DIE TRANSFUSION DES BLUTES UND EINSPREUTZUNG DER ARZENEYEN IN DIE ADERN

DES HISTORISCHEN THEILES ZWEYTES UND LETZTES BÄNDCHEN

BY: Dr PAUL SCHEEL (1803)

A TRANSLATION OF SELECTED SECTIONS OF THIS BOOK BY PHIL LEAROYD

This is the second volume of Paul Scheel's book, which was published in 1803 and is a continuation of his 1802 book of the same name. A third volume with the same title and credited to Paul Scheel but written by J. F. Dieffenbach was published in 1828 after Sheel's death. The three volumes can be viewed or downloaded together as a single 'book' at:

https://wellcomecollection.org/works/z5ng8tnz

As the title 'The transfusion of blood and the injection of drugs into the veins: historically and in consideration of practical medicine' suggests the content covers historical information about both transfusion and infusion, continuing in a time frame that follows-on from the 1802 book (though this book also includes information regarding Italian and Dutch research that Scheel had omitted from that book). In fact, the sections of this volume numerically follow those of the first volume, i.e. starting at §. 86, however, the numbering of the sections of this book contains two errors in that section §. 145 is followed by §. 155, leaving a gap in the numbering, and number §. 156 is repeated twice. I have re-numbered the sections after §. 145 correctly as well as also providing the section numbers as they appear in the book in square brackets in the translation and the index presented below. This index is also not a true translation of the original as it is produced in shorthand-word type format that does not lend itself easily to an accurate English translation. I have therefore taken the liberty of producing a 'modified translation' of the index below that will hopefully make easier reading (and more sense).

The book content includes information about both transfusion and infusion. Although the balance of these two topics was very biased towards transfusion in Sheel's first book, the opposite is true in this second volume. As a result, I have translated only those sections that relate to transfusion events. These can be identified in both the index and translated text presented below – the infusion sections are listed in the index in grey and have not been translated. Although Scheel identifies in his first volume that the effects of the court case in France related to the human transfusions performed by Denis and Emmerez did not completely ban transfusions, the paucity of historical transfusion information presented in this volume would certainly support the belief that it had a devastating effect on subsequent experimentation, even on animals. The transfusion material presented in this book would also strongly indicate that the animal experiments were also biased towards its use to resuscitate the near dead rather than as a replacement for blood loss.

Scheel identifies in the preface to this book that unlike his first volume, he does not comment on the material presented. This does however result in the fact that much of the information presented appears to be a catalogue of 'expanded references' including some that do not even deserve mention as they are of very debatable value. In addition, the information presented on some researchers is in unnecessary detail whilst that of others is identified only as having been published,

and his balanced unbiased comments that were so useful in his first volume are missing from this book.

Even so, it is hoped that this translation will enable it's content to be appreciated by a wider audience. 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. Whilst some of the words / terms used by Scheel are obviously open to interpretation, especially given the date that it was written, I have attempted wherever possible to maintain the author's original meaning, intent and detail, so as to make the translation as 'un-interpreted' as possible. As with any translation the wording may be purposely or inadvertently altered in an attempt to 'make it read better' but in doing so there has to be an element of personal interpretation involving something on the lines of 'I think 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 this English translation does not 'flow' as well as it could. Although I have taken great care not to misrepresent the author's original wording I cannot guarantee that this work does not contain 'translational errors', especially as some letters and words in the original scanned text are not easily readable. The reader is therefore recommended to check specific details against the original German text. I have added an occasional comment in square brackets to clarify some words / terms. All words in italics are as published in the original text.

The references referred to in the text are presented in the original book at the bottom of the respective pages where they appear. I have sequentially re-numbered these and presented them together, as written, at the end of this translation.

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Note: This index includes some dates that are not included within the general text of the translation. The third column provides the page number of this translation.

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History of transfusion and infusion among the French: from 1673 to modern times.

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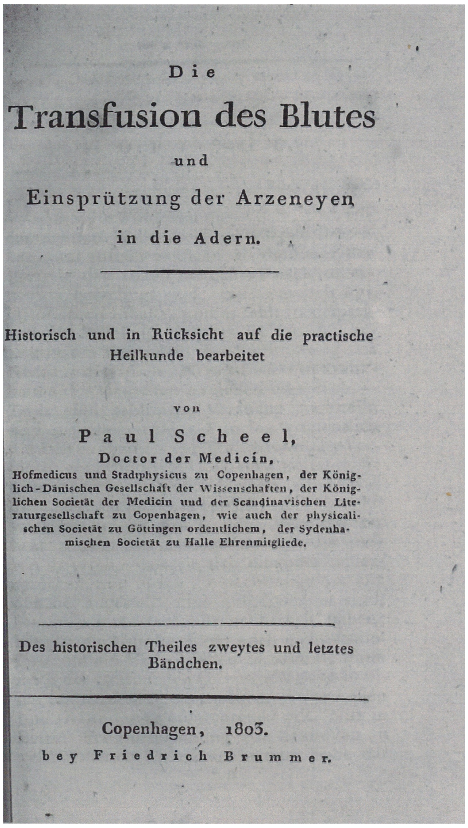
Note: The numbering in the book jumps from 144 to 155 and number 156 is repeated

History of transfusion and infusion in Germany: from 1700 to modern times.

Dr PAUL SCHEEL – BIOGRAPHICAL INFORMATION

Paul Scheel was born on 28th February 1773 in Itzehoe (Holstein), the son of lawyer Paul S. and Cecilie Margrethe Scheel. He was physically weak from his early childhood. He studied natural and spiritual sciences in Gottingen in 1791 and then, from 1794 he studied medicine in Copenhagen as a student of Mathias Saxtorph who, before he had graduated his Medical Exam (in 1796), got him employed as a reserve doctor at the Birth Foundation and then provided him with a Royal Travel Scholarship from 1796 to 1798, during which time he studied obstetrics at Osiander in Gottingen. Returning to Copenhagen, he acquired a Medical Doctorate in 1798 in obstetrics, settled down as a doctor, received the title Hofmedicus in 1801 and was appointed City Physician in 1802. About the same time he collaborated with other authors to produce German translations of the publications of the Danish Society of Sciences (1798-1800), one of which was Transfusion and Infusion (in 1801, together

with E. Viborg). This dissertation he reworked into a detailed monograph: “The transfusion of blood and the injection of drugs into the veins”. In 1804 he was invited to be the Professor of Obstetrics and Gynaecology in Kiel, which he refused. His increasing tireless professional activities, especially as an obstetrician, together with his other extensive social and political commitments, compounded his already feeble physique. He contracted fever and died at the age of 38 on the 17th June 1811.



Die

Transfusion des Blutes

und

Einsprützung der Arzeneyen

in die Adern.

Historisch und in Rücksicht auf die practische Heilkunde bearbeitet

von

Paul Scheel,

Doctor der Medicin,

Hofmedicus und Stadtphysicus zu Copenhagen, der Königlich-Dänischen Gesellschaft der Wissenschaften, der Königlichen Societät der Medicin und der Scandinavischen Literaturgesellschaft zu Copenhagen, wie auch der physicalischen Societät zu Göttingen ordentlichem, der Sydenhamischen Societät zu Halle Ehrenmitgliede.

Des historischen Theiles zweytes und letztes Bändchen.

Copenhagen, 1803.

bey Friedrich Brummer.

Title page of ‘Die Transfusion des Blutes und Einsprützung der Arzeneyen in die Adern’ by Paul Scheel (1803)
(Image credit: Wellcome Collection)

PREFACE

The second volume of this book is, against my will, not the same as the last, and contains less than the reader of the preface to the first volume is entitled to expect: it is only historical content, and lacks the conclusions that I promised to draw from the accumulated experiments, to determine the benefit of infusion and transfusion in human diseases. Although, numerous experiments have been made, and some individual points, namely the applicability of the transfusion in the case of bleeding, are no longer subject to doubt, there are still some important questions to be answered by new experiments, especially as regards the *Chirurgia infusoria*, many of the older ones, by contradicting one another and by the negligent manner in which they are employed and recorded, are of little use to us; so I did not believe I could close the acts and pass a judgment without being guilty of the most criminal carelessness where the life and health of people are concerned. Only with regard to the injection of drugs for various animal diseases have I allowed myself a few suggestions, and here, moreover, contented myself with being the faithful, in part literal, reference for all infusion and transfusion attempts that have come to my attention. In the third and last volume I will try to fulfil what I promised in the preface to the first; this may happen late, but then hopefully for the better; it will contain at the same time a gleanings of what should have been left out of my story, and an addendum to the more recent experiments, of which we can expect many important ones from the Copenhagen Veterinary School. I am most grateful to the writers and experimenters for contributions of all kinds; only with their help can I hope to achieve for transfusion and infusion what I intended.

I will give preliminary news of what is happening especially in the north with regard to these operations in the Nordic Archives for Arzeney and Natural History.

Finally, I cannot help but express my most devoted gratitude to the respected critical journals of Germany for the encouraging indulgent judgment which they made on the first part of this work.

Copenhagen, 29th March 1803.
Scheel.

History of transfusion and infusion among the Italians: from 1665 to the beginning of the eighteenth century.

§. 86.

The active spirit of the Italians did not lag behind the rest of Europe in handling these operations.

If I settle for the fact that the biographers of Paolo Sarpi ascribe the invention of the blood circulation to this in some respects eminent spirit and, besides, the injection into the veins and liver ducts of the blood, then the physician and natural scientist, who was in his day highly respected, is Francesco Folli, the first and most ardent to claim the invention of infusion. If he really was the inventor, as he claims, at least he has this against him, that he made his invention known only late (1680) (1) and besides, he did little to perfect it. The Harveyian writings and the knowledge of the grafting of trees, as he assures us, stimulated in him the idea of the possibility of transfusion in 1652, which could not only cure many diseases but also rejuvenate people and give them an unusually gigantic size. In his writing *della coltura delle vite*, he gave hints about this and, towards the end of 1654, communicated his invention to the Grand Duke of Toscana Ferdinand II, so that he could have it carried out, since in his opinion, should it be successful, only a monarch is worthy of this operation.

For eleven years he heard nothing of it; now that he was no longer living in Florence, he wrote his *Recreationem physicam* (Florent. 1665, 8.) and dedicated it to the Grand Duke so that he might tell him something about his transfusion, since it is easy to conclude from the hieroglyph of the frontispiece and from the matter dealt within that would easily lead to the conclusion that it was written for the defence of transfusion. But since the Grand Duke did not comment on this subject, Follius concluded that he had either not made any experiments on it, or that he did not want to tell him either (2), and therefore remained silent about the matter until after eleven years when he painfully learned that transfusion was being carried out successfully in England. His invention must presumably have been brought there by travelling England. His Stadera is intended to defend it, especially when it came to his attention that Raimondo Gianforti, in his *Consulti e risposti medicinali Cent*. 2, *resp*. 44 (3), and his *Santinellis Confusio* argued against transfusion The reasons which he weighs the readers in his opinions do not stand out from other similar theoretical defences of transfusion of his time; I therefore pass them over. To undertake the operation, he suggests a kind of little funnel made of bone, with a small incision, so as not to compress the open vein of the healthy person onto which it is placed, and from which the blood is drawn into through a tied bladder or intestine, to which a fine silver tube is attached, that is inserted into the patient's vein. Here one must take care that no air overflows with it. If, instead of the intestine, one were to take a prepared artery, one could choose one which has a small branch in it from which the air could exit. The transfusion tube can be left in the patient's vein if it does not cause significant pain, in order to save the trouble of inserting it again. According to his experiments, the blood will overflow well from the bladder, without the need to squeeze it (p. 86, l. c.).

His writing proves in several places that the experiments mentioned by him were not a real practice of transfusion or infusion; so in this respect Folli is still under Major, with whom one can otherwise compare him to in many respects. In addition to a copper plate, which represents the transfusion tools described above, Folli's portrait is reprinted all around with the same decoration of the work; proof of the value he places on his invention. He prefers human blood for transfusion to animal blood, which could cause disadvantages; for example, a dog found to be ill after the blood of a sheep had been passed into it, and because the moist and serous parts of the blood could have caused the dog to have broken out in horns and wool. He judges

infusion favourably, and calls it a daughter of transfusion, that is more beneficial, more pleasing, and more applicable.

If the compatriot and contemporary of Folli, the famous naturalist Redi, had really occupied himself, as the former suspected, with transfusion and infusion experiments, it would certainly not have been without profit for these operations; but unfortunately this is not the case, and apart from the observation made by some that infused air is fatal to warm-blooded animals, whilst on the other hand, there is often much air in the veins of cold-blooded animals (4), I know of no further attempt by Redi.

§. 87.
Fracassati – Infusions, 1667. Not translated

§. 88.
Malpighi – Infusions, 1668. Note translated

§. 89.
As far as I know, Dominicus Cassini at Bologna was the first Italian to perform a transfusion. On 28th May 1667, he let the blood overflow from the carotid of a lamb into the jugular of another lamb, from which as much blood had previously been drained as the vein could give. The vein of the lamb that had received blood were then tied at both ends and cut over. When let free, the animal followed the surgeons, without betraying any weakness; the wound subsequently healed quickly and it grew like the other lambs; but after six months, on the night of 5th January 1668, it suddenly died, and when it was opened, the stomach was found to be excessively full of rotten food. The cut jugular vein was found to have grown together, and a small branch made the union of the upper part with the lower part (7).

§. 90.
Another remarkable transfusion was made on 2nd May 1668 in the house of Mr. Griffoni with the help of the surgeon Mr. Andreas Carasaini. They had a sniffer dog, not very big for its kind, who was thirteen years old and had been completely deaf for three years, who walked very little, and because of weakness could no longer lift his feet, but dragged them on the ground. The blood of a lamb was poured into this depleted dog. After the operation, after being untied, he lay for an hour on the table on which the operation had been performed; then he jumped down and looked for his masters, who had gone into another room. After two days he ran around outside the house, contrary to his habit, with the other dogs; he no longer dragged his feet, and besides the fact that he ate more and with more eagerness, he also began to give clear signs of the restoration of his hearing, by turning to them at the whistling of his masters. On 13th June he had almost entirely regained his hearing; he was much livelier than before the operation, and with regard to his hearing showed only the imperfection that when he was called, he turned back as if the voice came from a distance (8).

§. 91.
In Rome, from October 1667 to January 1668, Ippolito Magnani conducted the following transfusion experiments on dogs:

1) First he performed a transfusion according to Denis's method on one dog into another without doing any harm to it.
2) In the following experiment, the dog that had previously lost its blood received new blood, and with it at the same time, new strength. A year later the dogs lived partly with the experimenter, partly they had run away from him.

3) A dog that was so weak from the loss of blood that the bystanders despaired of its appearance received new life and cheerfulness through new blood.
4) Another, who had only been given new blood twenty-four hours after a similar loss of blood, came to and ran away, although he had been so weak that he had not moved and was carried to the operation. Afterwards he was often found walking again in the street.
5) A dog which had been given too much blood from another dog, vomited from the overcrowding, sweat and the night afterwards, very copious urination.
6) A dog, to which he gave the blood of a sheep in the presence of many spectators, urinated blood and, as he suspects, died because of the excessive amount of blood infused into it. After death, not only were the veins very full of blood, but the bladder was also full of blood. Therefore, one must be very careful in determining the quantity. The estimation of the same according to the time of overflow in comparison with a quantity of blood which has previously been allowed to flow into a bowl is probably not entirely reliable, since the blood flowing into the vein finds more resistance than that flowing into the open air. It has therefore been suggested that a flexible canal of known size should be filled with blood and that this should be pressed into the vein. To this end, Mr. Baldassar Coluzzi would prefer a bladder, one end of which could be squeezed shut with fingers or small pliers in order to force the blood into the veins from the other end. According to Magnani's improvement, three soft pieces of intestine would be used for this purpose, which one puts into each other for greater security. There is no need to fear coagulation so much with arterial blood. Glass tubes are recommended because of their smooth surface and because you can see the blood in them; he broke a glass tube only once because an assistant let go of the dog. The introduction of such tubes into the veins of people is completely painless, as we learned when they were introduced during blood letting. In smaller animals it is better to take the blood from the carotid than from the crural artery.
7) On the 6th January blood from a sheep was transfused into a moderately large, old, extremely mangy dog, which was so dull that it seemed insane. After the operation he was much livelier than before, he walked around and shook himself several times, but urinated blood and died of bleeding because he had accidentally torn his vein with his paws.
8) In the evening of 15th January one transfused sheep blood into a dog, which had previously transferred its own blood to another. So much blood was brought to him too, at the instigation of the spectators, that although he regained his strength after the operation, he turned around in a circle and then lay down in a corner of the room. That night, and also the following day and evening, he urinated a considerable amount of serous blood; he also ran around in a circle with quick steps and trotting, and a noise could be heard in his intestines, like a shaken vessel of water. On the morning of the 17th the dog died. The abdomen was found full of a dark red serum; a similar but darker, somewhat greenish matter was in the stomach; the intestines and kidneys also contained them, but here it was more blood-like. It was also there in the heart, the bladder and the left cavity of the cranium, but here it was thicker. All this sufficiently proves that the amount of blood is too great and explains the origin of the coincidences mentioned.
9) Afterwards, with the caution mentioned above, the transfusion was made from a sheep into an old, very thin greyhound, without any of the above accidents occurring; on the contrary, he received new strength and was constantly well.

As a constant phenomenon in these experiments it was found that the heart changes its pulse rate and beats more frequently as long as the foreign blood overflows, but returns to its previous pulse rate if the overflow of the new blood is stopped with the

finger. This must serve as a warning to us to only slowly overflow the foreign blood, so that the circulation is not disturbed too much.

The remaining part of the text in which these experiments are found (9) are taken from excerpts from the smaller French transfusion writings by Denis, Lamy, Gadroys, and others.

§. 92.

Soon the Italians also imitated the French doctors, who modestly recognize them as their teachers in this regard (just as they (10) do justice to the Germans with regard to the first invention of transfusion and infusion), in the use of transfusion on people. Joh. Guil. Riva from Piedmont, Doctor of Medicine, a respected anatomist and surgeon Clement the ninth, made three remarkable transfusions from animals into humans in 1667 in Rome. I regret that I cannot give more of these important experiments than the following; the court testimony of the fact itself, which was made known not without pomp as follows:

Exemplar Fidei trium sanguinis transfusionum er animalium trium viventium arteriis, in trium laborantium morbis diversis hominum venas, celebratum Anno 1667 mense Decembris Romae, non bestiali more, sed faciliori et humana methodo , prosperoque eventu a Jo. Guil. Riva, Pedemontano etc. A principalioribus comprofessoribus, qui praesentes operationibus interfuere subscriptae et testificatae; legalitate invicti et triumphantis Capitolii munitae, nec non sigillo Serenissimi Senatus, inclitiq. Populi Romani authenticatae. Typis editum pro Transfusionis munimine ad Dei gloriam humanique generis beneficium. Ab aliquibus virtute praeditorum Amicis.

Then follows the document itself, dated the 19th December 1668; signed and confirmed with Eyd by Protomedicus Constantius, the Archial and Professor Trullius, (who testifies to his presence at the transfusion attempted at Dr. Sinibald), the Vice - Protomedicus Petraglia, and the Doctor and Lecturer at the Roman Archigymnasio, Jacob Sinibald, and accompanied by two notary instruments. The aforementioned persons affirm that they were present at three transfusions and were in part assistants, which Riva carried out most skilfully (egregie peractis) from the arteries of three sheep into the veins of three patients on the 10th, 11th and 15th December 1667 according to a method in which the vein neither has to be exposed nor dissected out, but in which one only makes an appropriate and somewhat larger opening in the same with the lancet, as with ordinary bloodletting. In all of them the blood had been seen most clearly overflowing into the vein, with the exception of the second, employed on Doctor of Medicine and Professor Joh. Franc. Sinibald, an already completely abandoned and almost dying consumptive, on who even the famous Fonseca, a fierce opponent of transfusion, had approved its use as in a completely hopeless person. In this case, no blood has flowed out of the opened vein, nor has any blood been brought to him, except for a few drops of coagulated blood which are overdone by pressure with the fingers. Sinibald died not after the operation, but several months later, not from the wound or the flooded blood, but from catarrh, which was already fourteen years old and which was aggravated in winter with fever and ulcers in the lungs.

Of the other two, the one who had been suffering from a quotidian fever for sixteen days, as they say, left after the fever had remained away for a few days, and therefore nothing definite could be said about the failure (11).

Nothing further is mentioned about the third; it seems, therefore, that he has been cured, since he would otherwise have been listed next to the dead Sinibald, or in the case of imperfect restoration, at the same time as the second patient (12).

§. 93.

The second who performed the transfusion on a person in Rome is Paulus Manfredus from Lucca, Doctor and Extraordinary Professor of Practical Medicine at

the Rome Archilycao. We have only insufficient news of this transfusion, even though Manfredi himself wrote a treatise on this subject (13). Not knowing the French transfusion method, he invented the following method himself in connection with the Doctors Camayo and Simoncelli, which he, like Elsner (*Acta Nat. cur*. I c.), who was an eyewitness there, exercised on a feverish carpenter on the 2nd January 1668. He tied (*Manfredi* l. c. p. 15.) the arm as with bloodletting, drew a line with ink over the vein and cut the skin that had been lifted into a fold, brought a thread coated with wax under the exposed vein and tied a silver tube that had been inserted into it (but this ligature is not absolutely necessary as the tube can also be held in the vein with the finger), then this tube is combined with the one introduced into the artery of the animal (14), and the blood is left to overflow. He had tried in vain to use the animal's crural artery for the transfusion and found it too small, so he continued to take the carotid, following the example of the experimenters at Bologna. He says nothing more about success than that one has dissipated as much blood as one wanted without harm (*tantum sanguinis quantum libuit, innocue communicavimus*). The whole operation is no more painful than bloodletting. In order to avoid coagulation of the blood in the tubes, the tube in the human vein must be connected directly to the tube in the artery of the animal; it can also be smeared with human fat (p 28.)

After a couple of unsuccessful attempts, in one of which he found the crural artery of the animal too small, and in the other of which the glass tubes were broken, he finally succeeded on 21st December 1667, in carrying out the transfusion on animals with good success.

The rest of his writing contains nothing instructive for us, and it is on the whole from the fact that it does not contradict the statement of the author in the preface: he wrote it down in three days.

§. 94.

While these experiments were being made in Rome, transfusion found an eager opponent there in the Doctor of Philosophy and Medicine, Bartholomew Santinelli.

"It would be very good", he says (15), "if this operation, which one can see because of its extravagance, that it is a product from abroad, and that will hopefully be smothered in childhood, was limited to animals only, but: *Homo, res sacra, jam per lusum et iocun occiditur et cetera*, from Seneca's epistle against the murder of gladiators." "The operation is," he continues, "abhorrent to be performed on the jugular vein; the one on the arm is better and milder, according to my friend Magnani method; but this also has several complaints." Of the infused blood he says (Cap 3), it is to be ensured that it does not distribute itself properly in the veins and therefore regurgitate or stagnate, as Magnani's experiment with the dog, the dizziness and twisting sickness got from it, and the urination of other dogs, prove. The quantity of the blood transferred cannot be precisely determined (Cap 4). It is cruel to take human blood for transfusion, but it is absurd to expect the blood of cattle to be of benefit in people's veins. When the blood of a ram through its *Partes ercrementitias*, which leads to the formation of horns, claws, wool, etc., if it is certain that in men it does not produce such parts, it is to be feared that it will cause corruption of the more noble parts. With similar reasons, our author goes on to fight transfusion in a few other chapters, whose sister, infusion, is just as unkind. Finally he shows that they are fighting against Hippocrates' doctrines (Sect. 3. C. 2.) and against God's command (C. 4.), which in the books of Moses forbids the inner enjoyment of blood. Nor is it decent for a doctor to use means which are based more on experience than on reasoning, as is the case with transfusion, which has nothing better to say about the objections made than experience, and thereby make yourself guilty of empiricism. In the last chapter Santinelli uses jurisprudence to prove that the practice of transfusion is illegal.

§. 95.
As feeble as the weapons may appear to us with which Santinelli and others like him fought transfusion, they were of importance at the time he was living and made transfusion suspicious in the eyes of the public and the government, and this, to such an extent, that it was forbidden by the authorities (16) to transfer animal blood into humans.

I do not know whether transfusion from one person to another was allowed, and the details of this prohibition. The Parisian transfusion attempts, which had a bad reputation, probably had an influence on the judgment of the magistrates in Rome; for the unfortunate failure of the Roman transfusions on humans does not seem to have caused the overthrow of this operation in Rome, since Santinelli (*l. c.*) reproaches the friends of transfusions in Rome for citing only the experience favourable to them and not enough theoretical reasons themselves.

This transfusion ban in Rome appears to have affected the rest of Italy and deterred its use on people.

§. 96.
Bagliv – Infusions, 1685 - 1700. Not translated.

§. 97.
Lanzoni – Infusions, 1689. Not translated

History of transfusion among the Dutch: from 1668 to modern times.

§. 98.
If I settle for the fact that the well-known Ludewig de Bils, in his so-called *Anatome incruenta*, caused the blood to clot in the veins by injections, and that his follower Tob. Andreä (21) praises the inventor of transfusion and infusion, the famous anatomist Regner de Graaf is the first to perform these operations in Holland. It is just a shame that he does not describe his experiments in more detail, but only mentions them in passing in his writings.

So he tells us for example in his essay *de Clysteribus* (22) that he had happily carried out a transfusion in Delft in the presence of many spectators by means of tubes made of duck bones stuck into each other. This operation would, however, be more easily accomplished if one had used a bird intestine ten to twelve inches long with duck bones or other small tubes tied at the ends.

In the same place (23) he reports that he never saw any good effect from the gradual injection of purifying agents into the veins; he did not yet dare to say with any certainty what to think of the alternates.

§. 99.
Of the writings that appeared in Holland at this time on transfusion and infusion, I have, in addition to a historical text published in 1668 *Ondervinding door de beroemdeste Geneesheeren etc.*, Leuwarden 1663, of which I know nothing more than the title, nor a *Lamzweerde Auctarium ad Sculteti armamentarium* (1672)by the Amsterdam Doctor J. Bapt, there are a number of reports on this subject from the English and French scholarly papers from Lowers, Majors, etc. a. where the transfusion and infusion instruments of Manfredi, Lower and Major are engraved in copper.

Joh. Van Horne dedicates in his *Microtechnae seu methodica ad Chir. Introd.* (Lugd. Bat. 1663 and 1668) of which I only know the third edition of 1675, a paragraph on transfusion, and tells on page 156: he practiced it easily and happily in the presence of many spectators. With regard to their application to humans however, he leaves their value to be put on hold until experience will have more

decided about it. About the same is his judgment on infusion; in a letter to Major (24): he did not find it difficult on dogs, but he could not infer with certainty about humans from such experiments on animals.

§. 100.
Anton de Heyde – Infusions, 1683. Not translated.

§. 101.
It seems out of caution that transfusions were not thought of in Holland even at the time when this operation had the greatest reputation, but on the other hand, the Dutch remained within the limits of moderation in their judgment of them, even at the time when it had sunk into undeserved contempt. At least the judgment of Professor Anton Nuck from Leidner is of this quality, and he is completely fair with regard to its use, which it can bring about in physiology for demonstrating blood circulation and in medicine for saving those who would have bled to death (26). In terms of their application in serious illnesses, it is less favourable to them. He criticizes the transfusion tools of his predecessors for the fact that the communications tube is either too inflexible if made of metal, or too slack if one uses an intestine; he therefore suggests the windpipe of a hen or young duck as equidistant from those two extremes, and depicts his transfusion tube on the last panel, Figures 14 and 15.

Before proceeding, I would like to mention that Barchusen (27) also favourably mentioned transfusion, and from the benefit of the blood ingested through the mouth concludes the good effect of blood transfused into the veins.

§. 102.
Kerkring and van Aalsem – Infusions, 1771. Not translated.

History of transfusion and infusion in England: from 1700 to modern times.

§. 103.
Friend – Infusions, 1703. Not translated.

§. 104.
Colbatch, 1704, Cockburne, Becket and Browne Langrish – Infusions, 1747. Not translated.

§. 105.
Luzuriaga – Infusions, 1780. Not translated.

§. 106.
At the time when the spirit of humanity was beginning to lead the English physicians to the eager investigation of the best means of reviving seemingly death people, transfusions were again sought for this purpose.

Thus, in his *New hints relative to the Recovery of Persons drowned*, London 1785, the surgeon Fuller advised, in addition to the use of electricity, to attempt the transfer of warm blood from the vein of an animal into the vein of the apparently dead man.

Similar suggestions and hints can be found in the *Transactions of the Royal Humane Society*, and in: *An essay on vital suspension etc*. by a Medical Practitioner, 1793.

§. 107.
Among the new admirers of such transfusions in England, Doctor Harwood at Cambridge deserves to be named with distinction. After several previous attempts,

which he had made on his own, he finally made the following experiment in March 1792 on the occasion of his lectures on comparative anatomy, in the presence of his audience. He let a German spaniel dog bleed to death to such an extent that, apart from a few twitches, no sign of life remained, and thereupon passed new blood from the jugular vein of a sheep into its jugular vein. Within a few minutes this restored the animal's life and strength to such an extent that, after the operation was completed, it ran after its master, ate its food and continued to be perfectly well. In another of his transfusion attempts, the dog had got too much arterial blood from a sheep; he felt overcrowded and began to eat grass just as he was put in the open air, to the great astonishment of an old servant who stood by and who seriously believed that the dog was already beginning to become a sheep (34). It wasn't Doctor Harwood's fault that he could not bring about an equally happy resuscitation of a bleeding person by means of a transfusion. Harwood once heard (as one of my friends, Doctor Versmann in Gottingen wrote to me from reliable news) that near the town a man was about to bleed to death from a dangerous gunshot wound. Immediately he packs a calf and a sheep into a cart and hurries to the aid of the bleeding man with his transfusion apparatus (the tubes of which are supposed to consist of veins prepared for this purpose). Unfortunately when he arrived he found him dead and all rescue impossible.

§. 108.
We read the following striking transfusion attempt in *Historical Magazine*, May 1792, p. 167:

At Eye, Suffolk, where no less than twenty people fell victim to the rabies in a short period of time, a young person of sixteen was saved in the following manner. A surgeon, Mr. Russell, who saw the sad condition of the hydrophobic patient and knew how impotent the usual curative method was, opened his vein and let him bleed until he fell down and seemed to be lifeless; then Mr. Russell opened another vein, and gradually let the blood of two lambs overflow into him. The patient gradually came to and not only remained alive, but also gradually regained perfect health and strength of soul.

No matter how slight in the tone of the story itself and the traces of irony may be, so as not to load the just reproach of gullibility on myself, I did not dare to present this case to my readers without having made more detailed inquiries into it. I therefore asked one of my friends in London to inquire about it from men of science, who might have been informed about it, and at his request the famous President of the Linnean Society, J. E. Smith, undertook the business, but in vain; nobody wanted to know about such a wonderful cure for hydrophobia. This is enough said to determine the historical value of this story, which probably owes its origin to a witty mind (for what reason, is unknown to me).

§. 109.
Seybert – Infusions, 1793. Not translated

§. 110.
Seybert – conclusions from these experiments. Not translated.

§. 111.
The famous Darwin does not belong among those who distinguished themselves through experiments on transfusion; His reputation as an astute doctor and original thinker is, however, too great for his mere judgment on this subject not to deserve a detailed citation. In his *Zoonomia* (36) he thinks that at the beginning of a nervous, or so-called putrid fever, when the small pulse and other signs indicate the lack of the stimulus of expansion, a repeated transfusion of about four ounces of blood per day from a healthy person or animal, e.g. a sheep or a donkey will be of great use.

Furthermore, during the illness itself, as long as the stomach is still inactive, it can be repeated every two or three days, until at last one can dare to entrust food to the stomach itself again (1. c. Vol. II. p. 605.). In the case of cirrhosis of the oesophagus or a similar obstacle to nutrition, transfusion must also be used as an aid (l. c. p. 120. 676.); milk or mucous substances could perhaps be used to spray into the veins, but there is still insufficient experience on this.

Thirty years ago Darwin suggested the transfusion to an old man who was suffering from a complete occlusion of the oesophagus; the patient considered it for a day, but then declared that he would rather die quietly, since life was of little value to him. At this decision he remained just as steadfast as Atticus, and thereby foiled Darwin's attempt.

To start the transfusion properly, the blood does not have to be exposed to air, and maintained at its natural temperature, and one must be able to properly determine its quantity. To this end he recommends a transfusion instrument made from a fresh chicken intestine an inch long with a tube as thick as a swan feather attached to one end and a tube as thick as a raven's feather at the other. After the man and the animal have thereby been brought into contact, the intestine, the capacity of which is known, is allowed to run full in portions, and so the blood is pressed into the human vein. To prevent the blood from cooling down, perform the operation in a warm room and hold a 98 degree Fahrenheit warm vessel under the tube. (l. c. p. 604.)

§. 112.
In the Medical Extracts on the Nature of Health; by a friend to improvement (37), a popular work of the kind of which there are not many, can consequently be used to determine the judgment of non-physicians about how transfusion weighs, it is recommended only as the remedy in violent blood flows. Then the author gives a somewhat volatile history of this operation, and complains that it has wrongly fallen into disrepair; at the same time it draws attention to the stimulus which the overflowing arterial blood, in addition to its effect by expanding the vessels, exerts by means of its greater amount of oxygen.

§. 113.
Haighton – Infusion of Mercury. Not translated.

§. 114.
In Doctor Willich's *Series of Lectures on Health*, which I only know from the advertisement in the *Public Advertiser* 1798, the history of transfusion is presented as one of the various means by which one sought to prolong human life.

I would also like to mention on this occasion that James Mackenzie, in his *History of Health and the art of preserving it*, Edinb. 1760, remembers transfusion in a similar manner, and that his judgment of it is very moderate and reasonable.

§. 115.
Latest injection attempts, 1796 - 1800. Not translated.

History of transfusion and infusion among the French: from 1673 to modern times.

§. 116.
Nothing proves better how much in France, after a brief exaggerated admiration, an equally exaggerated contempt for transfusion and infusion so closely connected with it followed, than the judgment made by Peter Dionis, surgeon of Dauphins and lector of surgery in Paris, about allowing the same.

He only carries it out he says (41), to warn against it and to instil a righteous disgust in his audience. All the poor people who would have had a transfusion carried out on them in France have fallen into foolishness and frenzy and finally died. Parliament then forbade it with severe punishment, and thereby put a stop to an innovation which would have caused much harm against the love of one's neighbour and against religion. This horrible operation died again with its inventors, and has now almost been forgotten.

§. 117.
Petit – Infusions, 1710. Not translated.

§. 118.
Helvetius – Infusion, 1718. Not translated.

§. 119.
Deidier – Infusions, 1721.

§. 120.
Quey – Injections of milk, 1735.

§. 121.
Mr. de la Chapelle is the first to bring the completely forgotten transfusion back to light in his preface to *Cheyne's method naturelle de guerir les Maladies*, Paris 1749. He judges that it is set aside too early, and that diligent experiments with it on animals would probably give important results for the maintenance of health and the prolongation of human life. To this invitation to try, he adds on 48 octave pages, a description of the transfusion method and some of the most excellent experiments.

§. 122.
Through the above, La Chapelle gave cause for this subject to be suggested again in a learned paper, the *Mercure de France* (46). An unnamed person, who signed himself to *M. J. P. V. D.*, had a letter indented in the same, in which he put forward some questions concerning the transfusion. The reply to this letter was two letters from Doctor Regent, Mr. Cantwell, the first of which contained nothing more than compliments to the unnamed person and the assurance that he would reply in more detail shortly. In the actual answer he admits that transfusion has not yet been adequately investigated, then raises a number of objections, which are primarily based on the diversity of the constitutions and the blood of different individuals, and in the end admits that everything that can be said against transfusion must first have confirmation from experience before one can consider it important.

All of this had no noticeable consequences with regard to the fate of transfusion and infusion in France.

§. 123.
Regnaudot – Infusions, 1778. Not translated.

§. 124.
Regnaudois judgment on infusion. Not translated.

§. 125.
Lassus, professor at the Surgical College, in his *Discours historique et critique sur les decouvertes faites en Anatomie*, Paris 1783, gives a brief ten pages on the volatile history of transfusion and at the end pronounces a judgment of condemnation.

The judgment given in the famous *Encyclopedie universelle* (T. 41. p. 226. sqq.) about transfusion and infusion, and even the history of these operations, which is

presented there, not infrequently shows traces of the unfavourable opinion which their author harboured about them. In order to criticize historical inaccuracies in this, by the way, very well-written article of that great work, there would not be a complete lack of material.

§. 126.
Bichat – Infusions.

§. 127.
Portal – Infusions, 1800. Not translated.

As regards to the transfusion of blood, Portal judges that it is connected with very many difficulties; one must namely: 1) ensure that just as much blood is poured in again as there is draining, since overfilling the vessels could lead to dangerous accidents and even death; 2) the overflowing blood of another animal must have approximately the same degree of warmth as its own blood, since otherwise it could easily become harmful; 3) run the risk of communicating the diseases of animals to man with their blood; 4) to make the operation difficult in and of itself, for partly it is not easy to insert the tube into the artery of the animal, partly the animals bled easily to death during the operation; the blood in the tubes often coagulates if you don't keep them warm. Finally 5) don't even align much with it; a number of diseases have no effect on the blood at all; moreover, every individual has the blood that is most useful for him and most analogous to his constitution in quantity and quality.

Although Portal now declares transfusion to be a mere medical curiosity, he made experiments with it in order to demonstrate the circulation of blood to his listeners.

He took two dogs fastened to a board and tied a small tube of copper with a tap, which is used for fine anatomical injections, into the crural vein of one and into the crural artery of the other. The communication tube between these two was made of glass. Just as you opened the two taps, the blood overflowed from one dog to the other. However, this attempt failed him three times because the violent movement of the dogs upset the apparatus; but at last he succeeded in tying them as tightly as possible to their board, and he got the following results.

The blood overflowed from the crural artery of one dog into the crural vein of the other; the dog that received the blood made ever stronger movements in order to get away, while the other, which gave blood, became weaker by the same degree. After a few minutes, however, the blood-receiving dog seemed to grow weak; this weakness, however, disappeared again when the jugular vein was opened to allow a proportionate amount of blood to flow out again when he received it from the other dog. Portal continued the transfusion until one dog was almost bleeding to death and near death. The one who had received new blood did not seem to be affected at all by the operation and continued to feel well afterwards.

Portal believes that far more blood can flow out of an animal without killing it if, slowly and in proportion to the loss of blood, a lukewarm liquid, such as water or broth, is brought into its veins while it is bleeding, and he refers in this regard to Lower's attempt at injecting beer.

§. 128.
Injection with types of gases – Societé d'Emulation. Not translated.

History of transfusion and infusion in the Italians: from the early eighteenth century to modern times.

§. 129. Sandris, Pinelli, Pasta and Brogiani – Infusions. Not translated.

§. 130.
Caprezzo and Mazzuoli – Infusion, 1717. Not translated.

§. 131.
Fontana – Infusions, 1781. Not translated.

§. 132.
Few of the newer distinguished themselves by their transfusion attempts as the knight Rosa, Professor and President of Medicine. Faculty of Modena, which his well-known hypothesis of the circulation of blood and the condition of the arteries prompted him, in his opinion, hoped to find evidence in transfusion that the arteries in the living body are not completely full of blood, but that their turgescence depended on a *vapore espansile animale* connected to the blood. This is what gives rise to his strange attempts, he relates in his *Lettere fisiologiche*. It is the famous Scarpa who, as I reliably learned in Italy, was Rosa's assistant, and to whom the operative part of these experiments belongs.

In order to determine by means of a decisive experiment whether the blood vessels are completely full of blood or not, Rosa decided to carry out a transfusion on an animal without having previously drained the slightest blood to make room for the new blood (56). The success met his expectations.

The following is the experiment (57): From the carotid of a male calf, which weighed 156 pounds, the blood was transferred to the jugular vein of a female calf, 141 pounds, weak and trembling with frost on 17th February 1783. The blood flowed into its veins with the greatest ease. The male calf grew weak, the female seemed warmer. As the stream of blood began to weaken, the transfusion was stopped; the male calf passed out (basiva); the female seemed livelier, quickly got on her feet as one untied her, and went about cheerfully. After the former had been weighed again and found to weigh 150 pounds, it was left to bleed, losing over a pound of blood. The latter (the female calf) had urinated twice since it was weighed, perspired considerably after the operation, and seemed almost to be sweating; as it was re-weighed, it was found to weigh 145 pounds; consequently it had got at least five pounds more blood.

It was lively, but gradually began to change, her flanks beat often and strongly, and there was an urge either to cough or to vomit. Half an hour later all this subsided, the animal seemed healthy and livelier. It was to be killed, however, which was done by stabbing the spinal cord on the neck, and by opening the carotids. It had an extraordinary amount of blood, for after death her weight had dropped to 129 pounds.

I cannot decide, says Mr. Rosa, whether this calf would have been able to live with so much increased blood mass: but it lived with it; this much blood circulated in it, and if one accounts for half an hour, where perhaps the lungs suffered a little; so it lived quietly and lively for more than two hours: five pounds of blood, indeed not even four or three pounds, could not possibly have found a place in a calf whose vessels are completely full of its own.

Even more often Mr. Rosa, on whom the transfusion from now on found more and more an eager, active admirer, attempted resuscitation on bleeding animals with the same.

The first attempt of this kind, which was unsuccessful because of the weakness of the animals, was made on 8th March 1783 on two calves. The first of these weighed 97 pounds 6 ounces; after losing about three pounds of blood from the jugular, it convulsed and died. The other weighed 125 pounds; as it had lost a little more than twice as much, it developed very violent convulsions; to make it bleed to death completely, the veins were opened, but no blood came, and yet it did not die until the spinal cord was cut in the neck.

The following experiment with a lamb worked better. The same weighed about forty pounds. After the butcher had made a very large incision (*un fquarcio molto indifcrete*) in his neck, the jugular was opened to make it bleed to death, only taking care that the blood should flow out slowly to avoid the convulsions that tended to follow too rapid an evacuation. The blood ran out completely, the jugular ceased to bleed, the animal passed out, the movement of the heart disappeared, and there was no longer any sign of breathing; the lips were pale, the eyes collapsed, the eyes were cloudy, and the neck and limbs completely slack; in short it was dead or in a deadly faint. Then preparations were made to transfer the blood from the previously prepared carotid of a calf; but one could not find the opening in the vein again, and therefore had to make a second opening further towards the heart. The air in the transfusion tube was first expelled by driving the blood through, then it was brought into the vein and the blood was allowed to overflow, which also flowed into it very quickly. Mr. Scarpa was the first to notice among those present that the blood flowing from the vein into the heart produced a strong rumble in it (*un gran Fremdito*), and clear, very lively pulsation, which was noticed by all those present. As the blood entered the heart, the hand on the sternum felt at first a slight expansion, then a wave-like or worm-like movement of the same, then an untidy and finally a distinct pulsation. The abdomen also began to lift and move a little. The lamb began to move its nostrils, and soon afterwards to respire softly and small, opened one eyelid, and then breathed freely, and opened its eyes, which had become lively again, to the astonishment of all present. The blood ran in until the calf turned pale (*allibbiva*). When the tube was then pulled out, the carotid gave only a few ounces of blood, the calf was empty, and the lamb superfluous with blood; but the latter lost a few ounces of blood from the upper part of the cut jugular. The lamb's vein was then tied up, the skin incision simply unified, and it placed on the feet. The first thing it did was urinate, immediately afterwards it drank, shook its fur several times; when it saw a little dog it was used to living with, it came closer to it to push it and jumped around in the room. His body was a little distended and its appearance changed; it seemed livelier, one might say almost drunk: sometimes it gasped, its flanks went a little, and it had some coughing impetus. The rest of the day it drank several times, and urinated often, but did not eat anything. Some blood was still being lost from the wound because it was not properly bandaged. The next day it seemed more plump and inflated, like its comrades, but it began to live with them again as if in healthy days. The large wound healed in less than twenty days. The lamb gave no sign of malaise, and grew visibly and became extremely fat in comparison with three others of its kind.

Since this experiment was made without preparation, the animals could not be weighed beforehand: the calf, meanwhile, weighed about a hundred and the lamb forty pounds; the former could, in comparison with previous experiments, lose at least fifty ounces of blood from the carotid, while the lamb from its vein could certainly not lose much more than twenty ounces. If you want to do a lot of calculations, you can assume that the calf shed ten ounces of blood during and after the transfusion, so that the lamb received at least forty ounces, hence twenty ounces more than his own. Of this it lost maybe three, four, or six ounces, so it still had over a pound more than its own.

These experiments, says Mr. Rosa (a. a. O. S. 299) prove: 1) that the vessels of a living and healthy animal are able to take up and circulate a much larger amount of blood than they contain in their natural state, without life suffering from it; that consequently the vessels are not entirely full: 2) that one can mix the blood of one animal of various kinds with the blood of another in its veins without harming life: 3) that the resuscitation of an animal that has bled to death and thereby become lifeless is possible through the re-drawing of the arterial blood, of an animal of a different kind.

Mr. Rosa wanted to confirm all of this even more through experiments (58); to this end he again took a fat lamb weighing fifty pounds, opened the jugular vein with more care, and let the blood run out slowly, to avoid convulsions. It shed 23 ounces, then stopped bleeding, and lay with no sign of life, so that everyone present declared it lost without salvation. A calf, whose carotid had meanwhile been made ready for transfusion, was then put into contact with him; the blood overflowed, the flexible tube was full and expanded, and it seemed as if one again felt some movement in the heart of the lamb; but then one began to doubt whether the blood would also properly overflow; the tube was loosened; the spring coils came out of the artery and vein, and it was over five minutes before the apparatus could be set back. At last the blood flowed freely again; it was felt in the vein, with the rumbling (*fremito*) mentioned above and a distinct pulsation. Finally one felt this rumbling and the pulsation also in the precordia; the lamb began to move its nostrils a little; it moved the respiratory muscles of the abdomen; new warmth spread over the whole body; it opened its eyes, and finally came fully back to life. As one felt that the heart was beating as full and as strongly as before, and that the calf was becoming weak, so one stopped the transfusion; the two ends of the vein were tied and the wound was bandaged. The lamb urinated. When it was then weighed again, it was found to have increased its weight by eight ounces, which, not counting the urine left, had increased in blood. It was now running around as if healthy; ate on the same day, and in the evening jumped around with his peers. The wound healed in a few days and almost without festering. This lamb also became visibly fat after the transfusion and grew faster than the other lambs.

In order to make the same experiment on large and at the same time extremely robust and durable animals, Rosa took two donkeys, one dark in colour, large and young, the other small, chestnut brown, aged and exhausted from work he was to receive the blood of the other if he had full veins, but it was decided to give him new blood from the artery of a young bull after he had bled to death from his artery. All three animals were weighed, and then tied on the anatomical table so that they could be brought close to one another.

The jugular of the smaller donkey, which weighed 286 pounds, was prepared, and the carotid of the larger of 421 pounds; very arduous work, because this artery lies so deeply between the muscles of the donkey, and, moreover, is extremely small in this animal, so that it took the skill of a great anatomist (Scarpa) to find it. In the meantime the two wounds were large, and the loss of blood from their smaller vessels was considerable. At last it was possible to unite the two vessels mentioned, and the blood overflowed freely. The transfusion tube, although sewn from strong leather, and having only one small opening to the artery, became very dilated, and pulsed with great force. The blood from this artery was unusually bright red. The donkey that lost it groaned miserably and visibly lost its strength. But since the blood overflowed so well, one wanted to make the transfusion quite abundant, and did not stop with it until the animal was extremely weak, gave only a little more blood, and got cloudy eyes, and until the pulse and that breathing was not entirely absent, but was at least extremely weak, and until, which was worse, the hind legs and thighs had already lost their warmth.

The donkey was on its least legs; and unfortunately the disconnection of the first transfusion apparatus and the reapplication of a new one in its jugular vein to connect it with the carotid of the bull caused considerable hesitation in these large, difficult-to-handle animals. Finally, the transfusion succeeded; the bull's blood expanded the transferring tube, and the rumble and pulsation could be felt in the vein. The donkey now began to give out signs of life again; the abdomen rose; a new warmth spread over the body, the eye became lively again; you could feel rumbling in the chest and a disorderly pulse. Blood was continued to be passed into the animal, and just as it had previously been provided that too much blood was allowed to flow out, so it was now done by supplying too much blood. The bull

weighed almost as much as the donkey, and consequently, as Rosa knew from other experiments, it had a much larger quantity of blood, and yet the transfusion was not stopped until it had given up all of its blood and nothing flowed out of the artery.

The donkey was alive now, but was weary; and just as he had previously suffered from excessive emptying, so now it suffered from overcrowding. They laid him on the ground and began to tie the vein; but the donkey got sicker and fainted and died. When it was opened after death, half-congealed and blackish blood was found in the heart; the vessels as a whole were considerably expanded.

The other donkey, which had received the blood of the one just mentioned, was meanwhile still tied up on its bed; the jugular vein had withdrawn between the muscles, and was always giving blood from its uppermost part. They wanted to prevent it on both sides, but could only be achieved with one; the skin wound was sewn up, and the donkey was left in freedom. He seemed dissatisfied, stood very profoundly, and didn't feel like doing anything. Blood was still flowing from the wound. He was now led into the stable; here he tried to eat, but the movement of the jaw increased the flow of blood so much that the blood flowed off in a stream, and that, as it could not be able to stopped by scattered plaster and bandages, that animal could not eat for several days, but just had to put up with drinking. Finally the congealed blood closed the opening of the vessel itself. It took a long time and over two months for the large wound to heal. Incidentally, the donkey was always well, and became fat itself.

From the difference in the weight of the two animals given, Rosa concludes that this donkey has received at least fifteen pounds more of blood than its own, which would say much in the case of a donkey, an animal distinguished for the narrowness and weakness of its vessels. He estimates the blood lost after the operation to a maximum of five pounds.

To show that it was possible to impart foreign blood without harm, and to double the mass of blood without fatal success, Rosa took a young and fat sheep weighing 89 pounds and gave it new blood from the carotid of a 132 pound calf without giving up the old. The transfusion was continued until the calf began to become dull and until the blood stream became weak. The sheep received all this blood without the slightest movement. He was then bandaged, and weighed again, and found to weigh a good 92 pounds. Once in the open, he soon got up on his feet, but at first seemed stunned, his flanks struck him slightly, his gaze was dull, his eye seemed bristling and a little red. He lay down in a corner of the room and often gnashed his teeth, but gradually things seemed to get better with him: he began to move his feet, looked around with a sore eye and an angry look, and went to a dog and another sheep, and finally set off at everyone who came near him; in short he acted as if drunk or angry. He was brought into the stable: here he was found on the same evening, that is, eight hours after the attempt, eating; he jumped around, was no longer restless, and seemed to be perfectly fine.

On the evening of the following day it was said the sheep is no longer alive. Rosa wanted to convince herself of this, but only found its horns; the keepers of the stable were not there, and no one could say how he would have died; but this is shown with certainty that it has been eaten. Rosa, however, was also satisfied with the imperfect outcome of this experiment, which at least showed that an animal could live for a time with a large increase in its blood mass.

In order to make the same experiment on an adult animal, Rosa took a sheep weighing ninety pounds and six ounces, and let it bleed until it fell over; until then he had shed forty-one ounces of blood, and afterwards another twenty ounces, until at last no more blood flowed from him and he was declared dead by all bystanders and also by the butcher. Then they carried him, as completely limp as he was, to a calf weighing a hundred and forty-six pounds, and let the blood overflow into him from its carotid. During the overflow it caused the rumbling and pulsing already mentioned in the vein; then a mild warmth began to spread over the body; the limp limbs regained

firmness; the animal raised its head, closed its mouth, moved its nostrils and eyelids, and wanted to free itself. When he was brought back to himself, the vein and wound were bandaged, and he was weighed again. He had weighed twice, and yet he had gained a pound and a half in weight and was now impatient to regain freedom. All in all, he had received about seven pounds of new blood from the calf, which had completely bled to death. Rosa says nothing about the further success.

Numerous eyewitnesses were present in all of these and the following experiments.

On 25th August 1783, Rosa attempted a new resuscitation attempt on a 74-pound sheep of one of his friends, to please the owner of San Vittoria. The animal was fasted the morning before, and its jugular vein was then opened. It was bleeding to death earlier as usual, perhaps because of its greater liveliness, because after ten to eleven minutes he was no longer giving any blood and was on the last puff, with closed eyes, open mouth and completely slack limbs. The blood of a fat calf was then passed into it in the usual way. The success was the same: in a minute the mutton opened its eyes, in two minutes it was restored to full life. They bandaged him and put him in the open; at first he staggered, and had no steady gait; but he walked on and, without bothering about anything else, sought to eat something off the bare ground. He did not want to drink, and he hardly tasted any salt. At last he came to the next meadow; here it began eagerly to eat grass, grew stronger, and lost itself grazing in the open field. They wanted to lead him back, but he began to run, jumped over three wide ditches, and hurried to his usual pasture, until at last some farmers caught him at the fourth ditch after he had run an Italian mile. He was panting but not weary. After he had rested a little, he was weighed again and found to weigh 73 pounds, which weight, however, given the eaten grass and the rest of the circumstances after the operation, made it unreliable; but he had apparently received more blood than he had lost. He was locked up; here he remained quiet for three hours; then he ran about briskly as he was seated on the meadow with another sheep; but out of suspicion he did not allow himself to get close out of mistrust, and at last began to run away, jumped over fences and walls and finally over a wide ditch, where his comrade could hardly follow, with whom he was finally caught again at a distance of two Italian miles. Eyewitnesses to this experiment were Marchese Gherardini, Count Greppi, Professors Scarpa and Cerretti, and Doctors Soncini and Viscontini.

Rosa concludes from this that an animal can live very well with the blood of an animal of a different species and constitution; he also complains that transfusion has hitherto been neglected too much, since it could have preserved the lives of so many people, especially those who suffer from the violent blood flow after childbirth, wounds and the like. and which can be saved by sacrificing a calf or a sheep. Calf's blood seems to him the most appropriate for transfusion into a person.

During the transfusion, Rosa recommends that caution is exercised in letting the air from the communication tube be expelled by the blood beforehand so that it is not driven into the veins. The neglect of this precaution caused a young lamb, which had been bled to death in the usual way, to be brought back to life by the arterial blood and to walk again, but only for a short time. For after the operation it got a short breath, strong flanking, seemed to be distended and was hoarse; it shook itself and worked in vain for air; the anxiety increased from time to time; when taking a breath one heard rumbling in the lungs, which steadily increased; the lamb grew weaker and weaker, lay down, and died in less than ten minutes.

The question, whether the mechanical introduction of some fluid which irritates the heart and fills the veins, could at least for a time bring the animal back to life, Rosa tried to decide by the following experiment, from which it became clear that the resuscitation could only be ascribed to the arterial blood. He made a young sheep, weighing sixty pounds, bleed to death in the usual manner, but no more than a faint trace of life and that on the whole it lost no more than twenty ounces of blood; then

he had a syringe full of milk, as warm as it came from the cow, drift into his vein. This seemed at first to produce the same effect as the transfused blood; the animal began to recover from its utter weariness, it took a deep breath and moved: on the second injection the resuscitation did not increase; rather, the animal grew dull; the third infusion of milk finally did not improve the condition, the movements of life ceased entirely, and after a few minutes the lamb was completely dead. The whole quantity of the milk injected was about three pounds. The lamb, which had already become cold, was now opened and the heart, the lungs, and the large trunk of the vena cava were found completely filled with black blood and milk, which were only incompletely mixed with one another.

Rösa also tried to revive a bleeding lamb by injecting it with blood water heated to about twenty-six degrees, but in vain; the animal did not even begin to move again thereafter. From this he deduces that only the *vapour animalis* of the arterial blood is what brings about the resuscitation.

§. 133.

In February 1784 Rosa was given the opportunity to attempt a transfusion on a chamois in Modena. She was five years old, well fed and extremely lively, so much so that he didn't even dare to weigh her as this would weaken her by working too hard. Precisely because the animal was so tender, the decision was made not to let it bleed to death until it was lifeless, but only to transfer a moderate amount of blood from it into a calf. This is also done by means of the ordinary tubes (the windpipe of a goose, which one found very convenient for this purpose), from its carotid into the vein of a small calf. This had just endured a long transport of many miles in the severe winter cold, and was so weak, frozen and powerless that it received the new blood, but with no corresponding success.

The chamois finally began to faint; and now the transfusion apparatus was separated, after having previously reduced the overflow of blood by compressing the vein, and the blood was allowed to flow into a bowl in order to examine the fibre of the same. The animal was now frightened; the breathing became stronger and quicker, with great exertion of the precordia and abdominal muscles; the heart beat weaker and barely noticeable and fainting. The artery was then tied, and new blood was poured into the chamois from the carotid of a large calf through the jugular vein. At first she gave no sign of life, although the blood overflowed freely; but gradually one felt a movement within; the breathing returned, the eyes opened, and the strength returned. In the meantime the blood flowed over from the big calf in large quantities; the chamois began to gasp again, breathing deeply, quickly and heavily. It was feared that it might suffocate, so the tubes were removed from each other. The calf barely gave a few more lots of blood.

The chamois seemed very overflowing with blood and in need of bloodletting; however, to put an end to the operation, the vein was tied up without further ado, the wound was bandaged, and the animal was placed on the litter. It was still difficult to breathe, it seemed numb and thirsty, and drops hung from its nostrils. Two hours later the animal seemed calmer. The following day it had eaten nothing or very little; but it was perfectly calm and tame, and the eye had its natural liveliness; on the third day it finally ate eagerly. Except for the wound, she was perfectly fine on the fourth day, and remained so until two months later she was struck by a horse and developed a large abscess on the shoulder, which was initially neglected and from which it died in the middle of the third month.

One transfusion that was difficult for anyone before him was done by Rosa on a sea turtle weighing about fifty pounds. He peeled off the underside of her skin, prepared a sizable vein of the peritoneum, and passed arterial blood from a calf into it. As soon as the blood came to the heart first, the animal shook itself; the heart seemed at first to become a little rigid and dilated, then it rose and assumed a far greater volume than before. The large arterial trunks (*tronchi arteriosi*) which extend

from the heart seemed to have doubled in volume, there was a great deal of foam in them, and they were moving quickly; in the arterial canals (*tubi arteriosi*) one could not detect the slightest movement either now or during the whole course of the experiment. In the meantime one of the auxiliary arteries was cut, and the blood flowed out of it in a high but uniform leap, and not in bulk as in warm-blooded animals. The turtle breathed more often and more strongly than usual, and its interior began to warm, and the thermometer placed under the heart rose from 15 degrees to 21-22. The heart changed its movements strikingly, and took on the form of its previous slow, successive, undulating movement, a distinct systole and diastole, just as in warm-blooded animals. This movement of the heart was, to be sure, much faster than ever seen in tortoises, but not as fast and as frequent as in warm-blooded animals, and the movement of the blood in the vessels also did not correspond to that of the heart. The stream of blood flowing from the artery was also considerably less than that which overflowed from the transfusion tube into the turtle; and for this reason it took a considerably long time for the calf to bleed to death. Some of the blood which oozed from the open artery of the turtle was caught: it was less warm than the blood of warm-blooded animals, had a mixed smell, like the blood of calf and turtle, and seemed to coagulate only slowly. After the operation, the turtle began to get weaker and weaker; the heart moved slower and weaker; after five hours its movement was extremely slight, the animal was on its last legs, and the next morning it was found dead. Although it was very weakened by the mishandling during the long land transport, Rosa thinks that the warmth of the new blood and the greater expansion of the vessels accelerated death.

He repeated this experiment on another sea turtle, which weighed only 41½ pounds, and was extremely weak from the transport. The result was the same, only the phenomena were less obvious, and the animal lost its strength sooner. Because it was so dull and lost a lot of blood anyway through the wounds that had to be made to remove the shell, they did not open a vein, but let the calf's blood overflow in as long as it wanted, without draining the turtle. The trunks of the great arteries, as well as the auricles and the heart, became very dilated, and the whole body seemed distended. When the overflow of blood finally ceased, the heart sank a lot and gradually moved more slowly. The turtle was now re-weighed and found to weigh 45½ pounds. The body remained distended; but after five hours she was dead (59).

§. 134.
As I was fortunate enough to make the acquaintance of the famous Scarpa in 1800 while travelling through Pavia; he verbally gave me brief news of a transfusion that he had carried out in Vienna in Count Dieterichsstein's house on a bleeding sheep from the carotid of a calf. The success was completely the same as Rosa describes it. The animal became very courageous after the operation, and placed in the garden in the open air, jumped over a wide fountain. Count Dieterichsstein, he told me, came up with the idea of trying many transfusions to see whether the wool could be improved as a result. The device Scarpa used was a sizeable leather tube, like a tobacco pipe, with quills at the end. The flexibility of this tube also affords the advantage that by compressing it one can moderate the flow of the blood. The carotid and jugular are to be preferred to the crural vessels. To resuscitate asphyxia people, one always has to transfuse into the jugular vein.

History of blood transfusion and infusion in Denmark: from 1665 to modern times.

§. 135.
Bartholin's judgment on infusion, 1665. – Not translated.

§. 136.
The famous professor of botany and chemistry in Copenhagen, Olaus Borrichius, went a little further, like Bartholin, because he made real experiments with the infusion. It is a shame that he only mentions them in passing in his academic Oration de Sanguine, which he held on the occasion of the doctorate of 148 baccalaureates in 1676. In this speech he derives transfusion and infusion from Medea, which she may have learned from the Egyptians. After a brief message of the attempts by the French, English and Germans, he tells us that he, too, had tried infusions during his stay in Leiden, but we learn nothing more than that purging agents if they were suddenly and violently injected killed the animal by interrupting the blood circulation, but caused a strong purge by a gradual and slow injection. From practicing transfusion on humans, he is deterred not only by the lack of adequate attempts, but also by the Mosaic Law against the consumption of blood, and he therefore expresses the wish that the theologians should decide whether this prohibition also applies to the medical application of the same.

These are the passages I know of older Danish scholars on this subject. I am not aware of any Swedish writers, old or new, except for a brief mention of transfusion in Professor Murray learned speech in Upsala on the advancement of anatomy.

§. 137.
Our famous Callisen, in his excellent system, does not do complete justice to the newer wondrous art, infusion and transfusion; the former is cited only in passing and without judging its worth; from the latter the unfounded accusations of the opponents of this operation: that it caused nonsense, madness, heated fever, are re-established. In more recent times, however, they have been employed again with some happy success; attempts would have to decide (61).

§. 138.
In view of the great influence which deserving death as a popular writer has on the eradication of medical prejudices, the favourable mention of transfusion in his *Sundheds Journal*, June 1796, p. 37, the friends of this operation will certainly not be indifferent, as it paves the way for its reintroduction in practice. After a brief history of the same, mostly according to Haller, Professor Tode suggests them in the case of very great blood loss and other asphyxia in order to set the heart moving again. Full-blooded people could gladly add some of their excess to it, even from a small artery, if they were bandaged well afterwards. It is, however, necessary to provide a suitable apparatus so that the blood does not clot during the operation.

§. 139.
The candidate of theology, Georg Heinrich Lund, as a writer, did nothing for infusion or transfusion; but I have to cite him as he was about to have his blood transfused because of a facial cancer, if he had not been cured by the cosmetic agent. (See his *Aflandling om Kräfts-Lägedom, Kopenh*, 1797. p. 272.)

§. 140.
The greatest merit for transfusion and infusion in Denmark undoubtedly goes to Professor Viborg, and his careful and systematic attempts, which are just as numerous, make an epoch in the history of infusion.

He practiced transfusion as early as 1791 on the occasion of the investigation of the snot disease in horses [i.e. equine influenza], among other important experiments which testify to his equally beneficial observational spirit and zeal for science. In order to decide on the infectiousness of the blood of snotty horses, he brought considerable quantities of blood from a sick horse to a healthy horse several times, sometimes directly with a flexible tube, sometimes by means of injection with a bladder (62), with the following success:

First, on 15th October 1791, he passed the blood of a snotty sixteen-year-old mare through a flexible tube into another healthy seventeen-year-old mare. He often took the tube out of the vein in order to convince himself that the blood was flowing, and through this and through the increasing smallness of the pulse in the horse whose blood was drawn, and through the fullness of the same in the healthy horse, whose blood vessels opened on the opposite side, he was given sufficient assurance that the transfusion was really going on. Up to 5th November, three weeks after the operation, no sign of illness could be noticed.

Therefore, on 6th November, four pounds of blood were drawn from the outer jugular vein of a horse, which had the highest degree of snot and worms, into a bladder lying in lukewarm water, and this blood was pressed into the right jugular vein of the mare mentioned, without opening the vein on the opposite side. The pulse became fast and small, but soon afterwards it became natural again. In the 7th one noticed accidental fever, and on 8th November it was limping with the left hind foot, which swelled up to the hock. On 9th November the limp disappeared, but the tumour remained; the incidents of fevers increased and the horse got clear incidents of snot (for a more detailed description, see ibid.), and died on the sixth day after the injection of fever and profuse sweat.

Professor Viborg repeated this experiment on three old but healthy cart horses, with the blood of a gelding, which had the snot to an undoubted degree. One horse received a quart of blood into the jugular vein on 13th October 1792, in the manner just described. From this it developed a fever, with fast and small pulse. After twelve hours, however, it was well again. After six to seven days the lymphatic glands under the jaw were found to be unusually large, and the horse received several undoubted coincidences of snot, whereupon it was killed for anatomy.

The other horse received only half a quart of the blood mentioned on 15th October, from which there was no noticeable fever, and the pulse was hardly noticeably quicker. Even after six weeks there was no sign of contagion in life, nor was it found, killed and opened.

On the 22nd October the third horse received three nodules from the blood of that snotty gelding in the jugular vein, but by mistake at the same time with some air that was in the bladder. Immediately afterwards the pulse became so fast and small that you could hardly feel it. The horse snorted heavily, threw a lot of dung and would not eat; however, these coincidences barely lasted eight hours, so that, in Professor Viborg's opinion, they can only be ascribed to air. Until the 27th October it was as usual; then it got a watery discharge from both nostrils, and finally the snot of which it died on 31st October in heavy sweat.

§. 141.
Viborg – Infusions. Not translated.

§. 142.
Viborg – Infusion experiments with Arnica. Not translated.

§. 143.
Viborg – Infusion experiments with gum Arabic. Not translated.

§. 144.
Viborg – Infusions. Not translated.

§. 145. [155]
Abildgaard – Injection of gases [155]. Not translated.

§. 146. [156]
My own attempts at transfusion and infusion are neither as numerous nor as important as I would have liked.

My first attempts at transfusion, from the crural artery of a cat into the jugular vein of a dog, and from the same artery of a young pig into a dog, failed because of the smallness of the arteries into which tubes of moderate diameter could not be inserted, so that I turned to silver tubes I had to take refuge in such delicacy that they clogged up with the blood and did not let it overflow. The following attempt worked a little better:

On 25th January 1796, in the open anatomy room of the veterinary school, where the warmth was almost on the ice, I let the blood of a three month old dog, who weighed 27½ pounds, run out of the opened external carotid until it stopped flowing, until there was no pulse and breathing, and the pupil was extremely dilated. This happened in about five minutes. I then tied both ends of the artery and let blood overflow into the jugular vein by means of a flexible tube from the carotid of an old horse intended for anatomy, which Hert Kuhn had meanwhile prepared. The tube in the horse's artery gave three ounces of blood in half a minute, so that since the dog remained in contact with the horse for about six minutes, it can be assumed that about 30 to 36 ounces of blood were spilled into it. As the new blood got into his veins, his pulse and breathing returned, and the dog grew livelier. After the mentioned time had passed, the transfusion tubes were separated, the wound was cleaned and it was stapled together with a few stitches. The pulse that had previously beaten eighty times in a minute was now two hundred and hardly countable. A quarter of an hour later it was 170. The dog was aware of it, lay quietly on its bed and, when called, lifted its head. He didn't want to eat or drink. He remained in this condition until half past seven in the evening, when he became more restless, rose to his feet, but soon lay down again, and died of convulsions.

At the autopsy on the following afternoon, the wound was found blackish, the heart and vessels not overly filled with blood and not noticeably inflamed. The blood had coagulated a little; the lungs paler as usual, and healthy, except for a few yellowish spots; the liver very large, and especially in some places darker in colour, with yellowish, as if gangrenous, areas therein. The gall-bladder was very full of natural bile, the stomach full of food, incidentally, as was the whole intestinal canal in its natural state; the brain is not very bloody.

Was it an excessive amount of flooded horse blood that killed this animal? Calves weigh 160 to 170 pounds and, according to Rosa's experiments, contain about five to six pounds of blood (1. c. p. 123. sqq); Boyle found only 1½ pounds in a 30½ pound lamb, and only 5¼ pounds in a 118 pound sheep (Phil. Trans. N. 191. Dec. 1680), and according to Drelincourt (Canicidium 1) a bulldog had only about five pounds of blood. According to this ratio, the three pounds of blood flooded over would have been far too much for such a small and young dog. Since, however, no sign of excessive plethora was found after death, the horse's blood must have overflowed less strongly into the dog than into the glass in which it was caught before the transfusion. Or did the dog just die from the consequences of the wound and the dissection of the artery, which I, an inexperienced surgeon, did not do in the best possible way, and from the consequences of the nerve that was tied off at the same time as the carotid? In experiments on dogs, the pain and fear which they endure must be taken into account, since these animals are often more sensitive than one imagines. Prof. Viborg saw a dog from which a not very significant cystic tumour in the abdominal muscles had been extirpated without bleeding during the operation.

The brother of the above dog was drained of blood from the jugular vein on the same day until no respiration and no pulse could be felt. It was almost half an hour before he was completely bled to death. He was then brought into connection with the carotid of a horse; the blood flowed well into the dog's jugular vein, but without bringing it back to life. When the dog had finally been given up as completely

lifeless, one tried the galvanic stimulus on the thigh, but without being able to cause the muscles to contract. The *jugular vein*, *vena cava*, and the *sinus venae cavae* were found to be extremely full of blood; the heart was also very large and contained clotted blood.

Mr. Prof. Abildgaard and Viborg, Assessor Rafn, Dr. Smith and several other gentlemen were present

Probably, partly the combined too much debilitating effect of the loss of blood and the cold, partly the too violent and rapid refilling of the heart from the large carotid of the horse, which suppressed the still backward life of this organ more than it made it work, was the cause of this resuscitation attempt failed.

[Note: The rest of this section contains infusion experiments and has therefore not been translated – PL]

History of transfusion and infusion in Germany: from 1700 to modern times.

§. 147. [156]
Khon – Infusion into people, 1701. – Not translated.

§. 148. [157]
Bohn – Infusion of air, 1710. Not translated.

§. 149. [158]
Chilian – Infusions, 1718. Not translated.

§. 150. [159]
In his *Conspectu Chirurgiae* (Halle 1721. 4. p. 527), Johann Junckers, practicing physician at the Halle orphanage, there is a section on the transfusion of blood and infusion on four pages. He describes these operations and limits their use to violent blood flows alone.

The Professor of Medicine, Doctor Fürstenau, also admits a few pages to these operations in his *Desideratis Medicis* (Leipz, 1727, p. 444). With R. J. Fortis he contradicts the possibility of rejuvenation; otherwise he does not express his judgments decisively.

Neither can we be satisfied with what is going on in Heister's *Institute. Chir. Cap*. 14. from transfusion and infusion takes place; all the more so since it is only written to others. Of the former he judges exactly as Peter Dionis (see above); the latter, he thinks, can perhaps be used with patients who cannot swallow because of apoplexy or angina, and milk, broth, and even the blood of another animal can be sprayed into the veins of patients who are exhausted by strong blood flows. He mentions the better transfusion apparatus with flexible tubes, but itself (1. c. Tab. XI.) depicts a very imperfect apparatus made up of two short straight metal tubes.

§. 151. [160]
Haller und Sprogel – Infusions, 1751. Not translated.

§. 152. [161]
Kersting – Infusion, 1770. Not translated.

§. 153. [162]
Brinckmann suggests infusion in asphyxia, 1772. Not translated.

§. 154. [163]
Köhler, Löseke and Lieberkühn – Infusions. Not translated.

§. 155. [164]
Hemman – Infusions, 1778. Not translated.

§. 156. [165]
Blumenbach – Injections of gases, 1783. Not translated.

§. 157. [166]
Siebold – Infusions, 1789. Not translated.

§. 158. [167]
Abrahamson – Infusions, 1789. Not translated.

§. 159. [168]
Meckel attempts to infuse pseudo-deaths. Not translated.

§. 160. [169]
Girtanner – Infusions, 1790. Not translated.

§. 161. [170]
Metzger's judgment on transfusion and infusion, 1792. – Rougemont, Arnemann, and others, 1793-99. Not translated [provides a comment on references only – PL]

§. 162. [171]
Häfener – Dissertation on Infusion and Transfusion, 1798. Not translated [provides a comment on references only – PL]

§. 163. [172]
Hufeland – Recommendations on Transfusion and Infusion in Asphyxia, 1799. – Kausch's criticism of this proposal. Not translated [provides a comment on references only – PL]

§. 164. [173]
Richter – Use of transfusion, 1785, 1801. Not translated [provides a comment on references only – PL]

§. 165. [174]
Balek – Infusions in two people, 1784, 1802. Not translated.

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2. An der Stelle seiner Rec. phyf. die auf die Transfusion Bezug hat, sagt Follius p. 47. Die Kunst der Wiederverjüngung sey nicht so schwer, wie man glaube. Dass ein Greiss von hundert Jahren die Haare gewandelt und noch vierzig Jahre länger gelebt, und dass ein andrer dreymal wieder jung geworden sey und 340 (!) Jahre gelebt habe, erzähle die Geschichte. “Lasst uns also, fährt er fort, unverdrossen auf ein Mittel sinnen, wodurch Ars brevior, vita longior werde, und zugleich darauf, dass wir durch ein frommes Leben die ewige Seligkeit verdienen mogen". Er habe 1654 dem Grossherzog hierüber seine Gedanken mitgetheilt, habe aber, da er unterrichtet worden sey, dass Fr. Redi mit Zu.ziehung dieses Fürsten eine Menge Versuche, namentlich über das Viperngift anstelle, von der ganzen Sache geschwiegen, um nicht, im Fall der Grossherzog auch daraber Versuche angestellt habe, ihm vorzugreifen.
3. Dieses Werk ist mir nicht zu Händen gekommen.
4. Redi Lettere a Nic. Stenone, 4 Febb, 1667.
5. Fracassati epist. de Cerebro in Epist. Anatom. Malpighi et Fracassati. Amst, 1669. 12, p. 233. 251. u. w.
6. De Polypo cordis; in ej. Oper. L. Bat. 1687. T. II.
7. Giornale de’ Literati per il Tinassi 1668. N.7.p. 91: Rilaz del successo di alcune Transfusione di Sangue fatto negli animali.
8. Giornale de'Litterati, a. a. O.
9. Relazione dell' Esperienze fatte in Inghilterra, Francia ed Italia intorno la famosa tr. del sang. Per Nicolo Angelo Tinassi. In Roma, 1668.
10. Manfredi u. a.
11. Aliorumquo duorum alterum, sexdecim dierum quotidiana laborantem, ut nobis prolatum fuit, post aliquot dies cum febris intermissione dubios sui de eventu nos relinquentem discessisse.
12. Acta Nat. Cur. p. 325. An. I. in welche es durch Joach. Georg. Elsners Mittheilung eingerückt ist.
13. De Nova et Inaudita Medico Chirurgica Operatione sanguinem transfundente etc. Romae 1668. 4. 32 S.
14. Eines Widders, der Kupfertafel zu Folge, denn die Beschreibung der Operation selbst ist so flüchtig und kurz geschrieben, dass die Art des Thieres gar nicht angegeben wird.
15. Confusio Transfusionis etc. Auctore B. Santinelli, dedicirt an den Prinzen und Cardinalen Rospiglioso. Rom 1668. 8. 139 S. S. 7 und 11.
16. S. Mercklin de ortu et occasu transf. sang. Cap. VI. p. 83, wo er sagt, es sey: aliquot abhinc annis, (er schrieb ohngefähr 1670) Romae, et ni fallor Lutetiis quoque Parisiorum publice interdictum, ne quis posthac circa sanguinis e bruto in hominem transfusionem faciat experimenta. Er führt zwar keinen Gewährsmann für sich an, aber da er damals, laut seiner Vorrede, gerade aus Italien zurück kam, so konnte er von der Sache unterrichtet seyn.
17. Bagliv Diss. de vesicantium usu et abusu, Cap. I.
18. Ej. Dissert. varias, Diss. IV. N. XII.
19. Dec. III. An. 9-10. Os.21. und 204.
20. Acta Nat. Cur. Dec. UI. An. 9-10. Obs, 21. und 204. und Ej. Animadversiones variae ad Medicinam, Anatomiam et Chirurgiam facientia. Ferrar. 1688.
21. Bilanx Bilfiange et Clauderianae balsamationis, p. 89.
22. L. Batav. 1668. p. 210. seiner Oper. omn.
23. Oper, omn. p. 231. de usu siphonis.
24. S. dessen Chir. Infusor. placidis cl. viror. dubiis impugnata, pag. 62.
25. Pag. 187. Obs. go.

26. Nuck Operationes et experim. chirargica, L. Bat. 1696, geschrieben 1692, der Dedicacion nach zu urtheilen. Pag. 166.
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29. Further considerations concerning alkali and acid, Lond. 1704.
30. Of Sea sickness, p. 115.
31. Becket Collection of tracts, p. 44.
32. Physical Experim. upon brutes etc. London, 1747. p. 152.
33. Luzuriaga Inaug. Diss. Edinb. 1780. p. 26. Sie findet sich nicht in der Delectus Diss. Edinensium, ich bin daher genöthigt, diese unvollständ ge Nachricht aus Seybert bald anzuführender Schrift aufzunehmen.
34. S. den Brief des Cav. Cetti aus London, in Sammlung Phys. Aufs. von einer Gesellschaft Böhmischer Naturforscher; herausgegeben von J. Mayer. 3r Bd. 1793. und Medical extracts on the nature of Health. Vol. III. p. 657.
35. S. dessen Inaugural - Dissertation: being an attempt to disprove the doctrine of the putrefaction of the blood of living animals. Philadelphia. 1793. 8. 78 S. auf der 40sten Seite.
36. Vol. I. Sect. 32. Lond. 4. 1796.
37. A new Edit. Lond. 1796. 8. Vol. III. p. 653.
38. On pulmonary consumption. Sec. Ed. Lond. 1799.
39. S. §. 31 dieser Geschichte, T. I.
40. Dessen Einspr. v. Quecksilber, s. l. c. §. 67. p. 194.
41. S. dessen Operations, 8te Demonstrat.
42. S. dessen Lettre d'un Médicin des Hopitaux du Roy, Namur 1710. p. 22, 23, 33, 34. 37.
43. T. II. p. 75. 81.
44. Hist. de L'Acad. des Sciences, 1718. p. 231.
45. Deidier sur la bile des Cadavres pestiforés etc. Zuric, 1722.
46. May, pag. 158-161. und 63.
47. S. Schillingii comment, de Lopra ex recens. J. D. Hahn.
48. Herholdt und Rafns Auszug, 2ter Th. p.9 et sqq.
49. S. dessen Mémoires sur plusieuri Maladies, T. II, p. 268 sqq. Paris 800.
50. Bulletin des Sciences par la Soc. philom. An 5. N. 3. Mellin Mag. Encycl. An. V. Messidor 15. pag. 16. Voigts Magaz, f. d. Naturkunde etc. 1 Bd. 3 St. p. 26.
51. Der verdienstvolle Hofrath Voigt übersetzt dies (a. a. O.) durch: “mit einem schaumigten Blut gefüllt und von der eingeblasenen Luft geschlagen“, und bedient sich des letzteren Ausdrucks, um eine Hypothese damit zu bekräftigen, nach welcher er die nachtheilige Wirkung der eingeblasenen Luft aus ihrer plötzlichen Explosion im Herzen nach einer vorhergehenden starken Compression in den Adern erklärt, wodurch das ganze System in Unordnung gebracht werde. Das Unrichtige der Uebersetzung lehren die Französischen Worte; gegen seine Erklärungsart der angeführten Erscheinungen aber ist hier der Ort nicht Einwendungen zu machen.
52. T. VII. Parte V. p. 153.
53. Fontana opuscoli scientifici, Firenze 1783. p. 172. Dass sich der ungünstige Erfolg dieser Versuche recht gut mit der eben erzählten glücklichen Infusion au jenem von der Viper gebissnem vereinigen lasse, hoffe ich in der Folge zu zeigen.
54. L. c. T. II. p.110.
55. A. a. O. S. 130. und Append. 337.
56. 1. c. p. 77.
57. a. a. O. S. 121.
58. A. a. O. S. 300.
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61. L. C. p. 313. T. I.
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68. A. a. O. T. III. p. 232.
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