

II. THE METHOD

The principle of the method consists in connecting an artery of the animal by a cannula to an apparatus made of celloidin or other dialyzing membrane, in the form of tubes, immersed in a saline solution or serum,² and providing for the return of the blood to the animal's body by another cannula attached to a vein. The tubes and cannulae are filled completely before attachment with a saline solution which approximates in composition to the salt content of the serum of the animal. This is displaced into the body by the inflow of blood, when the circulation in the apparatus is established. The blood leaving the artery flows through a perfectly closed system and returns to the body within a minute or two without having been exposed to contact with the air or any chance of microbial infection, while the diffusible substances which it contains can pass out, more or less rapidly through the walls of the tubes. Coagulation of the blood is prevented by injection of hirudin. The substitution in the animal's body of saline solution for an equal volume of blood leaves the physiological condition as nearly as possible unchanged, and chemical results obtained by this method may be expected to represent normal conditions very closely, closer, e.g., than when large quantities of blood are drawn off for analysis.

The proportion of blood (i.e., after admixture of saline)³ tem-

²The outer fluid may, of course, be water, but this leads very quickly to haemolysis of the red corpuscles. Any constituent of the blood which it is desired to retain in the animal's system may be prevented from dialyzing out by the addition of the proper amount to the outer fluid. Where the object of the experiment is merely to remove from the blood abnormal constituents, as e.g., poisons, or constituents specifically secreted into the blood by a certain organ, normal serum from a similar animal may be used, thus insuring complete balance of all normal constituents, inside and out.

³The blood in such cases is, of course, correspondingly diluted by the volume of saline solution originally present in the apparatus, so that, for example, if the volume of a dog's blood be taken at 74 cc. per kilogram, an apparatus holding 37 cc. per kilogram, would, at the beginning of an experiment, hold not one-half but one-third of the total blood corpuscles, serum proteins, etc. But owing to the well known phenomena of the automatic regulation of the concentration of the blood by absorption by the tissues, it is probable that the admixed saline is removed more or less rapidly, thus diminishing the total volume and increasing the proportion outside the body.