

the abdomen as to fix the ribs and the diaphragm and cause death by asphyxia. The autopsy findings proved that both the liver and spleen may be ruptured by excessive transfusion.

In these experiments, too, there were instances of a certain amount of œdema of the lungs.

Transfusion in the normal animal caused an immediate rise in the blood pressure. This rise continued until from 15 to 110 m.m. mercury had been gained. After the maximum was reached there was usually a decline though the pressure as a rule remained higher than normal. This was in direct contrast with the effect of the intravenous infusion of normal saline solution, which we found to be capable of raising the pressure of a normal animal, but a few m.m. of mercury, even when the solution was infused from a high column with a large tube under a strong head of pressure. The salt solution rapidly traversed the vessel walls of the part of the body which normally absorbs water, viz., the gastro-intestinal tract and to a lesser degree the pulmonary tract. In this manner the abdominal viscera were rapidly water-logged, the abdomen over-filled with free fluid, and the enlarged viscera soon became so rigid as to arrest the respiration by fixing the diaphragm and movable ribs. Whereas normal salt solution could not sustain the blood pressure at a higher level than normal, the direct transfusion of blood may do so. It was found that at death an over-transfused animal showed a residual pressure of from 15 to 30 m.m. mercury. It was also found that an animal recently killed and then subjected to a transfusion, may exhibit a rise in carotid pressure as high as 60 m.m. mercury. This contrasts with the rise, under parallel conditions, of 10 or 15 m.m. mercury by saline infusion. Blood transfusion exerts a far greater influence upon the blood pressure than saline infusion, because blood is not only thicker, but better than water.

After having found that the blood of normal animals of the same species is physiologically interchangeable; that the blood pressure may in the normal animal be raised and sustained; that if the transfusion be given with too great rapidity the pulmonary circulation may be so embarrassed as to precipitate an acute and fatal œdema of the lungs; that if the transfusion is given more slowly the blood may be transferred from the pulmonary to the systemic circulation in safety; that an excessive transfusion thus given may cause serious damage to the abdominal viscera and immediate death; and after having established a safe technique and the limits of safety, we then turned to some of the problems that might have a clinical bearing. The first was hæmorrhage.

Every degree of hæmorrhage, even after the cessation of the respiration, the circulation and the heart beat, was treated. A separate group of experiments, in which the hæmorrhage was so profound that the ani-