

# A DOZEN YEARS OF SHROUD SCIENCE GROUP

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## ABSTRACT

Founded in 2002 by Mario Latendresse and coordinated by the author from 2005, the Shroud Science Group on Yahoo! (SSG) is currently a group of 147 scholars mostly from USA, composed of academics, researchers and scholars presenting a remarkable multidisciplinary approach, necessary for Shroud studies.

From 4<sup>th</sup> of December 2002 to 5th of June 2014, 25763 messages have been exchanged. The SSG analyzed virtually all of the data pertaining to the Turin Shroud (TS), discovering many interesting facts through the various discussions among the members. The most interesting arguments were about the hypothesis of the body image formation and about the flax fabric dating.

The SSG organized an International Conference on the TS and three others have been organized by some of its members who also published more than a dozen papers in international scientific journals and many dozens of papers via conferences, websites, books and other journals. This work describes the most important results published by SSG members.

## 1. INTRODUCTION

There are many hundreds of scholars in the world interested in scientific studies of the TS, the most important Relic of Christianity [Schwalbe R. N. Rogers, Jumper et al, A. Adler], and many of them are interested in exchanging of their points of view or in a verification of their result, but there is no official center able to coordinate these studies.

The “Centro Internazionale di Sindonologia has a Diocesan Commission addressed to the scientific studies about this important Relic (Commissione Diocesana Sindone, Via San Domenico 28 Turin, Italy), but it seems unable to satisfy the huge number of requests for information. (The author has unsuccessfully tried to communicate in the past.)

At the beginning of the 2000, with the coming of the social networks, some scholars tried to group each other with the aim to both discuss problems related to the TS and to keep informed on the news relative to the study of the TS

The so-called “2002 Restoration” of the TS [Ghiberti, B. Schwartz], an invasive heavy intervention made with the highest secrecy (also named by one author a “*Scientific disaster*” [Meacham 1]), by which the patches of the sixteenth century were removed with the backing Holland Cloth, prompted the researchers to express their comments using the latest computer technology."

The intervention was allowed by the Vatican because a group of experts declared that the burns caused by the 1532 Chambéry fire are dangerous for the flax fabric as they trigger chemical reaction that keep on damaging the TS; this reaction has been named “autocatalytic decomposition” of flax.

The need of discussion was increased in the second half of 2002 by the dispute about the intervention already done. It was especially raised by a famous American chemist, Raymond Rogers who, answering a question from the author and copying B. Schwartz, A. Arnoldi, D. Crispino, L. Schwalbe and W. Meacham, wrote in reference to the main reason that justified the so-called “2002 Restoration”: “*There is no danger of autocatalytic decomposition to the Shroud!*”

[Rogers 1, Rogers 2] and therefore the main reason that justified the heavy intervention appeared without scientific support.

The next Section will describe in the detail how the Shroud Science Group (SSG) was born from this need of communication among the TS scholars.

## 2. SSG'S BIRTH AND DEVELOPMENTS

On 5<sup>th</sup> of June 2014, twelve years after its foundation in December 4<sup>th</sup> 2002, SSG is composed of 147 members mostly American and Italians, but also coming from Europe, Lebanon, Philippines, Hong Kong and Australia; they are academics, researchers and scholars that exchanged 25763 messages.

As above mentioned, the so-called "2002 Restoration" of the TS made in June-July 2002, significantly increased the discussion among many scholars because many were not convinced of the necessity of the work done, as recounted in [Ghiberti]. A first mailing list for discussions about the TS can be found for example on 25<sup>th</sup> of October when R. Rogers, answering to the author, added P. Savarino, E. Marinelli, F. Zugibe, and S. Pellicori to his mailing list.

On 7<sup>th</sup> of November 2002, induced by the author, Emanuela Marinelli proposed a mailing list, named *Shroud Debate Project* (SDP) that was addressed to scientific discussion on open issues related to the TS. She wrote: "*as General Coordinator of the project, I appointed as Scientific Coordinator Prof. Giulio Fanti .... who will organize the debate, that must remain only scientific, without any polemic.*"

She received 34 positive answers to be discussants, 19 positive answers to be readers (with the request of the possibility of become discussant in the future) and 5 negative answers. Among these scholars there were names as F. Zugibe, B. Walsh, R. Van Haelst, L. Schwalbe, R. Rogers, S. Pellicori, W. Meacham, M. Latendresse, M. Alonso and D. Scavone.

Among various proposals to SDP, for example S. Mattingly on 31<sup>th</sup> of October suggested to widen the current discussion on the following topics: TS preservation; image formation; carbon dating, with the final goal to produce published scientific papers.

M. Latendresse after the very positive results of SDP, founded a group on Yahoo! named "*Shroud Discussion Group*" that was more organized than a simple mailing list and tested it for a while, inviting R. Rogers, A. Arnoldi, T. Wally, D. Scavone, R. Van Haelst and R. Dinegar on 4<sup>th</sup> of December 2002.

After about one month of testing, M. Latendresse proposed to all the SDP members to participate in his new group on Yahoo! and all agreed; the author officially entered on 15<sup>th</sup> of January 2003, while the leaders of SDP (Emanuela Marinelli, Raymond Rogers and the author) decided to disband SDP. By mutual agreement this new group was called *Shroud Science Group* (SSG).

At the beginning M. Latendresse formed three different groups named *Shroud Science Group* (SSG), *Shroud History Group* (SHG) and *Shroud Religion Group* (SRG) in order to categorize the treated arguments and to have a group (SSG), in which only strictly scientific arguments could be discussed.

While the SSG immediately flourished (more than a hundred messages per month after April 2003), unfortunately the SHG and SRG had so few messages that their members asked to be absorbed into the SSG, thus cancelling the other two groups. There was a positive effect: there was now only one group discussing all the problems regarding the TS. On the other hand, there was a negative effect: the scientific discussions included many exchanges that consisted of 'chats.'

M. Latendresse, the "*Group Owner*" left the SSG in 2005 switching the leadership to the author who leads the Group on Yahoo! with the help of three "*Moderators*": J. Botella from Germany, M. Alonso from France, R. Schneider from U.S.A.

The group, which is private, is composed of various academics from around the world, researchers, scholars and it has the advantage of presenting a remarkable multidisciplinary, necessary for TS studies; the invitation of a new member requires the presentation of the new scholar and the approval of SSG Members within three days from the announcement.

Very interesting scientific information on body image, radiocarbon dating, bloodstains, pollen, coins and many other topics, still open, with reference to studies on the TS have been developed also as a basis of various scientific papers published in scientific journals too.

During these years, some famous members like R. Rogers, S. Benford, G. Novelli, K. Dreisbach, B. Wiech, F. Zugibe, and other passed away, and many new members joined, giving new points of view.

Perhaps during the first years a greater variety of scientific arguments have been touched with fruitful results, while more recently, there has been a reduction in the number of topics discussed, but perhaps with more details. It is worth mentioning the fact that, while the presence of many famous members increased significantly the level of scientific discussion during the first years, more recently this level lowered when sometime the journalistic interest prevailed the scientific discussion.

The twelve years of discussion in the SSG has enabled members to analyze all the open questions regarding the TS, touching various religious and historical aspects but mostly discussing scientific arguments. The most important ones are reported in the next Section.

### **3. RESULTS**

The scientific studies regarding the most important Relic of the Christianity are stopped from the 1988 radiocarbon result. In 1995 [Saldarini] and in 2009 [Poletto], the Vatican, through pronouncements by Cardinals of Turin, announced that no new samples after 21 April 1988 (for the C-14 dating) had been removed from the TS for the purposes of new research. The statement seemed to aim to discourage further research, even though interest in the TS remained high all over the world. In order to fulfill the desire of many that scientific studies on the TS continue, the SSG formed to enable the members to look at the current open questions as well as to analyze TS samples in the hands of several researchers [Fanti & Gaeta].

It's difficult to numerate all the interesting results produced by the more than one hundred scholars in their discussions, which entail more than twenty thousand messages as well as images and attachments.

The following sections present the most important results relative to the studies performed by researchers belonging to the SSG.

In fact, even if the papers published by SSG Members don't explicitly mention the Group, it must not be forgotten that frequently the primordial ideas relative to many projects, have been debated at SSG level. Thanks to the reaction of some member to these ideas, the various authors of papers were helped in their findings just by the Group's discussion. The author many times experienced this help and takes here the occasion to thank all the SSG members for their very useful contribution; a great number of published papers would not have seen the light without this help.

The list will start from the direct products of the SSG, like conferences and scientific papers, continuing with a synthesis of the papers published by SSG members in scientific journals. After other publications, the list finishes with the main arguments touched on during discussions in the SSG.

#### **3.1 Conferences**

##### 3.1.1. 2008 Ohio Conference

Following many discussions of open topics by the group, the SSG Group, with the special help of J. Marino and S. Benford, organized in 2008 the International Conference: “*The Shroud of Turin: Perspectives On A Multifaceted Enigma*” that held from 14<sup>th</sup> to 17<sup>th</sup> of August, 2008 at Ohio State University in the Blackwell Hotel of Columbus, Ohio, USA [SSG Int. Conf.].

36 papers were presented and widely discussed by the numerous experts and a number of students, predominantly from Italy had the occasion to present their works in the form of poster papers that were exhibited during the whole conference. The author’s students won the top three cash prizes [SSG Report on Int Conf.]. First Prize was a Framed Replica of the Shroud of Turin and \$750 USD; second prize of \$350 USD and a third prize of \$150 USD have been also awarded.

The Conference was such a success that the author was officially asked to organize another conference in Italy or in Europe two years later in occasion of the 2010 TS exhibition.

### 3.1.2. Initial organization of 2010 IWSAI

After the request formulated in Ohio, the author made an effort to organize a conference in 2010 in Padua, Italy, in his University, but this idea soon vanished because someone in Turin took action to prevent it. Alternatively the author proposed to P. DiLazzaro, a SSG member, to organize a gathering at ENEA of Frascati. DiLazzaro agreed to the proposal. While at the beginning the workshop was to have been organized by the SSG, additional events induced the organizers to cancel any reference to the group.

In any case the “*International Workshop on the Scientific Approach to the Acheiropoietos Images*” (IWSAI) held at ENEA Research Center of Frascati (Italy) from 4<sup>th</sup> to 6<sup>th</sup> of May 2010 (Chairman P. Di Lazzaro) was a success [IWSAI] with the presentation of 36 papers of authors coming from U.S.A. and Europe.

### 3.1.3. Other Conferences

In 2012 (28<sup>th</sup>-30<sup>th</sup> of April) the Centro Español de Sindonología organized with a SSG Member, C. Barta, at Valencia, Spain, “*The First International Congress on the Holy Shroud in Spain*” in which about 40 papers were presented or added to the proceedings [Valencia Conf.].

Two years later, some SSG members decided to organize another conference in order to present additional research regarding the TS. In particular J. Marino and Mark Antonacci, among others, are organizing the International Conference: “*Shroud of Turin - The Controversial Intersection of Faith and Science*” that will held at St. Louis, Missouri from 9<sup>th</sup> to 12<sup>th</sup> of October 2014; 40 presentations are foreseen [St. Louis Conf.].

## **3.2 Papers published by SSG**

### 3.2.1. 2005 List of Evidences

A great number of papers have been published by SSG Members but one of them has been officially published under the name of the SSG because it was entirely derived from the many discussions of the Group. Its title is “*Evidences for Testing Hypotheses about the Body Image Formation of the Turin Shroud*” [Fanti et al. 1] and it was signed by 24 authors.

This is the result of the first goal posed by the researches of SSG in order to better understand the TS: to compile a list of evidences of the TS upon which to base their further debate on the body image formation problem.

It is composed of 87 “*Type A facts*” that refer to “*unquestionable observations*” made on the TS about “*Chemical-Physical Characteristic of the Linen Yarns and Fibers*”, “*Optical Characteristics of the Cloth*”, “*Body Image*”, “*Blood and Body Fluids*” and “*Other*”; 61 “*Type B facts*” that refer to “*confirmed observations or conclusions based on a proof made in reference to TS studies*”; 39 “*Type C facts or observations*” that “*were evidenced by some researcher but that*

are not universally accepted “. Following a proposal of H. Felzmann, the paper finally adds 21 analogies between the TS Man and Jesus Christ, from the Old and the New Testament.

Other revised versions [Fanti et al. 2, 3] of this “*List of Evidences*” (as it was synthetically named at SSG level) followed this paper, improving some sentences there contained that were widely discussed in SSG after its publication.

### 3.2.2. Special Issue on the TS

As the author was asked by Bentham Science Publishers in 2010 to work as Guest Editor for a Special Issue on the TS, he invited the SSG to submit papers on this argument. For an internal problem Bentham cancelled the project but the author continued the editing procedure with Academic Journals Editor. In particular the Special Issue was published in the Scientific Research and Essays Journal on 2012 [Fanti 4].

Many SSG Members sent their proposals and the papers of M. Antonacci, C. Barta, T. Heimburger, F. Lattarulo, R. Morgan, N. Svensson and the author were accepted by the referees of the scientific Committee designed by the author.

He also extended to all interested non-SSG researchers the invitation to publish and therefore the Special Issue consisted of 12 papers signed by the following first authors: F. Alconchel-Pecino, G. Baldacchini, A. Carpinteri, G. Lucotte and J. Macedo.

This Special Issue treats various analyses on the TS including hypotheses on body image formation, forensic aspects, characteristics of mineral particles found in the dusts vacuumed from the TS, digital image processing techniques and study of ancient copies of the TS.

## **3.3 Publications on Journals of SSG Members**

### 3.3.1. Chemical dating

One of the biggest open issues on the TS is certainly the dating. In fact, in 1988, the TS had been radiocarbon dated [Damon] to a medieval age, despite a series of clues attesting a much older age. This result produced hundreds of messages on SSG to prompted various publications.

In 2005 R. Rogers published a paper in Thermochemical Acta Journal [Rogers 3] in which disputed the 1988 radiocarbon dating of the TS on the basis of his discover regarding the lack of vanillin in lignin contained in the linen fibers. In fact his preliminary estimates of the kinetics constants for the loss of vanillin from lignin indicate a much older age for the cloth than the than the Medieval assigned in 1988.

In addition he declared that “*Pyrolysis-mass-spectrometry results from the sample area coupled with microscopic and microchemical observations prove that the radiocarbon sample was not part of the original cloth of the Shroud of Turin.*”

### 3.3.2. Statistical Analysis of 1988 C14 Dating

Pushed by the many discussions in SSG regarding the 1988 radiocarbon dating of the TS, the author obtained a University Research Project financed by Padua Athenaeum for 54,000 € by which he developed new dating studies on samples coming from the TS.

With the help of M. Riani of Parma University, F. Crosilla of Udine University and A. Atkinson of the London School of Statistics, the author demonstrated from a statistical point of view that the 1988 dating of the TS is not acceptable because of the presence of a systematic effect that highly biased the result. This systematic effect can be due to an environmental factor perhaps also correlated to the body image formation process [Riani et al.].

### 3.3.3. Opto-chemical Dating

Once demonstrated (Section 3.3.2) that the 1988 C14 dating of the TS was not scientifically reliable, the author tried to determine the date of the TS using alternative methods. This was difficult, as will be synthesized in the following steps.

First of all it was necessary to find a series of ancient flax textiles having known ages; about two dozen samples have been found from 3500 BC to 2000 AD. Then it was necessary to find a property of the flax textile capable of establishing a direct correspondence between the sample's historical date and its property: two properties related to the peak amplitude of both Raman and FT-IR spectra have been found with the help of P. Baraldi of Modena University and A. Tinti of Bologna University [Fanti et al. 4]. This procedure allowed to define a calibration curve with the corresponding uncertainty able to correlate the measured property to a historical date.

After this, samples coming from the TS were subjected to the same analysis and their results converted in corresponding historical age. The Raman analysis determined an age of the TS of 200 BC  $\pm$ 500 years at 95% confidence level, while the FT-IR analysis furnished an age of 300 BC  $\pm$ 400 years at 95% confidence level [Fanti & Gaeta] thus confirming the incompatibility with the C14 result.

#### 3.3.4. Mechanical Dating

A procedure similar to that described in Section 3.3.3 has been applied for a mechanical dating, using a new cyclic loading machine able to test single flax fibers [Fanti & Malfi 1]. By means of this machine, five different mechanical parameters (Breaking Strength, Young Modulus relative to the last part of the increasing loading cycles, Young Modulus relative to the first part of the decreasing loading cycles, Loss Factor relative to the last complete loading cycle and Loss Factor relative to an inverse loading cycle) have been successfully correlated with the corresponding sample's ages.

The five corresponding dates of the TS have been combined together to reach the most probable mechanical dating of the TS: 372 AD  $\pm$ 400 years at 95% confidence level [Fanti & Malfi 2].

Having three new dates of the TS coming from opto-chemical and mechanical methods, these results have been combined together giving the most probable date of the TS as 33 B.C.  $\pm$ 250 years at 95% confidence level. A compatibility analysis additionally showed that only the First Century AD is common to the three results and is in very good agreement with the date suggested by tradition in which Jesus Christ was enveloped in the TS [Fanti & Malfi 3].

#### 3.3.5. Image Formation: hypotheses

Perhaps the most important challenge to Science from the TS is the issue regarding the body image formation, which up to now has been unexplainable. Rivers of words have been written on this in the SSG; the discussions have initiated various hypotheses that are only able to partially explain what everyone can see, touch and measure on the TS. The discussions have produced a great number of papers, the most significant being the ones published in scientific journals.

The author synthesized in a critical analysis all the most interesting hypotheses of body image formation [Fanti 1] leading to the inference that a source of radiation is the best hypothesis and that, of the various hypotheses based on radiation, Coronal Discharge (CD) is the best, although no complete results can be obtained.

The cited paper reports: "*CD may be caused by various more or less scientifically identified sources such as (ball) lightning, earthquakes, and radioactive environments (radon), but perhaps the truth lies beyond science. Some consider that imaging of the TS by a CD may conceivably be a byproduct of the Resurrection, and this may be why the image cannot be reproduced scientifically.*"

#### 3.3.6. Image formation: CD

Many researchers have studied in the details both the theoretical aspects and the experimental results derived from the application of particular hypotheses of body image formation on the basis of the TS features cited in [Section 3.2.1](#).

After some discussion in the SSG, the author published a paper [\[Fanti et al. 5\]](#) about the CD hypothesis that prompted even additional SSG comments. This led to the author publishing the results of this discussion at the 2008 TS Congress [\[Fanti 2\]](#) and finally a scientific paper [\[Fanti 3\]](#) summarizing all the interesting points previously evidenced. The paper concludes: “*Experimental results with CD show similarities with the TS body image, and discussion is based on notes posted by SSG researchers. .... Up to now no sure conclusion can be reached about the mechanism that really formed the body image because it is not possible to experimentally reproduce the source of energy necessary to obtain an experimental copy of the TS image.*”

### 3.3.7. Image Formation: Excimer Lasers

Another hypothesis of body image formation is based on the UV radiation emitted by excimer lasers. This hypothesis has been first formulated by G. Baldacchini and followed with great interest by P. Di Lazzaro who published many scientific papers on this subject [\[Baldacchini et al., Di Lazzaro et al. 1, 2\]](#).

For example [Ref \[Baldacchini et al.\]](#) reports: “*In summary, our results demonstrate that a short and intense burst of directional deep-UV radiation can provide a linen coloration having many peculiar features of the Turin Shroud image, including hue, coloration of only the outermost fibers of the linen yarns, and lack of fluorescence.*”

### 3.3.8. Physicochemical interpretation of the Turin Shroud imaging

F. Lattarulo published a paper [\[Amoruso & Lattarulo\]](#) discussing a hypothesis of TS body image formation based on electrostatic discharges produced by a natural event. He wrote: “*This extremely superficial degradation is assumed as being originated by electrostatic discharges (ESD, often also referred to as partial discharges in gases, or corona effect) triggered by an exogenous electric field of seismic nature.*”

A theoretical model of electrostatic fields, based on the Lambert’s cosine law, supports the numerical results there obtained that shows the similarity between the ESD distribution along a rough numerical manikin and the luminance distribution of the TS body image.

A further development of this paper has been published with the collaboration of a student in thesis with the author who confirmed the previous results [\[Fanti et al. 6\]](#).

### 3.3.9. Particle radiation from the body to explain the TS’ images and its carbon dating

M. Antonacci published a paper [\[Antonacci\]](#) about the hypothesis of body image formation based on particle radiation coming out from the human body wrapped within it. According to his hypothesis, the radiation “*could account for or explain all of the primary and secondary body image features, the excellent condition of the cloth, its back side imaging, its possible coin and flower images, and the still red color of its centuries old blood marks. Particle radiation could also explain the Shroud’s 1988 radiocarbon dating.*”

### 3.3.10. Hypothetical role of calcium in the body image formation process

S. Benford and J. Marino proposed and preliminarily tested [\[Benford & Marino 1\]](#) a hypothesis that tries to explain the image color with the presence of “*precipitated calcium carbonate crystal, originating from a natural fabric washing process*”.

According to the authors, “*Evaluations using scanning electron microscope, Micro-Attenuated Total Internal Reflectance Fourier-transform infrared analysis (ATR-FTIR), secondary ion mass spectrometry, chemical analyses, and microscopic comparative analyses all revealed nearly identical findings as those found on Shroud image fibers.*”

Nevertheless they conclude that “ *several other experiments need to be conducted*” to validate this hypothesis.

#### 3.3.11. Comments on Garlaschelli’s copy of the TS

Among the various hypotheses of body image formation, SSG also considered that presented by L. Garlaschelli who supposed that the TS body image was made in the Middle Age by an artist who used chemicals [Garlaschelli]. After a lively discussion in SSG, T. Heimburger with the author presented a paper at IWSAI in 2010 [Heimburger & Fanti] where they evidenced the disagreement of many TS features with the experimental result proposed.

After the publication on a scientific journal [Garlaschelli] of these very debatable results, T. Heimburger with the author published in the same journal a critique showing why the analyses were not scientifically acceptable [Fanti & Heimburger]. After the journal editor invited Garlaschelli to reply, there was no answer, implicitly admitting the correctness of the published critics.

It is interesting to evidence here the important role of the SSG judgment about scientific work also produced by non-SSG members; it could be utilized to great benefit if the Vatican forms a scientific commission.

#### 3.5.12. Craig’s hypothesis of artist

Another artist-based hypothesis on the TS image formation makes reference to the a modified carbon dust drawing technique brought to light by the SSG Member E. Craig [Craig & Bresee]. She “*showed that the dust transfer technique is able to form images more similar to the Turin cloth than any previously described technique.*” It concludes that “*Macroscopic, microscopic, and image analyses were performed to show that an image could be created on fabric with physical properties and image features similar to those reported for the body image on the Turin cloth.*”

Nevertheless the author demonstrated that this last sentence was not fully true, commenting in a paper [Fanti & Moroni]: “*Perhaps the best 3D results are obtained by the carbon dust technique proposed by E. A. Craig, but it presents many open questions, which do not fully explain the formation mechanism.*”

#### 3.3.13. Superficiality of mages on TS fibers

As reported in Section 3.2.1, the formulation on new hypothesis about the TS body image and verification is based on a list of typical features. To better define some of these characteristics a group of scientists of the SSG discussed the results of new investigations and experiments performed on TS fibers in order to deepen some aspects regarding the superficiality of the image. These results were summarized in a paper [Fanti et al. 3] that reports in its Summary: “*Originating from a discussion among the members of the Shroud Science Group, this paper was compiled thoroughly describing the unique characteristics of the body image superficiality. This concept of superficiality is here described at the fabric, thread and fiber levels. At the fabric level, we show the importance of the geometry of the fabric. At the thread level, the very specific distribution of the color is emphasized. Finally, at the fiber level, we confirm that the color is a chemically altered layer about 200 nm thick found at the surface of the colored fibers (the inner part remains uncolored). We suggest that the chemical alteration that produced the discoloration is related to the primary cell wall of the linen fiber.*”

#### 3.3.14. Doubly Superficiality of the TS image

Subsequent to SSG discussions regarding the body image and based on the analysis of the new TS images made in 2000 and in 2002, the evidence of a fainter image of the face on the back side of the TS led to the proposal of the presence of a double superficiality of the image.

Thanks to a degree to a thesis led by the author, it was possible to numerically enhance this faint image of face also with the application of special image processing like the application of the 2D Fourier Transform and the Gaussian filter. The paper published [Fanti & Maggiolo 1], so

concludes: “*Body features were identified by template matching. The face and probably also the hands are visible on the back of the Turin Shroud, but not features related to the dorsal image.*”

In order to explain some additional results, the author published a subsequent paper in *Sindon*, [Fanti 5], but a SSG member published a paper [Di Lazzaro et al. 3] criticizing the discovery. The critique that the observation about the double superficiality is merely a trick of the eyes-brain system is commented by a companion paper being presented at the St. Louis conference. In this paper also a possible trick used to sustain the aim of the paper is discussed (hypothetical presence of an apparent image of face properly selected among scourge marks) [Fanti & Maggiolo 2].

#### 3.3.15. Manikin simulating the position of the TS Man

By means of studies performed at Padua University with the help of thesis students, the author numerically overlapped a digitized copy of the TS with a numerical manikin to define the most probable shape of the TS Man. This result, also published on a scientific paper [Fanti et al. 7], was object of a debate on SSG that, with the many messages exchanged, also produced another publication [Latendresse].

#### 3.3.16. Open issues regarding the Turin Shroud

The actual state-of-the-art of our scientific knowledge of the Turin Shroud has been presented by the author in a paper [Fanti 6]. First of all, the problem of the formation of the body image is examined; the problem of conservation is also considered, together with that of the radiocarbon dating of 1988, which provided a debatable result. Other minor problems like that of DNA and pollen analysis are discussed and questions recently raised about the possible presence of coins and writing on the TS, which do not seem to be confirmed by the latest photographs, are also mentioned.

Then some open issues defined by STURP, after the important scientific research carried out in 1978, are also discussed, because until now they have not supplied complete answers. Lastly, some recently-answered questions are reported related to the enveloping of a man that was really dead, the negativity and the 3D features of the body image.

#### 3.3.17. The Shroud of Turin and its ancient copies

C. Barta published a paper [Barta & Carracossa] describing the features of some TS copies. It states that: “*It is relatively easy to demonstrate the artificial execution of the ancient copies of the Shroud. Even though there are many peculiar characteristics of the Shroud image, conclusive evidence can be reached with only a few of them.*”

In agreement with the author of the present paper, it is there stated that “*the original Shroud of Turin can not be the work of a painter because it would have been clear after a few minutes of direct inspection by the experts who have analyzed it with the specific instrumentation used on several occasions.*”

#### 3.3.18. Radiocarbon dating: sample area

A predominant argument debated on the SSG is the radiocarbon dating of the TS. Among the various discussions, one prominent hypothesis is that the 1988 dating of the TS was impacted by a Medieval reweaving.

M. S. Benford and J. Marino published a paper [Benford & Marino 2] in which this hypothesis is documented by many clues. They conclude: “*.... it is impossible to quantify the amount of surface carbon, other contaminates, and/or intruded newer material in the radiocarbon sampling area ... to determine if either the surface carbon, or the manipulation it represents, had any impact on the 1988 radiocarbon dating. ... Further, characterization of the remaining C-14 samples, Raes samples and the Holland cloth to ascertain the presence of cotton, surface dyes and other restoration substances in accordance with these findings, is warranted.*”

### 3.3.19. Digital image processing and the radiocarbon dating sample area

To support the results of the previous paper, J. Morgan performed a digital image processing [Morgan] using an ultraviolet-fluorescence photograph in which enhanced the contamination effects in the area of 1988 for radiocarbon dating.

He wrote: “*The results of this analysis demonstrate the anomalous nature of the radiocarbon data sample area. ... A one sample z-test demonstrated that there is a statistically significant difference between the mean z-scores for the four radiocarbon data samples and the mean z-score for a sample area of the Shroud with representative ultraviolet fluorescence.*” but he concluded with a non-definitive statement: “*While this investigation corroborated Rogers’ claims regarding the anomalous chemical nature of the C-14 sample area, the rewoven area posited by Benford and Marino could not be identified via digital image processing of the UV-F image.*” thus inducing the TS researchers to continue in their studies.

### 3.3.20. Forensic aspects and blood chemistry of the TS Man

SSG Members N. Svensson and T. Heimburger published a paper [Svensson & Heimburger] regarding forensic aspects and blood chemistry from their studies performed on the TS. In particular they considered the cheek and nose injuries, the dumbbell and streak shaped wounds due to the scourging, the scalp wounds due to the crown of thorns, the swollen knee caused by a crossway fall, the wounds in hands and feet, the intact shins for the non-broken legs, the chest wound, as well as the rigor mortis.

They finally concluded that “... *the most likely causes of death are compromised circulation due to intense pain, compromised preload caused by the hanging position, hypovolemic shock due to dehydration and blood loss ... , accentuated by trauma-induced coagulopathy ...*”.

### 3.3.21. The veiled sufferings of the TS Man

The Passion of Jesus described in the Gospels and more in general in the Bible very well agrees with the sufferings of the TS Man, however many additional details can be unveiled that demonstrate how extremely severe were the tortures inflicted to that Man. This is the subject of a recent paper published by M. Bevilacqua and his colleagues [Bevilacqua et al.], in which it is reported that “*The dislocation of the right shoulder shows a trauma suffered during the carrying of the cross to Calvary ... A violent blunt trauma involving the root of the neck and back caused an injury to the entire brachial plexus, which explains the lowering of the right shoulder, the enophthalmos and the right hand flat posture ... The crossing hands on the pubis, ... indicates that he has been subjected to excessive traction of the upper limbs up to the disarticulation during the nailing and the suspension on the cross.*”

With these results, obtained both from accurate measurements on the TS image and from experiments on parts of cadavers, the authors conclude that “*The fall and/or the flagellation have caused a pulmonary contusion with haemothorax and possibly a cardiac contusion and then myocardial infarction and heart rupture [From the Psalm 22:14, “My heart has turned to wax; it has melted within me” and from the Psalm 69:20 “Scorn has broken my heart”].*”

### 3.3.22. About the so-called “2002 Restoration”

As mentioned in the Introduction, the so-called “2002 Restoration” of the TS set off many discussions about the way the Cloth was handled for an apparently unjustified reason, in reference to the hypothetical additional damage produced by the “autocatalytic decomposition” of flax in correspondence of the burns caused by the 1532 Chambéry fire.

Among the various researchers against this intervention it must be mentioned W. Meacham [Meacham 2] who showed his disappointment writing: “*Deep concerns over the “restoration” led a group of 52 Shroud researchers to petition the Vatican in 2006. .... This aggressive operation was in stark contrast with modern precepts of conservation, and resulted in important scientific data and heritage features being lost, along with great opportunities for sophisticated testing and*

sampling. *The long-term negative impact of the intervention is feared to be substantial; the underlying premise, that the image was threatened, has been shown to be false.*”

### 3.4 Other publications of SSG Members

It is almost impossible to mention the huge number of publications by SSG members that have appeared in books, journals, websites, and newspapers. For example, the website of B. Schwartz (www.shroud.com) contains many hundreds of scientific papers, and about 150 works have been discussed during the four Conferences mentioned in [Section 3.1](#): many of them have been written by SSG Members. Below are some that were significant in SSG discussions

#### 3.4.1. Autocatalytic process of charred material

The chemistry of autocatalytic processes in the context of the TS was the first argument discussed in depth in the SSG; it is Message #6 of 5<sup>th</sup> December 2002 from R. Rogers. There he wrote: *“Based on the facts of chemistry and current storage conditions, the Shroud of Turin is in no danger of catastrophic autocatalytic decomposition. The only practical way to extend its life is to keep it cool, but it must not be stored too cold.”*

In conclusion: *“The fact that the Shroud survived the fire of 1532 by 470 years without obvious acceleration of any degradation processes should provide all of the proof necessary that autocatalysis is not a significant problem. None of the products observed during restoration of the Shroud could be involved in autocatalysis, and they should cause no fear for the longevity of the cloth.”* A paper [\[Rogers 4\]](#) followed this message confirming that the so-called “2002 Restoration” was not necessary.

#### 3.4.2. Image formation

The argument regarding the hypothesis of the TS body image formation is preponderant in the SSG discussions. In addition to the scientific papers on the theme presented in [Section 3.3](#), various other have been published elsewhere, also supporting different points of view.

R. Rogers was not convinced of a hypothesis based on radiation; he sustained a different mechanism based on the gas diffusion ruled by the Maillard reaction that is a form of non-enzymatic browning involving an amino acid and a reducing sugar. He supposed that the TS flax fibers are coated with a thin carbohydrate layer of starch fractions, various sugars, and other impurities, probably confusing this layer with the Primary Wall Cell typical of flax fibers.

He proposed [\[Rogers & Arnoldi, Rogers 5\]](#) that amines from a recently deceased human body, having a temperature higher than 40 °C, (putrescine and cadaverine) may have interacted with this carbohydrate layer and undergone what's known as a "Maillard reaction.

Also M. Alonso supposed gas diffusion as the predominant mechanism of image formation; after a long debate in the SSG and his disagreement to publish a joint paper [\[Fanti et al. 3\]](#), he published at Dallas Symposium a paper in which he explained his point of view [\[Alonso\]](#), but the author explained in a paper why he was in disagreement [\[Fanti 7\]](#) with this gas diffusion hypothesis.

#### 3.4.3. 1988 Radiocarbon dating

We have seen in [Section 3.3](#) that also the argument about the 1988 radiocarbon dating of the TS is widely discussed in the SSG and many papers on this argument have been published. Among the notable ones it must not be forgotten the works of Refs. [\[Van Haelst, Brunati\]](#), where it was demonstrated that the Nature paper [\[Damon\]](#) contains statistical errors.

The argument continued to be discussed in the years; for example A. Lind in 2010 [\[Lind & Antonacci\]](#) proposed the neutron radiation as the cause of the evident bias detected in the 1988 results.

#### 3.4.4. The Death of the TS Man

Another argument discussed in the SSG, even if apparently obvious, is about the death of the TS Man. Notwithstanding many medical analyses performed by SSG Members [Zugibe, Faccini et al.], that showed evident signs of death, one SSG member, H. Felzmann sustained [Felzmann] that the Man was enveloped alive in the TS, basing his discussion on old and highly criticized works [Hoare].

Also in this case the discussion has been prolonged because, as sometimes happens in disputes about the TS characteristics and hypotheses, some researchers prefer to base their assumptions on subjective deductions, also biased by religious feelings. leading to less than fully-scientific conclusions.

#### 3.4.5. Analysis of TS dusts

During the STURP campaign in 1978 some dusts were vacuumed from the back of the TS and sampled in filters [Riggi di Numana]. These have been studied and a statistical analysis of its content has been presented at SSG Ohio Conference in 2008 [Fanti & Basso 1].

Thank to a Research Project financed by Padua University (Italy), a detailed analysis of the content of these dusts, also using scanning electron microscopes, has been more recently published at Valencia Conference in 2012 [Fanti et al. 8]. Grains of pollen, linen and cotton fibers, mites, spores and fungi, mineral particles and particles possibly coming from body fluids have been studied and the classification of some of these particles has been possible. It also resulted that there are few cotton fiber mixed with linen ones and that many mineral particles coming from these dusts are compatible with the Jerusalem soil.

#### 3.4.6. Significance of the Frei's analysis on pollen

It is well known that M. Frei detected the presence of many pollen grains [Frei] on the TS related to locations corresponding to the historical path of the TS, but recently his findings have been questioned [Ciccone].

This fact raised a discussion on SSG in which also P. Maloney, W. Meacham, R. Rogers, A. Whanger actively participated to see if M. Frei's results are reliable, considering more recent publications [Danin et al.].

After the recent discovery from the TS vacuumed dusts of the same pollen grains detected by M. Frei [Fanti & Gaeta, Fanti & Malfi, Fanti et al. 9], it can be concluded that M. Frei's findings are reliable.

#### 3.4.7. Numismatic analysis

Numismatic analyses have been performed in the past comparing the body image of the TS with some Byzantine coins representing Jesus Christ (defined as the kings' King) also by A. & M. Whanger [Whanger & Whanger 1, 2] which demonstrated a strict correlation between the two images.

These and other papers were used in the SGG as a basis for discussions that led to new interesting results. For example the author arrived to demonstrate that the engravers who produced the face of Christ on the Byzantine solidus minted in 692 B.C. for Justinian II had only seven probabilities on one billion of billions to engrave such a face without having looked at the TS image [Fanti & Malfi 3]. Many other analyses are reported in the same book also demonstrating that the image of Christ on the coins obeyed the rigid Byzantine canons that were taken directly from the TS image.

#### 3.5.8. History of the TS

As described in Section 2, the SSG is not only devoted to the science applied to the TS but also to the history, therefore some messages regarded various historical aspects of the TS. For example D. Fullbright discussed about the transfer of relics from Palestine [Fullbright 1] and about

the recently discovered shroud of Akeldama [Fullbright 2] making a comparison with the TS, D. Scavone about the presence of the TS at Edessa [Scavone 1] and with A. Piana [Scavone 1, Piana 1] about the obscure period of the TS after the sack of Constantinople in 1204; A. Piana also presented a hypothesis that the TS, before the siege of 1706, was secretly removed from the Savoy capital at the beginning of the seventeenth century to stay in the town of Maddalene, near Fossano, 80 kilometers south of Turin [Piana 2] .

### 3.5.9. Religion and the TS

The SSG is heterogeneous from a religious point of view, being composed of Members who follow different creeds, but being prevalently oriented to the scientific aspects, the group isn't concerned with the specific religious beliefs of its members.

In any case, some disputes arose because assumptions were based on religious aspects; for example some scholars of positivistic and rationalistic tendency show greater difficulty in accepting a body image formation hypothesis based on forms of radiation that are not clearly reproducible in laboratory. In fact, hypotheses strictly related to natural phenomena are preferred even if it is much more difficult to attempt to explain the image formation.

In reference to published papers on the argument, notable contributions are a comparison between the scientific aspects of the TS and the description of the Passion, Death and Resurrection of Jesus Christ reported in the Bible published in Ref. [Fanti 1] and the study of D. Fullbright [Fullbright 3] who doubts that Jesus gave his Shroud to “the servant of Peter” as reported in the Gospel of the Hebrews.

## **3.5 Discussions on SSG**

It is not possible to report all the many arguments treated in the SSG; some of them have been mentioned above and other examples of discussion follow here below.

- T. Fleming will present a paper at 2014 St. Louis Conference about a Biophotonic hypothesis of body image formation that “*examines how the Shroud may have arisen via the Resurrection of Jesus Christ*”. He supposes the presence of biophysical reactions related to the ultraviolet radiation termed biophotons that is produced “*when each chromosome suddenly cleaves into two daughter chromatids*”.
- P. Iacazio made many proposals to study TS fibers using innovative instruments like AFM (Atomic Force Microscopy). The author has performed some experiments in this area.
- The SSG discussed the possible presence of coins on the eyes of the TS Man but at the moment no sure proof of their presence seems detectable [Fanti & Basso 2].
- A discussion regarded the possibility to detect the AB group in blood samples coming from the TS, as declared by P.L. Baima Bollone [Baima Bollone et al.], but many SSG experts doubted this finding because the ancient blood is deteriorated.
- A. Danin [Danin et al.] detected the presence images of many flowers on the TS, but this finding can be attributed to a pareidolia effect [Di Lazzaro 3], therefore the discussion is still open.
- Some discussion was related to the religious aspects connected to some body image formation hypotheses based on radiation and M. Carreira manifested his influential point of view.
- One discussion was oriented to the specific identity of the TS Man, also in light of some studies that assert that the name of Jesus can be found on the cloth. Although this can't be concluded from a strictly scientific point of view, the author, who has studied the question for fourteen years of study, believes from both a scientific and faith perspective that the TS corresponds to the photograph that Jesus Christ wanted to leave to us. It shows evidence of a burst of energy released during the Resurrection and leaves indications of the many signs of his Passion in the most important Relic of Christianity. Other SSG scholars prefer to limit their analyses to the scientific realm only, so the debate has no end.

## CONCLUDING REMARKS

This paper describes the most important results published by the SSG members since its inception in 2002. Founded in 2002 by Mario Latendresse and coordinated by the author from 2005, the SSG is currently a group of 147 scholars mostly from the USA, composed of academics, researchers and scholars presenting a remarkable multidisciplinary approach, necessary for Shroud studies.

From 4<sup>th</sup> of December 2002 to 5th of **June 2014**, **25763** messages have been exchanged commenting all the news pertaining to the TS. Perhaps the most interesting arguments treated were about the hypothesis of the TS body image formation and the dating of the flax fabric, but also other still open arguments like, bloodstains, pollen, coins and many other topics that have been discussed; many of them brought to light many new interesting aspects

The SSG organized an International Conference on the TS and SSG members were involved in the organization of three other Congresses. In addition, SSG members published more than a dozen papers in international scientific journals as well as contributing to many websites, books and other journals

Taking advantage of the many discussions that SSG stimulated, its members published many important works in scientific journals about the chemical, opto-chemical and mechanical dating on the TS, the lack of correctness from a statistical point of view of the 1988 C-14 dating, the image formation hypotheses based on various kind of radiations and other hypotheses, the very peculiar feature of the body image, the configuration of the Man enveloped on the TS and other interesting aspects of various disciplines.

These important results obtained by the SSG demonstrate the necessity to maintain and increase the scope of such a group, attempting to collect all the data regarding the most important Relic of the Christianity. This group also proved to be able to verify the correctness of new hypothesis formulated to try to explain the many secrets still hidden in that body image that still continues to puzzle researchers worldwide.

The SSG should perhaps be joined with the Centro Internazionale di Sindonologia in Turin in order to strictly collaborate with it, thus increasing the interest of new scholars to study the arguments relative to this very important Relic. The author is convinced after 14 years of study that, despite the impossibility of confirming authenticity from a strictly scientific view with 100% certainty, that it is the only one "photograph" of Jesus Christ who resurrected from the dead.

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