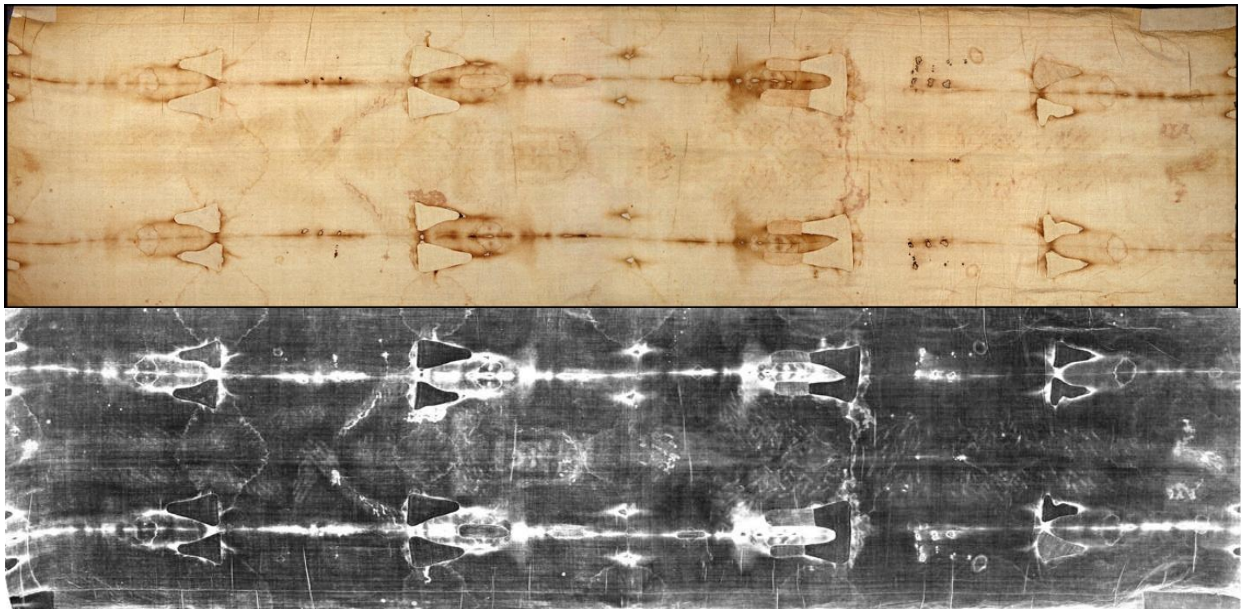


Five Page Summary on the Shroud of Turin

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Q1. What is the Shroud of Turin, and why is it of special interest?

The Shroud of Turin is one of the most mysterious and potentially significant items in human possession. A shroud is a piece of cloth that a person is buried in. Turin or Torino is a city in north-western Italy. The Shroud of Turin is a linen cloth that measures about 441 cm (14 feet 6 inches) long by 112 cm (3 feet 8 inches) wide. It is made of linen thread woven into a 3-to-1 herringbone weave. The linen thread is made of fibers from the flax plant, with each fiber about one fifth the diameter of a human hair. The unique characteristic about the Shroud is that it contains full-size front and dorsal (back) images of a man who was crucified exactly as Jesus was crucified according to the New Testament. There is also blood on the Shroud that is located consistent with Jesus' crucifixion. In the figures below, the top image shows the Shroud in normal front lighting whereas the bottom image shows the Shroud as it appears on a camera's negative, which is useful since photography enhances the contrast. The front image of the body is to the left and the dorsal image is to the right, between the two horizontal scorch marks and 16 patches that were caused by a fire in 1532. The ultimate questions are whether the Shroud of Turin could be the authentic burial cloth of Jesus and be evidence of Jesus' resurrection.



Q2. Where is the Shroud of Turin?

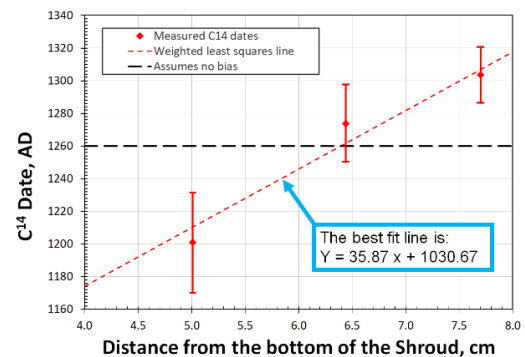
The Shroud of Turin was brought into Turin, Italy in 1578. It is kept in the Cathedral of St. John the Baptist in Turin. For security and to prevent damage to the Shroud, it lays flat in a large rectangular stainless-steel container filled with inert gas. The shroud is usually exhibited only a few times a century. It was last exhibited to the public in 2015. Two to three million people usually come to see the Shroud in a typical exhibition.

Q3. What is the history of the Shroud?

What is now called the Shroud of Turin was exhibited as Jesus' burial cloth in Lirey, France about 1355 AD. A continuous history of the Shroud exists from this exhibition in Lirey till it came into Turin, Italy in 1578. Prior to its exhibition in Lirey, evidence such as documents, coins, and artwork indicate that it was well known and highly revered in Constantinople for centuries. There is an ancient tradition that Jesus' burial cloth was hidden in a niche above a gate in the wall around a city due to the intense persecutions against Christians in the early centuries. This may have been in the period of about 200 to 500 AD. Analysis of pollen and limestone dust from the Shroud indicates that it was probably in Jerusalem during part of its history.

Q4. Has the Shroud been dated?

In 1988, samples were cut from the corner of the Shroud and sent to carbon dating laboratories in Tucson, Zurich, and Oxford. The combined mean or average date from all three laboratories was 1260 to 1390 AD, but the laboratory mean dates were not statistically consistent with each other. When they are plotted versus their distance from the short end of the cloth, it indicates that the carbon date changes by about 36 years per cm across the sample location. Four papers have now been published in peer reviewed journals that conclude that the mean laboratory dates obtained in 1988 are not consistent with each other within their uncertainties, so that it cannot be claimed that these three samples are representative of the Shroud. This means that the 1988 carbon date (1260 to 1390 AD) for the Shroud should be rejected, i.e. given no credibility. Four new dating methods (Tensile strength, Ramon and FTIR spectroscopy, and Wide Angle X-ray Scattering) dated the Shroud to the first century consistent with the time of Jesus, but contradicting the 1260-1390 AD carbon date.



Q5. If the Shroud is from the first century, why did carbon dating give a date of 1260-1390 AD.

Each of the three laboratories cut their sample into smaller pieces called subsamples. This resulted in 12 subsamples that were carbon dated, resulting in four evidences: 1) the mean or average date of all 12 subsamples was 1260 to 1390 AD, 2) relative to their distance from the short end of the cloth, the carbon dates for the samples increase at a rate of about 36 years per cm (91 years per inch) rather than all being the same, 3) the measured carbon dates for the 12 subsamples have a specific range and distribution, and 4) a carbon date of about 700 AD was obtained for the Sudarium of Oviedo, which is believed to be the cloth that covered Jesus face after his crucifixion, as mentioned in John 20:7, and is thus related to the Shroud. The correct explanation for the 1260-1390 mean date must be consistent with these four evidences.

According to American nuclear engineer Bob (Robert A.) Rucker, the only hypothesis that is consistent with all four evidences is the neutron absorption hypothesis. This hypothesis proposes that about 2×10^{18} (two followed by 18 zeros) neutrons were homogeneously emitted in Jesus' body. A human body is made of atoms, which are made of protons, neutrons, and electrons. Jesus' body, with an estimated weight of about 175 pounds, should have contained about $2 \times$

10^{28} (2 followed by 28 zeros) neutrons. This means that the number of neutrons emitted is only about one neutron for every ten billion neutrons that would have been in his body. This neutron emission is not a normal process but cannot be ruled out if Jesus' resurrection was a real historical event. A small fraction of these neutrons would have been absorbed in the trace amount of N-14 in the fibers to produce new C-14 in the fibers by the [N-14 + neutron produces C-14 + proton] reaction. These new C-14 atoms in the fibers would have shifted the measured carbon date to the future relative to the true date, since carbon dating measures the ratio of C-14 to C-12. Under normal conditions, this ratio only declines due to the decay of C-14 with a 5730-year half-life, but neutron absorption can produce new C-14 that will cause this ratio to increase, thus shifting the carbon date to the future relative to the true date. That the neutron absorption hypothesis is consistent with the above four evidences was confirmed by Rucker's MCNP nuclear analysis computer calculations in 2014 and 2025 (Papers 13, 33, and 41 on his website www.shroudresearch.net). MCNP is standard nuclear analysis software used in the nuclear industry. MCNP was produced by the Los Alamos National Laboratory in Los Alamos, New Mexico, USA, and is fully verified and validated to US government standards by comparison of MCNP calculations to thousands of experiments in nuclear facilities.

Q6. Is there any way to prove that neutrons were emitted from the body?

In the scientific method, a hypothesis must be consistent with all the evidence to be true, and it should make predictions that can be tested. If a prediction when tested is found to be false, then the hypothesis must be false, at least as stated. But if a prediction when tested is found to be true, then the hypothesis gains in credibility. It may take multiple predictions to be tested and found to be true before it gains sufficient credibility for most scientists to conclude that the hypothesis is probably true. Thus, a hypothesis is accepted as probably true when its predictions are tested and found to be true. But for a hypothesis that makes no predictions and for a hypothesis that has not yet had its predictions tested, even if it is consistent with all the evidence, the best thing that can be said is that it may be true. The above neutron absorption hypothesis may be true because it is consistent with the above four evidences related to carbon dating of the Shroud. The MCNP computer calculations, based on the assumption of neutrons being homogeneously emitted in the body, predicts that the carbon dates will vary significantly across the Shroud. For example, if it is assumed that the usual equation will be used to calculate a date from the measured C-14 to C-12 ratio, then this hypothesis predicts that about 75% of the locations on the Shroud will carbon date to the future relative to today, and that the carbon dates for the area near the right and left elbows will carbon date to about 3500 to 4500 AD. (If the usual equation is used to calculate a date from the C-14 to C-12 ratio, and this ratio is greater than is normal in our environment, for example due to neutron absorption, then this equation will produce a date to the future.) In 2002, to protect the Shroud, the 16 patches that were put on in 1534 were removed. To their surprise, when these patches were removed, they found fully carbonized or burned material under the patches. This material was broken off and placed into 42 small sample jars that were placed into a vault in Turin, where they are to this day. If access is granted to a few of these sample jars, then the fully carbonized material can be removed from a few of the jars and carbon dated. And if the location was recorded in 2002 for where the material in each sample jar came from on the Shroud, then the carbon dates can be associated with a particular location on the Shroud. If the resulting distribution of measured carbon dates on the Shroud is consistent with the predictions of the MCNP calculations, then this would be

strong evidence that the hypothesis that neutrons were emitted in the body is probably true. This test of MCNP's predictions is attractive because it only carbon dates material that has already been fully burned and removed from the Shroud, so that it does not require access to the Shroud. Rucker promotes this process of carbon dating material from a few of the 42 sample jars to test the predictions of his neutron absorption hypothesis.

Q7. What motivated Bob Rucker to perform computer calculations on the Shroud of Turin?

The carbon dating of the Shroud was performed in 1988. The results were published in the February 16, 1989, issue of the journal *Nature*. In this same issue was a letter to the editor from Tom Phillips (PhD in particle physics) in which he stated that if Jesus' resurrection was a real event, then radiation may have been emitted from the body that could have added new C-14 to the cloth so that it would carbon date younger than its true date. Rucker read the paper on the 1988 carbon dating a few years after it was published. Though at that time he did not know about Tom Phillips' letter to the editor, he recognized that the different average carbon dates from the three laboratories might be explained by neutrons that were emitted in Jesus' body in his resurrection. He also concluded that nuclear analysis computer calculations should be done to determine whether this could be true. Rucker had to wait for about 20 years for computers to get fast enough and cheap enough to allow him to do the required calculations on his own desktop computer using software (MCNP) that he was familiar with. Results of his MCNP calculations in 2014 and 2025 (Papers 13, 33, 35, 41 and 44 on his website) confirmed that neutron emission from the body would produce carbon dates consistent with the above four evidences. No other current hypothesis is consistent with the above four evidences, including the common assumption that the Shroud dates to 1260-1390 AD.

Q8. How were the images formed, and is the process related to the results of the carbon dating?

The only systematic scientific examination of the Shroud was conducted by the Shroud of Turin Research Project (STuRP) in 1978. About 26 American scientists were invited to Turin, Italy to perform non-destructive testing of the Shroud over a period of five days, 24 hours per day. Their main goal was to determine how the images were formed. However, after 120 hours of testing, they could only conclude that the images were not formed by pigment as in paint, dye, or stain, and not by a scorch with a hot object, not by any liquid, not by a photographic process, and not by body decay products. Based on evidence related to the images, most leading Shroud researchers now believe that the front and dorsal images on the Shroud were formed by radiation emitted from his body. Rucker agrees with this assessment. His neutron absorption hypothesis proposes that the neutrons were emitted in the body by splitting of deuterium (heavy hydrogen, H-2) nuclei (plural of nucleus). The deuterium nuclei would have preferentially split because deuterium requires the least energy to split the nucleus. The splitting of about 0.0004% of the deuterium nuclei in the body would have emitted enough neutrons to shift the carbon date of the 1988 sample area from 33 AD to 1260 AD. If this number of deuterium nuclei split, an equal number of neutrons and protons would be emitted. The neutrons would have shifted the carbon date forward but would not have caused the images. According to Rucker's image formation hypothesis (Papers 34, 41, and 44 on his website), the protons would have produced the images by creating an alternating electric current in the fibers, which would have deposited heat in the very thin outer circumference of the image fibers. This is because the "skin effect of an

alternating current” (see Wikipedia) causes the electrons in an AC current to flow preferentially toward the outer radius of the conductor. According to this image formation hypothesis, the electrically deposited heat scorched the thin (0.2 to 0.6 micrometer thickness) outer circumference of the fibers, consistent with the evidence on the Shroud. This thin discolored region around the circumference of the image fibers, produced the front and dorsal images of the crucified man on the Shroud. Thus, image formation is related to the shift in the carbon dates because they both result from the splitting of deuterium nuclei, with the emitted protons forming the front and dorsal images and the emitted neutrons shifting the carbon date forward.

Q9. Is the Shroud of Turin the authentic burial cloth of Jesus? If it is, what does it mean?

There are two criteria to determine whose image is on the Shroud of Turin: 1) the front and dorsal images are of a man that was crucified exactly as Jesus was crucified as described in the New Testament, and 2) his body emitted radiation which formed the front and dorsal images and shifted the carbon date forward. In all the documentation available to humanity, only Jesus in his resurrection satisfies these two criteria. This means that the most credible conclusion is that the Shroud of Turin is the authentic burial cloth of Jesus and that it includes scientific evidence for his resurrection. Thus, what was the best argument against the authenticity of the Shroud (the average or mean carbon date of 1260-1390 AD) becomes one of the best arguments in favor of the authenticity of the Shroud when all four evidences related to the carbon dating of the Shroud are considered. And when it is recognized that the best hypotheses to explain the image formation and carbon dating of the Shroud requires that radiation was emitted from the body, this becomes strong scientific evidence that Jesus’ resurrection is a true historical event. This changes everything because Christianity is based on Jesus’ resurrection being true (1 Corinthians 15:14, “if Christ has not been raised, our preaching is worthless, and so is your faith”) and if Jesus’ resurrection is true then Christianity is true, which has immense implications for what people should believe and how they should act.

Q10. What is the Biography for Bob Rucker?

Bob Rucker earned an M.S. degree in nuclear engineering from the University of Michigan, then worked in the nuclear industry for 38 years doing nuclear analysis computer calculations for advanced nuclear reactors, radiation detectors, and criticality safety, as well as doing statistical analysis of experimental data. During this time, he earned professional engineering certificates in nuclear engineering and in mechanical engineering and published 41 documents with US government agencies. Since 2013, he has been applying his nuclear engineering skills to research on the Shroud of Turin. He has written over 40 papers on the Shroud that are available on the “papers” page of his website www.shroudresearch.net. His most recent videos are at <https://www.youtube.com/watch?v=TWcqpRWONdI&t=4870s>, which in six months has had over 540,000 hits, and <https://www.youtube.com/watch?v=vSAU2ushM1M> and <https://www.youtube.com/watch?v=640oo9AH20Q&t=42s>. He has made many Shroud presentations including at the University of Michigan and the University of Dallas. He organized the 2017 International Conference on the Shroud of Turin held in Pasco, WA, USA, and made five 50-minute presentations at the 2025 international Shroud conference in St. Louis (shroud2025conference.com).