



The history of blood transfusion prior to the 20th century – Part 1

P. Learoyd

British Blood Transfusion Society, Enterprise House, Manchester Science Park, Manchester, UK

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SUMMARY

Blood transfusion, that is the transference of blood from the circulation of one individual to that of another for practical therapeutic purposes, is of relatively recent origin. Although it only became a routine practical possibility during and shortly after the Second World War, the concept of the infusion of blood has a much longer history. Practical transfusion has to some degree paralleled and in many instances been the consequence of developments in other sciences. However, the early history of blood transfusion is to some extent one of mysticism, professional rivalries, disregard of published work and a desire to maintain the status quo with regard to 'established medical procedure'. This article summarises some of the major aspects relating to the early history of blood transfusion.

Key words: Francis Potter, Galen, History of Transfusion, Jean Denis, Richard Lower, William Harvey.

Because humans must have recognised over time that the loss of blood was frequently associated with weakness and death, the older history of blood transfusion is based on the traditional idea of blood being the 'living-force' of the body. A practical example of this was given by some Greeks and Romans who committed suicide by 'opening a vein'. Probably as a result, blood was believed to have numerous mysterious properties including that of carrying a person's mental and physical characteristics. Early attempts at replacing lost blood involved the drinking of blood by the patient, preferably from a young, healthy, fit person or animal (for review see Pelis, 1997). This somewhat mystical fascination with the properties of blood is to some degree still with us today, manifesting itself via such terms as 'hot blooded', 'bad blood' and so on.

EARLY REFERENCES TO THE USE OF BLOOD

Early references regarding the use of blood for what can at best be described as 'medicinal' purposes normally involved the removal of old or 'bad' blood and replacing it with something else. One of the first references relating to such an 'infusion' is quoted in classical mythology. Publicus Ovidius Naso (43BC–AD17/18), also known as Ovid, was a Roman poet and author. Ovid's most ambitious work consists of a 15-book catalogue of Greek and Roman mythology called *Metamorphoses* (or 'Transformations'). In the 7th book, Ovid describes how Medea, the wife of Jason (of the Argonauts) made her aged father-in-law Aeson young again by removing blood from his veins and replacing it with an elixir, "*Medea unsheathed a knife and cut the old man's throat and letting the old blood out, filled the dry veins with the juice.*" with an elixir made from "... a thousand nameless things". Medea is also reported to have killed Peleus, the father of Achilles, by pretending to use the elixir on him, but poisoning him instead, having gained his confidence by first changing a sheep into a lamb (Ovid's *Metamorphoses*, 2000).

Pliny the Elder (Gaius Plinius Secundus), lived from AD23 to AD79 and was a Roman author and philosopher who died in the eruption that destroyed Pompeii. He described how spectators rushed into the arena to drink the blood of dying gladiators. These people believed the gladiators' qualities of strength and bravery were present in blood and could be transmitted by drinking their blood. The situation apparently became so bad that by AD193 Septimus Severus issued a decree prohibiting the practice.

In this era, Claudius Galenus, better known as Galen, born in AD129, a prominent Roman physician, surgeon and philosopher and one of antiquity's most accomplished medical researchers, advised that the drinking of the blood of a weasel or a dog was a cure for rabies. Galen's understanding of anatomy and the role of blood were based mainly on his own dissections of animals but was influenced by the 'humorism' theory of Hippocrates, which stated that the body was filled with four basic substances, called humours, which are in balance in a healthy person, but a deficit or excess of any one was the cause of all diseases and disabilities. The four humours were black bile, yellow bile,

Correspondence: P. Learoyd, British Blood Transfusion Society, Enterprise House, Manchester Science Park, Lloyd Street North, Manchester M15 6SE, UK.

Tel.: +44 (0)161 2327999; fax: +44 (0)161 2327979;

e-mail: bbts@bbts.org.co.uk

phlegm and blood, each of which could increase or decrease in the body (as well as ebb and flow around the body) dependent upon diet or activity, affecting the person's personality and physical health (for review see Giangrande, 2000). This theory and Galen's teachings influenced Western medical practice for over a thousand years.

There are references to the application and/or drinking of blood in the rituals, beliefs and celebrations of many cultures, based on the concept of improving a person's health, ability or vitality. Some of the ancient kings of Egypt are thought to have bathed in blood, believing that such baths were able to "... *resuscitate the sick and rejuvenate the old and incapacitated*". Similarly, ancient Norwegians reportedly drank the blood of seals and whales as a remedy for epilepsy and scurvy and believed that blood held a person's 'power', which was transferable by applying it to the skin. One of the best known references regarding the 'power' of blood is the legend of the vampire, who is stated to live forever by drinking the blood of living people.

Although these references refer to the drinking or application of blood to the skin, an ancient Hebrew manuscript (Dutton, 1925) refers to a possible transfusion as follows:

"Naam, leader of the armies of Bed-Adad, King of Syria, afflicted by leprosy, consulted physicians, who in order to cure him drew out the blood from his veins and put in that of another."

Because most of the ancient and medieval references probably refer to the ingestion of blood rather than to its infusion it is difficult to determine when the first authentic attempt at transfusion actually occurred. One of the most frequently quoted candidates for the first transfusion is Pope Innocent VIII, Giovanni Battista Cibo (or Cybo), who was reputedly 'transfused' some time between 1490 and 1492. Pasquale Villari (1827–1917) the Italian historian stated that the Pope had some sort of illness that rendered him semi-comatose and that a physician named Abraham Meyre transfused the Pope with the blood of three 10-year-old boys. Villari states that the blood of the dying Pope was passed into the veins of one of the boys, "... *who gave him his own in exchange*". The process was apparently repeated with the other two boys, but the Pope's condition did not change. It is possible that this presumed 'transfusion' stems from an incorrect translation of an earlier account of the Pope's illness. If this is the case, what is likely to have happened is that the Pope drank the blood. In any event, the three boys, "... *costing one ducat apiece*" died, as did the Pope some time later (presumably from his illness). Although quoted by many people as being the 'first transfusion', the incident is open to interpretation (Lindeboom, 1954) and has been the subject of much debate and controversy (Gottlieb, 1991).

It should be noted that throughout the middle ages the belief persisted that a variety of physical and mental ailments were the result of 'bad humours' or poisons in the blood, the removal of which would cure the patient. This was achieved by bleeding

the patient and therefore bloodletting was extensively practiced using venesection and leeches (Schmidt & Ness, 2006).

THE FIRST EXPERIMENTAL TRANSFUSIONS

After the incident involving Pope Innocent VIII, there are few references regarding the administration of blood until the early 17th century when one of the most important discoveries permitting the transfusion of blood was made, that of the theory of the circulation of blood.

The English physician William Harvey (1578–1657), who studied medicine in Padua and then worked at St Bartholomew's Hospital, London, was the first person to describe in detail that blood flowed through a systemic circulation of blood vessels in one direction, being pumped through the body by the heart. Before this discovery, blood was believed to 'wash' forwards and backwards in the vessels like 'the tides of the sea'. Harvey lectured on the subject of blood circulation for a number of years and finally published his findings in a book entitled '*De Motu Cordis*' in 1628. Without the knowledge of blood circulation, it is thought likely that references to the transfusion of blood must be considered at best questionable.

Harvey's discoveries initiated considerable speculation regarding not only the possibility of the transfusion of blood but also the infusion of other medications or potions. Harvey himself is in fact thought unlikely to have used blood transfusion in relation to his medical practice, though there is evidence that in order to test his theories he pumped water through the circulation of a dead man.

Although Harvey is credited with the discovery and most accurate description of the circulation of blood through experimental method, other people can be identified to have made significant discoveries regarding the circulation of blood prior to Harvey. The Arab-Muslim scholar and physician Ibn al-Nafis (1213–1288) accurately described the pulmonary transit of blood as well as capillary and coronary circulation of blood, published in his book *Commentary on Anatomy in Avicenna's Canon* in 1242 (which also contained many new anatomical discoveries). He stated that that the 'blood in the right chamber of the heart must arrive at the left chamber by flowing through the vena arteriosa to the lungs, where it is mingled with air, and reaches the left ventricle via the arteria venosa'. His discovery disproved the theory of Galen who suggested that invisible pores in the intraventricular septum allowed blood to pass from one side of the heart to the other. Ibn al-Nafis is also stated to have been an early advocate of experimental medicine, post-mortem autopsy and dissection (Iskandar, 1974). However, he grew up during the time of the Crusades and Mongol invasions, which together with the limitations of the diversifications of culture and language at that time, contributed to his discoveries being largely unknown in Europe.

The Spanish physician and theologian Michael Servetus (1511–1553) is credited with being the first European to describe the function of pulmonary circulation (in 1552), although his achievements were not widely recognised at the time, mainly

because his findings appeared in a theologian text entitled *Christianismi Restitutio* and not in a book on medicine. Most copies of the book were burnt shortly after publication because of persecution by religious authorities due to his participation in the Protestant Reformation. He was condemned by Catholics and Protestants alike and burnt at the stake as a heretic (Hillar & Allen, 2002).

Realdo Colombo, an Italian professor of anatomy and a surgeon at the University of Padua from 1544 to 1559 is credited with the (independent) discovery of the pulmonary circulation and the fact that the main action of the heart is contraction rather than dilation (as had been previously thought). Both of these discoveries were later confirmed by William Harvey. His work though remained largely unrecognised throughout Europe possibly because it contradicted the accepted Galenic tradition. Colombo published his work, *De Re Anatomica* in 1559 shortly before his death (Eknoyan & De Santo, 1997).

In 1628 Johannes (Giovanni) Colle, a professor at the University of Padua (who may have known about Harvey's work) wrote about blood transfusion as a possible 'method of prolonging life', though there is no evidence that he ever attempted to carry out an actual transfusion (Maluf, 1954). Similarly, a decade earlier in 1615, Andreas Libavious (1555–1616), a renowned German doctor and chemist, wrote the following (satirical) comments while defending his chemical theories against critics:

“Let there be a young man, robust, full of spirituous blood, and also an old man, thin, emaciated, his strength exhausted, hardly able to retain his own soul. Let the performer of the operation have two silver tubes fitting into each other. Let him open the artery of the young man, and put it into one of the tubes, fastening it in. Let him immediately after open the artery of the old man and put the other tube into it, and then the two tubes being joined together, the hot and spirituous blood of the young man will pour into the old one as if it were from a fountain of life, and all of his weaknesses will be dispelled. Now, in order that the young man may not suffer from weakness, to him are to be given good care and food, but to the doctor, hellebore.”

The fact that Libavious recommends placing the tubes in the arteries of both people suggests an unlikely practical approach and in fact he made no claim that he had actually performed the procedure, there being a suggestion that he was in fact more likely ridiculing the whole idea (Oberman, 1996).

On the basis of his readings of Ovid's story of Medea, Francis Potter (1594–1678) is thought by some to possibly be the first person to conceive of blood transfusion on a practical basis. Potter was the vicar of Kilmarton in Somerset, who although elected as a Fellow of the Royal Society in 1663 was apparently something of an eccentric and recluse, whose work was documented in the writings of his contemporary and friend,

John Aubery. According to these writings, Potter originated the idea of 'blood transfusion out of one man into another for curing disease' as early as 1639, and devised quills (as needles) and pipes (as tubes) for the purpose. In December 1652 Potter wrote to John Aubery reporting that he had attempted the procedure of transfusion between two chickens, as follows:

“I am as yet frustrated in ipso limine (but it is my owne unexpertness, who never attempted any such thing upon any creature before) for I cannot although I have tried divers times strike the veine so as to make him bleed in any considerable quantity. I have prepared a little cleare transparent vessel (like unto a bladder) made of the craw of a pullet, and I have fastened an ivory pipe to one of the neckes of it, and I have put it into a veine which is most conspicuous about the lower joint of the hinder legges; and yet I cannot procure above 2 or 3 drops of blood to come into the pipe or the bladder.”

Potter did report a number of improvements to his 'transfusion apparatus' though there is no written evidence that he actually used it, however, it is possible that his work did in fact influence others (Webster, 1971).

Following the publication of the description of the circulation of the blood and the role of the heart by Harvey it is only to be expected that several people in different European countries should write about blood transfusion, resulting in conflicting priority claims as to the first person to actually transfuse blood. One certainly false claim is made by the Florentine physician, Francesco Folli (1624–1685), who stated that he read of Harvey's work in 1652 and formed the idea that the transfusion of blood should be possible to cure diseases and to rejuvenate the aged. In 1680, Folli published a book in which he wrote:

“This I pointed out in my pamphlet on life culture which was published for no other reason than to make known to all that blood transfusion had been invented by me at the end of 1654 and demonstrated to his Serene Highness Ferdinand II, Grande Duke of Tuscany, of undying memory. The novelty of it had pleased him, or the fascinating ingenuity or the considerable experimental elaboration. To no one else did I impart my idea, believing that if such an invention were successful, Monarchs alone were worthy of it.”

His book also contains a detailed description of the apparatus required for a blood transfusion and the method of using it. He even postulates the need for 'twenty young men' to be present as blood donors so that the patient is able to receive blood from a 'fresh' donor every day over a considerable period. His transfusion apparatus is described as a funnel connected by a tube (formed from a goat's artery) to a gold or silver cannula that was inserted into the patient's vein (Keynes, 1949).

Though Folli describes the theory of transfusion, towards the end of the book he identifies that he did not actually carry out the process. Whilst Folli has been incorrectly stated to be the ‘discoverer of transfusion’, others have identified that it is more accurate that he is remembered as having said ‘I told you how’ and not ‘I told you how I did it’ (Gilder, 1954). Folli should for example certainly receive credit for suggesting the use of an arterial segment as a connecting piece within his proposed (direct transfusion) equipment, something which Lower was to later use in his equipment.

In 1658, a Benedictine monk, Robert des Gabets, described a type of blood movement called ‘*communication*’ by which he meant “... *the effective passage of blood of a healthy man or other animal to the veins of an individual weak or diseased*”. He also claimed that 7 years earlier a Friar called Eloy Pichot had prepared an instrument consisting of two small silver tubes connected by a small leather purse that could be used for this purpose (Jennings, 1883).

The earliest injections into the circulation may have been performed in 1642 by a German, Georg von Wahrendorff, who is stated to have injected wine into the veins of hunting dogs through small fowl bones as well as treating ill dogs with various medications using the same process. In addition, Johann Daniel Major (1634–1693) is stated to have infused medication intravenously, as well as suggesting that blood transfusion was possible using equipment consisting of a silver cylinder that had a cannula-like spout at the bottom, the contents of which were ‘ejected’ into the recipient by a piston (Maluf, 1954).

The established priority claim for proposing and demonstrating the intravenous administration of medications (into the veins of dogs) is made by Dr (later Sir) Christopher Wren (1632–1723). In 1656, he developed an animal bladder attached to two quills for this purpose. Dr Thomas Sprat, in his history of the Royal Society in 1667, records the following about Wren:

“... he was the first author of the Noble Anatomical Experiment of Injecting Liqors into the Veins of Animals: an experiment now vulgarly known, but long since exhibited to the Meetings at Oxford, and thence carried by some Germans, and published abroad. By this operation, Creatures were immediately purged, vomited, intoxicated, killed or revived, according to the quality of the Liquor injected. Hence arose many new experiments and chiefly that of transfusing blood, which the Society has prosecuted in many instances, that will probably end in extraordinary success.”

It should be noted that Wren’s description to the Royal Society of intravenous injection (which included the possible use of this technique for the injection of blood) was an important forerunner to the initial efforts to perform blood transfusions. Wren’s experiments were later to be described in some detail by his associate Robert Boyle, the noted chemist and physician, who also performed many of the early experiments on dogs using ‘*liquors*’, which included such substances as ale, wine and

opium (Boyle, 1663). Although the accepted practice at the time, the animals used in these experiments were obviously treated unacceptably by present day standards and were reported in Royal Society publications to have undergone “... *suffering vomiting, intoxication and I fear death*”.

The Royal Society was founded in London during 1661 and received its Royal Charter in 1662. It was this ‘philosophic assembly’ of distinguished scientists that witnessed the beginnings of experiments of blood transfusion in animals. It was the practice of the time that experiments should first be demonstrated in front of colleagues and peers and then written down and published, usually by the Royal Society itself. Among several persons involved in these experiments was Richard Lower, then a doctor practising in Oxford, who claims priority for the first practical blood transfusion.

THE FIRST ANIMAL TO HUMAN TRANSFUSION

A series of entries in the *Journal Book of the Royal Society* record the earliest suggestions and attempts to carry out blood transfusions in animals and a report dated 31 May 1665 mentions a direct transfusion from one dog to another. After Robert Boyle’s experiments, the major part of future work was done by Dr Richard Lower. His first transfusion experiment (written in a letter to Boyle) was read to the Royal Society on the 26 September 1666. Lower’s book on the heart entitled *Tractatus de Corde* includes a lengthy account of the first description of a successful direct artery to vein transfusion. It seems clear that he was the first person to define the appropriateness of transfusion for blood replacement in severe haemorrhage since he was able to demonstrate that a dog could be exsanguinated to the point of death and then be ‘completely restored’ by transfusion (Lower, 1669).

The diary of Samuel Pepys provides a valuable insight into Richard Lower’s early experiments in blood transfusion, though his comments were related to the concept that a person’s ‘personality’ is somehow linked to their blood. His diary entry of 14 November 1666 describes one of these transfusions performed at Gresham College, London, as told to him by Dr William Croone (1633–1703) as follows:

“Dr Croone told me that at the meeting of Gresham College tonight, which it seems they now have every Wednesday, there was a pretty experiment of the blood of one dog let out till he died, into the body of another on one side, while all his own ran out on the other side. The first died upon the place, and the other very well and likely to do well. This did give occasion to many pretty wishes, as of the blood of a Quaker to be let into an Archbishop, and such like; but as Dr Croone says, may, if it takes, be of mighty use to man’s health, for the amending of bad blood by borrowing from a better body.”

Lower’s work was the stimulus for a series of experiments on animals by various people throughout Europe that eventually

led to the transfusion of blood from an animal to a man. On the 22 November 1667, Richard Lower, assisted by Dr Edmund King, transfused a man named Arthur Coga (Lower, 1667). This event was also described by Samuel Pepys as follows:

“We discoursed a man that is a little frantic, that hath been a kind of minister, that is a poor and debauched man, that the College have hired for twenty shillings to have some blood of a sheep let into his body; and it is to be done of Saturday next. They propose to let in about 12 ounces; which they compute, is what will be let in a minute’s time. They differ in the opinion they have of the effects of it; some think it may have a good effect upon him as a frantic man by cooling his blood, others that it will not have any effect at all. But the man is a healthy man, and by this means will be able to give an account of what alteration, if any, he do find in himself, and so may be useful.”

The event recorded by Pepys actually took place and was later detailed in the *Transactions of the Royal Society*. The initial part of the account describes the quills and silver pipes used to carry the blood between the carotid artery of the donor sheep and a vein of the recipient’s arm and concludes:

“The blood did run all the time of those two minutes and we concluded upon the man’s saying he thought he had enough. The man after this operation, as well as in it, found himself very well, and hath given in his own narrative under his own hand, enlarging more upon the benefit he thinks he hath received than we think fit to own as yet. He urged us to have the experiment repeated upon him within three or four days after this, but it was thought advisable to put it off somewhat longer.”

This second ‘experiment’ was in fact performed (the following month) apparently without mishap. Afterwards the recipient, Mr Arthur Coga, said he felt better, although Pepys wrote in his diary that “... he is cracked a little in the head”. This second experiment was not recorded in the *Transactions of the Royal Society*.

Lower’s description in 1667 of the first transfusion contains comments on “... some trials of the same operation, lately made in France ... by a M. Denys that illustrate the claims and counter-claims as to who actually performed the first transfusion. The priority claim produced a heated debate between Dr Richard Lower and a Dr Jean Denis (or Denys), which has been the source of much discussion since (Walton, 1974). The chronology of events appears to indicate that the first printed reference to an actual (animal to animal) transfusion appeared in the 19 November 1666 edition of the *Transaction of the Royal Society*, which mentions Lower’s transfusion experiment performed before the Royal Society. These experiments were also published on the 31 January 1667 in the *Journal des Savants* (Hoff & Guillemin, 1963).

Dr Jean Denis was a young physician on the large staff attached to King Louis XIV of France. Denis, together with a surgeon Paul Emmerez, initiated his own transfusion experiments in early 1667, during which time they performed a number of (direct) dog to dog transfusions. On the 15 June 1667, Denys was asked to treat a 15-year-old boy who had suffered from a fever for many months, for which he had been bled by his physicians 20 times, “... to assuage the excessive heat”. (It should be remembered that these early transfusion experiments were carried out at a time when the popular medical treatment used for many illnesses was ‘blood letting’, i.e. bleeding patients in accordance with Galen’s theories). Denis wrote about the boy as follows:

“Before this disease, he had not observed to be of a dull spirit, his memory was happy enough, and he seemed cheerful and nimble in body; but since the violence of his fever, his wit seem’d wholly sunk, his memory perfectly lost, and his body so heavy and drowsie that he was not fit for anything.”

The patient was bled (about three ounces) and then received nine ounces of blood from the carotid artery of a lamb. The change in the patient was described by Denis as ‘startling’, and presently the boy was showing “... a clear and smiling countenance” whilst prior to the transfusion he had apparently passed the time “... in an incredible stupidity”. The boy had also felt “... a very great heat along his arm”, but there were apparently no further ill effects (Keynes, 1967). Denis’ second transfusion was performed on a 45-year-old man using a reported 20 ounces of lambs’ blood, who was described by Denis as stating that he felt stronger after the transfusion.

Denis submitted a report of this transfusion to the Royal Society in July 1667 but it was not published until the 23 September 1667. Therefore, it appears that Lower performed the first animal-to-animal transfusion in November 1666, whilst Denis performed the first animal-to-human transfusion in June 1667. The reasons behind the confusion and subsequent claims for priority are based on actions taken by the editor of *Philosophical Transactions*, Henry Oldenburg (Myhre, 1990).

Denis preferred to use animal blood for transfusion because he believed it less likely “... to be rendered impure by passion or vice”. This way of thinking about blood as carrying a person’s (or in this case an animal’s) temperament or strength was still typical of the time, reflecting some of the views of blood identified from antiquity. Following the transfusion of at least four people, Denis performed a further transfusion in 1668 on a 34-year-old man that was to have severe repercussions. Antoine Mauroy was described by Denis as suffering ‘a severe phrensy’. Apparently one aspect of the man’s mental state involved him running through the streets of Paris clothed “... only in nature’s garb, followed by an admiring throng”. Denis was approached to perform a transfusion on the man to allay the “... heat in his blood”. Shortly after, 10 ounces of blood was removed from a vein in his arm, being replaced with five or six ounces of blood from a calf with no obviously untoward (or beneficial) effects. Two days later, the man was transfused a second time. This resulted in what

would now be recognised as a haemolytic transfusion response as a result of inter-species incompatibility. Denis' account of this second transfusion, reported in *Philosophical Transactions of the Royal Society of London* in 1668, could in fact be considered to be a classic description of this phenomenon:

“As soon as the blood entered his veins, he felt the heat along his arm and under his armpits. His pulse rose and soon after we observed a plentiful sweat over all his face. His pulse varied extremely at this instant and he complained of great pains in his kidneys, and that he was not well in his stomach, and that he was ready to choke unless given his liberty. He was made to lie down and fell asleep, and slept all night without awakening until morning. When he awakened he made a great glass full of urine, of a colour as black as if it had been mixed with the soot of chimneys.”

Denis also recounts that on the second day, Mauroy had further haemoglobinuria and epistaxis. However, by the third day his urine had cleared and his mental state had apparently improved so much that he returned home to his wife. Denis attributed the colour of the urine to a ‘*black cholera*’ that had been retained in the body and had sent ‘*vapours to the brain*’ causing the patient’s mental disturbance. Several months later, Antoine Mauroy again became violent and irrational and his wife persuaded Denis and Emmerez to repeat the transfusion. A transfusion was attempted, but since the flow of blood was poor, it was apparently abandoned. Mauroy, however, died the following evening (Maluf, 1954).

The physicians in the Faculty of Medicine of Paris, an apparently extremely conservative body who refused even to recognise Harvey’s theory of blood circulation, were opposed to transfusion and published pamphlets condemning the practice, presumably because the ‘approved’ medical practice of the day frequently involved bleeding the patient (principally by the use of leaches). These physicians persuaded Mauroy’s widow to accuse Denis and Emmerez of contributing to the death of her husband because of the transfusion. At one point Mauroy’s widow offered to withdraw the lawsuit provided she would receive payment from Denis, however, he refused, replying that “. . . *those physicians, and herself, stood more in need of the*

transfusion than even her husband had done’. The case, therefore, went to court, which resulted in Denis being exonerated due to the fact that Mauroy’s widow was shown to have poisoned her husband using arsenic.

However, as a result of the trial and the publicity it attracted the Faculty of Medicine of Paris subsequently issued a decree stating that the procedure of transfusion was not to be performed without the permission of one of their members. As the Faculty was actively opposed to transfusion this permission was never given and blood transfusion rapidly fell into disuse. In 1678, an edict from the French parliament ruled transfusion to be a criminal act if performed in France. This had repercussions in London where the Royal Society rapidly distanced itself from transfusion as well. Finally, in 1679, the Pope announced a ban on the procedure and as a result, quite understandably, interest in the practice of blood transfusion rapidly waned (Hoff & Guillemin, 1967).

The animal-to-human blood transfusions of this period were of course performed with no knowledge of inter-species immunity problems, with no viable anticoagulation methodology and with limited practical or functional equipment. None of the transfusions involved the clinical practice of blood replacement following haemorrhage (as originally commented by Lower) and were frequently based on the popular concept of transferring personality, vigour and/or youth. Not until 1749 did a Dr Cantwell, a member of the Faculty of Medicine in Paris, state that transfusion was valuable in extreme emergencies involving severe blood loss (Oberman, 1996).

The subsequent development of transfusion by James Blundell and colleagues will be discussed in a concluding review.

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CONFLICT OF INTEREST

The author has no competing interests.

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