

Science and the Shroud of Turin

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Magis Center of Reason and Faith

Introduction

The Shroud of Turin is a burial shroud (a linen cloth woven in a 3-over 1 herringbone pattern) measuring 14 ft. 3 inches in length by 3 ft. 7 inches in width. It apparently covered a man who suffered the wounds of crucifixion in a way very similar to Jesus of Nazareth. (Notice the position of the blood stains—the bold brown color—in relation to the image of the body—the fainter sepia hue—in Figure 1 below).

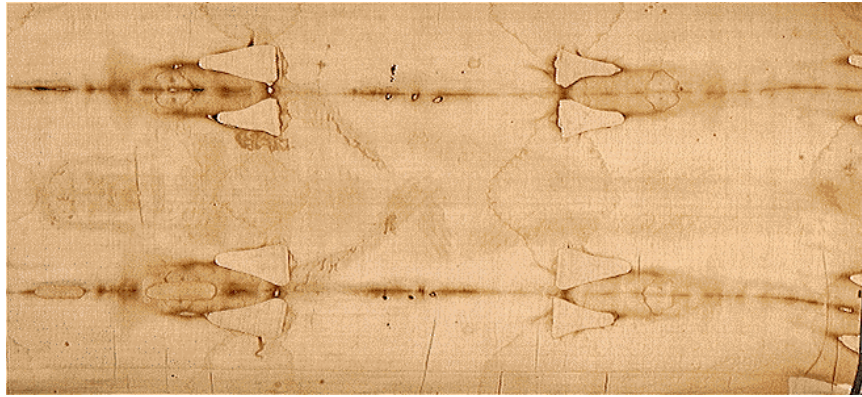


Figure 1

The cloth has a certifiable history from 1349 when it surfaced in Lirey, France in the hands of a French nobleman – Geoffrey de Charny.¹ It also has a somewhat sketchy traceable history from Jerusalem to Lirey, France – through Edessa, Turkey and Constantinople.² This

¹ This history is recounted in Appendix I (Section I) of a forthcoming book *God So Loved the World: Clues to our Transcendent Destiny from the Revelation of Jesus* (Ignatius Press -- coming 2016). The history is well captured in Wilson, Ian. 1978. *The Shroud of Turin* (New York: Doubleday).

² This history is recounted in Appendix I of my forthcoming book *God So Loved the World: Clues to our Transcendent Destiny from the Revelation of Jesus* (Ignatius Press – coming 2016). There are six important sources of this history: De Gail, Paul. 1983. “Paul Vignon” in *Shroud Spectrum International* 1983 (6) (<https://www.shroud.com/pdfs/ssi06part7.pdf>).

John Long 2007 (A) “The Shroud of Turin's Earlier History: Part One: To Edessa” in *Bible and Spade* Spring 2007 (<http://www.biblearchaeology.org/post/2013/03/14/The-Shroud-of-Turins-Earlier-History-Part-One-To-Edessa.aspx>).

John Long 2007 (B) “The Shroud of Turin's Earlier History: Part Two: To the Great City” in *Bible and Spade* Fall 2007 (<http://www.biblearchaeology.org/post/2013/03/20/The-Shroud-of-Turins-Earlier-History-Part-Two-To-the-Great-City.aspx>).

John Long 2013 (A) “The Shroud of Turin's Earlier History: Part Three: The Shroud of Constantinople” (<http://www.biblearchaeology.org/post/2013/03/28/The-Shroud-of-Turins-Earlier-History-Part-Three-The-Shroud-of-Constantinople.aspx>). See also Ian Wilson *The Shroud of Turin* 1978 p. 156.

history is confirmed by the pollen grains found by Max Frei, the coincidences between the Shroud and the Sudarium (facecloth) of Oviedo, and the coincidences between the Shroud's seven unique facial features and those attributed to the Mandylion – the Holy Image of Edessa.

The Shroud has undergone considerably more scientific testing than any other relic in human history. The 1978 STURP Investigation and subsequent investigations were remarkably thorough, and with the exception of the questionable 1988 carbon dating, all the evidence points to its being the burial cloth of Jesus:

1. *Four contemporary dating tests:* The vanillin dating test of Dr. Raymond Rogers, the two spectroscopic analyses (of Dr. Giulio Fanti, et. al), and the compressibility and breaking strength tests (of Dr. Giulio Fanti, et. al) date the Shroud to a time commensurate with the life and crucifixion of Jesus (see below Sections II and III).
2. *Three kinds of extrinsic dating evidence:* Testing of pollen samples by Dr. Max Frei, roman coins on the eyes of the image on the Shroud, and 120 coincidences of blood and fluid stains between the Shroud and the Sudarium (Facecloth of Oviedo) give evidence of a date and location of the Shroud's origin similar to that of Jesus (see below Section IV).
3. *The blood stains on the Shroud:* The blood stains tell a story very similar to the highly unusual crucifixion of Jesus of Nazareth – they were imprinted on the Shroud before the image was made (the opposite of what would need to be done by a forger – see below Section I).
4. *Formation of the image on the Shroud:* The image was not formed by dyes, chemicals, vapors, or scorching. The only known explanation for the formation of the image is an intense burst of vacuum ultraviolet radiation (equivalent to the output of 14,000 excimer lasers) emitted from every three-dimensional point of the body in the Shroud (see below Section V).

As will be seen, the combination of the above evidence is exceedingly difficult to explain in any way other than the burial cloth being that of Jesus of Nazareth. Moreover, the formation of the image by an intense outburst of vacuum ultraviolet radiation is suggestive of a resurrection event similar to that described in the Gospels. The above scientific evidence requires that a new carbon dating test be done which observes the standard protocols for sampling. When these protocols are observed, it would be surprising if the result was not similar to the results of the four new dating methods mentioned above – approximately 50 A.D. If this result is obtained, it would indicate that the Shroud of Turin is very likely the burial shroud of Jesus Christ with evidence suggestive of His resurrection in light.

I. The Blood Stains in Relation to the Image

John Long 2013 (B) "The Shroud of Turin's Earlier History: Part 4: To Little Lirey"
(<http://www.biblearchaeology.org/post/2013/09/05/The-Shroud-of-Turins-Earlier-History-Part-4-To-Little-Lirey.aspx>).

The Shroud has deposits of real human blood. Dr. Alan Adler (expert on porphyrins: the colored compounds seen in blood) and Dr. John Heller (physician) studied the blood flecks gathered on the STURP (Shroud of Turin Research Project) tapes in 1978. They compared the porphyrin with the spectra of blood spots, and determined that the blood on the Shroud is real.³ Furthermore, as Dr. Raymond Rogers (leading expert in thermal analytical chemistry) notes:

The x-ray fluorescence spectra taken by STURP showed excess iron in blood areas, as expected for blood. Microchemical tests for proteins were positive in blood areas but not in any other parts of the Shroud.⁴

Some researchers have found that male DNA and an AB blood type are also present on the cloth. Though genetic testing confirms these findings, there is no guarantee that they belong to the man on the Shroud. The samples are so old and the possibility of contamination so great, that they could have originated with someone else.⁵ However, the blood stains on the Shroud match those of the Sudarium (facecloth) of Oviedo which touched the same face (see below Section IV.C). The match of the blood stains themselves, the blood type, and the male genetic character suggest that these characteristics came from the same face that touched both cloths (see below Section IV.C).

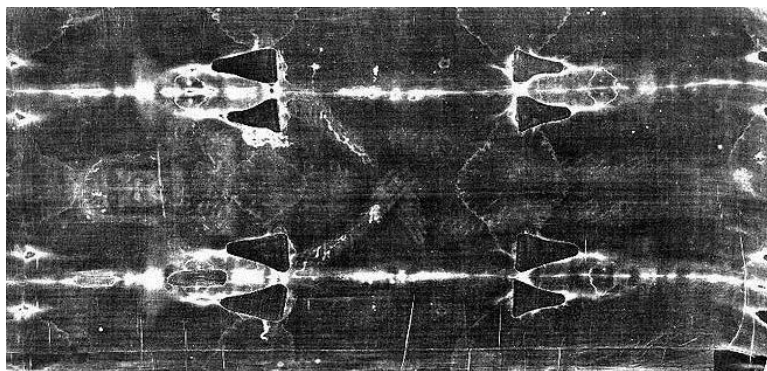


Figure 2

The image on the Shroud is anatomically perfect and a perfect photographic negative (See Figure 2). The image was formed after the blood stains congealed on the cloth, and the image and blood stains, relative to one another, are anatomically correct. The odds of a 13th Century forger being able to place blood in a precise way on the cloth without an existing image is highly unlikely – making the forgery hypothesis somewhat dubious from the outset. The image was not produced by any paint, dye, powder, or other artistic chemical or biological agent and has no brush strokes. This was confirmed by multiple tests which were overseen by Dr. Raymond Rogers who noted:

The Shroud was observed by visible and ultraviolet spectrometry, infrared spectrometry, x-ray fluorescence spectrometry, and thermography. Later

³ See John Heller and Alan Adler “Blood on the Shroud of Turin” in *Applied Optics* 19 (16) 1980 pp 2742-2744.

⁴ Raymond Rogers *Shroud of Turin Guide to the Facts*. <https://shroudstory.wordpress.com/2012/02/26/introduction-to-ray-rogers-shroud-of-turin-faq/> Question #2.

⁵ See *ibid* Question #2.

observations were made by pyrolysis-mass-spectrometry, lasermicroprobe Raman analyses, and microchemical testing. No evidence for pigments or media was found.⁶

There are some microscopic particles of paint on the cloth unrelated to the image, but these are explained by a medieval custom called “sanctification of paintings” in which an artist would paint a copy of the Shroud and then touch the painting to the Shroud to sanctify it. This contact led to the transfer of some microscopic particles of paint onto the Shroud which moved around it when the Shroud was folded and rolled.⁷

Inasmuch as the blood is real, and the image was not produced by a medieval forger (see below Section VI), the Shroud seems to have enveloped a *real* man who was crucified in a similar way to Jesus of Nazareth – who underwent a very unique kind of crucifixion – including being crowned with thorns (pertinent to the charge leveled against Jesus to be “king of the Jews” – Jn 19: 2-3), being flogged (which Pilate ordered for Jesus before presenting him to the crowds – Jn 19:1-5), and being pierced in the side by a spear similar to a Roman pilum (which was thrust into Jesus’ side to assure that he had already died – Jn 19:34). The precise nature of the torments undergone by the man on the Shroud is detailed by Dr. Pierre Barbet in his famous work *A Doctor at Calvary*.⁸

The confluence between the Shroud and the Gospels is so close, it is difficult to imagine how it could be anyone other than Jesus. But we are getting ahead of ourselves here, for we still have to present the evidence for this claim coming from the multifold scientific investigation of it.

II. Dating the Shroud

Prior to the 1988 Carbon 14 dating, the Shroud was considered by many experts to be the authentic burial cloth of Jesus -- for the reasons mentioned above. Some physicists also thought that it might indicate his resurrection, because of the way in which the image was likely formed (see below Section V). Furthermore, the presence of pollen grains dating back to First Century Palestine (see below Section IV.A) and the presence of Tiberian coins minted in Judea in 29 AD -- on the eyes of the man in the Shroud (see below Section IV.B) indicated an origin of the Shroud around the time of Jesus’ death. Then came the 1988 Carbon testing which showed a date of origin between 1260 and 1390 AD (around 1350).

Since the laboratories involved in the 1988 Carbon 14 test were beyond reproach and the fibers taken for the test *seemed to be* from the Shroud itself (and not from thread or cloth used to mend the Shroud or provide a backing for it), the result appeared unquestionable – which cast doubt on all the evidence mentioned above. Though Carbon 14 testing is by no means

⁶ See *ibid* Question # 1.

⁷ See John Iannone “The Shroud of Turin – Evidence it is Authentic” in *New Geology*. (<http://www.newgeology.us/presentation24.html>).

⁸ Pierre Barbet, *A Doctor at Calvary: The Passion of Our Lord Jesus Christ as Described by a Surgeon* (New York: PJ Kennedy) 1953.

incontrovertible⁹ and there were significant problems following the protocols for the 1988 test, the result shocked most of the 1978 STURP committee of scientists as well as the religious community.

The negative result of the 1988 Carbon 14 test did not discourage researchers who felt that the evidence for the Shroud's authenticity was too great to simply be abandoned in the face of one negative test that could be fallible for many reasons. Ironically, this led to a resurgence of new creative Shroud research which gave rise to four new testing methods (see below Section III), comparisons with the Sudarium of Oviedo – the facecloth of Jesus (see below Section IV.C), and new studies of the image formation on the Shroud (see below Section V). This new research seriously calls into question the result obtained from the 1988 Carbon 14 test because it overwhelmingly shows that the Shroud not only dates back to the time of Jesus, but also could not have been a forgery, and possibly shows a “relic” of his resurrection. At the very least, this calls for a new Carbon 14 dating test to be performed with all of the standards recommended by the scientists who found flaws in the 1988 procedure -- Raymond Rogers, Giulio Fanti, Leoncia Garza-Valdez, Stephen J. Mattingly, John Jackson, and Mario Moroni (see below Section II).

At present the preponderance of scientific and historical evidence favors the authenticity of the Shroud. In fact, the preponderance is so great that a change in Carbon 14 dating should be expected from new tests – with the swing back in time of approximately 1,000 to 1,600 years from the date given by the 1988 carbon testing (1260-1390). This would put the date of the cloth between 250 BC and 350 AD (see below Section III). Thus, the mean predictable date of the Shroud's origin would be approximately 50 AD – quite near the time of Jesus' crucifixion.

As noted above, the 1988 Carbon 14 testing showed that *the fibers removed from the Shroud* were 638 years old (with a probable origin at around 1350). Note that this test did not show that the *Shroud* originated in 1350 A.D., but only that the fibers extracted from the Shroud (which could have come from threads or cloth used to mend it after the fire of Chambery in 1532). As we shall see, the fibers removed from the Shroud were probably not from the original Shroud, but from dyed cloth added to the Shroud at that time. Furthermore, the testing did not account for microbiological contaminants or the additional carbon that would have been added by the fire. These problems indicate that the 1988 Carbon 14 testing was very likely invalid and skewed toward a much later date.

At the very outset, there were problems associated with the sampling of fibers used for the 1988 Carbon 14 test. The STURP team recommended that seven different samples from different parts of the Shroud be sent to seven labs across Europe and the United States. This was inexplicably changed. Instead of taking fibers from many parts of the Shroud, the samples were taken from a single strip from a questionable part of it. This one sample was divided into three parts and sent to only three labs. To make matters worse, chemical and microscopic testing on the single strip was not performed (even though there were experts present who could have done so). Though arguments broke out about these problems, the samples were sent to the three labs which no doubt performed the tests professionally. The problem was not with the Carbon 14 testing, but rather with the gathering of the samples.

⁹ See William Meacham “Carbon14 Debate from the Shroud Newsgroup: alt.turin-shroud” (<http://www.shroud.com/c14debat.htm>) 1998.

We now turn to the three discoveries that challenge the validity of the 1988 Carbon dating:

1. Problems with the samples used to make the tests (discovered by Dr. Raymond Rogers) – Section II.A.
2. Microbiological contaminants producing additional carbon content that were not removed prior to the 1988 testing (discovered by Drs. Garza-Valdes and Mattingly) – Section II.B.
3. Additional carbon content embedded in the Shroud from the fire of Chambery and other carbon contaminants (discovered by Kouznetsov and Jackson—and modified by Moroni and associates) – Section II.C.

II.A

Raymond Rogers on Aberrant Samples used in the 1988 Carbon 14 Testing

Though the Carbon 14 testing at the three laboratories at the University of Arizona, University of Oxford, and University of Zurich were done very professionally, the collection of the sample to be tested was seriously flawed in two respects. First, the sample came from a *single* strip from a *single* site on the Shroud. According to Rogers:

The use of a single sample, assuming it was representative of the whole cloth, defied normal procedures and protocols established before the radiocarbon study. It was a serious mistake.¹⁰

Though this single sample seemed to avoid the many patches and charred areas (from the fire of Chambery), there was no guarantee that it represented the *original* part of the cloth. Such a guarantee could have only come from following ordinary protocols – namely, obtaining fibers from *multiple* sites of the cloth.

Secondly, the two scientists charged with certifying the originality of the single strip (Franco Testore, professor of textile technology at the Turin Polytechnic, and Gabriel Vial, curator of the Ancient Textile Museum, Lyon, France) approved the single sample for Carbon 14 testing without making any serious chemical or microscopic characterization of it.¹¹

These two flaws in the collection procedure made it impossible to guarantee the validity of the sample by normal Carbon 14 sampling protocol. Indeed, the procedure was wide open to an invalid sample which Rogers later discovered to be the case:

The area where the radiocarbon sample was obtained had been photographed in 1978 with an ultraviolet source... While making the UV photographs, the source was heavily filtered to exclude visible light and the camera was heavily filtered to exclude any effect of the UV on the film... The area where the radiocarbon sample was taken is relatively dark, a fact that is not the result of dirt, image color, or scorching. The cloth is much less fluorescent in that area,

¹⁰ Raymond Rogers *Shroud of Turin Guide to the Facts*, Question #5.

¹¹ *Ibid* Question #5.

brightening into more typical fluorescence to the right. The photograph proves that the radiocarbon area has a different chemical composition than the main part of the cloth. This was obviously not considered before the sample was cut.¹²

The ultraviolet photography should indicate fluorescence where the Carbon 14 sample was taken – if it were free of dyes (like the other parts of the cloth). However, the 1978 UV photography shows that the sample was taken from a darkened (non-fluorescing) area which suggests the presence of a darkening agent – such as dye.

Rogers and Adler discovered the chemical source of this darkening through further analysis. According to Rogers:

I found that the radiocarbon sample was uniquely coated with a plant gum (probably gum Arabic), a hydrous aluminum oxide mordant (the aluminum found by Adler), and Madder root dye (alizarin and purpurin). *Nothing similar* exists on *any other* part of the Shroud. The photomicrograph shows several fibers from the center of the radiocarbon sample in water. The gum is swelling and slowly detaching from the fibers.¹³

Rogers explained the significance of this discovery in an important article published in the peer-reviewed journal *Thermochimica Acta* in 2005:

A gum/dye/mordant [(for affixing dye)] coating is easy to observe on radiocarbon [sample] yarns. No other part of the shroud shows such a coating. [This indicates that] The radiocarbon sample had been *dyed*. Dyeing was probably done intentionally on pristine replacement material to match the color of the older, sepia-colored cloth. The dye found on the radiocarbon sample was not used in Europe before about 1291 AD and was not common until more than 100 years later. Specifically, the color and distribution of the coating implies that repairs were made at an unknown time with foreign linen dyed to match the older original material. The consequence of this conclusion is that the radiocarbon sample was not representative of the original cloth. The combined evidence from chemical kinetics, analytical chemistry, cotton content, and pyrolysis-mass-spectrometry *proves* that the material from the radiocarbon area of the shroud is significantly different from that of the main cloth. The radiocarbon sample was thus not part of the original cloth and is invalid for determining the age of the shroud.¹⁴

Rogers' results speak for themselves. If the sample was drawn from a piece of linen which was dyed in the 14th Century (by a dye available in Europe only after 1291), one should expect a carbon dating result from the 14th Century – in *all three labs* which took fibers from the same

¹² Ibid.

¹³ Ibid.

¹⁴ Raymond N. Rogers. 2005. "Studies on the Radiocarbon Sample from the Shroud of Turin." *Thermochimica Acta*, Vol. 425, Issue 1-2, January 20, 2005. pp. 189-194. Italics mine.

dyed strip used for the sample. As yet, there has been no scientific response to rebut Rogers' chemical and microscopic analysis and his contention that the sample came from fabric of much later origin.

II.B

Garza-Valdes and Mattingly on Microbiological Contaminants

Dr. Leonicio Garza-Valdes (professor of archaeology and pediatrics) in conjunction with Dr. Stephen J. Mattingly (renowned microbiologist) discovered a bioplastic coating of bacteria and fungus on the linen fibers (60% by weight) caused by living microbes that absorb and add C14 to the cloth and thereby skew the date by several centuries. These microbes were not known at the time of the 1988 test and were not removed by the C14 cleaning protocol.

In the Journal of the University of Texas Health Science Center at San Antonio, Jim Barrett reported on the research of Garza-Valdes and Mattingly:

Dr. Garza said the shroud's fibers are coated with bacteria and fungi that have grown for centuries. Carbon dating, he said, had sampled the contaminants as well as the fibers' cellulose.¹⁵

Barrett also interviewed Dr. Harry Gove (co-inventor of the use of accelerator mass spectrometry for carbon dating and professor emeritus of physics at the University of Rochester in New York) who noted: "This is not a crazy idea. A swing of 1,000 years would be a big change, but it's not wildly out of the question, and the issue needs to be resolved."¹⁶

II.C

Kouznetsov, Jackson and Moroni on Carbon Contaminants

The Fire-Model Tests of Dr. Dmitri Kouznetsov in 1994 (and Drs. John Jackson et al. in 1998), replicated the Chambery Fire of 1532. They showed that the fire added carbon isotopes to the linen.

Later tests, principally by Mario Moroni and associates showed that Kouznetsov's and Jackson's estimates of elevated carbon seemed to be exaggerated. In Moroni's model, the carbon content from the fire would have only made the age of the Shroud younger by 300 years. This means that the Shroud's date of origin -- calculated from the result of the 1988 Carbon 14 testing -- should be 1050 instead of 1350. Antonacci reported the team's findings as follows:

Moroni's fire model results yielded a 300 year younger result with a pretreatment method that removed 37 percent of the original sample.¹⁷

¹⁵ Jim Barrett 1996. "Science and the Shroud Microbiology Meets Archaeology in a Renewed Quest for Answers" in *The Mission* (A Journal of the University of Texas Health Science Center at San Antonio) Spring 1996.

¹⁶ Ibid.

¹⁷ Mark Antonacci "Appendix F- Fire Simulation Model" *The Resurrection of the Shroud: New Scientific, Medical, and Archeological Evidence* (New York: M. Evans and Company) pp. 270-271

II.D Summary and Conclusions

If the Kouznetsov-Jackson-Moroni skewing of the 1988 Carbon 14 tests were the only problem, it would be quite puzzling because it would imply a medieval forgery in 1050 instead of 1350. However, when this finding is combined with the skewing discovered by Garza-Valdes and Mattingly (perhaps 300 years or more) and the radical skewing produced by “non-original fibers” used in the 1988 Carbon 14 test (discovered by Raymond Rogers—see above II.A), it seems increasingly apparent that the 1988 Carbon 14 test was invalid—and the result may be skewed by a factor of 1,300 years. If this problem is to be resolved, another Carbon 14 test will have to be performed according to the specifications and protocols (mentioned below in Section III.E).

Since Carbon 14 tests are by no means infallible, these new tests will have to be compared to the four new tests developed by Rogers and Fanti (see below Section III) to obtain an optimal result.

III. Four New Scientific Dating Methods

Dr. Raymond Rogers and Dr. Giulio Fanti (Professor of Mechanical and Thermal Measurement at the University of Padua’s Engineering Faculty) developed four new tests for dating ancient materials which are unrelated to Carbon 14 dating. Rogers’ test results were reported in the *Thermochimica Acta* in 2005¹⁸ and Fanti’s results in a book published in 2013.¹⁹ These tests show a strong likelihood that the Shroud originated around the time of Jesus and that the 1988 Carbon 14 testing was seriously in error. We will examine each of the test results in turn.

III.A Raymond Rogers’ Vanillin Test

Rogers developed a vanillin test to measure the age of cellulose in ancient fabrics. Lignin (lignocellulose) can be converted to vanillin, an organic compound that decays with age. By measuring the percentage of vanillin in cellulose fibers in various materials of ancient origin, the age of fabrics (within a defined range of error) can be reasonably estimated. Rogers performed these vanillin tests on several ancient fabrics, and then compared them to the Shroud. He concluded that the 1988 Carbon 14 test was not consistent with the vanillin test:

If the shroud had been produced between 1260 and 1390 AD, as indicated by the radiocarbon analyses, lignin should be easy to detect. A linen produced in 1260 AD would have retained about 37% of its vanillin in 1978... The

¹⁸ Rogers, Raymond N. “Studies on the Radiocarbon Sample from the Shroud of Turin.” *Thermochimica Acta*, Vol. 425, Issue 1-2, January 20, 2005. pp. 189-194.

¹⁹ See Giulio Fanti and Saverio Gaeta 2013 *Il Mistero della Sindone: Le Sorprendenti Scoperte Scientifiche sull’enigma del Telo di Gesu* (Milan: Editore Rizzoli).

Holland cloth and all other medieval linens gave the test [i.e. tested positive] for vanillin wherever lignin could be observed on growth nodes. The disappearance of all traces of vanillin from the lignin in the [S]hroud indicates a *much older age* than the radiocarbon laboratories reported.²⁰

Rogers anticipated the objection that the fire of Chambery would have heated the Shroud, accelerating the disappearance of vanillin in the cellulose fibers, but he responds that the fire alone could not have been responsible for the disappearance of all the vanillin in the Shroud, because the Shroud was folded, and therefore was not exposed evenly to the heat. Moreover, the Shroud was not situated near the fire long enough to produce a complete disappearance of vanillin (if it originated in the 13th or 14th centuries – as supposedly indicated by the Carbon 14 testing). He notes in this regard:

The fire of 1532 could not have greatly affected the vanillin content of lignin in all parts of the shroud equally. The thermal conductivity of linen is very low... therefore, the unscorched parts of the folded cloth could not have become very hot... The cloth's center would not have heated at all in the time available. The rapid change in color from black to white at the margins of the scorches illustrates this fact... Different amounts of vanillin would have been lost in different areas. No samples from *any location* on the shroud gave the vanillin test [i.e. tested positive].²¹

If the fire of Chambery cannot explain the absence of vanillin in the Shroud, then what can? Rogers says we will have to make recourse to the same process that explains vanillin's complete absence in the Dead Sea Scrolls and other ancient materials (which are over 1,500 years old) -- namely, the *aging* process:

Because the shroud and other very old linens do not give the vanillin test [i.e. test negative], the cloth must be quite old... A determination of the kinetics of vanillin loss suggests that the shroud is between 1300 and 3000 years old. Even allowing for errors in the measurements and assumptions about storage conditions, the cloth is unlikely to be as young as 840 years.²²

The median age of the Shroud (within Rogers' broad margins of error) is 2,150 years old – which allows the origin of the Shroud to be situated near the crucifixion of Jesus (30 AD). This result agrees with the three new dating tests performed by Giulio Fanti (and colleagues) at six laboratories in Italy and the U.K.

III.B

Giulio Fanti's Fourier Transformed Infrared Spectroscopy Test of Cellulose Degradation

²⁰ Raymond N. Rogers. 2005. "Studies on the Radiocarbon Sample From the Shroud of Turin." *Thermochimica Acta*, Vol. 425, Issue 1-2, January 20, 2005. p. 192 (italics mine).

²¹ Raymond Rogers. 2005 pp 192-193.

²² Raymond Rogers. 2005. p. 194.

Dr. Giulio Fanti carried out three new dating tests on fibers from the Shroud he procured from Giovanni Riggi:

1. Fourier Transformed Infrared Spectroscopy Testing of Cellulose Degradation.
2. Raman Spectroscopy (Laser) Testing of Cellulose Degradation.
3. Mechanical Tests of Compressibility and Breaking Strength of Fibers.

Fanti carried out his test with six teams in six different laboratories throughout Italy and the U.K. -- Padua, Bologna, Modena, Udine, Parma and London. In 2013, he published his results in a new book entitled *Il Mistero della Sindone*,²³ which in combination with the Vanillin Test of Raymond Rogers, shows the strong likelihood that the 1988 Carbon 14 dating was in error by a large factor. We will give a basic description of each testing procedure and the results obtained by Fanti in his six labs in this and the following two subsections.

In his Fourier Transformed Infrared Spectroscopy Test of Cellulose Degradation, Fanti used a specially transformed infrared light beam to excite the molecules of the material. The resulting reflections made it possible to evaluate the concentration of particular substances contained in the cellulose of the linen fibers. According to Fanti, since cellulose degrades over time, it is possible to determine a correlation with the age of the fabric.

Fanti examined nine different ancient textiles of varying ages (five from Egypt, three from Israel, and one from Peru) – along with two modern fabrics -- and developed a calibration curve which represented how the trend of degradation varies with age. Then he measured the same parameters on the Shroud and derived an estimate of its age by making a comparison with the calibration curve. He determined that the origin of the Shroud – at a 95% confidence level – occurred around 300 BC (+ or – 400 years) – therefore between 700 BC and 100 AD.²⁴

III.C

Giulio Fanti's Raman Spectroscopy Test for Cellulose Degradation

The Raman Laser Spectroscopy Test for cellulose degradation is similar to the Fourier Transformed Infrared Spectroscopy Test, but uses a different method to excite the molecules. Once again, the resulting reflections made it possible to evaluate the concentration of particular substances contained in the cellulose of the linen fibers. He then generated a new calibration curve from the same nine ancient materials (and two modern materials), and compared this to the measurements obtained from the Shroud. He then determined that the origin of the cloth – with a 95% confidence level – occurred at 200 BC (+ or – 500 years) – therefore between 700 BC and 300 AD.²⁵

III.D

²³ Giulio Fanti and Saverio Gaeta 2013 *Il Mistero della Sindone: Le Sorprendenti Scoperte Scientifiche sull'enigma del Telo di Gesu* (Milan: Editore Rizzoli).

²⁴ Fanti's book -- *Il Mistero della Sindone: Le Sorprendenti Scoperte Scientifiche sull'enigma del Telo di Gesu* – is not yet translated into English. Stephen E. Jones translated the results of Fanti's three new dating tests in Stephen E. Jones 2013 "New Tests by Prof. Giulio Fanti Show the Shroud of Turin Could Date from the Time of Christ" in *The Shroud of Turin* blog. (<http://theshroudofturin.blogspot.com/2013/04/new-tests-by-prof-giulio-fanti-show.html>).

²⁵ See the comment and references in the previous note.

Giulio Fanti's Mechanical Test of Compressibility and Breaking Strength of Fibers

This mechanical test is substantially different from the first two spectrographic tests. Instead of measuring the level of particular substances in the cellulose (as above) this test used a multiparametric mechanical method made possible by constructing a new mechanism capable of loading and unloading cycles of single linen fibers. Using a petrographic microscope, Fanti was able to separate Shroud linen fibers from dust particles vacuumed from the Shroud. He then mounted them on supports for testing. In collaboration with Dr. Pierandrea Malfi, he performed tests of tension and compression on the nine ancient fabrics from Egypt, Israel, and Peru. He developed five mechanical parameters (tensile strength, Young's modulus in direct cycle, Young's modulus in reverse cycle, loss factor in direct cycle, and loss factor in reverse cycle) to give five different age-dependent curves of the samples. He then measured the corresponding mechanical properties of the Shroud, and compared them to the five age-dependent curves generated from the nine ancient materials. He determined from this that the origin of the Shroud occurred – with a 95% confidence level – around 400 AD (+ or – 400 years) – therefore between 1 AD and 800 AD.²⁶

III.E

Summary of the Fanti and Rogers Dating Tests

Fanti averaged the results of his three tests and obtained a mean origin date of 33 BC (plus or minus 250 years) with a confidence level of 95%. The three techniques used by Fanti were used and verified in other labs in Italy and the U.K. (see above). This means that there is a strong likelihood that the Shroud originated between 283 BC and 217 AD – which allows the origin of the Shroud to be situated near the time of Jesus' crucifixion (30 AD). Recall from Section III.A above, that Raymond Rogers obtained a similar result – within broader parameters -- from his Vanillin Tests of the Shroud.

If Fanti's and Rogers' dating techniques continue to bear scientific scrutiny, then a rescheduling of Carbon 14 testing will be unavoidable. When this occurs, the deficiencies of the past will have to be remedied. This will entail scheduling the tests at seven laboratories (instead of three) and assuring that the selection of the samples comes from different parts of the Shroud which are not near darkened (non-fluorescing) regions. Furthermore, the selection will have to be done with expert thermal chemists and archaeologists present who can perform the chemical, microscopic and textile tests necessary to avoid gross errors such as a selection of dyed fibers. Additionally, the threads will have to be cleaned to remove the bioplastic covering from microorganisms, and the age estimates will have to be adjusted to account for the carbon buildup from the Chambery fire.

If all these procedures are followed, the result will be significantly different from the 1988 Carbon 14 test – indicating an older age of the Shroud – probably corresponding to the age shown by the other four chemical, spectroscopic, and mechanical tests performed by Rogers and Fanti. If the carbon testing does not show this result, and the other four tests continue to bear scientific scrutiny, the Carbon 14 test may have to be “bracketed” because it will likely have too high a degree of carbon contamination to give accurate aging data.

²⁶ See the comment and references in the previous two notes.

IV. Other Indications of the Shroud's Age

The above analysis was restricted to five directly measurable tests of age (within defined parameters and margins of error). But these do not exhaust the age indicators of the Shroud of Turin. As we saw above, there are three additional circumstantial indications of the Shroud's origin at the time of Jesus:

1. The presence of pollen grains discovered by Max Frei.
2. The presence of two Roman coins (leptons) on the eyes of the man in the Shroud.
3. Similarities to the facecloth of Oviedo (known as the "Sudarium Christi") indicating that the same face touched both cloths.

We will examine each of these age indicators in turn.

IV.A Max Frei's Evidence of Pollen Grains

Max Frei was a Swiss botanist and a criminologist who was a professor at the University of Zurich and one of the best known criminologists in Europe. He was science editor of the German periodical *Kriminalistik*, and carried out several pollen classifications on both the Shroud and the facecloth of Oviedo (see below Section IV.C).

Frei used adhesive tapes to collect dust samples from the Shroud during the 1978 STURP investigation. He later classified 58 pollen grains by comparing them to pollen grains in the largest botanical museums around the world. He concluded that of the 58 pollen grains discovered on the Shroud, the largest number (45) were from the region of Israel (specifically from sedimentary layers from two thousand years ago near the area of the Sea of Galilee), and 6 grains from the eastern Middle East (2 grains from Edessa, Turkey, and 1 growing exclusively in Istanbul--Constantinople). The remaining grains came from France and Italy. Importantly, 13 of the pollen grains are *unique* to Israel, and are found at the bottom of both the Sea of Galilee and The Dead Sea.²⁷

The botanist Avinoam Danin of the Hebrew University of Jerusalem noted:

As far as establishing the Shroud's provenance, *Zygophyllum dumosum* is the most significant plant on the list. Max Frei identified pollen grains of this species on the adhesive tapes he examined. The northernmost extent of the distribution of this plant in the world coincides with the line between Jericho and the sea level marker on the road leading from Jerusalem to Jericho. As *Zygophyllum dumosum*

²⁷ See Max Frei, Identificazione e classificazione dei nuovi pollini della Sindone, in *La Sindone, Scienza e Fede, Atti del II Convegno Nazionale di Sindonologia*, Bologna, November 27-29, 1981, CLUEB, Bologna 1983, pp. 277-284, on p. 281. See also P.C. Maloney, A contribution toward a history of botanical research on the Shroud of Turin, in *Proceedings of the 1999 Shroud of Turin International Research Conference*, Richmond, June 18-20, 1999, Magisterium Press, Glen Allen, Virginia, USA 2000, pp. 241-266, on pp. 244-246.

grows only in Israel, Jordan and Sinai, its appearance helps to definitively limit the Shroud's place of origin.²⁸

The three major regional similarities of pollen grain groupings indicate a high probability of the Shroud's origin and travels. The abundance of grains -- and unique grains -- indigenous to Palestine indicate a high probability that the Shroud originated there. It was probably manufactured there and exposed to the open air for a considerable period of time. Frei also believed that some of the grains came from the aloes used to anoint the body and from grains that adhered to the wetness of the body after the crucifixion.

Since we know where the Shroud surfaced in Europe (Lirey, France -- in the hands of Geoffrey de Charny in 1349), we can deduce from the pollen grains that the Shroud must have traveled to Turkey (Edessa and Constantinople) before its arrival in France. The fact that Geoffrey de Charny was married to Jeanne de Vergy -- a fifth generation descendant of Othon de la Roche (a leader of the Fourth Crusade who occupied the area of Constantinople in which the Shroud was kept) corroborates this.²⁹ Frei also helped to make a connection between the Shroud of Turin and the Sudarium (facecloth) of Oviedo by showing a similar origin in Palestine from the presence of indigenous pollen grains from that region on the Sudarium.

As we shall see, the Sudarium also bears the same blood and aloe stains as the Shroud (see below Section IV.C). Frei first used dust samples not taken by him from an investigation of the facecloth in 1978 and then used his own samples obtained in 1979. According to Emanuela Marinelli:

As on the Shroud, also on the Sudarium he found cells of the epidermis of Aloe socotrina. He also identified the pollen of 13 plants, four of which do not grow in Europe but are frequently encountered in Palestine, in the deserts, in salt places or on rocks, and five others are Mediterranean plants that grow also in Palestine. Frei stressed: 'The Acacia albida is typical for the Dead Sea area and the Hyoscyamus aureus still grows on the walls of the Old Citadel of Jerusalem. These two plants are represented also on the Shroud'.³⁰

Frei's studies were complemented and completed by the studies of the biologist Carmen Gómez Ferreras, of the *Universidad Complutense* of Madrid.

The work of Frei and Gómez Ferreras is important for showing that the two cloths had a similar geographical origin—namely, Palestine. The blood and aloe evidence is even more important because it reveals that both cloths touched the same face (see below Section IV.C). Since the Sudarium can be dated to 616 A. D., we must assume that both the Shroud and the Sudarium originated prior to that time. Thus, when we combine the pollen, blood and aloe

²⁸ Avinoam Danin, "Pressed Flowers" in *Eretz Magazine* 55 (1997), pp. 35-37 and 69.

²⁹ See John Long 2013 (B) "The Shroud of Turin's Earlier History: Part 4: To Little Lirey" (<http://www.biblearchaeology.org/post/2013/09/05/The-Shroud-of-Turins-Earlier-History-Part-4-To-Little-Lirey.aspx>)

³⁰ Emanuela Marinelli "The Question of Pollen Grains on the Shroud of Turin and the Sudarium of Oviedo" Geological and Natural CC by the University of Rome *La Sapienza* (<https://www.shroud.com/pdfs/marinelli2veng.pdf>).

evidence on both the Shroud and the Sudarium, we may conclude that both cloths originated in Palestine before 616 A. D., which casts doubt on the 1988 Carbon 14 test and the medieval forgery hypothesis.

IV.B Roman Coins on the Eyes of the Man in the Image

The presence of coins on the eyelids of the man on the Shroud was first identified by the Greek classical numismatist Michael Marx who saw their images in the photographs of Enrie (1931) and Secundo Pia (1898). Marx identified four raised letters – UCAI -- on coins that looked like Jewish lepta -- “widow’s mite” coins – copper coins minted by Pontius Pilate in 29 AD in Judea (see below Figure 3). This discovery was initially challenged by some numismatists who claimed that such a coin would not have had a Roman “C” but rather a Greek “K” – because this was the way Tiberius’ coins were typically minted. However, Fr. Francis Filas (Professor at Loyola University Chicago) responded to the objection when he was given a lepton with the “C” inscription on it (see below Figure 4). Later, Filas and Duke University Professor Alan Whanger discovered five additional leptons with the same inscription – indicating that it was unusual, but by no means, rare.

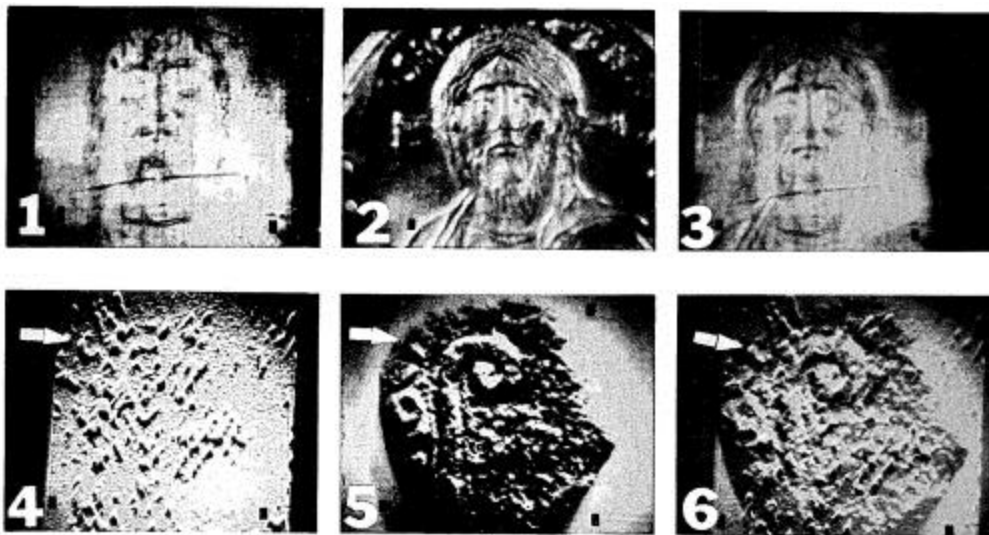
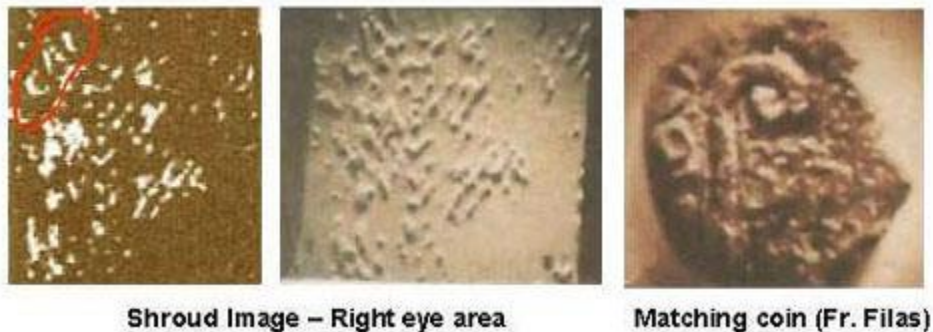


Figure 3



Shroud Image – Right eye area

Matching coin (Fr. Filas)

Figure 4

These coins enabled Whanger (and others) to use a polarized overlay photographic analysis to show that the images of the coins (on the eyes of the man of the Shroud)

corresponded almost perfectly to the actual coins with the unusual “C” mint. Whanger described the discovery as follows:

We have done this by means of the polarized image overlay technique that we developed which enables the highly accurate comparison of two different images and the documentation of the various points of congruence....Using the forensic criteria for matching finger prints, we feel that there is *overwhelming evidence* for the identification of the images and the matches with the coins.³¹

Whanger has made these results well-known internationally through a variety of media:

We have published these findings in the referenced professional literature and in many lay publications, have issued an international press and video release in 1982, have shown the findings personally to many thousands of people, and have produced detailed documentary videotapes showing the identification of these images and their congruence to two Pontius Pilate lepta.³²

Whanger’s polarized imaging overlay analysis is complemented and corroborated by the *digital* imaging analysis of Professor Robert Haralick (an internationally known computer imaging expert). Haralick’s results show evidence of “OUCAIC” on the coins on the eyelids of the man in the Shroud. This is a more extensive result than the previous one (UCAI) by Marx, Filas, and Whanger. He notes in this regard:

The evidence is definitely supporting evidence because there is some degree of match between what one would expect to find if the Shroud did indeed contain a faint image of the Pilate coin and what we can in fact observe in the original and in the digitally processed images.³³

If Whanger is correct in assessing the evidence as “overwhelming” and Haralick is correct in assessing it as “definitive,” then it is highly probable that the image of the man on the Shroud of Turin has two Jewish lepta, minted in 29 AD by Pontius Pilate in Judea at the time of Jesus, on his eyelids. If this is the case, then it agrees strongly with the pollen grain evidence of Frei and Danin – which further challenges the medieval forger hypothesis and the 1988 Carbon dating test.

IV.C The Sudarium of Oviedo

The Sudarium Christi (the facecloth of Christ) is kept in the Cathedral of Oviedo (in northern Spain). It is a poor quality linen cloth measuring 84 x 53 centimeters. Though it does

³¹ Alan D. Whanger 1997 “A Reply to Doubts Concerning The Coins Over the Eyes” in *The Shroud of Turin Website* (<https://www.shroud.com/lombatti.htm>).

See also Alan D. and Mary Whanger, “Polarized Image Overlay Technique: A New Image Comparison Method and its Applications”, *APPLIED OPTICS*, Vol. 24, No. 6, 15 March 1985, pp. 766-772.

³² Whanger 1997.

³³ Robert M. Haralick 1983 *Analysis of Digital Images of the Shroud of Turin* (Blacksburg, VA: Publication of Spatial Data Analysis Laboratory, Virginia Polytechnic Institute and State University).

not have an image of a face (as does the Shroud of Turin), it has features indicating that it was applied to the face of a man who was newly deceased. It has bloodstains and serum stains from pulmonary edema fluid which match the blood and serum patterns and blood type AB of the Shroud of Turin. The length of the nose on both cloths is 8 centimeters (3 inches). The similarities between the two cloths indicate the high probability that they touched the face of the same crucified man who was crowned with thorns. The evidence of pollen grains on both cloths (see above IV.A) corroborates their origin in Judea.

Why is this cloth significant for dating the Shroud of Turin? Its history – which is traceable to 616 AD -- can be better documented than the Shroud of Turin.³⁴ If both cloths touched the same face, then the Shroud of Turin must also go back to 616 AD – approximately 800 years earlier than the age determined by the 1988 Carbon 14 tests. In order to establish this, we will examine the blood, pulmonary fluid, and other stains on both cloths.

The Sudarium was applied to the face of a crucified man at a time proximate to his death in an upright position (if we suppose the face is that of Jesus, it would have been applied to his face while he was still upright on the cross). This was a typical part of Jewish burial custom (out of respect for the deceased) – and frequently done for people whose faces had been disfigured (out of respect for the deceased and the mourners).³⁵ According to the Investigation Team of the Spanish Centre for Sindonology (who performed the analysis on the stains) and Dr. José Villalaín (who performed the medical examination),³⁶ the main stains are composed of one part blood and six parts fluid from the pleural oedema. According to Guscini:

This liquid collects in the lungs when a crucified person dies of asphyxiation, and if the body subsequently suffers jolting movements, can come out through the nostrils. These are in fact the main stains visible on the Sudarium.³⁷

The Investigation Team determined that the cloth was folded over which left four stains for every imprint of fluid on the face of the crucified man – the front and back surfaces of the part touching the face as well as the back and front surfaces furthest from the face (the folded over part). This fold enabled the Investigation Team to create a timeline for the events that occurred immediately after the cloth had been applied to the dead man:

³⁴ I have outlined the history of the Sudarium of Oviedo in Appendix I (Section I.C.3) of a forthcoming book -- *The Souls Upward Yearning: Clues to Our Transcendent Destiny from the Revelation of Jesus* (Ignatius Press – coming 2016). The Sudarium has been in Oviedo since 718 where it remains to this day. However, its history prior to that time was traced by Bishop Pelagius in his *Book of the Testaments of Oviedo* and the *Chronicon Regum Legionensium* --1121). Pelagius discovered the line of bishops who received the Sudarium when it arrived in Cartagena (from Palestine) in 616 to its arrival in Oviedo in 718.

See Mark Guscini 1997 “The Sudarium of Oviedo: Its History and Relationship to the Shroud of Turin” in *Proceedings of the Nice Symposium on the Shroud of Turin* – May 1997 (<https://www.shroud.com/guscini.htm#top>).

³⁵ See Mark Guscini 1997 “The Sudarium of Oviedo: Its History and Relationship to the Shroud of Turin” in *Proceedings of the Nice Symposium on the Shroud of Turin* -- May 1997 (<https://www.shroud.com/guscini.htm#top>).

³⁶ Guillermo Heras, J.D. Villalain, J.M. Rodriguez. 1998, *Comparative Studies of the Sudarium of Oviedo and the Shroud of Turin*. III Congreso Internazionale de Studi sulla Sindone Turin. (<http://www.teachingfaith.com/files/books/Sudarium.PDF>) pp. 1-17.

³⁷ Guscini 1997.

[The first stain was made while the body was still on the cross.] The second stain [on the back side of the part touching the face] was made about an hour later, when the body was taken down. The third stain [the back side of the part folded over] was made when the body was lifted from the ground about forty-five minutes later. The body was lying at the foot of the cross for about forty-five minutes before being buried. The marks (not fingerprints) of the fingers that held the cloth to the nose are also visible.³⁸

The presence of a fluid that would have formed in the lungs during asphyxiation and the drying patterns of the blood and fluids on all four sides of the cloth indicate a series of events strikingly similar to those recounted about the burial of Jesus in the four Gospels. Furthermore, it is evident that the facecloth was taken off the dead man's face before the main Shroud was applied (prior to the burial). This corresponds to the account of the empty tomb in the Gospel of John:

Simon Peter, following him, also came up, went into the tomb, saw the linen cloth lying on the ground, and also the cloth that had been over his head; this was not with the linen cloth but rolled up in a place by itself (Jn 20:6-7).

How can the investigators be so certain that the Sudarium touched the same face as the Shroud of Turin? There are six major kinds of coincidences between the two cloths:

1. The blood stains contain human male DNA and are the rare type AB.³⁹
2. The length of the nose through which the pleural oedema fluid was discharged was just over 3 inches (eight centimeters) – the same size as the man on the Shroud of Turin.⁴⁰ (Compare Figures 5 and 6 below). Remember the Sudarium has no image like the Shroud and was folded).
3. Since the Sudarium was not used to wipe the face, but only placed on the face in a stable position, the stains on the Sudarium can be laid over the image of the face on the Shroud of Turin. The positioning of the wounds relative to the beard is an exact fit. (Compare Figures 5 and 6 below). This would be extremely difficult to duplicate unless the face that touched the Sudarium and the Shroud were very similar.⁴¹
4. The stain on the side of the mouth (visible on the Sudarium) was confirmed to be present on the Shroud through the VP-8 photo enhancements of Dr. John Jackson --of the STURP Investigation team.⁴² (Compare Figures 5 and 6 below).
5. The blood stains resulting from the thorns on the nape of the neck on the Sudarium correspond perfectly to the blood stains on the Shroud of Turin.⁴³
6. Dr. Alan Whanger used Polarized Image Overlay Technique on photographs of both cloths and discovered 70 coincidences on the frontal stains of the Sudarium and the Shroud, and 50 points of coincidence on the rear side of the Sudarium and Shroud. There are so many coincidences between the wounds and fluid markings of both cloths that Guscini notes, "The

³⁸ Guscini 1997.

³⁹ See Guillermo Heras, J.D. Villalain, J.M. Rodriguez. 1998, p. 15, and Guscini 1997, p.12.

⁴⁰ See Guillermo Heras, J.D. Villalain, J.M. Rodriguez. 1998, p. 15, and Guscini 1997, p.11.

⁴¹ See Guillermo Heras, J.D. Villalain, J.M. Rodriguez. 1998, p. 15, and Guscini 1997, p.11.

⁴² See Guillermo Heras, J.D. Villalain, J.M. Rodriguez. 1998, p. 15, and Guscini 1997, p.11.

⁴³ See Guillermo Heras, J.D. Villalain, J.M. Rodriguez. 1998, p. 15, and Guscini 1997, p.3.

only possible conclusion is that the Oviedo Sudarium covered the same face as the Turin Shroud.”⁴⁴



Figure 5



Figure 6

In view of the similarities in blood type and facial features, as well as the 120 points of coincidence in the positioning of blood and fluids on the two cloths, it is difficult to avoid Guscini's conclusion – that the two cloths touched the same face of a man crowned with thorns and severely beaten.

So why is this coincidence so important for purposes of dating the Shroud of Turin? As noted above, the documented history of the Shroud of Turin begins in 1349 in the hands of Geoffrey de Charney which is compatible with the 1988 Carbon dating of the Shroud. However, the documented history of the Sudarium of Oviedo goes back much earlier -- to 616 in the Middle East. If the two cloths originated at the same time by touching the same face, and the Sudarium can be documented to 616 in Cartagena, Spain, then we must conclude that the Shroud also goes back to 616 as well. We may also infer that both the Shroud and Sudarium were in Palestine prior to 616. Why? The pollen evidence on both cloths is telling. Like the Shroud, the pollen evidence on the Sudarium shows its probable origin in Palestine. Thirteen pollens are from Israel, and four of them are unique to that region.⁴⁵ When we compare the pollen evidence on the Sudarium and the Shroud, it shows that both cloths originated in Palestine, and since they touched the same face, we can conclude that they were in Palestine before 616. The combined evidence of the Shroud and the Sudarium once again throws the 1988 Carbon testing into question (which dates the Shroud to 1350). If the Shroud was in Palestine before 616, then the 1988 Carbon dating would be in error by at least 734 years.

⁴⁴ Guscini 1997, p.4.

⁴⁵ Emanuela Marinelli “The Question of Pollen Grains on the Shroud of Turin and the Sudarium of Oviedo” Geological and Natural CC by the University of Rome *La Sapienza*.
(<https://www.shroud.com/pdfs/marinelli2veng.pdf>)

IV.D Summary of the Dating Evidence

The 1988 carbon dating cast doubts on the Shroud's origin in the First Century – and therefore on its authenticity as the burial cloth of Jesus. As we have said, Carbon 14 dating is by no means infallible. William Meacham, an archaeologist and carbon dating expert, has noted in this regard:

Over the years a whole host of difficulties have come to light with C14, e.g. modern living samples which give ages of hundreds or thousands of years, or centuries-old samples which give dates in the future. The causes of these phenomena are known, but in many other cases anomalous dates have not been satisfactorily explained.⁴⁶

As we have seen above, the carbon 14 dating of the Shroud conflicts with four other dating methods (Roger's Vanillin test, Fanti's infrared spectroscopy, Fanti's Raman laser spectroscopy, and Fanti's mechanical compressibility and breaking strength test) and three other reliable circumstantial methods of dating the Shroud (Frei's pollen evidence, Whanger's polarized photographic overlay analysis of the coins, and the evidence for the Sudarium having touched the same face as the Shroud from the analysis of Heras, Villalain, and Rodriguez). Each of these seven kinds of evidence can stand on its own, but in combination they corroborate one another in pointing to a First Century origin of the Shroud. It is truly difficult to imagine that all four of the above tests and the three circumstantial methods of dating the Shroud are fallacious – and it is even more difficult to imagine that they are off by a factor of 1,350 years! When a single carbon 14 test departs so radically from so many other kinds of equally substantial evidence, Meacham recommends:

As an archaeologist with 25 years of experience using C14 for the dating of excavated samples, I know what most archaeologists do when C14 produces a date which conflicts strongly with other evidence from a site: 1) run more dates on different samples from the same context, and then 2) put the aberrant dates down to some unidentified problem (usually in a footnote to the site report if mentioned at all)...This happens often in archaeology, even on sites and samples which were thought to be ideal for C14 dating. Very rarely is the problem of these individual aberrant dates ever resolved or even addressed.⁴⁷

In the case of the Shroud of Turin, considerable work has been done to explain the aberrant finding of the 1988 carbon 14 test:

1. Roger's discovery of dye on the fibers used for the carbon 14 test (indicating the likelihood that the fibers were of later origin – and not from the original Shroud),

⁴⁶ William Meacham, "C-14 Debate from the Shroud Newsgroup: alt.turin-shroud" in *The Shroud of Turin Website* (www.shroud.com).

⁴⁷ Ibid.

2. Garza-Valdes' and Mattingly's discovery of a bioplastic coating on the fibers (produced by microorganisms over the centuries) that could have affected the carbon dating by a factor of several centuries, and
3. Marone's analysis of the carbon buildup in the cloth from the fire of Chambery and other sources which could have affected the carbon dating by a factor of 300 years.

In the face of these problems, the 1988 carbon dating cannot be given much credibility, and a new carbon 14 dating will have to be performed according to the specifications given above in Section II.B.5. It is difficult to imagine that a new carbon 14 testing—with the above protocols in place—would not result in a much earlier date of the Shroud's origin. If it did result in a finding substantially different from the seven other dating techniques mentioned above (around the time of Jesus – within a suitable margin of error), then the new carbon dating test would have to fall into the category of what Meacham calls “an anomalous date which has not been satisfactorily explained.”⁴⁸

V. The Image on the Shroud

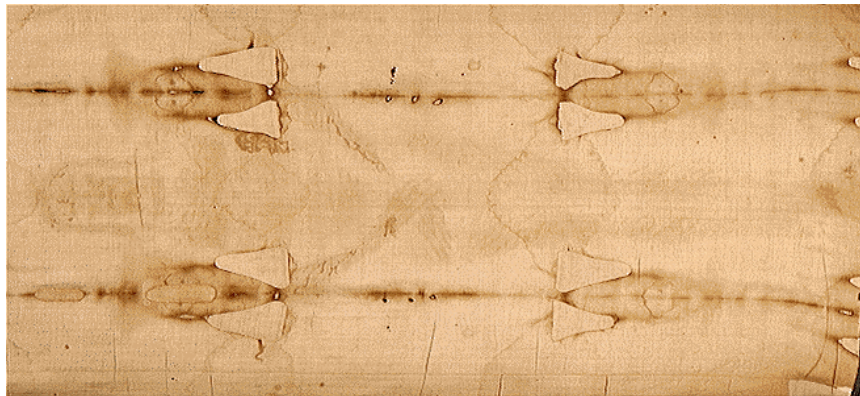


Figure 7

Explanations of the formation of the Shroud's image remain in the category of “scientifically plausible hypotheses.” We currently do not have a *definitive* explanation for how this unique and mysterious image was created from the body of a deceased man. The most plausible current hypothesis comes from a combination of two teams of researchers:

1. John Jackson's team who proposed the vacuum ultraviolet radiation hypothesis in 2008 to explain three (out of five) enigmas of the Shroud's image, and
2. Paolo Di Lazzaro's team who experimentally substantiated Jackson's hypothesis in 2010.

⁴⁸ Ibid.

According to Jackson, an intense burst of vacuum ultraviolet radiation produced a discoloration on the uppermost surface of the Shroud's fibrils (without scorching it), which gave rise to a perfect three-dimensional negative image of both the frontal and dorsal parts of the body wrapped in it.

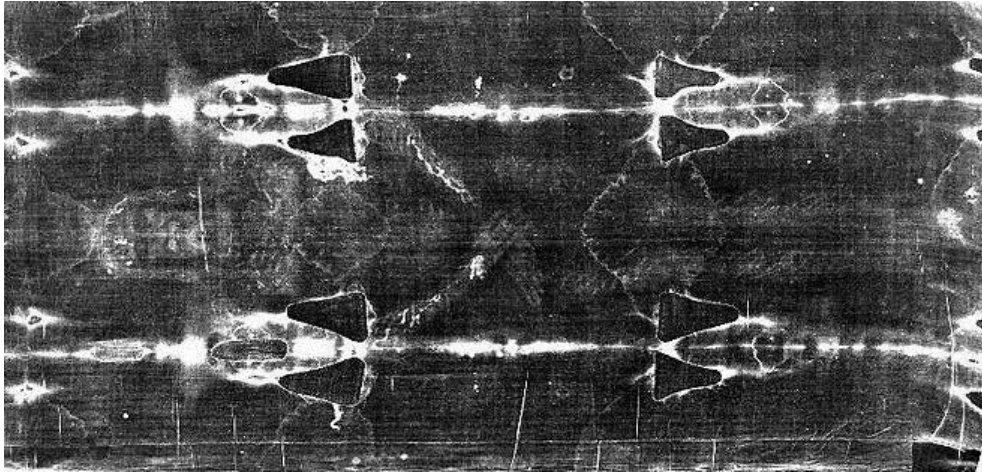


Figure 8

As will be shown below, this hypothesis (and its corroboration by Di Lazzaro) explains only three out of five enigmas on the Shroud. In order to explain the final two enigmas, Jackson had to propose a more “unconventional” (and possibly scientifically uncorroborateable) hypothesis that the burst of intense vacuum ultraviolet radiation be emitted from every three-dimensional point within a mechanically transparent body. This hypothesis still stands today as the only explanation of the Shroud's double image as well as the combined interior (skeletal) and exterior image of the hands.

Currently, we know of no *natural* explanation for the seemingly unique occurrence of such a burst of vacuum ultraviolet radiation from either a decomposing body or the geological/atmospheric conditions within a tomb. Though this is suggestive of a possible *supernatural* origin of the radiation – perhaps as a part of Jesus' resurrection – we cannot prove this scientifically, because we cannot construct a scientific test for a supernatural cause – all we can do is eliminate every *known* natural cause of this seemingly unique radiation. The uniqueness and current inexplicability of this phenomenon gives us reason to *believe* that God has given us evidence of Jesus' resurrection. This belief can be strengthened by further understanding of the light phenomenon that seems to be the source of the image as well as the continued elimination of natural causes for it. We will explain this conclusion in three steps:

1. The 1978 STURP investigation of the image.
2. The hypothesis of John Jackson, and
3. The experimental substantiation by Paolo Di Lazzaro.

V.A

The 1978 STURP Investigation of the Shroud's Image

Prior to the STURP investigation, Secundo Pia and subsequent photographers discovered that the Shroud image was a perfect photographic negative --as distinct from the blood which is a positive image (Compare Figures 7 and 8 above). Furthermore, the work of Dr. Pierre Barbet (and others) showed that the image of the Shroud – relative to the blood stains – was anatomically perfect. These two early findings suggested that medieval forgery was unlikely. The results of the STURP investigation in 1978 and the 3-D imaging of the Shroud by Jackson, Jumper, and Ercoline in 1982⁴⁹ showed how exceedingly unlikely a medieval forgery would be.

So what did the STURP investigation find in 1978? The image was caused by rapid dehydration, oxidation and degradation of the linen by an unidentified process, coloring it a sepia or straw yellow (see the pale yellow color in Figure 7 above). The range of possible causes is restricted by the unusual characteristics of the image – namely, its *superficial* character limited to the uppermost surface of the cloth and the fact that the image does not fluoresce. This meant that the surface was likely produced by light radiation, *but not by heat radiation*.⁵⁰ Dr. John Jackson (and other physicists) theorized that a plausible cause of such “light radiation” might be a short intense burst of vacuum ultraviolet radiation.

V.B **The Hypothesis of John Jackson**

Why did Jackson select a radiation hypothesis instead of a chemical one? Because a dye, powder, ointment, or other chemical source of the image could not explain three enigmatic dimensions of the image adequately:

1. Chemicals cannot explain the superficiality of the Shroud image (limited to the uppermost surface of the fibrils without penetration to the medulla of the fiber). Chemicals that touched the Shroud would have in many places penetrated beyond that surface.
2. Chemicals do not explain how the image is evenly present on the many areas of the cloth which did *not* touch the body.
3. Vapors from chemicals on the body (or from the body itself) could not have produced a perfect photographic image on the areas of the cloth which did not touch the body.

⁴⁹ See Jackson, J.P., E.J. Jumper and W.R. Ercoline, "Three Dimensional Characteristic of the Shroud Image," *IEEE 1982 Proceedings of the International Conference on Cybernetics and Society*, October 1982, pp. 559-575.

Jackson, J.P., E.J. Jumper, and W.R. Ercoline, "Correlation of Image Intensity on the Turin Shroud with the 3-D Structure of a Human Body Shape," *Applied Optics*, Vol. 23, No. 14, 1984, pp. 2244-2270.

⁵⁰ See Jumper, E.J. and R.W. Mottern, "Scientific Investigation of the Shroud of Turin," *Applied Optics*, Vol. 19, No. 12, 1980, pp. 1909-1912.

Jumper, E.J., "An Overview of the Testing Performed by the Shroud of Turin Research Project with a Summary of Results," *IEEE 1982 Proceedings of the International Conference on Cybernetics and Society*, October 1982, pp. 535-537.

Jumper, E.J., A.D. Adler, J.P. Jackson, S.F. Pellicori, J.H. Heller and J.R. Drusik. "A Comprehensive Examination of the Various Stains and Images on the Shroud of Turin," *Archaeological Chemistry III, ACS Advances in Chemistry* No. 205, J.B. Lambert, Editor, Chapter 22, *American Chemical Society*, Washington D.C., 1984, pp. 447-476.

In view of this, Jackson moved into the realm of radiation—which held out the potential of resolving all three of these enigmatic features.⁵¹

There is only one problem with a radiation hypothesis—radiation not only gives off light (which could produce discoloration of the fabric), but also heat which could scorch or burn the cloth. The STURP investigation showed that the image on the cloth was not the result of a scorch, because it did not fluoresce.⁵² So Jackson needed to find a kind of radiation that would not produce an accompanying heat radiation sufficient to scorch the cloth.

Vacuum ultraviolet radiation is an excellent candidate for explaining the Shroud image because VUV radiation would not have scorched the cloth. It dissipates so quickly that its initial energy could discolor the cloth in a brief burst without scorching or destroying it in the process.⁵³ Furthermore, vacuum ultraviolet radiation could be limited to the surface of the fibrils without penetrating to the medulla of the fibers. Jackson and Propp note in this regard:

Of particular note, are the observations that the image discolorations reside on the surfaces of the image fibrils and that the inside medullas are not colored. We point out, again, that vacuum ultraviolet radiation would be absorbed at the surface of the fibrils, which would leave the medullas unaffected, thereby satisfying those requirements.⁵⁴

Finally, a short burst of ultraviolet radiation would also explain how the image was perfectly present (sufficient to produce a perfect photographic negative) on the many parts of the cloth that did *not* touch the body. Thus the Jackson hypothesis is able to explain three enigmas of the image on the cloth.

⁵¹ Jackson's supposition was later confirmed when it was found that the cloth has a *double* image—one on the front surface of the cloth and a fainter, but nonetheless distinct image on the back surface of the cloth—however there is *nothing* in between the front and back surface images! Chemicals and vapors could not have done this, and it requires that the body in the Shroud be mechanically transparent. See below Section III.B.

⁵² According to Barry Schwartz, a well-known Shroud expert, "Since the color of the image is very similar to the color of the scorches, STURP understood the need to test this theory and performed specific experiments for that purpose. A primary test was to photograph the Shroud using ultraviolet fluorescence photography, since true scorches on linen will always fluoresce in the red. As there are many documented scorches on the Shroud from the 1532 fire, testing this was not difficult and the results of the tests were published in this peer reviewed reference: Miller, V.D. and S.F. Pellicori, "Ultraviolet Fluorescence Photography of the Shroud of Turin," *Journal of Biological Photography*, Vol. 49, No. 3, 1981, pp. 71-85. Every documented scorch on the Shroud fluoresced in the red, as expected. However, the *image* did NOT fluoresce and in fact, even quenched the background fluorescence in the image areas. The only conclusion possible from these observations is that the Shroud image is NOT the product of scorched or heated linen." Barry Schwartz, comment in "The Image on the Shroud of Turin is Not a Scorch" in *The Shroud of Turin Blog*—shroudstory.com, 2012. (URL: <http://shroudstory.com/2012/02/10/the-image-on-the-shroud-of-turin-is-not-a-scorch/>).

⁵³ See Jackson, John P., "Is the Image on the Shroud Due to a Process Heretofore Unknown to Modern Science?" *Shroud Spectrum International*, No. 34 March, 1990, pgs. 3-29.

⁵⁴ Jackson and Propp. "Comments on Rogers' 'Testing the Jackson Theory' of Image Formation." (<http://www.shroud.com/pdfs/jacksonpropp.pdf>).

Yet there is another enigma. A cursory glance at the image reveals the bones of the hand encased within flesh – as if the image recorded both the inside of the hand (the skeleton) and the outside of the hand (the flesh surrounding the skeleton) at the same time. As Jackson notes:

There is, however, one particular observation that definitively places the Shroud image in a unique category... If we examine this image region carefully, we can see... that the finger bones are visible well into the palm of the hands, extending right up to the base of the wrist. These cannot be interpreted as tendons, because tendons and ligaments are much too narrow. Rather, we see that the thickness of the fingers are individually preserved well into the palm of the hand. It thus seems as though we are looking at the internal skeletal structure of the hand imaged through the intervening flesh tissues onto the Shroud cloth.⁵⁵

How could this unique image forming process occur? It would require that the frontal part of the cloth *collapse* into the dorsal part of the cloth during the process of image formation – as if the body were completely transparent – not impeding the collapse of the cloth. If the cloth had not collapsed, only the outside of the body would have been in the image – which is clearly not the case (because the skeleton of the hand is visible along with the flesh surrounding it). Thus it seems that the vacuum ultraviolet radiation is emanating evenly throughout the body, and that the body presents no obstacle to the collapse of the cloth. In Jackson's words:

I propose that, as the Shroud collapsed through the underlying body, radiation emitted from all points within that body and discolored the cloth so as to produce the observed image. As will be seen below, this assumption [also] explains the superficiality of the Shroud image and, perhaps, the differentiation in fibril coloring.⁵⁶

If Jackson is correct, then when the blood attached to the Shroud, the body impeded the collapse of the cloth; however, during the time of image formation, the body became mechanically transparent – it still remained a 3-dimensional source of light, but lost the mechanical quality of solidity which would have impeded a collapse of the cloth. The loss of “mechanical solidity” enabled the newly configured body to emit a burst of evenly distributed intense radiation while the cloth collapsed through it -- giving rise to the flattened 3-D image. Jackson explains:

We must assume that the Shroud initially covered a body shape [at the time that blood was being transferred to the cloth], but, for some reason, that body did not impede the collapse of the Shroud during the time of image formation.⁵⁷

Despite the unconventional nature of this hypothesis, Jackson believes that it is warranted, because it is currently the only explanation for all of the observed data on the cloth:

⁵⁵ John P. Jackson, "An Unconventional Hypothesis to Explain all Image Characteristics Found on the Shroud Image" in *History, Science, Theology and the Shroud* ed. by A. Berard (St. Louis: Symposium Proceedings) 1991 (<http://theshroudofturin.blogspot.com/2012/01/john-p-jackson-unconventional.html>).

⁵⁶ Ibid.

⁵⁷ Ibid. See also John Jackson: “Is the image on the Shroud due to a process heretofore unknown to modern science?” *Shroud Spectrum International* No. 34, March 1990, pp. 3-29.

...in the case of the Shroud image, the cloth did collapse *into* and *through* the underlying body structure. As a physicist, I admit to having my own difficulties with this concept, but I also know that scientists must be ready to overturn even their most hallowed principles if observation warrants.

Jackson's hypothesis seems to break completely with everything we know about bodily decomposition – and verges on the miraculous. How could a decomposing body give rise to such an intense burst of radiation? How could it become mechanically transparent so that this ultraviolet radiation could emanate evenly through it during the process of image formation?

We may here be on the verge of having to use a *transphysical* explanation to explain the observational data. Nevertheless, Jackson and others persist in this line of thinking, because no other *natural* explanation seems to meet the requirements of the enigmatic image on the shroud. If Jackson's hypothesis could be experimentally confirmed in the laboratory—with short bursts of vacuum ultraviolet radiation producing an image similar to that on the Shroud, it would confirm his hypothesis as realistic and tenable. It would not answer the question of how a decomposing body could produce this very special kind of radiation – or how the cloth could collapse through the body while vacuum ultraviolet radiation emanated evenly from every point within it – but it would show that the Jackson hypothesis could explain at least three enigmas on the Shroud – the restriction of the discoloration to the uppermost surface of the fibrils, the absence of scorching in the image areas, and the perfect 3-dimensional negative image in places where the body did not touch the cloth.

The first step in this experimental verification occurred in 2010 (see below V.C), but before discussing it, we will want to examine yet another enigma of the Shroud image that can also be answered by Jackson's hypothesis—the *double* image on the frontal part of the Shroud discovered by Fanti and Maggiolo in 2004.⁵⁸

The Shroud of Turin has a *double* image—that is, a superficial discoloration on the front surface of the cloth—closest to the body—and a fainter image on the back surface of the cloth—furthest from the body. However, there is no discoloration on the fibers *between* the front surface and back surface of the cloth. Both images correspond to each other anatomically—though the one on the back surface of the cloth is fainter than the one on the front surface. The double image is evident only on the frontal part of the Shroud (but not on the dorsal part) — particularly in the area of the face and hands.⁵⁹

Chemical and vapor explanations of this double image are inadequate, because none of them can explain an image occurring on the front surface and the back surface of a cloth without

⁵⁸ Giulio Fanti and Roberto Maggiolo, “The Double Superficiality of the Frontal Image of the Turin Shroud” in *Journal of Optics A: Pure and Applied Optics*, Vol. 6, No. 6, 2004, p 491.

⁵⁹ See Ibid. No researcher has yet been able to make a digital scan of the back surface of the frontal part of the cloth, because there is a backing which was made to protect it, and the custodians of the Shroud are reluctant to have it removed. However, Fanti and Maggiolo enhanced photographs of the back surface of the cloth by a special method – “This was based on convolution with Gaussian filters, summation of images, and filtering in spatial frequency by direct and inverse bidimensional Fourier transformations.” This brings the image of the face into perspective sufficiently for matching with the front surface of the cloth.

leaving any residue in-between. In order for chemicals or vapors to reach the back surface of the cloth, they would have to go *through* the cloth leaving an obvious residue in the process. Given that the image could not have been produced by *slowly* dissipating radiation (which would leave a scorch), we are left with Jackson's explanation of a short intense burst of vacuum ultraviolet radiation (which dissipates before scorching the cloth) emitted evenly throughout a mechanically transparent body.

Could this kind of radiation produce the *double* image on the frontal part of the Shroud? It would if we accept the validity of Jackson's mechanically transparent man (collapsing cloth) hypothesis. If the cloth collapsed into the body, the light energy would have made superficial images on both the front surface and the back surface of the cloth without penetrating more deeply. Think of it this way – the vacuum ultraviolet radiation is completely *surrounding* the cloth collapsing through the body. Thus, it is making contact with both the front surface and the back surface of the frontal part of the collapsing cloth. However, it does not penetrate either surface of the cloth deeply, because the vacuum ultraviolet energy dissipates so quickly. Thus, the radiation hits both the front and back surface of the collapsing cloth simultaneously, but dissipates so quickly that it does not penetrate into the center of the cloth from either side.

Jackson predicted that such a double image would be the consequence of his hypothesis before its discovery by Fanti and Maggiolo. Jackson and Propp reasserted this prediction in 2004:

In 1990, one of us (Jackson) offered a [mechanically transparent man] hypothesis as an attempt to explain simultaneously all observations regarding the Shroud image. This hypothesis was ventured only after a systematic study of alternatives had failed to account for various image characteristics and, though unconventional, this hypothesis makes a variety of testable predictions that are a-priori falsifiable by means of the Scientific Method. Recently, one important prediction of the hypothesis, that a double superficial frontal image without an associated dorsal image should exist on the Shroud, was reported by Fanti and Maggiolo.⁶⁰

In sum, there are five major enigmas of the Shroud image:

1. The fact that the image is limited to the uppermost surface of the fibrils and does not penetrate to the medulla of the fibers. This implies that the image was not produced by chemicals or vapors of any kind.
2. The fact that the image is not a scorch (but rather discoloration coming from dehydration). This implies that the image could not have been produced by *slowly* dissipating radiation (which would have scorched it).

⁶⁰ John P. Jackson, Keith E. Propp. 2004. "Comments on Rogers' 'Testing the Jackson Theory' of Image Formation." The Shroud of Turin website 2004 (<http://www.shroud.com/pdfs/jacksonpropp.pdf>). Jackson and Propp refer to three previous investigations for this conclusion. See Jackson, John P., "Is the Image on the Shroud Due to a Process Heretofore Unknown to Modern Science?" *Shroud Spectrum International*, No. 34 March, 1990, pgs. 3-29. See also Jackson, John P., et al., "Correlation of image intensity on the Turin Shroud with the 3-D structure of a human body shape" *Applied Optics*, Vol. 23, No. 14, 15 July 1984, pgs. 2244 – 2270.

3. The image is a perfect photographic negative in which the image intensity is related to the distance of the cloth from the body. Thus, the image was present regardless of whether the cloth touched the body. This implies that radiation – and not chemicals or vapors– was the source of image formation.
4. There is a double image on the frontal part of the cloth (a more intense image on the front surface – nearest the body – and a less intense image on the back surface – furthest from the body – without any effects between the two surfaces). This implies that the radiation was surrounding both surfaces of the cloth – further implying that the cloth collapsed into a mechanically transparent body.
5. Parts of the frontal image – particularly the hands – show an image which is resolvable into three dimensions, in which the inside skeletal parts of the hand are proportionately related to the surrounding exterior flesh on the hand. This implies that the cloth collapsed into *and through* a mechanically transparent body.

The more conventional part of Jackson’s hypothesis – that a short intense burst of vacuum ultraviolet radiation emitted from the decomposing body – can explain the first three enigmas. However, the fourth and fifth enigmas – the double image on the frontal part of the Shroud as well as the inside (skeletal)-outside (flesh) characteristic -- require the unconventional part of Jackson’s hypothesis – in which the body became mechanically transparent, allowing the cloth to collapse into and through it while light emanated evenly from every three-dimensional part of the transparent body.

V.C Partial Confirmation of the Jackson Hypothesis in 2010

In 2010, six physicists from three research centers (Frascati Research Center, The University of Padua, and Casaccia Research Center) were able to confirm the Jackson hypothesis under experimental conditions by creating a burst of ultraviolet radiation through an excimer laser. According to Paolo DiLazzaro, director of the six-member team:

We have irradiated a linen fabric having the same absolute spectral reflectance of the Turin Shroud...with pulsed deep-UV radiation emitted by an ArF excimer laser. We have shown that 12 ns, 193 nm laser pulses are able to color a very thin layer on the linen yarn...The colorless inner part of a few fibers...suggests that we have locally achieved a coloration of the outermost part of the fibers. To the best of our knowledge, this is the first coloration of a linen material resembling the very shallow depth of coloration...observed in the Turin Shroud fibers.⁶¹

The team specified that three of the above five enigmas were explained and experimentally confirmed by this method precisely as Jackson predicted. In an interview with Sci-News, Di Lazzaro said:

In particular, vacuum ultraviolet photons account for [1] the very thin coloration depth, [2] the hue of color and [3] the presence of image in linen parts not in contact

⁶¹ Paolo Di Lazzaro, D. Murra, A. Santoni, G. Fanti, E. Nichelatti, and G. Baldacchini. “Deep Ultraviolet Radiation Simulates the Turin Shroud Image,” *Journal of Imaging Science and Technology*, July-August 2010, p 6.

with the body. Obviously, it does not mean the image was produced by a laser. Rather, the laser is a powerful tool to test and obtain the light parameters suitable for a shroud-like coloration.⁶²

He adds that a single laser alone could not explain the image over the full length of the body. In fact, it would have taken *14,000* lasers like the one used by Di Lazzaro et al. to produce a full body image like the one on the Shroud. The characteristics of the kind of light impulse that would be needed to produce an image like that on the Shroud are quite remarkable. According to Di Lazzaro:

[The ultraviolet light necessary to form the image] exceeds the maximum power released by all ultraviolet light sources available today says Di Lazzaro. It would require “pulses having durations shorter than one forty-billionth of a second, and intensities on the order of several billion watts.”⁶³

How exactly could a normal decomposing body do something like this?

In sum, Di Lazzaro’s research confirms Jackson’s theory that a short intense burst of vacuum ultraviolet radiation can produce an image on the uppermost surface of the fibrils which is discolored through dehydration (rather than a scorch) yielding a perfect photographic negative image – on parts of the cloth not in contact with the body. However, his experiment did not confirm how the other two enigmas of the image originated – the double image on the frontal part of the Shroud and the image of the inside and outside of the hands.

Recall that Jackson had to supplement his vacuum ultraviolet radiation hypothesis with the more unconventional hypothesis of a mechanically transparent man to account for these other two enigmas. We should not be surprised that DiLazzaro and his team were not able to confirm the fourth and fifth enigmas of the image because they were not able to reproduce a mechanically transparent body in which light emanated evenly from every part. These two enigmas may never be reproducible under experimental conditions, because the only known explanation of them (from Jackson) supersedes the known laws of physics. Thus, we may be left with a plausible explanation for the image that cannot be, strictly speaking, physically reproducible, and experimentally verifiable.

V.D

Does the Shroud Give Evidence of Jesus’ Resurrection?

The research of the 1978 STURP Investigation, as well as subsequent research of John Jackson, Giulio Fanti, Paolo Di Lazzaro and their teams, shows the likelihood that sometime after the blood deposits had dried on the Shroud, the decomposing body in the Shroud emitted a short intense burst of vacuum ultraviolet radiation that led to a dehydration and discoloration of

⁶² Sergio Prostack 2011 “Scientists Suggest Turin Shroud Authentic,” December 21, 2011 in *Sci-News.com* (<http://www.sci-news.com/physics/scientists-suggest-turin-shroud-authentic.html>).

⁶³ Frank Viviano 2015 “Why Shroud of Turin’s Secrets Continue to Elude Science” *National Geographic* April 17, 2015 (<http://news.nationalgeographic.com/2015/04/150417-shroud-turin-relics-jesus-catholic-church-religion-science/>)

the frontal and dorsal parts of the Shroud, giving rise to a perfect photographic negative image. Jackson's research also suggests that the body inside the Shroud became mechanically transparent and emitted light evenly from every 3-dimensional point within it. This allowed the frontal part of the Shroud to collapse – creating an image (of both the inside and outside of the hands) as well as a double image on the frontal part of the Shroud.

So where do we stand? The first three of the above five enigmas (see above V.B) of image formation can be explained by a short intense burst of vacuum ultraviolet radiation emitted from the body. This explanation has been shown to be realistic through experimental replication (by Paolo Di Lazzaro et al.). The fourth and fifth enigmas imply that the body in the Shroud became mechanically transparent and emitted light evenly from every three dimensional point within it.

Jackson, Fanti, and DiLazzaro show that alternative *physical* explanations either contradict the above enigmas or fail to explain them:

- **Chemical and vapor explanations** fail to explain four of the above five enigmas (1, 3, 4, and 5). With respect to the first enigma, chemicals and vapors would not be limited only to the uppermost surface of the fibrils, but would have penetrated to the medulla of the fibers on many parts of the cloth. Furthermore, with respect to the third enigma, chemicals and vapors would not give rise to a perfect photographic image – even the most recent ingenious attempts to do this have resulted in multiple imperfections and “clumping.”⁶⁴ With respect to the fourth and fifth enigmas, chemicals and vapors cannot reproduce the double image (with nothing in between) and the interior image of the skeleton of the hand.
- **Heating or scorching explanations** violate the second enigma because the image is not a scorch as shown by its failure to fluoresce.
- **Other radiation hypotheses** besides vacuum ultraviolet radiation will likely violate the second enigma because they would not dissipate quickly enough to prevent scorching on the cloth. Furthermore, heat radiation of this kind would penetrate to the medulla of the fiber violating the first enigma.

⁶⁴ An organic chemistry professor at the University of Pavia, Luigi Garlaschelli and his team, who were funded by an Italian association of atheists and agnostics, tried to reproduce the Shroud image by using ochre, acid, and a special heating technique. According to the Catholic News Agency, “they created their image by placing the linen over a volunteer before rubbing it with a pigment called ochre with traces of acid. The linen was then ‘aged’ by heating it in an oven and washing it with water.” They then added blood stains. Though the image bore some resemblance to that on the Shroud superficially, it was by no means a replica of it. First, adding the blood stains afterwards is not consistent with what happened on the Shroud, but if the attempted forgers had placed the blood stains on the cloth first, they would have ruined them when adding the ochre and acid to produce the image. Furthermore, the image they produced was quite distorted. As Jackson noted, “. . .while the images of Garlaschelli’s shroud on the internet look authentic, when taken from a 3-D perspective, “it’s really rather grotesque. The hands are embedded into the body and the legs have unnatural looking lumps and bumps...” Catholic News Agency, “Experts question scientist’s claim of reproducing Shroud of Turin” October 6, 2009, (http://www.catholicnewsagency.com/news/experts_question_scientists_claim_of_reproducing_shroud_of_turin/)

At present, there is no alternative physical explanation for all five enigmas on the Shroud besides the 2-part explanation of John Jackson:

1. A short intense burst of vacuum ultraviolet radiation which was...
2. Emitted evenly by a mechanically transparent body from every three-dimensional point within it.

Currently, the known laws of physics cannot explain how a decomposing body can emit an intense burst of vacuum ultraviolet radiation. Furthermore, they cannot explain how such a body could become mechanically transparent and emit light from every three dimensional point within it.

So, where does that leave us? If Jackson's explanation continues to be the only one that explains all five enigmas, and if future articulations of the laws of physics cannot explain how a decomposing body could become mechanically transparent and evenly emit vacuum ultraviolet radiation from every three dimensional point within it, then we are left at the brink of a *transphysical* or *metaphysical* explanation. Under these conditions, it would be both reasonable and responsible to *believe* that a *transphysical cause* interacted with the decomposing body to transform it into an intense burst of light.

Evidently, we cannot *scientifically prove* a transphysical cause, because science is restricted to the domain of physical causation. However, if the above conditions hold, we can reasonably *infer* the possibility and perhaps the likelihood of such a transphysical cause. This is sufficient for reasonable and responsible belief.

Does this transphysical explanation of the Shroud's image point to the resurrection of Jesus? Jesus' resurrection was not a resuscitation of a material corpse but rather, a transforming event which gave rise to what St. Paul called a "spiritual body"—a body transformed in glory, spirit and power.⁶⁵ Could this transformation of a material body into a burst of intense light signify a beginning point of the transformation of Jesus' body from a physical one to a spiritual-glorified one? Though there can be no scientific proof of this, it is a reasonable inference from the parallels between the explanation of the Shroud's enigmatic image and the testimony of St. Paul and the Gospel writers. In this sense, we might say that the image on the Shroud presents a clue – even a relic – of Jesus' resurrection.

VI. Conclusion

Why would we think the body in the Shroud was that of *Jesus*? As explained above, it is exceedingly improbable that the Shroud is a medieval forgery. First, there are no paints, dyes or other pigments on the Shroud (except for the small flecks coming from the sanctification of icons and paintings which touched it). Secondly, the anatomical precision of the blood stains—which are real human blood that congealed on the Shroud *before* the formation of the image—are in

⁶⁵ This is explained in detail in Chapter 4 of a forthcoming book—*God So Loved the World: Clues to Our Transcendent Destiny from the Revelation of Jesus* (Ignatius Press—Coming in 2016)

precise anatomical correlation to the image itself. How could a medieval forger have accomplished this? Thirdly, it is exceedingly difficult to explain how pollen grains indigenous to Palestine appeared in abundance on a shroud of probable Semitic origin (if it originated in medieval Europe) and how coins minted in 29 A.D. in Palestine appeared on the eyes of the man on the Shroud. How could a medieval forger have duplicated these first century Palestinian characteristics of the Shroud? Fourthly, the five enigmas of the image on the Shroud almost certainly preclude a forgery. How could a medieval forger have used vacuum ultraviolet radiation to discolor the cloth on the uppermost surface of the fibrils? How could he have created a perfect photographic negative image? How could he have created a double image on the frontal part of the Shroud? And how could he have known how to duplicate the interior and exterior of the hands in perfect proportion to each other? Thus, it does not seem reasonable or responsible to believe that the Shroud is a medieval forgery.

Beyond this, there are three probative kinds of evidence pointing specifically to *Jesus'* place and time of origin and to his *unique* crucifixion and resurrection:

1. The material of the Shroud, the pollen grains on it, and the coins on the man's eyes, all have their origin in First Century Palestine – the place where Jesus was purported to have died.
2. The blood stains come from a crucifixion event identical to the one described in the four Gospels – which was very unusual, if not unique, in many respects – such as being crowned with thorns, being flogged, and being pierced with a Roman pilium (see above – the Introduction to this article).
3. The five enigmas of the Shroud's image point to a *transphysically* caused burst of vacuum ultraviolet radiation from a mechanically transparent body. This is suggestive of the transformation of Jesus' body from a physical one to a spiritual-glorified one (as reported by St. Paul and the four Gospels). The spiritual-glorified transformation of Jesus' body was *unique* to the Christian view of resurrection.⁶⁶ It was not known in Judaism (which held to a resuscitation of the flesh) or pagan cults (which held to ethereal or ghostlike views of immortality). Thus, the enigmas on the Shroud's image point to the *uniquely* Christian view of resurrection implied by Jesus' risen appearance.

The odds of this First Century Palestinian burial shroud -- with the unique features of Jesus' crucifixion and resurrection -- being that of anyone else is exceedingly remote. Inasmuch as the image is not a forgery, and it originated from a real person living at the time of Jesus, crucified

⁶⁶ N.T. Wright elucidates several Christian mutations of Second Temple Judaism's doctrine of resurrection. One of these mutations is the change from a merely corporeal resurrection (like a resuscitated corpse) in Jewish doctrine to a spiritual-corporeal resurrection ("spiritual body"-- "pneumatikon soma"—1Cor.15:44) in the Christian view. This is remarkable in view of the fact that early Christians did *not* want to separate themselves from the doctrine of Second Temple Judaism. Why then, did the early Christians do this? After an exhaustive analysis, Wright concludes there is only one explanation—they saw the risen Jesus in a spiritual-glorified-powerful form—which evidenced both his former corporeality as well as his spiritual transformation. See N.T. Wright 2003 *The Resurrection of the Son of God* (Minneapolis: Fortress Press) pp 200-274. I have outlined the steps and substance of Wright's argument in Chapter 4 in a forthcoming book—*God So Loved the World: Clues to our Transcendent Destiny From the Revelation of Jesus* (Ignatius Press—Coming in 2016)

in the unique way of Jesus, and producing a burst of intense vacuum ultraviolet radiation from his decomposing body, who else would it be? Given all this, we might reasonably infer that the Shroud is the burial cloth of Jesus which contains not only a relic of his crucifixion, but also his resurrection in glory. If so, it shows both the truth of the most significant event in human history as well as the accuracy of the Gospel accounts of it.