‘DE LA TRANSFUSION DU SANG’

By: Dr LOUIS JULLIEN

‘HISTORIQUE’

A TRANSLATION OF PAGES 1 - 46 BY PHIL LEAROYD

A copy of the book ‘Blood Transfusion’ by Louis Jullien, published originally in Paris, London and Madrid in 1875, can be viewed or downloaded from the following sites:

https://wellcomecollection.org/works/bvcssjmd

https://books.google.co.uk/books/about/De_la_transfusion_du_sang.html?id=uv0nHAu-86sC&redir_esc=y

I have translated the ‘historical section’ of this important 329-page book on transfusion from the original French 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 well as his ‘conversational’ style, 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. 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 French text.

Jullien uses a large amount of quotation marks and single sentence paragraphs in the original script. I have attempted to lessen the effect of this as much as possible in the translation whilst at the same time hopefully maintaining the overall information in a less disjointed presentation than it would otherwise be.

The first section of this book, titled ‘Historique’, covers a large amount of summary information regarding transfusion in antiquity and ‘pre-Harveyian’ history, including the writings of Libavius and Colle. The infusion experiments performed in England by Wren, Clarke, Boyle and Hensaw are mentioned together with Boyles’ detailed description of Lower’s transfusion of a dog in 1666. Jullien then provides interesting information regarding Denys’s reasons for performing transfusions that are based around ‘feeding’ the recipient, and in doing so also provides a defence for the use of animal donor blood, whilst at the same time arguing that it replaces the patient’s ‘corrupted’ blood. He also however recognises that by replacing blood ‘the forces of the sick are not diminished’, i.e. compared with the normal practice of ‘bleeding’. The author then provides a description of the three transfusions performed by Denys on humans together with a summary of the sentence given by the lieutenant of criminal cases. Interestingly the published arguments that occurred between Lamy and Gadroys are discussed prior to moving onto the points made by Merklin in the name of the church.

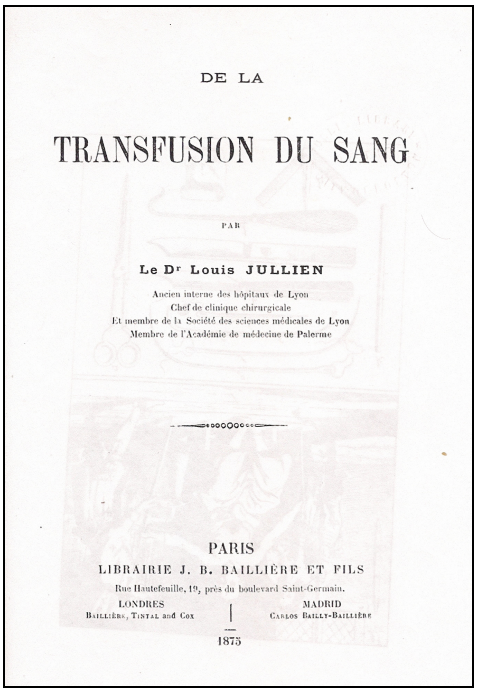
Then by necessity, moving the history to the 19th century, Jullien provides a summary of Blundell's research work as well as his early transfusion cases; he then moves onto the argument provided by Prevost and Dumas against performing transfusions at all and Ore's detailed analysis of research work, together with Bishchoff's research into the use of defibrinated blood. This leads finally to a description of the work of Gesellius and others in proposing the reintroduction of the use of animal blood for transfusion to humans.

It has to be said that there are sections of this text that are similar in presentation and information content to that used by Pierre Cyprien Oré in the 'Physiological history of blood transfusion' section of his book 'Etudes historiques et physioloiques sur la transfusion du sang' published in 1868, something that Jullien admits to in his text.

The history section does not include numerically arranged references that relate directly to the text but the author does provide a bibliography at the end of the book that are sub-divided into the three different historical time periods used. The history section of the book includes the first two of these time periods, i.e. 'Antiquity – 1850' and '1850 – 1873' but I have also included the bibliography for the third time period (i.e. '1873 – 1875') that doesn't form part of the history section for completeness and convenience. They are reproduced as printed.

LOUIS JULLIEN

Remarkably little has been published about the life of Dr Louis Jullien. He was born in Lyon on the 19th August 1850 and graduated as a Doctor of Medicine in 1873. He became an Associate Professor in Nancy in 1875 and was the surgeon at Saint-Lazare prison for women in Paris. A became a specialist in venereal disease and was the author of numerous publications on the subject of sexually transmissible diseases and associated subjects. He died in Paris on the 21st December 1913.


DE LA

TRANSFUSION DU SANG

PAR

Le Dr Louis JULLIEN

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1875

Title page of De la Transfusion du Sang (1875)
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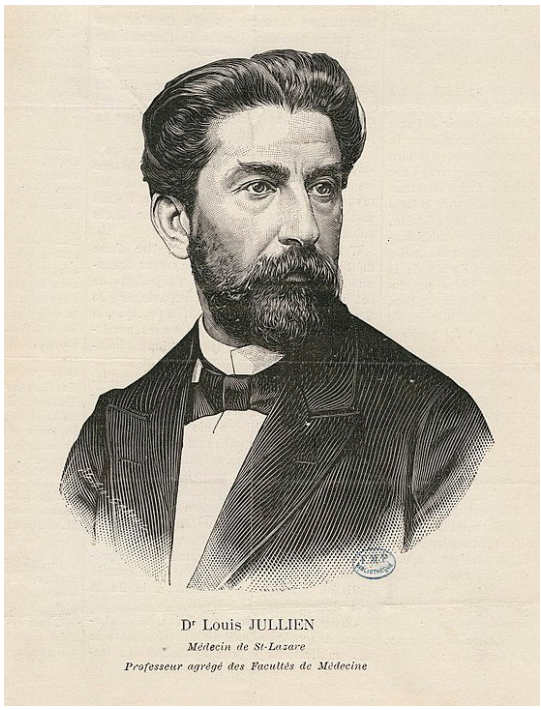
Dr Louis JULLIEN
Médecin de St-Lazare
Professeur agrégé des Facultés de Médecine

Dr Louis Jullien (1850-1913)
(Image credit: Wikimedia Commons)

'HISTORICAL'
Louis Jullien (1875)

Lamartinière, in a letter to Colbert published in Volume XII of *The Reasoned Encyclopaedia of Human Births,* published in Neuchâtel in 1746, sought to establish the age of the transfusion. According to this author, evidence of this is found:

1. In the *History of Ancient Egyptians*, where these people practiced it for healing of their princes.
2. In the *Book of Wisdom of Tanaquila*, wife of Tarquin the Elder, where it is said that she used transfusion.
3. In *Herophilian's Anatomy Treaty,* where it is spoken of quite clearly.
4. A collection of a former Jewish writer, which was shown in Lamartinière by Ben-Israel Manasseh, rabbi of the Jews of Amsterdam, and contained the following words: "Naam, Prince of the Army of Ben-Adad, king of Syria, suffering from leprosy, used doctors *who, to cure him, drew blood from his veins and returned others*.
5. The *Sacred Book of the Priests of Apollo,* where this operation is mentioned.
6. The *Searches of the Eubages*.
7. The *Works of Pliny, Celse* and several others, who condemn it.
8. *Ovid's Metamorphoses.* Medea, pretending to yield to Pellias' daughters who asked her to give back to their father his youth and vigour, said:
   … Quid nunc dubitatis inertes?
   Stringite, ait, gladios, velerem haurite cruorem,
   Ut repleam vacuas juvenili sanguine venas.
   (Metamorphoses, liv. VII.)
9. The *Treaty of the Sacrifices of the emperor Jullien,* of Libavius, in which the author speaks of transfusion, as having been an eyewitness to such an operation.
10. Finally, Marcil Ficin, Abbot Trithème, Aquapendente, Harviée and Fra Paolo, had experienced it themselves.

That is certainly a very large list of important documents; so have judged most French authors, all of whom merely copy it without comment, some without indicating the source. I hasten to add that I have not had the opportunity to resort to the original text of the *Book of Wisdom* or the *Research of the Eubages*; but I don't have any difficulty in counting Herophilos as one of the ancestors of transfusion, this great genius, who had devoted so much zeal to the study of the circulation, and who, if Tertullian is to be believed, had not retreated from human vivisection: Ovid's famous quotation "Herophilus, ille medicus aut lanius qui sexcentos homines exsecuit, ut naturam serutaretur, qui hominem odit ut nosset", and what value should be attributed to the strange conceptions of this poet, whose constant concern is to make us witness, on every page of his writings, to metamorphoses of which he had certainly never glimpsed the possibility?

In more recent times, it is in the 15th century that we find the first vestiges of the operation of transfusion. It was Mr. Wils who made them recently known in a letter to the *British Medical Journal* (1863). "In the 15th century," he says, "blood transfusion was known and applied". In the *Life of Jérôme Savonarole,* by Villars, we find this fact mentioned by Sismondi: "The forces of Pope Innocent VIII were falling fast. He had for some time been plunged into such drowsiness that at times he seemed dead. All means of awakening his exhausted life had been put into use, when a Jewish doctor proposed to obtain the desired result by means of transfusing the blood of a sound young man, a method that had so far only been performed on animals. So we exchanged the blood of the old and feeble pontiff against that of a young man. They did it three times again, and the experience cost the lives of three young men;

probably he had allowed air to enter their veins; but no effect was achieved, the pope was not saved; he died on April 25, 1492.

A century later, the chronicles of the Italian doctors of Catherine de Medici's court, who sacrificed children stolen from the streets of Paris, told of inserting a tube into their carotid arteries the tip of which penetrated into the vein of a great lord.

We look forward to a more defined period. It was opened by Libavius in 1615. Here is a passage from his very explicit writings: "Adsit juvenis robustus, sanus, blood spirituoso plenus; adstet exhaustus viribus, tenuis, macilentus, vix animam trahens. Magister artis habeat tubulos argenteos inter se congruentes, aperiat arteriam robusti, et tubulum inserat muniatque; mox and aegroti arteriam findat, et tubulum femineum infigat. Jam duos tubulos sibi mutuo applicet, et ex sano sanguis arterialis, calens and spirituosus saliat in aegrotum, unaque vite fontem afferet omnemque langorem pellet."

It remains to be seen, however, whether Libavius treated our subject seriously or ironically. In support of the second hypothesis, Sprengel alleges Libavius's joking tone, which adds a little later: "Sed quomodo ille robustus qui sanguinem suum transfundendum exhibuerit non languagescat?... Danda sunt ei bona confortantia, et cibi; medico vero helleborus."

"Working in anatomy," says Astruc *(Traité de la maladie des Femmes*, Volume IV, p. 285), "we had been advised to inject the vessels, to better distinguish their ramifications". In this example, it was imagined that liquid remedies, especially purgatives, sweats and fondants, would be injected into the veins of patients, in the hope that by acting directly on the blood, they would act more effectively.

Jean Colle, professor of Padua, described transfusion in a medical treatise printed in Venice in 1628, under the title: *Methodus facile parandi jucunda, tuta et nova medicamenta*, c.7. There is also talk of the attempt in 1642 by the hunter of a gentleman of Lusace, named Wahrendorf, to inject blood into the veins of a dog.

But it is certainly the Harveyan theory that has suggested in England, as in many places, the idea of infusion and transfusion. It was around 1656 that, for the first time, a Frenchman spoke publicly about it; it was Denys, who had the loyalty [towards transfusion] for us to keep as a memory. "We know," he said in a letter to M. de Montmor, "and there are several honorary persons who can testify, that it was more than ten years since Dom Robert de Galatz, a Benedictine cleric, gave a speech on transfusion, and there are still several copies of it; it is true that most scoffed for this proposal, and it was believed that it was impossible". The English, seeing that no state of this invention was made in France, wanted to seize it as an abandoned thing, and practiced it on beasts. *(Journal des Savants*, Monday, June 28, 1667, p.96)

However, according to Christophe Wren, professor of astronomy at Oxford, [it was] in 1657 in England that Timothy Clarke, Robert Boyle and Henshaw attempted to inject drugs into the veins of the body, and their example was soon imitated by Richard Lower. It was found that, administered in this way the drugs produced the same effects as if they had been taken by ordinary means. From then on they did not appear to be exposed to such numerous changes, and it was believed above all, in cases where the patient could not swallow, to have discovered, a great way to carry the remedies into the body and ensure their effectiveness. It was then that Lower conceived and implemented the idea of blood transfusion. The first experiment was made in 1666. It was a small little 'morning dog' through whose veins a large amount of blood was poured from the artery of another [dog]; as soon as the little dog was untied, he immediately ran, and the second appeared as if it had only been plunged into water.

A little after, Robert Boyle communicated to the Royal Society of London, on behalf of Lower, the account of this experiment and the process used by the author to transfuse the blood of one animal into another.

"First, you have to take the carotid artery of a dog or any animal that you want to pass blood into another's body, and having separated it from the nerve of the eighth conjugation, keep it uncovered by about an inch; then, in its upper part make a strong ligature that cannot be untied, and an inch below, pointing towards the heart, make yet another ligature that can tighten or let go as it is needed. These two knots made, pass two wires under the artery between the two ligatures; then open the artery and put a small quill pipe in, and connect the artery tightly with the two threads over that pipe, which you will stop with a small cap. After that, open the jugular vein of the other animal an inch and a half in length and make a loose knot at each end, and between these two loose knots pass over the vein two threads, as in the artery; then make an incision in the vein and put two pipes in it, one in the lower part to receive the blood of the other animal and carry it to the heart, and the other pipe in the upper part, which comes from the test, by which the blood of the second dog can flow into dishes. These two pipes being put in this way and keep the ends closed with a stopper until it is time to open them."

"Everything is thus prepared, link the dogs to each other on the couch, so that we can pass other pipes into the first two; because you cannot approach the necks of the dogs close enough to each other, you have to put two or three different pipes in the first two to carry the blood from one to the other. After that, uncork the pipe that goes down into the first dog's jugular vein, and the other pipe that comes out of the other dog's artery; and by means of two or three other pipes, depending on what it needs, join them to each other, then let go of the loose knot, and immediately the blood will pass impulsively through the pipes as through an artery, and at the same time as the blood flows into the dog, uncork the other pipe that comes from the upper part of the jugular vein (having previously made another ligation around its cervix, or at least pressing the other jugular vein with the fingers), and at the same time let the blood flow in the dishes (not continuously, but depending on whether you judge that its strength will be able to allow it) until the other dog starts screaming, weakening, falling into convulsions, and at the end dies on that side."

"Then pull the two pipes from the dog's jugular vein, and having fully tightened the loose knot, cut the vein over it (which can be done without any harm to the dog, because one of its jugular veins is sufficient to carry all the blood from the body and from the upper parts, because of a large anastomosis through which the two veins unite towards the larynx). This done, stitch up the skin and let go of the dog, which will jump off the table, shake and run away as if nothing had been done to him." *(Journal des Savants*, Monday, January 31, 1667, p.21)

The superior mind of R. Boyle, grasping the scope of such an experiment, soon asked Lower to re-test, and gave him a number of questions to solve. There are sixteen of these proposals, and I will mention a few:

- If there is some considerable change observed in the pulse, urine and other excretions of the receiving animal and in the amount of its imperceptible perspiration?
- If a dog which has some disease that can be attributed mainly to the mass of blood, will he be cured by the exchange of that blood or that of a healthy dog? And if a healthy dog will receive these diseases by injecting the blood of a sick dog these diseases are not of an infectious nature.
- If, a purgative, given shortly before the operation to the dog that will have to supply the blood, whoever receives it will be purged, and what will be the effects?
- If the operation succeeds if the blood of one animal is injected into the veins of another of a different species, such as a calf in a dog; and a cold-blooded animal, like a fish, a frog, a turtle, in the vessels of a warm-blooded animal, and *vice versa*?
- If transfusion can be done on a full dog for some time, and what effect will it have on small dogs?

R. Boyle's appeal was heard and Ed. King, immediately afterwards published some experiments. They do not present anything very remarkable except that they were made from vein to vein, and that he did not transfuse arterial blood, as Lower had done.

At the same time, Coxe was injecting blood from a scab-infected dog into the veins of a healthy dog. The sick dog was healed, and the other was unarmed. A bizarre result that may explain the effect bleeding has on an animal probably suffering from a disease other than scabies.

Around the same time, a writer who was very acquainted with paradoxes, known as Sprengel, Jean-Daniel Major, a doctor at Kiel, argued that he was the inventor of the new method in his treatise titled *Chirurgia infusoria,* Kiloni, in-4, 1667. But Major did not convince anyone. His trials were known in 1667. He pulled three to four ounces of blood through the vein of the arm of a very dumb man, then untied the ligature and replicated it below the wound, so that the healthy person's blood penetrated without mingling with the one contained in the lower part of the vessel. Then he stung the vein of the healthy individual and covered the wound, lest the contact of the air break down the blood. For this purpose he used a vase similar to a suction cup, from which the fluid could flow; he had been careful to spread ammonia salt there before, in order to prevent the blood clotting.

Let us also quote the *Nova clysmatica* of Jean-Sigismond Elsholtzius, who was led, it seems, by his own meditations, to do some experiments on the subject before us.

While these experiments were being carried out in England and Germany, Denys, a doctor of medicine at the Faculty of Montpellier and professor of philosophy and mathematics in Paris, was also experimenting. He said that "… on Thursday, March 3, Mr. Emmeretz, our surgeon, and myself, were brought two small dogs that had never been fed together and which by their faces seemed to be animals of different species, one being a pet spaniel and the other a short haired dog resembling a fox. This dog was full and a little bigger than the other dog, being twelve inches tall whilst the other dog was only ten inches tall."

"We proposed to do not only what was stated in (Richard) Lower's letter which is to pass the blood of one animal into another by killing the one who communicates it in order to keep the one who receives it, but we wanted to keep them both and for this we resolved to open the dog's crural artery, persuading ourselves that by drawing blood from the artery that carries it from the thigh to the extremities, convulsions would not be so much to be feared for the dog as by pulling it by the carotid that carries it through the cervix in the brain; besides that the crural artery is not so loose or so depressed as the carotid, we would not be obliged to use untied pipes, which are prone to clogging up when the blood passes there, and the dog does not suffer so much, it would be easier [for it] to escape. Indeed, it happened in the presence of several people worthy of faith, as we had planned, and in a fairly simple and easy way."

Denys insists, says Oré, on how the pipes were placed in the crural artery and jugular vein. The process is similar in this respect to that of Richard Lower; he was thus able to pass the blood from the artery into the vein, at the same time as it was flowing, using a third pipe, blood was collected into a dish.

"When we had drawn by this third pipe nine ounces of dog blood into a dish", continues Denys "(which is much for an animal of this size), the dog who had given him as much, and who therefore had little left, began to weaken; therefore we immediately stopped his artery, tightening the loose knot; and, after also making two strong ligatures to the dog's jugular vein instead of the two loose knots we had made there, we detached the dogs."

As these experiments were varied and repeated in several ways, Denys resolved to practice transfusion on humans. It was on June 15, 1667 that the operation was performed for the first time. Denys entrusted this operation to Emmeretz. However,

before reporting it, it is right to pass before the reader's eyes the reasons that determined it. They are explained in a letter to Montmor, master of the requests:

"By practicing transfusion," says Denys, "we are merely imitating nature, which, in order to feed the fetus in the mother's womb, makes a continuous transfusion of the mother's blood into the child's body by the umbilical vein. Getting a transfusion is nothing more than feeding by a shorter path than is usual, that is, putting all-done blood in your veins instead of taking food that only turns into blood after several changes. This abbreviated way of feeding is preferable to the other, in that the food taken by the mouth, having to go through several parts that are often ill-disposed, can contract several bad qualities before having arrived in the veins; it is subject to several alterations, which are immediately avoided by putting perfect blood in these veins; in addition, this operation agrees with doctors who approve of the bleeding and those who do not approve of it: because it removes corrupted blood, and these, because by putting new blood in the place of the one being drawn, the forces of the sick are not diminished, and at last reason seems to teach that diseases caused by the weather and the corruption of blood must be cured by the transfusion of pure and well-tempered blood."

After responding to those who condemn transfusion as useless, Denys responds to those who condemn it as barbaric.

"What gives them this view is that they imagine that, in order to do the right thing, the animal that provides the blood is of the same species as the one who receives it, and thus one can only prolong the life of one by shortening that of the other." But Denys makes it obvious that this is not necessary, and that on the contrary the blood of animals is better for men than that of men themselves. The reason he gives is that men, being agitated with various passions and little regulated in their way of life, must have a more impure blood than beasts, which are less prone to these disturbances, and that indeed there is little corrupt blood in the veins of the beasts; instead of always noticing some corruption in the blood of men, no matter how healthy they are supposed to be, and even in the blood of small children, because they were fed their mother's blood and milk, they sucked corruption with food. Moreover, Denys adds, why should the blood of the beasts not be suitable for men, since it is of the same species as the milk and flesh from which they usually feed? It might be added that, as a few authors have noticed is true, that barbarians who feed on human flesh are subject to several unfortunate diseases of which those who feed on the flesh of animals are free, it must be concluded that, since the flesh of men is more unhealthy than that of animals, their blood is also less suitable for transfusion.

All of these reasons serve as a preamble to two transfusion operations performed on humans.

"The first was made on a sixteen-year-old young man, who, following a fever that had lasted two months, and in the course of which he had been bleed twenty times, had remained in stupor and drowsiness. Denys drew three ounces of blood and transferred nine ounces of arterial lamb's blood to him. This young man lost three or four drops of blood from a nose bleed, and then he became calm again; his sleep ceased to be restless; his limbs gained more strength and agility, put on weight, and always got better and better until he was fully healed!"

This first experiment was fortunately successful, and Denys tried a second; but more out of curiosity than out of necessity, for the individual on whom it [the transfusion] was made had no illness: "He was a strong and robust [sedan] chair-bearer, about forty-five years old, who, for a quite modest sum, offered to endure this operation. As he was doing well and had a lot of blood, he was given a much larger transfusion than the first; about ten ounces of blood was taken from him, and in return was given about once as much blood from a lamb whose crural artery had been opened to diversify the experience. This man, who of his naturalness was quite cheerful, was in very good spirits throughout the operation, made several reflections, depending on his scope, on this new way of healing, of which he could not admire

the invention enough, and complained of nothing other than that he felt great warmth from the opening of the vein up to the armpit. As soon as the operation was done, he could not be prevented from dressing the lamb from which he had received the blood; then he went to find his comrades, with whom he spent some of the money he had been given; and, notwithstanding that he had been ordered to rest for the rest of the day, and that he had promised to do so, on lunchtime, finding an opportunity to earn money, he carried his chair normally for the rest of the day, assured that he had never done so well; and the next day he begged us to use him again when we wished to repeat the same operation." *(Loco cit. 93.*)

The first transfusion in England was in the same year; Lower and King opened a young sheep's carotid artery, and Mr. Arthur Coga's arm vein, which is usually bled. They inserted two pipes, one to the man's vein, the other formed by several pen pipes [quills] inserted into each other, to serve as a communication channel, and to drive the blood that came out of the sheep's artery into the vein of the man destined to receive it. The blood flowed continuously for at least two minutes into the man's vein; during which time they judged that Arthur Coga had received 9 or 10 ounces of blood. He found himself, moreover, so little inconvenienced, that four days later he came to ask the two scholars to repeat the experience.

At the same time, these facts were repeated in Flanders, Italy. In 1668, Fracassati, Riva and Manfredi, performed a transfusion on a man. A doctor named Sinibaldus was willing to submit to it. And we find in detail the procedure used by the surgeons of Rome for human-to-man transfusion. "They mark on the skin, with ink, the path of the vein through which they want to bring in blood; then they remove this skin, and make with the razor an incision, following the mark, about two inches long, in order to discover the vein and separate it from the surrounding flesh; they then pass a needle threaded under the vein, to bind it, by means of a waxed thread, with the cannula that must be inserted into it to convey the blood."

Let us also mention a curious attempt on a parrot. He was injected to rejuvenate him with the blood of two starlings. This barbarity only hastened its end, which took place shortly after the operation.

For their part, Denys and Emmeretz performed a third operation and then a fourth operation in France. The first could only have one surgical result, it was obtained.

Baron Bond, son of the Prime Minister of the King of Sweden, having been afflicted with a serious illness, was subjected to various remedies; "a number of bleeds from the foot, arm bleeds, purges and enemas". The patient was so weakened by this medication that he frequently fell into syncope. Vomiting and convulsive movements complicated his condition. Seeing him lost we tried transfusion: he was transfused with two cups of calf's blood; convulsions and vomiting ceased, the pulse became more responsive. Twenty-four hours later, the symptoms reappear; we returned to the transfusion. The patient seemed to regain some vigour, but he soon succumbed. The autopsy explained the death; all the intestines were found to be gangrenous.

The second fact is important enough that we need to report it, as Mr Oré did, in great detail: "The patient in question was thirty-four years old. Since the age of twenty-six, he had given unequivocal signs of madness. This madness had presented marked intermittency. The patient had alternatives of agitation and calm. Soon his agitation became extreme; he fell into a complete state of delirium. Being in the country, four leagues from Paris, despite all the precautions used to prevent him from escaping, he managed to escape and arrived naked in the streets of the capital. Mr. Montmor, touched with pity, entrusted him to Denys, who, together with the surgeon Emmeretz, gave him the transfusion. Emmeretz opened the crural artery of a calf, and having taken ten ounces of blood from the vein of his right arm, he was transfused five to six ounces of calf blood; at the same time, the patient felt a pronounced warmth in his arm and under his arm. The delirium subsided a little and Denys performed a new transfusion on his left arm, which was more abundant than

the first. The calm returned completely after several days; for, knowing that it was Christmas, he brought his confessor to give communion; he confessed so accurately that his confessor gave a public testimony of his common sense. His wife increasingly confirmed the good effects of the transfusion, telling Denys that, in the present day (it was at the full moon), her husband used to be very carried away and very angry with her; instead of being humane and gentle with it, as it was at that time, he had been in the habit of swearing and hitting her. Since then, this man became quiet, was able to go about his business, and passed his nights in an uninterrupted sleep." (*Abstract of the Philosophical Transactions of the Royal Society of London*, Part 6, 1790, p.387 and following)

"This man, who had been operated on towards the end of 1667, remained cured until January 1668; he relapsed at that time. His wife, having given him remedies that had had no effect, begged Denys to do the transfusion again; he refused at first; then, yielding to the urgent requests that were made to him, he began the operation, but soon the sick man was taken by a general tremor. *The transfusion was not done*, and death occurred during the night. Suspecting that he had been poisoned by his wife, Denys asked for the corpse to be opened and could not get it. The woman assured him that offers of money had been made to her to maintain that her husband had died as a result of the transfusion; she asked Denys to argue otherwise; he refused, and complained to the criminal lieutenant. A sentence of the Châtelet ended this challenge." (These last details can be found in Volume XXVI of the *Dictionnaire des Sciences*, Neuchâtel.)

Excerpt from the sentence given to the Châtelet by the lieutenant of criminal cases.
Paris, April 17, 1668.

"In this case, evidence of the following facts has been proven:

1. The transfusion operation was performed twice on Mauroy, who was insane, and a third was tried. It succeeded so well the first two times that we saw this man enjoy for three months all his common sense and perfect health.
2. Since the first two operations, his wife gave him eggs and broth for food and slept with him four times. Despite the advice of those who treated him, and without telling them, she led her husband home, who went there only with great reluctance.
3. Since that time he frequented public houses, took tobacco, and having fallen ill, his wife made him drink spirit liqueurs and broth to which she mixed certain powders. Mauroy complained that she wanted to poison him and gave him arsenic in his broths, she prevented the assistants from tasting it, and, simulating the madness, she threw the contents of the spoon on the floor.
4. Mauroy had frequent quarrels with his wife; she beat him even though he was ill; having once thrown a box at his head, she said that he wouldn't repent, though she might die.
5. When the transfusion was tried for the third time, it was after very strong insistence by his wife. Those who were to practice it consented to do so only with the permission of the Solicitor General. On the same day that the operation began, barely a little blood had come out of the patient's foot or arm, a tube was placed in the vein; then the madman began to cry, though, it seems, the calf's blood had not yet passed through his veins, and the operation was not continued. The patient died in the night.
6. This woman did not want to allow anyone to open her husband's body, giving the reason that he was already in the coffin, when he was not there.
7. Long after the death of said Mauroy, three doctors offered money to this woman to form a complaint, accusing the transfusion of killing her husband; she said, when these people had left her home, that she had agreed with them, and that if

those who had done the operation refused to give her what was necessary for her to return to her country, she would do what she had concluded with the others.

A witness testified that she came to ask him to inform the operators that, if they did not want to provide for all her needs throughout her life, she would accept the offer of the aforementioned doctors. Another witness testified that a doctor offered him 12 gold louis d'or to claim that Mauroy had died during the operation of the transfusion itself."

"There is ample need to inform this case in a comprehensive manner and to examine this woman; to inform, in order to know what these powders were; why she gave them to her husband, who had ordered them; why she prevented the opening of the body by her lies. New information will have to be taken, and in the meantime we will secure the aforementioned woman."

"As for the three doctors who offered her money to persecute those who had done the operation, and who had been seen with her, they would be assigned one day to appear in person."

"Finally, considering that the first two transfusion operations were successful, and that a third was undertaken at the urging of the woman, who, moreover, very poorly observed the orders of the operators, and who is suspected of having caused the death of her husband, it is requested that one day be summoned to appear in person in order to complete the case."

"On which, it was decreed that the widow Mauroy would be subpoenaed to appear in person, and would be examined on the above information, and that more information would be taken on the content of Mr. Denys' complaint, and that in the future, transfusion could not be done in humans without the approval of a doctor of the Faculty of Paris."

The enemies of transfusion triumphed. The toughest of them all was Lamy. Portal gives us a summary of the reasons aligned by this Doctor Regent of the Faculty of Paris. He claims that this operation is more a new way to torment the sick than to cure them, because the diseases that are said to serve as a cure are precisely those that come from *the excessive heat of the blood, or its corruption.* In those caused by too much heat, transfusion cannot take place; because the blood that is tempered, being warmer than the patient's own blood, will increase the heat of the blood of it, far from diminishing it; it won't be any more useful in diseases that comes from blood corruption because the little foreign blood that is received by this operation will rather corrupted by all the mass of blood that is in the body of the sick, that the weather of the whole mass of blood will not be corrected by this little foreign blood; for if the corruption of the blood of a miserable rabid animal is so great that a little foam or steam that comes out of its body through perspiration is able to infect the whole mass of blood of an animal that is doing well, how will a little foreign blood not be infected by mixing all the blood of an animal that is attacked from these diseases?

Lamy not only thinks that blood transfusion is useless, he also believes it to be pernicious and capable of giving rise to diseases; for, as the blood of a calf or animal of any kind is composed of several different particles intended to nourish the different parts of his body, he asks whether this blood is passed through the veins of a man, what will become, for example, the various particles of this blood that nature had intended to produce the horn?

Secondly, as the mind and dying usually follow the temperament of the body, and the temperament of the body depends particularly on that of the blood, it is feared that the blood of a calf, transfused into the veins of a man, also communicates to him the stupidity and brutal inclinations of this animal*. (Journal des Savants,*10, 1662.)

Gadroys responded to Lamy's arguments in a letter to Father Bourdelot: He first contrasts Lamy's reasoning to the experience to which everything yeilds. There is no longer any question, in physics and medicine, whether an animal can feed on the

blood of another animal of different species, since two dogs who had been given calf's blood eight months earlier were still alive at the time he was writing, and a small spaniel, which was languid in old age, after receiving the blood of a kid, not only had it worked well, but was, so to speak, rejuvenated. Then responding to Lamy's objections, he remarked:

1. That, although the blood that is transfused appears warm to the touch, nevertheless it can refresh; just as a veal broth that is left to cool, feels warm when swallowed.
2. That, as for the observation that a little foreign good blood put with a large amount of corrupted blood cannot correct the former, does not prove that the transfusion is useless, because one can make blood drain as large as we want before transfusing it again, and that, for that matter, nothing will prevent a large quantity of common blood from being put with a small amount of corrupted blood, which will remain in the veins.
3. Let us not be afraid that horns may develop from those to whom has been transfused with the calf, or that the brutality of this animal will be communicated with its blood, since it is not feared that the same accident will happen to those who take cow's milk.

Finally, to confirm the usefulness of transfusion, he reports an experiment on a patient reduced at the last end. This is the one recounted above, with the observation of the great Swedish lord.

On this point, the adversary's response is to overwhelm the sick, not to relieve them, to give them blood through transfusion, since the greatest secret of medicine is to remove them by bleeding, the experience having shown that the abundance of blood is dependent on nature almost in all diseases. It is true that it is said that transfusion is always accompanied by bleeding, and no blood is given before; but it is obvious that it is destroying what the bloodletting has done; that it is not unloading nature, but only changing its burden; and that a patient would not be more discharged than a porter would be who unloaded a bag of peas to be loaded with a bag of beans.

And assuming that transfusion was of some use, it would be necessary, in order to carry it out, to use the blood of man and not the blood of the beast; because women's milk is better as a children's food than that of any other animal, it follows that it is preferable to any other for transfusion. (*Journal des Savants,* p.15*,* 1668.)

Tardy, in his letter to Le Breton, doctor of medicine at the Faculty of Paris, admits that men are better for transfusion than animals; but he also admits that, while transfusion is not good for all diseases, and especially for pleurisy and all hot diseases, in which it is more useful to remove blood than to give blood, however it should not be rejected, because it can be useful in many other cases. (*Journal des Savants*, February 6, 1668)

Gurge, Lord of Monipolli, took part in this discussion, and in a letter to Father Bourdelot he said that the middle must be kept between the two contrary opinions we have spoken of so far. According to him, this operation is not as safe or of as great a use as some claim; but it is also not entirely useless, much less pernicious, as others assure. It is a dubious remedy, which can produce good effects if it is well administered, and that can have very unfortunate consequences if it is not used with great caution.

For his part, Lamy wrote again to Moreau in response to Gadroys' objections; but his answers are merely a repetition of the arguments set out in his first letter.

At the same time, a book by Eutyphronus, philosopher and physician, was published with the title "*De nova curandoprum morborum ratione per transfusionem sangis dissertation"* in which the author refuses to admit transfusion; he scoffs that, in order to authorize transfusion, it has been argued that it is an abbreviated way of

feeding by putting all-done blood in the veins, instead of having fun doing it in the ventricle; he says that it is the shortest, but not the safest, path, and that it is almost as if a person who would be on a third floor, wanting to come downstairs, would not bother to go down the stairs, but to take the shortest path would jump out the window; for since nature has shown no other way to drive blood through the veins than to pass it through the ventricle, there is temerity in taking other paths.

For his part, the illustrious Perrault expressed his disapproval. "It is very difficult," he writes, "for an animal to accept a blood that has not been cooked and prepared at home. It is proper to nourish him, the blood from which he draws his spirits, has passed through the ducts and filters of his body; other filters and ducts would change a proportion that must be accurate... it would be strange if we could change blood as we change a shirt."

But the most terrible assault on transfusion was by Merklin, in his book entitled: "*Tractatio med. curiosa de ortu et occasu transfusionis sanguinis, quae fit e bruto in brutum, a foro medico penitus eliminatur; illa quae e bruto in hominem paragitur refutatur; et ista, quae ex homine in hominem execretur, ad experientiae examen relegatur. Authore Georg. Abraham Merklino jun. doct. medic. Norimbergensi Ord. et in S. R. C. Academia Natur. curios, dict, Chron. Norimbergae anno. 1679*."

Chapter 6 draws from the arguments of the Sacred Books: "Positions, sive argumenta aliquot ex sacris et profanis scriptoribus contra transfusionem afferuntur; quae Romae et Lutetiis Paris. interdicta est; et ab aliis etiam el. virus improbatur. Duplici gravissimae occurritur objectioni. …Ibse sapientissimus Deus, y est-il dit, cujus consilia inserutabilia sunt, non uno sacrarum litterarum loco, mystis am praeconibus, belluini sanguinis usum sub indignationis poena humano generi prohibuit, ut videre est. Gen., C.9, vers. 4, Levit., c. 3, vers. 17, and cap. *7,*vers. 26, 27, itemque, caput 17, vers. 10, 12, 13, nec non caput 19, vers. 26. Deuteronom., 12, vers. 16. Samuel., cap. 4, vers. 33 et 34, etc. Haee interdictio etsi nobis sine ulla addita ratione sufficientissima, et tanta omnino esse possit, ut ne latum quidem unguem, ab ea discedere nobis liceat."

Besides, what is the use of transfusion? Can it provide services? No, "... Non facit contra lepram, non contra luem veneream, non contra cancrum, erysipelas aliaque ulcera externa: non contra variolas; non contra pleuritidem, aliasque internas inflammations; non contra haemorrhagias; non contra rabiem, nec denique contra ullum alium morbum" (caput III).

The ninth and final chapter, however, contains some reservations about human-to-human transfusion: "Transfusio sangis ex homine in hominem duplici modo fieri potest; nec approbatur, nec improbatur, sed in medio reliquitur et ad experientiae examen relegatur."

This condemnation in the name of the Church is, it should not be forgotten, that of an individual, Merklin. A few authors have suggested that the court of Rome had fulminated against transfusion. We looked through the Bullarium with the utmost care, without being able to find any allusion that, near or far, would have any relation to our subject.

From 1679 we have only a few isolated attempts to mention. In Dantzik [Gdańsk], Dr. Schmidt tried transfusion again. He injected drugs into the veins of those with syphilis, gout, apoplexy, and apparently managed to cure many of them.

In Frankfurt-on-the-Oder, surgeons Balthazar, Kaufmann and Mathieu-Godefroi Purmann healed a leper in 1683 by passing the blood of a lamb through his veins.

Francesco Folli, from Florence, in 1680, spoke of transfusion, especially from the point of view of the operating manual and instrumentation.

Michaelis Ettenmuller, from Leipzig, in 1682, recommended transfusion against fevers, hypochondria and scurvy. A small amount of blood must be injected several times.

M. de La Chapelle, in 1749, in a book entitled *Natural Method of Healing Diseases*, was the first to try to bring minds back to the study of transfusion, but his efforts were unproductive.

Later, Michel Rosa, a professor in Modena in 1788, practiced many experiments on animals; one of its most important conclusions is that one can, without danger to life, mix the blood of an animal of the blood of a different species. This process can bring back to life an animal rendered bloodless by haemorrhage.

Darvin, a doctor from London in 1796, formally advises to make the transfusion on the man with blood from a man, donkey or sheep,

In all cases where we find ourselves in front of patients exhausted by putrid fever, in the squirrhe [tumour] of the oesophagus. The full list of bibliography published later contains a number of other, less important indications, which would have taken too long to incorporate into our history.

XIX CENTURY

The transfusion of blood had long been almost forgotten, when, around 1815, several authors, almost at the same time, wrote about it: Hufeland, in his book *De usu transfusionis praecipue in asphyxia*, published in Berlin; De Groefe in a work entitled *De novo infusionis methodo*, and Petrus Christius de Boer in his *Dissertatio physiologica medica de transfusione sanguinis*.

We would like to quote these names to make it clear that Blundell is generally wrongly credited with resurrecting the issue; no doubt it was his experiments that shed the most light on this problem, it was the truly scientific method he used that paved the way. But who can calculate the degree of influence that the aforementioned authors have on his studies?

Anyway, one reads in the *Medico-chirurgical transactions,* from 1818, the account of the clinical fact that urged him towards this study: "A few months ago, I was called to a woman who was wasting away as a result of uterine haemorrhage; the losses had stopped before I arrived, but the fate of this patient was decided; despite the best efforts of the doctors, she died after two hours. Later, reflecting on this sad scene, because there were circumstances that gave a particular interest, I could not help but think that the patient could have been saved by a prior transfusion, and although there was little opportunity to operate in the usual manner, the vessels could have been filled with ease and promptness by means of the syringe."

However, fearing that the blood was no longer fit for animal function after its passage through the syringe, afraid of the many dangers that practice should prove to be illusionary, with a perfect method and an admirable clarity of deduction, he instituted a series of experiments of which here is the statement and conclusions:

1. "Transfusion of blood from one dog's artery into the veins of another, using the syringe." It was evident from these experiments that blood is not rendered unsuitable for the animal's use by passing through the syringe.
2. "Transfusion, by syringe, of arterial blood from an animal in its own veins." We saw that the blood remained fit for purpose in life, although it had been repeatedly passed through the syringe.
3. "Experiments in which the blood stayed for some time in the cup of the syringe." These experiments proved that the blood was obviously unfit for function when it spent 30 to 60 seconds in the cup of the syringe; but they are invalidated by those that follow.
4. "Experiments in which a dog was completely deprived of his blood and received human blood." It can be concluded from these experiments that human blood cannot be substituted in *large quantities* for that of dogs. It is obvious that the death was not accidentally produced, either by the speed of the injection, by the

excess, by the prolonged stay of blood in the syringe, or because the animal had been held in an apparent state of death that was too prolonged. All of these accidents had been carefully avoided.

5. “Transfusion with venous blood, instead of arterial blood.” These experiments were conducted in the same way as those in where arterial blood was injected. The animals subjected to experimentation lived.
6. “Experiments on injecting air into the veins." It seemed that air, either atmospheric or from the lungs, could be injected into a dog's veins without disturbing its functions.
7. “Experiments on how long it takes a dog's blood to clot.”

The following year, 1819, he performed transfusions to a young man with persistent vomiting, symptomatic of pylorus cancer. Unfortunately, the patient died of starvation on the third day. Blundell therefore concluded that transfusion should be reserved only for haemorrhage. The opportunity to put it into practice in one of these cases soon presented itself; this time, the transfusion was well indicated, it was a uterine haemorrhage. The patient was in a desperate state. At first he injected 4 ounces of blood, the patient gradually returned from her syncope. He again made two injections of the same quantity and was successful. In 1826 and 1827, two new cases arose, which brought him further success.

From the beginning of this research, we see a singular number of books on this interesting issue. In 1819 Moefft published his *Dissertatio de sanguinis transfusione* in Berlin; Tietzel, in 1824, published, under the same title, an important work; finally, a fellow of Blundell, Waller, brings his share: *Observations on the transfusion of blood*.

Finally, in his inaugural thesis in 1823, Mr. Milne-Edwards, incidentally touching at this point in the history of circulation, asserts, with boldness that events have fully confirmed, that the transfusion of blood can be of valuable assistance in the treatment of severe haemorrhage.

But let's record a discordant note. Taking scientific form the arguments made by Perrault in the past, Mr. Prévost and Mr. Dumas mercilessly condemn the transfusion in terms that we think are interesting to report: “This operation, unfortunately too famous, and which has been so abused in an ignorant and barbaric century deserves to be abandoned. If you take the blood that is injected into an animal of a different species, but whose blood cells are of the same shape, albeit of a different size, the animal is only imperfectly identified, and it can rarely be kept for more than six days. Animals subjected to these tests have some phenomena that we must not omit: the pulse becomes faster, the breathing keeps its normal state, but the heat drops with remarkable speed when it is not artificially maintained from the moment of the operation; faeces become mucous and bloody, and retain this character until death; instinctive faculties are not impaired. These observations apply to the injection of fresh blood, as well as to that of blood extracted for twelve and even twenty-four hours; it is enough to prevent clotting by ordinary agitation, and to separate the fibrin, isolated by means of a cloth. If a bird is injected with circular blood, the animal usually dies in the middle of a very violent nervous accident, comparable in their speed to those obtained by the most intense poisons. They still manifest themselves, when the subject on which one operates has not been weakened by a significant loss of this liquid. Cow and sheep blood was transfused to cats and rabbits. Either the operation was performed immediately after the blood was extracted, or the blood was left in a cool place for twelve hours and even twenty-four hours, the animal was restored for a few days in a large number of cases. Sheep's blood transfused to ducks excites rapid and very strong convulsions, followed by death. Often we have seen the animal die before we have finished emptying the first syringe, though he had experienced only a very weak bloodletting before and that he was very well. We will limit ourselves, in closing, Mr. Prévost and Mr. Dumas, to the

few words on the question that Mr. Blundell has recently successfully attempted, but from a different point of view from ours; and if it has been mentioned here, it is in order to prove that the transfusion on man must be abandoned as absurd and dangerous, as long as we are not further ahead on the full knowledge of the active principle of blood." *(Bibliothèque universelle de Genève,* p. 226 and follow, t. XVII, 6th year, 1821)

From 1825 to 1828 the work multiplied, Doubleday; Jewell, Burton-Brown, Clément, Hertwig, published new observations in English journals. However, as early as 1828 Dieffenbach carried on this frantic activity and soon released his considerable work. The author points out that transfusion can be done in two ways:

(1) Immediate transfusion using an intermediate tube from the animal's artery to the other's vein.
(2) Mediate transfusion (Blundell's), which is done by pushing blood from an animal's vessels into a vein using a syringe or other similar device, more or less long after it has been released. In Mr. Oré's book, there is a very detailed analysis of this method: for us, we are merely reporting the conclusions.

1. An animal depleted of blood can be brought back to life by the blood of an animal of its kind; and continue to enjoy perfect health.
2. When blood comes from a different species, it can sometimes produce signs of revitalization; but this can never maintain life.
3. If, in order to carry out the transfusion, the blood of an animal of a very different species is used, death is always the result, even when the amount injected is very small.
4. Prior bleeding makes mammals less sensitive to the deleterious action of the blood of cold-blooded birds or animals.
5. The injection of the blood of mammals or fish always causes birds to perish, and death is always accompanied by accidents similar to those produced by narcotic poisons.
6. If, after the injection of foreign blood, the animal experiences strong evacuations through vomiting, stool or urine, this kind of seizure usually reduces the danger.
7. Blood, exposed to air for a long time, loses its invigorating properties only when it begins to decompose; but once rotten, it produces the same effects as any other rotting animal substance.
8. Neither age, sex nor different body conditions determine any change in the action of transfused blood.
9. Transfusion does not always transmit diseases.
10. Venous blood is the most suitable for this operation.
11. Transfusion, even done with animal blood of the same species, is still dangerous, and much more than some physiologists have thought. As for its use as a means of therapy, this operation seems indicated in the case of imminent death by haemorrhage, and only when all other resources have been useless; but you should never use anything but human venous blood.

In 1838, a physiologist of great renown and great merit, Bischoff, took up these experiments on an even larger scale, and by their number, their variety, their precision, made an immense step towards the question. I borrow from Mr. Oré the summary of his work:

After recalling, at the beginning of his memoir, the research of Prévost, Dumas, Dieffenbach, he stops, with great emphasis, on the facts that seem to result from the experiences of these physiologists:

1. The essential need to defibrinate the blood to successfully carry out the transfusion; because one of the difficulties of this operation, along with one of the most serious dangers, is the speed with which fresh fibrin clots.
2. The serum and fibrin cannot bring life back to an animal that has lost a lot of blood as a result of haemorrhage; hence this conclusion, that blood cells are the real *active ingredient* of this liquid (Dieffenbach).
3. The threshing of blood used to remove the fibrin, as shown by Muller, does not alter the blood cells in any way.

Bischoff is surprised, however, that the blood of mammals injected into birds can lead to devastating effects, as the blood cells of the former, being smaller than those of others, should not stop circulation in the heart and brain (p.319). So he felt it necessary to do new experiments. They can be divided into three series:

1. Experiments in which mammalian blood was introduced into bird veins (chicken, rooster, goose, duck), *after being defibrinated.*
2. In the second series are those where the same operation was done with *non-fibrinated blood.*
3. In the third set of experiments, Bischoff asks himself the following question: "Can defibrillated blood, taken from animals belonging to a species, bring back life if it is injected into the veins of an animal of a different species, when the latter has been greatly exhausted by considerable haemorrhage?"

From these three sets of experiments, Bischoff draws the following conclusions:

1) Fresh non-defibrinated mammalian blood, injected into the veins of a bird, produces death in a matter of seconds, producing violent symptoms similar to those observed in poisoning.
2) Defibrinated mammalian blood, injected into a bird produces no phenomena similar to the previous ones, and the animal remains alive without a functional disorder.
3) Defibrinated blood has the property to bring back to life those animals in a state of apparent death only when it is injected into animals of the same species. However, as in defibrinated blood the blood cells have descended into the serum, and the numerous experiments cited up to this time prove that the serum does not have the property of reviving animals when injected alone into the vessels; the result is that it is the blood cells that possess this invigorating effect.
4) The property of mammalian blood to produce death in birds cannot come from a mechanical obstacle to circulation. It follows that it is the fibrin which, as a result of its exit from the vessels, passing from the state of dissolution in which it is during life to the state of coagulation, contains this deleterious principle. It will therefore be useful and advantageous to defibrinated the blood when you want to perform a transfusion.

Strange destiny that of transfusion! After these many works at the beginning of the century, there was a great silence, and for several years the pages of the journals of the time did not even have the opportunity to write the name of this operation.

From time to time only a few bold attempts are reported to public opinion, such as the fact of Nelaton, that of Monneret, but especially that of Messrs. Devay and Desgranges, whose we will report all the details at a later date.

It was only since 1860 that scientific investigations, which alone can lead to the success of the practice, regained favour.

The names of Oré, Moncoq, Colin, Nicolas, Roussel are linked to the best conducted and the most effective long-term research, and which, we owe the rapid succession of improvements to them, constituting one of the most interesting periods

in the transfusion file. At the same time, more convenient and more regular operating instruments were delivered to surgeons each year by skilled Parisian and Belgian manufacturers.

Abroad, Landois, Eulenburg, but especially Panum and Belina, packed experiences with arguments in favour of defibrination of blood, a practice generally followed at the time.

However, a reaction occurred. While the pros and cons of human transfusion of defibrinated human blood were still being discussed, in France the last word seemed to definitely remain with the transfusers *in toto* despite the opinion of the defibrinators, a work by Dr. Gesellius appeared in St. Petersburg to signal the beginning of a real revolution in therapeutics. In this remarkable work, very learned and impetuous, and requisitory, against which fibrination will not rise again, the author, considering that the only rational transfusion is that which uses the blood in its entirety; that, on the other hand, it is inhumane and unwise to accept from one man the sacrifice of his blood for another; that, in any case, this would be an extreme resource and consequently an insurmountable obstacle to the popularization of transfusion, proposes to return to animal to man transfusion, as practiced by Denys, Lower, King and the most of the first transfusers. (Franz Glénard, *De la coagulation spontanée du sang.* Paris, 1875)

This call was heard: Hasse, Kush, Kusten and many Italian doctors undertook experiments and work on this subject, and sought to extend the scope of indications to a very large number of chronic conditions, except for mental ailments. But beside the names of Livi, Sponza, Albini, Vizyoti, enthusiastic supporters of the new method, why do we have to point out those of their opponents? Panum and Landois resumed their experiments; Ponfick and Worm Muller instituted new ones, and coldly discussed the theoretical and practical results of this "retrograde innovation." We owe a special mention to the work of Worm Muller, an admirable monument that will long dominate the experimental history of transfusion, and to which it is only justice that we pay tribute to the many credits we have to make to him.

In closing this history, if we look closer to the state of the issue, we will see that the study of transfusion has been limited exclusively to the practical side. The remarkable work of Maurice Raynaud, Brouardel, Béhier, Blondeau, Anger, Lemonnier, Roussel, Glénard, Madges, Playfair, and Braxton-Hicks marks the final stage of the issue in France and England.

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