

Questions and Answers on the Shroud

by Robert A. Rucker, April 24, 2019

Nature of the Radiation

I would like to answer (A) several questions (Q) that Hugh brings up.

Q1) What types of radiation were emitted from within the body?

A1) We don't know for sure at this point. There has been inadequate experimentation on the Shroud to determine the exact components of the radiation. As a result, when I answer this question, I must give a very general answer. I usually say, "The image could have been formed by electromagnetic radiation and/or charged particles such as protons or electrons". The "such as" in this statement is not meant to restrict the options to only protons or neutrons but to give examples of what "charged particles" are. Indeed, any of the many charged particles in what is called the "standard model of physics" may have caused the image. A type of particle that is outside or beyond our standard model of physics could also have caused the image. We don't really know. On this issue, I say in paragraph 4 of Ref. 1 that "The main type of radiation that caused the image is believed to be charged particles such as protons and electrons, but low energy electromagnetic radiation such as infrared, visible light, and ultraviolet might have also contributed to forming the image. Highly penetrating radiation such as neutrons, X-rays, and gamma rays are not believed to be primarily responsible for the image because if this were the case, then the image would have been just as strong on the outside of the wrapped configuration as on the inside of the wrapped configuration (toward the body), which would be contrary to the evidence on the Shroud."

Q2) Which particles were collimated and which were not?

A2) Anything that caused the image, such as charged particles and/or electromagnetic radiation, had to be collimated to maintain a vertical one-to-one relationship between each point on the cloth and each point on the body that was vertically above or below the cloth. Since there was no lens between the body and the cloth, to form the good resolution image on the cloth, each point on the cloth had to receive information (the information that defines the appearance of a naked crucified man) from only one point on the body, so the radiation had to be vertically collimated to carry this information. In contrast to this, neutrons, since they are so penetrating, would not have been primarily responsible for the image, for then the image would have been just as strong on the outside of the wrapped configuration as on the inside of the wrapped configuration (facing the body), which is not the case. Thus, neutrons do not have to be vertically collimated, but may have been emitted uniformly in all directions. But they also could have been vertically collimated. We don't really know. In my approximately 400 MCNP nuclear analysis computer calculations that I ran in 2014, each taking between 6 and 13 hours on my computer, I ran cases with neutrons both vertically collimated and uniformly emitted, i.e. not vertically collimated. But this was too much information to report at the Shroud conference in St. Louis in October of 2014 or in my papers (Ref. 2). I had to choose a small subset of my calculations to report on. I chose to report the case for neutrons that were emitted uniformly in all directions thinking that perhaps the charged particles were vertically

collimated due to magnetic and electrostatic fields that may have been present. Neutrons have no electrical charge so they would not have been affected by magnetic or electrostatic fields, so under these assumptions, the neutrons may not have been vertically collimated, but could have gone uniformly in all directions.

Q3) In your concept, were the charged particles emitted within the body?

A3) Yes, they had to be emitted within the body to carry the information to the cloth regarding the presence of the bones in the body, since some bones (teeth, bones in the hands, etc.) can be seen on the cloth.

Q4) There appears to be a conflict for protons emitted within the body. The protons, if emitted within the body, would have to penetrate some distance through the body before they exit from the body, yet not be able to penetrate an air gap distance of more than about 3 to 4 cm between the body and the cloth because at greater gap distances, the fibers are not discolored. This appears to be a serious objection to the neutron absorption hypothesis because the average density of a human body is about 1.0 g/cm³ whereas the density of air is only about 0.012 g/cm³. How can the protons penetrate the body but not penetrate the air much further than 3 to 4 cm?

A4) I am not saying that the cause of the image had to be protons. Protons are often suggested as the cause of the image only because: A) there are so many protons in the human body, about 2×10^{28} , B) because it is one of the most stable forms of matter that pure energy could coalesce into, and C) because experiments have been performed with protons showing that they can discolor fibers. These reasons might be suggestive, but they don't require the image to be caused by protons. It may be another type of particle that is in the standard model of physics, or it might be a type of particle that we know nothing about. If that were the case, then perhaps the reason that the particles are diminishing as they go from the point of emission to the point where they would hit the Shroud is due to decay, rather than due to scattering or absorption. If the image is due to protons, then there is another possibility that ought to be considered, but I must go outside of science for this. The Biblical text (John 20:3-9) indicates that Jesus' burial cloth was empty. Christians believe that Jesus' body had disappeared from within his burial cloth in the tomb (Ref. 3). This disappearance was probably not by a disintegration of the atoms that were in his body but by a transition of the body into an alternate dimensionality (Ref. 4). I believe that it is reasonable to assume that the radiation was emitted from the entire body by the process that was causing the entire body to make the transition into the alternate dimensionality, so that the radiation was being emitted throughout the body, and that the radiation was being emitted during the entire transition process. This transition process may not have been instantaneous but may have taken place over a very small fraction of a second, such as a milli (10E-03) second, micro (10E-06) second, or nano (10E-09) second. If we assume that the image was caused by protons, then as the body disappeared, from 100% present to 0% present, the protons could have readily penetrated the remaining fraction of the body as it approached 0% present. This is a possible solution to the question and can be calculated by MCNP nuclear analysis computer calculations though I have not yet performed these calculations.

My papers listed below can be obtained on this blog site or on the research page of my website at <http://www.shroudresearch.net/research.html> .

Ref. 1 "Image Formation on the Shroud of Turin", paper 22 on my website

Ref. 2 “The Carbon Dating Problem for the Shroud of Turin, Part 3: Neutron Absorption Hypothesis”, paper 13 on my website

Ref. 3 “The Disappearance of Jesus’ Body Part 1: Biblical and Theological Considerations”, paper 1 on my website.

Ref. 4 “The Disappearance of Jesus’ Body Part 2: Physical Considerations”, paper 2 on my website.

The Fine-Tuning Argument Against the Neutron Absorption Hypothesis

The fine-tuning argument related to the carbon dating of the Shroud does not prove that the God of the Bible was intentionally deceiving others. The fine-tuning argument is that the range of the possible number of neutrons emitted from within the body is so large that it is extremely unlikely that just the right number of neutrons (2×10^{18}) would have been emitted to produce a carbon date (uncorrected value of 1260 ± 31 that produces a corrected range of 1260 to 1390, with a 95% probability) that exactly agrees with the earliest uncontested date for the existence of the Shroud, indicated by when it was first exhibited in Lirey, France, about 1355 to 1356. There are several problems with the reasoning in this “fine-tuning” argument.

1) The starting point for this criticism (the carbon date of 1260 ± 31) should be rejected from use in dating the Shroud (see my previous reply) because a statistical analysis of the measurement data indicates that samples were heterogeneous, i.e. that they were basically different implying the probable presence of something (a systematic bias) that had changed the ratio of C-14 to C-12 and C-13 on the samples, thus changing the dates. Since the amount that the dates have been changed cannot be known, they ought to have been rejected from use in dating the Shroud. This is standard practice in statistical analysis. When this is done, the fine-tuning argument collapses.

2) The carbon date of 1260 AD is the average of the average uncorrected values from the three laboratories. The average uncorrected values from the three laboratories in Damon, et al (Ref. 1, Nature, Feb. 16, 1989) are Tucson (646 ± 17), Zurich (676 ± 24), and Oxford (750 ± 30) where the value is the years before 1950. The value of 17 for the uncertainty for Tucson is calculated in Table 5 of Ref. 2. This value is used instead of the value of 31 given in Damon (Ref. 1) because the value in Damon cannot be calculated from the data. The equivalent years AD (uncorrected) is Tucson (1304 ± 17), Zurich (1274 ± 24), and Oxford (1200 ± 30). Allowing for twice the uncertainty produces a corrected date range of about 1295 to 1390 for Tucson, 1285 to 1380 for Zurich, and 1245 to 1295 for Oxford. Only two of these (Tucson and Zurich) would include the date when it was exhibited in 1355 to 1356 in Lirey, France. The Oxford data does not. Thus, the argument that the carbon date exactly agrees with the 1355-1356 date is not entirely true. Notice also that the uncorrected date for Tucson (1304 ± 17) is different from Oxford (1200 ± 30) by 104 ± 35 years ($104/35 = 3.0$), which falls outside the normal 2.0 criteria for acceptance. Thus, Tucson and Oxford obtain statistically different values for the date of the Shroud, so they can not all agree exactly with the 1355 to 1356 date for the Shroud. This indicates that something strange is going on, so the data ought to be rejected from use to date the Shroud.

3) The end point for this criticism (about 1355 to 1356) is arrived at by cherry-picking the evidence. There are very good reasons for believing that the Shroud was in Constantinople prior to 1204 AD, long before the C^{14} date of 1260 to 1390. This is confirmed by Byzantine coins starting in 692, the Hungarian Pray Manuscript (1192-1195) containing an image of Jesus' burial cloth with the same L-shaped pattern of burn holes as on the Shroud of Turin, and the report (1203-1204) of French crusader Robert de Clari that Jesus' burial cloth was exhibited weekly at the Church of St. Mary in the Blachernae district of Constantinople. In the debate, my Byzantine coin minted in 1025 to 1028, at least 232 years ($232/31 = 7.5$ sigma) before the low end of the carbon date range of 1260 to 1390, was criticized by saying that it could have been anyone with long hair. But it should be clear who this image is, because on the other side of the coin it says "Jesus Christ, King of Kings", though not in English of course. The image of the face on my coin is a very common image on both coins and paintings for over a thousand years, including paintings that clearly depict the crucifixion of Jesus. To say that this image could be anyone with long hair is not reasonable.

I never said, nor do I believe, that the number of neutrons emitted from within the body (2×10^{18}) that is required to shift the carbon date at the sample location from about 30 AD to 1260 AD (uncorrected) is random. In fact, it appears to be carefully chosen, not for deception but for revelation. The number of neutrons appears to be closely related to the number of protons that are needed to form the image on the Shroud. If the number of protons emitted within the body were a factor of perhaps five smaller, no image would have been formed because it would have been insufficient to discolor the fibers. And if the number of protons emitted within the body were a factor of perhaps five greater, the entire image would have overexposed so that it showed no details. In other words, to form the image on the Shroud by protons emitted within the body, the number of protons would have to be within a certain range, so that the number of neutrons emitted from within the body would probably also have to be within a certain range. There are at least two possibilities for the reason for this relationship between the number of neutrons emitted and the number of protons emitted: 1) the ratio of neutrons to protons that exist in matter, and 2) the ratio of neutrons to protons that would coalesce from a pure energy source such as a singularity. I have not calculated values precisely, but my best estimate is that the number of protons emitted within the body would have to be within about a factor of 5 of the number of neutrons (2×10^{18}) emitted within the body. Trying to think logically, if God exists, and if God came into this world in the person of Jesus, and if Jesus was resurrected from the dead (all of which Christians believe), then God could have had a purpose in building the physics of resurrection into the basic fabric of the "laws of physics" of the universe when he created it. It would be very reasonable for God to do this if he wanted to leave physical evidence of Jesus' resurrection, such as a "snapshot" of Jesus' resurrection on his burial cloth. The number of neutrons included in the burst of radiation from the body could also have had a divinely intended purpose, such as measurability of the carbon date distribution to prove that the neutrons came from the body and not from some other source.

Do we have any evidence of the fine-tuning of the universe in other areas? Yes, most definitely. Modern science has concluded that our universe is extremely fine-tuned for life to exist

(<https://www.youtube.com/watch?v=Qmlc42oRjm8>). This fine-tuning is exhibited in the values of the basic constants of physics. If we assume the big-bang, if the gravitational constant were just a little higher or a little lower, then no galaxies, stars, or planets would have formed, and thus there would be no life anywhere in the universe. A little higher for the gravitational constant and the big-bang would have recollapsed into a singularity. A little lower for the gravitational constant and the gas produced by the big-bang would have continued to expand without collapsing into any solid matter such as stars or planets. This same fine-tuning argument applies to so many physics constants that the question becomes why does human life exist, why does any life exist, and why does the universe exist? Thus, the fine-tuning argument that is being used against neutron absorption causing the shift in the carbon dating of the Shroud, if applied generally, would mean that human life should not exist, any life should not exist, and the universe should not exist. But they do exist. How can this be so?

Two answers are given to this fine-tuning argument. 1) Of the trillions upon trillions upon trillions of universes (each consisting of all the galaxies) that naturally came into existence, we just happen to live in the one universe that contains intelligent life, i.e. human beings. But there is no detailed concept how all these universes could have been formed and there is no evidence that other universes were formed. We only have evidence for one universe – ours. Thus, this option is without foundation. This option also violates the philosophical prohibition of an infinite sequence of cause and effect. 2) The second option is that there must have been an intelligence outside of our space-time reality, call it God if you want, that created the space, time, and matter in our universe. This creation was accomplished by choosing the initial basic constants, laws, and boundary-conditions of the universe for the purpose of producing intelligent human life. Under this explanation, it is entirely reasonable for this intelligence to build into the basics of the universe ways to communicate to his creation, such as producing an image of a crucified man on linen at the moment of resurrection by the emission of a certain number of protons from within the body, and that this specific number of protons implies a specific number of neutrons for measurability and evidence that they came from within the body. I am merely arguing that there could be a reasonable explanation for the image that we see and the carbon date that we have measured, so that deception is not necessarily implied.

Ref. 1 "Radiocarbon Dating of the Shroud of Turin" by Damon, et al, *Nature*, Feb. 16, 1989

Ref. 2 "The Carbon Dating Problem for the Shroud of Turin, Part 2: Statistical Analysis"

Understanding the Carbon Dating of the Shroud

TylerB says that "Atheists are just following the evidence" and then refers to the carbon dating. It may help you to feel good to think this, but I'm sorry, that is not what atheists are doing. Atheists are assuming that the conclusion reached in the Nature paper (Ref. 1, usually called Damon) is true, that "The results provide conclusive evidence that the linen of the Shroud of Turin is mediaeval." It is too easy for atheists to like this conclusion because it agrees with their worldview, so they do not want to, or are unable to determine whether the scientific data in Damon supports this conclusion. This is called "confirmation bias" and is something that everyone should be careful to avoid. The real question should be whether the measurement data obtained in the 1988 carbon dating of the Shroud (Damon) proves

their conclusion that the Shroud dates to 1260 to 1390 AD. In Ref. 2, I list several things that indicate there is a significant problem with the data and conclusion in Damon:

1. There are 13 other date indicators that are consistent with the first century and contradict the 1260-1390 date (Section 6C of Ref. 3).
2. The carbon dates from the three laboratories don't agree with each other. For example, results from Tucson and Oxford are different by 103 years with an uncertainty of 35 years, which falls outside the normal criteria for acceptance.
3. The carbon dates reported in Damon are a function of (are dependent on) the original location of the sample on the Shroud (Figure 3 in Ref. 4). A slope of about 36 years per cm is indicated by the measurement data reported in Damon.
4. Each carbon date measurement produces two data values, the measured value itself and a measurement uncertainty. The conclusion in Damon was reached by ignoring half the data, i.e. all the measurement uncertainties (implied in sentences 2 and 3 in paragraph 23 of Damon, which starts with "More quantitatively").
5. The data reported in Damon indicate that a systematic bias was affecting the measurements. A "systematic bias" is explained in Section 7 of Ref. 3. This means that the measured values were altered by an unknown amount, so that the dates in Damon should be rejected from use in dating the Shroud.

I realize that these points may not be understood by the layman. This is partially because the time limitations and the format of a debate did not allow me to develop the presentation in a systematic and complete manner. I will have to depend on the honest seeker of truth to read and study my papers in the references.

To further explain the fifth point above, in my statement, I said that based on a complete statistical analysis (using a chi-squared analysis as in Damon, Ref. 1) of the measurement values compared to the measurement uncertainties, there is only about a 1.4% chance they are consistent (lower-left corner of Table 5 in Ref. 4). This indicates that something unexpected was affecting the measurements with about a 98% probability. The measured values for the samples should have been consistent with the measurement uncertainties because the samples sent to the three laboratories (Tucson, Zurich, and Oxford) were cut from the corner of the Shroud next to each other. Because the samples were originally next to each other on the Shroud, their measured values should have been in agreement, within the measurement uncertainties, but they were not. This indicates that the variations in the measurements were not only due to random measurement errors but also due to something else that was causing a bias, or error, in the measurements. This "something else" in statistical analysis terminology is called a systematic error or bias and causes the samples to have basically different measured values of the ratio of C-14 to C-12 and C-13, which is what is being measured in carbon dating. When samples are basically different in the measured quantity, they are said to be heterogeneous instead of homogeneous. "Hetero" means different whereas "homo" means the same. This means that measurements on heterogeneous samples are not to be believed because the measured values have been changed by something. Since the publication of Damon (Ref. 1), the 12 statistical analyses on the data in Ref. 1 that I am aware of have all concluded that the samples are heterogeneous so that the data should not be used to date the Shroud (Ref. 5). My explanation for this is the neutron absorption hypothesis (Ref. 6). This hypothesis is the best explanation for the data in Damon because it is the only hypothesis that is consistent with everything that we know about the carbon dating of the Shroud of Turin: the date, slope, and range of the 1988 measured values on the Shroud samples, and the 700 AD date for the Sudarium, since the Sudarium is believed to be Jesus' face cloth and thus related to the Shroud. The forgery/artist hypothesis is not consistent with the slope or range of the 1988 data and thus should be

rejected. I hope the honest seeker of truth will pursue these issues by studying my references. My papers listed below can be obtained on this blog site or on the research page of my website at <http://www.shroudresearch.net/research.html> . I am sorry that this has to be so long. Robert A. Rucker

- Ref. 1 "Radiocarbon Dating of the Shroud of Turin" by Damon, et al, *Nature*, Feb. 16, 1989
- Ref. 2 "Status of Research on the Shroud of Turin"
- Ref. 3 "The Carbon Dating Problem for the Shroud of Turin, Part 1: Background"
- Ref. 4 "The Carbon Dating Problem for the Shroud of Turin, Part 2: Statistical Analysis"
- Ref. 5 "Understanding the Statistical Analysis of Carbon Dating of the Shroud of Turin"
- Ref. 6 "The Carbon Dating Problem for the Shroud of Turin, Part 3: Neutron Absorption Hypothesis"