

**MEDICINISCH-CHIRURGISCHE AUFSÄTZE  
HISTORISCH-PRACTISCHEN INHALTS**

**BY: JOHANN ALEXANDER HEMMAN (1778)**

**A TRANSLATION OF PAGES 122-216 OF THIS BOOK:  
'HISTORY OF INFUSION AND ATTEMPTS TO DEMONSTRATE  
THE SAFE USE OF THIS OPERATION'  
BY PHIL LEAROYD**

The book 'Medicinisch-chirurgische aufsatze historisch-practischen inhalts' (i.e. Medicine-surgical apparatus historical-practical content) published in 1778 in Berlin [by Christian Ludwig Stahlbaum] can be viewed or downloaded from the following site:

[https://books.google.co.uk/books/about/Medicinisch\\_chirurgische\\_Aufs%C3%A4tze\\_histo.html?id=ryRgAAAaAAJ&redir\\_esc=y](https://books.google.co.uk/books/about/Medicinisch_chirurgische_Aufs%C3%A4tze_histo.html?id=ryRgAAAaAAJ&redir_esc=y)

This 227 page book, as the title suggests, includes a variety of different topics areas, identified in the content list (see below). Chapter V (pages 122-216 inclusive) of the book is titled 'History of infusion and attempts to demonstrate the safe use of this operation'. Although identified as 'infusion', this chapter contains a large amount of historical information on early blood transfusions.

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The chapter on infusion-transfusion in this essentially 'non-transfusion' book is identified as a reference in Franz Gesellius' book 'Die Transfusion des Blutes, eine historische, kritisch und physiologische Studie', published in 1873, in which Gesellius also presents a somewhat critical comment as follows:

**J. A. Hemman**, *Medicinisch chirurgische Aufsätze*. Berlin 1778, 2. Auflage 1791. Hemman, Royal Prussian Pensionair-surgeon, a young scholar who died prematurely, is very taken with transfusion. He gives a history of transfusion almost entirely according to Haller, and therefore somewhat inaccurate; asserts that this operation is wrongly referred to in library books as a medical antiquity, it deserves to

be used again, but one does not have to place such exaggerated hopes on it, such as rejuvenating life.

I have translated Chapter V of this book from the original German into English in the hope that the content may be appreciated by a wider audience. Whilst I am obviously aware that instantaneous computer-generated translation is possible, this process struggles with specialist terminology and also produces a 'colloquial style' not always representative of the original text. In addition, automatic reading-translation of this book is complicated by the fact that it is printed in a variation of Old German Script that makes interpretation of the original text more difficult and therefore automatic translation accuracy less reliable, i.e.



Example of German Script similar to the print type used in this book  
(Image credit: fiverr.com)

I have tried to produce a translation that is as 'un-interpreted' as possible, in that I wanted to maintain the author's original meaning / wording as much as possible, though the Old German script type, occasional poor print reproduction, the author's writing style and some of the terminology used, makes an accurate translation difficult. As such there are a number of places within the text where the words, terms and names originally used are open to interpretation. Where this is the case, I have added alternative words / explanations in square brackets within the text. I have attempted wherever possible to hopefully maintain the author's meaning, intent and detail and avoid (purposely or inadvertently) altering the text to 'make it read better', because in doing so there has to be an element of personal interpretation involving something on the lines of 'I believe that this is what the author is actually trying to say'. I wanted 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.

I cannot guarantee, especially given the above comments, that this work does not contain 'translational errors' and the reader is recommended to check specific details against the original German text. I have maintained the original paragraph settings. The references to the text within the book are included at the bottom of each page; I have listed these together and placed them at the end of the translation; whilst the references are reproduced as written, I have translated some have author's accompanying comments.

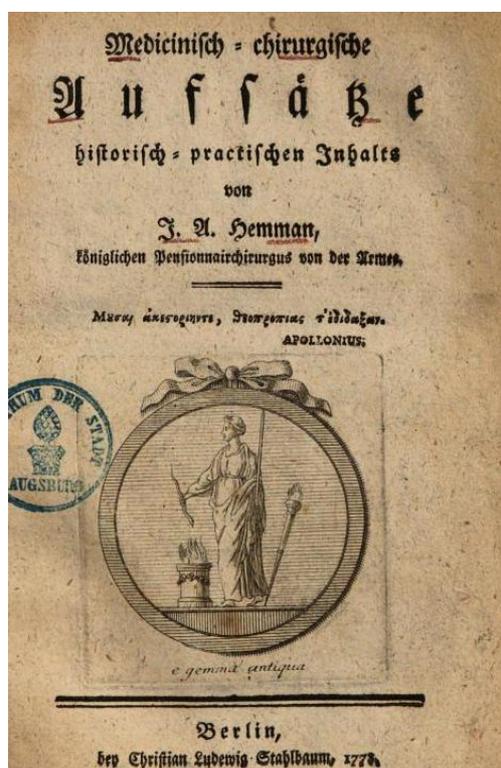
Hemman identifies in his dedication at the beginning of the book that he has 'gathered together several experiences on one and the same subject' that 'either explained or confirmed the reported case'. As the title and content of chapter 5 identifies, his experience is in infusion and not transfusion, even though he includes this subject as well and as such the author moves variably between information on transfusion and infusion. The initial information presented, which is on transfusion, is

not as an historical timeline but as a commentary on the history of transfusion events highlighted by the author. A main section of this is to essentially examine the reasons why it fell into disrepute, blaming the attitudes of both supporters and detractors. He critically comments for example on factors such as operator carelessness, that too much blood was occasionally transfused too fast, that the wrong type of patient was frequently selected (i.e. ones who in hindsight could never have been saved / cured by transfusion) and the detrimental effects of the coagulation of blood during transfusion, together with the erroneous claims and arguments put forward over the ability of blood transfusion to change character, abilities, youthfulness, etc.

Given the date of publication, the author includes a reasonably balanced discussion of the use and misuse of transfusion, commenting that theories of its use were put forward that were not based on experimental data, arguing that in the light of the history he presents, transfusion needs to be re-examined and evaluated without prejudice – he admits that any surgeon of his time who even suggests using a transfusion to treat a patient would incur 'the reputation of extreme boldness'.

Within the text, Hemman mentions and comment on the work performed by Libavius in 1615 – he considers any 'descriptions' of transfusion prior to this date to be allegorical – as well as that of Major, Elsholt, Lower, Coxe and Denis, together with accompanying arguments for and against the use of transfusion.

I have also translated the sections that deal with infusion within this chapter, as it was difficult to easily distinguish these from the sections on transfusion and present it in a coherent way. These include a somewhat rambling explanation as to why Hemman believes infusion to be important, which is mainly based on the deleterious effects of the digestion on the effectiveness of some drugs that are taken orally and therefore drugs given by infusion are more effective. Towards the end of the chapter he also discusses the treatment of various conditions by the infusion of a variety of different medicines, including a lengthy description of some of his own infusion experiments and treatments.



Title page of *Medicinisch-Chirurgische aufsätze* (1778)  
(Image credit: googlebooks.com)

## CHAPTER V

### HISTORY OF INFUSION AND ATTEMPTS TO DEMONSTRATE THE SAFE USE OF THIS OPERATION

Among the many other excellent inventions of our ancestors, this operation, whose further exploration would certainly have promised the most fruitful results, experienced the undeserved fate of being forgotten and superseded by other inventions which, apart from their novelty, do not deserve the slightest preference. This operation once again proves that neither the intrinsic excellence of an invention, nor the amount of evidence for its easy, sensible and incidental application, does anything to gain its general approval, but that it depends for the most part on a multitude of other competing circumstances based on nothing less than the goodness of the thing itself.

Who would have believed at that time when this operation was appointed, that an invention that was advertised with the greatest enthusiasm, which was copied all over Europe, which gave the opportunity for the most fruitful discoveries in physiology and pathology, which so often worked in a wonderful way in the most desperate diseases; which, if employed with a little caution, would never do any harm, and which would still offer help where it seemed that art had come to grief, who would have thought back then that after a few years this wonderful invention would fall into complete obscurity again? And yet it happened. It is seen in the book cases as a medical antiquity, along with the writings of its inventors, improvers, and defenders and no physician in our times would dare to use this operation, even if it were the only means of saving the patient's life, without incurring the reputation of extreme boldness.

These reflections made me think to tell the history of this operation again, especially since I myself had seen some of the happy effects of the same eyewitnesses without even imagining that I would ask the scholars many new things. Perhaps it is not entirely irrelevant to investigate the reasons why this operation, in spite of its many happy successes, so soon fell into bad repute and was forgotten. At the same time I shall examine the objections that have been made again; likewise the reasons from which one inferred the harmfulness of the same, and if I could add something to the fact that this excellent invention of our ancestors would be examined by some good doctors, supported by new ones, and pulled out of the darkness again, then I would have achieved my whole end purpose.

Even in the most ancient times it is believed that traces of transfusion can be found. The fable where the famous sorceress Medea (1) cuts the old Aeson's throat open with the sword, drains the old blood, and instead pours new juices through which the gray-headed, weak, dull, decayed, pale and wrinkled old man regains black hair, new flesh, cheerfulness, smooth face, and a new youthful life, as an allegorical idea of the transfusion of blood. That the ancients just wanted this cover to present the thought of this operation cannot be proved, but it is more than likely that this fable may have given them the opportunity for its invention, since, as I shall show in a moment, it emerged from the bosom of the chemical school, which all ancient mythology in general used to apply to objects of their art.

What Marsilius Ficinus (2) says about the nourishment of human blood, to disturb the life spirits (*calor innatus*) weakened by age, and to revitalize old people with new forces, should not be applied to the transfusion without compulsion, but is explained more by sucking the blood through the mouth. I therefore want to put the current passage below in context.

From a dark passage by Magnus Pegelius, (3) in which it is said that one could bring means from outside through a special and unusual surgical art to the human body, which could change and improve many internal defects, cannot be inferred with

certainty to be about transfusion, because this passage can also be understood just as well by enemas as by that operation.

So it remains to be agreed that before 1615 a clear, convincing and undoubted description of this operation was made by the only author. Andreas Libavius (4) mentions it for the first time in this year, and indeed in such a convincing way, and with so many facts, that it is clear from them that it must be practiced on a regular basis at this time, and must not be regarded as a mere speculation. But he does not pretend to be the inventor of it, in fact he is not even convinced of its safe application, but merely presents it as the ridiculous advice of a grandiose Paracelsian, of which he makes fun. Take, he lets his Paracelsian say, a young, strong, cheerful, full-blooded youth, and likewise an exhausted, weak, thin, and frail old man. Anyone who wants to practice the art must have two silver tubes that fit one inside the other. He then opens an artery in the healthy person, brings one tube into it and fixes it, then opens an artery for the other, and brings the female tube into it. When this happens, the flexible tubes are joined together; the healthy and spiritual blood will pass from the young person into the old, bring a new source of life into his body, as it were, and pick up and take away all weaknesses and ailments of old age.

The chemical physicians considered blood to be the sweetness and source of all life, in whose radical moisture the calor innatus resides. (5) They made a distinction between the coarse and impure blood, which is in the veins, and the spiritual, which is in the arteries. Helmont taught that in the heart, through a special kind of fermentation, this invigorating spirit was first generated in the blood. (6) He therefore rejects blood-letting under all circumstances as extremely harmful, because this spirit would be carried out at the same time as the blood and the body would thereby be completely weakened, (7) so that afterwards the disease could not be overcome by the invigorating forces. Old age consists only in the extinction of these vital forces (8) and in the lack of the fermentations by which they are produced. This theory, which was drawn from Paracelsus and only developed afterwards, could easily lead his students to the idea of correcting defects of the body with the most natural balm in life, namely with youthful spiritual blood. According to their doctoral teaching, this had to be done especially in diseases where these vital forces died out, e.g. to be in the hectic, the weaknesses of old age, and so on, of the most splendid use. The passage from Libavius given above fully confirms this, and among other things especially the fact that the blood from an artery should be allowed to return to an artery.

From this great opinion, which they had of the nature and properties of the blood, it also followed that they believed that the most potent medicine could be drawn from the blood itself, if one knew how to separate these spiritual forces of the blood through chemical art. A multitude of such preparations is found in the works of Paracelsus, Crollius, Peter Fabers, Helmont, and other physicians of the chemical school. (9) That this operation has now and then been carried out literally by the chemical physicians is certain, although it may not have happened quite often; because Johann Colle (10) in 1728 thinks of it as a common and well-known thing of his time. When Harvey first made the circulation of blood known in that same year, this discovery gave a new cause for the more frequent practice of this operation.

The chemists, guided by the slogans of reason given above, had certainly attempted nothing more than the transfer of blood from the body of a found [healthy] person to a sick person, but now this invention was much further expanded through the discovery of the circulation of the blood. They [transfusions] were no longer regarded as merely a remedy, but were also used partly to confirm the newly discovered circulation of the blood, partly also to attribute the properties of blood, the effect of various remedies on the same, and to explore other physiological, pathological and practical truths.

It has been found that when the blood is passed from one animal into the other, after having fastened a tube in an artery of the one and a vein in the other, as much blood spilled over from the first as it did out the other, drained through another opened vein, so that the first animal would be completely exhausted by the run-off of blood, but the other remained fresh and lively, and by this the circulation was evidently shown. It was found that different injected juices had quite different effects on the economy of the body, and that most of the remedies brought about by this method still perceived the throws [injections] as if they were taken through the mouth.

There was now an argument about the honour of the invention: the English, the Germans, the French and the Italians vindicated it, each as theirs. Lower, Clarke and others claimed it was from the English; that Johann Babtista [Jean-Baptiste] Denis (11) had the honour of inventing, which Lower complained about, (12) that someone else wanted to rob him of his discovery. Sturm, (13) Dehr, (14) and Etmüller, (15) claim that the famous professor at Altorf, Mauritius Hoffmann was the first inventor, and claim that he already explained and described it in a special program from 1663. Johann Major (16), while he was still a Practicus in Hamburg, wrote a special little work in order not to lose the honour of this invention. Mr von Haller's opinion of this man was that he had promised a lot but carried out little. (17) In the book indicated he gives mere advice, and it does not seem that he made any experiments himself. Nor does he deny that attempts at this operation, which were carried out on hounds, were already found in Caspar Scottus. (18) Johann Siegmund Elsholz also claims (19) that he fell on it by himself as early as 1661, since he found that warm water, which he injected into a vein, passed back into the arteries. But it is equally very likely that the majority of these men, who dispute one another for the honour of the invention, at the same time, and without one lending the other his invention, found it by themselves, since experiments on the circulatory system of the blood, that had recently been discovered, were carried out in all countries; so it is certain that the Germans and the English are the first of all nations to make their attempts at this known publicly.

Etmüller relates (20) that as early as 1642 the hunter of a certain nobleman in Lustre [Luhre], who had many hunting dogs, was jokingly blowing Spanish wine from his mouth into an open vein with the help of a goose bone. After the wound had been bandaged, the dogs became quite intoxicated and fell asleep. In the same way this hunter brought medicines to his sick dogs and cured them of their sickness. Christoph [Christopher] Wren (21) made the same experiment in 1656, alone with far more artificial preparations, and in the following year it was repeated at his event by Timothy Clarke. D. Henshav [Henshaw] also made various attempts at this time. They sprayed different chemical liquids, but also water, beer, milk, wine, serum lactis [whey], and meat broth into the veins, and also tried to pass the blood from one animal into the other. But partly because of their little [limited] practice, partly also because of the imperfection of the instruments that they used in their experiments, it never really succeeded. Though they gave [performed] their attempts to the Royal Society, they did not believe that the operation could ever be brought to the level of perfection that could be used on people with certainty.

Robert Boyle at last invented some fancier tools in 1663, and made various experiments with injections of different kinds into the veins of living animals. In 1664 Johann Major wrote his already planned [mentioned] Prodrum, in which he asserted that in 1662, without having known anything about the attempts of the English, he fell for [discovered] this operation on the following occasion. He had noticed that after malignant diseases, even if the crisis did occur, many people lost their lives by suppressing excretion through the skin. Since, in his opinion, the reason for this would be to look for too great a viscosity of the blood, he hoped this fault would be cured by a volatile penetrative agent which would be injected directly into the blood through the veins, after a portion of the spoiled blood had previously been drained off, and thereby still save a person who was already in the last few

moves, and for whom art could no longer do anything to save life. But this remained only a thought until he received news of the English attempts through a certain Mr Sachs von Löwenheimb, and now he considered it a duty to make this little work known as quickly as possible so as not to be robbed of his invention. Apart from this deduction, as I have already said, the text itself contains nothing but rationales about the operation, suggestions as to how they should be used in various situations, and what one can expect from it in general. Since the matter did not take the slightest step forward even with the effort of this man, I consider it entirely unworthy of the effort to persevere any longer in the investigation and examination of his theoretical ideas. I will only cite the writings that were made known partly by him and partly by others on this occasion in Germany for and against this discovery. (22) About this time Johann Siegmund Elsholz (23) also made experiments on this in Berlin, and performed this operation not only several times on animals, but also on three soldiers from the electoral guard. One of these had an old ulcer on his left foot, and something of an aqua plantaginis genus was injected into one of his veins near the ulcer: the second was due to a cold fever, and a spoonful of carduibenedic water was poured into his median vein, finally, in the case of the third, who had developed a scorbutic rash because of a careless way of life, a portion of aqua cochleariae was injected into a vein of the arm. Each of them had a little blood drawn before the injection was made; the operation was carried out easily and without difficulty, and the patients did not complain of the slightest evil [adverse] coincidences either under [during] or after the time.

In England Lower improved the apparatus for transfusion, and finally brought what Clarke and his other predecessors had doubted about to perfection in 1666, and made the happiest [successful] experiments at Oxford [Oxford]. He tied two dogs next to each other on a wide table, fastened a tube in the carotid of one, after the artery had previously been tied off above and below. In this same way he also fastened a tube in the venam jugularem of the other, and united the two tubes by interlocking quills. Then an artery was opened for the dog that was supposed to take fresh blood through the venam jugularem, through which the peculiar blood could run off in order to make room for the new, and the ligatures in both the artery as well as the vein were loosened, whereupon the blood passed through the arteries of one into the veins of the other. These experiments were repeated several times in the presence of a large number of spectators. On the first attempt he let the blood from a large dog into a small one, and from the opened artery of the dog once more ran as much blood as he could possibly have by nature. In order to be even more certain that one dog received completely foreign blood, because it was possible that the blood of both animals mixed with each other during the operation, he gradually let the blood of several dogs into a single one.

From this he drew the conclusion that one animal could live with the blood of another without harm, for he also let the blood of sheep into dogs, and from these again back into the other. Furthermore, that one could give the blood of a young one to an old one, one found [healthy] into a sick one, a cold-blooded one into a warm-blooded one, a grim and tearing one into a fearful one, a tame one into a wild one, and this not only from one animal to another but also of different genera. At the same time he hoped that these experiments would solve many important problems about the nature and properties of animals. (24)

At the same time Boyle read a statement in the Royal Society of Science in which he not only wished the problems which Lower had already raised be answered by experience, but also added various new ones, and sent the whole statement to Lower. This included whether a dog would still recognize its master immediately after the operation, if foreign blood was given to him; if he knew some arts beforehand, would he still keep them, or would they get lost; whether a hunting dog, when he received blood from someone else, thereby changed his nature and

disposition at the same time; whether animals, after repetition of the operation, changed the colour of their hair and feathers, and so on.

Edmund King and Thomas Coxe now made another improvement, and let the blood from one vein into the other, instead of always being passed from the nature of one animal into a vein of the other. The first performed (25) two happy lucky [successful] ones in front of royal company; experiments which confirmed the merits of his new method. He conducted the blood of a calf into a sheep after he had previously drained all the blood from the latter, so that it lay almost dead on the operating table. The blood drained from the sheep was 49 ounces, and because it had been noticed that 10 ounces had flowed out in 49 seconds, the blood was allowed to overflow from the calf for 5 minutes, during which time the sheep could have completely recovered its 49 ounces of blood.

Coxe made another attempt. (26) He passed 16 ounces of blood from an old, scratchy [mangy] dog into a lively young and healthy dog, after as much blood as he received had been drained from another opened vein during the operation. The infusion happened, here also from one blood vessel to the other. In the young dog not the slightest change was noticed in the sick [donor's] blood, and the other, on the contrary, became completely healthy after a period of 10 to 12 days from this loss of blood.

Even though drugs had already been injected into a person's veins, transfusion had not yet been performed on them. The French finally dared an attempt which the English still considered too bold. Denis, a doctor in Paris, first made experiments with the surgeon Emmerez on various animals, which all turned out happy [successful], (27) and Gayant also repeated with good success, since he passed the blood from a young dog to an old one and thereby brought him life and cheerfulness. As a result, they believed they were justified in attempting the experiment with people as well. Since these attempts, which were partly due to unexpected coincidences, partly because of the unpredictable choice, did not turn out to be a big deal, subsequently contributed a great deal to the deterioration of the operation, I will tell them a little more laboriously [detailed].

The man, (28) whom had an unhappy first affair had gone mad out of love, and because it was initially believed that this coincidence would be lost in time, he married: but this melancholy degenerated into a complete frenzy so that he at paroxysm had to be bound, but he had sensible periods at times. He had already spent seven years in this way, when he fell again into a new violent paroxysm, raved about for a few days and nights, and was finally taken as a lazareth [beggar]. Denis was asked to try a transfusion on this person, who was then 34 years old.

He did it at once with Mr Emmerez in the presence of many spectators. First 10 ounces of blood were drained, but because of the restlessness of the patient, no more than 5 to 6 ounces of calf blood could be brought back [given] to him, so they repeated the attempt after a few days with another one, especially since after the first, he seemed to be a bit calmer. Since it was believed that because of frost, lack of sleep, and coughing, he would not have excess blood, the second time only 2 to 3 ounces of blood were withdrawn from him, and on the other hand a whole pound of calf blood was admitted through a vein opened in his arm. During this overflow he felt a warm current up to his shoulder. The pulse rose immediately, and a heavy sweat broke out on the face. The patient complained at the same time of severe kidney pain and nausea, so that they had to stop the infusion. No sooner was the wound bandaged than the patient broke away [vomited] everything that he had taken [eaten] in the few hours before. He passed a large amount of urine, went to the stool, had nausea and a tendency to vomit for a few hours, after which he fell into a deep sleep, which lasted until the following morning. He again drained a large amount of black urine, was quite lively, and from then on spoke sensibly and acted

as if he was found [healthy], so that after a few days a clergyman had no hesitation in offering him the sacrament.

For two whole months after the operation this person lived healthy, until at last through debauchery in love with his wife, which he had been forbidden to do, and especially through excess in wine, brandy and tobacco, he fell into a hot fever. In addition there was the fact that the woman wanted nothing less than the health of her husband, because during the attacks of his madness she had the best opportunity to satisfy her inclination to slovenliness. Believing that he would now become completely sensible, she brought him some arsenic and at the same time, in order to cover up her crime, demanded in the most impetuous way from Mr Denis that he repeat the operation on her husband, which had worked so extraordinarily well the first time. When he did not want to consent due to various circumstances, she threatened to force him to do so by virtue of the authority. At last they gave in to this persistent behaviour, but before the operation could be carried out for the third time, the man died with the most violent convulsions. The surgeons immediately suspected a hidden malevolence, and wanted to open the body, only the woman knew how to prevent this and brought the body underground without further investigation. The envious and enemies of the new operation triumphed over this incident, and three physicians from the Faculty [of Medicine] were vile enough to bribe the woman with gold that she should accuse the surgeons in the courts of murdering her husband. The matter was brought before the criminal courts by Mr Denis himself. His lawyer defended not only his clients, but also the new operation itself with the greatest vivacity, and the most convincing opinion for it were two persons, a man and a woman, whom Mr Denis saved by the same, after they had already been given up by all the doctors. (29) The rest of this dispute does not belong here.

The second unfortunate attempt was made on the Swedish Baron Bond (30), who was suffering from a violent inflammation of the intestines. Foreign blood was poured into him because the intestines had already caught fire and he was lost without salvation. Regardless of this, he seemed to get new strength after the first infusion, but shortly after the second repetition he died, and after death the intestines would be found completely destroyed by the fire [cancer]. Just as ill-considered was the attempt that was made on a Prince from the House of Conde, since the patient was already suffering from a morbo coeliaco [intestinal disease]. (31) Calf's blood was poured into him, but he died immediately after the operation, and that which was an inevitable consequence of his illness was now written by the opponents on account of the operation. Envy, gibberish and malice on the one hand, and imprudence on the other, were the reasons that the operation in France had such a bad reputation that the Parliament believed it had the right to forbid its further exercise. The lucky [successful] attempts were not heeded, and if one could not exactly deny them, every effort was made to put them down. Denis had cured a young person of a lethargy by infusing lamb's blood into him after the doctors had almost killed him by bloodletting twenty times, (32) and had already given up all hope of ever curing him. Since it had been found, the opponents maintained that the fear of this unusual attempt, and not the operation itself, was the cause of this wonderful cure, but it was sufficiently shown (33) that if fear could have done something, it would have done it just as well before than after the operation, and that, moreover, it is clear that the patient had even less fear, as he no idea of it, because he believed that the lamb used for the operation should only suck up the bad blood from him.

Now I just want to touch on the reasons that were put forward for and against the operation. Its friends maintained that transfusion was nothing more than an imitation of nature. Nature nourishes the fruit in the womb through a true transfusion of blood from the mother's body through the umbilical vessels, art imitates this. (34) Furthermore, transfusion provides nutrition by the shortest possible route, without the nutrient having to be prepared first by digestive and sanguineous routes, this is

especially useful in such cases when the digestive powers are weakened or spoiled, so that a good nutritional juice could not possibly be made. The opponents objected (35) that the operation could never be advantageous because not only does the blood of animals have different properties and mixtures than human blood, but also that humans themselves were endowed with a different blood according to the differences in their temperaments. So it would always be that the let in blood, whether it is taken from animals or people, would never mix with the blood of the body in which it was left, but rather cause all sorts of fermentations, stagnations, and other disorders. They also said (36) that it was necessary to reduce the mass of the blood, but not to increase it, and that from this increase of the blood all kinds of bad accidents, urination, vomiting, and internal inflammations must arise. (37) To this it was answered that this difference in juices between the blood of different people, or the blood of people and animals, is being credited too highly, because experience teaches the opposite, in that one species in the animal kingdom could be nourished by another or by the sap of the vegetable kingdom. The former was shown by undoubtedly successful attempts at transfusion and the latter by the inoculation of grafts on stems of a different genus. Moreover, the stomach is not the only tool of digestion, but only the first and coarsest degree of digestion was performed in it. The rest, namely, that this nourishing juice, worked up in the first digestion routes of the stomach and intestines, in blood, and so afterwards in this way various other juices, which are used to maintain and nourish the various parts of the body, as the muscles, bones, ligaments, ribbons, fat and the other secreted juices, when bile, saliva, and so on are required, was transformed, took place in other tools. Since the blood already survived the first degree of concoction, it could be passed on to another animal without hesitation, because it would be assimilated and made similar to the blood already present through the circulation and further processing in the animal tools, and made like it, even if some difference should be present, so that afterwards it would be perfectly adept at nourishing and maintaining the body. Moreover, in the doctrine of nature, reasoning could prove nothing against experience. At all times the most wonderful, nourishing and well-established discoveries would have countered with apparent reasoned conclusions: only a hundred years ago one would have to have attached a great deal of weight to the rational conclusions from which one would have inferred the harmfulness and poisonous properties of antimony, because they even moved parliament to forbid the use of this remedy: since everyone would agree that antimony was no less a poison, but rather a wonderful remedy; so those conclusions must necessarily have been wrong, and who can guarantee that this cannot be the case again? (38)

Now the attempt was made to transfuse people in other countries, and because they went to work more cautiously, the outcome was less sad than in France. Lower and King did it in 1667 to Arthur Coga (39) in the following way. They opened a vein on the arm, left 6 to 7 ounces of blood away, then put a silver tube into it, and now released the carotid artery of a lamb, in which they also fastened such a tube, and united both of them with one another by quills inserted into one another, 9 to 10 ounces of blood across. The patient did not feel a warm current through his arm, as in France; perhaps the length of the tube (it was the length of three quills) was the cause of this, because the blood had already cooled somewhat in its passage through it. The patient was completely well after the operation, and after a few days asked for it to be repeated, but this did not happen because they wanted to determine the measure more precisely, which would convince them that no more or less blood was spilled than was drained.

Balthasar Kaufmann and Gottfried Burmann, (40) also made similar attempts in Germany in 1668. They drained blood from the median vein of a young person afflicted with leprosy at various times, and again poured blood into him from the opened jugular vein of a lamb. The success was very happy because after three months he was completely cured.

The experiments which they then made on two soldiers and a fisherman, to whom they also infused lamb's blood, were less fortunate. The first two had a high degree of scurvy, and the other a hair worm (*Estiomenos*). The patients on the whole got worse after the operation, they fell into a kind of stupid melancholy, lost their strength, and it took a whole year before they were completely restored. Various experiments were carried out in Italy as well. An experiment was made in the house of Mr Cassini (41), and all the blood from a lamb was allowed to drain through the opened throttle [sic]. Then, through this same vein, he was given fresh blood, which had been let out from the carotid of another lamb. When it had received a sufficient portion of blood again, it was untied. One did not feel the slightest sign of weakness in it, but followed those who had performed the operation, ate the food presented, grew large, and gained weight like another, without the slightest difference. Not long afterwards this experiment was repeated in Mr Griffoni's house on a mediocre thirteen-year-old Spanish dog, which was dull, weak and deaf, almost unable to walk with old age, but only dragged its rear-end. After all the blood had been drawn off beforehand, lamb's blood was poured into his veins. After the operation was completed, he remained on the table for an hour, although the bands had already been removed from him. Thereupon he jumped up and looked for his master, who was in another room. From now on he was able to walk again, he regained his appetite, his numbness disappeared, and in general he achieved a great increase in youthful strength of his own.

Paul Manfredi (42) also tried transfusion on the encouragement of a Dutchman named Camay, first on animals, and then on people with happy success. He shortened much of the length of the operation, and made it quicker and with less inconvenience. He discarded the little brass tubes and quills, and chose gold or silver ones instead, and glass tubes instead of the latter. (43) Hippolytus Magnani (44) and Simon Allius (45) also made various successful experiments on animals, and tried to make the use of them more general. Here, too, it had opponents. Bartholomew Santinelli (46) denied it with the greatest vehemence. The reasons he opposes are the same as I have already given above, but he relies now and then on the unfortunate successes of transfusion, and maintains that a dog died immediately after the infusion of blood, which Magnani performed. Likewise, a medicus, Denatius Dentroni lost his life through the same thing. Wilhelm Riva (47) made three experiments with transfusions on people in Rome and let sheep's blood flow into their veins. Two of them died some time after the operation, but here too she was innocent of this bad outcome. One of these patients, Doctor Franciscus Sinibaldi, was already suffering from consumption in the coldest of features, one could not get any blood from his veins after the opening, and it was also not possible to infuse him with foreign blood. A few months afterwards he felt exhausted, without the wound that had been made to have contributed to it in the least. The second had a persistent quotidian fever, and died after a few days, as the fever had already subsided, of a fresh attack of the same. Regardless, this was sufficient to bring the operation into a bad reputation here as well.

Infusion offered the opportunity for transfusion: when one was concerned oneself with the latter, the former seemed to be completely disregarded, and only the various bad successes caused this was now explored again with more zeal. I now want to tell the more distant story of the same, but I pass over all those attempts that have been made with physiological and pathological intent with silence, and am content to savour the results of just some of them; Mr von Haller has dealt with them more extensively. (48) Almost all drugs, when sprayed [injected] into the blood, gave the same effect as if they had been taken by mouth. The sour spirits caused the death of the animal at such speed, and the blood was found quite skilfully at the section. According to the experience of Fracassatus, sulphur oil alone made an exception, because a dog that was injected into the vein did not die, but rather developed a very

strong appetite from it, so that it devoured everything that was given to him with the greatest eagerness.

Alkaline salts, refractory as well as volatile, also thicken the blood if they are injected in considerable quantities, and kill the animal, although it is commonly believed that they are supposed to dissolve the juices. Flammable spirits, injected in considerable quantities, also thicken the blood with deadly results. The medium salts seem to have the fewest harmful effects on the blood, if the quantity of them when injected into the blood is not too great.

I now come to the most excellent point of my investigation, namely the effect which drugs injected into the blood vessels have caused on animals as well as on humans. Joseph Lanzonius (49) sprinkled a little bit of liquor into the veins of a vicious dog, which he usually used in scabies, the dog immediately began to break violently, but it soon subsided again. He started eating again and after 5 days he was completely healed of his scabies. Elsholz (50) squirted a purgative into the veins of a dog, as much as was sufficient for a human, he was very sick a few hours afterwards, got a few sedes [i.e. seats – bowel movement] and after these he became quite lively again. A wine made from the emetic crocus metallorum, which this writer injected into another dog, also caused a very strong vomiting, but the dog lost its life, and this not because of the emetic effect but rather because of the thickening properties of the metallic crocus. Dalisneri (51) healed a man who had been bitten by an otter, and in whom various dangerous coincidences had already occurred, by injecting staghorn spirit into his veins.

This operation has been found to be particularly effective in epilepsy. Möller (52) used it to heal a Madgen [sic], which had been afflicted with it from her earliest youth. He sprinkled [injected] her with 6 grains Refina Gallappe dissolved in Mayen flower water, she got a bad vomiting, which was lost shortly afterwards, and she was freed from her protracted and rooted illness. Purrman (53) healed a 22-year-old man and 38-year-old woman in this way, both of whom had been afflicted with epilepsy for many years. Within three weeks, he injected each of these patients three times in succession, each time with one ounce of Spiritus Gran. et rad. Pæoniae with some Mayen flower alcohol in the median vein, and they were both completely cured. With another woman this injection would not suffice, the paroxysm remained for three months, but after this time it reappeared. He then sprinkled an ounce of the aqua hirundin in which some sal volat. succin. had been dissolved, a couple of times, and the disease ceased entirely without the woman having had any other accident. Schmid (54) made this experiment on two women, one of whom was 36 and the other only 20 years old; they both had such violent epileptic paroxysms that little hope was given to their healing. Regardless of this, a laxative, dissolved in an anti-epileptic alcohol, was injected into both of them. The former had some gentle bowel movements a few hours after the infusion. The next day the paroxysm returned, but much less so than before, and after a while it disappeared altogether. The second had four sedes [i.e. seats – bowel movement] on the first day and a few the following day, but the outcome was less fortunate through the patient's own fault, for not only did she expose herself to the cold air immediately after the operation, but also did not observe any diet.

In rooted venereal evils one has seen no less fortunate successes of it. Moller (55) saw in the Lazareth [Hospital] at Danzig a soldier who was infected in an almost incurable way by venereal disease, he had open ulcers on his shin, his right arm was very swollen and paralyzed, and he had such a severe headache that one could not touch it without increasing it most sensitively. A decent medicament was injected into him with such successful results that after 24 hours not only the violent headaches but also the swelling and paralysis of the arm disappeared, and after 3

days the external ulcers healed of their own accord without any external means. Schmid made several experiments in this disease in this same hospital. (56) He tried it on three different soldiers of which one died. One of them, a sturdy, strong man, was so badly infected that there were already large tumours on both arms. A laxative was injected into his median vein; after this injection he complained of the greatest pain in the elbow; the vein in this area was so swollen that one could notice it from the outside, and that one needed to force the stagnant juices through the fingers against the shoulder. Four hours later the remedy began to work, and he had very strong definitions [sic] this day and the next 5 days. The tumours of the bones now disappeared of their own accord, with no other means employed, and the patient was so completely healed that not the slightest trace of this hideous disease remained.

The just mentioned Schmid made various other successful experiments with another doctor, Doctor Scheffler, by injecting altering drugs in the hospital at Danzig. (57) Dreyen patients, among whom one had gout with severe limb pain, the second had an apoplexy and the third was labouring with an alternating braid [?], were all injected with traditional remedies through the median vein of the right arm. The first already had the greatest relief of pain the following day, immediately after a few days travelled to an upcoming mass and had no further attacks from his coincidence / accident. The second never felt another attack of his apoplexy after the time, and the third was also healed of the ulcers which had been caused by the alternating braid [?], so that from now on they could go about their business again.

Purman (58) had this operation performed twice on his own body, and both times it was accompanied with a happy [successful] result. The first time it was used because of a persistent scratch all over the body, again which many remedies had already been tried in vain. He was given a few spoons full of spoonweed water, into which theriac spirits had dripped, injected into his median vein. To his greatest astonishment, the scratch disappeared after 3 days, but because no blood had been drained from the vein beforehand and the liquor was injected with too much vehemence, he became faint after the operation; and at the place of the opened vein a great apostem, which only healed after a long time. The second attempt was made because of a day-long fever, with which he had been afflicted with violent thirst and diarrhoea for 16 weeks, and which had refused to give way to any remedy. So he let himself be injected a few spoons full of carduibenedicten water through the median vein, the fever changed immediately, and after 8 days he was completely freed from it. This time neither swelling nor dizziness followed, because the operation had been carried out with great care, and a portion of blood had also run out beforehand. Another case in which a very persistent fever was cured by this operation is recorded by Bartholin (59).

Chiliani (60) saw a successful attempt at an old incurable venereal ulcer. A soldier who had already salpert [sic] twice nevertheless retained an open ulcer on the right side of the lower maxilla in the region of the tonsils, which could not be healed by internal or external means. Since there was now nothing left, the infusion was carried out by a skilled regimental surgeon, and a small portion of genuine Balsam de Mecha, which was dissolved in spiritu lignorum, was injected through the median vein, after this mixture had previously been diluted with aqua lignorum, and warmed up to the degree of natural blood heat. One and a half ounces of blood had previously been drained, and the patient felt no discomfort from the operation, except that it ran warmly through his arm. The opened vein was properly connected, and after a few weeks the ulcer gradually healed of its own accord, without further use of the slightest means. Some time afterwards this same doctor repeated the experiment anew (61) with a non-commissioned officer, who had such severe headaches that they often threatened to turn into ravages, and it seemed they had arisen from a metastatic accumulation of an acrid moisture. The patient had had open thighs for many years from which a sharp gauche flowed off, these were finally healed and the imaginary unbearable headache arose, so that he could neither sit up

nor stand because of the pain. It was decided to try the infusion, and for this purpose one dissolved again some of the eighth Balsam de Mecha in Mayen flower spirit, and the mixture diluted with water of the same flowers. The operation was carried out as before; the day after all pain left the patient, so that he could go home. This good appearance lasted only four days, after which the pain returned, and indeed so severe that the person finally became quite mad and died after three weeks. This ugly outcome can certainly not be blamed on the operation in any way, because it first occurred so long after it, and because the cause here was evidently a metastasis of the suppressed discharge of the acrid moisture through the feet onto the brain. The operation evidently alleviated the accidents, and if this suppressed outflow had been restored by Spanish fly, the result would certainly have been quite different.

I have now presented this operation and its successes with all the faithfulness of a historian, and although it would be desirable that one had not stopped in the middle of the career, but had driven it to an even greater degree of perfection through many more visits, which the astute Bagliv (62) already wished it earlier, but I believe that what has already been done is sufficient to decide with certainty whether it is worth or not. From the whole of the preceding story it is immediately evident that neither transfusion nor infusion of proper means, which are not contrary to the nature of the blood, are in and of themselves connected with some danger to the patient's life, and it can be immediately determine in every incident, where the outcome did not turn out as desired, the error that caused this.

That from the mixing of the blood of different species did not result in any noticeable disorder, either in humans or in animals, as is also shown by all experiments which are made about it. Dogs lived just as well as before, not only after they had been given the blood of other dogs, but also of other species of animals, such as sheep and calves, and even humans were well with the blood that had been given to them from other species of animals. If bad coincidences followed the transfusion, they always had their reason either in the operator's carelessness or in other accidental circumstances, which one could not always avoid. One of the first was that too much blood was poured in; that one was not careful enough in the choice of patients, almost always being employed to people for whom all hope had been given up, and who could not be saved by any means without performing miracles, and therefore also could not be saved by transfusion; of this type were the Swedish Baron Bond, the old Doctor Sinibaldi, and the Prince von Conde, who died of the natural consequence of incurable diseases, and not of the transfusion. One of the others was the tendency of the blood to coagulate when exposed to external air, for this, and not the cold, is, according to the experience of Mr Hewson (63), the most excellent cause of it. Since the blood now had to pass through long tubes which were filled with air, this coagulation was almost always inevitable, and Sturm (64) and others found this to be the case in almost all experiments. These coagulated blood clots must naturally arouse all kinds of accidents if they stagnate in the vessels, which will be written afterwards on account of the operation. (65)

That the blood of other species than their own that flowed into them had an influence on the character of animals and man, and that it changed the direction of the abilities and their inclinations cannot be shown from any of the experiments made about it. The dog, into which lamb's blood was poured into, which after the operation found its master, and in other attempts, which were made in England, Germany, and France, no change in the inclination of the animals was ever noticed. In human beings, too, it cannot be asserted with certainty that the animal blood which flowed in had an influence on the faculties of the mind. Dionis (66) claims that all those on whom the operation was made in France have either become fools or mad; but the angry, bitter, and violent tone in which he speaks of this operation, and the obvious falsehood that everyone died after it, deprive his testimony of all weight. Obviously one notices in his whole procedure that it did not matter to him to say an untruth

more or less about a thing which he despised out of party spirit. Purman's experience seems to prove somewhat more, but since there was no noticeable change in one of the patients after the lamb's blood flowed in, it is still very uncertain whether the two other patients suffered from melancholy after the operation, or rather taken from another cause, especially since this is not noticed in England either, but rather found that the patient was noticeably relieved from a previous melancholy.

From the facts cited it is evidently clear that the transfusion really lifted stubborn diseases, but whether for that reason it can be recommended as a safe cure, and whether it will achieve everything that is praised of it?, these are questions that I don't dare to answer with yes. The Chymists as well as the Galenists both had too high an idea of the properties of blood; the former considered it, as I have already said, to be the vehicle of the vital forces and the seat and abode of the flame of life. The others believed that it not only constituted the first basis of man because the fetus received its origin and form from it, but that also after time all the individual structures would get their growth, individual characteristics, and pollination from it. According to this theory, the different temperaments of people were also due to the different mixture of blood. Both therefore believed that by infusing a young spiritual blood they would not only relieve the most serious illnesses, rejuvenate old age, keep people in a stable youth, even impart immortality to them, but also improve their temperament and with it their character. A choleric person, they said, could be given, as an example, the blood of a phlegmatic, and this again a sanguine blood, and both temperaments would be tempered and improved by this manipulation. Disunity and ingrained hatred among married couples; in this way siblings and friends could be uplifted and love, friendship and mutual trust restored. If, for example, some of the woman's blood flowed into the man, and this flowed in again with the blood of the former, so the spirit of one blood would combine with the spirit of the other, generate a new temperament, and merge into the gentlest harmony. This would cause so strong a sympathy between the two that the most stubborn, intolerable and rebellious spouses would be transformed into the most tender lovers, and mortal enemies would be transformed into the warmest friends, and through this operation the doctor, apart from his other important tasks, could still earn the great merit of the state, that it restored peace, harmony and lost calm in families. (67)

Now in our times these lofty ideas, which the ancients had of blood, have for the most part disappeared due to the more exact investigation of the nature of blood, the fiercest motive for which this operation was undertaken fell away by itself. In addition, if the blood is really spoiled, such as for example, in the case of rotting fever, the new one admitted will improve little, because it will certainly be infected in a short time by the spoiled that remained behind and will also be spoiled. But the fine volatile constituent of the blood, which pervades all parts of the body and is intimately united with the animal substance, whether its nature cannot actually be determined right away, does not have some influence on the body, and can improve its defects, especially in nervous diseases, I do not dare to deny myself, and from this the happy successes achieved by this operation can be explained without compulsion.

Although infusion did not promise so extraordinary and miraculous effects as transfusion, it proved, as I have shown above, none the less extremely effective in curing the most desperate diseases; and it is a real loss to the art of medicine that it has so quickly been neglected again. This operation is easy to carry out (68) and can be carried out without any particular difficulty. It is not dangerous, as the experiments cited above show, and even with spirituous mixtures and traumatic evacuation means, as surely as one should have suspected, there were not bad coincidences, how much less would they arise if the injected mixtures were made homogenous with the nature of blood. From the year 1660 to 1680 it was practiced excellently, but after a while it fell into disrepair, and to this end there were in part some bad effects of transfusion, which were at the same time accused, and in part

the natural softness of people, who abhor everything that they believe could cause some external pain, and they rather plunge themselves into the most obvious danger, and tolerate the cruel pain even if they can decide to undertake an operation, because out of one effeminate fear, imagine the pain that the knife causes them to be far greater. Purman counts (69) among the causes of their decline, that the inventors and friends of them, at least in Germany, Major, Elsholz, Etmüller and C. Wren in England, died so early that this invention was still in the cradle, so to speak, could train it to perfection, and through this our writer says that the noble work gradually got stuck and decayed.

Another mistake was that theories were already being created at a time when experiments should first have been made, and this was primarily the mistake in which Major and Etmüller fell. I have already characterized the first according to a remark of Mr von Haller, and the second is just as little free of the same. On a few experiments he bases an extensive theory, according to which he determines the diseases in which infusion can be used, and, according to equally uncertain principles, assembles means to apply them in every particular case, without it occurring to him once that he ought to try to ask nature whether or not it agrees with these abstracting sages, which is more or less always the case, even with the proudest and most astute theories, when nature is not consulted enough. The remedies which he suggests for injecting into the blood are salmiac alcohol, half an ounce, stag's horn alcohol, and the alcohol from human blood, from 2 grains to half an ounce, to which one could add a little camphor alcohol, whereby this would not only be an excellent sweat-inducing agent, but also a very effective agent in malignant fibres. Should both spirits coagulate, they could be diluted with a little water. The sal volatile oleosum sylvii, sal volatile cornu cervi, spiritus cinamomi with oleo succini could be used as heart-strengthening remedies, and in nerve accidents one could inject a solution of Opium. In addition, he forbids the injection of Purgier Brechstein and urine-inducing agents, and considers it more advisable to allow these to be taken by mouth. After this time infusion was practiced less and less by concurrence of the circumstances just mentioned, it now also lost the thrill of novelty that it had retained for a while. The more one distanced oneself from the point in time of the invention, the more the imagined danger increased; one considered it a boldness to apply it to people, and this statement was proved by fine theoretical reasons. Regardless of this, Mr Röhler (70) tried it a short time ago, in a case where all other help would have been in vain. A musketeer swallowed a large piece of stringy beef, which, being too large, remained over the stomach in half the throat, and could be brought into the stomach in its own way by means of instruments. The most violent symptoms occurred, and the patient was already close to death when Mr Röhler finally tried infusion and injected 6 grains of emetic tartar, dissolved in water, injected through a vein. After half an hour there was a tendency to break which increased again and again and finally became so strong that the jammed piece of tendon would be broken out with such vehemence that it flew eight feet away. In this case infusion was certainly the only means, and who would think of doing it on a similar occasion? Mr Tode (71) seemed to cast doubt on this experience, whether he was not ready to cite the reasons for his doubt, because the experiments which emetics are injected into the veins, as a whole, correspond to their final purpose, and some of which Mr von Haller (72) has collected together are certainly not unknown to him.

To further confirm this, I want to cite a case from my own experience. Among many other attempts which I have made on dogs with injected medicaments, I also injected a mediocre dog with 4 grains of emetic tartar dissolved in 2 ounces of water. Immediately after the operation the dog was quite lively, half an hour later he was trembling all over and ran restlessly around the room, he began to vomit, and an hour after the operation he vomited very severely three times; I let him drink warm meat broth, he ate it with great appetite and broke himself again. Thereupon he lay quietly

for a few hours, and took very strong breaths, after which he got up again and ran around as lively as before.

Almost everyone who tried infusion usually noticed vomiting after it. Was this an inevitable consequence of the operation, or did it depend on fortuitous circumstances? It was answered (73) that the cause differed from this, and that it could be contained partly in a weakness in the natural tone of the stomach, partly in the disease itself, partly in sharp crudities and humidities which weighed down the stomach. In order to prevent this troublesome accident, it would be necessary to prescribe a mild laxative at any time before the operation. It also depends on the nature of the injected liquor, because violent evacuation means by their very nature induce vomiting. In the case of altering juices however, this will never happen if the stomach is clear of crudities and a little blood has been drained from the vein before the injection; because if the vessels expand more because of the increased mass of the blood due to the injected juices, this can also happen in the vessels of the stomach, and this alone is a sufficient cause of vomiting, as is also sometimes noticed with other diseases, that the rupture is not caused by cruditates, but by an expansion of the vessels, either by full blood, spasms or inflammations, and in this case it goes without saying that no evacuation devices have to be used.

The reasons for which this operation was once used were because most of the medicaments are altered, weakened, and often destroyed in their entirety in their passage through the digestive tract, so that afterwards, when they are brought into the blood, they can no longer achieve the desired effects, and furthermore, because in many diseases it is impossible to convey anything to the patient through the mouth than in apoplexy, angina, and other diseases of this kind. It was also hoped by this method to cure incurable, malignant and protracted illnesses, such as exhaustion, podagra, epilepsy, apoplexy, consumption, venereal disease, scurvy, malignant and lazy fevers; because in several of these coincidences the cause lies in a real corruption of the blood, the above-mentioned cases also show that one was not deceived in this hope.

The famous Heister (74) himself is not averse to infusion, and believes that it can certainly be used in apoplexy, angina, and other dangerous coincidences can be used with benefit, likewise, a great loss of blood is best done by either injected milk, meat broth, or blood of healthy people or animals, can be most easily and best eaten. Their usefulness is beyond doubt, says this excellent surgeon, since there are so many credible testimonies of their worthiness, in the most desperate cases; but far more experiments must be made before the cases in which it can be used with good success can be determined with certainty.

A more recent writer (75) calls this operation a crude idea, because it would make the medicaments salutary only if they were made similar to human nature by the digestive tract, and thus made adept at combining with our juices. But is this thought correct? I do not think so, and I hope to give the strongest reasons to back up my doubts.

Since one could never discover a special kind of salt in the blood itself without violent manipulation, so it always seemed improbable to me that they should pass over into the blood unchanged. Of the acids, especially at first glance it seems quite improbable, because they precipitate the milk, and yet they should pass through the nutritional juice, (76) but since all the conjecture proves nothing, I tried to convince myself of this through practical knowledge.

#### First attempt

I took a dog and fasted him for two days in a locked place, and on the third day I gave him a large serving of good meat broth mixed with wine vinegar. The mixture coloured the juice red. Two hours later the dog was strangled, the milk vessels and

the milk capsules were strongly attached with chyle. The chyle from this was collected in a wine glass, but the file/filling juice did not colour it red, rather the whole thing took on a dull brown colour.

#### Second Attempt

Another dog, which fasted for as long as the first one (and this also happened in the other experiments), was given meat broth with vitriol alcohol, a little bit sour, enough. The chyle from the milk capsule was caught again and file/filling juice was poured in again, but the chyle changed its colour just as little as the previous time.

#### Third Attempt

Since now, after these experiments, the acids had to be completely transformed before they went out of the intestines, since they could not be further discovered in the chyle, I was now eager to see how the alkaline salts would behave, and with this intention I had a dog take a large portion of milk, again after fasting two days earlier. I had previously dripped so much oleum tartari into this milk that the file/filling juice turned it completely green, the dog was strangled again and the chyle collected, but it was also not coloured green by the blue juice, but remained completely blue, and was still there when I diluted it with water. Since in the first attempts so little of a vegetable acid as a mineral acid had passed into the milk juice unchanged, I believed that this would also take place with the alkaline salts, and I wanted something which seemed to me to prove the analogy, do not sacrifice the life of a dog without necessity, but rather save him for another attempt.

#### Fourth Attempt

Now that the acidic and alkaline salts completely changed their nature in their passage through the obstructions; so it was certainly worth the effort to investigate whether this would also happen with several medicaments, but here the difficulty was in finding features by which one could discover their presence. This was easiest with cinchona bark, because its astringent component stains all iron solutions black. Since it was easy to suspect that a dog would not drink a large quantity of them because of their bitterness, I had only a lot of them boiled in a quart of water, and mixed half of this decoction with two quarters of good, fat milk. The dog that was destined for the experiment had not eaten for two days, but it was a little difficult to take in the milk, and he sat down a few times before he ate the whole portion. After two hours it was strangled, cut open, and the chyle was collected from the milk capsule. A small portion of the milk, which was poured off from the whole portion, was immediately coloured black by an added solution of iron-vitriol, but the chyle remained unchanged.

From these few attempts, which I gladly carried on, if time and circumstances allowed me, at least so much follows that very many remedies lose their whole nature and quality before they get into the blood, and perhaps these are the most and besides Mercury and some strongly smelling substances, perhaps very few more pass into the blood completely unchanged. Since these means, regardless of whether they do not pass into the blood, still cause great changes in the body, so they only have to affect the solid parts, and the effect must afterwards transplant itself further through the nerves. Further investigation of this important subject is too far from my intention to go further.

That the cinchona bark does not pass unchanged into the blood through the nutritional juice can also be shown in another way. Rosenstein (77), Unzer (78), and others have suggested that intermittent fever in infants should be treated in this way by letting the wet nurse take fever bark, whereupon it would then be passed onto the child through the milk. Because some infants lost the fever by themselves, at the time when the wet nurse took china, which, as even Mr Rosenstein admits, is not

unusual, this has probably confirmed this opinion even more, and yet nothing is less true than that a cold fever is cured in this way. I myself have seen two cases of this kind where the nurse had to take a very large quantity of fever bark without the fever being lost in the child she was suckling; afterwards I healed both of them in a short time by means of Chinese lysts. With one of these wet nurses I tried the milk in different colours, but I could never notice a taste in it that was in the least similar to that of China.

Mr Platner (79) considers the remark that the vegetable acids dissolve the blood, whereas the mineral acids thicken it, is extremely correct in practice, because in various feverish fevers there are times when the blood tends to thicken, while there are times when it tends to dissolve. But if, as is clear from my experiments above, the two kinds of acids do not pass into the blood at all, then the importance of this difference disappears by itself, unless they also have a different effect on the solid parts, which, however, can hardly be determined.

If most of the remedies are changed so completely by the concoction [sic] that they retain almost nothing of their original nature and quality, then it follows very correctly that in those cases where the fault lies in the blood itself, and where they are effective only if they retain all their properties, can do nothing, and in such cases infusion would certainly have all possible advantages. Of this kind are mainly the putrid fevers, where the blood evidently tends to putrefaction. Let it also be said that antiseptic agents could actually pass into the blood without losing their strength in the digestive tract, but this is hindered by another circumstance, which occurs immediately with all such diseases, namely the almost total destruction of the digestive powers. The appetite is completely lost right from the start; neither food nor medicine can be properly dissolved and assimilated, because partly the moisture necessary for dissolution is spoiled, partly also the strength of the solid parts of the stomach and intestines is weakened; how are the antiseptics to be made to be brought to the blood in order to be able to put a stop to its corruption? Experience also teaches that so few of these illnesses will be cured, when they attain a high degree of malice. Alexander (80) has therefore proposed a very astute method in the case of such diseases of introducing antiseptic agents into the blood unchanged through the skin. Namely, he wants the sick to be washed diligently with antiseptic decoctions, and the whole air to be made pregnant with such parts. Through many experiments he has found that a high degree of putrefaction can be restrained in this way, and through another experiment he has found it beyond doubt that such antiseptic parts absorbed through the skin really get into the blood. He sat a live rabbit in a saltpeter solution heated to a hundred and ten degrees, and left it for 10 minutes; after 18 hours he heated the same solution to a hundred and five degrees and left it for half an hour. It ran around the room after every bath. It was killed two hours after the last bath, and a piece of paper was dipped into the blood-water [sic]. This now, when it was dried and exposed in the flame of a light, immediately set fire, spurted, and gave off a bright flame like saltpeter.

If, in this extensive and traceable manner, medicinal products are actually brought to the blood unchanged without causing damage, but rather inhibiting the corruption of their own in the most emphatic manner, why should they not be brought about in the much easier way by infusion as well? The objection made above on account of its brutality says nothing at all, as soon as the remedy is of the kind that it easily mixes with the blood, and does not break the connection between its parts. In the case of lazy fever there is also a re-natural state of the blood, the digestive instruments are unable to make the medicinal products similar to human nature, even if this were really necessary, why should one not attack the root of the evil here right away, and put a stop to the further foulness of the blood by antiseptic means? Alexander, just mentioned, and others who have made experiments on foulness, teach that as long as an animal body still has life, it never attacks the solid, but perhaps its liquid parts: what kind of soil detriment is there, or where is the raw thing,

if one adds antiseptic agents to such juices changed by the fouling and deviating from their nature, which are homogeneous to them, easily mix with them, and prevent the further progress of the fouling. Let it be said that it could be proved (which, in my opinion, is not so easy) that absolutely no liquid body, which has not previously survived the concoction, could mix with the blood without destroying the whole peculiar nature of it, so this could only apply to completely healthy blood, but not of blood which has already lost its natural mixture through foulness, as is the case with all lazy fever.

In general, it is a false assumption that the medicinal products must first be made similar to our nature through digestion, and that they would only be salutary if they accepted the properties of our juices. Mercury is certainly not changed in the least by digestion, as is the volatile principle of strongly smelling substances such as musk, camphor, etc., because the smell of them can still be discovered through transpiration. All that may happen is that these remedies are wrapped up in the digestive juices, enveloped, and thereby weakened in their effectiveness. The very great effectiveness of such agents when they are injected directly into the blood, as for example, carduibenedicten and Mayen flower waters, taken by mouth do nothing, prove this more than enough, and at the same time teach that the powers of many medicinal products are extraordinarily diminished by digestion.

Since it has now been agreed that there are medicaments, the mixture and individual properties of which can never be completely abolished by the digestive forces, and can never be recreated, whether they are weakened by the wrapping, but instead pass unchanged into the blood; since the experiments of Mr Alexander also show that by being sucked in through the skin a great number of medicaments pass over to the blood, and are mixed with it without damage, for in their passage through the absorbent vessels of the skin they are certainly very little changed: so it follows from this not only that what has just been said, that the medicaments, if they are to be effective, must first be made similar to our juices is unfounded, but rather that it is precisely because of this that the majority of drugs lose their strength because they are transformed by digestion, and made similar to the nature of our juices.

All such medicaments can therefore be injected directly into the blood without causing any disadvantage, if they are only of the type that they easily mix with the blood, no coagulation, dissolution or other natural change, whereby the natural mixture and connection of the same is cancelled. Furthermore, the quantity of the juices to be injected must be taken into account at the same time, for if the quantity is too great, so that it cannot be assimilated by the blood, then for this reason alone the most innocent and the most similar to blood juices can cause all kinds of evil accidents and death itself. Lower noted, therefore, that too large a quantity of injected milk resulted in death in a dog, and Marherr (81) suspects that even chyle could cause damage for this reason, if too large a quantity was brought into the blood and that, therefore, nature has attached the valve, which closes the thoracic duct in the case of its infection, but not so that blood might not penetrate into it, but rather to moderate the excessively strong influx of milk so that no more of the same is ever passed over than the lungs and the other sanguification tools can gradually transform into blood.

From this it also follows that the explanation which was given earlier, as I have already mentioned, in defence of infusion and transfusion, namely that a concoction and assimilation could still take place in the blood itself, is based on nothing less than a mere hypothesis, but is really destroyed by experience, in that the change takes place with the injected, decent medicaments, as with the milk juice. They are likewise mixed with the blood by the movement of the lungs, after they have been drifting around with the blood for a while, and are made to resemble the same in nature, the more effective parts of it work in this cycle, since their forces are not destroyed by any manipulation or weakened by being wrapped in other juices, they

are stronger on the nerves or on the naturally changed and diseased animal juices themselves, and the watery ones, which serve them as a mere vehicle, are either passed from the blood either through the urinary tract or through transpiration. This becomes an experience to highlight this more.

A 16 year old woman was incapacitated for a time with constant nosebleeds, inadvertently at such a flow of blood, a large vessel of cold water was suddenly poured over her head. The violent shock had such an unfortunate effect. The nosebleed subsided, but she immediately had a very violent epileptic attack, which lasted half an hour with the most curious contortions of the body. At the same time she lost her menses from this time on, which should have settled in the usual way after a few days. Usually the paroxysm came back every month, but in very warm weather it occurred more often, so that often two paroxysms occurred in one day. All possible means, even electricity, have been tried many times, but in vain; the paroxysms could not be diminished in any way, nor the menses restored. She had lived in this way for eight years. I saw the person about this time, and was consulted by her; since I could now very easily conclude from the long list of the remedies used, which I was informed at the same time, that in this case ordinary remedies would do nothing, I finally decided to try infusion, all the more so because I was urged by the patient to choose even the most desperate remedy, if only one could hope to some degree the likelihood of improvement by using it. Many attempts, which I always make with happy results on animals with this operation, and the history of them, which I compared with my experiences, and which also seemed to me to decide in their favour, finally outweighed all the doubts which had hitherto prevented me to try this disreputable, uncommon and out-of-fashion healing method.

I therefore had half a drachm of musk with six ounces of distilled water rubbed for eight hours in a glass mortar, and then filtered it through blotting paper. I left this septic fluid to stand covered for two days in a quiet place, after which I filtered it once more in order to separate out all the coarse particles. Then I opened the median vein in the usual way, having previously put on a bandage above and below, let 4 ounces of blood run off, and afterwards sprinkled one ounce of this solution, which I had warmed to the degree of blood warmth, in warm water with the aid of a thermometer. The operation was very easy and without dizziness, and the patient did not feel the slightest discomfort, either under or after it, except that two hours after the infusion she felt a slight tingling through all the muscles of the whole body. The operation had been started a few days before the new moon, at which time paroxysm usually occurred. It actually took place three days later, but extremely weakly, and under the same conditions the menses began to flow again, and this flow continued quite strongly for a few days. From that time on she never had another attack of epilepsy, her menses have always been correct, a year later she got married, and three years after the operation she still lives in a happy but still sterile marriage.

Let it also be said that one would consider it too easy and too daring to use infusion in such cases where the blood itself is not spoiled, but where only the remedies through the aid of circulation, when they have been brought directly to the blood, in their entirety should work in all their strength, without its efficacious powers having previously been weakened, should work on the suffering part; reason already tells us that in the event of a proper dissolution and putrefaction of the blood they must be of the of most excellent use, because the antiseptic agent alone can not enough work immediately on the blood attacked by the foulness and hinder its further progress, but also for another reason, which I will cite in the following. But, according to Pringles (82), observations and experiences on this subject will not easily cast doubt that the blood in a living body can turn into real putrefaction.

Before I go any further, I would like to mention an experience which not only sufficiently confirms the safe use of infusion in feverish fever, but also the excellent effectiveness of the same. The patient on whom I attempted this was a 39 year old day labourer, of a strong and robust constitution; he had been suffering from a real

lazy hospital fever for 12 days, without any use other than minor household remedies because of his poverty. He lay in a small, dull room, where the windows and doors had been carefully kept covered, because they feared that the somewhat cold damp air (it was at the end of September) might be harmful to the patient. The patient lay in a constant stupor, the urine and bowel movements leaked against his knowledge, the pulse could hardly be felt, he had not eaten for a whole day, and a trembling indicated that death was not far distant. In these extremely dangerous circumstances, where all other help was in vain, I dared the infusion, although I could hardly hope to achieve anything. So I immediately boiled an ounce of cortex with a quart of water, dissolved 2 drachms of volatile staghorn salt in this decoct that had been poured off, and filtered it three times through blotting paper. With great difficulty I then opened the median vein, because it was not only extremely contracted, but also did not want to swell, regardless of the ligament that was put on. Because of the patient's extreme weakness, I did not dare to draw off a little blood beforehand, but instead immediately injected 3 ounces of the above decoction (it was at 10 o'clock in the morning) to which the degree of warmth of blood had been given by warm water. The patient did not feel the least bit under this treatment; half an hour later the very corpse-like face showed again some redness, large drops of sweat broke out on the forehead, and the pulse rose very noticeably. The whole skin, which had previously been dry and tense, became damp, a very strong, stinking sweat broke out, and after three hours the patient awoke from his stupor as if from a deep sleep. I then had him take a few spoons of old Rhine wine, which greatly strengthened him. In the evening I had an apple mousse with Rhine wine prepared for him, which he also took some of, the sweat lasted the whole evening, and the pulse was soft and quite strong. New deliria appeared after midnight, the patient tossed around restlessly, the skin became dry again and the pulse began to drop noticeably. As this continued the following morning, I again dissolved a drachm of the essential salt of china in 4 ounces of distilled water, strained it several times through blotting paper, and again added 15 grains of volatile staghorn salt. As the forces grew weaker and weaker, I opened the bandage at 2 o'clock in the afternoon, pulled apart the lips of the opened vein, which had not yet closed, and after draining almost 4 ounces of blood I injected another 3 ounces of the above solution and put on a bandage on again. The pulse rose again after an hour, and the patient regained strength. There was again a very strong sweat, and that night, a very strong, stinking diarrhoea. The next day the patient was much more lively; he had some biscuits with wine, and I let him use Minders Polion [sic] internally. The patient recovered daily after this last critical emptying, but the day after the second operation there was pain and a swelling of the glands under the right armpit, which finally went over into an abscess, it was wrapped in softening poultices, and finally opened, whereupon the patient rose again and was completely restored after a few weeks.

This story not only confirms the safe and beneficial use of infusion, but also proves the amazing difference in the antiseptic power of the bark when it is brought directly into the blood, as here, and when it is only taken by mouth where it is so infinitely less effective that either no or very few antiseptic parts can pass into the blood, as the above experiment shows. This is also confirmed by the observations made by Mr Pringle. (83) He found that wine was almost always more potent than a decoct of bark or serpentaria, and when the patients could no longer take it, they sometimes recovered with a spoonful of wine; the cause is very striking, because the wine, as daily experience teaches, immediately passes into the blood, but not the other antiseptic decoctions. But since cinchona bark has powerful healing powers in such diseases, which cannot be denied, so this work must necessarily be done in another way.

I believe that this apparent contradiction can easily be resolved if one looks at the matter closely. Alexander has very probably shown that the putrefaction of the juices

is brought about by nothing less than a poisonous property of the air, but rather by a relaxation of the solid parts, by warm or cold moist air. For since the proper movement of the blood depends solely on the lively spring force of the solid parts, this movement must necessarily be greatly weakened when the solid parts have lost their natural elasticity. Because of this slow circulation of the juices, there arises a fermenting movement of the same, and finally, if this cause is not removed, a true putrefaction. The small and equally falling pulse, which is a characteristic feature of this disease, can be explained very well from this theory.

Since the cortex and other antiseptic substances, through their robotic [sic] and astringent power, strengthen the solid parts and lift the limp state of them, so for this reason alone they can have their nourishment from rotten diseases, even though they do not pass into the blood immediately. But if putrefaction has become too rampant, not only that the few juices which belong to the concoction can no longer be separated from the blood in their natural state, but that the vital forces and the irritability of the solid parts themselves must be reduced it is necessary that china and all other means which act only on the fixed parts are ineffective, and this is also confirmed by experience.

Wine does something else because it easily surrenders into the blood, and infusion is certainly the only certain means of rescue in a high degree of putrefactive diseases, because it immediately attacks the root of the evil.

## REFERENCES

NOTE: Actual references are reproduced as originally written – comments by the author have been translated from the original German in English.

1. Ovid. de Metamorph. 1. VII.  
...Stricto Medea recludit  
Enfe fenis jugulum ventremque exire cruorem  
Passa, replet succis, quos postquam combibit Aeson  
Aut ore exceptos, aut vulnere, barba comæque  
Canitie pofita nigrum rapuere colorem  
Pulfa fugit macies: abeunt pallorque fitusque  
Adjecto cavæ fuppleatur corpore rugae:  
Membraque luxuriant...  
The hopes that were made of transfusion were nothing less than what was happening here with old Aeson.
2. De studioforum fanitate tuenda lib. II. c. 11. Quos hectica senilis exedit, medici diligentes liquore humani sanguinis, qui arte sublimi destilavit ad ignem, reficere moliantur. Quid ergo prohibet, quo minus senio quafi confecto interdum hoc etiam potu reficiamur? Communis quædam est ac vetus opinio, aniculas quasdam fagas (quæ Striges vulgari nomine nunsupantur) infantium sugere sanguinem, quo pro viribus juvenescunt. Cur non et nostri fenes omni videlicet auxilio destituti sanguinem adolescentis fugant? sani inquam adolescentis, læsi temperati, cujus sanguis quidem sit optimus, sed forte nimius. Sugant igitur more hirundinum, ex brachii sinistri vena vix aperta unciam unam aut duas ...
3. Thesaur. 1604. p. 111. Ratio chirurgica infignis et rara homini communicans extera, quæ ipsi bona, et interna multa, quæ noxia, avertens: quæ ratio alios varia agere et alterare in homine possit. Pasch de novis inventis etc. p. 304, attaches great importance to this passage, and fully understands infusion. Compare this with Scapper Dissert, super medicinam curiofam. Rostock 1698, quæst. IV.
4. Defensio syntagmatis arcanorum contra Henning Scheumannum, Francof. 1615. fol. C. IV. p. 7-8.
5. Johann Peter Faber Palladium Spagyricum. Sämtliche Schriften, Hamburg 1713. Tom. II. p. 671.
6. Aufgang der Arzeneykunst. Sulzbach 1683. Fol. Tractat von dein Lebensgelste. S. 251.
7. Tractat von den Fiebern. S. 314.
8. Tractat 28. 5. 257.
9. Plinius (lib. 26. cap. I.) erzählt, daß sich die ågyptischen Konige durch ein Bad aus Menschenblute von dem Aussake befreyet härten. Pliny (lib. 26. cap. I.) tells that the Egyptian Kings were freed from the fake by bathing in human blood. Pau (philosophical study on Egyptians and Chinese Tom. I, page 148) considers this to be a fable, because it emerges from many other circumstances that the Egyptians knew too well the nature and means of evil, so that they should have resorted to such an unpleasant and cruel means. Peter Faber (l. Cit.) believes that this is to be understood allegorically, and that through it, to be understood as a healing balm, which is prepared from the spiritual blood of young boys. However, this explanation has a certain degree of truth when one considers that even the most adventurous narrative is generally always based in some truth. And what if this were to be understood as referring to transfusion?
10. Methodos facile parandi jucunda, tuta et nova medicamenta. Venet. 1628. C.7
11. Extrait d'une lettre à M ... sur la Transfusion du sang. Paris, 1667. This writing was immediately entered into the Journal des sçavans of that year, p. 44. indent.
12. de corde.

13. *Philosophia eclecticæ*. Tom. I. p. 489.
14. *Irenæi Vehr præsidium novum chirurgicum de methæmochymia*. Francofurti 1668. 4.
15. *Differtatio de chirurgia infusoria*. Lips. 1668. 4.
16. *Prodromus a se inventæ chirurgiæ infusoriæ sea quo pacto agonizantes aliquamdiu fervari poffint infuso in venam sectam liquore peculiari*. Lipsia. 1664. 4. In the following year in Frankfurt this work was again placed with Joh. Dan. Horsts judgment about this operation.
17. *Bibliotheca anatomica*. Tom. I.
18. *Technica curiosa*. Herbipoli, 1664. In this article he relates that a certain prince intoxicated dogs with wine that was sprayed into their veins, and also caused diarrhoea in the dogs, with drugs brought in this same way.
19. *Clysmatica nova &c*. Colon. Brandenb. 1667. p. 7.
20. *de chirurgia infusoria*. Cap. I.
21. *Acta Philosophica Societ. Reg. Anglic. de Ao 1668*. Amstelod. 1674. p. 102.
22. *Deliciæ hibernæ*, Kiel 1666. In this work the trials which Moller employed with infusion on people were told. 2) *Chirurgia infusoria placidis clariff. virorum dubiis impugnata, cum modesta ad eadem responsione*. Kiel. 1667. In this he replies to 20 objections made to him by various scholars, but he does not answer 66 other objections. 3) *Occasus et regreffus chirurgiæ infusoriæ*. Gotha. Of which a German revision appeared shortly afterwards: the rise and fall of the new way to cure by injecting into the veins. Major defends himself against an unnamed writer to whom Elsholzen had bestowed the honour of the invention. At the same time he confesses that he did not do the work himself. 4) *Appendix sum Scripto occasus et regressus chirurgiæ infusoria*, Kiel. 1667. The manipulations of the operation and the tools necessary for it are described therein. 5) *Memoriale anatomico - miscellaneum*. Kiel. 1669. In this work Berke promotes a special appreciation for opium. It was sprayed into the face of a dog and caused diarrhoea. Major defends himself against Clarke for being the inventor of infusion. 6) *Hanemann nova ars Clysmatica enervata*, Stadæ. 1670. 12. 7) Well-intentioned consideration of the main reasons, which are given in a so-called *ortu et progressu Clysmaticæ novæ*, 1667. Both of these writings are directed against this operation.
23. *Clysmatica nova etc. colon. Brandenb.* 1667.
24. *Bonet Medicina septentr.*
25. *Transactiones Philosophicæ*. No. 25.
26. *ibid.*
27. *Extrait d'une lettre à M - sur la transfusion du sang, à Paris, 1667*. This writing was immediately incorporated into *Journal des sçavans* of that year, p. 44.
28. *Lettre a Mr. de Montmor touchant deux experiences de la transfusion faites sur les hommes, à Paris. 1667. 4. Acta Philosophica*. No. 32.
29. *Acta Philosoph.* No. 36. *Bonet. med. septentr, lib. 1. p. 200.* Lettre, touchant une folie inveterée guerie par la transfusion, à Paris, 1668.
30. *Acta philosophica*. No. 28.
31. *ibid.* No. 28. et 30.
32. *Extrait d'une lettre à M. sur la transfusion du sang. à Paris. 1667.*
33. *C. Gadroys lettre à Mr. l'Abbé Bourdelot pour servir de reponsè à la lettre ecrite par Mr. Lamy contre la transfusion, à Paris, 1668.*
34. *Extrait d'une lettre &c.*
35. *Lamy lettre à Mr. Moreau contre les pretendues utilités de la transfusion, à Paris, 1668. 4. 2) Seconde lettre de Mr. Lamy pour confirmer les raisons, qu'il a apportées dans la premiere lettre contre la transfusion, à Paris, 1668. 3) Lettre de Mr. Gurge de Montpellier à Mr. Bourdelot sur la Transfusion, a Paris, 1668. 4. 4) Recueil de quelques nouvelles observations de la transfusion du sang et de l'Infusion des medicaments dans les veines, à la Haye, 1668. 12. 5) Pierre*

- Martin de la Martiniere opuscules contre les circulateurs et transfusion du sang. 1668. 6) Claudius Perrault in den memoires der Academies zu Paris vom Jahre 1667.
36. Euryphronis de nova curandorum morborum ratione per transfusionem sanguinis. Paris. 1668. 4.
  37. The lesser throw-in objection was well founded, and this carelessness was one of the reasons that the transfusion sometimes went badly. Birch (histor. societatis. Reg. Tom. II. P. 179) notes one such case, where a sheep died of a burn of the intestines after too much blood was taken in. Blood in the urine occurred in the above-mentioned case of Mr Denis, although without damage. Santanelli (confus. transfusion.) saw death in another for this very reason, and Gurys, (lib. Cit.), a man who also judged this operation very cheaply, believes that the nasty consequences, that have been noticed from time to time after transfusion originated from this excessive amount of admitted blood, and that if one was to promise success one had to admit only a small portion of blood, which could be assimilated into that already let in.
  38. Lettre du C. Gadoys. &c.
  39. Acta philosophica. No. 30.
  40. Chirurgischer Lorbeerfranz. Frankfurt und Leipz, 1692. Theil III. S. 284.
  41. Acta philosophica. No. 42.
  42. De nova et inaudita chirurgica operatione, sanguinem transfundente de individuo in individuum, prius in brutis deinde in homine experta. Romæ. 1668. 4.
  43. A transparent tube was indispensable for the operation, so that one could see whether the blood was flowing properly and did not stop, which would have made the whole experiment incorrect.
  44. Relazione dell' Esperienze fatte in Inghilterra, Francia ed Italia in torno la transfusione dell'sangue per tutto genaro. 1668.
  45. Relazione della transfusione &c.
  46. Confusio transfusionis seu confutatio operationis transfudentis sanguinem de individuo in individuum. Romæ. 1668. 4.
  47. Ephemerid, Natur. curiosor. Dec. 1. obs. 149. Bonet medicin. septent. lib. VIII. p. 769.
  48. Elementa Physiologiæ Tom. II. lib. V. §. 24 seqq. Tom. I. lib. III. §. 8. seqq.
  49. Dissert. med. de clysteribus. Ferrariae. 1691.
  50. L. cit, p. 16.
  51. Galer, di Minerva Tom. VII. p. 153.
  52. Elsholz I. c. p. 48. Etmüller de chirurgia infuforia. I. 1.
  53. Chirurgia curiosa. Tom. III, p. 707.
  54. Acta Philos. no. 30.
  55. Elsholz I. cit.
  56. Acta Philos. no. 30 et 39.
  57. Acta Philos, no. 39.
  58. Chirurgischer Lorbeerfranz. Theil 3. p. 277.
  59. Acta Hafniensia, vol. III. observat. 59.
  60. Breßlauer Samlungen de 20, 1718. p. 994.
  61. ibid. S. 1086.
  62. De praxi medica ad priscam observandi rationem revocanda. Lugduui, 1699. p. 389.
  63. An Expérim. Inquiry into the proprieties of the blood etc. Lond. 1775.
  64. Lib. et loc. cit.
  65. Since this accident had to happen in almost every operation, and it is observed that in very severe cases it resulted in bad consequences; so it is very probable that the coagulated blood clots will be dissolved again and made liquid if they have been driven around in the veins, and that only in a few special cases did bad consequences result from this.

66. Cours d'operations de Chirurgie, à Bruxelles, 1708. S. 498.
67. You can read Franz Klein's dissertation on this: Sanguinea apollineæ palestra acies, quam fine strage furdis auditum, coecis vifum, deliriis mentem, vetulis iuventutem, uxoribus pacem restituendo instruxit autor, dum D. Jo. Vit. Helmuth medicinæ Doctorem inauguravit Herbipoli, 1680, 4. Read Elshols Clyrmatica nova S 59. f. and the above-mentioned writings, which were written in France to support this operation.
68. The manner in which this operation is carried out can be found at Lamzwerde appendix, ad Sculteti armamentarium chirurgicum, where the inventions of Lower and others are cited at the same time, as well as at Heister institutiones chirurgiæ, Amstelodami 1739 P. II, p. 449.
69. Chirurgia curiosa. Tom. III. p. 711.
70. Schmuckers vermischte chirurgische Schriften, S. 335.
71. Nóthige Erinnerungen für Aerzte und Krante, dieden Tripper bellen wollen. Kopenhagen. 1777.
72. Element. Physiolog. Tom. I. lib. III, §. II.
73. C. F. Gramani et aliorum epistolae cent. Rostock et Lips. 1714. 8. Epift. 37.
74. L. cit. Pars II. p. 448.
75. Platners Briefe eines Arztes an seinen Freund. Leipzig, 1770, Theil 1, S. 161.
76. The chyle is fine, truely mild, because it is prepared in the cell tissue. (Thouvenel de corpore nutritivo &c.) But with less respect, it is precipitated by acids, with the fact that this is not fibrous, but exudes rather like a powdered chalk.
77. Anweisung zur Kenntniß und Kur der Kranteheiten etc.. Göttingen. 1774.
78. Medicintsches Handbuch. Hamb. 1770,
79. I. et I. cit.
80. Medicin. Versuche u. Erfahrungen. Leipz. 1773.
81. Prælectiones in Hermanni Boerhave institutions medicas, Viennæ, 1772. Tom. II. p. 83,
82. Beobachtungen über die Krankheiten einer Armee. gr. 8. Altenburg, 1774.
83. lib. cit. p. 371.