CAPILLAR-BLUT UNDEFIBRINIRTES ZUR TRANSFUSION

By: Dr. FRANZ GESELLIUS

A TRANSLATION OF PAGES 26-47 BY PHIL LEAROYD

'MY TRANSFUSION DEVICE, BOTH FOR SIMPLE NUTRITIONAL AND FOR DEPLETORY PURPOSES'

Franz Gesellius's 48 page booklet 'Capillar-Blut undefibrinirtes zur Transfusion: ein neuer apparat zur transfusion, sowohl zur einfachen, als auch zur depletorischen ['Capillary blood un-defibrinated for transfusion: a new apparatus for transfusion, both simple and depletory'] was published in 1868 in St Petersburg by Buchandlung A. Münx. A copy of this booklet can be read or downloaded from the following sites:

https://wellcomelibrary.org/item/b21054216#?c=0&m=0&s=0&cv=0&z=-1.3677%2C-0.0951%2C3.7355%2C1.9027

https://books.google.co.uk/books?id=rr1bAAAAcAAJ&pg=PP1&source=gbs_selected_pages&cad=1#v=onepage&q&f=false

The fourth section of this book (pages 26-47) is titled 'Mein apparat zur transfusion sowohl zur einfachen – ernährenden als auch zur depletorischen, i.e. 'My transfusion device for both simple nutritional and depletory purposes' in which, as the title identifies, the author describes and illustrates his apparatus designed for the collection of donor capillary blood for transfusion purposes.

The apparatus essentially comprises a 'cupping head' designed to be applied to the blood donor's back or thigh, which via a pump creates a negative pressure that holds the device onto the donor's skin, which is then punctured with 19 spring loaded 'sharp knives'. The cupping device, and the connected syringe infusion device, are both covered with water jackets designed to keep the capillary blood warm and therefore according to the author keep it fluid. His description includes a stylet cannula designed to apparently allow a depletory transfusion to be performed from the same patient's vein.

I have produced a translation of this booklet from the original German into English to enable its content to be appreciated by a wider audience. Whilst I am aware that instantaneous computer generated translation is available, this process 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.

I have reproduced the original paragraph settings and general layout as accurately as possible; however, the original text contains print in variable font sizes and a variety of words / phrases in bold font and/or italics – mainly names of people and publications – but this is used inconsistently throughout the document. As a result, I have not reproduced this in the

translation below, but the author's use of quotation marks has been included. The spelling of the names of people and places has been reproduced as originally printed. The references within the original text are identified by asterisks and placed at the bottom of the relevant pages where they occur, I have sequentially renumbered these and placed them at the end of the translation.

Title page: 'Capillar-Blut undefibrinirtes zur Transfusion' by F. Gesellius (1868)
(Image credit: Wellcome Library)

Dr FRANZ GESELLIUS – BIOGRAPHICAL INFORMATION

The son of a Neubrandenburg doctor, Franz Gesellius was born on the 8th September 1840 in Malchin, Germany. After studying medicine in Greifswald, Berlin and Breslau, he joined the Greifswald Corps in 1861 and the Berlin Corps in 1862. Following his time in the army he obtained his doctorate in Rostock. Initially living in Helsinki he went to Helsingfors and eventually settled in St Petersburg. He was instrumental, together with Oscar Hasse, for reviving experimentation and research during the 1870's on the transfusion of animal blood into humans. However, when he reviewed his own and other animal-to-human transfusions for which he could find records, this showed that 56 percent of patients died shortly after the transfusion and that many other patients were not helped by the procedure. He subsequently founded the St Petersburg Herald in 1875, of which he remained editor-in-chief until his death from meningitis on the 24th March 1900 in St Petersburg.

IV. MY TRANSFUSION DEVICE, BOTH FOR SIMPLE NUTRITIONAL AND FOR DEPLETORY PURPOSES.

As Martin (1) states, all kinds of devices for transfusion had already been specified before, but all of them fell out of use because they were impractical; unfortunately it was impossible for me to even obtain the description of these older instruments. All the newer ones use a syringe, mostly made of glass, here and there with small devices e.g. that of Mosler, which conveniently has a scale marked with cubic centimetres, so that one can give an exact account of the blood mass that has already been injected at every minute, along with a plunger that can be pulled and screwed; Eulenburg and Landois constructed an "air catcher" for the glass syringe, which C. Uterhart in Rostock created using a peculiarly practical and simple device formed from the glass syringe itself (2).

Martin (L. c. page 89) describes the execution of the transfusion as follows:

"Once the necessity of the operation has been determined, first of all choose a strong, healthy man who is willing to do it, or if this is lacking, a strong, determined woman who is not frightened or depressed, from whom you want to take the blood, and at the same time you arrange for one or more knowledgeable assistants whose help one cannot do without. You also have to get a basin with 30-32° R warm water, a few cups to collect the blood and fill the glass syringe with pure water that is just as warm. Then, at the same time, the median vein, or if it is too small, the cephalic or basilic vein, is exposed by means of a 1-$1^1/_2$ inch long skin incision, and the flat trocar is inserted into the vein, which can also be raised slightly with two threads inserted underneath, to a depth of $^1/_2$ inch in the direction of the heart, while at the same time an assistant carries out the bloodletting on the arm of the subject from which the blood is to be borrowed. As the blood flows into the cup, which has also been rinsed out with warm water, the syringe is emptied of the warm water it contains and the fresh blood is quickly sucked up from the cup - (the supporters of arterialized blood first defibrinate the venous blood) – whereby the liquid consistency of the blood, not foamy, can easily be controlled in the glass. Without hesitation, place the tip of the filled syringe into the funnel-shaped opening of the trocar tube which is covered with rubber, standing in the vein and fixed there by a reliable assistant, after removing the grain from it, slowly push the plunger downwards. After removing the syringe, it is immediately cleaned with warm water, unless it is considered advisable to fill it again with the freshly flowing blood and to repeat the injection immediately.

By examining the pulse and heart, as well as by observing facial features in general, one can be convinced of success. If this is not the desired one, repeat the entire procedure after making sure that there are no clots in the syringe or tube.

Since it is not always easy to find the median vein which has collapsed in a person bleeding to death, it may sometimes be necessary to look for it in the other arm as well, just as it has occasionally happened without any disadvantage that the transfusion was carried out first in one arm and then in the other.

When the necessary quantity of blood has been transferred, the cannula of the trocar is removed from the vein and the wound is bandaged in the same way as after an ordinary bloodletting. It goes without saying that the greatest attention should be paid to this small wound in the following days, and at the first signs of inflammation, cold compresses made with lead water or with snow, ice, etc. should be applied, but in general the person being operated on should be carefully observed."

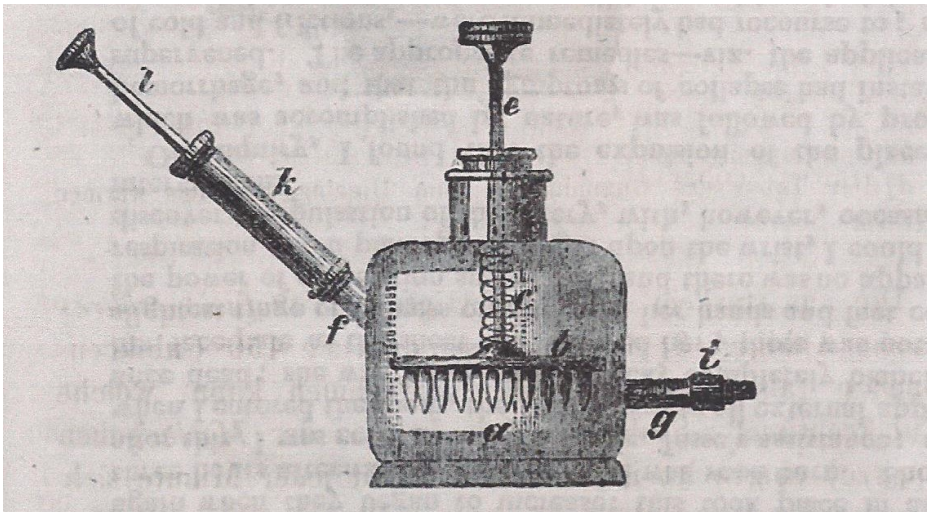
When it comes to the timing of the transfusion, Martin expressly warns against "too late."

The instrument that I constructed consists of 1) a cupping head for obtaining capillary blood, and 2) a "transfusion tube" that can be screwed on and off the cupping head.

The cupping head (see illustrations 1a and 1b) is constructed as follows:

It is made of strong glass, located at the top, under a brass knob and fastened with a spring, is the very wide and round cupping sniper, whose five rows of knives, nineteen in number, have an opposite position. (See Figure 1c)

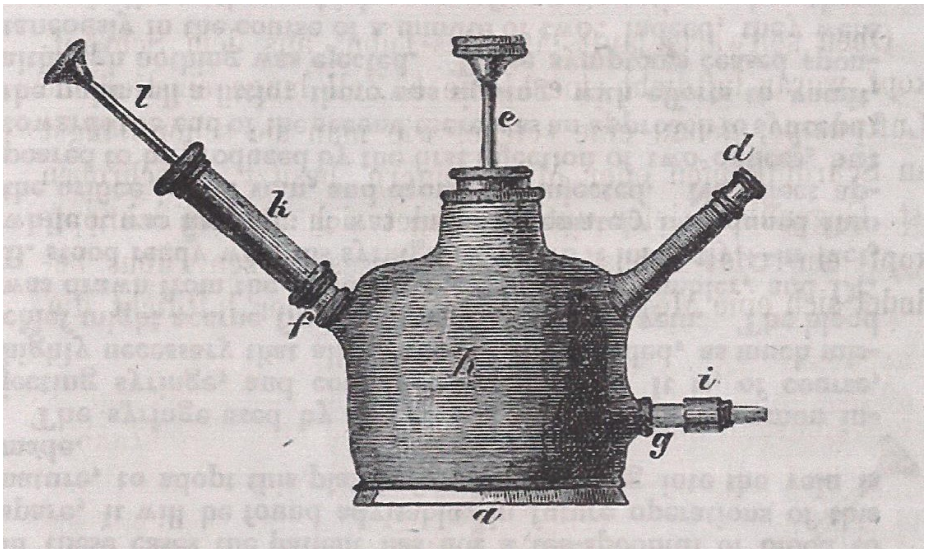
Figure 1a



a) The strong glass cupping head.
b) The cupping head with the 19 knives.
c) The spiral spring.
d) The brass casing.
e) The rod with the knob, which is hit with the palm of your hand to send the cupping sniper flying into the flesh.
f) The glass tube with the air pump *k*. *l*.
g) The second glass tube, onto which the transfusion tube is screwed at *i.*

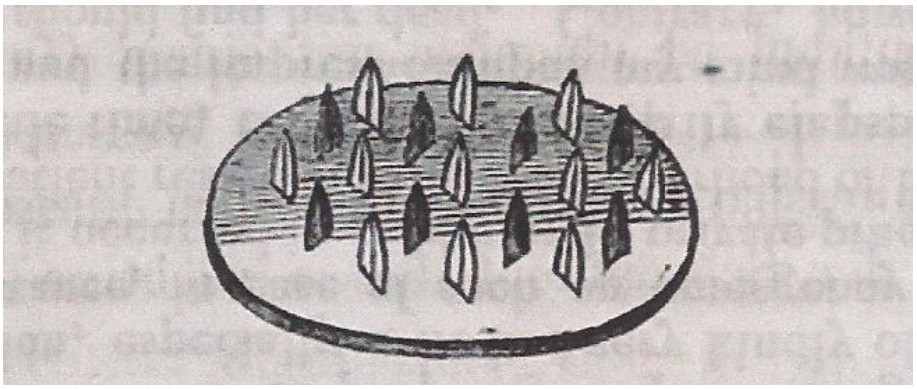
A glass tube runs out of the top sideways from the cupping head, to which is a small airtight 5-inch-long single-hole air pump, exactly the kind that has long been used on cupping heads or milk teats. Opposite, lower down, there is a glass tube on the cupping head, at the end of this short tube there is a brass screw to which the “transfusion tube” must be screwed onto in an airtight manner. The entire cupping head is surrounded by a rubber jacket, which serves to be able to pour warm water (up to 34° R) into the closable opening of the cupping head so that it receives the all-important heat.

Figure 1b



h) The rubber jacket
d) The tube of the rubber jacket for pouring in the warm water.

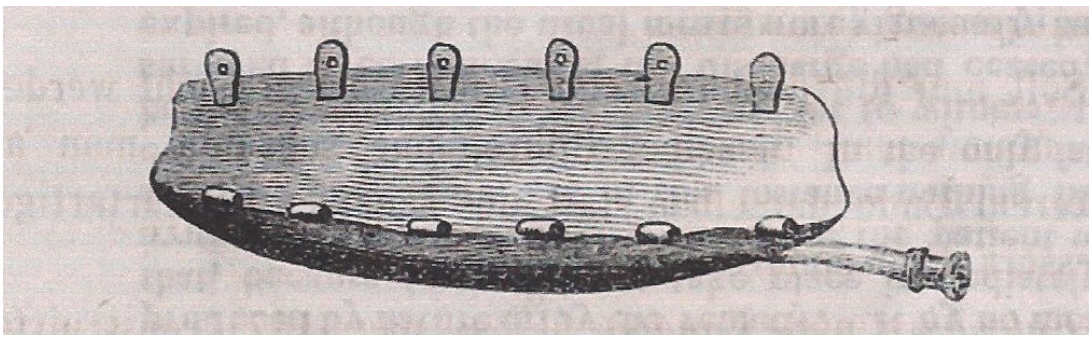
Figure 1c



The position of the knives of the cupping head.

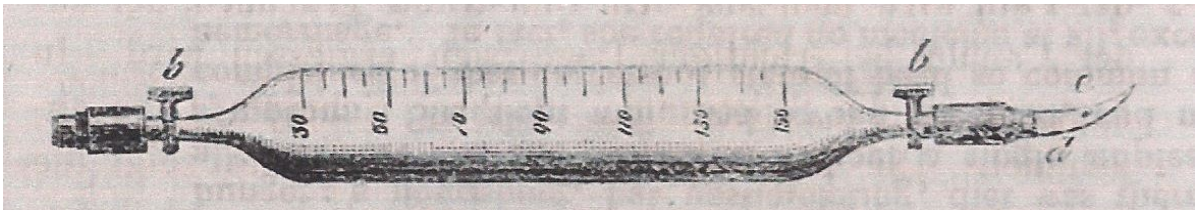
The “transfusion tube” (see Figure 3), made of strong glass, is so large that it can hold 150 cubic centimetres (i.e. 5 ounces) of blood, which is engraved with a cubic centimetre scale in the glass (like on Mosler's syringe), so that one can give an exact account of the mass of blood injected with this tube at any minute. There are airtight ground glass taps at the two syringe-like ends of this tube. The tube is enclosed in an elongated tube-like rubber jacket that can be easily buttoned around the tube in such a way that only the graduated scale of the transfusion tube remains uncovered. Warm water up to 34° R is also poured into the easily closable opening of this jacket in order to be able to communicate the necessary and important temperature to the transfusion tube in order to prevent the blood from clotting. (See Figure 2)

Figure 2



The rubber hose for the transfusion tube with the rubber bands that can be buttoned together.

Figure 3



The strong glass transfusion tube with removable infusion trocar for the nutritional transfusion (*d*, *e*), the glass stopcocks *bb* and the engraved cubic centimetre scale.

At one end of the tube, which is closed with a tap, there is also a brass screw that fits exactly on the lower tube of the cupping head for airtight attachment to it. At the other end of the transfusion tube, which is closed with an airtight tap, there is a screw-on, hollow, somewhat curved narrow small, sharp infusion trocar, which, after filling this tube with blood and after the rubber jacket has been emptied of its obtrusive warm water contents, is slowly pushed from top to bottom into a bulging larger arm vein in a subcutaneous manner.

By opening the taps, depending on the weight of the blood and the air pressure the contents of the transfusion tube will slowly and steadily flow into the vein under precise control.

This would be the transfusion tube for simple or nutritional transfusion.

If the depletory transfusion is to be carried out, the same tube is used, but instead of the sharp trocar-like knife, a different device is screwed onto the lower end.

Eulenburg and Landois (L. c. page 147) constructed a stiletto cannula for subcutaneous application of the transfusion, which is shown in Figure 3, is the same cannula (according to Moncoq's information (L'Union 1863), modified by them) that ends at the front in an un-pierced trocar tip. The canal of the cannula tube opens laterally approximately in the middle of it. The execution now takes place in such a way that the stylet is pushed transversely through the swollen vein, so that the lateral opening lies in the middle of the venous tube and is directed centrally. Whether the latter is really the case can be seen from the jet of blood that will pour out of the cannula when it is in the correct position. In Figure 4 the stylet cannula is shown in its correct position. The mark *a* (Figure 4) on the edge shows the side on which the lateral opening on the tube is located; the corresponding marks *bb*, *cc*, *dd*, which are placed at equal distances from the latter opening, can provide information about the position of the opening when the stylet cannula is inserted .

Figure 4

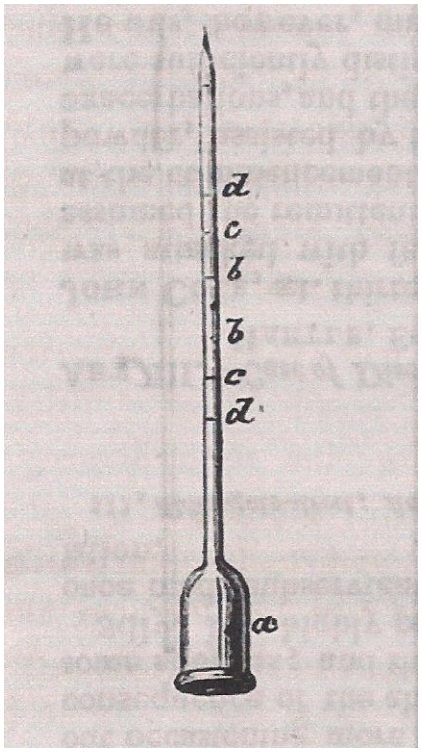


Figure 5

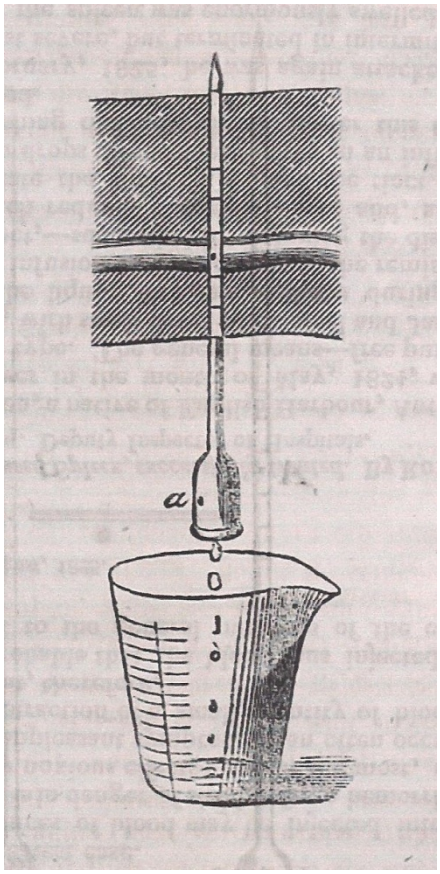
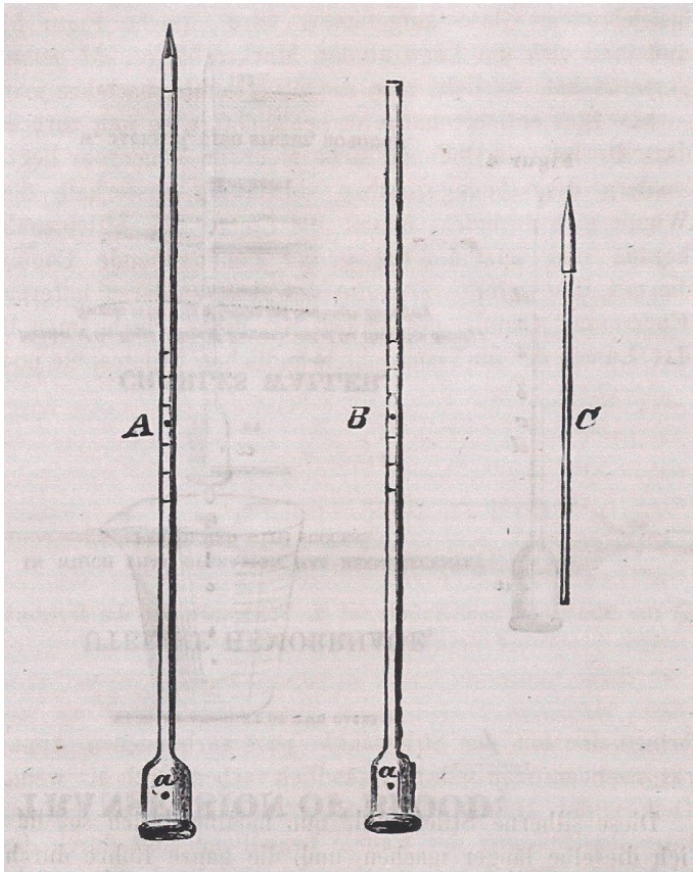


Figure 6

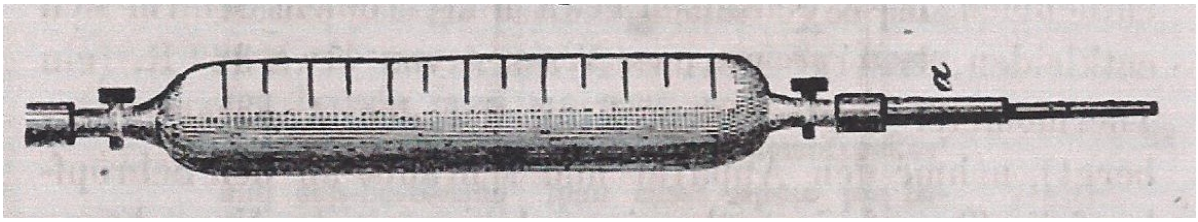


The stylet cannula with a removable tip I modified for depletory transfusion.

I then modified this silver stylet cannula in such a way that I had it made longer and had the entire tube drilled through. The tip was provided with a long, ground-in solid tube, which was exactly long enough to reach straight up to the lateral opening without covering it. The following drawing will make what has been said clear. In Figure 6A, the stylet cannula is shown individually - taken apart - in its composition in Figure 6B.

After the stylet cannula has been pushed subcutaneously from bottom to top through the vein with the lateral opening towards the heart in the manner just described and, as a sign that it is in the correct position, the venous blood flows, in order to know exactly the amount of phlebotomy blood that has been drained, is collected in a glass marked with cubic centimetres (see Figure 5) and the position is noted exactly at the marks *bb*, *cc*, *dd*, then the stylet cannula is pulled back after you have drained as much blood as intended, so that the lateral opening is no longer in the venous tube, but is visible to the eye completely outside the wound, the tip of the stylet cannula is removed and the blood-filled transfusion tube is placed on the cannula resting in the vein, with a cannula attached at the lower end; this is pushed into the lumen of the stylet cannula located in the venous tube and the apparatus is now connected to the stylet cannula, after having first opened the taps a little to expel the air from the lower tap to the lateral opening of the cannula by the sinking of the blood, then, as soon as the apparatus is in the correct position, since the marks indicate exactly the same position as the stylet cannula was in during bloodletting, open the two taps completely, close the lower open opening of the stylet cannula with your finger and slowly and steadily the capillary blood is constantly driven into the vein by the law of gravity.

Figure 7



a) The mouthpiece for attachment to the stylet cannula for the depletory transfusion.

From the above it follows that one is able to transfuse blood into the same opening of the vein from which the blood was just taken:

This apparatus would therefore be the one for depletory transfusion.

The execution of the “nutritive” and “depletory” transfusion follows from the foregoing; nevertheless, I will describe the execution of the operation as follows:

Once the indication for a transfusion has been established, first choose a strong, healthy man, explain to him that you intend to take blood for transfusion from him using an almost painless cup from his back or thigh, and then leave him to undress behind a screen, get warm water of about 34° R (a thermometer is in the case that houses the apparatus), take the apparatus and screw the transfusion tube onto the cupping head, depending on the device for nourishing or depletory transfusion. First of all, let us assume that a “nutritional” transfusion is to take place. Before screwing it onto the cupping head, put the tube-like rubber jacket around this tube, after first filling it with warm water at 34° R, then fill the rubber bag that encloses the cupping head with the same water, screw the tube into the cupping head as follows already mentioned, now open the tap of the tube, which is next to the cupping head, make sure that the end tap of the tube next to the trocar knife is tight and closes well, now place the cupping head on the back of the healthy man so that the tube hangs perpendicularly downwards, make pumping movements with the small air pump for about a minute, during which you press the cupping head against the back with your left hand so firmly that the opening of the cupping head is completely covered with flesh. After these pumping movements, the individual giving the blood will say something like, “Doctor the cupping head is pulling so hard!” then it's time (you can already feel it when pumping, when the air is expelled and the flesh swells into the cupping head), after a few more pumping movements have been made, by a strong blow with the flat of your hand on the button at the tip of the cupping head, the knives, which are immediately retracted by the spring, rush energetically into the flesh, immediately the capillary blood squirts in abundance and immediately runs into the perpendicularly hanging downwards transfusion tube, which is bathed in warm water. In no time at all, the tube is filled with blood.

Removing the cupping head, unscrewing the tube and closing the upper open tap is the work of a moment, as is the draining of the cumbersome warm water from the tube-like shell that encloses the tube, since in the few seconds in which the blood still has to remain in the tube, cooling in no longer to be feared; the arm (usually the left one), in whose largest vein, (median, cephalic, or basilic vein) which has previously been made to swell by all kinds of manipulations (e.g. by a field tourniquet in the case of my instrument), the transfusion is to be made, is held up by the surgeon, who is standing in front of the patient lying on the bed, by placing his arm either on his left or right shoulder or by having someone hold it up, depending on what is most comfortable for the surgeon and now, open both taps a little, so that a large drop of blood appears at the front of the opening of the trocar knife - which is very important, otherwise you would bring air into the vein and, as is well known, cause instant death, - you slowly lower the sharp and heavy instrument into the vein, now remove the bandage that was put on to bulge the vein and then completely open both taps of the tube and slowly and steadily the capillary blood flows into the vein due to the physical law of gravity. The operation can now be interrupted at any second without removing the instrument out of the vein by just turning the lower or upper tap to be closed, and you also

know at any given second how much blood has been injected on the engraved scale on the tube.

However, it could now happen that the median, cephalic or basilic vein cannot be found from the outside. In this case there is a lancet in the case, as well as a needle and threads; therefore, make a 1-1$^1/_2$ inch long incision in the skin, as Martin (L. c.) suggests, look for the vein, lift it up a little with a pair of threads inserted under it and proceed as above.

In any case, the whole thing is an incredibly simple, easy-to-implement, completely safe operation; just don't forget the warning printed above. [Note: this warning is regarding air ingress into the patient's vein, which is printed in bold in the original text - PL].

The procedure of depletory transfusion is as easy and simple as the operation just described.

While someone is taking the capillary blood from the "healthy" person, the surgeon pushes the stylet cannula, modified by me previously shown and described, from bottom to top through the arm vein of the sick individual, which has been made to bulge as stated above, so that the lateral opening lies in the middle of the venous tube, centrally towards the heart. Whether the latter is really the case will be seen from the stream of blood that will pour out of the cannula, the mark corresponding to the lower opening (see Figure 4, mark *a*) provides precise information about the position of the lateral opening, one now remembers exactly the position between which marks (e.g. between *bb* or *cc* or *dd*) the stylet cannula lies in the vein. The phlebotomy blood is allowed to pour out into the glass marked with cubic centimetres, which is also in the case, in order to know exactly how large a quantity has been drained. Once sufficient blood has been withdrawn, the cannula is pulled out so far that the lateral opening of the stylet cannula is no longer in the venous tube, but completely outside the wound and accessible to the eye, immediately of course the blood will stop flowing, pull the tip of the stylet cannula out, now remove the transfusion apparatus from the healthy person, unscrew the transfusion tube with the device - (mouthpiece) - from the cupping head, let the warm water out of the tube-like rubber jacket surrounding the transfusion tube and simply inserts this tube (the mouthpiece) onto the stylet cannula located in the venous tube. Before the apparatus is returned to the exact position that the stylet cannula was in during the bloodletting, you open both taps a little so that a large drop of blood can appear at the lateral opening of the stylet cannula, otherwise air would be brought into the vein, which would cause instant death. Once this important thing has happened, slowly lift the attached device higher, close the lower opening of the stylet cannula with a finger of your left hand and make sure that the instrument is brought into exactly the same position as when the stylet cannula was in the vein when the blood was being drained; once the same position has been obtained, both taps are opened completely and slowly and steadily, by the law of gravity, the capillary blood is driven into the vein and the depletory transfusion is done. Then push the stylet cannula deeper again so that the lateral opening is outside the venous tube, remove the apparatus and the stylet cannula and bandage the wound as after a normal bloodletting.

Of course, the capillary blood transfusion may be repeated either on the same arm or on the other arm.

During the operation, the face, pulse, and heartbeat of the transfused individual are observed; for this purpose a competent assistant is needed; in the worst case, where one cannot be obtained immediately but the transfusion is urgent, you can also arrange this on your own. It goes without saying that the greatest attention must be paid to the small wound, which is immediately bandaged as after an ordinary bloodletting; it is also obvious that after the slightest sign of inflammation it should be covered with lead water, ice or snow.

The capillary wounds of the healthy individual from whom the blood was taken are covered with an oiled piece of linen that is secured with strips of adhesive plaster.

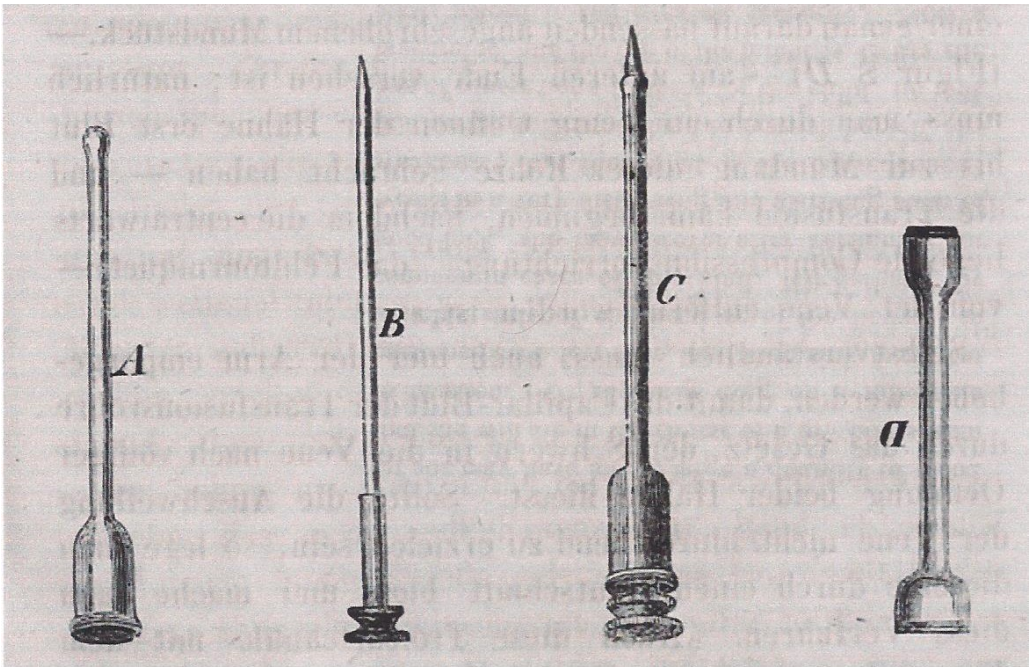
Since the tube only holds up to 5 ounces of blood, one could argue that this would be too little; however, since according to Martin's table (L. c. page 46) in half of the successful cases, no more than 4 ounces of blood were infused and transfusing more would hardly be advisable because of the fear of overfilling the right heart, I believe that the contents of my transfusion tube are large enough for the purpose.

After each transfusion, the apparatus is cleaned with warm water with the greatest care, especially the strong tubes and the taps. If any tap should break while cleaning, replace it with a silver tap that closes exactly.

I like to believe that small improvements can be made here and there to this really simple instrument. I look forward to such communications with pleasure.

Thus, the cannula for subcutaneous transfusion mentioned by Eulenburg and Landois (L. c. page 146) could very well be used, they say as follows:

Figure 8



D. The mouthpiece for cannula *A* to be screwed onto the transfusion tube.

"For this purpose (for subcutaneous transfusion) a cannula (Figure 8A) with a rounded button at the end is used, into which a thin trocar can be inserted, which is shown isolated in Figure 8B and inserted into the cannula in Figure 8C. The latter is introduced in the following way. First, the median basilic vein is made to swell and the trocar cannula is inserted obliquely lengthways into the bulging vessel (towards the heart). Once the stylet has penetrated deep enough, it is pulled out of the tube. If the opening of the cannula is in the venous tube, a jet of blood will follow the out-flowing stylet, which at the same time fills the cannula with blood and expels the air from it. The cannula can now be pushed forward a little further as needed, without fear of injury to the vein wall. If the cannula is in a good position and you have once again made sure that there is no more air in it, you attach the well-filled syringe (in this case the transfusion tube filled with capillary blood, which has a mouthpiece screwed onto it that fits exactly) - (Figure 8D) - at the lower end; of course, blood must first be brought to the mouth of this tube by opening the taps a little - and the transfusion can begin after the centrally located compression device - (the field tourniquet) – has been removed from the vein."

Of course, the arm must also be raised here so that the capillary blood of the transfusion tube flows into the vein through the law of gravity after both taps have been completely opened. If the swelling of the vein cannot be achieved sufficiently, it should be exposed through an incision in the skin and then this procedure should be carried out. (I have also included this trocar cannula with the mouthpiece that has to be screwed onto the transfusion tube into the case.)

May this device of mine finally settle not only the question of the most expedient and safest method of transfusion, but also the question of whether non-defibrinated or defibrinated blood should be taken.

It is obvious that once the public has been informed about transfusion, they will demand from every doctor that he perform the operation, even more so when they learn that the puncture into the vein can be made painless can, which is very easy to obtain, take the “Emotionally Paralyzing Douche Apparatus from Dr. Richardson” (available in excellent quality from Albert Krage in Nuremberg for 12 guilders). As is well known, this apparatus is intended to produce local insensibility during surgical operations and consists of an ether bottle and the necessary atomizing apparatus, which is equipped with ball-shaped bellows. The narcotic beam directed onto the bulb of a thermometer causes the mercury column to fall to 6° below 0 in 30 seconds and a snow crust forms on the globe. If water is held in a $^1/_4$" wide test tube into the jet, it must be frozen in 2 minutes. If the jet is directed onto the back of the hand, the skin becomes insensitive to the pinching and will turn white within a minute at the latest.

During incision operations and after the first cut of the skin, after it has been rendered insensitive, the injection can be administered directly into the wound, thereby producing greater insensibility. The beam must be continued for as long as the operation lasts.

From this it follows that if you direct the jet to the point of the median, cephalic or basilic vein where you intend to make the puncture with my transfusion apparatus, this puncture can be made painless, and there is also the advantage that the vein that has already been bulging with the field tourniquet becomes even plumper due to the cold, which in any case makes the operation even easier and more pleasant.

I will have these devices working here under my special supervision as soon as orders arrive at Münx'sche Verlagsbuchhandlung, Newski Prospect, Haus Maderni, St. Petersburg.

An elegant case with a lock would then contain the following items:

1) The cupping head with an air pump attached to it.
2) The transfusion tube with removable infusion trocar.
3) The silver stylet cannula for depletory transfusion.
4) The silver mouthpiece, which must be screwed onto the transfusion tube.
5) The last mentioned silver trocar cannula, along with a precisely fitting silver mouthpiece for possible attachment to the transfusion tube.
6) The tubular rubber bag for the warm water to cover the transfusion tube.
7) A lancet for possible skin incision.
8) Two needles and a roll of strong silk.
9) A glass etched with cubic centimetres for bloodletting.
10) A thermometer.
11) A field tourniquet.
12) A small glass funnel for pouring the warm water into the coats.
13) This brochure.

On the lid of the case would be printed, respect. "Transfusion apparatus according to Dr. med. Franz Gesellius. (St. Petersburg.)"

Although the advantages of my apparatus are already apparent from this brochure, I would like to summarize them in the following order:

1) The not entirely harmless bloodletting of a healthy person, which is always difficult to obtain and may always be permitted with reluctance, has become superfluous in order to obtain blood for transfusion.

2) The reprehensible defibrination is eliminated.

3) The more oxygen-rich capillary blood is used, which is more suitable for transfusion because it has a more invigorating effect than venous blood, and is even more suitable than pure arterial blood because it is mixed blood and as such also contains venous blood, of which we know that its fibrous material can be dissolved in the protein, which is important for nutritional transfusions.

4) This capillary blood is easy and always obtainable and may be given willingly.

5) Obtaining blood for transfusion is extremely rapid, faster than any other procedure for this purpose.

6) Transfusion as an operation has become completely safe for the person being transfused through the apparatus, because the blood cannot coagulate due to the heat of the apparatus and because the danger of air entering the vein is prevented by the exclusion of atmospheric air.

7) The operation with this apparatus is infinitely simple and is therefore quicker than any other transfusion procedure.

8) At every second during the operation you are able to take stock of the blood mass that has already been injected.

9) The blood is not driven quickly into the vein by force, but slowly and steadily by the law of gravity, as a result of which there is no fear of fainting, overfilling of the right heart, etc.

10) You can easily interrupt the transfusion at any second without having to pull the apparatus out of the vein.

11) The depletory transfusion, i.e. bloodletting followed by transfusion takes place from one and the same vein opening, so a double wound is not necessary.

12) The apparatus is easy to keep clean

13) The transfusion can be carried out conveniently in three ways with this apparatus.

14) The operation can be made painless for the person being operated on by Richardson's emotionally paralyzing douche apparatus, thus eliminating the horror for the audience.

15) Due to the simplification of transfusion brought about by this apparatus, it will perhaps become common property of all scientific physicians, and the therapy will therefore probably be greatly enriched.

1. E. Martin. Ueber die Transfusion bei Blutungen Neuentbundener. [On transfusion in bleeding patients after childbirth] Berlin. 1859 (Hirschwald).
2. Berliner klinische Wochenschrift, Jahrgang 1868, page 112.