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COMMENTARY

The relics of Jesus and Eucharistic miracles: scientific analysis of shared AB blood type

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Abstract
Various relics ascribed to have been in physical contact with the historical Jesus of Nazareth have been evaluated for the presence of blood, including the Tunic of Argenteuil, the Sudarium of Oviedo, and most famously, the Shroud of Turin. Interestingly, the blood type on all three textiles was found to be AB by serological testing; a similar result was observed for various modern Eucharistic miracles, in which consecrated hosts are reported to change into human cardiac tissue and blood. As AB is a relatively rare blood type, these collective observations have been used in numerous contemporary media outlets to support the idea that all such objects share a common origin. Here, the scientific validity of mutual blood type expression is evaluated. As discussed, AB antigens are not unique to human red blood cells but are also expressed in bacteria, providing a practical connection between such varied objects. Moreover, this article clarifies that the communal presence of specific and unique polymorphic markers would be required to validate that bloodstains associated with such items truly originate from a single source.

Keywords AB · Blood typing · Eucharistic miracles

Religious artifacts reported to contain the physical blood of Jesus: type AB

Numerous artifacts have been described throughout history that were allegedly stained with the blood of Jesus, particularly those associated with his passion and death. Three of the most famous include the Tunic of Argenteuil, a seamless robe suggested to be the garment that soldiers gambled over [1]; the Sudarium of Oviedo, proposed to be a face cloth mentioned in the gospel of John [2]; and most notably, the reported burial cloth of Jesus, the Shroud of Turin [3]. Serological (antibody) testing for all three objects was reported as type AB [1–4]. Various Eucharistic miracles have been chronicled in the twenty first century in which consecrated communion wafers are described as exhibiting properties of human flesh and blood [5–11]. For those tested, a similar AB typing result was obtained, which has been suggested to imply a common origin among these materials, as a type of reciprocal validation [5–11].

ABO blood groups (A, B, AB, and O) were originally described by Karl Landsteiner in 1900 through his work in transplantation immunology. These molecules are created by the addition of a specific sugar (carbohydrate) to a core structure; type A receives a different terminal sugar than type B (Fig. 1) [12, 13]. Remarkably, the immune system is able to recognize this subtle difference, reacting vigorously when mismatched blood is transfused into an incompatible recipient. Most of the population do not express either A or B antigens, termed type O (45%); approximately 40% express only the A antigen (40%), only 11% express just B antigens, and a small proportion express both A and B antigens, approximately 4–5% [14]. Because type AB is relatively rare, this has been used to bolster claims such as the odds of multiple Eucharistic miracles (and articles such as the Shroud of Turin and the Sudarium) showing a similar AB result in the order of one to 3.2 million or higher [15]. Such findings are often cited as evidence that all these substances originate from the same source [5–11, 15]. After all, how could it be coincidence that all such objects exhibit the same rare blood type?

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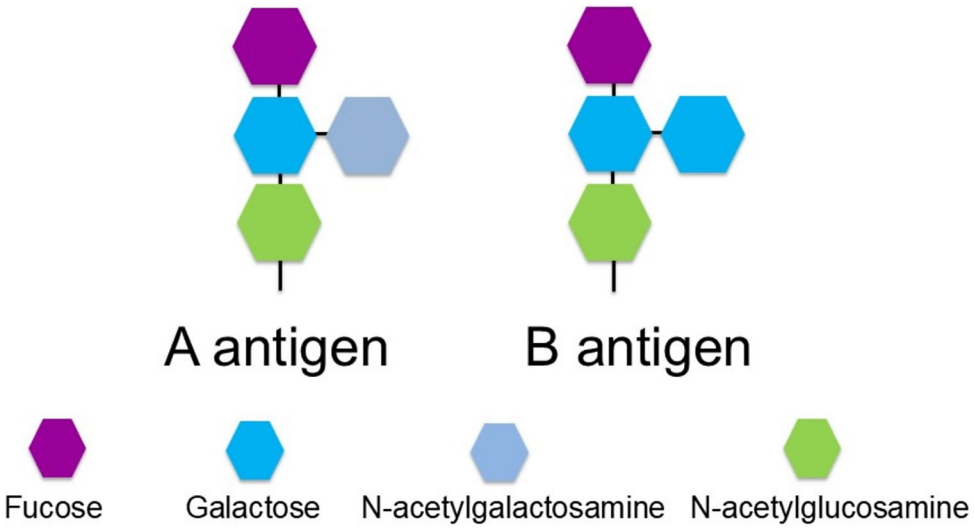

Fig. 1 Structure of **A** and **B** antigens. Only the terminal portion of the molecule is shown. The identity of individual carbohydrates is indicated

AB molecules are shared among humans and bacteria

It is important to point out that while A and B molecules were originally found on human red blood cells, it was later established that bacteria also express identical molecules on their cell surface [12, 16–23]. The presence of such shared antigens helps to explain why persons with blood type A have antibodies in their circulation specific for type B (and vice versa) and are thus not suitable matches for blood transfusion [14]. Because AB antigens are shared among humans and bacteria, one cannot be certain if typing results are authentic when dealing with aged or contaminated samples using these methods. *A sample could test positive for AB without any red blood cells even being present.* Thus, when one considers that a common denominator among such objects is the presence of bacteria, probability statistics such as ≥ 3.2 million to 1 become much less impressive and scientifically shift to a different result. It should also be emphasized that for even the most studied of these artifacts, the Shroud of Turin, the Sudarium, and the Tunic, such typing studies have never been published in a peer-reviewed scientific journal, which is the normal pathway for such findings. Relatedly, assertions of geometric congruence between certain bloodstains on the Shroud and the Sudarium have been relatively self-contained [2]; it is unfortunate that such studies have not been forensically evaluated by an extensive group of blood pattern experts.

Regarding the Shroud, the primary scientist on the Shroud of Turin Research Project (STURP) team who characterized the general chemical properties of the blood in 1978, Dr. Alan Adler, seriously questioned the AB findings because of the very issue that carbohydrates were shared between bacteria and other organisms [24]. In subsequent microscopic examinations conducted years later, Dr. Garza Valdes, a microbiologist, reported that Shroud blood fibers were heavily contaminated with bacteria and fungi [25]. Microbial contamination has also been found in various instances involving modern Eucharistic miracles, as well [8, 15], and has been suggested to be the primary cause for many of these appearances [26, 27]. In the case of the Shroud, adjacent white fibers (without blood) were found to be negative for AB; however, the argument can be made that contamination would primarily be localized within the bloodstains, which is the most abundant food source [28]. In analysis of the Sudarium, some B antigen reactivity in non-bloodstained areas was observed, together with strong B antigen and weak A antigen positivity of bloodstains [2]. In certain cases, bacteria may convert some type A structures to B antigens through deacetylation, known as acquired B type [29, 30]; however, with aged and/or contaminated samples it is difficult to have confidence in the true nature of AB antigens that are defined using serological methods. In any of the above cases, the types of serological (antibody) tests that were performed would not distinguish the true source of AB molecules as they recognize identical structures in both bacteria and humans.

In many of the Eucharistic miracle reports, the evidence of specificity controls in antibody binding was noticeably unmentioned [6–9, 31], raising additional questions about the validity of the results. In his book on the scientific examination of Eucharistic miracles, Serafini states that "the overall risk of an incorrect blood group determination for these analyzed blood samples [of miracle events] is becoming increasingly small" as methods have improved and have been carried out in various laboratories [8]. This is an oversimplification of the fact that even though techniques may slightly vary, the molecular principles of antigen recognition by antibodies remain unchanged. As none of the above articles in question is sterile (quite the converse), it is

reasonable to propose that shared AB antigens from bacteria could readily explain the observed shared blood type. Even with the use of more modern serological techniques (monoclonal antibodies, fluorescent labeling, etc.), the likely contribution of AB antigens from microorganisms cannot be excluded.

Determining the true origin of shared AB antigens

Scientifically, there are methods to allow one to distinguish whether such AB antigens truly originate from human blood cells or from bacteria. Such techniques require examination at the DNA level, which has never been done for any of the aforementioned textiles or Eucharistic miracle events. In modern day forensics, blood typing of dried bloodstains is typically evaluated with such methods which unlike previous studies which relied on antibody binding, utilize DNA probes to analyze the presence or absence of the genes for enzymes that create such structures. These enzymes are termed glycosyltransferases for sugar-transferring enzymes, or GT, for short; type A and type B antigens are created by GT-A and GT-B, respectively, which can easily be distinguished from one another by molecular probes [20]. Although bacteria and humans share common AB structures on the cell surface, bacterial GT-A and GT-B are distinct from their human counterparts. Thus, providing sufficient DNA was available, similar technology could be used to determine the true source (bacterial vs. human) of AB antigens present in these substances. Such methods are likely to be most suitable in the analysis of Eucharistic miracles where DNA is expected to be relatively fresh and less fragmented than for aged relics. This approach circumvents problematic issues of antibodies recognizing similar structures on different species and could provide information regarding their true origin.

Shared AB antigens are not sufficient to support the claim of a single origin

Finally, it should be emphasized that regardless of their circumstantial and controversial nature, the findings that AB antigens have been found on various relics and Eucharistic miracles are by no means sufficient to support the claim of a single, individual source. For any such declaration to even begin to be considered, demonstration of shared unique, specific identifiers would need to be provided. This requires the shared presence of genes or gene products that are truly different among individuals. At the DNA level, analysis of short tandem repeat (STR) regions or mitochondrial DNA typically serves this purpose in modern forensic analysis, although no comparative data currently exists for either textile relics or Eucharistic miracles. STR analysis of Eucharistic miracles was attempted without success, which, oddly enough, was attributed to a type of divine property of the DNA [8, 32], without consideration of other possibilities.

The transplantation antigens, or human leucocyte antigens (HLA), represent the most polymorphic systems present in man, at both the DNA and protein level [33]. Provided sufficient DNA was available, HLA typing could clearly establish if such samples share the same origin as a singular difference between HLA-A, B, or C would indicate incongruence among samples. If DNA degradation or contamination by multiple individuals was prohibitive, this issue could also be examined using serological techniques at the HLA protein level. Such antibody methods do not have the inherent problems seen with AB typing, as HLA antigens are polymorphic by nature and distinct for specific individuals. This approach is likely most appropriate for Eucharistic miracles where samples are relatively fresh. If conversion into heart tissue and blood is truly valid, then HLA expression should accompany this change. Immunohistochemical analysis has been performed successfully on such samples with antibodies to glycophorin A [8]. Modern multiplex antibody methods could prove especially useful in this regard; Tsujikawa and colleagues have shown that simultaneous evaluation of 12 biomarkers in one formalin-fixed paraffin-embedded tissue section is possible [34]. HLA serological analysis also provides an important quality control check to ensure that duplicitous tissue samples are not substituted in prior to examination of such materials: if genuine, HLA profiles should match in all cases. Scientific substantiation of any claims of shared origin among relics and/or Eucharistic miracles would require this level of evaluation, i.e. the study of molecules that are both unique to humans and exhibit variation among individuals. Anything less than this is relatively futile for supporting such declarations.

In summary, the current article has evaluated the proposed idea that AB typing results among various relics and Eucharistic miracles indicates a common origin for these objects. As AB antigens are mutually expressed by both bacteria and humans, this claim cannot be scientifically substantiated. Indeed, the most likely explanation for such observations is that they result from the presence of common antigens present on bacteria. Lastly, several alternative approaches are suggested to help verify any collective origins that may exist.

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Data availability No datasets were generated or analyzed during the current study.

Declarations

Competing interests There are no competing interests in the current study.

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