Comments on Rogers' "Testing the Jackson 'Theory' of Image Formation"

John P. Jackson, Ph.D. and Keith E. Propp, Ph.D[1].

In 1990, one of us (Jackson) offered a hypothesis as an attempt to explain simultaneously all observations regarding the Shroud image (Ref 1). This hypothesis was ventured only after a systematic study of alternatives had failed to account for various image characteristics (Ref 2) and, though unconventional, this hypothesis makes a variety of testable predictions that are a-priori falsifiable by means of the Scientific Method. Recently, one important prediction of the hypothesis, that a double superficial frontal image without an associated dorsal image should exist on the Shroud, was reported by Fanti and Maggiolo (Ref 3).

While we are open to receiving critical comments regarding our hypothesis, we shall consider them within the context of the Scientific Method, which involves testing observational predictions of the hypothesis against verifiable and documented observations of the Shroud. What is not science is to disregard a hypothesis solely on the grounds that it, or parts of it, may run against the current scientific paradigm, particularly when that paradigm has as yet failed to produce a consistent explanation for what is observed[2]. Alternatively, if observations can be explained by current science, then there is no necessary reason for invoking an unconventional explanation; if this can be accomplished in the case of the Shroud, then we would certainly reconsider our hypothesis and be compelled to look for discriminating observations.

It is in this spirit that we respond here to the paper of Raymond Rogers, *"Testing the Jackson 'Theory' of Image Formation"* (Ref 4). We thank the editor of the *shroud.com* website for providing us the opportunity to make these remarks.

The basic thrust of Rogers' paper is to show that radiation could not have been the cause of the Shroud image. To support this conclusion, Rogers poses three questions as follows, *"1.) Blood is not stable to heating. Was the blood affected by the intense flux of vacuum uv? 2.) Can significant differences be observed between image areas and non-image areas as a result of radiation effects? 3.) Why is there no color in the pores of the cloth?"*

In order to maintain focus, we shall only consider electromagnetic radiation that falls in what is loosely called the "vacuum ultraviolet" region. The deductive logic for considering this type of radiation as a candidate for image formation within the context of our hypothesis is discussed fully in Reference 1. Vacuum ultraviolet is so called because such wavelengths cannot be propagated in standard air. Zel'dovich and Raizer provide

---

[1] Both representing here the Turin Shroud Center of Colorado, *shroudofturin.com*

[2] Please note the comments in the last paragraph of this paper.

an experimental absorption curve for photon absorption in air (Ref 5). For the uv wavelength of 140 nm, near the start of the vacuum ultraviolet region, the absorption range for photon propagation in air is about 0.01 cm or 100 microns. The absorption is due to photo-dissociation and photo-electric absorption of oxygen. When radiation of this wavelength impinges upon cloth, dissociation of molecular bonds occurs and absorption occurs in distances much smaller than the diameter of a linen fibril. These absorption considerations will be important in evaluating Rogers' comments.

We now consider Rogers' "questions" in turn.

1. The stability of blood on the Shroud.

Rogers says (Ref. 4), *"The primary result of irradiation of cloth with energetic photons is heat. The blood was never heated to a temperature concordant with an intense flux of vacuum ultraviolet photons…It is extremely unlikely that any form of radiation interacted with the cloth.*

Comment: When the Shroud went through the 1532 fire, it was exposed to temperatures that were clearly able to discolor linen. In fact, there are scorch regions on the Shroud that have the same intensity as the body image. On-site reflectance spectroscopy in 1978 was unable to distinguish between the color characteristics of equal intensity body image and scorch regions (Ref 6). This means that the blood on the Shroud has been exposed to temperatures that are at least sufficient to color linen to the same degree as the body image. Moreover, we remind that the pyrolysis/mass-spectrometric analysis of the Shroud blood, which Rogers cites in his paper (Ref 4), was performed on blood samples that had been previously exposed to the temperature conditions of the 1532 fire. Hence, it must not be excluded that low intensity radiation could have acted to discolor the cloth and, simultaneously, raised the temperature of the blood to cloth-discoloring temperatures.

2. Can significant differences be observed between image areas and non-image areas as a result of radiation effects during image formation?

Rogers says (Ref. 4), *"There is no significant difference in crystal perfection between image and non-image fibers. The image was not produced by radiation."*

Comment: The similarity of fibers in image and non-image regions is likely due to the fact that the chemical changes that lead to image color exist only in a small surface layer surrounding the image fibers; beneath this layer, which accounts for most of the fiber mass, the physical and chemical properties are presumably the same. As noted above, vacuum ultraviolet radiation, being strongly absorbed in the fiber material, would produce alterations only in a thin surface layer of the fiber; hence, we are not be surprised that the bulk properties of the body image fibers, if they were exposed to vacuum

ultraviolet radiation to make the image, would resemble the fibers from the background cloth.

3. Why is there no image color inside the pores of the cloth?

Rogers says (Ref. 4), *"If the cloth fell through (was immersed in) an energy field, all of the pores in the cloth should have been filled with and subjected to the energy. There is no image color or erosion inside the pores of the cloth."*

Comment: On the contrary, in the macrophotographs of the body image, we believe that image color is evident in the pores between the threads of the cloth.

However, in this section, Rogers does make certain statements that need comment.

Rogers says (Ref. 4), *"Intense radiation exerts pressure as in a nuclear weapon. Radiation pressure coupled with ablation (the sudden appearance of hot gas, which gives the same propulsive effect as rocket exhaust) of the cloth by intense radiation should have thrown the cloth a considerable distance and probably would have torn it to shreds. Experiments we did with pulsed ultraviolet lasers on linen resulted in ablation and destructive shock waves. Samples often were converted into a little amorphous powder and gas…Fibers hit by intense, energetic radiation vaporize…The surface of the Shroud does not show the effects of radiation."*

Comment: Consider the following counter-example that shows that there does exist radiation that can produce Shroud-like chromophoric changes without violent mechanical effects, as implied by Rogers. On the Shroud, along either side of the face, we can observe scorch patterns whose characteristics indicate that they are undoubtedly due to thermal radiation that was generated during the 1532 fire. This is a simple example of where image-like discolorations were produced on the Shroud by radiation without any accompanying shock-dynamic or vaporization effects. Radiation represents a large category of phenomena that can be described by (1) intensity, (2) wavelength, and (3) event duration. Each of these variables can change by orders of magnitude. The laser experiment cited above represents but one point in this vast three-dimensional parameter space. Clearly, the entire category of radiation cannot be discarded on the basis of one, overly intense, laser experiment that corresponds to a single point in that radiation parameter space.

Conclusion

We therefore find that *"Testing the Jackson 'Theory' of Image Formation"*, offers no reason to disqualify radiation, specifically vacuum ultraviolet, as a possible mechanism of image formation.

In fact, there are good reasons to consider such a possibility. On pages 29-30 of his paper (Ref 7), Rogers provides his own list of thirteen "Requirements for a logical hypothesis" (although we believe that there are also others). Of particular note, are the observations

that the image discolorations reside on the surfaces of the image fibrils and that the inside medullas are not colored. We point out, again, that vacuum ultraviolet radiation would be absorbed at the surface of the fibrils, which would leave the medullas unaffected, thereby satisfying those requirements.

We also should point out, as discussed in Jackson's 1984 paper (Ref 2 – pg 2263), that any diffusion-based image formation mechanism that is hypothesized to transport and encode body shape information into the varying intensity levels of the Shroud image fails to account for the macroscopic resolution of the Shroud image as observed. This is a major problem for the validity of the hypothesis that is described in Reference 7. In Reference 1, we show how the resolution problem on the Shroud can be satisfied in the context of our hypothesis.

References:

1. Jackson, John P., "*Is the Image on the Shroud Due to a Process Heretofore Unknown to Modern Science?*", Shroud Spectrum International, No. 34 March, 1990, pgs 3-29.

2. Jackson, John P. and others, "*Correlation of image intensity on the Turin Shroud with the 3-D structure of a human body shape*", Applied Optics, Vol. 23, No. 14, 15 July 1984, pgs 2244 – 2270.

3. Fanti, Giulio and Maggiolo, Roberto, "*The Double superficiality of the frontal image on the Turin Shroud*", Journal of Optics A: Pure and Applied Optics 6, 2004, pgs 491-503.

4. Rogers, Raymond, "*Testing the Jackson 'Theory' of Image Formation*", http://www.shroud.com/pdfs/rogers6.pdf, 2004.

5. Zel'dovich, Ya. B. and Raizer, Yu. P., "*Physics of Shock Waves and High-Temperature Hydrodynamic Phenomena*", Academic Press, Volume II, 1967, pg. 604.

6. Gilbert, Roger Jr. and Gilbert, Marion M., "*Ultraviolet-visible reflectance and fluorescence spectra of the Shroud of Turin*", Applied Optics, Vol 19, No. 12, 15 June 1980, pgs 1930-1936.

7. Rogers, Raymond, "*Scientific Method Applied to the Shroud of Turin – A Review*", http://www.shroud.com/pdfs/rogers2.pdf.