

Forensic Analysis of the Image and Bloodstains on the Shroud of Turin: Contributions to the Evaluation of the Circumstances Surrounding the Burial of Jesus of Nazareth

Based on the book
**“42 days. Forensic analysis on the crucifixion and resurrection
of Jesus of Nazareth”**

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The present work discusses the scientific information obtained by the Shroud of Turin Research Project (known as STURP and constituted in 1978), the only team that has been able to research directly on the Shroud of Turin, in order to integrate the analytic results within a forensic context that will situate them in relation to the elements that are characteristic of this discipline, and therefore to try to understand the factors and circumstances that might have caused a determined perception of a reality set in a determined context 2000 years earlier. The study does not seek to question religious beliefs nor does it criticize any position or stance different from the historical facts, but rather concentrates on scientific information in order to reach a set of conclusions that explain the events, respecting the different perceptions that can stem from these events.

Regardless of this, we are well aware that the work might be understood differently because, even as early as the beginning of the 20th century, the first scientific theories about the Shroud were met with intense criticism. This situation brought Professor Delagne, a member of the Comparative Anatomy Department at the Sorbonne and also of the French Academy of Sciences, to state, regardless of his well-known agnosticism, that, *“A problem such as this, which is of a purely scientific nature, has been needlessly injected with a question of religiosity. As a result, passions have been inflamed and reason has been clouded. If the matter did not concern Christ but another person, such as Sargon, Achilles, or one of the Pharaohs, no one would have thought about objecting... I see Jesus as a historical figure and can find no reason whatsoever for anyone to make a fuss over the fact that there is still tangible evidence of his life on Earth.”* We consider that the scientific contribution could only enrich the meaning that these events might have from a religious point of view, and serve to differentiate the scientific and religious planes.

The study focuses on the characteristics of the body after the Passion and Crucifixion, and how these became reflected on the cloth that enveloped it. All of this, after having verified that the different scientific studies carried out on the Shroud of Turin confirm that it is a linen from the 1st century, that it was situated in the area where the historical events in question took place, and that it has been documented directly and indirectly practically from the beginning of its history in Jerusalem. To do so, we look to the historical events as they are told in the Gospels, where two different moments and settings pertinent to our study are described. On the one hand, there is Golgotha after the descent from the cross and, on the other, there is the Garden Tomb, where the body was taken to be buried.

In the first setting, the body was totally covered in blood, which the mid-day heat and air must have dried into a dark red, crusty layer that broke apart as the different parts of the body were handled, so that some trickles of blood from the last wounds produced on the cross must have flowed over it. His articulations could hardly be moved, and they maintained the crucified position due to the muscular contraction that tensed and hardened the entire body as that of a sculpture sculpted in time.

The characteristics of the Shroud indicate that this could not have been the cloth that wrapped Jesus' body directly following its descent from the cross. The morphology, the placement of the stains, the image that appears on it, the absence of other impregnations, the placement of the wrinkles, the delimited outline of the blood, the position of the body,... none of these elements are compatible with the characteristics of the Shroud, not with what is actually represented on it, and not with what it should represent had it been used in Golgotha.

The evidence indicates that the Shroud of Turin did envelop the body of Jesus, but that it must have done so under different circumstances, which coincides with the second setting, the Garden Tomb, where he was taken after his descent from the cross.

The body was washed there, a conclusion that has been reached by the majority of experts that have studied the Shroud from the perspective of Forensic Pathology, including Frederick T. Zugibe and Gilbert R. Lavoie. This act, as a previous step to burial, is also in accordance with Jewish law, even though it is true that an exception could be made with people that had been executed.

This was not the case with Jesus of Nazareth. The Shroud reflects, clearly and objectively, the reproduction of all the wounds where the cloth came into contact with the body, which had been completely covered in dry blood. Experiments have demonstrated that this could only have taken place after the washing of the body and the consequent softening of the crusty blood, leaving the wounds exposed and clean, humidified and hydrated by the liquid used for washing. This achieved the double objective of cleansing and dignifying the last act of a loved one, while it fulfilled the requirements of Jewish law, a circumstance compatible with the Gospel story that describes how Nicodemus brought over 100 pounds of myrrh and aloe to Golgotha (John 19:39).

This whole process gave rise to a series of elements whose characteristics – especially those of the bloodstains and of the image itself, due to their appearance and to the mechanism of formation – indicate that contact between the Shroud and the body was not very prolonged. What could have been the reason for such brief contact?

Our hypothesis is that during the process of the preparation of the body, it was discovered that Jesus had not died on the cross. It is not an idea conceived beforehand nor is it a questioning of seemingly inexplicable specific events, but rather the consequence of the study of objective elements that appear on the Shroud of Turin. The arguments are to be found in the Shroud itself and have been divided under two broad headings: On the one hand, the signs that indicate that the body which produced the image was not that of a dead person, and, on the other hand, the evidence of signs that somehow reflect vitality in the elements of the Shroud.

1. ABSENCE OF SIGNS INDICATING THAT THE PERSON ENVELOPED IN THE SHROUD WAS DEAD

When a person dies, a series of changes called abiotic phenomena take place. These refer to the alterations that occur in a lifeless body from the moment when vital biochemical processes cease. When this occurs, it is the environmental factors that passively influence the body, provoking a series of modifications that can be studied to confirm the situation of certain death and to deduce some of the circumstances surrounding it.

The most suitable conditions to conduct these types of studies begin with the examination of the corpse, although sometimes this is not possible and they must be conducted on indirect elements. The circumstances of our study present important limitations, and yet, if we analyze the characteristics of the Shroud in relation to its intimate contact with the body of Christ after the crucifixion, we reach some interesting conclusions about its stiffness, immovability, cadaveric hypostasis, and temperature.

Death too is a dynamic process, and once life is extinguished, cellular and biochemical processes take place at a different rhythm and at different times depending on general and external factors, such as the cause of death and the environmental conditions, and also depending on individual and internal factors, such as can be seen on the different organs or the specific pathological states of the deceased. This means that when we study the evolution of post-mortal processes, we must bear these factors in mind. As far as the case that concerns us, one of the most transcendental elements is the time factor, that is to say, the time elapsed between the descent from the cross and the preparation of the body in the sepulcher.

Death by crucifixion was slow and occurred after a cruel and prolonged agony. Different studies conclude that Jesus' agony lasted a few hours on a progressively debilitated state, so much so that the centurion in charge of hastening his death did not apply the crurifracture, as he had done with the other culprits, but rather stabbed him with a spear, mistaking him for dead, as a way of confirming his expiration.

The evaluation of the signs derived from cadaveric or abiotic phenomena that would indicate the existence of certain death must be made taking into account that the objective element being analyzed, the Shroud of Turin, came in contact with the body about two hours after its descent from the cross.

Under these circumstances, this is the study of the elements that indicate an absence of signs of death:

1.1. Stiffness

After death, under normal circumstances, all of the body's muscles reach a state of relaxation and flaccidity that is maintained for a variable, though not very prolonged, amount of time. After this initial stage, a slow and progressive process of muscular contraction takes place. It is commonly known as cadaveric stiffness or *rigor mortis*, and it affects both striated and smooth muscles.

The process begins within two or three hours of death, usually in the head muscles and continues in a descending manner, although it also depends on the position of the corpse.

Complete stiffness sets in after a period of 8 to 12 hours, and reaches its utmost intensity, to the point of being unable to move the joints, which become fixed by the contracted muscle masses, after a period of 24 hours. At that point, it begins to disappear, a process that becomes obvious 36 to 48 hours after death.

The presence of stiffness and its evolution can have multiple exceptions related to individual factors, to the cause of death, and to the atmospheric conditions. From the point of view of the analysis of the Shroud, the great majority of authors identify a state of stiffness in the figure that can be demonstrated by the partially flexed position of the knees and neck, and also by the muscular contraction that can be observed in the image of the dorsal part of the body where, as Bucklin (1982) and Basso (2000) had pointed out, very little surface has been flattened by the effect of the weight, which is especially surprising in the area of the buttocks. This stiffness has been understood as an objective sign of death, as it has been identified as *rigor mortis*.

A comprehensive analysis of the circumstances that caused the appearance of the image upon the Shroud of Turin, however, reveals elements that have a different meaning.

The information is objective; the image does show signs of stiffness in the position of some joints, as well as a state of muscular contraction. The study of the circumstances surrounding the Passion and Crucifixion of Jesus indicates that, in the hours previous to the final preparation of the body, he suffered multiple traumatismos of severe intensity capable of causing the wounds reflected on the Shroud and of significantly altering his general state, even to the point of disabling him from carrying his gallows to Calvary as the other two culprits did. All of this must have caused symptoms of traumatic shock in which the destruction of muscle tissue played an important role due to the intensity, length, and nature of the scourging.

Traumatic shock produces a widespread reaction independent from the initial cause and sets off a series of metabolic alterations of carbohydrates (increasing the amount of glucose in the blood), proteins, fats, and electrolytes that have a repercussion upon the metabolism. One of the possible electrolytic alterations, a loss of calcium resulting in hypocalcaemia, can increase neuromuscular excitability, especially when calcium levels drop sharply in a short span of time, not due to a maintained chronic situation. The result of hypocalcaemia is a widespread muscular contraction or a muscular hypertony, which can result in symptoms of tetany, alterations that tend to affect the lower limbs with greater intensity. Another sign characteristic of tetany derived from the neuromuscular activity caused by hypocalcaemia is the so-called "midwife's hand", characterized by a muscular contraction in which the hand's interphalangeal articulations are extended, the metacarpophalangeal are flexed, and the thumb's metacarpophalangeal articulation suffers an adduction that "hides" it underneath the hand.

These physiopathological symptoms, compatible with the traumatic situation endured by Jesus, could explain why the stiffness of the image on the Shroud of Turin is different from *rigor mortis*. This circumstance, the existence of cadaveric stiffness, is more difficult to accept if we bear in mind its characteristics.

On the one hand, there are signs of stiffness in articulations such as the ankles, knees and cervical column, the first showing extension (dorsal flexion) and the others flexion. There is also an important widespread muscular contraction capable of leaving the mark of the muscular masses upon the Shroud without causing a flattening effect of the image. These characteristics indicate that processes of stiffness are present throughout the entire anatomy, and that they should therefore be subjected to the characteristics of the process causing the person's death. If

this is so, it is surprising that while the feet, knees, and neck maintain a position compatible with that of a person on the cross, the upper limbs have reached a position different from the adduction and rotation of the shoulders (arms in cross) and flexion of the elbows to a greater or lesser degree. This becomes more difficult to explain when it is caused by a passive process, such as cadaveric stiffness, than when vital mobility takes place, with limitations and difficulty, but subjected to vital processes.

If the stiffness of the image on the Shroud was due to the postmortem processes of *rigor mortis*, we would have to take into account the special circumstances of the cause and context of death and its repercussion on the general evolution of cadaveric stiffness. On the one hand, Brown Sequard explained that when death occurs after significant muscular damage and dehydration, cadaveric stiffness sets slowly and with little intensity. This does not correspond to the Shroud because, even though a short amount of time (approximately 2 hours) would have passed between death and contact with the Shroud, the stiffness seems widespread and marked. We would also have a hard time explaining the characteristics of the image's stiffness from the point of view of muscular weariness or exhaustion because, in these cases, cadaveric stiffness is premature and weak which, again, stands in contrast with the absence of stiffness in the upper limbs and with the persistence of flexion and widespread muscular contraction in the knees and neck, regardless of the manipulation of the body during the washing and preparation before it was covered with the cloth.

Finally, the analysis of the image of the hands also proves to be interesting. Regardless of their posture, which we will analyze later, the length and position of the fingers, with the thumbs tucked beneath the palms, have been explained in the context of a damaged median nerve and of other circumstances, yet the discoveries would be compatible with tetany caused by hypocalcaemia which, as we have already explained, causes the so-called "midwife's hand". The hand appears in a peculiar position, as if making a hollow with its palm or trying to gather water, while also showing adduction of the thumb. It is possible that the cloth, drenched with aromatic substances, adapted itself to the hand in this posture and, afterwards, once it was removed and allowed to dry, the image appeared slightly distorted and showing a longer hand, as it appears on the Shroud.

In conclusion, the analysis of the image on the Shroud of Turin shows certain incompatibilities between the stiffness described and cadaveric stiffness, while it is compatible with hypocalcaemia, which can come about after symptoms of traumatic shock, due to the events surrounding the Passion and Crucifixion of Jesus.

1.2 Hypostasis

One of the most surprising aspects of the image on the Shroud is the similarity between the frontal image and that of the dorsal part of the body, even though the circumstances of the body's contact with the cloth on either side were completely different. The cloth's contact with the dorsal part of the body was longer and more intense, as it took place with the body in supine position upon the extended Shroud. The contact of the body's frontal part with the linen took place when it was draped by the head and drawn progressively from the head to the feet. Therefore, contact with the dorsal part was intimate and close, which could not have been the case with the frontal part, since the only force of contact was provided by the weight of the linen, probably drenched in its central part with the products intended to prepare the body for burial.

Regardless of the different circumstances, the characteristics of the images are very similar, even after subjecting them to fluorescence tests.

Something similar occurs with the wounds, even though the majority of them and the most severe are to be found on the dorsal part, their morphological characteristics can hardly be differentiated from the wounds on the front.

When death occurs, after cardiac activity comes to a stop, a progressive vascular contraction that transfers blood from the arteries to the veins takes place. Once this process begins, the blood becomes subject to gravity, and so it moves to the more inclined and lower areas of the body, which receive a significant volume of blood (depending on the cause of death), and it causes the capillaries on the parts with greater blood flow to the lower parts become weak and pale. This can be seen upon external examination of a dead body, in the stains of a violet red color, similar to that of blood, that are known as cadaveric hypostasis or *livor mortis*.

The transfer of blood to the more lower parts of the body, in supine position as the body was wrapped in the Shroud, would have caused an accumulation of blood in the areas with greater flow, meaning the posterior parts of the body, with the exception of the pressure points, those areas where the body's weight rests, that compress the capillaries and send blood to the neighboring areas not submitted to the same pressure. This process causes the formation of hypostasis, but when skin sores or ulcers exist due to the presence of wounds, the blood accumulated in the wounded areas exit the body through the sores, as hemorrhages or as post-mortal bleeding, and impregnates the entire area.

The characteristics of the wounds suffered by Jesus during the scourging, with their effect on the skin and muscle tissue, and the image which they have left upon the Shroud, which shows remains of the blood surrounding each of the wounds after the body was washed, are not compatible with a postmortem situation, which would have brought on the formation of hypostasis and the resulting post-mortal hemorrhage in the wounded area on the dorsal part of the body. This situation would have caused a big bloodstain on the dorsal figure and, therefore, the absence of an image because, as analyses have demonstrated, there is no trace of an image where bloodstains are present, probably due to the interference with the chemical reaction, which caused alterations in the small fibers and the formation of color.

On the contrary, the wounds appear delimited and confined to the area of contact, with no signs of strong hemorrhaging and with a surprising similarity between the anterior and posterior sides, circumstances that have more to do with a vital process because, even though important hemorrhaging took place during the Passion and all throughout the crucifixion, it could not have caused a hypovolemia strong enough to prevent the formation of hypostasis, especially if we verify that in other parts of the Shroud there are obvious signs of hemorrhages that took place shortly before coming into contact with it (the head, the wound on the side, the wrists, the feet, the trickles of blood in different places, ...)

1.3 Body Temperature

The human being is a homoeothermic animal that maintains its temperature due to a set of exothermic processes. When death occurs and these processes come to a stop, a progressive cooling of the body (already a corpse) begins until the body temperature matches the ambient temperature. This gradual process is known as cadaveric cooling or *algor mortis*.

The decrease of a corpse's temperature takes place after a certain amount of time. At first, there is a plateau of thermal balance that can last up to two hours, and after that, the temperature decreases progressively.

Sometimes this evolution goes through a phase of hyperthermia, an increase rather than a decrease of the corpse's temperature, but this only happens in extraordinary situations provoked by certain causes of death.

In the case of the studies of the Shroud of Turin, the evaluation of body temperature is only an indirect element that may have helped the formation of the image, as it facilitates the diffusion of the products from the contact (weft) side to the external (warp) side. The existence of hyperthermia would have helped the diffusion of the products and contributed to creating a delimited and photographic image, since it would have acted along with the sweat produced by the sympathetic activation of shock which, due to its own composition and to the presence of other products derived from the blood, would have contributed to the formation of the image on the Shroud with the characteristics that we can observe today.

If Jesus had died of traumatic shock with an important hypovolemic component and with the multiple wounds distributed throughout, – especially if we keep in mind that the body was taken to the tomb, a cold and humid hollow in a rock, late in the afternoon, and that it was washed – the body's temperature when it came into contact with the linen must have been inferior to average body temperature. This would have made the diffusion of the degradation products and the formation of the image on the side of the linen that did not come into direct contact with the body rather difficult. If, as we have discussed, he had not yet been dead, his physiopathological characteristics would have more than likely caused a hyperthermia that would have contributed to the formation of the images that we can observe on the Shroud.

2. EVIDENCES OF SIGNS OF VITALITY

Life is characterized by the maintenance of basic functions in order to preserve the homeostasis of the organism, a complex physiological framework with multiple consequences, the majority of which can be studied directly or indirectly through the different means for analysis that have been developed.

The medical forensic study, as opposed to the clinical study, has important limitations imposed by the circumstances of the investigation, and many studies can only be carried out indirectly, based on signs or evidences that are related to a determined situation or event.

From this point of view, we have evaluated the elements of the Shroud of Turin in relation to the absence of signs compatible with a postmortem situation. We will now evaluate, from the same perspective, the meaning of some of the other elements present in the Shroud, which may indicate that they were brought about through vital mechanisms. Both approaches must be comprehensively related to one another, as it is insufficient to choose just one (the absence of signs of death or the evidences of elements of vitality) or, even worse, to reduce the analysis to the isolated consideration of some of these signs.

The main signs of vitality can be seen in the characteristics of the bloodstains, the position of the hands, the general posture of the body, and the muscular contraction.

2.1 Bloodstains on the Shroud

The cessation of life affects all tissue progressively and gradually. Blood undergoes different changes in all of its elements and components, that become more and more distant from their vital characteristics until they fully become post-mortual alterations that can be used to evaluate the date and some of the circumstances of death. This evolution, which also occurs with other tissue as well, is influenced by the elements and context which cause a person's death, so that the individual factors, the cause of death, the physiopathological evolution until death (with a shorter or longer period of agony),... will influence the changes that blood undergoes after death.

Blood becomes very liquid and loses its capacity to coagulate, due to the release of fibrinolytic elements, 30 to 60 minutes after vital functions have stopped. Even so, a slight capacity to coagulate still exists in some cases up to 6 hours after death, and it is possible for a post-mortual clot that cannot be destroyed by fibrinolytic products due to its size to be formed after death by an immediate post-mortual coagulation. Generally, however, within 60 minutes of death, we can see the presence of liquid blood that does not clot or that does so with great difficulty and in an incomplete manner after leaving the blood vessels through a post-mortual hemorrhage. This characteristic is totally different from vital hemorrhages, which still have all of the coagulation mechanisms that allow the blood to coagulate relatively quickly.

The goal of crucifixion was a slow and painful death, and the Romans introduced a series of modifications that made agony the main objective of the sentence, even beyond death itself. Without a doubt, the most documented crucifixion is that of Jesus of Nazareth, including the punishments he suffered during his detention and his posterior judgment and Passion. The documentation has allowed a physiopathological evaluation of the repercussion of these events on Jesus, and has been integrated into the studies of the Shroud. The conclusion of these works has revealed that the different punishments inflicted during Jesus' crucifixion and the specific aggressions that characterized each one of them, both during the Passion and on the cross itself, brought on a traumatic shock in which hemorrhaging and dehydration caused the hypovolemic component to become one of the main physiopathological alterations. If they had resulted in the death of Jesus, hypovolemia and the slow evolution of the process should have facilitated a quick postmortem coagulation and a progressive liquidity of the blood, even though it would have probably been limited by the very circumstances that caused it in the first place.

The bloodstains on the Shroud provide us with important information related to the evaluation of their meaning and how they were produced, bearing in mind the aforementioned circumstances that we have exposed and that situate the evaluation in a global context with relation to the general characteristics of the events.

We will go on to evaluate these elements and their relation to the vital or post-mortual origin of the hemorrhages that produced the stains on the Shroud of Turin.

The bloodstains have been one of the most persecuted focal points of analysis in the studies of the Shroud. With time, most of the questions brought up about them have been answered, although the progress of science, and especially of technology, continuously offers new possibilities.

The evaluation on the whole of the analyses performed on the Shroud has allowed us to distinguish two big groups of bloodstains. On the one hand, there are the stains formed by the exudation of coagulated wounds, which have soaked the cloth upon direct contact and which are basically the wounds caused by scourging and those provoked by the crown of thorns (Adler, 1999). The other stains on the cloth come about by soaking it with liquid blood (Brillante, 2002; Schneider, 2004), a point that Rogers (1978) insisted upon as well. This last author also concluded that the liquid blood in the body came into contact with the cloth on its warp side, the same side on which the image appears, and based his arguments on the fact that the stains on the weft side (the reverse side) were weaker and smaller, characteristics that, according to our preliminary experiments, and as opposed to what has been suggested up to now, appear on the contact side when the Shroud is soaked in oil or oily substances used for the preservation of the body. This is one of the elements of our hypothesis, which considers that during the preparation of the body at the sepulcher, oily substances were also poured on the cloth to help preserve the body. The presence of the oily substances makes the stains weaker on the contact side and, due to the occupation of that side and to the retention of the oil by the threads of the weft, which have a greater absorbing capacity, the blood travels through the capillarity to the other side, where it appears with greater dimensions. The diffusion of the products of the Maillard's reaction in the same direction helped to form an image in the deeper parts of the cloth's weft, thus explaining the negative image of the Shroud.

The evaluation of these stains must originate from the proven fact that the washing of the body was the only way the prints of the wounds inflicted by the whip could have been reflected, but not the stains corresponding to the hemorrhages of the Passion, nor the sweat and dirt of Golgotha. This means that the blood on the Shroud flowed from the body once it had been washed and prepared, which would be difficult to defend if Jesus had already been dead, and the blood had been post-mortal and shed in the manipulation of the body during its preparation.

The characteristics of the bloodstains present and the lack of any other stains that should have been produced in the absence of vitality, together with the results of Adler's (1999) research that discovered a retraction ring on some clots through the analysis of the image in ultraviolet light, or the different color of the stains on the forearms and wrists and their limited extension, which indicate different moments and a possible hemostasis, make the relation with vitality more obvious yet.

2.2 *The Position of the Hands on the Image of the Shroud of Turin*

The evaluation of the position of the hands on the image of the Shroud also makes it compatible with a vital situation.

Two elements stand out in this evaluation. For one thing, we can observe that the left hand covers the right, and that they are placed differently. While the fingers on the right hand are completely extended, those on the left are flexed and seem to hold onto the hand beneath them, which could be a position related to vitality. Also, the characteristics described and the fact that the hands are longer than the anthropometrical proportions should be (Heller, 1983; Whanger, 2005) may have to do with symptoms of tetany from hypocalcaemia caused by traumatic shock and resulting in the so-called "midwife's hand", which causes a semi-flexed position of the palm and an adduction of the thumbs. This could explain the image on the Shroud and the great length of the fingers after having come into intimate contact with the cloth soaked by a liquid substance.

Whatever the case may be, either an attempt to hold the other hand, or a consequence of a muscular hypertony due to hypocalcaemia, the situation would indicate a vital process.

2.3 The Unseen Thumbs

The fact that the fingers appear very well delimited and, on the contrary, the thumbs cannot be seen, has been a debated, controversial issue for some time.

The reasons given to justify the lack of thumbs in the image have been different, but the most widely accepted is an injury of the median nerve caused by pushing the nails through the wrists.

One of the earliest experiments that set out to prove it was done by Pierre Barbet (1937 and 1963), who worked with amputated arms in different ways to try to find the exact place where the nails could have held Jesus' body onto the cross, resisting his weight. He concluded that they were put in through the space of Destot, on the ulnar side of the wrist, and added that this would have affected the trunk of the median nerve.

Barbet's works were important but criticized because they did not coincide with the placement of the wounds on the Shroud. Posterior works, including Zugibe's, revealed that Barbet's description actually did correspond to the nail placement on the wrists, but that it was done on the other side, on the radial part. This placement would allow the nails used in crucifixion to produce an injury of the median nerve, which would have caused intense causalgic pain and limited motor movement of the median muscles, provoking the so-called "preacher's hand", as it reproduces the position of the priest's hand in blessing.

After these new conclusions, it was argued that the thumbs did not appear in the image on the Shroud due to cadaveric stiffness, which would cause the thumb to retract beneath the palm. Recent studies by Zugibe, however, have proven that even if there is an injury to the median nerve, cadaveric stiffness does not provoke a muscular contraction that moves the thumb beneath the hand. Instead, it remains in its usual position, next to the index finger.

When these studies are applied to the Shroud, where the thumbs are hidden beneath the palms, they indicate that the thumb placement is not a postmortem phenomenon, but rather that it can be provoked by a muscular hypertony due to hypocalcaemia produced by traumatic shock. It would therefore be a sign of vitality, as we have previously explained.

2.4 Muscular Contraction

The muscular contraction present in the body of the image on the Shroud of Turin, as we have already explained in the part corresponding to the absence of signs of certain death, is not similar to the circumstances of *rigor mortis* or cadaveric stiffness. The previous point regarding the vital origin of this widespread muscular contraction with different effects on different anatomical regions is further completed with the evaluation of the position of the thumbs beneath the hands, which cannot be justified by cadaveric stiffness in itself or by an added injury of the median nerve, which probably did exist. Both the presence of stiffness and the displacement of the thumbs to the ulnar side of the hand, however, can be explained as vital processes related to neuromuscular hyperexcitability and the resulting hypertony of the muscle masses derived from

hypocalcaemia that traumatic shock, such as that suffered by Jesus of Nazareth, could have caused.

2.5 Position of the Body Enveloped by the Shroud

The image on the Shroud reveals that the body was not completely extended on a flat surface in supine position. We have already discussed the flexion of the neck and knees and the extension of the feet but, besides this position caused by muscular hypertony, the image, where the figure corresponding to the dorsal part of the body is slightly longer than the anterior (the dorsal image measures 202 cm, while the length of the frontal image is only 195 cm), could have only been produced if the body was sitting up slightly and resting on a soft surface, as the studies performed on the Shroud have demonstrated.

These two elements (slight sitting up and resting on a soft surface) are more compatible with the measures applied to an injured person, in order to facilitate their breathing and ease their pain and discomfort caused by the wounds and the forced position maintained during crucifixion, than with the funeral rites performed hastily and meant to honor and purify the body of a deceased person, but whose final destiny was eternal rest upon a flat stone.

The comprehensive analysis of the events based on the objective elements of the Shroud, both on the image and on the stains, although not limited to them but rather including them in historically documented facts, creates an extraordinary situation. Its analysis results in information which allows us to conclude that the different elements characterizing the moments and events that occurred around the sepulcher and ended with the Shroud enveloping the body of Jesus of Nazareth are more compatible with a vital situation, due to the characteristics of the signs that are present and to the absence of signs of death, and also due to their meaning (reclining position and soft surface). They insist upon a situation compatible with life and distance themselves from funerary practices carried out on a dead body.

How those present in the Garden Tomb may have interpreted the events, and what perceptions and feelings grew out of them, is not a part of scientific evaluation, which does not wish to question these events, and we consider that they cannot be questioned by it.

BIBLIOGRAPHY

- Adler A. D.: "The origin and nature of blood on the Turin Shroud", in: "Turin Shroud – Image of Christ?" Proceedings of the Symposium of Hong Kong, 3-9 March 1986, Cosmos Printing Press Ltd., Hong Kong, March 1987: 57-59.
- Adler A.: "The nature of the Body Image on the Shroud of Turin", 1999,
- Adler A. D., "Further Spectroscopic Investigations of Samples of the Shroud of Turin, Proceedings of the 1998 Dallas Shroud Symposium, Michael Minor, ed., Dallas 2000. Also published in "The Orphaned Manuscript," A Shroud Spectrum International Special Issue, Dorothy Crispino.
- Baima Bollone P. L., "Sindone e scienza all'inizio del terzo millennio", Ed. La Stampa, Torino 2000.
- Baima Bollone P. L., Marino C., Pescarmona G.: "Il significato del colore delle macchie di sangue della Sindone ed il problema della bilirubina", *Sindon Nuova Serie*, Quaderno No. 15, Giugno 2001, pp. 19-29.
- Barbet, P., *Les Cinq Plaies du Christ*, 2nd ed. Paris: Procure du Camel de l'Action de Graces, 1937
- Barbet, Pierre. *Doctor at Calvary*. New York: P.J. Kennedy and Sons, 1953; New York, Image Books, 1963.
- Basso R., Bianchini G., Fanti G.: "Compatibilità fra immagine corporea digitalizzata e un manichino antropomorfo computerizzato " Congresso Mondiale "Sindone 2000", Orvieto, 27-29 Agosto 2000 <http://www.iro.umontreal.ca/~latendre/art1.pdf>.

- Biblia de Jerusalén. Ediciones Nauta 1969
- Brillante C, Fanti G, Marinelli E. Bloodstains characteristics to be considered in laboratory reconstruction of the Turin Shroud. IV Symposium Scientifique International du CIELT. Paris, 25-26 Avril 2002
- Buckling R.: The Shroud of Turin: Viewpoint of a Forensic Pathologist, Shroud Spectrum International, N.S., Dec 1982 and Legal Medicine annual, W.B. Saunders, Philadelphia, July 1982
- Fanti G, Schwartz B, Accetta A, et al. Evidences for testing hypotheses about the body image formation of the Turin Shroud. The Third Dallas International Conference on the Shroud of Turin. Dallas, Texas, September 8-11, 2005
- Heller J. H. and Adler A. D.: "Blood on the Shroud of Turin", *Applied Optics*, Vol. 19, No. 16, August 15, 1980, pp. 2742-2744.
- Heller J. H. and Adler A. D., "A Chemical Investigation of the Shroud of Turin," *Canadian Society of Forensic Science Journal* 14 (1981), pp.81-103.
- Jumper E. J., Adler A. D., Jackson J. P., Pellicori S. F., Heller J. H., and Druzik J. R., "A comprehensive examination of the various stains and images on the Shroud of Turin," *ACS Advances in Chemistry, Archaeological Chemistry III*:205, 447-476 (1984).
- Lavoie, GR; Lavoie, BB; Donovan, RVJ and Ballas, JS. Blood on the Shroud of Turin: Part I. Shroud Spectrum International, 7:210, June 1983.
- Lavoie, GR; Lavoie, BB; Donovan, RVJ and Ballas, JS. Blood on the Shroud of Turin: Part II. Shroud Spectrum International, 8:1520, Sept. 1983.
- Lavoie, GR; Lavoie, BB and Adler, AD. Blood on the Shroud of Turin: Part III. Shroud Spectrum International, 20:36, Sept. 1986.
- Lorente Acosta, Miguel. 42 días. Análisis Forense de la Crucifixión y Resurrección de Jesucristo. Aguilar, Madrid 2007
- Rogers R. Research Notebook: Shroud, October 1978.
- Rogers R.. "Scientific method applied to the Shroud of Turin, a review", <http://shroud.com/pdfs/Rogers2.pdf>, 2002 Rogers R. Shroud Science Group communication 2003, 2004.
- Schneider. Shroud Science Group communication 2004.
- Whanger A. D., Shroud Science Group communication 2003-2005.
- Zugibe, Frederick T. Forensic and clinical knowledge of the practice of crucifixion. "A forensic way of the cross". 1998
- Zugibe, Frederick T. The man of the Shroud was washed. *Sindon N.S. Quad. N° 1*. June 1999
- Zugibe F., *The Crucifixion of Jesus, a Forensic Inquiry*, M. Evans & Co. New York 2005.