

the testimony of M. Donne, that about two hours after its injection, rabbits, birds and dogs have been opened, 'I have collected,' he says, 'the blood in the different organs, in the lungs, the liver, the spleen, and everywhere I have found the blood containing a certain number of white globules in all stages of formation, and of red globules more or less perfect: invariably the spleen has presented to me special circumstances, so established and constant that it behoves me to mention them.' M. Donne further adds, 'that he believes that he has also traced, by direct observation and experiment the transformation of the minute oily and fatty particles found in the milk into white globules.' He injected numerous animals, birds, reptiles and mammals with various proportions of milk; and, strange to say," observes Mr. Hassall, "the creatures thus experimented upon experienced no injurious effect beyond a momentary shock, with, however, the single exception of the horse, to which the experiment proved fatal in seven different cases. If almost immediately after the injection of milk, a drop of blood be withdrawn from the system at a distance from the point where the milk was introduced, a number of the globules of the milk may be detected quite unaltered, and which may be recognised by their general appearance, their smaller size, and, lastly, by the action of acetic acid, which dissolves the red globules, renders apparent the granular texture of the white, but leaves untouched the molecules of the milk. If the blood be again examined, at about the expiration of two hours, the smallest milk globules will be seen to have united themselves with each other by threes and fours, and to have become enveloped, by circulating in the blood, in an albuminous layer, which forms around them a vesicle analogous to that which surrounds the white globules; the largest remain single, but are equally enveloped in a like covering. These soon break up into granules, in which state the milk globules of the blood bear a close resemblance to the white globules of the blood, from which finally they are not to be distinguished. The blood, Donne then remarks, 'shows itself very rich in white globules, but little by little these undergo changes more profound; their internal molecules become effaced and dissolved in the interior of the vesicle, the globule is depressed, and soon it presents a faint yellow colouration: they yet resist better the action of water and acetic acid than the fully formed blood globules, and it is by this that they are still to be distinguished. At length, after twenty-four hours, or at latest after forty-eight hours, matters have returned to their normal state; no more milk globules are to be seen, the proportion between the white and red globules has returned to what it ordinarily was.' In only one instance have I had the opportunity of noticing the changes spoken of by Donne, and that in the case of the man J. Pickles. He died about fourteen hours after transfusion, and I procured some blood from veins in the feet, and from the opposite arm; on submitting this blood to the microscope it was found to be loaded with white globules, presenting one of the best marked cases of Leucocythemia I ever saw. I failed, however, to notice a single milk globule; the red-corpuscles were very jagged."

Now, by reference to the Tables of Analysis of Milk and Blood by Simon and Mulder, we note the very close relationship which exists between them, and couple with this the facts as observed by Donne, viz., the evident convertibility of milk into blood, and the conclusion is almost irresistible that it must be a valuable agent for transfusion. Yet we had no precedent to direct us; and although I searched all the medical records within my reach I could not find a single case to guide us.

It will be noted by the Institute, that it was on the 10th of

July, 1854, that the first case of transfusion with milk was effected in Toronto. In the *Association Medical Journal*, edited by Dr. Rose Cormack, under date Sept. 1st, 1854, the following letter, from William Bird Herapath, M.D., F.R.S., is published:—

*On the Employment of Injections of Milk, or Milk and Water, into the Peritoneal Cavity, Cellular Tissue, or Venous System, in the Collapse of Cholera.*

Sir.—In a paper read to the East Surrey Cholera Society, and published in the last number of the *Association Journal*, by Dr. Richardson, a proposal is made to inject the peritoneum and cellular tissue of cholera patients in the stage of collapse, with large quantities of water, for the purpose of rapidly supplying the loss of serum experienced by the excessive discharges from the intestinal mucous membrane. This extremely philosophical and ingenious suggestion is certainly highly deserving of a mature consideration, and a careful digest of properly conducted experiments. But it has occurred to me, whilst reading these remarks, that the injection of a fluid more closely approaching the character of serum in its chemical constitution would be more likely to give permanent benefit, and avoid the chances of destruction of the blood-corpuscles, occasioned by the difference existing between the specific gravity of their contents and of the rapidly imbibed water.

The most readily obtained fluid, having all the qualities we can desire is most assuredly cow's milk: it is always at hand in any quantity, whilst its tendency to coagulate may be obviated by adding a little solution of carbonate of soda or potassa, perhaps about one scruple of the salt to a pint of milk would be sufficient.

The only difficulties about the matter, would be the adulterations to which it may be subjected by fraudulent dealers, and the accidental presence of foreign bodies. Investigations at home and abroad have however shown that nothing enters more largely into the adulteration of milk than water. This is of no importance; but were the world-renowned "chalk and water" compound employed, fatal consequences would assuredly follow.

The entrance of foreign bodies into the circulation, or into the cavity of the peritoneum, or the muscles of the cellular tissue, may be easily prevented by attaching a fine muslin or gauze filter, or sieve, to the mouth of the injecting syringe. It remains to be proved whether this fluid would be absorbed by the peritoneal vessels as readily as water, or with sufficient facility to be of service.

The specific gravity of good pure milk varies from 1.041 to 1.033 or 1.020: serum varies from 1.026 to 1.037, and even 1.050, according to the presence of health or disease. Now to produce the difference in specific gravity required by the laws of endo-mosis to act in a state of health, water may be added to the milk. But the *specific gravity of cholera blood* would assuredly indicate an increase in the specific gravity, and no dilution would be necessary in this disease; but if it were adulterated with water only, it would be a matter of no great importance.

It seems highly probable that milk, or milk and water, would be a much more successful fluid for this purpose than water only, and would certainly offer many great advantages, especially if the injection were to be made directly into the venous system, as the corpuscles of the blood do not suffer any material alteration in form, when examined microscopically, after dilution with milk; they suffer nothing from the admixture, especially if the milk is obtained from an animal of the same kind as the blood experimented on, and if the milk used be pure and unmixt with water.

I apprehend also that the introduction of an albuminous constituent is essentially necessary, to supply the waste of this vital pabulum experienced during the exhaustive discharges of this disease.

It is quite a question whether the subsequent symptoms and fever, exhibited during the recovery from collapse, do not depend as much upon the loss of the albumen and salts of the serum, as upon the great difference subsequently existing in the relation between the quantity of the solids and watery fluid of the blood.

The chemical constitution of milk does not differ very materially from that of the chyle obtained by healthy digestion, which would of course be the only means nature would employ to regenerate slowly the lost liquor sanguinis.

Art physiologically directed comes to aid of nature, and, by employing her own Divine laws, assists her early efforts and wonderfully aids the cure—*gaus time*, an element of vital importance in this marvellously rapid and fatal disease.