

Comments. 1. The *method used* did not reveal any significant change in the total body metabolic rate during reticulocyte crises. 2. The basal metabolic rate was practically unchanged during an increase in circulating erythrocytes from about 1,000,000 to about 4,000,000 per cu. mm.

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Experimental Hypochloremia.

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Hypochloremia is associated with a number of morbid conditions occurring spontaneously or produced experimentally. We have produced it by perfusing distilled water or other chloride free fluids through the peritoneal cavity of rabbits. Dialysis readily occurs through the peritoneal membrane.^{1, 2, 3} When distilled water is injected intraperitoneally in rabbits a high percent of chlorides is rapidly deviated from the blood stream and the blood chloride falls.⁴

In 8 experiments distilled water at body temperature was perfused through the peritoneal cavity at the rate of 500 cc. per hour. Within an hour the respiratory rate increases and localized fibrillary twitchings appear. These become more generalized, and are followed by clonic and tonic convulsions of increasing severity. Spasmodic contractions of the diaphragm occur, and the animals die after 2 to 5 hours of perfusion. The blood chloride gradually falls, and a marked hypochloremia, as low as 118 mg. per 100 cc., results. The CO₂ combining power of the plasma falls. There is a moderate rise in the N. P. N., and a slight elevation of the urea. The secretion of urine soon diminishes and finally completely ceases. Hypoglycemia does not occur during the development of the symptoms and lethal effect. The addition of 0.12% glucose to the perfusion water in 7 other experiments had no notably beneficial influence.

The perfusion of Ringer's solution with glucose by the same methods resulted in no muscular twitchings or convulsions. These animals were alive and in good condition when the experiments were

¹ Curtis, G. M., *Biochem. Z.*, 1925, clxiii, 109.

² Heusser, H., and Werder, H., *Beit. z. Klin. Chir.*, 1927, cxli, 38.

³ Engel, D., and Kerekes, A., *Zeit. f. d. ges. Exp. Med.*, 1927, lv, 574.

⁴ Curtis, G. M., *Biochem. Z.*, 1927, clxxxv, 95.

terminated at the end of 8 or 9 hours. The blood chloride was slightly elevated. There was a continuous secretion of urine, or even a diuresis.

When 0.9% pure sodium chloride, with or without glucose, was perfused, the animals were without symptoms and were readily kept alive for from 8 to 10 hours. During all experiments there was a continuous secretion of urine, even to a moderate diuresis. The blood chlorides were elevated, averaging 546 mg. per 100 cc. There was but little change in the CO_2 combining power of the plasma, and a slight decrease in the N.P.N. and urea. In one experiment the serum calcium fell to 2.9 mg. per 100 cc., with no change in the combining power of the plasma for CO_2 . This animal showed no muscular twitchings or convulsions and was quiet during the latter part of the perfusion.

The perfusion of 4.2% glucose results in increased respirations, muscular twitchings and tremors, convulsions and eventually death in from $2\frac{1}{2}$ to 7 hours. The terminal blood is hypochloremic, 136 mg. per 100 cc. There is an enormous rise in the blood sugar. Perfusion of 0.45% sodium chloride and 2.1% glucose had no such lethal effect and the animal was alive when the experiment was terminated at the end of $9\frac{1}{2}$ hours. There was a slight rise in the blood chloride and an enormous increase in the sugar. Another animal was alive when the perfusion of an hypertonic solution, 0.9% sodium chloride and 2.1% glucose, was terminated at the end of 8 hours.

The perfusion of Ringer's solution with glucose, but *without sodium chloride*, resulted in increased respirations, muscular twitchings and convulsions, and the 2 animals died in 5 and 6 hours respectively. Hypochloremia developed, 181 mg. per 100 cc. The secretion of the urine diminished and then ceased.

These experiments led to the hypothesis that the loss of sodium chloride was an important factor in the development of the characteristic symptoms and the ordinarily fatal outcome following the perfusion of distilled water through the peritoneal cavity. The hypothesis was tested experimentally by supplying an adequate amount of sodium chloride to the blood stream throughout the perfusion with distilled water. This was accomplished by the timed intravenous injection of 2.5% pure sodium chloride by means of the Woodyatt pump. By this method it was possible to keep one animal alive $17\frac{1}{2}$ hours, more than 5 times as long as after perfusion alone. Occasional mild muscular fibrillation occurred, but no severe tremors or no convulsions. A marked diuresis was observed. There

was a slight fall in the whole blood chloride, however no hypochloremia as in the water experiments. The plasma chloride was high. There was no tetany although the blood calcium fell to 3.8 mg. per 100 cc.

When the combined intravenous infusion and transperitoneal perfusion was similarly maintained for 12 hours no symptoms developed. At the end of that time the intravenous injection of sodium chloride was stopped, but the perfusion of distilled water with glucose continued. Muscular twitchings then developed, became more severe and finally convulsions occurred and death followed after 5 hours of perfusion alone. In another experiment the simultaneous intravenous administration of Ringer's solution *without the sodium chloride* did not prevent the development of symptoms nor the lethal effect, and this animal died 5½ hours after the perfusion began.

These experiments represent a study of certain effects of peritoneal dialysis. It is difficult properly to evaluate, with the data at hand, the complex physico-chemical changes which result in the blood and tissues of the dialyzed animals. However, the experiments demonstrate the importance of sodium chloride to life and a state of well being.

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Phagocytosis of Red Blood-Cells Treated by Tannin.

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Northrop and Freund¹ found that red blood-cells of sheep suspended in dextrose solution are agglutinated by electrolysis whenever the potential is depressed to 6 millivolts or less, except in the case of $Mg\ Cl_2$ and $Ca\ Cl_2$. When, however, cells are sensitized by specific antibody, ricin,² colloidal stannic hydroxide,³ an emulsion of paraffin oil,¹ they are agglutinated below about 12 millivolts, that is, at a potential higher than the critical potential for agglutination of unsensitized cells. This observation constitutes evidence that from the physical-chemical point of view specific antibody mediates agglutination by the same mechanism as ricin, colloidal stannic hydroxide solution, and paraffin oil.

¹ Northrop, J. H., and Freund, J., *J. Gen. Physiol.*, 1924, vi, 603.

² Stillmark, H., *Arch. pharmacol. Inst. zu Dorpat*, 1889, iii, 59.

³ Landsteiner, K., and Jagie, N., *Wien. Klin. Woch.*, 1904, xvii, 63.