INTRODUCTORY NOTES

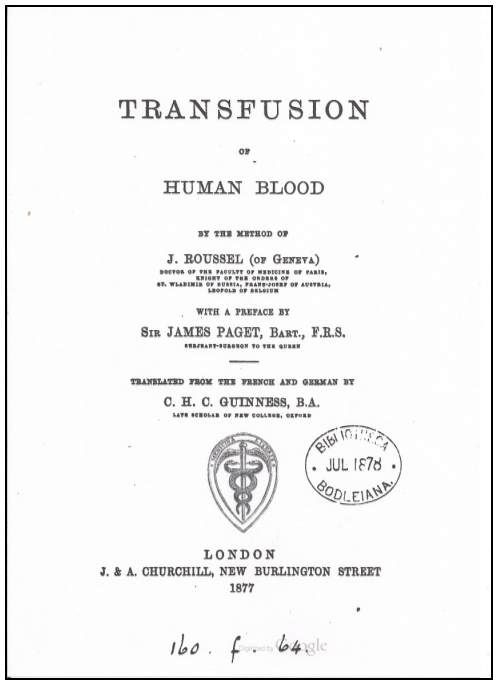
Joseph Roussel's book 'Transfusion of human blood by the method of J. Roussel' was translated into English by C.H.C. Guinness in 1877 [and published in London by J. & A. Churchill]. The translated book is available to view at the following website locations:

https://wellcomecollection.org/works/nmp52xs9

https://archive.org/details/transfusionhuma00rousgoog/page/n17/mode/2up

https://books.google.co.uk/books/about/Transfusion_of_human_blood_by_the_method.html?id=6h8DAAAAQAAJ&redir_esc=y

The book contains a preface written by Sir James Paget and an introduction by the author that concentrates on assuring potential blood donors that the process of donating blood is safe and essential to save lives – a message that has not changed since! The introduction is followed by a 'Historical Section' [pages 5-26] in which Roussel provides a lucid and concise summary of various pieces of information relating to the history of blood transfusion, from 'transfusion in ancient times' to a section titled 'transfusion in modern times' (i.e. the 19th century to 1876) that includes information regarding the 'Methods observed in transfusing by Richard Lower (1665)' and the 'Queries and Trials proposed by Robert Boyle (1667)'. The author provides an accurate concise historical summary of the major events and the people involved in them in a refreshingly non-nationalistic manner. At the same time he makes some interesting personal observations, especially regarding the lack of scientific advancement, e.g. 'Boyle's questions still await solution in 1887 as they did in 1667'. As such this section of the book is reproduced here as another useful source of information regarding the history of blood transfusion. I have reproduced the sentence structure, format, spelling and use of italics that occur in the original. The book does not include any references.


TRANSFUSION

OF

HUMAN BLOOD

BY THE METHOD OF

J. ROUSSEL (OF GENEVA)

WITH A PREFACE BY

SIR JAMES PAGET, BART., F.R.S.

TRANSLATED FROM THE FRENCH AND GERMAN BY

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Title page – Transfusion of Human Blood by the Method of J. Roussel (1877)
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TRANSFUSION OF HUMAN BLOOD BY THE METHOD OF J. ROUSSEL

J. Roussel
Translated from the French and German by C.H.C. Guinness

PREFACE

Dr Roussel having expressed a wish that I should introduce to English readers the translation of his work on Transfusion of Blood, I venture to say that it seems to me to deserve careful study.

The apparatus which he has invented and which is here described, fulfils better than any other known to me, the conditions requisite for the transfusion of pure blood unchanged *in transitú*. With its help transfusion may safely be performed by any one competent to practise surgery.

It may be hoped that the greater facility and safety of the operation may add to its more frequent performance, in the cases of peril of death from haemorrhage.

In these, the utility of transfusion has long been established beyond doubt, and now one cannot but hope that it may prove very useful, in some cases of impaired and deficient blood due to disease. Certainly it deserves trial in these cases, and I cannot doubt that Dr Roussel is justified in urging its use.

As to any damage to be sustained by the person who gives blood for transfusion, no fear of this can be felt by any one who, like myself, many years ago, bled healthy people in any number without harm. To a healthy person the loss of a few ounces of blood by venesection is, I believe, absolutely harmless.

James Paget.

INTRODUCTION

Transfusion of blood is a subject possessing interest for the whole body of those devoted to the art of healing, who should all be capable of performing the operation in urgent cases without hesitation. Above all, it is necessary that the operator should be enabled, without delay, to find blood to transfuse. Hence the necessity (not general in the case of surgical operations) that the public should have some notion of the subject of transfusion, since every one may be called upon, by giving a few ounces of his blood, to restore life to a brother or a friend suffering, it may be, from the cutting of an artery, which can happen by any ordinary accident.

This would more frequently occur in times of war, because few of war's victims are killed outright. The greater number succumb to the loss of blood ensuing on a wound, which would, perhaps, be slight were some one on the spot to stanch it, and to restore to the wounded man the blood necessary to the action of the heart.

It often occurs that a mother succumbs to haemorrhage in giving birth to a child. Hence the necessity that a husband or sister should not hesitate to offer her the blood requisite for transfusion.

The statistics of mortality show that more than 400 women annually die from haemorrhage in their confinement, in fact more than one every day. From henceforth not one should be allowed to die without first having recourse to this most marvellous remedy.

Direct transfusion is, moreover, of the highest value in cases of many lingering illnesses or decline, whether attended by haemorrhage or not; also in cases of general debility resulting from deterioration of the blood. The great vitality of the blood of a vigorous and healthy man has the power of improving the quality of the

patient's blood, and can restore activity to the centres of nervous force and the organs of digestion. It would seem that health itself can be transfused with the blood of a healthy man.

In cases where the circulation and respiration have ceased, owing to asphyxia from inhaling gas or carbon; in cases of strangulation, submersion, and in some cases of poisoning, the opposite arm to that in which the new blood is introduced must be largely bled. The mechanical movement produced by the transfusion often succeeds in re-awaking the heart, brain, and lungs to activity according to the efflux of the deteriorated blood on the one side, and the influx of the healthy blood on the other.

It is absolutely necessary that the public should understand – that the loss of nine ten ounces of blood at a time is a wholly insignificant loss to the vigorous body of an adult, who possesses in all from fourteen to fifteen kilogrammes; that the trifling wound produced by the lancet on the vein of the arm gives no pain, and is always healed in forty-eight hours; finally, that the health of the person from whom the blood is taken is not impaired at any period by the operation, as the blood is entirely restored in one day after two good meals. Fifty years ago the practice of bleeding was undoubtedly abused in nearly all maladies, and in consequence of its abuses it is now absolutely rejected where in many cases it might be beneficial. There is no reason why persons in perfect health should fear the loss of a few ounces of blood.

It is desirable that the public should know that though ten ounces of blood is no serious loss to a vigorous man, they yet are sufficient in most cases to resuscitate the dying man who has lost many kilogrammes. The fact is that the heart ceases to beat long before all the blood is expended; the haemorrhage ceases, but death ensues nevertheless.

The heart, just as is the case with a pump, requires the liquid to attain a certain height in order that it may act; a few ounces less than the minimum amount will be enough to stop it, whereas if these few ounces are supplied and the minimum surpassed the heart recommences its action.

The patient who has undergone the operation is doubtless very weak; it is true he has very little store of blood remaining; but after all he is not dead, and death is the only state which knows no remedy.

If Christian charity and the devotion of man to man be not mere empty phrases, if the progress of science be not a mere expression, before this year shall have reached its close it is to be hoped that all surgeons, both military and civil, all accoucheurs and all practitioners, will have accepted and adopted the practice of transfusion, while every adult and healthy man and woman should be ready to come forward to offer their arm as the natural and mysteriously inexhaustible source of the wonder-working elixir.

“For the blood is the life." – Deuteronomy, xii, 23.

HISTORICAL RÉSUMÉ

England may with justice claim to be the native land of transfusion, from a scientific point of view. It was publicly demonstrated for the first time at the Royal Society of London, in the May meeting, 1665, by Richard Lower, of Oxford, and Robert Boyle.

Historically speaking it is as ancient as the history of medicine itself.

To bestow blood on a man who is dying from having lost too much, or to replace by healthy and youthful blood that which disease or age has impaired, seems to be so logical a process and practically so easy of execution, that human ingenuity had seized upon the idea from the very infancy of the world, or at least from the very earliest ages of medical science.

Transfusion in Ancient Times – The Egyptians, the Hebrews, and the Syrians used to practise transfusion; their writers have mentioned it.

Naaman, chief leader of the army of Ben-Habad, king of Syria, being seized with leprosy, his physicians, in order to cure him, took the blood out of his veins and replaced it with other blood.

Herophilus, Tanaquilla in the time of Tarquinius Priscus, the books of the Eubages, those of the priests of Apollo, Plinius, Celsus, Libavius, &c., all mention the process.

Ovid in the 'Metamorphoses', lib. viii, makes Medea say:

> "… quid nunc dubitatis inertes?
> Strangite, ait, gladios veteremque haurite cruorem
> Ut repleam vacuas juvenili sanguine venas."

Fabricius of Aquapendente, Marcello, Ficinus, Trithemus, Harvée, Fra Paolo, speak of having witnessed the operation.

The list of persons known to have undergone transfusion begins with no less a personage than Pope Innocent VIII, April, 1492.

Villari, in the life of Jerome Savonarola, 'Ecclesiasticae Annales', 1492 (Raynaldi), asserts that the pope appeared to be dying, and that a Jewish physician endeavoured to prolong his life by giving him the blood of three young men successively. No effect was produced on the pope, but the three young men died.

The historian and some modern physicians infer that the deaths were caused by the intrusion of air into the veins, but it seems to me more probable that the operator simply attempted direct arterial transfusion by attaching a tube to the carotid artery of the young men, who died of haemorrhage in consequence; and the fact that no change was observed in the pope's condition proves to me that he really received no blood, or very little if any, because the apparatus, or even the vein itself, was obstructed with clots, and thus the penetration of the blood was prevented. It was doubtless because the blood could not be made to pass that the operation was repeated three times.

Similar results were frequent in those days, and still are produced when the direct transfusion with the arterial blood of animals is attempted.

It is the same process of direct arterial transfusion which is described by Libavius of Halle, professor at the school of Coburg in 1615, in his *Appendix necessaria synagmatis arcanorum chymicorum* (Francoforti, 1615, chap ix):

"Adsit juvenis, robustus, sanus, sanguine 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 et aegroti venam findat et tubulum foemineum infingat, jam duos tubulos sibi mutuo applicet, et ex sano sanguis arterialis, calens et spirituosus saliat in aegrotum, unaque vitae fontem afferet, omnemque languorem pellet."

This, again, is the same direct arterial transfusion with the same two silver tubes which the advocates of the transfusion of sheep's blood to man still practise in Germany and Italy, being less advanced, physiologically at least, than the Jewish physicians of the fifteenth century, who used to transfuse to man blood taken from his own species.

William Harvey's splendid discovery of the circulation of the blood inspired Francesco Folli of Firenze, in 1652, with the project of performing direct transfusion by a method which should have been the starting-point of extraordinary progress, were it not true of former times, as it is of our own, that great discoveries are doomed to suppression under the silence of inactive routine.

Folli proposed to attach a silver canula to the artery and a canula made of bone to the vein, and to connect them by a portion of an animal's artery, so prepared as to have a tube branching from its side, by which the air contained within could escape.

This is an almost perfect apparatus. Folli knew already in 1652 what I am still obliged to repeat every day to new opponents; viz. that if the blood encounters any air in the apparatus it coagulates, and obstructs the apparatus, and that this blood if once touched by the air, loses its vitality at once, and is injurious to the patient who receives it.

Had Folli's colleagues and fellow countrymen encouraged and imitated him, transfusion would long since have become a classical operation, and the honour would belong to Italy.

In France they had not dared practise arterial transfusion, because in opening the carotid artery of the blood-giver his life was inevitably sacrificed. In 1653 Robert des Gabets, a monk of Cluny, demonstrated the possibility of performing intra-venous transfusion, which he designated communication, by means of two little silver tubes which he had manufactured at Mâcon in 1651, under the direction of another monk, Dom Eloy Pichot. These tubes were connected by a leather ball the size of a walnut, and each contained a valve to regulate the flow of the blood. By compressing the ball the necessary force was communicated to the venous blood to make it penetrate, and the quantity of blood transfused could be measured.

Many apparatus recently brought out as novel are really constructed on this model, which was executed in 1651.

In Germany, in 1664, a work appeared by Major Jean Daniel, a physician at Leipsig, entitled "*Prodroma a se inventae chirurgae sive quo pacto aegri curantur*", in which he describes a complete process, which he had employed for some time previously, for transfusing into the veins of a sick person the blood of a healthy man. He used to put some salts of ammonia in the apparatus in order to prevent the coagulation of the blood. Some authors of the present day still assert the value of mingling the same substance with the blood with the same end in view.

In France, in 1667, Denys, professor of philosophy, who had read the letter from Richard Lower, of Oxford, to Robert Boyle, of the Royal Society of London, tried the experiment with his surgeon, Emmeretz. Following step by step the process of Richard Lower, they succeeded so well several times in restoring, by transfusion, dogs which had been bled to death, that they decided to try the experiment on man. The first transfusion was performed at Paris, on a boy aged sixteen, who had remained in a state of stupor and somnolence in consequence of a fever which had lasted two months, during the course of which he had been bled twenty times. Emmeretz and Denys drew three ounces more of blood from him, and transferred to him nine ounces of arterial sheep's blood. After a somewhat grave attack of congestion, in which the patient lost blood by the nose, he calmed down, and gradually mended till the cure was effected.

Elated by this success, the operators renewed their experiments on several patients, one being a furious madman; another a street porter, who submitted to the operation for a crown; and, with a little want of discretion, in the case of a man suffering from gangrene in the intestine, to whom transfusion could avail nothing.

As is always the case with innovators, they were jealously watched by numerous adversaries, and a terrible outcry was raised against them on all sides, especially by an individual named La Martinière, who is otherwise unknown, while on all sides quite a dictionary of abuse of a most unscientific nature was exhausted upon them.

Denys and Emmeretz belonged to the faculty of Montpelier, and on coming to Paris had all the physicians of the Parisian faculty ranged against them, and yielded to the force of numbers.

Next ensued a judgment of the criminal judge of Chatelet respecting an inquest upon a death, of causing which Denys was accused. The decision proves that Denys had nothing to do with the death; but in conclusion, the judge said that "in future transfusion may not be performed on a human subject without the permission of a doctor of Paris. April 17th, 1668."

Now, the Parisian doctors were opposed to transfusion because they were unable to perform it; consequently transfusion was abandoned, and lay forgotten for more than 150 years.

I trust that the like misfortunes are impossible in these days; but there are always La Martinières in the world.

William Harvey, the Englishman, during his studies at Padua in 1604, under the direction of Girolamo Fabrizzio of Aquapendente, was engaged on the subject of the venous valvules, which had already been discovered in the 15th century by Theodoretus, bishop of the town of Cyra, in Syria, who says in his third discourse, "*Venas tenuissimis tunicis vestivit deus et orificiis earum exilia opercula addidit*."

On returning to London in 1616, Harvey commenced his works, published in 1628, "*De motu cordis et sanguinis in animalibus*", and proved the centripetal motion of the blood in the veins, from the extremities of the limbs and from all the organs towards the heart, which is termed the Harveian circulation, or great circulation.

What we still term the lesser circulation, viz., that of the blood from the heart to the lungs, and from the lungs to the heart, had already been in part surmised by Aristotle, and by the Alexandrian School under Herophilus of Chalcedon, and Eristratus of Chios, 500 B.C. This theory, however, was obscured by grave mistakes which Claudius Galenus, 131 A.D., and, later on, André Vesalis had in part elucidated.

It was completely and clearly demonstrated at Geneva in 1553, by Michael Servet, who, in his treatise, "*Christianismi restitutio*", says, in speaking of the sanguineous current between the two cavities of the heart:

"Fit autem communication haec, non per parietem cordis medium, ut vulgo creditor, sed mango artificio a dextro cordis ventriculo, longo per pulmones ducto agiatur sanguis subtilis; a pulmonibus praeparatur, flavus efficitur, et a vena arteriosa in arteriam venosam transfunditur."

At Geneva then, as is unfortunately still the case, religious antipathies and quarrels had precedence over scientific questions, and in 1553 the fanatic Calvin, who pretended to combat the fanaticism of Rome, condemned Michael Servet to death as a heretic, and had him burnt alive at the stake, thus stifling in the roar of its pitiless flames the torch of science which was beginning to illumine Geneva, and would, perhaps, have conferred on my own country the glory of that discovery which England to-day claims with pride as her own.

Religious fanaticism in our days no longer dares at Geneva to make use of the stake: its weapons now are exile and calumny; from murder it has turned to robbery; and under the pretext of liberty it suppresses and confiscates to its own profit free hospitals in which I once was able to work unmolested, without provoking the jealousy of official cliques.

Harvey had dedicated his work to King Charles I, whose physician he was. He followed the king to Oxford during the civil war, and, not relaxing his devotion to science, founded with Bishop John Wilkins a society of savans under the title of the College of Philosophers.

When Oxford fell into the hands of the Parliamentary troops, and King Charles had been beheaded under the windows of his own palace, the College removed itself to London, and, on the accession of Charles II, who himself was a patron of natural science, was permanently established and received from the king the name of the "Royal Society", 1662.

He commenced the uninterrupted publication of the 'Philosophical Transactions', which register all the labours of the society's members, and preserve to us the precious text of Harvey's discoveries, as well as those of Richard Lower, Robert Boyle, &c. This gives to England the honour of possessing the first authentic documents on transfusion, while in other countries the labours of savans were lost for the most part, or were only partially preserved in oral traditions, which are uncertain and insufficient.

In England, Harvey, in proving the reality of the circulation of the blood in man, had opened the scientific road to the circulation of blood from one man to another.

Shortly afterwards Christopher Wren proposed the infusion of liquid medicaments into the veins, which borders very closely on transfusion of natural blood, the most effective medicament of all.

In 1665 Richard Lower, professor at Oxford, wrote to Robert Boyle, President of the Royal Society of London, the famous letter on transfusion of blood with the process of operation already employed at Oxford minutely described. This is the first authentic scientific document upon the operation which we possess (*vide* 'Philosophical Transactions', vol. i, Monday, December 17, 1666, page 353).

"*The method observed in transfusing the blood out of one animal into another.* - The method was promised in the last of these papers. It was first practised by Doctor Lower in Oxford, and by him communicated to the Honourable Robert Boyle, who imparted it to the Royal Society as follows:

"First, take up the carotidal artery of the dog or other animal whose blood is to be transfused into another of the same or a different kind, and separate it from the nerve of the *eighth paire*, and lay it bare above an inch.

"Then make a strong ligature on the upper part of the artery, not to be untied again; but an inch below, videl. towards the heart, make another ligature of a *running* knot, which may be loosened or fastened as there shall be occasion.

"Having made these two knots, draw two threads under the artery between the two ligatures, and then open the artery and put in a quill, and tie the artery upon the quill very fast by those two threads, and stop the quill with a stick. After this make bare the jugular vein in the other dog about an inch and a half long, and at each end make a ligature with a running knot, and in the space betwixt the two running knots draw under the vein two threads as in the other. Then make an incision in the vein, and put into it two quills, one into the *descendent* part of the vein to receive the blood from the other dog and carry it into the heart, and the other quill put into the other part of the jugular vein which comes from the head (out of which the second dog's own blood must run into dishes).

"These two quills being put in and tyed fast, stop them with a stick till there is occasion to open them.

"All things being thus prepared, tie the dogs on their sides towards one another, so perfectly that the quills may go into each other (for the dogs' necks cannot be brought so near but that you must put two or three several quills more into the first two to convey the blood from one to another).

"After that unstop the quill that goes down into the first dog's *jugular* vein and the other quill coming out of the other dog's artery, and by the help of two or three other quills put into each other according as there shall be occasion, insert them into one another. Then slip the running knots, and immediately the blood runs through the quills as through an artery, very impetuously. And immediately as the blood runs into the dog unstop the other quill, coming out of the *upper* part of the *jugular* vein (a ligature being first made about his neck, or else his other jugular vein being compress'd by one's finger), and let his own blood run out at the same time into dishes (yet not constantly, but according as you perceive him able to bear it, till the other dog begins to cry and faint and fall into convulsions, and at last dye by his side).

"Then take out both the quills out of the dog's jugular vein and tie the running knot fast and cut the vein asunder (which you may do without any harm to the dog, one jugular vein being sufficient to convey all the blood from the head and upper part by reason of a large anastomosis, whereby both the *jugular* veins meet about the larynx). This done, sew up the skin and dismiss him, and the dog will leap from the table and shake himself and run away as if nothing ailed him.

"There are many circumstances necessary to be observed in the performing of this experiment… *Secondly*, that you constantly observe the *pulse* beyond the quill

in the dog's *jugular* vein (which it acquires from the impulse of the *arterious* blood). For if that fails, then 'tis a sign the quill is stopt by some congealed blood, so that you must draw out the arterial quill from the others, and with a *probe* open the passage again in both of them, that the blood may have its free course again. For this must be expected when the dog that bleeds into the other hath lost much blood his heart will beat very faintly, and then, the impulse of the blood being weakened, it will be apt to congeal the sooner, so that at the latter end of the work you must draw out the quill often and clear the passage… The most probable use of this experiment may be conjectured to be that one animal may live with the blood of another, and consequently that those animals that want blood or have corrupt blood may be supplied from others with a sufficient quantity, and of such as is good, provided the transfusion be often repeated, by reason of the quick expense that is made of the blood."

"*Tryals proposed by Mr Boyle to Dr Lower to be made by him for the improvement of transfusing blood out of one live animal into another*. ('Philosophical Transactions', Monday, February 11, 1667, page 385, vol. i.)

"The following *quaeries* and *tryals* were written long since, and read about a month ago in the Royal Society, and so now come forth against the author's intention, at the earnest desire of some learned persons, and particularly the worthy doctor, to whom they were addressed, who thinks they may excite and assist others in a matter which to be well prosecuted will require many hands. At the reading of these the author declared that of divers of them he thought he could foresee the events, but yet judged it fit not to omit them, because the importance of the *theories* they may give light to may make the trials recompense the pains, whether the success favours the *affirmative* or the *negative* of the question, by enabling us to determine the one or the other upon surer grounds than we could otherwise do. And this advertisement he desires may be applied to those other papers of his that consist of quaeries or proposed tryals."

The quaeries themselves follow:

1. "Whether by this way of transfusing blood the disposition of individual animals of the same kind may not be much altered (as whether a *fierce* dog, by being often quite new stocked with the blood of a *cowardly* dog may not become more tame, or *vice versa*).
2. "Whether immediately upon the unbinding of a dog, replenisht with adventitious blood, he will know and fawn upon his master, and do the like customary things as before; and whether he will do such things better or worse at some time after the operation.
3. "Whether those dogs that have peculiarities will have them either abolished or at least much impaired by transfusion of blood.
4. "Whether acquired habits will be destroyed or impaired by this experiment.
5. "Whether any considerable change is to be observed in the pulse, urine, and other excrements of the recipient animal by this operation, or the quantity of his insensible transpiration.
6. "Whether the *emittent* dog being full fed at such a distance of time before the operation that the mass of blood may be supposed to abound with *chyle*, the *recipient* dog being before hungry will loose his appetite, more than if the emittent dog's blood had not been so chylous.
7. "Whether a dog may be kept alive without eating by the frequent injection of the chyle of another, taken freshly from the receptacle into the veins of the recipient dog.
8. "Whether a dog that is sick of some disease chiefly imputable to the mass of blood may be cured by exchanging it for that of a *sound* dog; and whether a sound dog may receive such diseases from the blood of a sick one as are otherwise of an infecting nature.

9. “What will be the operation of frequently stocking (which is feasible enough) an old and feeble dog with the blood of young ones as to liveliness, dulness, drowsiness, squeamishness, &c., and *vice versa*?
10. “Whether a *small* young dog by being often fresh stockt with the blood of a young dog of a *larger* kind will grow bigger than the ordinary size of his own kind.
11. “Whether any medicated liquors may be injected, together with the blood, into the recipient dog. And in case they may, whether there will be any considerable difference found between the separations made on this occasion and those which would be made, in such medicated liquors had been injected with some other vehicle, or alone, or taken in at the mouth.
12. “Whether a purging medicine being given to the emittent dog a while before the operation the recipient dog will be thereby purged, and how.
13. “Whether the operation may be successfully practised in case the injected blood be that of an animal of another *species*, as of a calf into a dog, and of *cold* animals, as of a fish, or frog, or tortoise, into the vessels of a *hot* animal, and *vice versa*.
14. “Whether the colours of the hair or feathers of the *recipient* animal, by the frequent repeating of this operation, will be changed into that of the emittent.
15. “Whether by frequently transfusing into the same dog the blood of some animal of another *species*, something further and more tending to some degree of a change of *species* may be effected at last in animals near of kin (as spaniels and setting dogs, &c.).
16. “Whether the transfusion may be practised upon pregnant bitches, at least at certain times of their gravitation, and what effect it will have upon the whelps.”

These questions, many of which are highly scientific and really well raised by Robert Boyle, have led to some experiments practised in England and in other countries, but no one has been able to give any positive answers to them based upon well-conducted operations.

Very generally the contact of the air and of the apparatus altered the blood transfused, and by various accidents prevented the clear perception of phenomena proper to the transfusion itself.

These questions, so interesting for the student of physiology, and for the art of healing which can only make progress by being based on the attentive study of the forces which it employs, still await solution in 1877 as in 1667.

I have been studying them for the last twelve years, but not having a laboratory in England I am unable to prosecute the study. I should, however, be glad to have an opportunity of solving them, in the country of their illustrious author Robert Boyle.

At the Royal Society of London at the public meeting of May, 1665, direct transfusion was tried upon some dogs by Richard Lower's method, but without success owing to the defect of a badly contrived apparatus. The series of quill pipes which Richard Lower employed is far inferior to the almost perfect apparatus previously proposed by Folli, which, however, continued to be ignored even in Italy itself.

The operation also no doubt failed because then as now the influence of a numerous public who were either merely curious, indifferent, or sceptical paralysed the performer of a delicate operation, which might have been easily carried to a successful issue in private.

The French men of science of that time conceded to the English savans the honour of having been the first to experiment on animals, but claimed the priority of the theory of operating on man for Robert des Gabets, 1651-1658. Denys had declared that he followed the process of operation indicated by Richard Lower, and tried at the Royal Society of London.

The English in return, in the ‘Transactions of the Royal Society' (1790), accorded to the French the honour of having brought about this great advance, viz. the

application of transfusion to man, at the same time declaring that the English savans would have accomplished the operation long since had they not been restrained by religious scruples and a law more rigorous in such cases than the laws of other nations.

Thus we see that already in 1660 there was a powerful class of persons who, knowing little themselves, wished to prevent others from acquiring knowledge, and thought it more humane to suffer a man to die through ignorance than to cut off the tip of a rabbit's ear for purposes of scientific research.

Antivivisectionists are by no means a modern development. "*Nil novi sub sole*?"

In 1668 Edmund King and Thomas Coxe tried transfusion on sheep, calves, and dogs, and shortly afterwards Richard Lower and Edmund King practised it with success on a lunatic named Arthur Cogan.

Nevertheless, the new operation succumbed in England no doubt to the same kind of opposition as in France, and fell thenceforward into oblivion. Nor was it till 120 years had passed that the word of transfusion was pronounced again.

For the philosophical mind it is very curious and interesting to see how closely the present condition of transfusion resembles the condition of its history 200 years ago. We find the same theories then as now, the same kinds of apparatus, the same experiments on animals, and the same stages in its gradual application to man, beginning with the transfusion of animal blood with the same error of not perceiving that there is a natural antipathy between the species. Then, again, we notice the same rare cases of success, want of foresight, the same disasters at regular public meetings, the indifference of professional bodies, the opposition, and almost the same abuse from adversaries (*vide* Gesellius and Panum), the same disputes as to priority of invention (*vide* Montcoq and Mathieu); the same reluctance to accept progress, and all the while then as now death's eager haste to reap unchecked its plenteous harvest of victims to haemorrhage and diseases of the blood.

England, which had been the last to fall asleep in 1668, was the first to reawaken in 1792, after a silence of 120 years.

In 1792 Russell, at Eye in Suffolk, was present at the death of more than twenty persons suffering from rabies. He decided to bleed almost to death a young man who was seized by this incurable and horrible form of hydrophobia; then he restored his strength by transfusion and cured the rabies.

The same year Harewood, professor at Cambridge, restored by transfusion a dog which had been bled to death in presence of his pupils.

Darwin in 1796 advised transfusion in cases of fever, of stricture of the oesophagus or stomach, and in cases of inanition.

In the rest of the world only some few men of science admitted the utility of transfusion, but practised it little if at all. Such are Manfredi and Michel Rosa of Modena, Mathieu Purman, Ettenmuller, Balthazar Kauffmann, Schmidt, Kuck, Hufeland, von Graefe, von Boer in Germany, de Lachapelle and Cantvel at Paris.

Transfusion in Modern Times. – A scientific sleep of twenty-five years then ensues, till in London Blundell, in 1818, decidedly re-aroused attention by his magnificent labours. He had seen a young mother succumb in two hours to puerperal haemorrhage, in spite of all means employed to save her. This terrible sight, which is also still frequent, had roused in him the determination to investigate the best means of conveying blood to one who is dying from the loss of it.

Blundell undertook a long series of experiments on animals, and obtained proof that the passage of blood through an apparatus does not render it unfit to perform its vital functions, but that if the blood has remained for longer than three seconds in contact with the apparatus or with the air, it always has fatal results, more or less rapid, upon the animal which receives it.

He subsequently attempted transfusion on man, and after two failures succeeded in saving life in many cases of haemorrhage. His process was simply to receive the

blood which flowed from the vein of the blood-giver's arm in a conical glass. This he next pumped into a syringe, and then injected it with great precaution, in order to prevent the penetration of air and formation of clot.

This does not constitute direct transfusion, but is mere injection of unimpaired blood.

Since the labours of Blundell transfusion has never been lost sight of in England and other countries, but, from want of a proper method and apparatus sufficiently perfected, the results but rarely answered the expectations of the operators, and the cause of transfusion made way but slowly.

Among the English operators the following deserve mention:

From 1820 to 1830: Blundell, Doubleday, Urvins, Waller, Brigham, Jewell, Boyle, Baxton Brown, Howell, Daviss, Savy, Pointer, Douglas Fox.

From 1830 to 1840: Blundell, Ingleby, Bird, Healey, Fraser, Ashwell, Banner, Tweedy, Collins, Samuel Lane.

From 1840 to 1850: May, Brown, Greaves, Waller.

From 1850 to 1860: Blundell, Brigham, Higginson, Simpson, Wheatkrop, Lever, Bryant.

From 1860 to 1870: Higginson, Braxton Hicks, Greenhalgh, Thorne, Currey, Playfair.

From 1870 to 1876: Lister, Aveling, Barnes, Thomas, Ringland, Wagstaffe, and many others whose names I am sorry to forget.

It is worthy of remark that the English surgeons were animated by so practical a spirit as not to be deterred from the transfusion of natural and unimpaired blood, by the difficulties of performing the operation which so constantly met them in the tendency of the blood to coagulate rapidly. They sought to perfect their methods without betaking themselves to the injection of defibrinated blood, filtered, cooled or re-warmed, in which the German operators lost their labour.

Moreover, the English surgeons left alone the transfusion of animal's blood to man, and sought in a healthy man alone for the source of the blood to be given to one diseased.

In France the following names of those who performed the transfusion of unimpaired blood may be successively mentioned:

Clement, Savy, Olivier, Abèle, Danyaux, Roux, Monneret, Nélaton, Marmonnier, G. Devay, Desgranges, Dutems, B. Maisonneuve, Michaux, Courcy, Gentilhomme, Blondeau, Oré, Raynaud, Lande, Béhier, Nicaise, Brouardel, Roussel, &c., &c.

The Germans were for the most part deterred by the coagulation which unimpaired blood produces in bad apparatus, consequently the majority of German operators made experiments on and practised with trifling success the injection of defibrinated blood, a process which is now condemned. The only Germans who have performed the real transfusion are Klott, Schroegler, Bickersteth, Schneemann, Meyer, Seyferth, and O. Heyfelder.

The direct transfusion of the arterial blood of animals (*e.g.*, sheep, or sometimes rams and calves) has often been tried, with a very small number of slightly successful results, by Denys and Emmeretz, Lower and King, Kauffmann, Purman, Michel Rosa of Modena, and since 1850 by Gesellins, Hasse, O. Heyfelder, Roussel, Kuster, Huter, Sander, Manzini, Rudolfi, Medegari, Caselli, Ponza, Albini, Dattera, Livi, &c.

I do not intend here to discuss the merits of animal blood, if, indeed, there be any, relatively to that of man, from which it is quite distinct in that it comes from a foreign species. I only wish to demonstrate the possibility of transfusing the blood of man, and the security which may attend the operation, if only one submits to the necessary conditions.

On comparing and examining the works of various authors on transfusion this operation is found to have been the means of saving life, from the time of Blundell, 1820, to the end of 1875, in at least *eighty* cases of women dying from haemorrhage in confinement, in *thirty* cases of wounds in war or of surgical wounds, in *fifty* cases

of diseases of the blood or anaemic consumption, in *twenty* cases of typhus, cholera, hydrophobia, syphilis, dangerous fevers, and in ten cases of blood-poisoning from asphyxia, scorbutus, &c.; say, a total of 200 authenticated cases of patients who have been rescued from death in a period of fifty years by the generosity of persons who have given them their blood, and by the skill and confidence of operators.

I have hopes that this number of persons saved may henceforward be attained each year, or even each month.