

# RECHERCHES PHYSIOLOGIQUES SUR LA TRANSFUSION DU SANG

By: J. F. DIEFFENBACH

A TRANSLATION BY PHIL LEAROYD

A copy of this relatively short paper titled 'Physiological research on blood transfusion' by Johann Friedrich Dieffenbach ('of Berlin'), published in the *Bulletin des sciences medicales* (Vol.19, No.109, Pages 181-187) in 1829 is available to read or download from the following site:

[https://books.google.co.uk/books/about/Bulletin\\_universel\\_des\\_sciences\\_et\\_de\\_l.html?id=8BYUAAAAQAAJ&redir\\_esc=y](https://books.google.co.uk/books/about/Bulletin_universel_des_sciences_et_de_l.html?id=8BYUAAAAQAAJ&redir_esc=y)

Essentially this paper is a summary of the results of the author's researches into various aspects of blood transfusion. He initially defines and identifies the differences between direct and indirect transfusion procedures and briefly summarises the major advantages and disadvantages of the two basic methods.

Dieffenbach then briefly summarises under a series of sub-headings the results of the different aspects of his research. Contrary to the results of some earlier researchers, he clearly denounces the ability of transfused blood in being able to permanently revive exsanguinated animals following either direct or indirect transfusion methods. At the end of his paper he succinctly summarises the different results of his research, clearly identifying for example the problems associated with cross-species blood transfusions and the detrimental effects of storage on blood prior to indirect transfusion.

Given the date that this paper was published, it if nothing else clearly illustrates how different researchers subsequently ignored such important information and continued to argue that for example animal to human blood transfusions were 'successful', as well as 'ignoring' that blood had already frequently started to coagulate prior to indirect transfusion simply because the patient's condition had 'improved'.

I have produced a translation of this paper into English to enable its content to be appreciated by a wider audience. Whilst I am aware that instantaneous computer generated translation is available, this process struggles with accurately reading the original text and interpreting specialist terminology, as well as producing a 'colloquial style' not always representative of the original text. In addition, an 'automatic translation' may either purposely or inadvertently alter the wording to 'make it read better' but in doing so there has to be an element of interpretation involving something on the lines of 'I believe that this is what the author is actually trying to say'. I want 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 in accurately identifying the original text and producing a true representative translation of 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 text. I have maintained the original paragraph settings and general layout of the text including the author's use of italics.

## JOHANN FRIEDRICH DIEFFENBACH (1794-1847) – BIOGRAPHICAL INFORMATION

Johann Friedrich Dieffenbach was born in Königsberg, Prussia, in 1794, where his father taught philosophy at the Gymnasium. When his father died when Johann was very young, the family moved to Rostock, his mother's family home. He originally studied philosophy and theology at the University there, but joined the Mecklenberg cavalry in 1813. After his discharge from the army in 1815 he returned home and studied medicine at the University of Königsberg (1816-1820), after which he attended the University of Bonn to devote himself entirely to the study of surgery. Following visits to Paris and Montpellier he received his doctorate at the University of Würzburg in 1822, after which he settled in Berlin, specialising in skin transplantation, plastic and reconstructive surgery. As well as his extensive work on reconstructive surgery of the face, he wrote on a variety of different topics, such as the treatment of urethral stricture (1826), better methods of bandaging (1829) and nursing (1832). It is during this period that he also researched infusion and blood transfusion, publishing *Die Transfusion des Blutes* in 1828. In 1832, he became an associate professor at the University of Berlin, and in 1840 became director of the Clinical Institute for Surgery at Charité Hospital where he focussed on reconstructive oral and maxillofacial surgery. He died in 1847 in Berlin, being now generally recognised as the founder of modern plastic surgery.

Additional information:

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Johann Friedrich Dieffenbach (1794-1847)  
(Image credit: en.wikipedia.org)

## PHYSIOLOGICAL RESEARCH ON BLOOD TRANSFUSION

By: J.F. Dieffenbach

There are two kinds of transfusions, one direct or immediate, the other indirect or mediate. The first consists of passing the arterial blood of one individual into the venous system of another, using a tube which places the vascular systems of the two individuals in continuity. The indirect method consists of collecting blood which has stayed more or less time outside the vascular system, and to inject it more or less pure, more or less altered into the venous system, using a syringe or any other similar instrument. The latter method has been called *infusorial transfusion*, while the former is actual transfusion.

Both of these processes offer advantages and disadvantages. By direct transfusion, blood flows from one individual to another almost immediately, without being exposed to contact with air, without coagulating, retaining its natural temperature and vitality. However this method, so apparently advantageous, is much less so when we consider it more closely: and first of all it is extremely difficult to apply, since it requires the bringing together of two suffering beings, who excite each other, and which, by the slightest disordered movements, disturb the operation; then it can be used less generally, since the animal which supplies the blood must be of a size to have arteries into which a tube of a certain calibre can be inserted. Direct transfusion from one man to another is an operation which cannot reasonably be considered, although Mr. Ashwell (*On parturition*; London, 1828) has proposed choosing the radial artery for this purpose; but where can I find someone who would agree to lend his arm? Another disadvantage attached to this method is that the tube becomes obstructed in a very short time by clots of arterial blood which attach to it, so that one can never know, not even approximately, what is the quantity of blood which was transmitted: this circumstance undoubtedly explains why certain experimenters were able to make transfusions from one animal to another of a completely different kind, without resulting in great danger for the life of the person who received foreign blood. Finally, in direct transfusion, it is always only arterial blood that can be passed into the veins.

Transfusion with the syringe, which Mr. Magendie spoke out against, however offers the advantage of great ease of execution; it can be used in small animals, and it is the only one which promises real advantages to human medicine, for example in cases of fatal haemorrhages. Moreover, Blundell demonstrated that it can be used without inconvenience, since he passed the entire blood mass of a dog through the syringe several times, without it having succumbed.

*Experiments on the revival of animals stripped of their blood; immediate transfusion.* It follows from the observations reported by the author that an animal from which almost all its blood has been withdrawn can be brought back to life by the immediate transfusion of the blood of another individual of the same species; this recall to life is observed even when there has already been a complete state of asphyxiation. However, not all the animals on which Mr. Dieffenbach operated came back, however carefully he carried out the operation, proving that the transfusion is not as innocent as some people wanted to make it out to be. These results, although not new, serve to confirm those already obtained by Emmerez and Denis.

*Experiments on the revival of animals deprived of their blood; transfusion using the syringe.* These experiments were carried out, like the previous ones, some successfully, and others unsuccessfully. In cats, the operation is less often successful, it is more successful in dogs and most in sheep and calves; that is to say, it is these latter animals that we have most often managed to bring back to life. Blood freshly drawn from other animals of the same species was always injected. By shaking the animal at the time of the injection, by rubbing it, and above all by hanging it by the hind feet, so as to make the blood flow to the brain we powerfully promote the return to life. Transfusion by injection has a greater number of successes than immediate transfusion.

*Research on the length of time that drawn blood enjoys the property of reviving.* The author was able to observe that the invigorating property of blood diminishes considerably

after the third hour of exposure to atmospheric air. The blood that had been drawn 6 hours ago only very rarely restored life.

*Can blood, after having been dried and diluted, bring back to life?* By drying the blood of an animal with gentle heat, then diluting it with water, and injecting it into the veins of another animal of the same species, which has just been killed by haemorrhage, we manage, in truth, to bring back some signs of life, but we can never revive the animal. It follows from this that the blood loses its vitality by desiccation, in the same way as by exposure for a certain number of hours to atmospheric air.

*Research on the transfusion of blood from one animal species to a different species.* Mr. Dieffenbach has never succeeded in completely reviving an animal with the blood of another of a different species. Sometimes he was able to awaken dogs from their lethargic state by injecting them with human or sheep blood recently removed from the vascular system; but they soon died amid convulsive symptoms, especially after the injection of human blood. Blundell was happier in this respect, since he claims to have completely revived a dog with human blood. Mr. Dieffenbach also varied his experiments: he began by subtracting only small quantities of blood, which he replaced with equal quantities of the blood of a different species or genus of animals. But quantity never exerted as marked an influence as quality. Here is the series of experiments which were carried out, 1° Injection of human blood into a cat; death of the animal. 2° Injection of ox blood into a sheep; the animal returned. 3° Injection of rabbit blood into a cat; died after a few days. 4° Injection of dog and pig blood into a cat; dead. 5° Injection of pig's blood into a cat; return to health. 6° Injection of calf's blood into a cat; dead. 7° Injection of dog blood into a cat, died after the second operation only.

The author has also proven by several other experiments that the injection of foreign blood, exposed for some time to the air, is less harmful to animals when they have been bled beforehand.

*On the transmission of diseases by means of transfusion.* 1° Injection of blood from a leprous cat into two other cats; with the first nothing was declared; in the second a slight skin condition occurred. 2° Injection of blood from a horse affected by miserliness and glanders into a healthy horse; at the end of 20 days, the latter also had miserliness. 3° Same experiment; here the operated animal died on the 8th day without any skin disease having started to appear.

*Research on the production of blood effusions in the brain by injection of blood into the carotids.* We injected 18 times, 45 ounces of venous blood from one horse into the carotid artery of another, each time pushing the injection forcefully towards the side of the head; as, following the operation, the animal did not appear considerably affected, we decided to cut its neck, and we could not find a trace of bloodshed in the brain, neither on the operated side than the other side, and all parts of this organ were in a normal state.

*Injection of blood from cold-blooded animals into mammals.* 1° Injection of turtle blood into a cat; this recovers after the emission of a large amount of red urine. 2° Injection of fish blood into a cat; death followed. Several other experiments that the author has made with the blood of carp, pike, and eel on dogs, cats, and rabbits, constantly caused death in the midst of the most violent nervous symptoms, if however the quantity of blood injected was not extremely small. The author concludes from all this that the blood of cold-blooded animals could not revive or sustain the life of mammals, but was on the contrary fatal to them.

*Transfusion in birds.* Transfusion has always been followed by death in birds, whether it took place from one individual to another of the same or different species. The experiments were carried out on pigeons, chickens, geese, ducks, crows, etc

*Injection of mammalian blood into birds.* An extremely curious thing is that by injecting a very small quantity of blood from a mammal into the veins of a bird, we produce death in the latter almost instantly. It would be completely useless to cite here the experiments carried out by the author, since they all led to the same result. The birds absolutely perish as if they were injected with a large dose of hydrocyanic acid. Messrs. Dumas and Prévost also obtained similar results. As soon as the injection is made, the animal opens its beak

sharply, the pupil contracts and dilates successively and extremely quickly, the heartbeat accelerates, and at the same moment the animal dies in the midst of the most violent convulsions. These are the only phenomena that we observe, but we observe them constantly. Among our domestic Gallinaceae, death comes most quickly; the Palmipedes resist a little more. A few drops of blood are enough to kill a pigeon; 30 to 40 drops can kill a goose. Despite all this, a large quantity of quadruped blood can be introduced into the digestive tracts of birds without them being inconvenienced in the least.

*Injecting the blood of cold-blooded animals into birds.* It results from the experiments reported by the author that the blood of fish, introduced into the vascular system of birds, is equally fatal to them, although in this case there are less violent accidents occur than with the blood of mammals.

*Injections made with blood drawn from capillary vessels.* When this blood is obtained using scarified suction cups, its action is completely the same as that of blood from the large vessels; but Mr. Dieffenbach thought he noticed that the blood expressed by leeches, after they have sucked an animal, does not exert such a harmful influence on birds as any other blood, which would not have remained in the digestive tract of these Annelida.

*Can blood serum bring you back to life?* Experiments carried out on dogs, cats, rabbits and guinea pigs, which were bled to extinction, and then injected with serum from the same or different species, have proven that the serum of the blood does not enjoy any invigorating qualities.

*Fibrin* does not enjoy, any more than serum, the property of restoring life.

*Cruor*,\* diluted in water and injected into the veins, produces absolutely the same results as blood in nature; thus the cruor of mammals causes birds to die instantly, it is therefore to the cruor that the blood owes its specialty, its invigorating property.

\* Coagulated blood.

### *Conclusions.*

An animal, bled to extinction, can be brought back to life by the blood of another individual of the same species, and continue to be well.

When blood comes from a different species, it can produce signs of life, but it can never maintain it.

If, when carrying out the transfusion, we use the blood of an animal belonging to a very distant genus, the operated animal always succumbs, even when only a very small quantity of blood is injected into it.

Mammals become less sensitive to the destructive action of the blood of birds or cold-blooded animals when they are bled beforehand.

Birds always die from injection of the blood of mammals or fish, and in this case present the symptoms of narcotic poisoning.

When, after the injection of foreign blood, the animal experiences strong evacuations through urine, stools or vomiting, the danger in which it finds itself is usually reduced by this sort of crisis.

Blood exposed to air only completely loses its reviving properties when it begins to decompose. Once decomposed, it produces absolutely the same results as any other putrefying animal substance.

Age, sex, and various other bodily states do not produce any change in the action of the blood (considered in relation to transfusion.)

Diseases are not always communicated by transfusion.

Venous blood is best suited for this operation.

Transfusion is always dangerous, even when it is made with blood of the same species; some authors have exaggerated its safety. As for its use in medicine, this means seems to be indicated in the case of serious haemorrhage where all other resources of the art are ineffective in preserving life; but we must never use anything but human blood.