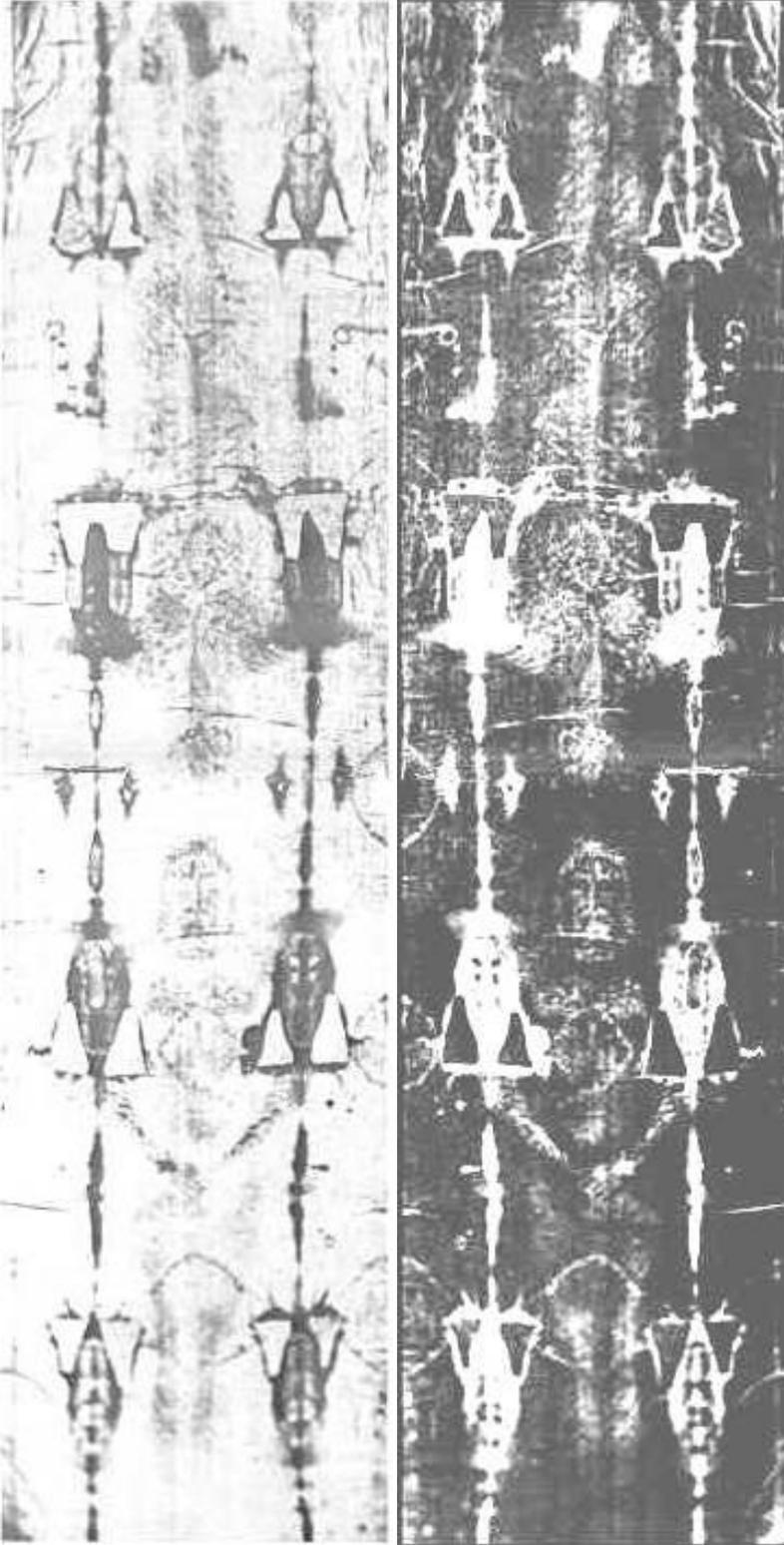


## An Intriguing Problem of Science and History



On this page are two photographs which provide the subject of the article on page 162, by the biologist, Professor Vignon. The one at the left shows a 14-foot length of linen cloth on which are figures thought by some to be the imprints of Christ.

The hypothesis is that Christ, after prolonged suffering and death, was laid on one half of this linen and the other half was folded over lengthwise—note the corresponding, inverted figure of a back at the top. The figures have been explained by natural chemical causes. During intense suffering the perspiration contains increased amounts of urea. Later this breaks down into water plus ammonium carbonate,  $(\text{NH}_4)_2\text{CO}_3$ , the latter again breaking down and giving off the gas  $\text{NH}_3$ —ammonia. The linen Shroud was impregnated with powdered medical aloes (*Aloes socotrina*) used as a preservative. Ammonia reacts with this. Thus were produced the brown stains in the fabric. There is no pigment.

The left-hand illustration shows the Shroud as it actually appears. The black marks were caused by a fire which scorched the Shroud while folded. The white triangles are patches inserted where the Shroud was burned through.

The right-hand illustration is a reproduction of the negative of a photograph of the Shroud. Since the original figure is a negative, the negative of its photograph becomes a positive. Only with the age of photography has it been possible to bring out the much more vivid positive imprint which many believe to be Christ's.

Two problems involved are: First, is this the chemically produced imprint of a being? Second, a historical problem: Was that being Christ? Professor Vignon confines his article to these scientific aspects of the question.

# THE PROBLEM OF THE HOLY SHROUD

By **PAUL VIGNON, Sc.D.**

Professor of Biology at the Institute Catholique, Paris  
Secretary General of the Italian and the French Commissions of the Holy Shroud

Translated from the French by

**EDWARD A. WUENSCHER, C.S.S.R., S.T.D.**



Detail of the face, showing negative imprint and weave of the cloth. The transverse lines are shaded wrinkles. Photo by Cav. G. Enrie.

**I**N 1902 the *Scientific American*<sup>1</sup> reprinted a report which I submitted to the Academy of Sciences at Paris relative to the remarkable cloth known as the Holy Shroud. This cloth, preserved in Turin, Italy, is venerated as the winding-sheet of Christ. Upon it are two figures, which represent the front and the back of a human body and are believed to be the imprints of the Body of Christ. In 1898, when the Shroud was photographed for the first time, it was discovered that the lights and shades of these figures are reversed as in a photographic negative. This led me to make a series of studies and experiments, in which I was assisted by several colleagues at the Sorbonne. Our findings in the laboratory tended to confirm the traditional belief about the figures on the Shroud. On the basis of several historical documents, however, many scholars, Catholic as well as non-Catholic, maintained that the figures (page 148.—*Ed.*) are paintings, dating from about the middle of the 14th Century.

Since then much light has been shed upon the question, both for the scientist and for the historian. In 1931, when a public exposition of the Shroud was held, Cavaliere Giuseppe Enrie made some excellent photographs of the entire Shroud and of all the details of the figures, the work being done in my presence and partly according to my suggestions. During the exposition, which lasted three weeks, we saw the Shroud repeatedly in different conditions of light, for long periods at a time, and on several occasions were allowed to handle it. Afterwards two Commissions were formed, one in Turin and the other in Paris, to study the question from every angle. In 1933, during another exposition of three weeks, the Shroud was again examined by many critical eyes, and the Commissions continued their investigation with additional data to guide them. Though they have not yet completed their work, they have made considerable progress.

It is quite certain that the figures on the Shroud are not paintings of the 14th Century. There are many representations of Christ, notably the image of Edessa, which could have been derived only from the Shroud. A careful study of these copies, which I completed recently, shows that the present Shroud of Turin was in Constantinople during the 12th Century, and that the face

<sup>1</sup> Vol. 86, pages 367-8, May 24, 1902.

visible upon it served as a model for artists as early as the 5th. The artists did not copy slavishly, but tried to interpret the face, translating the mask-like features into a living portrait, which was still a recognizable copy of the original. This disposes of the only positive objection ever brought forward in the name of history.

The figures on the Shroud, in fact, are not paintings at all. As already stated, they are negative images, and the idea of a negative became known only through the invention of photography in the 19th Century. No artist of any earlier period, therefore (certainly none of the 14th Century and, above all, none before the 5th), could have conceived the idea of painting a negative.

The figures, moreover, are very exact negatives. When they are photographed, they appear on the film with the natural proportions of a full-grown man, with a true perspective, with a noble, impressive countenance, and with a minute fidelity to nature even in minor details. Each one of these points involves principles of science and of art which were unknown or poorly grasped until comparatively modern times. It is hard enough to carry out these principles in an ordinary positive painting, in which the lights and shades have their normal values. On the Shroud, they are perfectly illustrated with the lights and shades reversed, though it takes a photograph to reveal the fact. Even today no artist can paint so exact a negative. No artist, in fact, has yet succeeded in making an exact copy of the negative figures on the Shroud, though competent artists have made the attempt.

**S**INCE the figures are not paintings, since they could not have been produced by any other artificial means, it remained to investigate whether they could have been produced by some natural process. After analyzing the first photographs of the Shroud and making our experiments in the laboratory of the Sorbonne, we concluded that the figures are the direct imprints of a human body. It was obvious at once that they were not produced by mere contact, for contact between the pliable cloth and the irregular surface of a human body would have caused considerable distortion, and there is little or no distortion in these figures. They could have been produced only by the action of vapors given off from the surface of a body, the action being most energetic where the reliefs of the body touched the cloth or were very close to it, less and less energetic at the concavities and the sides as the distance between the body and the cloth increased. That is why the resulting stains have such a delicate diffusion, shading off gradually till they fade away entirely. That, too, is the reason why the figures are negatives, the reliefs having caused a darker stain than the cavities and the depressions.

With the aid of Lieutenant-Colonel Colson, then Professor of Physics at the Ecole Polytechnique, I was able to determine what kind of vapors had acted on the cloth: humid ammoniac vapors, resulting from the fermentation of urea, which is exceptionally abundant in the sweat produced by physical torture and by fever. We also determined that the vapors had reacted with aloes, which were spread on the cloth and sensitized it to the action of the vapors. The detail photographs show that the aloes were in powder form. In my experiments I found that it was sufficient—favorable, in fact—that only a small amount of the aloes should remain on the cloth. I obtained imprints like those on the Shroud by placing cloths prepared with aloes over plaster figures soaked in a solution of ammonia. I proceeded in this way because it is impossible to have a human body in the requisite condition—one recently done to death by torture, as was the body which caused the imprints on the Shroud.

The conclusions which we reached after our first investigation have been confirmed by the new evidence derived from the two examinations of the Shroud itself, from the more exact photographs taken in 1931, and from subsequent experiments by members of the Commissions. It is now established also that there are particles of blood on the Shroud, so well preserved that they still show the composition of the blood. Beyond doubt, the two figures on the Shroud are the imprints of a human body.

This body was evidently that of a man who was crucified. The wound in the hand which can be seen (page 148) is placed (contrary to the universal practice of art) where the anatomy of the hand requires. Before crucifixion the man was scourged. From the markings I have reconstructed the scourge that was used. It was the kind called *flagellum*, having two or three thongs, each of which was provided with a metal ball at the end and with another about an inch and a quarter from the end. The man was also wounded about the head, as is shown by the trickles of blood and by several distinct punctures on the brow. There is a wound in the right side, such as would be caused by the stroke of a lance. Pierre Barbet, M.D., of the French Commission, has shown that the weapon entered between the fifth and the sixth rib and pierced the right auricle of the heart. The doctors of both Commissions are agreed that serum flowed from this wound with the blood, and that this is a sure sign that the man was dead when the wound was inflicted.

Briefly, the imprints on the Shroud are those of a man who was tortured exactly as is recorded of Christ in the Gospels. But was this man really Christ? In the present state of the question, this [material missing].

At the very outset it would seem that these cannot be the imprints of Christ. On the brow and at the back of the head there are the traces of many small drops of serum, indicating the first stage of decomposition. Of Christ, however, it is written that He was not to see the corruption of the grave. This is true; but just as the death of Christ resulted from natural causes, so was His dead Body subject to the operation of natural causes as long as He remained in the tomb. These signs of an incipient decomposition, therefore, are no difficulty.

Neither is there any difficulty in a cloth being preserved intact for 19 centuries. The Shroud, which is made of linen, is actually in a good state of preservation, except where it was damaged by fire;<sup>2</sup> but there are Egyptian linens 3000 years old which are still as good as new. There is just as little difficulty in the fact that the Shroud is woven in a twill pattern, for the ancients wove twilled fabrics of excellent workmanship, and the art of weaving was highly developed at the beginning of the Christian era.



How the face appears when the lights and shades are reversed by photography. Above the head is a water stain. Photo by Cav. G. Enrie. © 1935, Redemptorist Fathers of New York.

<sup>2</sup> This fire occurred at Chambéry, France, in 1532. The Shroud was folded several times in a silver case and was scorched along the edge of the folds, whence the two dark lines enclosing the imprints. One corner of the folds was burned through by a portion of molten silver where the triangular patches now are. The Shroud also received several water stains.

**B**UT there are gaps in the history of the Shroud. We have no complete record by which we can trace this cloth back to Christ. At most, this is a negative objection. For one thing, there were various reasons, of prudence and of religion, for the silence of the very first centuries. It is very likely, too, that early documents referring to the Shroud were lost or destroyed. The copies of the Shroud, however, to which I referred above, supply to a great extent for the lack of written records, since they prove that our present Shroud, with the imprints, existed at the beginning of the 5th Century. A text from the "Illatio," the Preface of the ancient Spanish Liturgy for the Saturday after Easter, shows that it was known in Spain in the second half of the 7th Century that the Shroud of Christ bore the imprints of His Body. A cloth which was venerated as the Shroud of Christ was preserved for many years in the Imperial Palace at Constantinople. Here it was not put on exhibition; but about 1203, when it was kept in the famous chapel of Our Lady of Blachernes, it was stretched out at full length every Friday, so that all could clearly see "the figure of the Lord." In 1204, when Constantinople was pillaged by the Crusaders, the Shroud disappeared. About 1355 we again find it, at Lirey, near Troyes in France. This was undoubtedly our present Shroud, for from this point onward it has a clear and continuous history. There are no documents to prove that it is the same as the Shroud of Constantinople, but certain copies of the Shroud, made at Constantinople prove it, and prove it despite the silence of Lord Geoffrey I de Charny, who brought the Shroud to Lirey, as to how it had come into his possession. It is to the point, moreover, to note that Lord de Charny went to the Orient as a Crusader in 1346.

In 1453 the Shroud was entrusted to the care of Duke Louis I of Savoy, residing at Chambéry. Ever since then the House of Savoy, now the Royal House of Italy, has guarded it with the greatest honor. In 1578 the then reigning Duke of Savoy had it transferred to Turin, where it is now enshrined in a magnificent chapel adjoining the cathedral.

History, then, does not prove that the Shroud of Turin is the identical cloth in which the Body of Christ was wrapped, though it does show that it has [material missing] not depend upon extrinsic sources, however, to decide the question. The Shroud itself, by reason of those remarkable imprints, is a document of the highest value, which the eye of science can read as clearly as if it were a manuscript written and signed by him who caused the imprints.

Before reaching a final conclusion we considered this question: Can the imprints be those of some other person besides Christ? In the end we had to grant that this is impossible. All the conditions necessary to produce the imprints were fulfilled in Christ, and could not have been fulfilled in anyone else.

**T**HE imprints show that the man was scourged, crowned with thorns, crucified, and pierced through the side. From the Gospels we know that all this was done to Christ as the result of exceptional circumstances. It is hardly likely, therefore, that the same series of outrages was inflicted on someone else. The man, moreover, was already dead when his side was pierced, as is shown by the blood and serum which flowed from the wound. The Gospels state that Christ was dead for about an hour when the soldier drove the lance into his side—"and immediately there came forth blood and water." It is still less likely that this occurred in some other case, the more so since it was something unusual in connection with crucifixion.

The manner in which the body was enclosed in the Shroud was also exceptional. It was customary for the ancients to wash and anoint a corpse and to swathe it in linen bands, besides

wrapping it in a shroud. In this case the corpse was simply enveloped in the long sheet,<sup>3</sup> upon which there was a certain amount of powdered aloes; and though the corpse was covered with sweat and blood, it was not washed or otherwise prepared for burial. This is exactly what happened with the Body of Christ. It was laid in the tomb enveloped only in the "clean linen cloth," just as it was when taken down from the cross. With the cloth there was a mixture of spices containing aloes, which were in powder form when used for such a purpose in the ancient Orient. The Body of Christ was treated in this summary fashion because the Sabbath was about to begin, making it necessary to postpone the ritual burial. It is hard to imagine the same combination of circumstances and apparent accidents in any other case.

Finally, the body could not have been enclosed in the Shroud long enough for decomposition to advance beyond the first stage, otherwise the imprints would have been destroyed. The Gospels relate that this condition was fulfilled by Christ, but only because He rose again, about 30 or 35 hours after His Body was laid in the tomb. In any other case someone would have had to remove the Shroud at exactly the right time and after all the other conditions were fulfilled, which seems quite impossible.

**BEFORE** publication of the accompanying article was undertaken, a survey of some of the sources of information as presented elsewhere was made—sufficient, it was believed, to justify publication. (Rev. Herbert Thurston, opponent of the Shroud, states in the "Catholic Encyclopaedia" that many articles have been published concerning the Shroud. Of books there are: Beecher, "The Holy Shroud;" Barnes, "The Holy Shroud;" Vignon, "The Shroud of Christ;" Hynek, "Science and the Holy Shroud.") However, publication must not be taken to imply that this magazine takes sides with regard to the question of the Shroud.—*The Editor*.

If, then, we take all the conditions which were necessary to produce the imprints, it must be granted, I think, that the data of the Shroud, with the Gospels as a key, are a means of identification as sure as a photograph or a set of fingerprints. It was Christ who left His imprints on this cloth, with a vivid record of the drama of Calvary, and with His true likenesses hidden in the stains till photography revealed it again to the world.

Though the main question is believed to be settled, the Shroud still presents some scientific difficulties. One of these is the fact that the rendering of the face is much more perfect than that of the rest of the body. It is finer, more detailed, more precise—so much so, in fact, that when the scale of values is reversed by photography, this "death-mask" stands out with the harmony and the contrasts of a living face—majestic, forceful, and still retaining an expression of deep sorrow. Why the

imprints of the face should have such a superior quality, and how so startling an effect could be produced by such simple means as vapors reacting with aloes, is something which we have not yet been able to explain.

The clots of blood present another difficulty. Many of them had already dried on the surface of the body, and yet they were transferred to the Shroud. I account for this by the fact that the fibrin of coagulated blood dissolves in a humid ammoniac medium, such as surely surrounded the Body of Christ in the tomb. After the dry clots were sufficiently dissolved they were transferred to the Shroud. I have obtained similar prints of clotted blood on cloth in this way. What puzzles us, however, is the perfection of the clots which were transferred to the Shroud. They are so complete and so minutely exact that they may be called "portraits of blood." Though I carefully supervised my experiments and used small pieces of select cloth, I could obtain only imperfect

<sup>3</sup> The Shroud is 3 feet 7 inches wide and 14 feet 3 inches long. It was once longer, for the Emperors of Constantinople distributed as relics pieces cut off from the ends.

prints, failing always either by excess or by defect. Here, on the contrary, all the clots, including the serum, are rendered with photographic accuracy.

One may ask, too, how the long sheet of soft linen could have been distended evenly enough to receive all those exact images of the reliquified clots. And why is it that the dry blood did not scale off from the cloth in the course of the centuries? It is still intact, even at those points where it accumulated in some quantity.

The clots which were transferred to the Shroud after being reliquified have the same color as the liquid blood which came upon the Shroud directly. This occurred, for example, where the blood flowed from the wound in the side after the Body was laid in the tomb.<sup>4</sup> This blood flowed over the side and across the arched loins, falling upon the little transverse creases in the Shroud. From the feet also liquid blood stained the Shroud directly, flowing along the soles toward the heels and onto the Shroud. This flow of blood resulted from the opening of the wounds by the extraction of the great nail, which pierced both feet at once. But the color of all this blood raises a new problem. It is a sort of dull carmine, whereas very old blood becomes brown. Here, then, is another riddle, but not an objection. The more perfect and minute all the stains and particles of blood are, and the more closely we can analyze them, so much the more is it impossible to represent these things in a painting, or to reproduce them by any artificial means.

**I** HAVE given only a hint of the vast field which the Shroud opens to the investigation of science, archeology, and history. I could give other data on these marvelous imprints, and point out other difficulties still to be solved. There is room for further research along many lines; but though the difficulties may remain, they leave unshaken the important fact that the Shroud bears the imprints of Christ, bringing to us from the distant past the true likeness of Him who so profoundly stirred the world and influenced the course of history.

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<sup>4</sup> This was a second flow of blood from the side, and it came from the *vena cava inferior*. The first flow, from the right auricle of the heart, came immediately after the stroke of the lance. It caused the dark stain on the front of the body, having clotted there while the dead body was left hanging on the cross.