nize one another in such a manner as to neutralize the solidifying effect of the $CaCl_2$ and the liquefying action of NaCl. When combinations of KCl and $CaCl_2$ were injected it was found that these two salts neutralize one another when combined in the proportions of 1M KCl with M/26 $CaCl_2$, M/2 KCl with M/104 $CaCl_2$, and M/4 KCl with M/208 $CaCl_2$.

It may, therefore, be inferred that at least one of the features of the antagonistic action of NaCl or KCl to $CaCl_2$ is the maintenance in protoplasm of a definite balance between its liquid and solid phases. This phenomenon possibly depends upon the formation of a balanced proportion of Na and Ca or of K and Ca protein salts. It may also be due to the formation of Na or K and Ca soaps.

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The lactic acid content of blood and spinal fluid.

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As a preliminary to the study of variations of the concentration of lactic acid in blood and spinal fluid in pathological conditions, it was found essential to establish the normal limits for human blood and spinal fluid. Clausen's method has been adopted as the most satisfactory procedure. This method comprises the following steps: The precipitation of the blood proteins by tungstic acid by the Folin-Wu procedure, and the removal of glucose from this filtrate by means of copper sulphate and calcium hydroxide; the extraction of the lactic acid from this glucose-free filtrate with ether; the oxidation of the lactic acid to acetaldehyde with potassium permanganate; the distillation of the acetaldehyde into sodium bisulfite solution, and the titration of the excess and combined bisulfite, with iodine. With this method, Clausen states the provisional figures for normal human blood are from 15 to 32 mg. per 100 cc. This indicates a variation of more than 100 percent. The object of the present

study was to investigate the lactic acid content of normal blood under standard conditions, eliminating all the known sources of error. The distillate is received into approximately 0.02 N $NaHSO_3$. This solution keeps but a short time. It was prepared daily from 0.1N stock solution. Kahlbaum's sodium bisulfite has been used. The solution must be stoppered and preserved on ice. This 0.1N solution was daily standardized against iodine. For the determination of the excess bisulfite 0.02 N iodine was employed and for the bound bisulfite 0.01 N. The iodine must be daily standardized against $Na_2S_2O_3$, and this in turn is checked against $K_2Cr_2O_7$. It is necessary to use very pure $NaHCO_3$. Kahlbaum's and Merck's reagent products were found satisfactory. The ether is probably the principal source of error. Merck's reagent ether with specific gravity of 0.720 gave the lowest and most constant blanks. With these reagents, the method gives blanks varying from 0.10 to 0.7 cc. of 0.01N iodine. Frequent blank and recovery determinations are necessary. For solutions of lactic acid in water, and lactic acid added to blood, in quantities to 120 mg. per 100 cc., the average recovery has been about 97 per cent. If the receivers are kept immersed in ice water, and the acetaldehyde is drawn over with gentle suction, about 75 per cent of the aldehyde is bound by the bisulfite in the first receiver, and the remainder in the second. A strong air current causes a loss of the aldehyde.

The length of time the blood has been standing after removal from the body before the determination is made, is an important factor influencing the results. Determinations are made on oxalated whole blood. If the glucose is removed from the filtrate immediately, no increase in lactic acid occurs during 24 hours at room temperature. If, however, the glucose is not removed, the lactic acid steadily rises. The average increase after 24 hours is about 50 per cent. There is noted also a slight decrease in the sugar. The whole blood on standing at room temperature shows a continuous increase in lactic acid with a drop in the sugar. After 3 hours, the increase may be 10 to 50 per cent; after 6 hours, 20 to 100 per cent, and after 24 hours, 75 to 400 per cent of the figure for fresh blood. The ingestion of carbohydrate produces a rise in the blood lactic acid, accompanying but not paralleling the increase in blood sugar. With the return to normal, the lactic acid lags behind the sugar. The

lactic acid of the blood has been determined in 30 cases, representing normals and hospital cases with no evident disturbance of carbohydrate, protein or fat metabolism. The bloods were obtained after a 14-hour fast, and after a night's rest, and analysed immediately. The figures varied from 11.7 to 18.0 mg., with an average of 15 mg. per 100 cc.

Clausen's method has been found applicable to the study of the lactic acid of spinal fluid. In human cases of encephalitis, brain tumor and cerebrospinal lues the lactic acid varied from 9 to 13 mg. per 100 cc. In tuberculous meningitis and meningococcus meningitis there was an increase exceeding 100 per cent of the normal, the figures were found to be as high as 22.5 mg.

157 (2680)

The influence of partial inactivation upon the potency of the bacteriophage.

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Bordet and Ciuca[1] believe that the bacteriophage phenomenon is a hereditary transmissible autolysis, in which the principle is generated by the bacteria themselves at a certain stage of their development under the influence of a similar lytic principle. Naturally, this conception requires the establishment of certain definite relationships between the amount of lytic principle which acts upon bacteria and the energy of the principle generated by bacteria. In their studies of these relationships Bordet and Ciuca made the following observations: The addition of a rather small amount of anti-colon bacteriophage to *B. coli* will result in only slight lysis. Furthermore, this minimal amount of the principle[2]

[1] Bordet and Ciuca, *Compt. Rend. Soc. de biol.*, 1922, lxxxvi, 295, and 1922, lxxxvi, 366 and 987.

[2] The lytic principle has to be diluted 10^{-8} aceording to Gratia, *Compt. Rend. Soc. de biol.*, 1923, lxxxviii, 629.