

About the Formation Mechanism of the Turin Shroud Body Image

Giovanni Fazio

Department of Mathematical and Computer Sciences, Physical Sciences and Health Science, University of Messina, Messina, Italy
Email: giovanni.fazio@unime.it

How to cite this paper: Fazio, G. (2024) About the Formation Mechanism of the Turin Shroud Body Image. *Open Journal of Applied Sciences*, 14, 3308-3315.
<https://doi.org/10.4236/ojapps.2024.1411218>

Received: October 19, 2024

Accepted: November 26, 2024

Published: November 29, 2024

Copyright © 2024 by author(s) and Scientific Research Publishing Inc.
This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).
<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

After almost fifteen years, we remind our fellow scientists of the Stochastic process, a natural mechanism for obtaining the Shroud Body Image. The above process is considered the only source of energy present in an ancient tomb: the thermal one emitted by the corpse of Jesus Christ. It, for all corpses, is notoriously so weak that the only process that could be triggered is the Stochastic one. However, the best-known expert scientists in the Shroud of Turin investigation did not take this model into account, even if it guaranteed a latent image, typical of the Stochastic process, and a fibrils distribution as appears on the Shroud surface. The above scientists and many others had already chosen the Radiative hypothesis, which is based on the emission of radiation (Ultraviolet) and nuclear particles (Protons and Neutrons) by the corpse of Jesus Christ. These emissions are impossible; conversely, if they were true, we would have to talk about miracles. Today, after four decades, it would be appropriate to accept that the Radiative hypothesis (which in the Turin Shroud case becomes a miraculous hypothesis) cannot be in line with both Physics and Theology. We think that we should all be more fiscal when we judge our work.

Keywords

Turin Shroud, Image Formation, Thermal Energy, Stochastic Process, Protons, UV Radiations, Neutrons, Radiative Hypothesis

1. Introduction

Nowadays, among the ones proposed, there is no mechanism able to generate the Body Image as it is on the Shroud of Turin with all its complex and fascinating characteristics that we see in **Figure 1**. Almost all the examined processes have an imprint related to the research area of each scientist who made the proposal. When

this happened, each of us was not free but conditioned by both our own research and culture. However, while the interest in the Blood Image was great but of a scientific nature (the bloodstains were very useful for obtaining information on the above archaeological find), the ones for the Shroud Body Image also had extraordinary characteristics such as depth, 2D and 3D properties, resolution, only two values of optical density, etc. [1]. The above archaeological find, known throughout the world, is an object that interests all of Christianity, which puts pressure on scientists to have total understanding.

Obviously, as written above, we too were influenced by our knowledge of the interaction between radiation and particles with the human beings. We know the effects of the above interaction when a very small dose is transmitted by radiation to the human body. This occurs because we are experts in Spectroscopy of Light Nuclei, Bremsstrahlung radiation accompanying the α -decay, spontaneously emitted by heavy and super heavy nuclei ($^{210,214}\text{Po}$, ^{226}Ra , ^{252}Cf), and dynamics of nuclear reactions involving heavy and super-heavy nuclei to study element with atomic number between $Z = 102$ and $Z = 122$. Just as an example, we mention some articles [2]-[5].

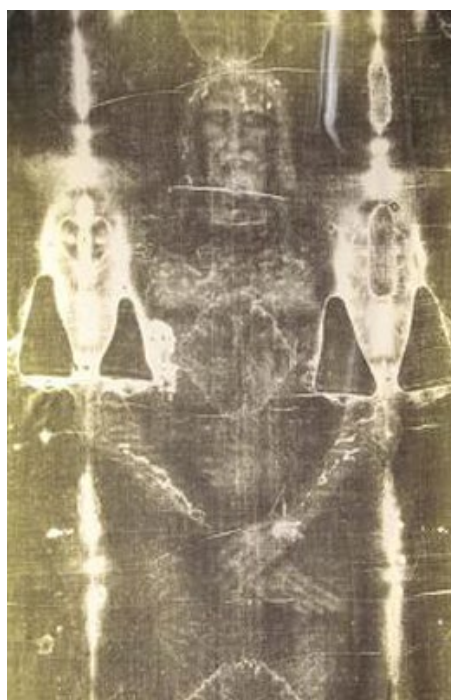


Figure 1. Frontal part of Body Image with its 2D feature, as it appears on the Turin Shroud.

Now, away from initial enthusiasm and with a greater critical sense, we want to investigate the process suggested by ourselves that was not accepted. We do it because this proposed mechanism of ours uses the only energy available in an ancient Sepulcher and provides a linear distribution of yellowed fibrils with results that appear after years or decades. This last result is due to the fact that the Shroud Body Image is a latent image.

However, today most scientists investigating the Shroud are convinced that the image is the result of a Miracle. The start is due to a scientist [6], who, in an unpublished article, proposed a photochemical reaction image process in an attempt to resolve the problem. In this approach, the use of the laser is necessary to identify the appropriate wavelength value, the duration time of irradiation and whether operating with a single pulse, repetitive pulse or continuous. Thus, various scientists have considered the ultraviolet radiation to resolve the Body Image formation. Others have investigated the protons-burial linen interaction and still others on a possible emission of neutrons useful for correcting the 1988 dating of the Shroud of Turin.

2. The Stochastic Process

Differently, we were impressed by the distribution of the yellowed fibrils that form the Body Image on the burial linen. Among yellowed fibrils and those that maintain the background optical density, we thought of a probabilistic process. Later, in scientific literature, we observed the relationship between the density of the yellowed fibrils and the distance between corpse and burial linen [7] [8]. The linear regression of this function awakened the instinct of the nuclear physicist: the distribution of yellowed fibrils is similar to that of people affected by low-level irradiation who manifest effects such as leukemia, solid tumors or death, with very long latency periods. For humans, the function [(Effects) *versus* (Dose)] has a linear trend passing through the origin. For yellowed fibrils, the function [(Fibrils Density) *versus* (Body-Linen Distance)] also has a linear trend with maximum density when the above distance is zero (areas of contact) [9]-[12].

This process, called Stochastic, occurs only when the absorbed dose (or energy) is low and has the following characteristics: 1) The effects are probabilistic in nature; 2) There is no Threshold-dose; effects are null only when the absorbed dose is zero; 3) Their frequency increases with the absorbed dose; 4) The effects can remain latent, appearing years or decades later; 5) The severity of the effect does not increase with the absorbed dose. Therefore, a stochastic distribution requires a small amount of energy. In our case, in an ancient tomb, the only energy available is thermal energy, which is transferred from the corpse to the burial linen. This occurs until thermal equilibrium is reached between the body and the burial linen. Furthermore, in an ancient sepulcher, there are no other sources of energy.

Thus, it was the thermal energy that triggered a Stochastic process, which, with the above latency, would lead to the formation of the Body Image. In fact, in this image, all the fibrils received thermal energy, similar to those who have been exposed to low doses of radiation. Some of them will turn yellow (like humans who have died) and will be distributed such that their density relative to the corpse-burial linen distance shows a linear trend [13]-[16].

Conversely, a no-stochastic process, known as a Deterministic process, occurs when the energy (or dose) is high. Its characteristics include: 1) The presence of Threshold-doses; 2) When the Threshold is exceeded, the effects all individuals

involved; 3) The latency period is short, only a few days or weeks; 4) The severity of effects increases with the absorbed dose. Therefore, in the case of a linen that absorbs a significant amount of energy, all the fibrils would turn yellow with the same optical density, precluding the possibility of obtaining an image. The same scenario occurs in the radiation-human interaction when the energy involved is substantial: death for all irradiated individuals. In this case, latency times cannot be discussed.

Thermal Energy, which propagates through the three known mechanisms (conduction, convection and radiation), was not considered by STURP team because, after the emission, it would reach the linen in a widespread manner. This is true if the threshold that triggers a potential deterministic process is exceeded. However, we believe that the amount of heat transmitted from the body to the linen was extremely low [16]. Therefore, this threshold was not surpassed, placing the effects in the stochastic realm.

Even today, no mechanism fully explains all the characteristics of the Body Image, only a portion. Given this situation, should we investigate the stochastic mechanism? The answer is yes! This process is based on real, observable phenomena rather than hypothetical ones. For example, the necessary energy considered is thermal energy, the only type present in an ancient sepulcher. This energy, supplied by the corpse wrapped in the burial linen and placed on the tombstone, is very weak. Therefore, it is the ideal quantity to trigger a stochastic process. Furthermore, it guarantees a latent image, which is one of the most important characteristics of the Shroud Body Image. In fact, the latency time of this image varies from years to decades. This result confirms that the Shroud Body Image is not a Miracle. Indeed, such extraordinary events are instantaneous. Additionally, the distribution of the yellowed fibrils resembles that of the corpses of individuals who were part of a group exposed to low-level irradiation years or decades earlier. These are the reasons that drive us to investigate further.

However, for our process, which is a natural mechanism, we are unable to evaluate the image depth and resolution for comparison with the values deduced from the Shroud. Therefore, an experiment lasting years or decades would be necessary. This is our limitation.

3. About the Radiative Hypothesis

What can we say about the miraculous hypothesis, known as the Radiative Hypothesis? Some scientists [17]-[20] propose that the hypothesis involves the emission of radiation in the far ultraviolet spectrum with a wavelength of $\lambda = 193$ nm, a value close to that of soft X-rays, emitted from the corpse of the Shroud man, believed to be Jesus Christ. It is important to note that the energy of this radiation ($E = 6.4$ eV) is sufficient to penetrate the linen to a depth of 200 nm [21]. However, in air, this radiation is absorbed by molecular oxygen (binding energy of 5.16 eV) and penetrates only a few microns [22]. As a result, any coloring would only occur in the contact areas. Therefore, we cannot accept this process, along with others

that we will discuss later, as they do not conform to the laws of physics. In fact, human beings can only emit thermal energy. This limitation is why the Radiative Hypothesis is regarded as a miraculous event. Consequently, the physics community does not accept the Radiative mechanism.

In this context, some scientists consider the Shroud man to be a proton emitter. These particles are thought to ionize the linen at a microscopic level (by removing electrons and oxidizing the linen), resulting in yellowing at a macroscopic level [23]-[25]. Unfortunately, they did not account for how protons would behave in non-contact areas. The kinetic energy of these particles is such that they would penetrate the linen to a depth of 200 nm only in contact areas. In areas without contact, upon encountering air, they would lose some of their initial energy. The question arises: will they be able to reach the target even when the corpse-burial linen distance is 3.7 cm? We believe this is impossible [26] [27]. Therefore, there will be no discoloration on the areas of the linen that are distant from the source used in the experiment.

Furthermore, some scientists have considered the possibility of neutron irradiation from the corpse of the Nazarene as a means to increase the radiocarbon (isotope ^{14}C) content in the linen, effectively “rejuvenating” the tissue [28]-[30]. This process is suggested to occur through the interaction $^{14}\text{N} (n, p) ^{14}\text{C}$, where the neutrons interact with nitrogen following the death of Jesus Christ and lead to the Resurrection. According to the authors, this would explain the erroneous radiocarbon dating conducted in 1988 at Oxford, Zurich, and Tucson Laboratories. We, the authors of this article, argue that the radiocarbon produced in this manner acted as a contaminant and was not removed during the cleanup operations following the radiocarbon dating of the Shroud. However, these attempts fall into the categories we recently discussed in another article [31]. Moreover, it is important to consider the presence of electrons, which are elementary particles capable of ionizing matter. In this context, neutrons should also be regarded as indirectly ionizing particles. When they pass through matter, neutrons do not interact with electrons directly but can produce recoil protons through (n, p) reactions. These recoil protons can then generate ion-electron pairs.

4. Comparing and Conclusions

In this article, the presence of a religious conflict of interest is evident. Scientists believe that the image of the Nazarene is present on the Shroud find confirmation of the existence of God. Conversely, those who assert that the image is a fake imply that God does not exist. The conflict is so pronounced that both sides overlook the fact that relics and icons have no place in core Christian beliefs.

When comparing the two models of formation, it becomes clear that their mechanisms are vastly different. In one model, the linen is affected by ultraviolet radiation, protons, or neutrons, while the role of electrons remains unexplored. In contrast, another model suggests that the tissue is influenced by thermal energy. The premise of the Radiative Hypothesis is largely speculative, whereas the Stochastic

process is viewed as a natural event involving the transfer of a small amount of heat [16]. This heat transfer initiates a series of events that, over time (years or decades), leads to the formation of the Shroud Body Image as we observe it on the Linen of Turin. Thus, it is more reasonable to favor the natural process, which is grounded in real and credible facts, over a mechanism based on events that have never occurred in the history of humanity.

Beyond all observations, investigations, declarations, and judgments, there remains a dominant issue: the emissions of ultraviolet rays, protons, and neutrons. If these emissions were factual, they would constitute miracles. However, supernatural events are, by nature, incomprehensible and unrepeatable for both humanity and science. Such events exist only within the realm of the Almighty and are characterized by their instantaneous nature. Miracles cannot be described step by step; this level of description is only applicable to natural events or the creation of fakes. Consequently, theology cannot accept the Radiative Hypothesis.

Additionally, we must consider Occam's Razor, which states that when various hypotheses are available for an explanation, the most probable is the one that requires the fewest special assumptions [32] [33]. This philosophical principle, while not a physical law, has held significant weight in the scientific community since the time of Newton and Leibniz. As Aristotle posited, nature operates in the simplest way possible.

Ultimately, it remains impossible to comprehend supernatural events. We emphasize the term "always", as God's action, being instantaneous, occurs at infinite speed—a concept beyond the grasp of science. Therefore, an event possessing these characteristics can never be fully understood.

Acknowledgements

The author wishes to thank Prof. Giorgio Giardina (University of Messina) for the difficult, sometimes harsh, but quite interesting discussions.

Conflicts of Interest

The author declares no conflict of interest regarding the publication of this article.

References

- [1] Jumper, E.J., Adler, A.D., Jackson, J.P., Pellicori, S.F., Heller, J.H. and Druzik, J.R. (1984) A Comprehensive Examination of the Various Stains and Images on the Shroud of Turin. In: *Advances in Chemistry*, American Chemical Society, 447-476. <https://doi.org/10.1021/ba-1984-0205.ch022>
- [2] Povoroznyk, O.M., Gorpnich, O.K., Jachmenjov, O.O., Mokhnach, H.V., Ponkratenko, O., Mandaglio, G., de Leo, V., Curciarello, F., Fazio, G. and Giardina, G. (2012) Experimental Evidence of ${}^6\text{He}$ Level at $E^* = 18.3$ MeV via the ${}^4\text{He} + {}^3\text{H}$ Three-Body Reaction. *Physical Review C*, **85**, Article ID: 064330.
- [3] Eremin, N.V., Fazio, G. and Giardina, G. (2000) Comment on Bremsstrahlung in Alpha Decay of ${}^{210}\text{Po}$: Do Alpha Particles Emit Photons in Tunnelling? *Physical Review Letters*, **85**, Article 3061.

- [4] Fazio, G., Giardina, G., Hanappe, F., Mandaglio, G., Manganaro, M., I. Muminov, A., *et al.* (2008) Role of the Target Orientation Angle and Orbital Angular Momentum in the Evaporation Residue Production. *Journal of the Physical Society of Japan*, **77**, Article ID: 124201. <https://doi.org/10.1143/jpsj.77.124201>
- [5] Giardina, G., Mandaglio, G., Nasirov, A.K., Anastasi, A., Curciarello, F. and Fazio, G. (2018) Uncertainties and Understanding of Experimental and Theoretical Results Regarding Reactions Forming Heavy and Superheavy Nuclei. *Nuclear Physics A*, **970**, 169-207. <https://doi.org/10.1016/j.nuclphysa.2017.11.010>
- [6] Lukasik, S.J. (1985) Some Speculations Concerning the Process Leading to the Formation of the Image on the Shroud of Turin.
- [7] Jackson, J.P., Jumper, E.J. and Ercoline, R.W. (1982) Three Dimensional Characteristics of the Shroud Image. 1982 *IEEE Proceedings International Conference on Cybernetics and Society*, Seattle, 28-30 October 1982, 559-575.
- [8] Jackson, J.P., Jumper, E.J. and Ercoline, W.R. (1984) Correlation of Image Intensity on the Turin Shroud with the 3-D Structure of a Human Body Shape. *Applied Optics*, **23**, 2244-2270. <https://doi.org/10.1364/ao.23.002244>
- [9] Meyerhof, W.E. (1967) *Elements of Nuclear Physics*. Mc-Graw-Hill Inc.
- [10] Moe, H.J., Lusak, S.R. and Schumaker, M.C. (1971) Radiation Safety Technicians Training Course. Argonne National Laboratory, Industrial Hygiene and Safety Division.
- [11] Fazio, M. (1973) *Enciclopedia della Fisica, Fisica Nucleare*. Volume II-Sezione XI, 108, Istituto Editoriale Internazionale. (In Italian)
- [12] Little, M.P., Wakeford, R., Tawn, E.J., Bouffler, S.D. and Berrington de Gonzalez, A. (2009) Risks Associated with Low Doses and Low Dose Rates of Ionizing Radiation: Why Linearity May Be (Almost) the Best We Can Do. *Radiology*, **251**, 6-12. <https://doi.org/10.1148/radiol.2511081686>
- [13] Fazio, G. and Mandaglio, G. (2011) Stochastic Distribution of the Fibrils That Yielded the Shroud of Turin Body Image. *Radiation Effects and Defects in Solids*, **166**, 476-479. <https://doi.org/10.1080/10420150.2011.566877>
- [14] Fazio, G. and Mandaglio, G. (2012) Can a Latent Image Explain the Characteristics of the Shroud Body Image? *Radiation Effects and Defects in Solids*, **167**, 220-223. <https://doi.org/10.1080/10420150.2011.595413>
- [15] Fazio, G., de Leo, V., Curciarello, F. and Mandaglio, G. (2014) Comparison among the Shroud Body Image Formation Mechanisms by the Linen Fibrils Distributions. *The Journal of the Textile Institute*, **106**, 896-899. <https://doi.org/10.1080/00405000.2014.930575>
- [16] Fazio, G., Mandaglio, G. and Anastasi, A. (2018) Describing, Step by Step, the Shroud Body Image Formation. *Heritage*, **2**, 34-38. <https://doi.org/10.3390/heritage2010003>
- [17] Baldacchini, G., Di Lazzaro, P., Murra, D. and Fanti, G. (2008) Coloring Linens with Excimer Lasers to Simulate the Body Image of the Turin Shroud. *Applied Optics*, **47**, 1278-1285. <https://doi.org/10.1364/ao.47.001278>
- [18] Fanti, G. (2010) Can a Corona Discharge Explain the Body Image of the Turin Shroud? *Journal of Imaging Science and Technology*, **54**, Article ID: 20508. <https://doi.org/10.2352/j.imagingsci.technol.2010.54.2.020508>
- [19] Di Lazzaro, P., Murra, D., Santoni, A., Fanti, G., Nichelatti, E. and Baldacchini, G. (2010) Deep Ultraviolet Radiation Simulates the Turin Shroud Image. *Journal of Imaging Science and Technology*, **54**, Article ID: 40302. <https://doi.org/10.2352/j.imagingsci.technol.2010.54.4.040302>
- [20] Di Lazzaro, P., Murra, D., Santoni, A., Nichelatti, E. and Baldacchini, G. (2012) Shroud-

- Like Coloration of Linen by Nanosecond Laser Pulses in the Vacuum Ultraviolet. Rapporto Tecnico RT/2012/16/ENEA, 7-26.
- [21] Fanti, G., Botella, J., Di Lazzaro, P., Heimburger, T., Schneider, R. and Svensson, N. (2010) Microscopic and Macroscopic Characteristics of the Shroud of Turin Image Superficiality. *Journal of Imaging Science and Technology*, **54**, Article 40201. <https://doi.org/10.2352/j.imagingsci.technol.2010.54.4.040201>
- [22] Fazio, G. (2022) Could the VUV Radiation Yield the Shroud Body Image? *Global Journal of Archaeology & Anthropology*, **12**, Article ID: 555837. <https://doi.org/10.19080/gjaa.2022.12.555837>
- [23] Rinaudo, J.B. (1994) Proton Model. British Society for the Turin Shroud. *Newsletter*, **38**, 13-16.
- [24] Rinaudo, J.B. (1995) Nouveau Mecanisme de formation de l'image sur le Linceul de Turin, ayant pur entrainer une fausse radiodation medievale. "L'homme du Linceul est bien Jésus de Nazareth". *Acts du Symposium Scientifique International du CIELT*, Paris, 10-12 Juin 1993, 293-299.
- [25] Lind, A.C. (2017) Image Formation by Protons. *International Conference on the Shroud of Turin. Seeking Solutions to the Mysteries of the Shroud*, Trac Center Pasco, 19-22 July 2017, 1-12.
- [26] Fazio, G. (2022) The Body Image on the Shroud Was Not Produced by Protons. *Scientific Culture*, **8**, 17-21.
- [27] Fazio, G. (2023) Discoloration Range and Shroud Image Depth Values Cannot Be Satisfied by the Same Proton Energy. *Open Journal of Applied Sciences*, **13**, 1224-1232. <https://doi.org/10.4236/ojapps.2023.138096>
- [28] Lind, A.C., Arthur, C., Antonacci, M., Elmore, D. and Guthrie, J.M. (2010) Production of Radiocarbon by Neutrons Radiation on Linen. *Proceedings of the International Workshop on the Scientific Approach of the Archeiropietos Images*, Frascati, 4-6 May 2010, 255-262.
- [29] Antonacci, M. (2012) Particle Radiation from the Body Could Explain the Shroud's Image and Its Carbon Dating. *Scientific Research and Essay*, **7**, 2613-2626. <https://doi.org/10.5897/sre12.376>
- [30] Rucker, A.R. (2016) MCNP Analysis of Neutrons Released from Jesus' Body in the Resurrection. *Shroud of Turin: The Controversial Intersection of Faith and Science Conference*, Saint Louis, 9-12 October 2014, 1-54.
- [31] Fazio, G., Leonello, M. and Riotto, F. (2024) Forcing in Christian Events: The Turin Shroud Case. *Open Journal of Applied Sciences*, **14**, 2351-2359. <https://doi.org/10.4236/ojapps.2024.149155>
- [32] Bayley, C.C. (1949) Pivotal Concepts in the Political Philosophy of William of Ockham. *Journal of the History of Ideas*, **10**, 199-218. <https://doi.org/10.2307/2707415>
- [33] Clark, D.W. (1971) Voluntarism and Rationalism in the Ethics of Ockham. *Franciscan Studies*, **31**, 72-87.