

ZUR TRANSFUSIONS-FRAGE

By: L. MAYER

A TRANSLATION BY PHIL LEAROYD

A copy of the paper titled 'On the transfusion question' by Dr. Ludwig Mayer, published in 1874 in the journal *Deutsche Zeitschrift für praktische Medizin* [reference volume 32, pages 271–275] can be read or downloaded from the following site:

https://books.google.co.uk/books/about/Deutsche_Zeitschrift_f%C3%BCr_praktische_Med.h tml?id=fFNfAAAAcAAJ&redir_esc=Y

Mayer begins by stating that he wants to avoid identifying the historical development of blood transfusion but concentrate on the most recent developments. He starts by looking at the conditions where transfusion is justified and would be currently indicated, giving priority to acute haemorrhages that threaten life through blood loss. He then includes various conditions where the blood is quantitatively or qualitatively altered, resulting in chronic anaemia – including transfusion used to shorten protracted convalescence. He then discusses the different diseases in which transfusion has been used, stating that the experience of the benefits of transfusion are still emerging and therefore it is worth trying in different clinical situations.

He then considers the types of transfusion, whether arterial or venous, whole blood or defibrinated, direct or indirect. He considers that the different options to some degree depends on circumstance, i.e. if a lamb is available then use it in chronic cases, but if acute, then he states that he would preferentially use human defibrinated blood. Interestingly, he argues that exposing the carotid artery of a lamb takes more time than a venesection and that he therefore recommends using human defibrinated blood – stating that the time it takes to do one lamb transfusion is equivalent to the time it takes to do two human defibrinated blood transfusions.

As for the method of transfusion, he recommends a simple syringe used with defibrinated blood, stressing that performing the method carefully, even with basic instrumentation, carries little if any risk, though he then goes on to consider the dangers of transfusing blood clots and the entry of air into the patient's vein. He shies away from describing individual transfusion methods and the discussion of various transfusion devices that are available but does at length discuss the different post transfusion symptoms seen in patients and the current theories regarding the causes of these various reactions to both human and animal donor blood.

Although Mayer quotes the work of a number of different people in this paper, he does not provide any references.

I have produced a translation of this paper from the original German into English to hopefully enable its content to be appreciated by a wider audience. Whilst I am obviously aware that instantaneous computer generated translation is available, this process however struggles with accurately reading the original text and interpreting specialist terminology, as well as producing a 'colloquial style' not always representative of the original text. In addition, an 'automatic translation' may either purposely or inadvertently alter the wording to 'make it read better' but in doing so there has to be an element of interpretation involving something on the lines of 'I believe that this is what the author is actually trying to say'. I want to avoid that as much as possible and try to present what the author actually wrote and

as a result the reader may find that the English text does not 'flow' as well as it could. Although I have taken great care in accurately identifying the original text and producing a true representative translation of the author's original wording I cannot guarantee that this work does not contain 'translational errors' and the reader is recommended to check specific details against the original text.

ON THE TRANSFUSION QUESTION

By

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Almost every work that deals with transfusion reads Mephisto's words: "Blood is a very special juice." Göthe probably did not suspect when he wrote this sentence that he would be quoted so often on a lively topic. But I have no doubt that one or the other of the critics would finally come out with the idea that Göthe had this operation in mind when he said these words. How many thoughts are attributed to the poet by the so-called interpreters, which he certainly did not think of in this or that passage. I refer only to Shakespeare on this point. But to return to this special juice, there are some who perhaps believed that its effect was too great, others who uncritically denied it any success, because they have been deceived at one time or another about their expectations of success. I believe, however, that since the transfusion question has again become the question of the day, especially as a result of recent work, it is appropriate to discuss the question briefly in this paper, because the views seem to me at this moment so vague that it is now time to be confronted with the whole question from a certain point of view, although it can only be that of the individual writer. If it has almost become custom in all works on transfusion the entire historical development of this operation from Magnus Pegelius, who made the suggestion, which was admirable for his time, of transferring blood from one man to another in order to rejuvenate him, until the Frenchman Denis (1667) actually performed the operation on living humans, in all its phases up to the present time, so we want to spare ourselves this and consider transfusion in its most recent development. In this regard, Gesellius in particular, threw the explosive into the smouldering coals, and rekindled the fire of all questions about whether defibrinated or non-defibrinated blood, arterial or venous blood, animal or human blood should be transplanted.

In every operation we undertake, we first ask ourselves whether it is justified, and only secondarily does the manner in which it is carried out come into consideration. So we would first examine the indication for transfusion. We are becoming increasingly bold with our interventions in the body and so this question has recently become much broader. It is clear that with all bleeding, whether it comes from the uterus, from a wound, from the stomach, intestines or kidneys, or from the lungs, which threaten life through the loss of blood, the transfusion alone is still indicated as life-saving. In addition to these acute cases, there are also a number of illnesses in which the blood is not only chronically quantitatively changed, but also acutely or chronically qualitatively changed, which prompt this operation. So we can state the indication in its broadest version in Leisrink's words: "Transfusion is indicated in all those pathological conditions where the blood, be it quantitatively or qualitatively, is so changed that it can no longer fulfill its physiological duties." Accordingly, we immediately conclude here on the indication for transfusion of named bleeding that occurs in chronic cases. Anaemias occur, initially in those where the blood's physical components are changed, where disproportions between red and white blood cells appear, as in chlorosis and leukaemia. Here are all the diseases which, because of their duration, impair blood formation in general and reduce the entire quantity of it, such as malarial cachexia (Tassinai), Morb. maculos. Werlhofii, the scurvy; perhaps also leprosy, which according to

Van Someren's latest views is a chronic blood disease with a reduction in red blood cells and an increase in protein (?), and ultimately protracted suppurations. And of chronic diseases which lead to lack of lack of blood due to lack of food intake, Leisrink recommends chronic gastric catarrh as an indication for transfusion, I consider this recommendation, especially since we know from Leube's work that nutrition via clyisma can be achieved very well, to be bolder than if one wanted to support the lives of patients by transfusion in the case of carcinoma uteri, of the stomach, of the rectum, i.e. in the case of incurable diseases to support the lives of patients through transfusion. As is well known, the red blood cells perish en masse in fever and so it could happen that even after febrile illnesses in convalescence, such as typhoid fever, a transfusion would be accompanied by success here and there and would shorten the protracted convalescence. Hasse has opened up a new avenue of transfusion by finding in direct arterial lamb's blood transfusion as essential aid, as he himself expresses, against phthisis pulmonum. Incidentally, Eulenburg and Landois have already stated that in phthisis the nutritional transfusion is likely to be of considerable value.

The success of Hasse's operations was a surprising and magnificent. The general condition of these patients soon left nothing to be desired and the local suffering demonstrably continued to improve. Furthermore, Hasse considers among the indications of the operation to be mainly acute and chronic anaemia and their subsequent conditions, as well as any infirmity following acute or chronic diseases.

Finally, the field of transfusion also includes cases in which there are qualitative changes in the blood, probably of a chemical nature; as a result, the bacteria question will probably come to a head in addition to the mechanical aspect.

At the top are pyaemia and septicemia. But without removing the local source of infection, I cannot imagine any improvement. This is where the different assessments and different results of this operation come from. In cases where the diseased part, i.e. an extremity, can be removed, improvement is conceivable; in cases where the manure process is on the trunk, transfusion is of no use. Dieffenbach had also already practiced the operation in the case of dog rage; unfortunately without success. It will sometimes be very difficult to carry out given the restlessness of the patient; in such a case, at least for me, it was downright impossible to carry out. Transfusion has been tried for cholera, unfortunately with the same success as with all other remedies. If we understand tetanus as a zymotic disease in the sense of Bill Roth, or if we assume that, as Eulenburg and Landois point out, every attempt to ingest food so often causes the most threatening reaction phenomena, then one could also assume in such a case, think of the transfusion, perhaps not just as a nutritional one, but according to Eulenburg and Landois, one could perhaps also fulfill a causal indication by supplying the central parts and especially the medulla oblongata with less irritating, oxygen-rich blood. It should also be mentioned here that the above named authors also in marasmus senilis, where nutrition is reduced to a minimum and one daily fears that life will go out, the nutritional transfusion, which makes life flicker, like a smoldering wick that is suddenly soaked with oil, is recommended.

Who knows now to what extent we will exceed the limits of our abilities? Only experience will teach us! The operation has been successfully practiced in cases of poisoning with carbon oxide gas, hydrogen sulphide, and illuminating gas; on the other hand, it would be decided to try it in cases of chloroform intoxication, opium and atropine poisoning, to supply fresh blood to the central organs. Finally, Mosler recommends blood injections for sugar urinary dysentery and uremia.

In all chronic cases, I would like to emphasize that the doctor should not hesitate too long before carrying out the operation, because of course the chances are worse if, for example, internal organs have already been affected by a suppurative process and morbus Brightii, amyloid degeneration, caseous pneumonia, general hyalinosis, etc. have developed. In this respect, the hospital doctor sometimes has an easier time because his intervention is much more independent than in private practice, where the most diverse considerations often cause the operation to be delayed or make it impossible to carry out. Unfortunately, these are the downsides of practice in general that the doctor doesn't just have to struggle with the

illness, but with various elements surrounding the patient! But do not shy away from any effort, in particular, do not postpone the operation until the approaching end of life, as it will of course no longer be of any use, only discredited. Our experience of the benefits of transfusion is still emerging, which makes it worth trying. It is of course more convenient to let the hopelessly sick die quietly so as not to torture them any further, as this expression is so popular, but it is inhumane and as a doctor I hold onto the obligation to extend the life of the person, even by 5 minutes, who is entrusted to my help.

If I now move on to assessing the types and the instrumentation required for the transfusion, I am writing here under the very fresh impression of a lamb blood transfusion that was carried out just yesterday (19 June). Now, whether one person decides on this form of execution or another on that form, the question is always whether arterial or venous, whether defibrinated or non-defibrinated blood should be chosen, whether directly or indirectly, i.e. from vein to vein, artery to vein, from artery to artery.

Well, first of all you just take what you have. If I have a lamb and time, i.e. in chronic cases, I do a lamb blood transfusion. In acute cases, apart from the fact that I prefer human blood rather than lamb blood, it seems to me that transfusion with defibrinated blood, namely into the vein, is decidedly preferable because it requires less time. Exposing the carotid in a lamb requires great care due to the soft venous plexus surrounding it and of course much more time than a venesection. The integration of the tubes into each artery and vein, their filling with a sodium bicarbonate solution, the connection with the rubber tube are decidedly much more complicated than the defibrination of the blood, in which, after Oré's experiments have shown that the cold prevents clotting, and after the direct lamb blood transfusion shows that the chills cannot come from the cooled blood, I do not pay much attention to warming the defibrinated blood to blood temperature, which would at least be time-consuming and complicated. It has already pointed out to Panum that it is superfluous to heat the blood to be transfused. You can also inject it with the temperature of the environment. With appropriate caution it is possible to transfuse defibrinated blood with any well-made enema syringe, the contents of which I know pretty well, provided with a rubber tube to be inserted into the vein, I completely reject every other instrument, no matter how ingenious or how boring one may have been in the invention of complicated syringes. With complete conviction and from my own experience, I can recommend the simplest syringe device to the general practitioner as the best and most practical device.

The operation is said to be completely harmless, but on the other hand it is often said to be dangerous. Every operation, no matter how small, if carried out with golden knives but sloppily and uncleanly, can harbour dangers; every major operation carried out elegantly with all the necessary precautions and with all the care, even with a table knife, loses its danger. That's exactly how it is with transfusion. If I am careless, even the most complicated and ingeniously invented instrument will not be able to prevent me from sending air or a clot into the vein, but for those who carefully carry out the transfusion with the simplest syringe, it poses no danger. This is the egg of Columbus. The danger of the operation lies primarily in the formation of clots, which can cause thrombosis and embolism, but which can also be prevented. As far as the entry of air is concerned, I recall Löwenthal's experiments on rabbits and dogs, which show that the entry of air into the venous system is completely harmless if it takes place away from the right heart (v. cruralis, brachialis, axillaris) and only on the v. jugularis is fatal. I also mention the reports of Devay and Desgranges, who observed recovery after a transfusion, despite the fact that some air bubbles had entered during the injection.

According to Löwenthal's reports, only two cases are known in the literature in which air ingress caused death, and in both cases the blood was injected into the jugular vein. The story of air seems to be a ghost that floats in everyone's mind and is painted over and over again in every new work on this subject. Contrary to Löwenthal's experiments, Kowalewsky and Wyssotzky found that animals could be given up to 200 centimetres of air without harm even into the central jugular vein in the direction of the heart, if the injection only takes place slowly and gradually, so that only small amounts of air reach the heart each time.

I had only put these few lines on paper when I carried out a second (25 June) lamb blood transfusion on the same patient with whom I had performed the first one, after the resection of the knee joint, after the thigh operation that had become necessary because of progressive defilement. Prof. Rüdinger, who on both occasions had the great kindness to prepare the carotid of the lamb and had also convinced himself of the inconvenience of connecting the two glass tubes with the rubber tube, devised two hard rubber cones that could be pushed into each other, each of which sat in a rubber tube, so that the connection is not made by pushing the rubber tubes over the glass tube, but simply by pushing the cones into each other, a process that is much easier and quicker to accomplish. It is only necessary to consider whether the insertion of the cones might give rise to clot formation due to by means of significantly increased frictional resistance.

Beigel found the main difficulty in the connection of the lamb's artery with the interposition tube. That didn't happen to me. I therefore believe that he may find his tweezers, which he inserts into the lumen of the carotid artery in order to be able to insert the tube more easily, unnecessary. In our case, both transfusions went quite quickly, but until you do a lamb blood transfusion, you do two transfusions with defibrinated human blood! By the way, it happened that I could not do the second transfusion, which I had planned to carry out on the afternoon of 24 June, until noon the next day, because no lamb could be found.

So it could happen that, to paraphrase Hamlet, we would give a kingdom not for a horse but for a lamb. Steiner also encountered the fact that even in Vienna, even during the Easter holidays he was unable to find a lamb. What is interesting is that he used a dog with the same benefit; however, the dark side of these animals certainly remains their unruliness, while the lamb does not move during the transfusion. By the way, even a healthy dog would often be just as difficult to find as a lamb. Steiner also considers them unsuitable because of the variety of illnesses that the dogs are subject to. In the lambs, too, I would like to note, a change similar to the septic disease is said to occur, which therefore does not make the blood of these animals appear entirely harmless, and urges caution to use only quite healthy, fever-free animals.

Now we are still faced with the question of arterial transfusion, as Hüter has proposed it. Do you want to wander on and on and the good is so close? With the two surgical methods mentioned, we are prepared for all eventualities, so that it is not necessary to seek more complicated and uncertain methods, which tend to prevent this transfusion from becoming a common property of doctors.

Leisrink reports that it occurred to an experienced surgeon in Hamburg that the resistance to an arterial transfusion was so great that the blood could not be collected in a sufficient manner and a venous transfusion had to be performed. That alone speaks against this procedure. This has also been encountered by Hüter himself, who himself considers the strong pressure required by arterial transfusion to be a dark side of the method. Apart from this, the method appears in a number of cases of great fragility of the capillaries, as is the case with pyaemia, septicemia, scurvy, morbus Maculosus Werlhof, etc., is actually contraindicated by the all the more likely rupture the same, thus represents a procedure which does not appear to be suitable for all cases. Hüter's transfusion may therefore celebrate triumphs here and there, but certainly not celebrating triumphal processions! What is described as the most important advantage of arterial transfusion by Hüter, that the transfused blood reaches the heart somewhat more slowly and more evenly than through venous transfusion, has been sufficiently refuted by Hasse's transfusion. If the heart strength has already fallen to a great extent, then arterial transfusion will not bring any particular advantage, since the *vis a tergo* is reduced.

Furthermore, the point of view is crazy in so far as we no longer operate *sub finem vitae*, but operate as early as possible, and no longer want transfusion to be regarded merely as an *ultimum refugium*.

Hüter himself notes that in future cases he will refrain from transfusion if he has a lack of pulse and dwindling heart action.

The danger of air ingress, as we have seen above, is not so great, and on account of this cause it is certainly not necessary to trouble us with arterial transfusion. Lastly, as to the

third advantage, namely, that the danger of phlebitis is avoided by arterial transfusion, we may be comforted by this, for if we do not maltreat the vein, there will be no phlebitis. However, the risk of phlegmonous inflammation occurring is at least possible with arterial transfusion. – Steiner's suggestion to make an attempt to trace the transfer of arterial animal blood into the brachial artery of the patient, instead of in his arm vein, I think has gone too far, because the ligation of the largest artery of the upper extremity is, after all, at least to be said, not an indifferent operation. That's why Schliep's direct transfusion from the animal's artery to the human artery does not seem to me to be of practical use and I have to describe it with Roussel as an aggravation of the blood recipient's suffering that is not justified in any way, not even taking into account the complexity of Schliep's syringe, which does not protect against clot formation. No less valid for Schliep's method are some of the objections which I raised against Hüter's and Hasse's proceedings. Schliep says: "If I were to be philanthropist enough to give my own blood rather than having the mutton injected into someone, I would, after weighing up the risks of opening the vein and the artery I would calmly open my artery."

Well, that's a matter of taste; I prefer a venesection wound that is healed in 3-4 days than a doubly ligated artery, which may take 2-3 weeks to heal. As ingenious as Schliep's method is, the reasoning about it is too individual, and the operation itself is certainly not suited to have a profound effect on practical life, for if we once appreciate the advantages of transfusions and methods in the various diseases, the transfusion must be made as easy as possible for every doctor to carry out in every direction.

Since I do not intend to write a monograph on transfusion, I can easily spare myself the tedious description of the execution of the individual methods. I also want to spare myself the discussion of the various devices; the whole criticism of most of them lies in their complexity. I hate all operations descriptions. Kept short they are usually unclear and communicated in all length and breadth, it is also an art, terribly boring. The "have seen" remains the main thing. The descriptions of instruments are usually even more unclear. The transfusion, however, is such a simple act that a detailed description is not necessary, and those who are particularly interested can find a rich yield in the various textbooks, monographs, essays, etc. It's not the place to give in-depth details here. We therefore pass quickly on to the symptomology, which seems to differ in some respects according to the use of the different kinds of blood. Certainly, however, the symptoms also depend on the amount of blood transfused, for it cannot be indifferent whether we for example inject 90 or 200 grams of blood. But there are individuals who tolerate the transfusion with venous human blood, which I have in mind at first, without any reaction. In some cases, patients mention a feeling of warmth in the arms and shoulders, including the chest, acceleration of breath, pulse, temporary palpitations, redness of the face, fainting. Severe back or lower back pain occurs as an annoying symptom, as Hasse reports. I have never observed these symptoms with venous human blood transfusions. The pulse continues to become fuller, tightness in the chest occurs. The heartbeat becomes stronger. After the transfusion, often in a very short time, there are chills followed by sweat; the latter is often present even without cold; the pulse may be soft, rapid during this time. The temperature is slightly elevated, and drops quickly to the normal curve. There is sleep, a feeling of well-being. The urine is coloured with blood here and there, does not contain blood cells, but contains protein. Heyfelder mentions transfusion with venous lamb's blood, the phenomena of which were exactly the same as those of transfusions with venous human blood. "With arterial blood transfusions, he informs, breathlessness, congestion to the brain, the lungs, the heart and the other internal organs, neither the pain in the kidney region, nor blood urine, nor albuminuria occurred, nor did the severe chills follow the violent attack of fever."

We can see from these words that the operation with arterial animal blood is somewhat more stormy. In the two transfusions mentioned above, the first of which was carried out on the 19th, the second on the 25th of June, there was at first a strong redness of the cheeks, then in the course of 60-90 seconds severe dyspnoea occurred, and while the first time there was no back pain at all, the second time severe pain occurred and the patient complained of intense kidney pain before the dyspnoea occurred. The latter was decisively reduced by applying hot wet cloths to the chest and by subcutaneous injections of ether. It did not last

more than half an hour. In the first case, after ten minutes and in the second after half an hour, there was a violent frost of about half an hour, followed by sweat and a rise in temperature to 40°C.; by evening, however, the patient showed the drop in temperature to 37.5°C. The sweating often follows right at the beginning of the transfusion. The pulse became fuller after the injection, but remained rapid. Contrary to Hasse's observations, Steiner also found the pulse, which was at first noticeably small, to become fuller and faster. Hasse mentions the slow and hard pulse and the stormy respiration as the first striking difference which the direct transfusion with arterial lamb's blood presented from the indirect transfusion with defibrinated venous human blood. Irresistible urge to defecate, even diarrhoea, as in our case a few hours later, occurs. Furthermore, Hasse mentions a violent itching of the skin over the chest, neck and hairy scalp, which lasted for several days. Unfortunately, the urine of our patients, which was always emptied with the stool, could not be examined. However, urine containing blood pigment and protein are sometimes emptied. Hasse assumes that this urine excretes not so much the constituents of the newly supplied viable blood cells, but rather a part of the decrepit blood cells already present in the patient's blood before the transfusion, for which there is now, as it were, no more space in the body. Sickness and nausea, a feeling of fullness of the body, headache, dizziness, and loss of consciousness are also symptoms that occur. The urticaria rash, which Hasse almost always saw after a few days, could not be observed in our patient. This is possibly caused by the skin irritation caused by fatty acids peculiar to lamb's blood, but foreign to human blood, when they are secreted by sweat. Hasse compares the pain in the area of the lower spinal nerves with the cross and back pain, which occurs at the beginning of many diseases, such as typhoid fever, intermittent fever, variola, and seeks its cause in the stimulus exerted on the spinal cord by the sudden change in the nature of the blood. Sander does not consider lamb blood transfusions to be harmless because of the level of fever that sometimes occurs. It is conceivable and even probable to him that the new blood exerts a stimulus on the vessel walls, and indeed foreign blood more and more regularly than similar blood, that this immediately results in a contraction of the vessels and a reduction in the release of heat. He also thinks that, according to Hüter's hypothesis, the elimination of capillaries and smaller vessels from the circulation could bring about the increase in temperature by reducing the emission of heat. Isn't this compensated for by sweat? Couldn't permanent fever be caused by infection with diseased lamb's blood? Should the stimulus continue to have an effect on the vessel walls for so long that it produces a serious fever? The cold that occurs here and there after venous human blood transfusions, still await an explanation. The cooling of the injected blood has probably been blamed for this, but the question arises as to whether this reason is valid. Here again we are faced with the great still unsolved mystery of fever. As a second point of concern, Sander describes the affection for the kidneys, which he calls very unpleasant and dangerous; after all, the outbreak of uraemia would be to be feared, and even without it, the subsequent weakness, polyuria and emaciation would not grant a completely unclouded prognosis. In one case he believed that he had to blame the kidney haemorrhage that had occurred on the result of the rupture of a number of glomeruli by the increased blood pressure. The question is whether, in such cases, the lamb's blood is to blame rather than an existing kidney disease. During his transfusion from artery to artery, Schliep mentions the extreme oppression, the most likely cause of which seems to him to be the suddenly increased lateral pressure. According to the investigations of Müller, who cites the important experimental result that the vascular system can absorb very large quantities of blood without any appreciable change in the normal arterial pressure, such assumptions certainly still seem to require experimental correction; it would be conceivable that we are dealing with phenomena of the nervous system (vagus), perhaps due to the specific effect of the mutton blood (Schliep). And so even now a thousand ideas and thoughts are connected with the exchange of blood between two individuals as in Dieffenbach's time, for up to this day the physiological question of transfusion is still unsolved. How does it work? Here opens up the wide field of conjecture, belief, and hope, which will only bear fruit through the seed of experimental research. Until now, Heine's word also applies to this question: "And a fool waits for an

answer." In the case of acute anaemias, one could at best accept that the quantity of the injected blood prevents a sad catastrophe, and Löwenthal's statement would also apply, who regards the transfusion as a haemostatic agent, for when new blood flows through the tissues, he says, it is obvious to remember that the vessels or organs (uterus) are brought into contraction by this very stimulus. But what about chronic anaemia? The blood transfusion does not serve as a means of nourishment, the physiologists teach us. And yet it must at least have an indirect effect on nutrition, if one looks through the medical histories and reads particularly emphatically: "The appetite improved." Does the blood act here through the multiplication of the blood bodies, does it act only as a stimulant, perhaps especially in the blood-forming organs, or does it serve, as one must remember in the case of lamb's blood, as a substitute, and is the body only given time to produce blood cells during the function of the lamb's blood itself? How long do lamb blood cells stay in the body? We must confess that we do not yet know anything definite yet, and it is very cheap when Heyfelder declares: "The transfusion acts not only as a quantitative substitute, but also qualitatively, like a chemical agent on all organs, especially on the heart and the kidney centres, which gives the impetus to a more energetic function and better nourishment of all organs. The healthy blood seems to act as an adequate stimulus on the tissues, so to speak." But I lack faith! "We know," Weber writes, "that the blood of animals, injected into humans, is indeed capable of eliminating the collapse of the nervous system by acting as an important stimulant, but that it is not able to replace physiological forces in the long run. Rather, the transplanted foreign blood breaks down in the body of another animal species and is excreted partly through the intestines and kidneys, partly into the tissues and especially into the serous cavities." Hasse's practical experience probably speaks against this, and Sander still found the blood cells originating from the lamb in the bloodletting blood after two days. Weber accepts the constancy of human blood: "But the blood of the same animal species completely replaces what was lost in all its functions and maintains itself viable as long as one's own."

The fresh breeze that is now blowing in the transfusion question will lead us into the harbor of certain knowledge. However, until we reach solid land, we must work diligently. After all, the whole value of life does not rest in what we have achieved, but in what we aspire to. From a practical point of view, however, the whole question will be further aided by precise statistics. If Hasse's assertion is correct, and is furnished by statistical evidence, that the lamb blood transfusion is more powerful in its effects and more lasting in its successes than the indirect transfusion of defibrinated venous human blood, that alone would be the advantage which would eventually pave the way. Obviously, I consider these words to be only an expression of enthusiasm. Only by statistical means will the accusation be made: that the transfusion is overestimated in its healing effects and that the cure would have taken place even without it (Uhde). I conclude with the wish that the hopes with which we drive fresh blood into the veins of our sick fellow human beings may be realized more and more, so that we may succeed, if not in rejuvenating their lives, at least in prolonging them.