LA TRASFUSIONE DEL SANGUE

BY: Dr ENRICO MORSELLI (1876)

A TRANSLATION OF PAGES 1-46 BY PHIL LEAROYD

The book 'The Transfusion of Blood' by Enrico Morselli was published in 1876 in Torino [by Ermanno Loecher]. A copy of this 603 page book can be viewed or downloaded at:

https://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwid0bP47LjtAhWjQUEAHVIcAGsQFjAAegQIBBAC&url=https%3A%2F%2Fbooks.google.com%2Fbooks%2Fabout%2FLa_trasfusione_del_sangue.html%3Fid%3DfsSCHAAACAAJ&usg=AOvVaw34K7fEHvePNeTOjTl-TuMj

This book contains a preface (though it is not titled as such) where Morselli identifies that the work is an extension of his medical thesis (which he had submitted in 1874).

The first section of the book contains an introduction where the author identifies that he originally thought that a chapter on the history of blood transfusion was not necessary as it had been covered by many other authors, but states that he changed his mind, arguing the usefulness of history in clarifying its role in establishing the stages of the development of information that is currently known, and states that he intends to use it in this way. He develops his theme by making the point that after falling into disrepute following Denis' trial in France, blood transfusion has moved into what he calls the 'scientific method', whereby it has become influenced by advances in physiology and blood chemistry, enabling the transfusion of blood to also advance practically. To illustrate this he makes the excellent point that the early transfusions were performed on patients suffering from diverse conditions, none of which included acute anaemia due to haemorrhage and none of which involved the transfusion of human blood. He states that the early misuse of practical blood transfusion, due to the influences of Aristotle, Hippocrates and Galen, has changed over its history related to the "question of limiting its use to its true indications". Having provided this information and exemplified the changes, he then identifies in the last section of this chapter how transfusion is again being used for a variety of different clinical conditions, the majority of which do not include post-partum haemorrhage and acute anaemia! – a case of 'history repeating itself'.

The format of the chapter on the history of blood transfusion in this book follows the same pattern as that used by other authors in that it starts with a discussion as to the origins of transfusion, including information on Medea, Pope Innocent VIII and Francesco Folli, followed by information relating to three time periods, the '17th century' (i.e. 1665-1668), the '18th century' (i.e. 1669-1818) and the '19th century' (i.e. 1819- 1875).

I have translated the introduction and historical chapter of this book from the original Italian 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. I have purposely produced this translation to be 'un-interpreted', in that I wanted to maintain the author's original meaning / wording as much as possible. As with any translation the wording may be purposely or inadvertently altered 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 believe that this is what the author is actually trying to say'. I wanted to

avoid that as much as possible and try to present what the author actually wrote and as a result the reader may find that the English text does not 'flow' as well as it could. Whilst some of the words / terms originally used are obviously open to interpretation, I have attempted wherever possible to hopefully maintain the author's meaning, intent and detail. 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' and the reader is recommended to check specific details against the original Italian text.

I have included Morselli's actual spelling of the names of people and clinical conditions as they appear in the book and where necessary have added amendments or explanations to these in square brackets directly after. I have maintained the original paragraph settings. The references to the text within the book are included at the bottom of each page. I have sequentially renumbered these and placed them, as written, at the end of the translation. Morselli makes the point that much of the information included throughout the book is not necessarily separately referenced but identified in the text by author / date and refers the reader to the extensive bibliography included at the end of the book. I have therefore also included this bibliography, reproduced as written, and included it after the references to this history chapter. It should however be noted that this extensive bibliography frequently lacks the titles of the work, and specific details of the reference and relates to the whole book and not just the first chapter.

It is interesting to note that the book also contains a chapter on the different types of equipment used to perform blood transfusion at the time of writing (see separate translation) and that the author uses an illustration of a transfusion device developed by Moncoq on the title page.


L A

TRASFUSIONE DEL SANGUE

DEL

Dott. ENRICO MORSELLI

con 25 incisioni.

ROMA TORINO FIRENZE

ERMANNO LOESCHER

1876.

Title page of La Trasfusione del Sangue (1876)
(Image credit: Wellcome Collection)

Enrico Morselli
(Photo credit: en.wikipedia.org)

ENRICO MORSELLI – BIOGRAPHICAL INFORMATION

Enrico Morselli is best known for his work as a psychiatrist and not for his book on blood transfusion. He was born on the 17th July 1852 in Moderna. His father died in 1855 and as a result was influenced by a great uncle who helped with his early education placing him in a private high school in Moderna. He subsequently studied at the Faculty of Medicine and Surgery at the University of Moderna, where he was taught by the zoologist Giovanni Canestrini and the anatomist Paolo Gaddi. He graduated in July 1874 with a thesis titled 'Blood Tranfusion'. It is this thesis which was later published as 'The Transfusion of Blood' by Loescher in 1876, a process which he describes in the preface. Within the book, he provides information relating to the lack of effectiveness of blood transfusion in the treatment of psychiatric patients, already therefore relating it to his career interests. On the 15th August 1874 Morselli was hired as a voluntary assistant at the Asylum Institute of Reggio Emilla. A few months later he obtained a post-graduate post in anthropology at the Institute of Higher Studies in Florence under the guidance of Paolo Mantegazza, the founder of the Italian Society of Anthropology and Ethnology. In February 1877 he married and moved to Macerata where he has been hired as Medical Administrative Director of the Asylum of S. Croce, and in 1880 he became head physician and forensic psychiatrist at the Turin Asylum. In 1881 he founded the Journal of Scientific Philosophy. He taught various disciplines over the years, including psychiatry, forensic psychology, experimental psychology and anthropology and became famous for a number of his publications. During this time however he never returned to blood transfusion and died in Genoa on 13th February 1929.

Additional information regarding Enrico Morselli' life and career can be found at:
https://it.m.wikipedia.org/wiki/Enrico_Morselli
https://web.uniroma1.it/archiviostoriapsicologia/enrico-morselli

INTRODUCTION

This work was presented in July 1874 as a free doctoral thesis at the Medical-Surgical Faculty of the University of Modena, and as such it obtained approval with honours and was deemed worthy of printing by the examining commission. However, since then it has had many modifications, I have made many additions to it, so that I can now regard it as an entirely new work. I have not failed to keep track of the continuous progress of science, and therefore I offer my colleagues a paper, which represents the current state of medicine, both in relation to blood transfusion, as well as in regard to all questions of physiology, anatomy, pathological and clinical, which have relevance to it. I will not say that my book fills one of the usual gaps, since I know how fast and swirling the scientific movement is today: but, after reviewing, reading and studying almost all the most recent publications on the subject, I am convinced that I have more than any other developed my theme in its entirety. My aim was not to publish new and original ideas: since a serious and impartial criticism of blood transfusion is not what I intend, it was enough for me to know and judge what others had done. Now I can say that my predictions of July 1874 have come true. Since then I have formed a severe opinion on account of certain enthusiasms and easy illusions, which have occupied the entire medical press in recent years: and today I see my ideas supported and advocated by very distinguished doctors and physiologists, such as Landois, Panum, Ponfick, Billroth, Meyer, Morton, Moutard-Martin, Paul, Labbée, Kuester, Chadwick, Mantegazza. This is certainly the finest reward that I could have expected for two years of continued work.

Florence, from the Archspedale of S. Maria Nuova,
20th December 1875.
E. Morselli.

THE TRANSFUSION OF BLOOD

Before accepting the practical applications of any scientific doctrine, it has always been considered necessary to deeply calculate its importance, studying the facts that refer to it and subjecting the theories to the examination of experience. This need is certainly greater for applications of therapeutics than for any other part of medicine.

In therapeutics we move away from the clouds of abstraction and put ourselves on the real path of medical experience. Rich in the knowledge that study and practice have learned in us, we have a duty to make the best and most sensible use of it in the bed of the sick. Useless and harmful is that therapeutic doctrine that receives no confirmation where it claims to expect it. And for any curative method to have the right to take its place in the arsenal of science, it must meet the following needs:

1. it is in accordance with physiology;
2. relies on the facts established by pathological anatomy;
3. offers the least possible inconveniences for its applications;
4. meets the precise indications of the disease;
5. is in harmony with the laws of the true clinic.

It is good to take care of this fundamental knowledge before undertaking the study of a therapeutic method of palpitating topicality such as blood transfusion. In the last three or four years this practice has acquired such a vogue, especially for

some of the clinicians in Germany, that it is feared by many that its importance and indications are not exaggerated.

Is it therefore prescribed that no period of medicine should be exempt from these harmful exaggerations? I believe that in the errors and oversights of the past there are too many reasons for sometimes painful experience in modern science, to proceed cautiously in the application of a therapeutic aid such as blood transfusion. Many times medicine has had to destroy the legacy passed on to it through the centuries, and often unfortunately it has felt the need to tear down vain idols surrounded only by the prestige of authority.

And must the same also happen to the transfusion, which contains in itself so much good that we can rightly expect immense advantages? We have seen with immense pain a rash charlatanism take over the resources of science this time, and drag it into the trivial publicity of the layman. Science - and this is indisputable for us - has its modesty: it has problems, methods, research, which in order to develop widely require the quiet sphere of the clinic and the laboratory. And in the current state of science, it will be convenient to first place the control of experience before the dubious successes of too broad applications.

What we will have to insist on in particular in this work is the exaggerated desire for innovations, of which the indications of blood transfusion have gradually moved away from the fundamental bases of physiology and pathological anatomy, to enter a much newer path, the greater the number of transfusers.

Now we ask whether it will not be good, once and for all, to plumb the bases on which the scientific doctrine of transfusion rests, and relying on experimental data to see if it can correspond and in what degree, to the hopes and illusions aroused.

However, we do not hide the serious difficulties that oppose a work such as ours, which brings a severe examination of many concepts currently considered to be in agreement with scientific knowledge, and which, as we hope to be able to demonstrate, are instead in complete disagreement. with the most fundamental facts of pathological physiology: but from this moment we do not hesitate to declare that many illusions will be destroyed and in the future, blood transfusion will be returned to its true physiological indication.

In recent years, blood transfusion has become the indispensable and, so to speak, fashionable subject. Writings, articles, magazines follow one another in a truly whirlwind way; and, remarkably, the writer is often not aware of repeating what was already said a thousand times before, of re-establishing what is very dated. Thus an overwhelming number of works on blood transfusion has been accumulated, most of which are not worth the time spent reading them.

And why do we also descend into this field already so cultivated by others? Why do we also come to add our name to the bottom of the long list of writers on transfusion?

The reasons for our work are quite complex. We will not bring a large number of original observations, nor will we come with the halo of new instruments for transfusion, nor with the glory of having carried out transfusions upright and backward: - we will come because we seemed to see a point of the question for one cause or for the other left aside and almost in the dark. Indeed, after the fervent enthusiastic transports, after the vaunted progress in transfusion therapy, it is a question of looking around and observing where we have arrived and where we will end up. It is a question of limiting the use of a precious method of treatment, of a truly energetic and reasonable therapeutic aid, to its true and precise indications. In short, it is a question of doing work that seems to us decent and useful for science.

Not only that: but our work will have the advantage of summarizing and presenting the true state of medicine regarding blood transfusion. We want that by the end of our book, those who will read us have an idea as accurate as possible of all the important problems associated with the transfusion. For this purpose, we have not neglected to obtain a very large number of written works on blood

transfusion, in order to be able to form a precise opinion of the importance they have for the progress of science. Placed several times in the happy circumstance of attending transfusion operations performed with rare skill by distinguished surgeons, having been part of a scientific congress which put on the agenda for several sessions and extensively discussed (1) the problem of blood transfusion, we have been able to judge with our own eyes the benefits of this operation, and collect clinical data that seem interesting to us, because they better determine its effects on the sick man. Therefore we will not be accused of having unfounded opinions, and we will not be denied the right to express our opinion. In the meantime, what we promise to maintain from now on is a calm impartiality and at the same time the sincerity of our judgments.

It will be good that our readers have an idea of the logical process that we will follow in this work. A preventive summary, if it may seem an old system, is however useful because it warns the reader of the fundamental concept developed by the author, and sometimes explains some parts of the writing that could seem digressions.

We will begin with some historical notes on blood transfusion. We would have liked to do without this chapter, as there is no one today who does not know something about the history of transfusion, this being the favourite theme of many articles on transfusion. But the teachings of the past are never useless, and I believe that the history of this operation can provide more instruction and advice than the history of any other medical question. There are many errors regarding the origin of the transfusion, which I think it is useful to erase.

In the second part we will study the doctrine of transfusion, and especially we will take advantage of the data of physiology and pathological anatomy. What is the physiological nature of the blood and its influence on the nutrition of the organs, what the relations between the material exchange of blood and that of the body, what finally are the alterations to which it is subject - this is, in our opinion, the basis of the scientific doctrine of transfusion, the theoretical points that should be determined first. We will therefore observe whether the experiences of physiology support the doctrine and practical applications of transfusion.

The third part will discuss the methods of performing it; and always with the experimental data with the facts established by physiology, we will try if it will be possible to resolve the question to which method should be given preference. This issue has already been resolved in a certain sense for some years, and in the last two years it has been re-awakened due to the reintegration of the ancient method of the first transfusers.

A fourth part will carry out the technique of the operation; and I will try to make known all the main processes hitherto put into practice by surgeons, together with the transfusion instruments. The technique of transfusion is strangely rich, so rich that it alone with its instruments constitutes a real arsenal. However, we will try to simplify all these processes.

The advantages, disadvantages and immediate effects of transfusion will be dealt with in part five. From this to the last there is only one step. The last part of our work will talk about the attempted or proposed applications of transfusion. If these are in accordance with the physiology, with the pathological anatomy of the blood and of the organism, in harmony with the clinic and with the experiment, how many high and arduous problems will not arise! And we, with the calmness of impartiality, with the security of positive facts, we will risk solving them.

Finally we will give the bibliography of blood transfusion. This series of indications is the richest that has ever been published, and the patient efforts it has cost us, make us believe that our work will not be entirely useless and disadvantageous.

HISTORY

HISTORY OF BLOOD TRANSFUSION

Blood transfusion has an adventurous history, a history that can teach a lot and give a lot to reflect on. Like every other major discovery made by science, transfusion has been the subject of fanatical worship, and exaggerated contempt; counted friends and admirers to the point of enthusiasm, enemies and adversaries to the point of slander. Born, so to speak, on occasion, it was suffocated just after two years of life: buried and forgotten for more than a century, finally resurrected and given back to therapy, transfusion has seen its domain gradually expand. It is an operation full of glorious and unexpected successes, overloaded with crimes of injured physiopathology, and therefore its history is all the more instructive.

The basic concept of blood transfusion is so simple, the idea of changing the vital liquid, the dripping flesh of Bordeu, the mood in which, according to Moses, the soul resides, is so flattering and seductive, that it is not wonder if it, in addition to exercising an attraction for vulgar minds, also has a very powerful attraction even for the doctor. In fact, this is an operation which, apparently offering few difficulties, always gives therapy some powerful resource and strangely deludes superficial intelligences. For the common people, a transfusion is a new life, a fertile source of energy, of strength, which would circulate in the veins of the sick man and of the decrepit man: and who knows that perhaps a perpetual youth would not come to surround the life of an evergreen crown of the most cherished joys? For the doctor then, to possess in the transfusion of blood a ready, powerful, sure means to triumph over certain desperate cases, and who knows? perhaps even of certain incurable diseases, being able to say a few times (which is more than rare) I have saved a life, constitute a strong reason to delude oneself and expect even the impossible from transfusion. Let's see if these general lines of transfusion psychology correspond to the teachings of history.

1. Origin of blood transfusion

Did the ancients know and practice blood transfusion? This question would have aroused an eternal discussion two centuries ago; now that questions of priority are given the futile importance they deserve, investigating whether transfusion was known in ancient times can only be done by knowing the concept that the ancients had about its applications.

When blood transfusion was the subject of long and fierce discussions in the seventeenth century, there were those who took the painstaking research to show that this practice is very ancient. Lamártinière [La Mártinière] (2) proved in fact that it was at that time only in the possession of witches, sibyls - and priests: extremes always touched each other everywhere. The Egyptians seem to have known it, and probably the priests of Apollo learned it from them, in the sacred book of which it seems to have hinted at transfusion. In the 'Book of Wisdom' by Tanaquilla sorceress, wife of Tarquinio the Superb, in the 'Treatise on Anatomy' by Herophilus, in the works of Pliny, by Celsus, and others seem to be talking about blood transfusion in several places (La Martinière).

But when you look at the works of Pliny, it can be seen that he does not already speak of blood transfused, but of drinking blood: "Sanguinem quoque gladiatorum bibunt, ut viventibus poculis, comitiales morbi: quod spectare facientes in eadem arena feras quoque horror est. At, Hercule, illi ex homine ipso sorbere efficacissimum putant calidum spirantemque et una ipsam animam ex osculo vulnerum: cum plagis ne ferarum quidem admoveri ora fas sit hui mana" (3). And Celsus also alludes to the use of making epileptics (*comitialis morbus*) drink the still hot blood of gladiators

killed in the amphitheatre. Here are also his words: “Quidam jugulati gladiatoris calido sanguine epoto, tali morbo sese liberarunt: apud quod miserum auxilium, tolerabile, miserius malum fecit” (4).

The book, however, in which antiquity has handed down to us no doubt evidence that transfusion was glimpsed, if not known, is the book of 'Metamorphoses', by Fr. Ovid, in which Medea, considered in classical antiquity as the expression higher than magic and as a woman very experienced in the medical art, suggests to the daughters of Pelia to empty the veins of the old father, promising them that she would infuse him with new and youthful blood: these lines repeated in all the writings that speak of transfusion, they sound like this:

Quid nunc dubitatis, inertes?
Stringite, ait, gladios, veteremque hăurite cruorem,
Ut repléam vacuas juvenili sanguine venas:
In manibus vestris vita est aetasqne parentis.
Lib. VIII, v. 333-336.

Other less certain indications are claimed to have found in the ‘Principles of Physics’, by Maximus, in the ‘Treatise on Sacrifices’ of the emperor Giuliano [Julian], and in an ancient Hebrew text shown by the Rabbi of Amsterdam to the Lamártinière [La Mártinière].

These references to transfusion, however, are too scarce and too indecisive for it to be considered that in ancient times transfusion was actually practiced. Some have believed that they see nothing more than a figment of the poets' imagination, and I too could not understand how an operation so important, so rich in attractions had been known in antiquity while we do not find sure traces of it in any author of classical medicine. What is certain in the meantime, that if the idea of transfusion had somehow flashed to the Greeks and Romans, as well as to the Egyptians, the fundamental concept had to be that of rejuvenating the old. In all the protean aberrations of the occult sciences, from Medea to Paracelsus, from Tanaquilla to Cagliostro, there are manifestations of vulgar desires and popular beliefs. Now certainly that of restoring youth to those who have reached the downward curve of the parable of life, instilling strength, energy and voluptuousness in those who have only the reminiscences of the past, has always been the most heartfelt aspiration in every age, the illusion most favoured by the plebs. [Note: ‘Pleb’ was the term used in ancient Rome to distinguish common people from nobles.] Filters, witchcraft, balms, spells, magic represent in the evolution of human thought the perpetual desire of a perennial youth cheered by a perennial love.

The illusory dream of rejuvenation, which perhaps occupied a large part of the dark mysteries of paganism, which manifested itself in the delirium of the orgies of ancient priests, was also cradled by philosophers, and passed by them, together with the famous philosophical stone, as a legacy to the alchemists of the Middle-Ages. Free and daring expression of popular thought, the witch was the highest synthesis of this powerful desire for youth and voluptuousness (5) also personified in the legend of Faustus. Goethe, certainly one of humanity's most synthetic and deepest minds, identified in his Faust the desperation of doubt, even the anxiety of youthful life.

Faustus, now old, tired of science, feels how much youthful ardour is necessary for him to rise to the high yoke of the mountain, and around the caverns to wander with spirits. Led by Mephistopheles the witch, he doubts the filters:

La speranza mi lascia ... E la natura
O la virtù d'un nobile intelletto
Balsamo non trovo che all'uom potesse
Rifar la giovinezza? (6)

And this desire to bring back youth fumbled throughout the Middle-Ages between the crucible of the alchemist and the doctor's ramblings. However, it is advisable to descend through the whole Middle-Ages and reach the Renaissance to find the first clues of real transfusion attempts. And, a very strange combination, we find it practiced for the first time in a pope, Innocent VIII.

In the chronicle of Rome written by Stefano Infessura, collected by Muratori (7), this unfortunate attempt at transfusion is narrated as follows: “Interea in urbe nunquam cessarunt tribulationes et mortes; nam primo tres pueri decem annorum, e venis quorum Judaeus quidam Medicus, qui Papam sanum reddere promiserat, sanguinem extraxit, incontinenti mortui sunt. Dixerat namque illis Judaeus se velle sanare Pontificem, dummodo habere posset certam quantitatem sanguinis humani et quidem juvenis, quem extrahi jussit a tribus pueris, quibus post phlebotomiam *unum ducatum (!)* proquolibet donavit, et paullo post mortui sunt. Judaeus quidem fugit, et Papa sanatus non est.”

Some have believed that this fact, which so ominously inaugurates the history of transfusion, has been called into question; in other more or less contemporary writers Raynald (8), Burchardi (9) mention it and tell it more or less with the same words. And a historian worthy of faith, judicious and expert in homeland things, Sismondi, Villari, accepts it as indisputable and mentions it. Villari's words are perhaps only the translation of the above passage: “The vital forces of Innocent VIII vanished rapidly; he had long since fallen into a kind of drowsiness, sometimes grown to the point of making the whole court believe him dead. Every means was sought in vain to reawaken the Pope's dull vitality, when a Jewish doctor proposed to attempt blood transfusion with a new instrument: something that had been attempted until then only on animals (10). The blood of the decrepit Pontiff had to pass through the veins of a young man who had to give him his. The difficult test was attempted three times, in which, without any benefit to the Pope, three young men subsequently lost their lives; perhaps due to air getting into their veins. On 25th April 1492, Innocent VIII ceased to live” (11).

That Jewish doctor was perhaps only the speaker of a vulgar opinion, but this fact, in which a Pope and a Jewish charlatan are in contact, at a time when certainly the ideas of freedom of conscience had not yet been proclaimed, shows that blood transfusion had already been glimpsed by the popular imagination.

Changing blood with blood, essentially changing the body and customs - this is the mother idea in which the transfusion is really foreshadowed. We wanted to give Marsilio Ficino (1499) the first idea of the possibility of transfusion (12), but he speaks of *sucking* blood, not infused again in the veins. In fact, he asks himself: “Cur i non et nostra senes omni videlicet auxilio destituti san guinem adolescentis sugant?” (13). Better certainly, indeed no doubt, is the hint that Girolamo Cardano makes in his works: “Sunt qui cum alio juvene bonorum morum duplici fistula, alli unica, commutare sanguinem posse sperent; quod si fiat commutabuntur etiam mores” (14). In this hope of some, an opinion that ran for the common people and for doctors is certainly made clear; but which he had not yet dared to formulate openly. Cardano speaks of it almost with doubt: he says in fact *quod si fiat*, “if this happened, if this could happen”; it is therefore evident that until then transfusion had been glimpsed possible and that its advantages were exaggerated as a marvellous thing, since otherwise the illustrious doctor would not have neglected to speak in more detail of such a serious operation.

As for the changing of customs with the change of blood, it is a prejudice that I have found still alive in the common classes; and since it is proved that many ideas of the ancient authors have passed down to our plebs in the form of prejudices, it is very probable then that even educated physicians seriously believed in the possibility of this fact. With the blood of the lion the daring and courage would be kindled in the hearts of the cowardly and fearful, and the lamb's blood would be able to mitigate the angry and combative disposition of others (Bos).

Meanwhile, a new era arose for the sciences, and especially for medicine. The revolution carried out by the Reformation, by modifying religious thought, also brought its effects into scientific ideas. Together with the free examination of dogmas, the desire to examine facts and to judge opinions in the same way as observation and experience was developed and embodied. The Aristotelian and Galenic fetters of the Middle-Ages now hindered science, which dared to develop independently of authority; and science and progress stealthily touched hands under the terror of the powerful Court of Rome.

Carrying out the marvellous annals of the Renaissance, we have something to boast of being Italians. A numerous, splendid pleiad of great names, a sublime series of stupendous discoveries surrounds the Italian genius with an immortal halo. In medicine, in anatomy, we can say that we have given life to the true experimental method, in fact Realdo Colombo discovered the small, Cesalpino the great, circulation. An immense discovery, which expanded and developed by the genius of Harwey [Harvey] brought a complete revolution in science, a discovery that certainly had the greatest influence in reforming medicine as a whole.

The knowledge that the vascular system was not full of vapours, spirits, air, but rather of blood, which circulated and thus touched all points of the body, had to lead directly to the idea of injecting medicinal substances into the veins in order to have faster and safer effects (15). In fact, towards the first half of the seventeenth century all doctors appeared to be dealing with these infusions. Boyle in England, Fracassati, Malpighi in Italy, Graaf in Holland, did experiments on living animals and published facts. It was therefore natural that the infusion of drugs should come almost immediately to that of blood. Science had only one step to take; take possession of the vulgar opinion of transfusion, adapt it to the new and fruitful discovery of the circulation and introduce it into medicine. The vague, popular, alchemical idea had already been transformed in a way more suited to the seriousness of science. The indication of transfusion, yes as a proof on the one hand of the circulation of blood (16), yes as a means on the other to bring a new life to the exhausted, frail, emaciated individuals, already meant a powerful progress in its applications.

At the beginning of the seventeenth century Libavius d'Halle wrote in fact: “Adsit juvenis robustus, sanus, sanguine spirituoso plenus: astet exhaustus viribus, tenuis, macilentus, vix animam trahens. Magister artis habeat tubulos inter se congruentes. Aperiat arteriam robusti et tubulum inserat muniatque; mox et aegroti arteriam findat et tuibulum faemineum infigat. Jam duos tubulos sibi mutuo applicet, et ex sano sanguis arterialis, calens et spirituosus saliet in aegrotum, unque vitae fontem afferet omnemque languorem pellet. Sed quomodo ille robustus e non languescet? Dando ei bona confortantia et cibi; *medico vero hebellorum*” (17). The operative process of transfusion cannot be described more precisely; and from this passage one might almost have the right to infer that transfusion had already been somehow experienced. And indeed Libavio reports that an empirical contemporary of his, whose name he does not give, had it in good credit. But giving hellebore to the doctor (that is, the medicine of madmen and crazy brains) shows that serious scientists despised this therapeutic aid because it was still in the power of charlatans and alchemists.

Until now it was always in full magic, and transfusions were in strange dreams. Giovanni Colle da Padova (1628) relying on the teachings of Aristotle, who wrote that: “Si senex haberet oculum adolescentis nonne videret ut adolescens? non sentiret et rationaretur ut juvenis, si cor et cerebrum juvenis possideret?’, he extended this beautiful syllogism also to transfusion and said that ‘etiam si sanguinem juvenis ob. tineret, viveret ut juvenis” (18). There is nothing to say the traditions of Medea were more easily gathered than Harwey’s [Harvey’s] discoveries. But in the meantime, unbeknownst to each other, the idea of transfusing blood was conceived and developed in several places by various scientists; men eminent for

knowledge and doctrine, studying circulation under all possible aspects, they reached the same thought by different paths. According to Sturmius d'Altorf (19) and Wehrius of Frankfurt the one who first conceived and practiced transfusion was Maurizio Hoffmann; but it may be that Hoffmann was one of the first to experiment with animals. According to Clark (20) since 1638 the reverend theologian Potter, starting from the concept of the Harvean circulation, proposed blood transfusion several times, but to no avail. Still transfusion did not offer itself serious and safe enough in the eyes of doctors, and those themselves who believed it possible retreated in front of the necessity of experiencing it.

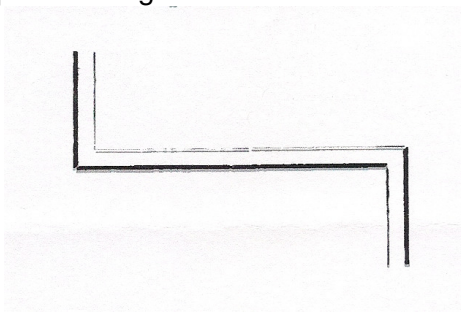
And so it also happened to the Tuscan Francesco Folli (from Poppi), an ingenious philosopher, who made himself famous for many useful discoveries and inventions (Targioni-Tozzetti). Here is how Folli tells us about the series of his discoveries (21): "In the year 1652 I read the libretto by Guglielmo Arveo in English, which deals with the motion of the heart and blood: which reading with some information about plants, produced in my imagination this third problem, that given the circulation of the blood it was possible to transfuse, with which one could not only cure some ailments, but rejuvenate and magnify further, as I mentioned in my booklet of Culture of the Vine, which I did not publish for anything other than to make it clear to everyone that the transfusion of blood had been invented by me and until (from 13 August) in the year 1654. Ferdinand II, Grand Duke of Tuscany, who, liking the novelty, was very pleasant in his genius and profuse magnificence; nor did I ever communicate this thought of mine to others, giving myself to believe that if this invention were successful, he was only worthy of it. Eleven years passed, and I never heard any news of this problem... Shy, how curious, he did not know what half a term to take to get news of it. I determined to write my Physical Recreation (22), which and from the hieroglyph of the title page and from the material I deal with in it, each one will be able, reading it, to recognize that thanks to the transfusion it was written... And remaining in the same ignorance as before, it dared not discover me with anyone; but when he least thought of it, I was told of how in England they had found a beautiful invention of rejuvenating, by transfusing the blood of youngsters into the veins of old people… I no longer wanted to be hidden and, taking the excuse to write about the culture of the vine (23), I discovered that I was the inventor of it … nor did I ever know that others have said to be an arrogated invention. With reason, therefore, I can call her mine, such as she is I and as mine I must by nature's obligation defend and protect her as best I can."

It is clear from this passage that Folli attaches great importance to the question of priority: but if this could tickle his self-love, it matters little to us, as we see how transfusion appeared to be conceived by various doctors as a logical consequence of the discovery of Cesalpino and Harvey. The fact is, that we are still in the mythical period, so to speak, of transfusion. In spite of his great talent, the Tuscan physiologist also conceived hopes for transfusion in agreement with vulgar opinions. In his dialogue on the Culture of the Vine he writes: "The circulation of the blood discovered by the very learned Arveo, and the grafting of plants produced this third thought in my intellect (that of transfusion), and yes, how different plants of different juice contribute to the augment of a single fruit, so I could easily believe that it could follow more in men and animals of the same spice, with improving the sauce of a younger one: I do not want now to bring us other philosophical and medical reasons that gave me hope, but it is enough that I did not mind the thought ... and I would like to have a lot of life, that it would succeed perfectly, to enjoy such a benefit ... " (page 44). Folli, however, did not attempt any experiments, and certainly (with all due respect to Ch. Prof. Scalzi and the other supporters of the Italian priority) he had little influence on the progress of this discovery (24).

Meanwhile, if it is certain that whoever first puts into practice and experiments any discovery gives science greater advantages than whoever is content to ruminate it in his own mind, it is undoubted that this merit regarding the transfusion of blood

belongs to the English and French doctors, who, if they were not ready to derive this logical corollary from the discovery of circulation, were however those who did not stand in the way of its practical applications. Without taking into account a certain French priest or friar named Don Roberto des-Gabets, who in an assembly held in the house of M. Montmor made a public speech on transfusion (1657) (25), there is no doubt that the first real experiments were not made in England. Dr. Clark tells us about the development of these experiences, and we believe, to end this paragraph on the origin of the transfusion, to quote the words, asking forgiveness from those who read us about our little and the much of others so far contained in this chapter (26).

"Circa finem anni 1656 aut circiter, Mathematicus ille insignissimus, D. D. Christophorus Wren primus infusionem variorum liquorum in massam sanguineam viventium animalium excogitavit et Oxonii peregit. Anno sequenti, viz. 1657, idem mihi tunc temporis sanguinis naturam provirili indaganti, quae ipse fecerat, etiam communicavit, ex quo tempore diligenter ad diversa hujusmodi experimenta facienda me accingebam; et inter alia, quae tunc temporis agenda decrevi, aquas, cerevisias cujusvis generis, lac, serum lactis, juscula, vina, spiritum vini et *animalium diversorum sanguinem* injicienda mecum statui... Et praeter fistulas alias, ad varias operationes adaptatas, quasdam Figura



in modum factas habui , et uno extremo in arteriam unius animalis immisso, altero in venam alterius, sanguis ab uno animali in alterum facilius trasfundi posset: et ut docto cuivis quod debitum est reddam, D. D^{r} Henshaw etiam e Societate Regiâ, vel ante hoc, vel circa idem tempus (uti et egomet) incassum tamen, eadem methodo, sanguinis transfusionem tentavit. Hinc fuit quod cum in Regali Societate inter alia experimenta (quod ex Archiviis illius satis liquet) sanguinis transfusio proponeretur, alii viri docti mecum opinabantur ex operatione tali nil fortasse sperandum, atque ipsemet difficultates recitavi, quae mihi hanc operationem peragenti contigerant. Dehinc res denuo tentata nobiscum non successit, donec Doctissimus et Exercitatissimus Anatomicus, D. D^{r} Lower, Oxonii, anno 1666, rem feliciter conficeret" (*Trans. Soc. Roy*. London, 18th May 1668, n. 35, § 3, p. 89).

As far as we could have developed the question of the origin of transfusion, we must recognize that we have now reached the first truly scientific period of its history, and that we must somehow agree with Clark when at the end of his protest letter: *hoc tamen audacter assero, nos in Anglia inventionem hanc a nullo accepisse pereg rino*.

However, I must note that in 1664, Mayor declared himself the inventor of transfusion (27) in a work in which he also declares himself the inventor of the infusion of medicines into the veins. However, it is certain that neither of the other, the credit for the discovery belongs to the good surgeon of Kiel: what, I hope, will be evident to the reader from the foregoing.

2. **First Period** (*17th century - Years 1665-1668*)

If it is true what Bailly says (28) that the true inventor is the one who seeks with knowledge of the cause, and in principle achieves the goal that he had proposed, certainly this merit with regard to blood transfusion in physiology belongs to the

Englishman Richard Lower, who in 1666 was the first to perform it on dogs with a truly scientific method and with real progress in physiological technique. King and Coxe imitated Lower in Oxford in the same year, and towards the end of 1666 (17th December) Boyle, already very expert in the infusion of medicines, repeated these physiological experiences on animals *.

* Since the rest of this chapter will only be a reference to the main points in the history of transfusion, I think it is useful to spare readers the many quotes I would need. On the other hand, the rich Bibliography at the end of this work can dispense me from showing vain erudition in the course of the book. Numerous notes, if they have an advantage for the author with the authority of the names, then have the very serious inconvenience of diverting the reader's attention.

The new discovery, which has now entered the serious field of physiological experimentation, could no longer retreat. Known the researches of Lower and his followers, Denys, Emmeretz, Tardy, redo the experiments in France, while Fracassati, Cassini, Griffoni, Riva and Manfredi imitated in Italy (1667). Meanwhile, what cannot be denied to Italian innovators is that they have given the physiological experiment of transfusion greater scientific security.

In the same year 1667 we see immediately the effects of the experimental method. This first scientific period of blood transfusion, begun by Lower and King, followed by the Mayor of Kiel in Germany, must be marked by real progress in the physiological practice of transfusion. Lower replaced immediate mediated transfusion: King revived animals bled to apparent death by injecting new blood: Gajant experimentally demonstrated the damage of excessive blood introduction, which stops the movements of the heart (June 1667): Hippolytus Magni found in Rome in this case, the passage of blood in the urine and extravagances in the serous cavities: Denys felt the tolerance that animals of different species have for mutual transfusion, and so the research of transfusion physiology opened the way for its application to medicine. This was not long in coming. On 16th June 1667, Denys made the first blood transfusion in man. This fact begins the experimental period of transfusion so well that it is worth the work to relate it for the most part with the very words of the Denys: “Puer qui naturå optime erat dispositus atque agilis, febri postea quadam contumaci correptus eaque jam ultra duos menses afflictus... perdiderat pene omnem memoriam: ingenium ipsius erat obtusum: et licet decem vel duodecim horas singulis dormiret noctibus, interdiu tamen mensam accumbens, comedens, aliaque agens quae somnum abigere aliis solent, sopore semper obruebatur (29). Sopor ille ex paucitate quae isti restabat sanguinis quaeque febrili ardore, quo erat correptus spissa nimium evaserat, oriri creditus est, adeoque bene sanari ipsum posse transfusione novi sanguinis creditum est.” The transfusion was done with lamb's blood, and they injected 3 ounces (about 90 grams?) of arterial blood by the immediate communication of the two vascular systems: the instrument was simple and consisted of a rigid silver cannula (*tubulos argenteos*). After the operation the patient showed himself: "multo hilarior et sine omne dormendi desiderio”, no doubt because of the strong reaction that took place.

Such a fortunate outcome definitively introduced transfusion into science. That same year 1667 saw transfusion operate, as well as in France, also in England, in Italy, in Germany. The first step was taken in the difficult path of therapeutic applications, it was indisputably demonstrated that transfusion in humans was possible, that it was indeed useful in certain diseases, and could also be done with a happy result using animal blood. Dragged along this path, it was no longer impossible for doctors to stop.

Denys and Emmeretz happily repeat the transfusion in a 16-year-old boy suffering from a stubborn fever, and after a preventive subtraction of 3 ounces of blood from the patient they inject him with 8 ounces of lamb's blood. Sure of the harmlessness

of the operation, they do not hesitate to experiment with it on the healthy man (30), and even on the son of Baron Bond, Prime Minister of Sweden. Their example was soon followed in England by Lower and King: from Mayor in Kiel: from Rivá in Rome, from Cassini in Bologna, from Griffoni in Udine, from Giambattista Pieri and all this in less than two months, in November and December. The Roman Guglielmo Riva, a skilled surgeon and anatomist, practiced it with extraordinary daring on subjects almost lost due to irrepressible diseases: and in general, among all transfusers, the Italians had the pride of having given the operation greater solemnity, greater artistic criterion, having improved the technique, resulting in most cases a fortunate outcome. In the first months of 1668, Tardy in Paris and Manfredi in Rome, were added to the aforementioned transfusers.

All these transfusions were made in very different diseases: insanity, chronic anaemia, phthisis, obstinate fevers, stomach cancer, typhoid, narrowing and gangrene of the intestine, evidently show that the first indications of transfusion were indeterminate, and that the operation was performed in cases that left nothing to hope for or in which any other method of treatment had been unsuccessful. Thus, for example, acute anaemia due to haemorrhage never appears in these transfusions, nor was human blood ever used. Transfusion was always practiced with that of lamb, mutton and even that of veal (Denys, Emmeretz). All this hints at a primitive state of physiology: - the functions in fact of respiration and nutrition were poorly understood, and the circulation was barely in a better period of progress. The mutual functional dependence of the circulation and breathing, the mutual influence of blood and the body, the chemical and histological composition of the blood, its attributions in the nutrition of the tissues - all these elementary bases of today's transfusion were then ignored or misrepresented. And as for the indications, the clinical, pathological anatomy, experimental pathology, and histochemistry of the organism, these were still to be born. Likewise the technique: uncomfortable processes were used that forced the patient and the operator to inappropriate positions, unsuitable instruments, such as rigid ivory or silver tubes (Denys, Manfredi): direct transfusion was always used, which can only be done with modern advances in surgical technique; and little attention was paid to the dangers and serious inconveniences of transfusion, such as the formation of blood clots and the penetration of air into the veins.

With all these serious transfusion issues, it was difficult not to fall into some exaggeration on the one hand, nor was it possible to always have lucky outcomes on the other. And as for the exaggerations, the first results encouraged too much, not to attribute to transfusion an importance that it could not and will never have. It was claimed to be good in cases where it was more dignified for science to blush with one's own impotence. Tardy wrote that transfusion was a sovereign remedy "*per sense et illos quorum vasa malorum humorum et corrupti sanguinis plena sunt*" was good "*ad sanandos morbos ex sanguinis acrimoniâ, quales sunt ulcers, erysipelata, ecc*." Denys to explain the reason for transfusing animal blood into man had the imprudence to write: "animalium sanguinem magis conducere hominibus, quamquam sanguinem humanum. Ratio (huius redditur) quod homines variis agitati affectibusinque diaetâ suâ parum ad normam viventes, sanguine magis impuro sint praediti, quam bestiae (?) minus eiusmodi immoderatis affectibus obnoxiae." And as for the failures, these were naturally not kept waiting. The son of the minister of Sweden, in spite of a transfusion, died (Denys and Emmeretz): a patient with intestinal narrowing and volvulus also died (Denys): an old decrepit weakened by age (Manfredi), and the doctor Sinibaldi, suffering from cancer, also died (Riva), nor did transfusion cure the maniac Arturo Cogo [Arthur Coga] (Lower and King). In the meantime, these fatal cases had to have their effect and they did.

The educated and uneducated public had followed the first cases of transfusion with interest. Already the change of blood was, as we saw, in the desires and illusions of the common people: and Denys's daring could not help finding supporters and admirers. In short, the reputation of this doctor grew to the point of disturbing the

dreams of the distinguished members of the Faculty of Paris. To make the position of Denys and his colleagues increasingly equivocal was added the fact that the entire Court, to which Baron Bond was attached, carefully followed the steps of the modest French surgeon. This was even more likely to exacerbate the jealous minds of other people's fame. An ordinary surgeon, foreign to the Faculty, who came out of the provincial school of Montpellier, hitherto unknown in science, dared to bring such a great revolution in medicine? In spite of the extraordinary successes, transfusion therefore began to be judged suspicious, then annoyed, and was later scandalously discussed. Lamy championed opponents, and wrote against the alleged usefulness of transfusion. In his letter he says it is good "torquendi potius aegrotas quam sanandi": and rightly observes to enthusiastic transfusers that it is of little use in the desperate cases in which it was advocated by them, because “parum illud sanguinis, quod mediante hac operatione recipitur, citius multo a totâ massâ sanguinea, quae in corporis aegroti est, corrumpatur, quam totius sanguineae massae intemperies pauco illo sanguine core rigatur.” It is undeniable that this reason is also not good for some modern fanatics. At the same time and in the same sense, La Martinière wrote to the famous minister Colbert, to magistrates, to priests, to abbots, to doctors, to ladies, to the whole world, that transfusion was a barbaric operation, coming out of the *boutique de Satane*, that transfusers were worse than the Cannibals, crazy wired people, etc.

Regarding these reactions of the old against the new, Agassiz is right. The same thing happens with every new scientific truth: at first one shouts: "Ce n'est pas vrai", then: "C'est contraire à la Religion" and finally: “Il y a longtemps que tout le monde le savait". So it was with transfusion. Fought on the side of utility, it was later claimed that using animal blood was a lowering of human dignity, that the blood of brutes should not run in the veins of the King of the Earth. And after having brought Religion, the Bible, the corporeal God and the spiritual God into the field, they wanted to prove that this practice was as ancient as it was barbaric (La Martinière), almost as if there were no truths recognized by man up to its origins.

Even in Italy, if there was no shortage of enthusiasts on the one hand, there was no shortage of fierce opponents on the other. The exaggeration on the usefulness of transfusion was pushed by Folli to say that if there were no more giants, it was "because Noah, perhaps not knowing the use of blood transfusion, could not pass it on to posterity" (31). And as for the opponents, their main argument was Aristotle's and Hippocrates' silence on transfusion. Gianforti, an opponent, after quoting the two fathers of philosophy and medicine, writes: "Thus the Prince of Philosophers almost foresaw and rejected the transfusion of blood, so that one will or will no longer have to believe these two great lights of philosophy and medicine, or transfusion will be useless, even harmful" (32).

This philosophical reaction only exacerbated the transfusers, who exaggerated even more the benefits obtained or only glimpsed. As proof of its real usefulness, it was cited that an old bitch injected with kid's blood had seen herself not only well after the operation, but also almost rejuvenated (Gadroys) (33). From this it was claimed that transfusion could *rallumer les flames languissantes, qui sont prêtes à s'éteindre dans une vieillesse caduque* (34). When the disease depended on thick, coarse blood, calf or lamb's blood was recommended, which *is fluid and subtle*: the cold *cloudy and slow* blood of apoplectic patients had to be replaced and set in motion by the *warm, energetic and active* blood of a vigorous young man. Gadroys, De-Gurye, Lamy, Bourdelot, Denys, Petit Pietro (under the name of Eutifrone), Santinelli, Folli, La Martinière, Tardy, Moreau, Montmor discuss and rant about transfusion: those who support it, applicable in all the most disparate and desperate cases, and those who reject it among the barbarous customs of savages. What was most lost in the meantime, amidst all these discussions, was the dignity of science: the common people, the court, the plebs, the clergy, the ladies, the ministers, took

part in the question, and leaving the philosophical norms of every discussion, it had become a crossroads thing.

A scandalous incident broke up the dispute. In the midst of so many disputes, Denys had accepted with Emmeretz the proposal to perform a transfusion in a madman, a certain Maunoir. [Mauroy] A transfusion was then carried out twice in this patient and always without damage: but finally having wanted to repeat it one last time, the madman died, according to La Martinière in their arms, but according to Denys a few days after the operation. However, this disaster does not seem to be due to the transfusion: the madman's wife, bought by the doctors of the Faculty of Paris, had poisoned her husband, and then filed a murder lawsuit, again at the instigation of the anti-transfusionists, against Denys. Following the trial, the court (Châtelet) admitted the surgeon's innocence, but on 17th April 1668, issued a prohibition decree in the French States for blood transfusion, without special authorization from the Medical Faculty of Paris. That was to say it was absolutely forbidding it.

The fall of transfusion in France, which, through the work of its great King Louis XIV and his great ministers, was gaining in the advances of science and civilization, an influence that lasted until a few years ago, naturally also led to the fall of transfusion in England, Italy and Germany. In Italy where the transfusions of Riva, Manfredi, Magni, Cassini had received the applause of doctors and the praise of foreigners, blood transfusion remained silent until 1679 when following a fatal outcome achieved by G. Riva in a case of hydrophobia (!) it was prohibited by the papal court. It was believed dead and completely buried: Mercklin wrote a book *De ortu et occasionu transfusionis sanguinis* and the Rev. P. Rodolfo d'Acquaviva was able to dictate a Latin poem on the same subject.

3. **Second Period** (*18th century - Years 1669-1818*)

It is a long period of silence, of oblivion, of contempt towards the poor transfusion of blood, the one that runs along the end of the seventeenth century, including the whole of the eighteenth and also the first years of the present nineteenth. This operation which had awakened in its appearance so many illusions in doctors, which had given birth in the hearts of the unhappy to the hope of having finally found the means to acquire health, youth and perhaps immortality, was now shamefully ignored by those themselves, who with their enthusiasm, had more hastened its ruin. For about 150 years, transfusion was hardly known by name even in physiology, judged severely and, we will say, unfairly, by the most eminent medical individuals, remembered only as an evident example of aberration of human ingenuity (35).

However, this long period should principally be noted for the important treatise of Lower *Sul'cuore e sul cuore*. In this book, the primary and essential indication of blood transfusion is mentioned for the first time - that is, of acute anaemia due to severe traumatic blood loss or puerperal haemorrhages - an indication that had previously escaped transfusers (1680).

A few isolated cases of transfusion appear here and there, almost to the shame of those who try it again. The already mentioned case of Riva (1670): a fatal case of Pett in a puerperal fever (1670?), one more fortunate than Kauffmann and Godefroy in an anaemic subject (1683), and a third of Purmann in a scurvy and leper (1683-1699) - make up all the case studies of this extended space of time

And as incidentally, among others, Nuck (1696) with favour, Hannemann (1706) with contempt, La Chapelle (1749) in earnest, but to make it ridiculous, and Mackenzie (1760), gives it as a means of extending your life. The great Haller (1774) hardly mentions it.

Meanwhile, the dawn of true experimental physiology was rising: the calculation of the comparative method was kept and work was done tirelessly for the progress of

physical and chemical sciences. The foundations of the new scientific positivism were becoming more and more solid every year, and the clinic and the therapeutics took laboratory research as their only equality. In this fruitful age, in this period of fervour, it was natural that a problem as vital as that of essentially modifying the blood of an animal with other and new blood, would begin to occupy minds again. An Italian, indeed a fellow citizen of mine, Michele Rosa from Modena, has the honour of having removed transfusion from oblivion and having again studied it as a 'blood graft' in animals. Rosa dealt with transfusion experiments from 1782 to 1785 and gave this practice the forms and foundation of rationality (De Cristoforis) as much as the progress of medical-physical knowledge could allow. Rosa experimented in the presence of Antonio Scarpa, then a professor in Modena, and Scarpa was able to repeat the experiences with brilliant successes in Paris in the presence of Vicq-d'Azyr, the first Parisian medical celebrities, and Brambilla, surgeon of Joseph II of Austria (36). At the same time as Rosa, in England attempts were also made to restore the honour of transfusion: Harwood, professor of Anatomy at Cambridge, experimented with it on animals (1785), and Darwin Erasmus in his famous Zoonomy found a place to speak benevolently about transfusion.

In the first years of our century the authors who dealt with transfusion were equally scarce. In France, Portal and Bichat made various experiments on transfusion of pure physiological interest (1800). In Germany and in England, transfusion, as a little-treated topic, paid the price of various inaugural dissertations, among which those of von Graefe, Hufeland and Leacock deserve to be read by anyone who wants to study the progress of this operation, and it can be same of the beautiful work of the Danish Scheele, which contains the most complete history of the transfusion (1803). Meanwhile, what we can say is that until Blundell's first memoir, which appeared in 1818, blood transfusion had been studied only on a physiological side, - that of its influence on circulation. The same experiences of Rosa da Modena are under this direction. And this was quite natural. The physiology of blood had just been sketched out by Spallanzani's research on digestion and assimilation, and the intimate processes of biological chemistry were still almost unknown. Very recently we absorbed the research of the chemist Lavoisier on respiratory function and anatomy in general behind the steps of the young and immortal Bichat, one can say, all the physiology to derive the foundations of the new anatomical systems. Blundell therefore descended on this unexplored field with all the energy of his will and his English character, and opened a new and fruitful path to Science.

4. **Third Period** (*19th century — From the year 1819 to the present day*)

The true scientific period in the history of transfusion begins with an illustrious name, that of Blundell and other no less illustrious names in France and Germany are linked to Blundell. Blundell, referring to the experiences already made by Rosa, Harwood, and Lower on animals, recognizes how useful transfusion could be in those cases in which the blood suddenly decreased (1818). He studies from all sides the problem of the injection of blood from one individual to another and lays down the first real laws which must regulate the scientific method, the indication and the technique of the operation. For the former he recognizes the usefulness of using *human blood in man*, and first transfuses venous blood (480 gr. taken from two men) into a woman suffering from severe haemorrhage during childbirth (1819). This daring innovation, unfortunately followed by a fatal outcome (37), nevertheless opened up a vast field to the practice of transfusion, and Blundell, not discouraged by an initial failure, tried the following year in another case of puerperal haemorrhage.

Certainly what follows is a beautiful and useful page in the history of transfusion. While Blundell proves that mediated transfusion is possible, that the physiological

and excitatory properties of the heart remain unaltered, that transfusion could and should have been done with *human venous* blood (1818-1824), Prévost and Dumas in Switzerland researched foreign blood introduced into the body and showed that heterogeneous transfusion has many drawbacks (1821); and Milne-Edwards (1823) publicly repeats the experiments and argues that this operation has the right to return to medical practice. On the other hand, the physiology and the practice of transfusion are becoming more and more complicated, enriching themselves with the progress of biological sciences: the scientific questions related to the problem of injecting the blood of an animal into the veins of another are accumulated even more, to increase, to intertwine. Difficulties arise everywhere, which are sought to be solved by experiment and observation: and so while on the one hand the scientific foundations of the doctrine of transfusion are being strengthened and established in a more positive way, on the other hand its applications are extended, and transfusion becomes a very important therapeutic aid.

At first we had the intention to follow these progresses step by step, to trace, if possible, the importance of the works, of the facts that have been accumulating in these years from 1820 to now: but the material has grown so much under our hands that we have been overwhelmed by our own work, and we have repeatedly had to lay down our pen. On the other hand, whilst it is true that every isolated fact constitutes a precious material for science, it is also true that with regard to transfusion almost all published facts resemble each other. But giving our readers an idea of the tremendous impetus brought by the experimental method to the question that concerns us seems to us too useful for the purpose of our work.

Transfusion, like any other scientific question, has its dark and gloomy sides, in which only experimentation is allowed to bring light; and these parts discussed, debated, balanced with the method of rigorous observation, always constitute the most dignified and serious heritage of science. Indeed, it is very flattering for man to have scrutinized these mysteries of biological laws for within, it is weighing, measuring the facts, to have ascended from their analysis to the highest peaks of scientific synthesis. And even the experimental part of the blood transfusion is full of facts and names, from Blundell to us.

First Dieffenbach (1828-33) studied transfusion in animals and experimentally tested the revivification of a bled animal, the impossibility of preserving life with heterogeneous blood, the conditions that make the results of the operation vary, the usefulness of using venous blood. Bourgeois (1828) studying apparent deaths, comes to important conclusions on the value of transfusion. Magendie (1832-42) confirms the experiences of Prévost, Dumas and Dieffenbach on the damage of heterogeneous transfusion. Kay (1834) overcomes the rigidity in the corpse by injecting blood, and in detached limbs revives and moves the muscles with it. Bischoff (1838) demonstrated the inconvenience and danger of fibrin clots forming and was the first to propose the *defibrination* of the blood. Brown-Séquard (1855) discovers the excitatory oxygenating action that blood exerts on the vital properties of the two systems, contractile and nervous, and then (1858-1862) studies the alterations and phases of blood cells injected from species to species, from class to class of animals. Defibrination, invented by Bischoff, is also found necessary by Polli (1852), who also discovers that the blood extracted from the vein coagulates later at a low temperature than at a high one, and studies the alteration of blood cells upon beating [i.e. defibrinating], oxygenation of the blood by this means and the little danger [sic] of air mixed with the blood. Martin instead (1859) condemns and fights the use of defibrination of blood and scientifically establishes that blood in nature [i.e. unaltered] should be injected. Eulemburg and Landois (1865) try to prove the influence of blood injected into the veins of dogs left in complete inanition. Polli's experiences are taken up by Oré (1865-68) who proves the usefulness of the globular element alone, the difficulty of the operation dependent on fibrin clots, the uselessness and the disadvantage of defibrination are proven. On the contrary,

Panum (1863) believes he can demonstrate that defibrination is not disadvantageous, that in transfusion one must inject defibrinated blood, and moreover only human blood.

I don't believe that any other scientific issue has been resolved in such contradictory ways as transfusion. What one experiences and confirms in one sense, others instead control and demonstrate in another, and in recent years the discussions and observations have been multiplied even more by this contradiction in the results. Thus while Belina-Swiontkowski (1869) accepts defibrination, Marmonnier (1869), Gesellius (1872-73) and Moncoq (1874) fight it decisively; while Brown-Séquard demonstrates that the active part is only the blood cells and that fibrin is useless, Bernard (1859), Gesellius, Heynsius, Roussel (1869), Schiltz, Greily-Hevitt, De-Cristoforis, Bèhier (1874) prove both the origin and little known function of fibrin, and its usefulness in injected blood. On the one hand we have Nysten, Amussat, Panum (1863) worried about the entry of air into the veins, and on the other Unterhart (1870) who experiences that one can inject air with impunity into the arteries and almost with impunity into the veins, if one has the foresight to choose a vein away from the centre. To Brown-Séquard (1868), who experiments with heterogeneous transfusion and studies the resistance of the blood cells of one species injected into another species, Giannuzzi (1873-74) contrasts with facts of a shorter duration of these same blood cells. Nor do the controversies over the doctrinal basis of transfusion seem to have yet to come to an end.

And even the technical part has become more complicated. Each of the transfusers believed in the right to modify previous processes, to invent new ones, to manufacture instruments. We have already mentioned the main instruments used by the first transfusers, which mostly consisted of a rigid direct communication tube and nothing else. However, with the introduction of the mediated method, these primitive instruments, also modified according to the needs of today's perfected technique, could no longer be of any use: and if Blundell contented himself with using a common syringe, we can today declare ourselves more fortunate than him, as we have an arsenal of tools and we no longer know in so much wealth which one to give preference to. Each one responds to some special indication. If we want to do venous mediated transfusion with defibrination, we have the instruments of Belina and of Panum, and an innumerable quantity of syringes. For mediated transfusion without defibrination, the difficulties of the operation have also made the instruments more numerous without simplifying them: those of Mathieu, Moncoq, Coppello, Unterhart, Ruggi and Luciani each have something good. For direct transfusion Mathieu (tireless in inventing instruments), Aveling, Moncoq, Oré, Roussel, Rouget and Del Greco, have all found ways to invent new instruments and of course each prefers his own. Likewise, while Polli, Desgranges, Savy, Marmonnier, Michel, Bèhier declare that transfusion can be carried out with a squirt, there is a Belgian doctor, Casse, who has manufactured an instrument with regular and continuous automatic pressure, without which he declares, transfusion is impossible. And to then measure the amount of blood that is injected, a counter mechanism was added to the transfuser (Noel), and a special manometer was increased by a dear friend of mine, doctor Lelli from Ancona, with happy thought (1874) that can measure, by increased pressure of a special gauge, the amount of blood that passes through.

Recently the reintegration of transfusion with animal blood (Albini, 1872), has enriched the arsenal of transfusion-surgery with other instruments. In addition to the cannula by Albini himself (1874) and those of Hasse and Postempski, I am pleased to mark here the instrument of Prof. Azzio Caselli of Reggio, who has already served with honour in many transfusion cases.

In addition to ordinary methods, the technique in recent years has been enriched with extraordinary methods. Von-Graefe (1866) proposed and Hueter (1869) was the first to practice transfusion by the arterial route several times, followed in this by Albanese of Palermo (1869). In the meantime, it cannot be ignored that the works of

the distinguished Berlin surgeon have not aroused the keenest interest in transfusion and have turned more learned Germany's attention to the complicated surgical problems attached to it. In addition to Panum's replacement transfusion (1863), Gesellius has his capillary transfusion (1868-72), for which blood is extracted from the healthy individual by means of cups (!); Karst, the transfusion with hypodermic injection (1874), and Guérin (1872) his reciprocal transfusion by which two individuals transmit blood to each other for an indefinite time. Thus each of the transfusers reforms the technique, often redoing well what others did before him and creating processes, methods, instruments, most of which die as soon as they were born.

More important is the field of practical and therapeutic applications of transfusion. We saw in the seventeenth century transfusion arousing useless illusions and being practiced in cases of organic diseases, such as tuberculosis, madness, cancer, contagious diseases, such as hydrophobia, syphilis, typhoid, leprosy, etc. Kept at the beginning of this century, by the categorical indications of Lower, Harwood, Blundell, Dieffenbach, Prévost and Dumas, within the most rational limits of quantitative lesions of the blood, it did not take long to spread. A remarkable number of operations attempted in very disparate cases by men eminent for practice, have expanded the applications of transfusion. We do not purposely say the indications as it seems to us that physiology, pathological anatomy, physiopathology, the clinic do not give reason for certain applications made in recent years.

In Blundell they follow in England Waller, Doubledey, Uwins, Brigham, Ralph (1820-26) who practice transfusions in cases of puerperal metrorrhagia, followed in this by Jewel, Brown, Howel, Klett, Schraegle, Bird, Ingleby, and by Crosse, Goudin, Savy in France (1827-32). From 1827 to 1842 we have Berg, Banner, Schneemann, Wolff, Bayer, Ritgen who apply it more or less happily to consecutive anaemia in uterine losses, and then in the last 30 years a considerable number of transfusions performed during pregnancy both in the intrapartum and in the puerperium, for uterine haemorrhages; this fundamental indication of blood transfusion.

Blundell (1825) had already transfused blood in a case of arterial wound: after him Philpott (1829), Roux (1830), Scott (1833), Walton, Blasius (1833-45), Michaux (1860), Gentilhomme (1866) injected blood in many cases of traumatic haemorrhages, both due to arterial wounds and subsequent to surgical operations. Lane (1835) cures a case of haemophilia; Pritchart (1843) heals a dyspeptic young man, with marasmus, extraordinary emaciation and heart palpitations; Polli (1852) a young woman with chlorosis [hypochromic anaemia], and with phenomena of cerebrospinal excitation.

These applications already seem scarce: in twenty or thirty years transfusion has almost by now passed the whole field, neither small nor well defined, of pathology. Clinicians and doctors compete for the pride of applying it in the most extraordinary contingencies and thus the fundamental, physiological concept of transfusion is altered. We already see Dieffenbach using it in hydrophobia (1838), Polli in severe hysteria (1852), Heine and Knauff in syphilis and Bright's disease (1868), Uytterhaven in haemophyllia [sic], Demme in diphtheria (1867), Prejalmini d'Intra, Friedler, Birch-Hirschfeld in tuberculous consumption. It is applied to acute poisoning of the body due to pyaemic infection from Hasse, Marcacci , Fischer; for typhus from Stockes; for puerperal state from Blundell; for cholera from Schiltz, Pastau, Whelson, Stadthagen. It is used in cachexia by Hasse, Fischer; in cancers by Concato, De-Cristoforis, Tassinari; in malaria by Hüeter, Albanese; Fischer in septicaemia.

So while we see some accept transfusion only in severe forms of idiopathic anaemia (Magendie, Coppello, Bèhier), we see others extend its wonderful advantage. Neudöerfer experiences it in slow anaemia following severe suppuration (1859-60), Nussbaum, Hasse, Polli boast it in chlorosis, Leisrinck (1870) believes it indicated in protracted convalescences, Mosler transfuses into leukaemia, together with Fischer, who then transfuses it also in acute opium and belladonna poisonings

(1873). After the studies of Kühne (1864) on carbon monoxide poisoning, transfusion is naturally also mandatory there, and it is better to open the door at any cost: therefore Martin, Evers, Hüeter, Fischer, Bardt teach us that in asphyxiated for gas-oxide you can revive functions with good blood injected into the veins. And in asphyxia of newborns, Bennecke and Belina-Swiontkowski unquestionably want it proved by injecting blood into the umbilical vein; and Maass and Betz support it in haematemesis, Aversa in epistaxis, Lange in eclampsia, Nussbaum in epilepsy, Saltzmann in tetanus, Krohn in gangrene due to erysipelas and asphyxiation due to gas-light and Josehnaus transfuses blood in the curious disease known as morbus maculosus. Here we must not forget those surgeons, especially Alemanni, who have practiced blood transfusion in individuals subjected to operations of high surgery, and among them Esmarch, Fischer, König, Petersen, Busch, Leisrinck, MacEwen.

And from the latest applications attempted or glimpsed, it is easy to see that the list is not yet closed, and indeed we should keep it open. Blood transfusion is no longer considered as a suitable means to fill a vascular system emptied of blood, nor as a cure for an altered blood crasis: rather it is studied, it is experienced as a *blood graft* (Polli) and we will, not before long, see it practiced to cure all the qualitative alterations that modern science has shown to form primitively in the blood, Masius's microcythemia [hereditary spherocytosis], Werholf's disease [ITP], scurvy, oligemia, hyperaemia, etc.

Nor must I ignore an innovation that in the past year (1874) we have seen practiced in transfusion. Already Denys, Lower, King, had unsuccessfully transfused individuals suffering from mania, melancholy, stupidity, Dieffenbach (1830) had also without results, carried out transfusions in stupid melancholy and in erotomania, Polli (1851-52) and Nussbaum (1864) had tried in vain in epilepsy. Ten years later Nussbaum, Leidesdorf, Meynert and Livi again opened up to transfusion, in this period of fervour, the vast field of psychiatry, and the last with the help of Prof. Caselli attempted it in skin dyscrasia, in stupid lipemania [lypemania?] followed later in this way by other Italian psychiatrists, namely Ponza, Rodolfi, Michetti and Bonfigli.

At the time of writing, we feel entitled to look back and by questioning the past we will persuade ourselves that the history of blood transfusion really exists and that it is a history rich in teaching, in important scientific questions. In this fascination that transfusion has always exercised on the souls of the learned and the uneducated, of doctors and laymen, in this irresistible need of human nature which tends to the marvellous under whatever guise it hides, and which escapes even the seriousness of science itself, it is worthwhile to scrutinize the reasons for the enthusiasm aroused by such an energetic, so reasonable therapeutic aid. And this enthusiasm has gone so far as to predict that transfusion introduced into practice will begin a new era of medicine (Gesellius) (38), as to nourish indefinite hopes, and instil a courage that borders somewhat on temerity.

We, although far from any exaggeration, indeed because out of any personal inclination, look in both camps, and we see the opponents decrease immensely in number, while the proponents increase and almost no longer number - we look at this enthusiasm and we are delighted. Science too must have its own intoxications, and it is natural that the conquest of a truth is surrounded by the always somewhat unbridled joys of victory. This is a psychological phenomenon which occurs in individual man and which also occurs in science when it achieves some victory over nature.

But will there be no illusions in this intoxication? Will it not be permissible to raise one's voice in this current that drags the experimenters, which wraps even the calmest minds in its coils? This is what I ask myself every day.

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2. La Martinière, Opuscules, Lettre à M. Colbert (*Journal des Sçavants*, 1667).
3. C. Plinii-Secundi, *Natural. Historiae*, Liber XXVIII, cap. 2.
4. Corn. Celsi. *De Re medica*, lib. III, cap. 23. *De comitialis morbi curationibus*, pag. 60-61.
5. Vedete G. Michelet, *La strega*, trad. ital. Daelli, Milano.
6. Goethe, *Faust*, trad. Maffei, pag. 32 e 143, atto primo.
7. Muratori, *Rerum italicarum scriptores*, tom. III, pag. 1241, Pars secunda.
8. Raynaldi, *Annales ecclesiastici*, 1492, pag. 412.
9. Vedi il Joannis Burchardii, *Diarium*, negli *Scrittori Monumenti della Storia italiana* del prof. A. Gennarelli, Firenze, 1854, vol. I, p. 193.
10. Non sappiamo dov'abbia trovato l'illustre storico che la trasfusione era stata fino allora tentata solo sugli animali. È un fatto che le prime esperienze di trasfusione si fecero soltanto quasi 150 anni dopo in Inghilterra dal Lower e King.
11. Villari, *Vita di Girolamo Savonarola*, Firenze, 1859, vol. I, pag. 140.
12. Sprengel, *Storia della medicina*.
13. Ficino, *De vita producenda*, Florentiae, 1499.
14. Cardano, *De rerum varietate*, lib. VIII, cap. 44°, pag. 441.
15. La prima idea di infusione dei medicamenti nel sangue sembra esser pata in Germania; diffatti nella versione latina del *Journ. des Sçavants* del 1666, num. 42, pag. 490, si legge: "*Maxime vero omnium arrist ipsi Bullialdo, quod ex Litteris tuis intellexit Infusionem jam factam esse in Germanid anno 1642, ut certum fit exinde Anglos, qui primi huius se rei inventores depraedicant, falli*."
16. Che la trasfusione entrasse in parte nella scienza come prova della circolazione, è provato dalle seguenti parole di H. Boerhaave: "Haecque est ratio (*della circolazione*) circumeuntis jugiter sanguinis, cujus inventi absoluta doctrina accurate explanati gloriâ immortale lucet Harwaei nomen: confirmavit illam infusion (dei medicamenti), Transfusion, microscopium vero ad oculum. Columbus, Cesalpinus, P. Paulo et Waena hujus quid norunt." Vedi *Institutiones medicae*, pag. 29.
17. Libavio, Appendix necessaria Syntagmatis Arcanor, chymicor., Francfurt, MDCXV, cap. IV. Pag. 7 e 8. – Si noti beneche questo brano fu scritto nei 1615.
18. Colle, *Methodus parandi tuta et nova medicamenta*, Venetiis MDCXXVIII.
19. Vedete l'opuscolo: *Transfusi sanguinis Historiam, methodum, ac artificium, effecta item et phaenomena, sub praesidio M. Jo. Christophori Sturmi Mathem. ac Phys. etc., etc., decernit*, lo. Cornelius Honn (di Norimberga), 1676, Altdorf, in 4°.
20. Clark, *Letter on the origin of injection into the veins, the Transfusion of Bloode* (*Philosophical Transactions*, An. 1668, p. 678). È notevole il brano del Clark: "Misso illo testimonio, quod a viro fide digno et Reg. Societatis consorte, penas te etiam num reperitur viz. Rev. Dom. Potter, theologum insignem, triginta ab hoc annis (scriveva nel 1668) consideratâ circulatione Harweana, socio huic nostro et aliis viris doctis, saepius Transfusionem sanguinis proposuisse".
21. *Stadera medica, nella quale oltre la medicina infusoria ed alter novità si bilanciano leragioni favorevoli e le contrarie alla trasfusione del sangue inventata già da* Francesco Folli *et ora dal medesimo descritta*. Firenze, MDCLXXX, un vol. in-8°, 217 pagine col ritratto dell'autore.
22. *Recreatio Physica, in qua de sanguinis et omnium viventium analogical Circulatione disseritur*, auct. Fr. Follio a Puppio: Florentiae, MDCLXV, in-8°, pag. 487.
23. *Dialogo intorno la cultura della vite* di F. Folli da Poppi, Fir., 1670, in-8°.

24. Che Folli non sperimentasse la trasfusione, si rileva dai suoi scritti. Nel dialogo sulla *Cultura della vite* egli scrive: “Una fra l'altre (invenzioni) ho sempre con ansietà bramata e *creduta possibile, benchè io non ne avessi tenuta esperienza*, e tale fu la trasfusione del sangue” (pag. 44). Nella *Stadera medica* aggiunge: - Conosco d'aver detto troppo intorno al modo di contenersi nella operazione, *non avendola sperimentata* (pag. 98). Più indietro aveva già scritto: “Il Duca tacendo, supposi o che *non ne avesse fatta fare esperienza alcuna*, oppure avendone fatte, non volesse che fossero note” (c. 29).
25. La relazione di questo discorso aggiunge che “la pluspart de mocquerent pour lors de cette proposition, et qu'on crût que la transfusion estoit impossible” (*Journal des Sçav*. 1667, pag. 184).
26. La questione sull'origine della trasfusione non poteva essere trattata altrimenti che collo scrutare le fonti, e col lottare contro la polvere delle Biblioteche. Intanto sulla priorità dell'invenzione, noi diciamo coll’egregio Dott. Ottoni che “altra cosa è fare un'osservazione, altra cosa è fare una scoperta: fare un'osservazione (e nel nostro caso concepire un'idea vaga, indeterminata) è avvertire un fatto senza studiarlo nelle circostanze, senza stabilirne le leggi, senza ricavarne le deducibili conseguenze fare una scoperta è reagire coll'intelletto sul fatto per analizzarlo, cimentandolo con esperimenti tendenti a stabilire la sua natura, le sue leggi; costringere, staremmo per dire, la natura ad ubbidire alla volontà dell'uomo” (*Riv. di* Soresina, fasc. 8°, 1874). E sotto questo riguardo certo la trasfusione non è italiana.
27. Mayor, *Prodromus a se inventae chirurgiae infusoriae*, Leipzig, MDCLXIV.
28. Bailly, *Histoire de l'astron. mod*., t. II, liv. 2^{me}, § VI.
29. Trattavasi qui forse di un lipemaniaco stupido? Non è improbabile. Notisi l'importanza data dal Denys all'anemia (o meglio oligoemia), e si vedrà che la indicazione fisiologica della trasfusione accennata dall'ardito innovatore è la stessa anche recentemente chiamata a giustificazione di certe trasfusioni.
30. Denys ci racconta questa esperienza: “La première experience ayant heureusement reussi, on en fit une seconde, mais plus par curiosité que par necessité; car celuy sur qui on la fit, n'avoit aucune indisposition considerable. C'estoit un porteur de chaise fort et robuste, agé d'environ 45 ans... Comme il se portoit bien et qu'il avoit beaucoup de sang, on luy fit une transfusion bien plus grande que la première, car on luy tira 10 onces de sang et on luy rendit à peu près autant de sang d'agneau, dont on avoit ouvert l'arterie crurale” (*Journal des Sçavants*, 1667, pag. 183).
31. Folli, *Cultura della vite*, pag. 48. Vedete un *Cenno storico* pubblicato dal Dott Bos nell’*Impaziale*, 1874, n° 23.
32. Citato dal Folli, nella *Stadera medica*, pag. 74.
33. “Canem hispanicam propter senectutem omnino languentem post receptum haedi sanguinem, non saltem bene se habere sed etiam quasi juvenescere...” (*Journal de Sçavants*, 1668).
34. Ecco il desiderio perpetuo di rifar la giovinezza, l'ansia perenne di poter dire con Faust:
    “Una giovine, sacra, ardente vita
    Per le fibre mi scorre e per le vene”
    Goethe, P. I, pag. 34.
35. Questo è anche il giudizio dei redattori della grande *Enciclopedia*, a. 1777.
36. Fu tanta la buona impressione di queste esperienze dello Scarpa sull'animo del Brambilla, che questi propose poi all'imperatore di chiamare l'illustre anatomico ad insegnare anatomia nella Università di Vienna. Scarpa accettava però l'insegnamento a Padova.
37. È da notarsi però a giustificazione del chirurgo inglese, che la donna non dava più segni di vita e che da 5 minuti era sospesa la respirazione (*Med. Chirurg. Transactions*, X, 1819).

38. Ecco le parole del Gesellius: Die Lammblut - Transfusion “wird in der Medicin eine neue Aera die - blutspendende – inauguriren” (*Die Transf. des Blutes*, Pietroburgo, 1873, pag. 159)

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