to bed or even give up his service. At the Front, the volunteers for the four transfusions were got without the least trouble. There will always be more than enough men willing to give blood for the sake of a badly wounded soldier. The question, of course, has a military side to it. Will the volunteer be disabled from duty? The answer from the medical side can, in my opinion, be a reassuring one. The withdrawal of sixteen ounces or even of twenty ounces should not lessen a man's physical capacity for more than two or three days. If one draws from the class of slightly wounded, who are kept in the hospital in the expectation of sending them back to duty in a week, as was done with the first two, there will be ample margin for complete recovery, and the requirements of the military will be satisfied. It should be said that one of the volunteers was sent down to the base for a short rest by the medical officer in charge because he complained of attacks of faintness some days after the transfusion, whereas he had not made the complaint at first. This, I thought, was obviously functional. If, however, a week's leave were allowed to volunteers as a sort of reward, the total loss of time to the military would be very small, and we would hear nothing of any such functional complaints. The last two chosen were "liars" who were going to base the next day. One had a sprained ankle; the other had loose internal semilunar cartilage. This is, perhaps, the better plan, to choose such as are going to base the next day, rather than the slightly wounded who are to be kept for return to their units in a week.

DIRECT TRANSFUSION OF BLOOD.

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"The cures of to-day oft fade by the morrow,
Thus humanity keeps its pain and its sorrow."

If ever poet's words were appropriate to a subject, these certainly are regarding the history of transfusion of blood. The story of this mode of treatment forms one of the most interesting tales in medicine if we had the time to relate it. Commencing evidently thousands and thousands of years ago, it has "faded oft by the morrow," only again to be revived in other forms. The subject becomes interesting and most important at the present time to the surgeons and the physicians who have been called to give their services and experience to the treatment of His Majesty's Forces.

Had it not been for some of my colleagues inviting me to put on record my experience, method, apparatus, and results in direct transfusion of blood, I would not at this time have ventured to write this short paper on the subject. I think if those engaged like myself in
military work will read the following remarks on this increasingly important subject by one who has practised it for many years, I am sure many will benefit not only in judging when to resort to transfusion, the best way of doing it, but what to expect from it. I am also certain that if they follow my advice and my technique, they will not be disappointed in their results. I do not claim any originality, not even in presenting my own simple apparatus. In this little brochure I will also mention how an unnecessary number of danger signals have been hoisted by writers on "Direct Transfusion of Blood," warnings against disasters to donor and patient, disasters which could not happen unless through utter incompetency and crass carelessness on the part of the operator.

Transfusion of blood from animals to men, from man to man, and from animals to animals (chiefly experimental) seems to have been practised from the very early ages. There are said to be references to it in early Chinese and Egyptian times many thousands of years ago, so that like electricity it has taken many ages to come to light with its many adaptations and perfections. Long ago transfusion of blood was done for the cure of disease by bleeding animals and injecting a water solution of it into the patient or victim. This, like many other things, fell into disfavour, and was viewed as a crime at one time, only later to be resurrected with the swing of the pendulum and brought into prominence as a great cure for some fell disease. We read of it taking an important place in medical matters and discussions in Harvey's time, meeting dire opposition by the Faculty of Medicine of Paris, which did not recognize Harvey's discovery and teachings. This opposition was only temporary, for very soon afterwards that body was among the pioneers of this ancient and classic procedure. Then time and again it seems to have "lumed" to fade once more in the horizon of fads and fashions. But within the last quarter of a century direct transfusion of blood has taken its proper place in the surgical work, and will, I am convinced, not now fade, but consolidate its utility in the archives of succeeding generations.

At the present time we have a great advance made by "transfusion," and a magnificent exposure of the benefits of "medicated transfusion" by Ehrlich.

I leave the subject of medicated transfusion which I see practised by some of my colleagues to report on and proceed to the consideration of direct transfusion of blood.

I may say I have never until the War broke out done "direct transfusion of blood" for the treatment of anything but collapse from hemorrhage, and, like many other surgeons, can tell of the numerous cases where it has been the means of saving the patient's life. But in the work with the unfortunate wounded, surgeons have to deal with cases which require surgical procedure, and who are at the same time unfit to undergo or to recover from anything of the kind.

In such cases a reminder of the value of direct transfusion of blood
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will not be unwelcomed. Such cases are in all hospitals, soldiers suffering from the results of great haemorrhage, and who have been unable from various causes to recover; patients with ununited fractures through a vitiated blood from dysentery; conditions brought about by a long sepsis and where septic wounds will not granulate. Cases of frost bite which will not discard the necrosed parts from not only the vital depression that is concomitant to many of these cases, but owing to the exhausting attacks of malaria, and, in fact, all such cases of "disappointing repair," where the much lauded tonic has been tried and failed, and even the beneficial beverage of a bottle of stout or beer at dinner turns out to be but a vaunted hope of replenished vigour. The blood in these cases I have found from pathological reports to be practically that of chronic anemia with little power or tendency to coagulate. I will not trouble you with these reports, but you may take it as correct that they all suffer from a great deficiency of globular elements, and particularly the white, with a deterioration as far as can be judged by the hemometer of the red.

Now, given such cases, it will be found that one of the most potent remedies in the hands of the surgeon is that of "direct transfusion of blood." It is astonishing the quick improvement that takes place with a well-done transfusion, as will be seen in the patient being quickly able to get up, which in itself is a means often of overcoming the pathological condition. I do not, of course, say it is often the means of bringing about, though temporarily, a healthier quality which enables the surgeon to proceed to further treatment.

Take, for instance, the case of frost bite, which had also suffered from chronic dysentery, who lay for months without showing any signs of discarding or defining properly the delineation of the gangrenous parts, with chronic symptoms of debility and exhaustion, blood vitiated with toxins, a once vigorous constitution tottering to its doom. Or I take the case of a long and serious operation, where a great, and likely a necessary but exhausting haemorrhage has taken place which takes long periods to (if ever) recover from. Given such cases as have occurred with me, and the surgeon will see the great benefit of a direct transfusion of blood, taking ten to twelve ounces from a plethoric or healthy or other soldier properly selected. The results will speak for themselves: wounds heal, cardiac impulses improve, better quality of blood, better digestion, etc., etc., all these become immediately evident.

For brevity let me observe the following points I have practised in direct transfusion of blood.

Choice of Cases.—These have been almost entirely confined to my surgical cases where there has been no idiopathic disease or dyscrasia present. I have not done "transfusion" in any patient who was still losing blood.

Choice of Donor.—If possible, take a near relative, preferably a healthy
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brother or sister, due attention being paid to past history. If impracticable, and you have to go abroad relatively, the utmost scrutiny must be exercised as to the probability of infection. The donor in average health can give ten ounces of blood without the least danger. The quantity can be easily estimated during the flow.

Dangers to the Donor.—These are few. If the donor is between 20 and 30 years of age, and healthy, ten ounces of blood can be withdrawn before the first symptom appears of haemorrhage, namely, a deep sigh. When this appears, it is an indication that the heart is finding difficulty in getting volume to contract on, and it is not a dangerous symptom, as experience will show.

The prime danger to the donor is faulty technique, which I shall refer to later. If the surgeon commands the respect and confidence of the donor, and explains that all the blood required of him will not affect his health, that the operation he can sit and see himself, that it requires no chloroform, he will be quite docile, and be no trouble, and will readily assent. I have drawn one and a half pints at one session without a sigh from the donor.

Dangers to Patient.—These are usually referred to as faulty manipulation infections through the blood. Injections of clots, injections of air, and materies morbi, dilatation of heart from large quantities or too rapid transfusion. To a careful and experienced surgeon these may be dismissed; even supposing a little air to be introduced, there is no danger. The author has frequently introduced small quantities of air without any untoward results. A small quantity of air is absorbed long before it reaches the cardiac cavities. Any one who has seen bad cases of gas gangrene and heard the gas being “churned” in the ventricles will readily acknowledge the harmlessness of the introduction of small quantities of air into the circulation. Regarding “premature clotting of blood or the introduction of clots,” all I can say is, I have never seen it. If the surgeon uses the simple apparatus I have constructed, and carries out the instructions herewith given, there will not be the slightest coagulation of blood or the introduction of clots.

The operation is very simple. If the veins at the flexure of the elbows of the two parties are large and appropriate, the two right arms are chosen, sterilized, and placed side by side. If the patient is lying on an operation table or bed, the donor may sit by his side, and each right hand is in the other’s axilla. By a tourniquet being applied in each arm, not tight enough to arrest the arterial flow, the veins stand out, and are easily exposed on their axes by the swift incision from a very sharp scalpel. It is not necessary to divide the vein. By a little patience the glass tube or transfuser can be inserted into the lumen of the vein through a longitudinal incision, and each lip caught by dissecting forceps, thus avoiding the necessity of stitching the vein later. The tourniquet
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should not be removed from the donor's arm during the transfusion, but, of course, must be from the patient's.

The transfuser I use in "direct transfusion of blood" is made of a glass tube bent at an open curve of three millimetres bore. Through this tube I have found blood travel when conducted as above at the rate of nine to ten ounces in thirty seconds. At the junction of the arms of the tube another glass tube joins it of the same calibre, to which an india-rubber tube is attached through which warm saline can at any moment be allowed to flow from a vessel held and controlled by an assistant.

This will be found of great interest, for at the operator's will, during the transfusion, which will demonstrate the remarkable speed at which the blood is flowing, I always insert the transfuser full of warm saline, and stop its flow the moment the blood enters the tube. This prevents the risk of coagulation taking place in the tube before entering the vein.

With the donor's pulse and respiration in the hands of an experienced person, the blood is allowed to flow for twenty to thirty seconds, then the transfuser is withdrawn, the tourniquet taken off the donor's arm, and both arms elevated; little or no blood will flow from the wound, and a couple of stitches to each wound, with a sterile pad and bandage, completes the procedure.

If the veins of the arm are not in one of the individuals suitable, it may be necessary to find a good substitute in the long saphenous or other distended vein of the leg.

The transfuser I refer to is easily made, and costs but a trifle. It can be at once sterilized, and kept so for any length of time.

One or two attempts will transform the operation to one of the greatest simplicity, and demonstrate that the results will justify the author's opinion in the efficacy and value of direct transfusion of blood.