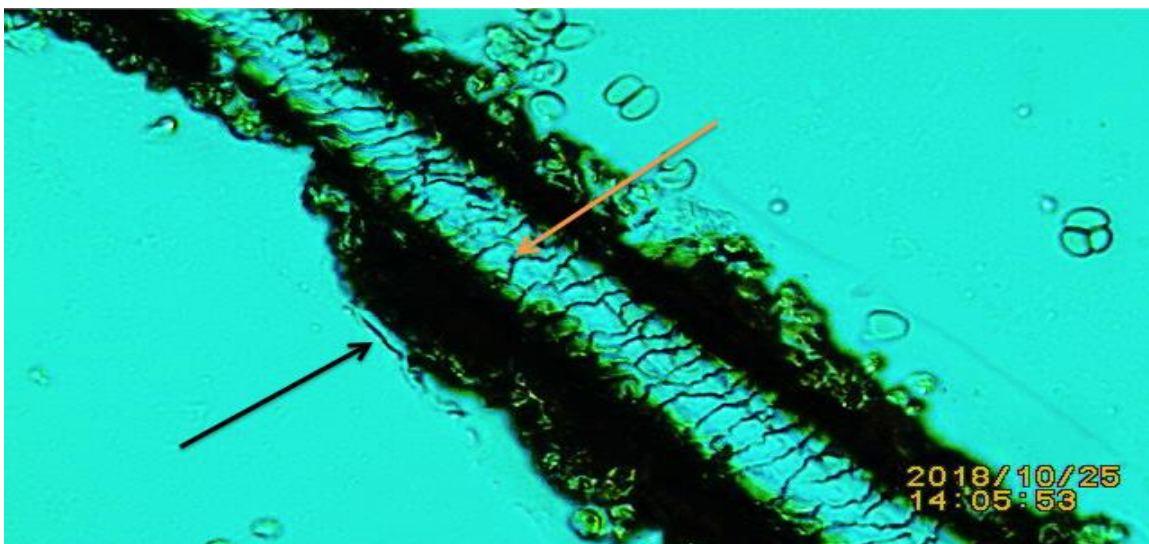


Figure 5: Another Microphotograph showing image of hair shaft transferred onto a glass slide (coverslip 0.017 mm in thickness) by whole blood drops. Black arrow pointing at clump of red blood cells. Orange arrow pointing at hair shaft outer cuticles.

3. Results

An image transfer (photographic technique) for the detection of human hair exocuticles is presented. The clumping or RBCs attracted to keratin is noticed. This clumping could potentially be a factor in intra-arterial plaque building. Both the diluted powder catalase solution and drops of whole blood expressed the property of adhering to imbricate pattern keratin exocuticles of the human hair shafts. Video-recordings of scraping the images with tweezers documented that only the cuticles were imaged, the hair shaft proper was not transferred onto the glass.

4. Discussion

The results observed by the adhesion of human hair cuticles to a thin glass slide are reported. Human blood contains catalase, which is essential for protection from reactive oxygen species such as H_2O_2 (2). There is one common denominator between the two substances used in the experiments herein presented, namely the protein enzyme catalase.

In all experiments (n=6) clumping or RBCs are seen adhering to the hair shaft. The mechanism underlying the results are proposed to be an electromagnetic one, this is supported by previous published findings where the diamagnetic potassium ferrocyanide also caused cuticles detachments. Also, in support of an electromagnetic binding phenomenon are reports citing catalase binding to magnetic materials, in addition catalase has been proven to have magnetic properties (3,4,5).

5. Medical Implications

The questions arise:

- Would the blood catalase/keratin binding capacity change with diseases or drug levels?
- Are the cytokeratins expressed in human arteries when in contact with blood a factor in vessel occlusion?
- Does the contact of whole blood with arterial keratin initiate blood clumping or clots?

6. Conclusions

Present Paradigm

The majority of papers cited in the literature, point at Reactive Oxygen Species as the culprit in atherosclerosis; and therapies rich in antioxidants are widely recommended.

Proposed New Paradigm

Antioxidant as Culprit in Plaque Formation

In support of antioxidants (such as catalase) as in plaque formation is supported by an increase in the blood level of catalase in unstable angina when compared to stable angina patients. This finding was published in 1992, others followed (6,7,8). Also supporting the new paradigm are links between the binding of blood catalase and cytokeratin in human arteries leading to vascular disease are described in a paper where a “high frequency of cytokeratin producing smooth muscle cells in human atherosclerotic plaques” was found (9,10). Additionally, in a very recent published review entitled “Antioxidants in the Fight Against Atherosclerosis: Is This a Dead End? The authors have echoed the confounding state in finding a genesis for cardiovascular diseases (11)

7. Recommendations

In view of the present stalemate in finding a genesis for atherosclerosis, this author recommends that: The new knowledge presented in this manuscript should be included in future research projects.

Question: Is the catalase present in human blood binding with the cytokeratin expressed in human arteries a factor in arterial obstruction?

Answer: Documentation introduced in this manuscript (catalase/blood clumping), as well as prior findings in the literature seem to support a positive answer.

References

- [1] Embi AA. Adhesion Failure of External Hair Cuticles Caused by Prussian Blue: Possible Electrochemical Roles of Sulfur and Cystine. *J Nat Sci*, 2(6):e194, 2016.
- [2] Nagababu E, Chrest FJ, Rifkind JM. (2003) Hydrogen-peroxide-induced heme degradation in red blood cells: the protective roles of catalase and glutathione peroxidase. *Biochim Biophys Acta*. 2003 Mar 17;1620(1-3):211
- [3] Doğaç YI, Çınar M, Teke M. Improving of catalase stability properties by encapsulation in alginate/Fe₃O₄ magnetic composite beads for enzymatic removal of H₂O₂. *Prep Biochem Biotechnol*. 2015;45(2):144-57. doi: 10.1080/10826068.2014.907178.
- [4] Doğaç YI, Teke M. (2013) Immobilization of bovine catalase onto magnetic nanoparticles. *Prep Biochem Biotechnol*. 2013;43(8):750-65. doi: 10.1080/10826068.2013.773340.
- [5] M. Bartoszek W.W. Sułkowski (2004) The effect of the magnetic field on catalase. *Physica Medica* 20:34-36
- [6] Rashtbari, S., Dehghan, G., Yekta, R., & Jouyban, A. (2017). Investigation of the binding mechanism and inhibition of bovine liver catalase by quercetin: Multi-spectroscopic and computational study. *BioImpacts* : BI, 7(3), 147-153.
- [7] JennichjenSlomp Robert E.Poelmann Adriana. C.Gittenberger-de Groot Victor E.Koteliansky Marina A.Glukhova2Ad J.J.C.Bogers. Cytokeratin expression in human arteries pertinent to intimal thickening formation in the ductus arteriosus. *Differentiation* Volume 61, Issue 5, pp 305-311 <https://doi.org/10.1046/j.1432-0436.1997.6150305.x>
- [8] Jayakumari N, Ambikakumari V, Balakrishnan KG, Iyer KS. (1992) Antioxidant status in relation to free radical production during stable and unstable anginal syndromes. *Atherosclerosis*. 1992 Jun;94(2-3):183-90.
- [9] Jahn L, Franke WW. (1989) High frequency of cytokeratin producing smooth muscle cells in human atherosclerotic plaques. *Differentiation*. Mar;40(1):55-62.
- [10] Jahn, L., et al. 1993. Cytokeratins 8 and 18 in smooth muscle cells. Detection in human coronary artery, peripheral vascular, and vein graft disease and in transplantation-associated arteriosclerosis. *Arterioscler. Thromb.* 13:1631-1639.
- [11] Paola Toledo-Ibelle and Jaime Mas-Oliva (2018) Antioxidants in the Fight Against Atherosclerosis: Is This a Dead End? *Curr Atheroscler Rep*. 2018; 20(7): 36. doi: [10.1007/s11883-018-0737-7]

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