WHERE ARE WE NOW AND WHERE DO WE GO FROM HERE?

by Mark Antonacci

More scientific research needs to be conducted by irradiating various types of low-energy radiation on linen, along with computer modeling of various radiation-based and other image-forming hypotheses. Various improvements and advances have been seen in DNA and blood testing techniques that could be undertaken again with blood from the Shroud. Portable X-ray fluorescence testing that could identify chemicals on the Shroud should also be undertaken before any future sampling from this cloth. However, these are just some of the minimally invasive or non-destructive testing techniques that could be undertaken on the Shroud or its samples.

Yet, by far and away, the most critical and productive forms of scientific testing that should be undertaken on the Shroud and its samples are those at the molecular and atomic levels. Whereas the Shroud now has thousands of items of unprecedented evidence, these new technologies could literally provide millions and billions of new, unforgeable items of evidence for our inquiry into the many aspects of this burial cloth. Let's first discuss testing the Shroud at the molecular level.

Multi-Spectral Imaging and Molecular Microscopy

When humans see objects, we perceive only the colors that are reflected from them in the visible spectrum that ranges from red to violet. Below red lies the infra-red part of the spectrum and above violet lays the ultra violet. These energies consist of electromagnetic waves with frequencies and wavelengths that are lower and higher than visible light. Although these forms of radiation are invisible, they allow us to identify and determine the chemical composition of unknown materials that they irradiate. We obtain this information because every chemical compound reflects, absorbs or emits infrared and ultraviolet radiation in its own unique spectrum that is routinely used to determine the chemical composition of unknown materials.

New technologies such as multi-spectral imaging and molecular microscopy continue to develop that allow objects to be viewed under the entire visible, ultraviolet and infrared light spectra simultaneously, allowing their composite images to become visible from *all* spectra at the same time. Cary 620 FTIR microscopes claim to provide focal plane array imaging that enables the collection of hundreds to thousands of spectra *simultaneously*. Its measurement modes also include transmission (back lighting), reflection, attenuated total reflectance and grazing angle. Agilent Technologies, which makes these instruments, claim they deliver unmatched imaging for biomedical and materials research including applications to forensics, chemicals, and polymers (such as cellulose, a naturally occurring polymer that comprises linen).[1] All of these applications clearly apply to a burial linen containing the unprecedented full-length frontal and dorsal body images of a tortured, crucified corpse on which 130 pristine human blood marks are found.

This non-destructive technology could map the entire Shroud linen and its samples, identifying not just every fiber of every thread, but also what is on every fiber. In a similar manner, this technology could examine the Shroud's many blood marks, its pollen or limestone grains, all parts

of the scorch marks, water stains and charred material at the molecular level (or any other materials collected over the centuries), allowing their individual chemical or elemental compounds to be identified throughout the length and width of both the inner and outer sides of this more than 14 feet long and 3-1/2 feet wide (4.34 m x 1.10 m) linen burial cloth. This new technology could conceivably scan the entire Shroud in a matter of hours, thereby allowing scientists to spend years analyzing all of the data contained upon it.

A Cary 620 FTIR microscope and imaging system's viewing mechanism could possibly be adapted by placing it on an arm or in a stable position that moves over the length and width of the entire Shroud. If this is not feasible, perhaps the entire length and width of the Shroud could be slowly slid or moved through the viewing aperture while it lays outstretched (or on a thin, lightweight surface). Such an examination would not only confirm many of the findings of prior examinations, but could provide many new items of information that we never knew existed, as well as resolve many of the outstanding issues regarding the Shroud.

For example, removing the backing cloth and examining both sides of the side strip and every part of the main portion of the Shroud at the molecular, chemical or elemental levels would definitively answer whether foreign material was rewoven into the Shroud at the radiocarbon site and whether the side strip is from the same bolt of fabric as the main portion of the Shroud. It could also determine if starch or tallow (candle wax), which could chemically bind to the molecular structure of linen, but not be detected by the naked eye or removed by standard pretreatment cleaning processes, was added to the Shroud at the radiocarbon site. It could identify any natural or artificial products on the Shroud and whether they have effected or caused the Shroud's unique full-length frontal and dorsal body images or its aberrant radiocarbon dating.

Examining the entire Shroud by multi-spectral imaging or molecular microscopy could also reveal what areas of the Shroud to avoid or concentrate on for future research. For example, parts of the cloth containing starch or wax or other foreign materials might be avoided, but parts of the cloth containing indigenous elements such as calcium, chlorine or nitrogen may be critical areas of concentration.

New technologies such as multi-spectral imaging and molecular microscopy continue to develop that allow for unmatched imaging of materials at their molecular, chemical or elemental levels. These technologies could also be applied to the wide variety of linen, blood, charred materials, pollen, etc. that have already been removed from the Shroud. Among other outstanding questions that molecular microscopy could shed new light on or definitely resolve are:

- whether the body images are comprised of oxidized, dehydrated cellulose;
- consisting of double-bonded carbon or oxygen atoms that were originally single-bonded together within the Shroud linen;
- whether some of the molecular bonds in the non-crystalline regions of the cellulose have broken and reformed;

- the types of limestone or pollen or other material on the Shroud. (This technology could even add clarification to previous identifications of certain pollen species on the Shroud.);
- whether discoloration is found on the Shroud linen where coin features and flower parts have been identified;
- whether there are two separate sets of water stains on the Shroud from two different events that occurred centuries apart.

Multi-spectral imaging or molecular microscopy could shed new light on or resolve whether discoloration is found on the outer side of the cloth at the hands and face of the reclined body. As we saw at this conference, Italian scientists have vigorously debated among themselves whether images of the hands and particularly, the face, can be seen on the reverse side of the Shroud. Yet, this is a tertiary point for such images could never have detailed resolution or contain three-dimensional or vertically directional information. Photos of these locations on the reverse side of the cloth will necessarily entail some enhancement as do many images. The main point is whether discoloration is found on the reverse or outer side of the cloth that correlate to the hands or face.

This non-destructive technology could also be applied to the Sudarium of Oviedo. By independently measuring the elemental or chemical results from the blood, pollen, limestone or other materials on the Sudarium and/or comparing them to those on the Shroud, new information and insight could also possibly be provided for the provenance of both cloths and their materials. Multi-spectral imaging and molecular microscopy could test every naturalistic and artistic hypothesis for image formation or explanation for the Shroud's medieval C-14 dating. As you know, thousands of tests and experiments have been performed on the Shroud and its samples, but only one result, its aberrant and controversial C-14 dating, has been found to be inconsistent with the Shroud's authenticity as Jesus' burial garment.

Testing for Radioactive Atoms on the Shroud

Testing the Shroud at the atomic level could reveal far more profound information from the Shroud than examining it at the molecular level. This information could answer some of the most fundamental questions that have perplexed generations of people throughout human history. This minimally invasive testing could easily refute the Shroud's 1988 radiocarbon dating by proving the entire cloth and its 1988 sampling site were irradiated with neutrons. Neutrons are bound together with protons within the nuclei of atoms and held together by the strong nuclear force, the strongest force known to science. This testing could prove that neutrons miraculously emanated from the length, width and depth of the multiply-wounded, crucified corpse wrapped in the Shroud under all the same circumstances and in a manner completely consistent with the resurrection of Jesus Christ.

Neutrons, of course, were not discovered until the 20^{th} century, which is also when scientists learned the effects of neutron radiation (or a stream of neutrons). Scientists discovered that neutron radiation will *create* radioactive atoms that virtually do not exist in nature. These radiocarbon atoms can *only* be created by neutron radiation. These radiocarbon atoms are created at known rates

and disappear at known rates. These rates have been well established from 80 years of research in nuclear science that has been conducted throughout the world.

If the Shroud had been irradiated by neutrons from the body wrapped within the cloth, trillions of radioactive atoms would have been created in its linen, blood marks, charred material and limestone. Most radioactive atoms are created and disappear within a short time, some within a matter of seconds, or fractions of a second.

However, two of these radioactive atoms, Cl-36 and Ca-41 have extremely long lives. If they were created within the Shroud by neutron radiation 2,000 years ago, approximately 99% of these radioactive atoms would still be found within the molecular structure of the Shroud's linen, blood marks, charred material or limestone.[2] If scientists measured the number of radioactive Cl-36 or Ca-41 atoms from any part of the Shroud linen, blood, charred material or limestone, they would not only prove whether these parts of the Shroud were irradiated by neutrons, but how many neutrons that particular location or sample received.

Neutrons also create radioactive C-14 atoms. If the Shroud's radiocarbon samples were irradiated by neutrons, its 1988 medieval carbon dating would be completely refuted. If any part of the Shroud was irradiated with neutrons, it would necessarily appear much younger than its actual age.

Unlike other radioactive atoms, C-14 is uniformly distributed on earth. That is because it is created by neutrons in the earth's atmosphere (77% of which is comprised of N-14) and then taken up in atmospheric carbon dioxide by photosynthesizing plants and spread throughout the biosphere. Only after scientists discovered how to create radioactive atoms in the laboratory, did they understand how C-14 was created in the atmosphere and distributed throughout the earth. Knowing the number of neutrons that irradiated a particular location on the Shroud would tell us how many *additional* radioactive C-14 atoms were *necessarily* created at that location on the Shroud by the neutron flux. Linen samples remaining from the Shroud's 1988 radiocarbon dating should be tested for the presence and amounts of radioactive Cl-36 or Ca-41.

Scientists could also measure the indigenous amounts of chlorine, calcium and nitrogen (which converts to C-14) from cloth, blood, charred materials or limestone on the Shroud. This knowledge combined with all the above knowledge and information regarding all three radiocarbon atoms from any of these Shroud samples would allow scientists to calculate *when* this neutron radiating event occurred, as well as the actual age of each sample.[3] If Jesus' burial tomb is extant, the presence of these radioactive atoms within its limestone samples would also confirm *where* this miraculous radiating event occurred. The above measurements and calculations of different types and amounts of radioactive atoms on various kinds of linen, blood, charred materials and limestone from different strategic locations on the Shroud would all corroborate whether this entire cloth was irradiated with neutrons, that each location received different amounts, when this event occurred, the age of the samples, and whether the body was the source of the radiation.

Nuclear engineer, Robert Rucker's calculations of the Monte Carlo Neutron Particle (MCNP) code developed at Las Alamos National Laboratory could confirm basic patterns of distribution for all three radioactive atoms throughout this burial cloth. The MCNP code indicates that while billions of new radioactive Cl-36, Ca-41 and C-14 atoms would be found at every sampling site on the Shroud, their lowest amounts would be near the four corners of the frontal and dorsal sides of the cloth if it was folded over the body and indicated in Fig. 1.

1.

These parts of the cloth would have been the farthest distance from the bulk of the body wrapped within the burial cloth. Since the foot is one of the narrower parts of the body, the distance from the long sides (by the corners) of the cloth to the foot would be greater than the distances from the long sides of the cloth to the man's shoulders, arms or hips.

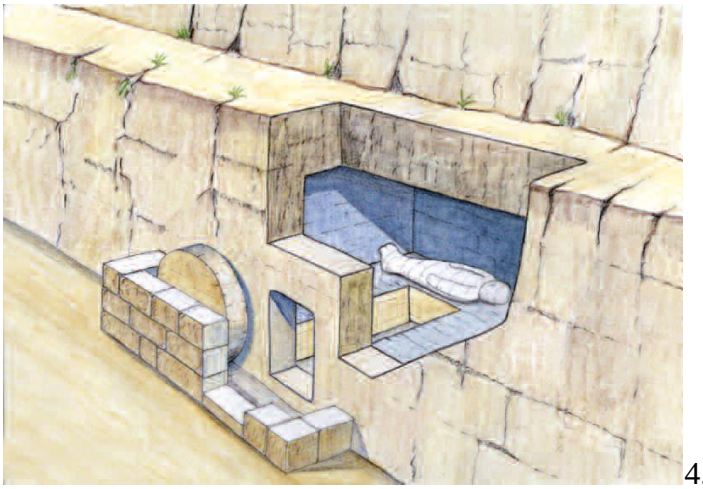
Some of the lesser amounts of radioactive atoms on the Shroud will be found across the ends of both short sides of the folded cloth as indicated below in Fig. 2. However, the amount of radioactive atoms would increase as you proceeded from the corners of the folded cloth toward the feet.

2.

The amounts of radioactive Cl-36, Ca-41 and C-14 atoms would begin to noticeably increase as you proceed from the corners along the long sides of the folded cloth as indicated below in Fig. 3. That is because even the long sides of the cloth are getting closer to the heavier parts of the body such as the calves, hips and chest regions.

3.

Please keep in mind that in the narrow confines of a typical newly-hewn Second Temple tomb, the two corners and two long sides of the folded cloth could easily have been scrunched against the back interior wall of the tomb just above the curved part of the U-shaped bench across from the opening. (See Fig. 4 below) Similarly, approximately three feet or so of the other two long sides of the folded cloth would have draped over the inside ledge of the U-shaped bench. If the bench had been simply hewn into the wall itself, as was sometimes the case, both long sides of the folded cloth could easily have draped over the outer portion of the limestone wall on which the body rested. (See Fig. 5 below)

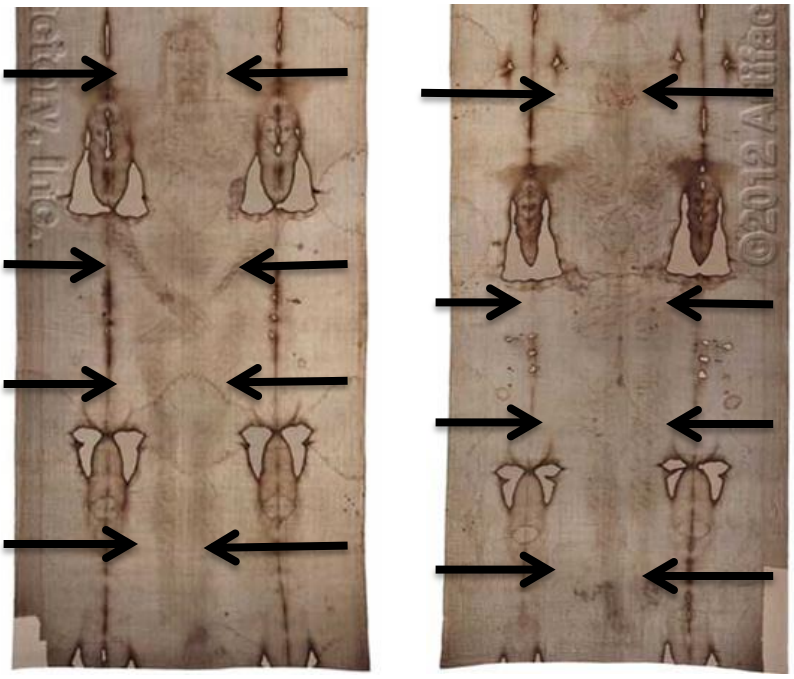


4.

5.

The above correlations between the amounts of neutrons that samples from the corners and the long sides of the Shroud received with their corresponding distances from the body, would not be as precise as seen in the first three images, where the more than 14' long and 3-1/2' wide cloth (4.34 m x 1.10 m) is naturally draped over the body completely *unencumbered* by the interior walls or bench of a typically small and newly-hewn tomb of this period. For this reason while samples already removed from the Shroud could be tested for the presence and amount of radioactive atoms, they would not likely indicate as direct of a correlation between distance and the body as the samples indicated in Figs. 6 and 7 below.

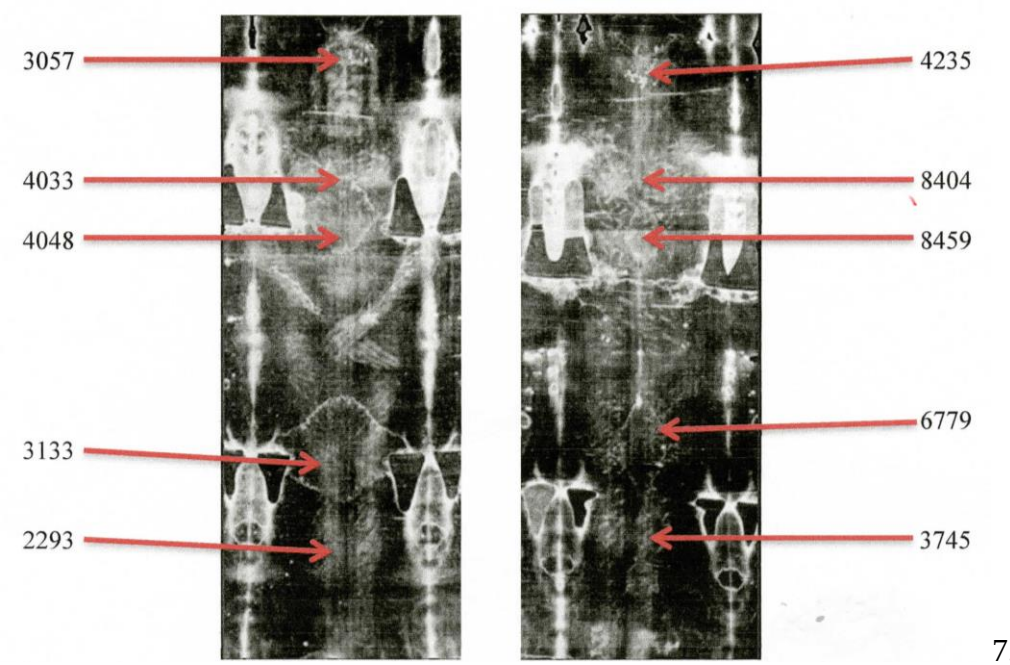
If neutrons uniformly emanated from the body wrapped in the Shroud, the number of radioactive atoms on this burial cloth would greatly increase as you proceeded *inwardly* from its outside edges *toward* its full-length body images, as seen below in Fig. 6.



6.
The number of radioactive Cl-36, Ca-41 and C-14 atoms would increase proportionately as you move from the outer edges of the Shroud toward its body images.

Both common sense and the MCNP code would confirm that a definite correlation exists between the number of neutrons the non-image parts of the Shroud received and their closeness to the body images. (The non-image parts of the cloth that were immediately next to the heavier parts of the body image will also contain more radioactive atoms than the non-image parts of the cloth that were immediately next to the thinner parts of the body image.)

Current evidence from the body images also indicates that proton radiation emanated from the length, width and depth of the dead body wrapped within the Shroud. If neutrons were simultaneously released from the body, the largest number of radioactive Cl-36, Ca-41 and C-14 atoms would easily be found *on* the Shroud's frontal and dorsal body images. The MCNP code and the leading hypothesis discussed earlier in this conference (the Historically Consistent Hypothesis) predict that the heavier and wider parts of the body images, such as the chest, abdomen and back, will have even greater amounts of radioactive atoms than the thinner parts of the body such as the ankles, calves and legs, as confirmed in Fig. 7.



7.

Fig. 7 confirms the more centered and denser parts of the body would give off the most neutrons.

That is because more neutrons would have been released at the thicker and heavier parts of the body. A correlation would clearly be found between the number of neutrons that irradiated each part of this linen cloth and its various locations laying over or under the length, width *and depth* of the body wrapped within it.

The MCNP code can convert the predicted distribution of radioactive C-14 atoms on the Shroud to their conventional C-14 calendar dates. As you can see, all the dates indicated on the body images in Fig. 7 are well into the *future*, and date farther into the future according to their placement over or under the bulk or weight of the body. An *accurate* radiocarbon date well into the future is *impossible*. Only *trillions* upon *trillions* of neutrons contained within neutron radiation could cause such impossible future dates to be inaccurately recorded by the conventional C-14 dating method. The conventional C-14 dating method merely counts the C-14 atoms within a sample and compares them to the C-12 (and C-13) atoms within the sample before attributing a date based upon its indigenous C-14 to C-12 ratio. The conventional C-14 dating method is unable to distinguish between the C-14 remaining within the linen from the time it was originally woven and the C-14 that was created within the molecular structure of the linen cloth by the neutron radiating event.

The amounts of radioactive atoms would be *highest* on the dorsal body image than on the frontal image on the Shroud. (The number of radioactive atoms on the non-image dorsal side would also be greater than on the non-image frontal side of the Shroud.) That is because the dorsal side of the cloth would likely have laid on the hard limestone rock surface found in newly-hewn limestone rock tombs of the Second Temple Period.

When the penetrating neutrons were emitted from the body, most of them would have easily passed through the frontal and dorsal sides of the linen cloth. Many of the neutrons that passed through the dorsal side, however, would have ricocheted or rebounded from the hard surface of the limestone rock back onto the dorsal side of the cloth, as confirmed by the MCNP code. A lesser amount of neutrons would also have ricocheted off of the more distant ceiling and walls of the tomb and onto the Shroud. (See Figs. 4 and 5)

Even though only one-millionth of one percent of the neutrons within the man in the Shroud were released, this would have amounted to more than three quintillion neutrons that would have been released. This would have caused *billions* of radioactive Cl-36, Ca-41 and C-14 atoms to be found at *every* postage stamp-size cloth and every dot-size blood sample throughout this entire burial cloth.

The great disparity of conventional C-14 ages throughout the non-image and body image regions on the Shroud linen cloth — ranging thousands of years for the same material — would clearly indicate that no date on the linen cloth is reliable. This obviously indicates that something is *systematically* wrong with the C-14 content throughout the entire cloth. For the linen cloth to date thousands of years into the future can only be explained by neutrons.

We are also aware that in 2013 scientists at the University of Padua scientifically dated the Shroud to the first century. These scientists have demonstrated a correlation between the age of linen with its strength and its ability to reflect light. While this method is not as established as radiocarbon dating, it may prove to be far more accurate and appropriate for the Shroud because its dating accuracy is not affected by whether the linen cloth was irradiated by neutrons.

Yet the most dramatic radioactive and C-14 carbon dating effects would be found from the Shroud's 130 or more human blood marks, almost all of which are uniquely aligned throughout both full-length frontal and dorsal body images. Human blood is much richer in chemical elements than linen. It contains approximately 100 times more N-14 than linen. If neutrons were released from the length, width and depth of body of the man in the Shroud, far more pronounced evidence of this event would be found on the blood marks than anywhere else on the entire burial cloth. At minimum, the Shroud's blood marks would carbon date tens of thousands of years into the future. Blood samples conventionally carbon dated from the man's right chest wound, the back of his right foot or from the scourge marks in the middle of his back, could date even farther into the future.[4]

We've heard many different presentations at this conference and elsewhere as to the cause of the unprecedented, full-length body images on the Shroud. Although protons from a disappearing body seem to be the most likely candidate, we do not have to prove or agree on how these images were created. If neutrons emanated from the length, width and depth of this multiply-wounded, crucified corpse it would be a miracle on several levels. These neutrons, along with protons, are held within the nuclei of all atoms by the strong nuclear force, the strongest force known to science. While scientists discovered neutrons and how to produce a stream of neutrons from a nuclear generator in

the 20th century, they can't even make the smallest part of a person's little finger generate neutrons — let alone generate neutrons from the length, width and depth of an entire *dead* body.

There are thousands of items of unfakable scientific and medical evidence scattered throughout both full-length human body images and their human blood marks on the Shroud of Turin. This evidence indicates that this man suffered the same extensive, preliminary wounds to his head, face, torso, legs, feet and wrists as did Jesus. He was then crucified and died with rigor mortis setting in in the crucifixion position. He also received a post-mortem wound in his right side from which blood and watery fluid escaped. These wounds not only appear to have been inflicted by Roman executioners with Roman instruments, but this corpse appears to have been buried according to Second Temple Jewish burial customs, in the same rock shelf in which Jesus was buried. While his body was still in rigor mortis, an unprecedented radiating event occurred to this corpse (as it disappeared) that encoded both unique full-length body images and their numerous pristine blood marks on his burial shroud. All of these events appeared to have occurred in the first century. If the Shroud was first examined at the molecular and then the atomic levels, it could literally produce millions and then billions of additional, unfakable items of evidence that the passion, crucifixion, death, burial and resurrection of the historical Jesus Christ occurred exactly as these events were described in the Gospels.

I might add that the Gospels are the most attested and reliable sources in ancient history by any criteria. We have a much greater number of ancient manuscripts of the Gospels and New Testament than we do for any other contemporaneous Greek or Latin works and these surviving manuscripts were written far closer to the time of the originals than any other surviving manuscripts. The Gospels and New Testament were congruently translated into every major language of their day and were the most widely circulated documents of their time (and remain so today). They not only contain eyewitness testimony for their events, but were written within the lifetimes of many of the people who witnessed these events. Moreover, most of the authors and eyewitnesses went to their deaths over their testimony.

If the Shroud's controversial radiocarbon dating was disproven by testing the cloth at the atomic levels, not only would the evidence from the Shroud be unanimous, but the central premises of Christianity would be completely corroborated by extensive, objective and independent evidence. No historical events have ever been documented by the most attested and reliable sources of ancient history and by extensive, objective and unfakable evidence.

No other religion or philosophy, including agnosticism or atheism, has ever had *any* objective or independent evidence for their central premises. We stand at a unique moment in human history! For the first time ever, we could not only have unfakable, objective and independent evidence for the central premises of a religion, but if anyone compared this objective and independent evidence to that of any other religion or philosophy, it would yield a billion to nothing shut out. However, this unprecedented evidence for the passion, crucifixion, death, burial and resurrection of Jesus Christ provides us with far more than comparative clarity among religions or philosophies. This

unparalled scientific, medical, and historical evidence of this sequence of events to Jesus could provide humanity with its first documented path to life after death.

While we may not have 100% absolute evidence of the occurrence of this sequence of events, we would have billions of items of evidence comprising close to 95-99%. Yet, that is not even the point! The point is that we can all be 100% *absolutely* sure that every one of us is going to die. (Not even the most ardent evolutionist thinks that humanity will evolve to the point where we will naturally acquire life after death. Only God can grant us life after death.) If you find any other comparable objective and independent evidence for the most important and miraculous events in human history, then you should consider it. But until then, think of the unprecedented evidence that humanity could acquire in a relatively short period of time by testing the Shroud at the atomic and molecular levels.

One of the biggest reasons that so many religions have appeared throughout history is to attempt to answer such basic questions as what happens after we die. Is there life after death? If so, how do we acquire it? Jesus provided these answers through his own life and death. He may have even miraculously left billions of unfakable items of unprecedented scientific and medical evidence from his actual body and his blood.* Billions of people throughout our world today could find eternal life from this overall evidence. Billions upon billions more could find eternal life in generations to come.

This evidence could have a more important worldwide effect than many people realize. Our world today is saturated with wars and conflicts in which religion is a direct cause or an underlying element. While such wars and conflicts have always existed, they have never been so widespread and potentially destructive as they are now. Rightly or wrongly, the basic reason that we have had such a variety of religions and philosophies is that none of them has ever been able to prove their central premises with objective and independent evidence. The extensive, objective and independent evidence that could be acquired from the Shroud of Turin could benefit all of humanity by eventually eliminating the underlying causes of such wars and conflicts.

If Pope Francis, the current owner of the Shroud, knew the benefits of testing the Shroud at the molecular and atomic levels, he and the world in general would consider using these techniques on the Shroud once the techniques are perfected. The world can only benefit from these minimally-invasive and harmless tests. Market forces have advanced the development of multi-spectral imaging and molecular microscopy. Only adaptations to the imaging system's viewing mechanism would need to be made in order to examine both sides of the large Shroud.

Even if we do not find that this particular form of radiation emanated from this corpse, we could still find that another form of radiation miraculously emanated from this crucified corpse. The

* Proton and neutron radiation not only consists of wavelengths, but *particles* comprised of neutrons and protons (and electrons). Like Jesus' blood marks, neutrons and protons from his body would literally be distributed throughout the Shroud. The protons would appear as superficial, full-length body images, while the neutrons would appear within radioactive atoms on the body images, blood marks and charred material, and other background or non-image areas of the Shroud.

testing that we advocate would still yield millions of items of evidence that would take years for scientists to collate and analyze. Think how much we learned from the only comprehensive scientific examination of the Shroud that occurred forty years ago. Think how much more people would learn about the Shroud and the critical events that happened to this man as a result of conducting more testing at the atomic and molecular levels.

Atomic testing techniques can be and needs to be perfected for softer, less substantial material such as linen and blood. Our foundation is researching these techniques and would welcome any financial assistance and scientific expertise that is offered.

The worst case scenario that can happen for the owners of the Shroud, the Vatican, is that it would be proven not to be Jesus' burial cloth. However, the vast majority of the world at large does not believe it is Jesus' burial cloth and have never even heard of it. Most people that have heard of the Shroud, believe its C-14 dating, which is the only test result among thousands that is inconsistent with the cloth's authenticity as Jesus' burial garment. They know very little about the thousands of contrary items of evidence on the Shroud, or that its C-14 dating could be easily and definitely refuted, thus making the infinite amount of unfakable evidence for the entire sequence of events that occurred to Jesus unanimous. The owners of the Shroud, its advocates, and everyone throughout the world at large have everything to gain and nothing to lose by testing the Shroud at the atomic and molecular levels.

Endnotes

1. http://www.chem.agilent.com/en-US/products-services/Instruments-Systems/Molecular-Spectroscopy/Cary-620-FTIR-Microscopes/pages/default.aspx.

2. The half-lives of Cl-36 and Ca-41 are 301,000 and 102,000 years. Only about 0.46% of the Cl-36 and 1.3% of the Ca-41 created within the Shroud linen cloth and its blood marks (or other material present) during the neutron radiating event would have disappeared naturally since 30 A.D.

3. See Appendix A of M. Antonacci, *Test The Shroud*, (St. Louis, Forefront Publishing Company, 2015).

4. It should be understood that under Part Two of the Historically Consistent Hypothesis the Shroud's unique blood mark features are explained by the momentary disappearance of the blood marks, along with their reappearance as the cloth collapses on the frontal side and rises slightly on the dorsal side. Under this hypothesis, whether and how quickly the blood marks disappeared and reappeared, would affect the questions whether they received any neutrons from the disappearing, radiating body and the amount of neutrons they received. Because the blood marks are so much smaller than the much longer, wider, thicker, and more complicated body, perhaps they could have both disappeared and reappeared slightly quicker than the body, and thus, acquired some neutron radiation before they disappeared and/or after they reappeared.

   Since scientific experiments and human history indicate the Shroud's blood marks could not be encoded naturally or artistically, and since they still have a unique reddish color after all these centuries, I suspect they did receive some neutron radiation. Cl-36 to Cl-35, Ca-41 to Ca-40 and C-14 to C-12 ratios from strategically selected blood samples from the body images compared to other Shroud cloth, charred materials, limestone or non-body image blood marks, along with MCNP Analysis, should reveal whether the blood marks received any neutrons, or received a partial amount, or the complete amount of neutron radiation that emanated from the body at each location. These ratios would be significant whether the blood marks disappeared and reappeared simultaneously with the body (or ever did so). If these blood marks disappeared *precisely* simultaneously with the body and reappeared immediately after the radiation ceased (and the neutrons stopped ricocheting), then the blood marks would radiocarbon date to their actual age, which is most likely the first century. Alternatively, if the pristine blood marks were encoded on the Shroud without disappearing or reappearing, then they would have received the complete amount of neutrons that irradiated every part of the cloth under this hypothesis. (Only the cloth was carbon dated in 1988.)

   Like the body, these blood marks may have also given off neutrons and protons as they disappeared and may have left evidence of either form of neutron or proton radiation on the Shroud. The evidence for protons would only exist if the blood mark(s) from which they derived had fallen off or never became encoded on the cloth. The evidence that neutrons irradiated from the blood marks could be indicated by elevated amounts of radioactive atoms on the linen underlying the blood marks on both sides of the Shroud.

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