Blood Ca was determined* by the Kramer and Tisdall[2] method, P by the Briggs[3] modification of the Bell-Doisy method, in both cases on citrated plasma. It was found necessary to add a known quantity of phosphate to the low P samples before a satisfactory estimation could be made. The analyses reported represent the changes in succeeding months based on the average of samples of venous blood taken on three successive days.

The data show clearly the abnormally low inorganic P in the blood plasma of animals confined to the hay-oats ration, either with or without $CaCO_3$ supplement. The plasma Ca, however, was normal throughout. The product of Ca × P for these animals is seen to be rarely above 30 and frequently much below 20, values which would be indicative of a rachitic condition in growing animals according to the results of Howland and Kramer.[4] In contrast is the normal composition of the blood of animals fed the hay-oats ration plus NaH_2PO_4. The Ca × P in these cases ranges from 50 to 75.

[1] Palmer, L. S., and Eckles, C. H., *Minn. Agr. Exp. Station Bulletin* 229, 1926.

* The analyses were made by W. M. Neal, analyst.

[2] Kramer and Tisdall, *J. Biol. Chem.*, 1921, xlvii, 475.

[3] Briggs, *J. Biol. Chem.*, 1924, lix, 255.

[4] Howland and Kramer, *Am. J. Dis. Child.*, 1921, xxii, 105.

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Filtration Through Living Membrane.

SAMUEL AMBERG AND LEONARD G. ROWNTREE.

From the Section on Pediatrics and Division of Medicine, Mayo Clinic, Rochester, Minn.

The mesentery of the bullfrog *(Rana catesbiana)* was used as the filtration membrane to test the rate of filtration of various fluids. The mesentery was so placed that a funnel could be easily approximated to it. This funnel led into a flask from which a glass tube connected with the vacuum pump and manometer and regulating stop cock. The animal was anesthetized with urethane. A catheter could be introduced into the bladder or into each ureter. This technic can also be applied to similar membranes in other animals.

During the experiment the flow of blood could be observed. Pulsation in some cases was readily visible at a pressure of 40 cm. of water. Even when no pulsation was visible, in some vessels at least, the flow of blood could be seen. Some membranes readily

stand a pressure considerably in excess of 700 mm. of mercury; none broke at a pressure of less than 180 mm. of mercury.

The lack of uniformity in the rate of filtration with membranes of different frogs, and also the lack of uniformity in the slowing of the filtration, has necessitated thus far relatively short experiments and the counting of drops. The initial rate of filtration can frequently be restored by releasing the pressure at intervals and allowing the membrane to rest a few minutes. As a rule, with increased pressure there was an increase in the rate of filtration, but the relationship was not mathematical.

If the 0.8 per cent solution of sodium chloride is cold, the rate of filtration may decrease one-half, but will return to the initial rate if the fluid is warmed again. The difference in rate of filtration of fluids at room temperature and at higher temperatures was not striking.

Acid or alkali was added to the solution of sodium chlorid within a range of pH 2.2 to pH 9 and more. On the whole, filtration of the more acid solutions was slower. A 10 per cent solution of sodium chloride filtered more slowly than a 0.8 per cent solution; a saturated solution of sodium chloride caused extravasation of blood, and filtration was slowed, but could be increased by washing with a 0.8 per cent solution. A half saturated solution of ammonium sulphate or a 50 per cent solution of glucose changed the membrane visibly.

The mesentery was permeable to hemoglobin and Congo red, and other dyes. It held back milk globules, letting through the caseinogen. There seemed to be differences in the rate of filtration of various protein solutions. When uritone was placed in the lumen of the intestinal loop surrounding the mesentery, the filtrate gave a positive formaldehyd reaction. Phenolsulphonephthalein thus injected did not appear in the filtrate, but did appear when injected intravenously, as did mercurochrome. Intravenous injection of 50 per cent glucose solution was followed by its appearance in the filtrate, but the rate of filtration of the sodium chloride was considerably reduced.

The process is not one of filtration alone. Protein always appeared in the filtrate, but apparently to a lesser degree when water was used as the filter fluid. Some calcium was also found in the filtrate. The membrane was alkaline to litmus. Filtrate of solutions of sodium chloride was alkaline, and phenolsulphonephthalein came through alkaline.

The method may lend itself to the study of absorption at the same time.