

Sindonology: Vehicle For and Against Authenticity of the Turin
Shroud

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ABSTRACT

The Turin Shroud is a piece of linen cloth bearing an image many believe to be that of Jesus of Nazareth. Over time, *sindonology*, the scientific study of the Turin Shroud, has expanded as a combination of academic disciplines, working together to come up with hypotheses as to the true identity of the Shroud. This investigation aimed to analyze the contributions of sindonology to two perspectives on the Turin Shroud's identity, one being that the Shroud is a medieval forgery, the other being that the Shroud is the authentic burial cloth of Jesus. It was established that six sindonological disciplines have contributed the greatest amount of evidence to both perspectives: blood studies, the pathology of the image, imaging studies, textile studies, scientific dating of the Shroud, and missing historical provenance. The discipline-specific data was collected from many public sources. Upon data review, it was concluded that the existing body of sindonological evidence has consistently grown with the development of new analytical scientific technologies, prompting researchers to reevaluate previously collected sindonological data. It is expected that this trend will continue, creating new opportunities for investigation. The significance of this investigation rested in its ability to act as an 'educational tool' for students of the Shroud and Shroud scholars to refresh themselves on sindonology and its clear-cut history of ever-evolving study. The hope is that by offering such an educational tool to the world, future generations of scientists will choose to study for themselves such culturally rich subjects as the Turin Shroud.

INTRODUCTION

The history of the Turin Shroud remains largely in question, but one thing we know for certain is that sindonology, the scientific study of the Shroud, has been a steadily growing and influential area of scientific and historical investigation for the past hundred years alone. Highly significant in the continued development of sindonology has been the great contributions it has received from a whole host of academic disciplines, including in the areas of blood studies, pathology, imaging, textiles, scientific dating of the Shroud, and analysis of historical records.

The Shroud itself is a very unique physical object, marked by many different distinguishing characteristics. The linen is riddled with scorch marks, burn holes, patches to fire damage, and tears in the fibers. These characteristics have often been more noticeable than the image on the Shroud, for that image is very faint, and can only be seen with the naked eye by standing a few feet back from the cloth (Wilson & Schwartz 2000). Despite its damages and repairs, which are to be expected from any historical artifact, the Shroud is remarkably well-preserved for its age, regardless of whether it is seven hundred or two thousand years old. To the touch, the cloth feels much stronger and more supple than might be expected of a textile that is at least hundreds of years old (Antonacci 2015).

If we go back in time, the turn of the twentieth century saw the first photographs taken of the Shroud by the amateur but accolade-rich Italian photographer Secondo Pia. (*Secrets of the Shroud* 2004). Since those photographs were taken, the Shroud took the world by storm, stimulating a sindonological revolution building up to the expansive research efforts undertaken by many different scientists in the 1970s and 80s, efforts under names such as the 1973 Turin Commission, the 1978 Shroud of Turin Research Project (or STURP), and the now-famous 1988 radiocarbon dating of the Shroud. (Wilson 1978)

Turning to the image on the cloth, one's eyes are directed towards the main body of the linen. The image is largely bounded by scorch marks running up and down the Shroud parallel to the edges of the cloth. Those scorches date from a terrible fire in Chambery, France in 1532 (Wilson 1978). Inside of these parallel scorches, it takes a few seconds, even when standing some feet back, for the human eye to begin making sense of the lights and darks that create the image. At some point, what comes into view is the faint depiction of a human body, with the front side of that body depicted on one end of the cloth, and the back or dorsal side of that body depicted on the opposite end of the cloth, taking up the bulk of the linen's fourteen feet (Wilson 2010). Red markings that appear like bloodstains in areas of the body corresponding to the wounds inflicted on Jesus of Nazareth, as told in the four Gospels of the New Testament, have been one of the primary reasons that the image on the Shroud has always been associated with Jesus. No matter how a person has viewed the real identity of the linen, it has just about never been called into question that the image is meant to represent the figurehead of Christianity.

This sindonology investigation was a review of existing scientific & historical data, the study of the study of the Shroud, in a sense. The goal of the project was to outline how

sindonology has impacted people's perspective on the Shroud's true origin or identity. This goal was formulated on the premise that, as scientific investigation has expanded, those holding an opinion on the Shroud have consistently fallen into two camps: one camp holding the perspective that the Shroud is a forgery or artwork, most likely a product of the Middle Ages, and one camp holding the perspective that the Shroud is the authentic and ancient burial cloth of Jesus of Nazareth. It was established in the early parts of the investigation that the scientific and historical findings of sindonology are the root cause of the two camps holding the perspectives they do on the Shroud, and to test this, an analysis of a cross-section of those findings was called for.

METHODS

Overall Procedure

These scientific and historical findings of sindonology were collected from publicly available sources, including peer-reviewed scientific articles, books, and a video documentary entitled "Secrets of the Shroud" (2004). These sources were authored almost entirely by Shroud scholars and by the very scientists who have previously worked hands-on with the cloth.

The findings collected seemed to the researcher to be some of the more notable findings of scientific research, facts and evidence that certainly might cause people to favor one perspective on the Shroud over the other. Those pieces of data were copied word-for-word into a lab notebook, and categorized appropriately (see Methods - *Breakdown of Data* below).

Breakdown of Data

The goal of the investigation was to delineate and examine the reasons why people have held and continue to hold the opinions they do about the Shroud of Turin's true identity, those reasons coming in the form of scientific and historical findings from previous investigations into the Shroud. In order to reach that goal, the large amount of collected evidence needed to be broken down in a manner that compared evidence favoring one perspective to evidence favoring the other perspective. Not only that, but that comparison had to be performed for each of the major academic disciplines which have had a significant impact on sindonology.

Realizing that this was the most appropriate path forward for breakdown of the data, the choice was made to highlight scientific & historical evidence in six major sindonological disciplines: blood studies of the Shroud, investigation into the pathology of the image, imaging studies, textile studies, analysis of dating tests performed on the Shroud, as well as an investigation into the Shroud's missing historical provenance, or absence in the historical record. For each of these six disciplines, the scientific and historical evidence pertaining to that discipline was divided up into evidence that has consistently supported the burial cloth perspective on the Shroud, and evidence that has consistently supported the forgery perspective

on the Shroud. That comparison was done with the t-chart shown below, for each of the six disciplines.

Forgery	Burial Cloth

Figure 1: Breakdown of Data - Comparison of Forgery-Supporting Evidence and Burial Cloth-Supporting Evidence

RESULTS

Blood Studies

The evidence, in the case of the Shroud's 'bloodstains,' largely chemical evidence, was broken down into how it has brought a bearing on each of the two perspectives. Some noteworthy data, collected from scientific inquiry into apparent 'blood' fibers, include the efforts by several Shroud scientists to investigate the chemistry of these so-called 'blood' fibers (see Figure 2). These scientists included Walter McCrone, John Heller, Alan Adler, and Ray Rogers, among others. What they uncovered was the presence of iron oxide particles on the cloth, a possible indication of the application of paint, along with the presence of biological proteins known to be components of real human blood and some badly degraded genetic information in apparent 'blood areas' around the top of the cranial image (Ford 2000 and Antonacci 2015).



Figure 2: Microscopic blood detail, showing characteristic herringbone twill (Porter)

An interesting connection between blood studies and the pathology of the Shroud's image was made when the blood fibers were tested for biological proteins or other chemicals expected to be found in human blood. The many chemical tests uncovered numerous biological traces in

the stains, including methemoglobin, heme porphyrins, and albumin (Ford 2000). One of the chemicals that emerged from that analysis was something called bilirubin. Bilirubin, in comparison to the total amount of blood present in certain stains, was found in a large quantity of the Shroud's 'blood.' Experts have since concluded that bilirubin builds up in the blood when someone has been tortured (*The Shroud and the Jew: Barrie Schwartz at TEDx ViadellaConciliazione*). Taking a look at the Shroud's image (see Results - *Pathology of the Image* below), one sees that the front and back of the Shroud-man are both peppered with what appear to be severe injuries (see Results - *Pathology of the Image* below). Of course, the likelihood that any medieval forger or artist would have placed real human blood on their work is very low, and the chance of that blood being the blood of someone who has been tortured is even lower. That is built, though, on the assumption that the red stains on the Shroud are indeed fibers covered in blood, a statement which, though still under heavy investigation, has been very well supported by scientific study.

Scientific analysis of Shroud fibers in areas of red blood-like staining has indicated that certain protein markers were found suggesting that if real blood, the blood on the Shroud would be type AB, a rare type in the world population but one fairly common among Middle Easterners (Iannone 2010). In Spain is kept another piece of cloth associated with Jesus, called the Sudarium of Oviedo. That cloth bears red staining remarkably similar to staining on the Shroud, and indeed science has offered much evidence suggesting that those stains, like those of the Shroud, are likely real human blood. One of the details uncovered from study of the Sudarium's stains is that if real blood, that cloth would bear blood of the type AB, just like the Shroud.

These conclusions have been hotly debated, but overall, the data has shown that the 'bloodstains' on the Shroud do contain components of real human blood, and as such are actual bloodstains. The iron oxide particles can even be explained by the presence of blood, but in the eyes of a number of scientists, their presence on the cloth will always prevent verification of the bloodstains, for them.

Below is the t-chart comparison of evidence contributing to each perspective for blood studies, created after collection of data. The t-chart provides a quick summary of notable findings in blood studies supporting both perspectives:

Forgery	Burial Cloth
<ul style="list-style-type: none"> - 'Blood' should not be this red if the Shroud is indeed ancient (Iannone 2010) - Microscopist Walter McCrone performed in-depth analysis of Shroud fibers from 'bloodstain' areas, found evidence of the presence of iron oxide, which could indicate the application of paint to the Shroud (Ford 2000) - For Heller & Adler (H & A), Shroud chemists, the task of testing individual fibers for components of hemoglobin proved extraordinarily difficult (Ford 2000) 	<ul style="list-style-type: none"> - H & A (Ford 2000) <ul style="list-style-type: none"> - Chemical testing of apparent 'blood' fibers: <ul style="list-style-type: none"> - High iron levels found using X-ray fluorescence - X and Y chromosomes found among heavily degraded DNA in 'head' region (Antonacci 2015) - Microscopy & chemical testing of Shroud fibers have provided evidence of a separation of blood and serum within the 'blood stains' resulting from the chest 'wound' (Zugibe 2005)

Comparison 1: Blood Studies

Pathology of the Image

An analysis of the Shroud's image joined with the study of what appear like 'bloodstains' on the Shroud has helped form an in-depth study of the pathology of the image. In other words, if the man on the Shroud of Turin is supposed to represent a real human being, what can forensic analysis tell us were some of the physical characteristics of that man, and what, ultimately, led to his physical condition as depicted on the Shroud?

'Renaissance men' the likes of Leonardo da Vinci were often well ahead of their time in terms of medical knowledge, and may well have been capable of creating many of the Shroud image's forensically accurate features, although such genius cannot account for all of the anatomically perfect features (Iannone 2010 and "*The Shroud and the Jew: Barrie Schwartz at TEDx ViadellaConciliazione*"). The image of a puncture wound on the wrist area of the man of the Shroud is inconsistent with all of the Gospel testimonies that describe the crucifixion of



Figure 3: Close-up of 'puncture wound' image in the right wrist area, with distinctive blood flow angles on forearms (Schwartz)

Jesus, all of which describe Jesus as having been nailed through the palm, and not through the wrist (see Figure 3). A debate over the original wording of the Gospel texts is connected to that controversy (Antonacci 2015). In addition, the pathology of the cranial images, both the frontal and dorsal sides, has shown that a series of sharp instruments would have inflicted puncture wounds all around the head, on either side of and on the top of the head. Strong and sharp thorns could have been capable of inflicting such wounds.

This might suggest, if one refers back to the Gospels, that the man of the Shroud was pierced about the skull with a cap, rather than a crown, of thorns. A circlet of thorns, one not enclosing the whole top of the head, is just about always depicted in religious artwork of Jesus, but that formation of sharp ‘thorns’ is inconsistent with what the Shroud image suggests (Zugibe 2005).

The man of the Shroud would have been well-built and somewhere in his early thirties. Facial features revealed from the front image suggest that he would have been of Arab or Jewish ancestry. In the last hours of his life, the man would have suffered from hematidrosis, or bloody sweat, dehydration from beating or whipping, a condition called *trigeminal neuralgia* triggered by puncturing of the nerves around the forehead, causing a pain that’s difficult to express in words, and he would have suffered the agony of being nailed through the wrists and feet in a manner consistent with Roman crucifixion, a feeling forensic pathologist Fred Zugibe once described as “lighting bolts” traversing the extremities (Zugibe 2005 and *Secrets of the Shroud* 2004). Wound patterns and angles of bloodflow on the Shroud image brought all of these details to the attention of the scientific community.

All of this has come to light from in-depth study of the Shroud’s image. The general pattern of the wound images could certainly have been inspired by a forger’s careful studying of the Gospels and of other sources available in the Middle Ages giving accounts of Jesus’ crucifixion. On the reverse side, some of these details would have been impossible for any forger or artist of the Middle Ages to know of, let alone replicate. Indisputable, though is the professional collaboration between scientists required for the pathology of the Shroud’s image to be investigated. Such admirable scientific investigation is testament to sindonology’s history of bringing people together (see Conclusion below).

Below is the t-chart comparison of evidence contributing to each perspective for pathology of the image, created after collection of data. The t-chart provides a quick summary of notable findings in image pathology supporting both perspectives:

Forgery	Burial Cloth
<ul style="list-style-type: none"> - 'Renaissance men' such as da Vinci were often well ahead of their time in terms of medical knowledge, could have placed many forensically accurate details on Shroud image (Iannone 2010) - The wrist 'wound' is not in line with the Gospel testimony of Jesus being nailed through the palm (Zugibe 2005) - The head 'wounds' would have been inflicted by a series of sharp instruments covering the head; more like a 'cap' than the traditional circlet of thorns often depicted in medieval Christian art (Zugibe 2005) 	<ul style="list-style-type: none"> - The Gospel word <i>cheir</i>, used when describing the crucifixion of Jesus, can also mean wrist and forearm (Antonacci 2015) - Various hypotheses exist for how the apparent 'nailing' of the hand-wrist area depicted on the Shroud would have been performed (Zugibe 2005) <ul style="list-style-type: none"> - Space of Destot - Exit 'wound' in the wrist? - Over 100 marks resembling the shape of wounds that would be inflicted by a Roman <i>flagrum</i> (Ford 2000) - 'Bloodflow' angle of the forearm would indicate death in an upright position (Wilson & Schwartz 2000)

Comparison 2: Pathology of the Image

Imaging Studies

Imaging can in many ways be considered the very first discipline of sindonology, since it was the Shroud's strange photographic properties which really allowed it to leave its footprint in the scientific world. What one observes when comparing the image with the naked eye to the image under a photographic lens is a reversal of lights and darks, as well as a reversal of left-right direction. The latter reversal refers to the fact that, as seen with the unaided eye, a stain in the chest area of the Shroud man's image appears on the man's left side - but with a camera, the stain actually appears on the right side of the chest. This contrast is also readily apparent by comparing which hand rests over the other on the front image, and in what direction the '3'-shaped forehead 'bloodflow' faces (Antonacci 2015).

As previously stated, the Shroud image under a negative filter is actually a photographic positive, giving a haunting realism to an image that is very faint under natural lighting (see Figure 4). It is almost as if the Shroud were a special kind of photograph, and various theories exist as to how photography could have been performed in the Middle Ages, when the Shroud, if a forgery, was likely to have been created (*Secrets of the Shroud*).

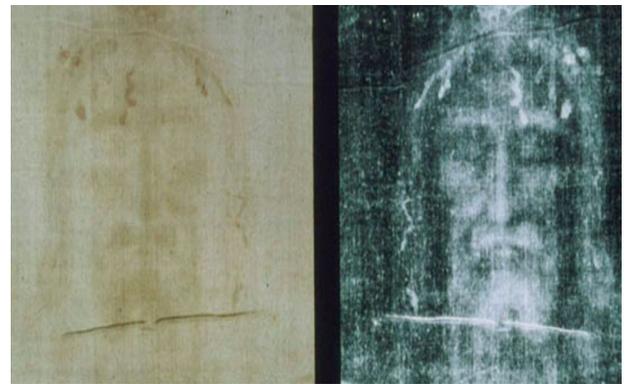


Figure 4: Positive vs. negative Shroud facial images (Gerig)

Under subdued lighting, the so-called ‘bloodstains’ of the Shroud as well as the body image appear to be one tone of color, indistinguishable from one another (Wilson 1978). Shroud photographer Barrie Schwartz noted that the kind of “shadow” one would expect to see on the image as a result of an outside source of light having been present at the image’s creation is markedly absent on the Shroud, a possible indication that any light or radiation involved could have come from the body itself (see Discussion below). The use of the VP-8 Image Analyzer has not only revealed that the Shroud’s image is encoded with three-dimensional information, unlike any other two-dimensional picture, but also that shapes over the eye images could possibly be the images of coins placed over the eyes of the man of the Shroud.

All of these discoveries have indicated to researchers the extreme difficulty that would be involved with painting or naturalistically creating an image such as the Shroud’s (Antonacci 2015) The various phenomena described by sindonologists, along with the similarity of the facial image on the Shroud to other known cloths associated with Jesus, has led researchers to conclude that an intricate and careful form of photography could have created the Shroud’s image if done correctly, and if not photography, a very special type of radiation must have been involved in order to create the amount of detail the image contains even at the microscopic level (Iannone 2010).

Below is the t-chart comparison of evidence contributing to each perspective for imaging studies, created after collection of data. The t-chart provides a quick summary of notable findings in imaging studies supporting both perspectives:

Forgery	Burial Cloth
<ul style="list-style-type: none"> - The ‘facial’ similarity between the Shroud, the Sudarium of Oviedo, and the Manoppello Image could be the result of the same artist/forgery creating all three images (Iannone 2010) - Shroud photographer & scholar Barrie Schwartz is of the opinion that the Manoppello Image is an artwork, which could signal that further Shroud study may reveal new evidence for the forgery perspective (Schwartz 2016) 	<ul style="list-style-type: none"> - Subdued light shows ‘wound’ images appearing similar in color to body stains (Wilson 1978) - Schwartz: “No shadows” on the Shroud as might be expected if the source of light was external to the body (Iannone 2010) - Jackson & Jumper: Possible coin images located over the ‘eye’ images (Iannone 2010) - ‘Facial’ similarity between Shroud and Manoppello images (Badde 2010) - ‘Facial’ dimensions identical between Shroud and Sudarium of Oviedo (Guscini 1997)

Comparison 3: Imaging Studies

Textile Studies

The physical threads and fibers that make up the linen of the Shroud of Turin have also been extensively investigated. The use of linen like the Shroud’s for burial practices would likely have been well-known to any medieval forger or artist. The high quality of the Shroud’s linen

when first created would likely have made it an expensive item for purchase, making the Shroud an unlikely, but not impossible, candidate for use in a quick burial like Jesus' would have been on the eve of the Jewish Sabbath. Pollen exines found on the linen's fibers by sampling with sticky tape, a task championed by Swiss criminologist Max Frei, could well have come from pilgrims who were allowed to touch the Shroud during medieval exhibitions, when the Shroud was exposed to the open air (Wilson 1978).

Exines are the hard outer shells of pollen, which are very durable through time. Many of the exines on the Shroud's fibers have been documented to come from plants that are native to the part of the world that is today Israel. Some of the exines are even local to the Israeli city of Jerusalem (Iannone 2010).

The pattern of the Shroud's weave is a distinctive three-to-one herringbone twill. The fibers that are part of the Shroud's body image are simply composed of oxidized and dehydrated cellulose. The areas of the body image which appear darker are accounted for by a larger number of oxidized and dehydrated fibers in those areas of the cloth. None such body image fibers have

been found underneath apparent 'bloodstains,' suggesting that, if real blood, the blood on the Shroud was deposited on the cloth prior to the mechanism of image formation (Antonacci 2015).

The Shroud's side strip is separated from the main body of the cloth by a seam, yet the weavework of the linen on either side of the seam is identical, suggesting that the Shroud was once part of a much wider piece of linen, then cut away from that roll when it came time for its use (see Figure 5). Study by textile expert Dr. Mechthild Flury-Lemberg has shown that when created, the linen of the Shroud would have been considered fine craftsmanship and "a professional work." A specific seam on the Shroud

has even found a twin on other pieces of linen - found in the ancient Israeli fortress at Masada (*Secrets of the Shroud* 2004).

All of this evidence suggests that the Shroud, throughout at least its known history, has been exposed to the air in many parts of the world as well as to pilgrims from around the world. No matter its true origin, the Shroud reflects a history of travel. All of these conclusions are supported by the existing historical record.

Below is the t-chart comparison of evidence contributing to each perspective for textile studies, created after collection of data. The t-chart provides a quick summary of notable findings in textile studies supporting both perspectives:

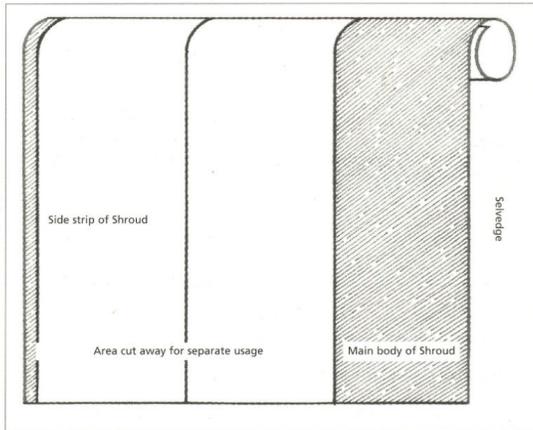


Figure 5: "How the Shroud was originally woven much wider than its present width" (Wilson 2010)

Forgery	Burial Cloth
<ul style="list-style-type: none"> - The use of linen cloths like the Shroud to enwrap human bodies was well known in the Middle Ages (Wilson 1978) - The quality of the Shroud's linen suggests that in its day it may have been a rather expensive item, making it an unlikely candidate to wrap a 'body' that required a quick burial, as Jesus' historical burial would have required (Wilson 1978) - Pollen exines present on and around Shroud fibers could unknowingly have been deposited on the cloth by scientific investigators/pilgrims observing the cloth up close (Iannone 2010) 	<ul style="list-style-type: none"> - Rev. Dr. Kenneth Stevenson: Pollen exines present on the linen are numerous and unique in geographic origin (Iannone 2010) - 3.5 inch-wide side strip suggests the Shroud was originally woven much wider than it presently appears (Wilson 2010) - Seam on Shroud identical to one found on cloths from the Masada fortress in Israel (<i>Secrets of the Shroud</i> 2004) - Shroud is a "professional [weaving] work" (<i>Secrets of the Shroud</i> 2004) <ul style="list-style-type: none"> - Dr. Mechthild Flury-Lemberg

Comparison 4: Textile Studies

Dating the Shroud

One of the most controversial and yet exciting aspects of sindonology has been dating the Turin Shroud. In 1988, for instance, a sample was taken from the Shroud in the area of the frontal image near the feet (Wilson 1978). The sample was sub-divided and delivered to three separate laboratories for the purposes of undergoing radiocarbon dating. The laboratories were located in Tucson, Arizona, Oxford, England, and Zurich, Switzerland. After careful verification of their results, all three were able to report that they were highly confident that the Shroud's linen was harvested between the years 1260 and 1390, about a thousand years after Jesus' death (Wilson & Schwartz 2000). Initially, the world heard this news and presumed that the fad of the Shroud of Turin would finally be over and done with.

But it was not so easy to accept these results, at least for some. Since 1988, the area of the sampling has come under fire as not being representative of the linen as a whole. Medieval artwork depicts the Shroud being physically held up in exhibition by its custodians in Turin, and one image shows the cloth being handled from the very corner the 1988 sample was taken from. The work of Dr. Leoncio Garza-Valdes has shown that a possible bioplastic coating on the Shroud's fibers could easily have skewed the results of the test (Iannone 2010, see Figure 6).

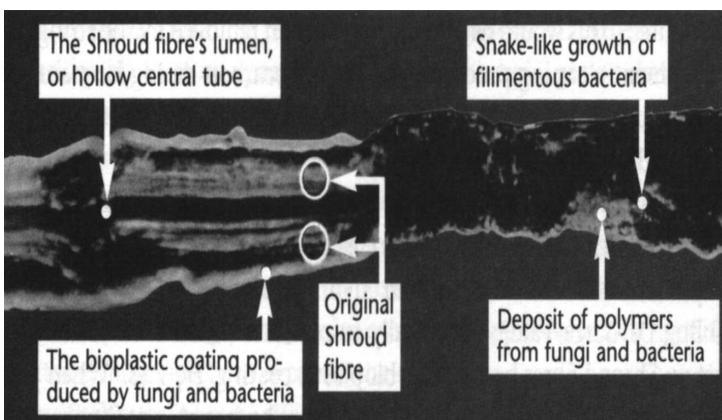


Figure 6: Bacteria on the Turin Shroud (Wilson 1998)

In 2013, the University of Padua in Italy brought dating the Shroud back to center-stage, performing a new dating test on the same fibers from 1988. That test gave an ancient date of 300 BC - 400 AD for the linen's harvesting (Stanglin 2013). Related studies also showed that carbon-14 overload of the Shroud's linen as a result of a major earthquake in the year 33 may have skewed the results of the test (Knapton 2014). For anyone familiar with the Gospel account of Jesus' death on Good Friday, one is reminded by that hypothesis of the earthquake that occurred in Jerusalem at the moment of Jesus' death on the cross.

No matter what test happens to be most near the mark, or if either actually is, it's clear that carbon dating will certainly continue to be debated within sindonology. There will likely be future tests for dating the linen, with or without radiocarbon analysis, that give new dates for the Shroud's creation.

Below is the t-chart comparison of evidence contributing to each perspective for dating of the Shroud, created after collection of data. The t-chart provides a quick summary of notable findings in dating supporting both perspectives:

Forgery	Burial Cloth
<ul style="list-style-type: none"> - Dating result (1260 - 1390 as the time of the harvesting of the Shroud's linen) were certified in three separate laboratories, in Tucson, Oxford and Zurich (Stanglin 2013) - 1988 tests performed at a high confidence level (Wilson 1978) - 1988 results would seem to coincide with Shroud's sudden appearance in France in the 14th century (Wilson 1978) 	<ul style="list-style-type: none"> - Univ. Padua study of same fibers from 1988 gave date 300 BC - 400 AD (Stanglin 2013) - Possibility of bioplastic coating that skewed results (Iannone 2010) - Earthquake could have increased C-14 content, cause for younger dating in 1988 (Knapton 2014)

Comparison 5: Dating the Shroud

Missing Historical Provenance

The history of the Shroud of Turin on paper only goes back to about the fourteenth century, when it appeared in France. Previous to that date, the existence of the Shroud is mere speculation, based on passing references in the historical record to images of Jesus (Wilson 1978). Those references have been somewhat ambiguous with respect to whether or not they refer to the Shroud, which is why the Shroud's provenance, or documented history, is only definitive going back to the fourteenth century. One such reference would be the notion that the medieval Knights Templar, a Catholic military order owing their allegiance to the Pope, venerated a "bearded head" (Wilson 2010) as part of their prayers.

It just so happens that just as the Shroud appears in the historical record in the fourteenth century, the 1988 carbon dating gave the date for the harvesting of the Shroud's linen right around the same time, between the thirteenth and fourteenth centuries. The Shroud was even written off as an artwork by Catholic French Bishop Pierre d'Arcis, who said that the artist had confessed what he had done to him.

There are no shortage of theories, however, as to where the Shroud was prior to the fourteenth century. Certain references to images of Jesus are interpreted as referring to the Shroud in many of these theories, in particular the hypothesis that the 'Abgar legend' involving the Edessa image of Jesus is actually referring to the Turin Shroud (Wilson 1978).

A very large part of the case for the Shroud's forgery or artistic origins is based on the huge amount of somewhat unsubstantiated speculation about the Shroud's travels from 33 in Jerusalem to the fourteenth century in France. But considering that there is so much time that needs to be accounted for in the Shroud's history, there is so much more of the historical record that historians should look into in order to piece together cohesive and compatible theories about the Shroud's ancient provenance.

The Shroud's L-shaped 'poker holes' can be compared to a similar pattern of circles present in a written manuscript, known as the Hungarian Pray Manuscript (see Figure 7). This manuscript actually predates the results of the 1988 carbon dating by almost a hundred years, yet the same L-shaped pattern of holes on the Shroud can be seen in one image of the Manuscript. The question of whether it was the Shroud which inspired the Manuscript or the Manuscript which inspired the

The Shroud

The Hungarian Pray Manuscript



Figure 7: Comparison of the Shroud and the Hungarian Pray Manuscript (Schwartz)

Shroud's image remains unresolved (Wilson & Schwartz 2000).

Below is the t-chart comparison of evidence contributing to each perspective for the Shroud's missing historical provenance:

Forgery	Burial Cloth
<ul style="list-style-type: none"> - The Shroud is never explicitly mentioned in the historical record prior to the 14th century (Wilson 1978) - Numerous artworks from before 14th century which seem to have correlations with the Shroud image could have inspired a potential forger (Badde 2010) - Theories about the Shroud's provenance in the missing years before the 14th century cannot account for the 'Shroud's' apparent disappearance after the sacking of Constantinople in 1204 (Wilson 2010) 	<ul style="list-style-type: none"> - The Knights Templar are said to have venerated a 'bearded head' (Wilson 2010) - Image of Edessa/ Abgar Legend (Wilson 1978) - Well-documented history of cloth known as Sudarium of Oviedo (Guscini 1997) - Hungarian Pray Manuscript (Iannone 2010)

Comparison 6: Missing Historical Provenance

DISCUSSION

Upon completion of a cursory inspection of evidence under the umbrella of sindonology, one can begin to consider how evidence supporting each perspective has been interpreted. Perhaps because there is such a great wealth of scientific and historical evidence for both perspectives, there have been as great a number of hypotheses as to how the image on the Shroud was formed. These hypotheses have always been based on the premise that traditional means of creating images like the one on the Shroud have already been scientifically eliminated (i.e. image creation by a scorch or dye of some sort) as possibilities. So, sindonologists had to get creative with what they had uncovered. A short list of some of their theories runs the gambit from a burst of radiation (in line with the burial cloth perspective) to medieval photography (in line with the forgery perspective). While some of these theories are falling more and more out of favor with the science, hypotheses on image formation collectively form one of the most common forms of Shroud study.

Review of the collected data revealed an interesting trend between the perspectives, that very often, important pieces of evidence bearing huge implications in one discipline had been discovered by the investigations of other disciplines. A good example would be the pathology of the Shroud's image, which was almost entirely uncovered by imaging studies. The abrasions evident on the kneecap and nose images, for instance, could not have been discovered without specialized photography of the Shroud.

Based on the analyzed significance of collected data, it was found that the profundity of the collected evidence within the larger context of sindonology is most likely what has

determined a person's siding with one perspective over another. The area of the radiocarbon dating would be a prime example of this observation. When the 1988 dating results came out and signified that the Shroud was medieval, a large number of people decided that those results were sufficient for them to no longer take an interest in sindonology. One of Oxford's professors who conveyed the results of the dating, Professor Edward Hall, roundly denounced those who continued to espouse the Shroud's authenticity after the test as stubborn "flat-earthers" (Wilson 1978). On the flip side of the coin, though, there were just as many scientists who took great joy in the results of the 2013 dating test by the University of Padua, which gave the Shroud an 'ancient birthday' (Stanglin 2013). Many of those scientists were so inspired that they delved deeper into why the 1988 results may have been invalid, and they composed a theory that not only refuted the medieval date result, but also reaffirmed the Shroud's place in history as the burial cloth of Jesus (Knapton 2014).

The degree to which evidence was profound, in a sindonological sense, has not only been a determining factor in many people clinging to one perspective on the Shroud over another, but also highlights a unique comparison that can be made between the Shroud of Turin in sindonology and the Shroud of Turin put 'on trial.' If one equates the playing field of sindonology to a courtroom, then the Shroud has been put on trial for a case of mistaken identity. The prosecution, those espousing the forgery perspective, are going to throw everything they can at the Shroud to get it to confess its true nature as a forgery or artwork. The defense, on the other hand, is going to throw everything it can at the prosecution in order to disprove all arguments against the Shroud's authenticity. In effect, the forgery perspective fights for a conviction, and the burial cloth perspective fights for an acquittal, the criminal charge being that the Shroud has impersonated the burial cloth of Jesus of Nazareth for hundreds of years.

At one point in sindonology's early history, the time before the 1898 photographs were taken, the prosecution almost assuredly had the case in the bag, with the only defense coming mostly from Catholics who had known about the Shroud for many years, and were brought up believing in it. At that point in time, there was no scientific or historical evidence to support the Shroud's identity as an ancient burial cloth. After the first photographs were taken, however, the world and the scientific community found itself so astounded by the haunting realism of the negative photographic plates that for the time being, sindonology investigation took off. In light of the Shroud's absence from science prior to that point, this would seem to have been a huge victory for the defense.

New evidence came to light half a century later. The investigation was reopened. The defense was becoming very excited with the potential for them being able to get an acquittal, when the 1988 radiocarbon dating seemingly stopped them in their tracks. For three prestigious institutions to all come up with the same result from such a respected scientific test seemed, in the eyes of many forgery-backers, to be the nail in the coffin for the defense. But not even this turning point in the history of sindonology was enough to rest the case. For before long the defense started researching to see if the prosecution's great triumph was founded on valid

evidence or not. The defense's efforts post-1988 continue to this day, and were rewarded greatly with a 2013 dating.

This fluctuating trend of perspectives on the Shroud, shifting back and forth in terms of which perspective seemed most dominant at any one point in time, is solid proof that not only has the scientific and historical study of the Shroud by sindonology had a huge impact on the mindset and opinions of the public, but also that we should expect sindonology to experience such turning points in the future. Where investigation rests at the present moment in time, seems too early to tell.

In light of the profound trends uncovered from this investigation, future studies could certainly follow a similar data collection format, only instead of focusing only on the Shroud, those studies might compare publicly available data on the Shroud to data on other cloths associated with Jesus, such as the Sudarium of Oviedo, the Manoppello Image, and the Divine Mercy painting. Days could also be scheduled to publicly present the collected data from this study in front of an audience, establishing an open-air discussion where questions are passed back and forth between audience and presenter, in order to affirm this investigation's original end goal of engaging people's opinion on the Shroud in order to form new questions about sindonology.

CONCLUSION

The fruits of this investigation could not have been more astounding.

Over the course of several months of research and hours of analyzing various scientific data in terms of their significance to a burial cloth and/or to a forgery perspective, there remains no definitive answer as to which perspective is correct. This question, quite probably, will never be answered, considering the existence such a large amount of evidence that only promotes further study. Much of the evidence collected seems to raise more questions than answers with regard to the piece of linen known as the Turin Shroud, and because of this, the scientific community and the world at large can expect the continued growth of sindonology for years to come, with new technologies revealing new mysteries about this cloth for future generations to ponder.

Amidst all this ambiguity with regard to the future of sindonology, there are a few certainties that have been uncovered. First, with regard to the contributions of various scientific and historical data to the two different perspectives on the Shroud's identity.

It would seem that the areas of pathology of the Shroud's image, textile studies, and imaging studies have most often contributed to the perspective that the Turin Shroud is the authentic burial cloth of Jesus of Nazareth. Overwhelmingly, the data in these sindonological studies have disproven all other theories: there's no paint, pigments, or dyes on the cloth; whoever the image on the Shroud is supposed to represent had to have suffered crucifixion, and a most brutal Roman crucifixion, at that; and indeed, this cloth remained, has had quite the travel

itinerary in its history, bearing extensive traces of pollen from plants native to Israel and even to the city of Jerusalem.

On the reverse side, it would seem that radiocarbon dating and the missing historical provenance of the Shroud have most often contributed to the perspective that the Turin Shroud is a brilliant forgery or artwork, probably of the Middle Ages. Overwhelmingly, the data in these sindonological studies have been quite telling with regard to the cloth's true origins: with a high level of confidence, three separate science laboratories, two in Europe and one in the western United States, gave right around the same date for the harvesting of the Shroud's linen, a date about a thousand years too late for any cloth being considered as a first-century burial cloth; there are literally over a thousand years of missing history before the Shroud as we know it today makes its first appearance in the written historical record; within those thousand years, countless ancient legends and traditions with regard to the face of Jesus would have been ample cause for any forger to attempt faking Jesus' burial cloth.

There is no easy answer with regard to the 'correct' way of interpreting scientific data, especially with regard to the Shroud. These conclusions, with respect to how various pieces of evidence lined up on the spectrum of Shroud perspectives, were ultimately reached by a careful review of the existing conclusions made by Shroud scholars. There were many pieces of evidence which showed promise to both perspectives, but in general, a preponderance of past scientific conclusions led to this project's generalizations about which data supported which perspectives. This might lead one to question the purpose of this investigation in the first place, which is elaborated on below.

Returning to the idea of the interpretation of data, this, in fact, has been one of the most contentious aspects of Shroud research, since as early as the turn of the twentieth century. Scientists and historians have drawn such different conclusions with respect to what certain pieces of data mean for the Shroud, that today, if one were to study the various hypotheses on the formation of the image on the Shroud, the experience would be similar to that of reading a menu at a diner. The hypotheses seem to go on forever. For those leaning towards the authentic burial cloth perspective, one can take a look at the Volkringer Effect, the Maillard Reaction, the coronal discharge hypothesis, or the rather unique and compelling argument of image formation by a flood of neutrons released during a major earthquake (Iannone 2010 and Knapton 2014). For those leaning towards the forgery perspective, one can take a look at the rather unique and compelling argument for medieval photography using silver sulfate, the more-debunked idea of the image having been rubbed onto the cloth, or even the Shroud being a stupendous and inexplicable feat of Renaissance artistic genius the likes of Leonardo da Vinci (*Secrets of the Shroud* 2004). Indeed, it would seem like a new hypothesis comes out every day.

All of this is well and good, but one is still left without an answer as to what it all means, why on earth anyone should spend five minutes reading about this thing called the Turin Shroud, much less dedicate an entire lifetime to its study. After all, this piece of linen is ripped, burned, and bears an image that is quickly fading; it's also half a world away for many potential Shroud

students in the western hemisphere, most of whom will never see it in person. The question remains as to why anyone should bother. Well the answer to that question may surprise some, and it's just as surprising as it is exciting.

When it boils down to it, the vast majority of Shroud scholars, incorporating total skeptics, unequivocal believers, and the majority who are in between, agree that there can be only two truths behind all of the science, and behind the cloth itself. The students of the Shroud, old and new, have two choices which they are at full liberty to make in their own minds and hearts.

The first choice: They can choose, based on their review of what's been said and what's been uncovered, to see the Shroud as the most amazing, the most ingenious, the most legendary forgery of a historical artifact ever known in human history, or perhaps the most unassuming artwork ever created. This would mean that the Shroud should be ranked above nearly every painting and sculpture on the planet; it would mean that prestigious institutions like the Louvre and the Smithsonian should spend time dedicating whole exhibits to this phenomenon known as the Shroud, at the prompting of most major news outlets; all of this would have to be true because the science would have convicted, in one's mind, the identity of the Shroud as the most perplexing scientific problem ever, an enigma that enraptured and baffled some of the greatest minds in the world for almost a thousand years before finally being debunked.

The second choice: They can choose, based on their review of what's been said and what's been uncovered, to see the Shroud as the most terrific artifact in human history, the monument of all monuments and the relic of all relics. This would mean that, for millions around the world, the Shroud would vindicate almost two thousand years of Christian Faith; this would mean that the Shroud would give passing references in the historical record a concrete identity, and would pretty much settle any existing doubt over the issue of the historical person of Jesus once and for all. After all, one would be hard pressed to find anyone associated with the Shroud's image other than Jesus of Nazareth. All of this would have to be true because the science would have convicted, in one's mind, the identity of the Shroud as the focal point of legend, history, and faith, all weirdly mixed up into one, for millions around the world.

This is the choice at hand, and the evidence shows that these choices will be sticking around for generations, even as sindonology expands and grows with new scientific technology. Most probably, science and history will never reach a point where a formal pronouncement is made with respect to either perspective. Maybe that is for the best: it keeps the next generation of scientists asking questions.

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