

toxins not neutralized by the antiserum or irreparable toxic damage, may be present. A logical justification, however, for attempts to produce very potent antibodies is apparent.

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A Quantitative Relation Between the Chloride and Acid Concentrations in Gastric Juice.

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Examination of the literature on the chloride content of gastric juice shows that the usual method for the study of such data depends on their being plotted against the time which elapsed between stimulation and collection of the fluid. Correlation of total chloride and acidity is made by direct visual comparison of such time curves. Regarding the existence of a relation between these 2 variables, 3 different conclusions have been reached: (1) that the total chloride concentration is constant throughout any one experiment. (2) Significant variations do occur, but they are always smaller than the concomitant changes in acidity and bear no relation to the latter. (3) A parallelism exists between such acidity and chloride curves. In the present investigation, decisive evidence is offered for the existence of an exact quantitative relation between the concentrations of acid and total chloride, and an explanation is offered to account for the differing conclusions of other investigators.

Experiments with 5 Pavlov pouch dogs were performed in the usual way. In almost every instance, the chloride values fluctuated within such narrow limits that they gave a distinct impression of constancy. In only 2 of the 19 experiments was the total range greater than 10mM. When the 2 variables were each plotted against the time, an unmistakable parallelism of the 2 curves was noted in 12 of the experiments. In the remainder, the occurrence of such a parallel relation may have been hidden by the combined influences of high experimental errors and a small range in acidity values. These experiments, therefore, support the notion of a parallelism between the chloride and acid curves; they also suggest an explanation for the failure of other investigators to observe this relation.

Such a parallelism may be indicative of a quantitative relation

between the chloride and acid concentrations; consequently, these variables were plotted against each other, thus excluding the time factor entirely. In all cases, the points so plotted conformed to straight lines, of which the slopes and the intercepts with the acidity axis were fairly uniform for the 12 experiments. Due to the accidental errors, however, the random variations of the individual points from these lines were rather large. To reduce the influence of these errors, the combined data of all 19 experiments were analyzed statistically. By this method, the observations were in even better agreement with a straight line, a result which is all the more significant because it includes the 7 experiments showing no definite parallelism of the time curves.

To show that the method of collection of the gastric juice had no influence on the result, data obtained from 3 dogs by the *discontinuous collection* procedure (described elsewhere¹) were similarly analyzed. Also, 2 experiments by a group of investigators² who have claimed that the concentration of total chloride is constant, were plotted with exclusion of the time factor. In all cases, the results completely verified the existence of such an exact relation.

Since the graph of total chloride against total acidity is a straight line, a similar relation must exist between the neutral chloride concentration (calculated as the difference between total chloride and acidity) and the acidity. A mathematical analysis of the graphs obtained from both total and neutral chloride values demonstrates that the Rosemann theory of hydrochloric acid formation is incompatible with the observations, whereas the Heidenhain theory, as modified and extended by Hollander and Cowgill,¹ is in excellent accord with them. In fact, the equations describing the experimental graphs have the same form as those derived on the basis of the latter theory. Furthermore, values for the isosmotic concentration (with respect to blood) of hydrochloric acid, calculated from the experimental equation in accordance with the theory, were in good agreement with those found in the literature.

¹ Hollander, F., and Cowgill, G. R., *J. Biol. Chem.*, 1931, **91**, 151.

² MacLean, H., Griffiths, W. J., and Williams, B. W., *J. Physiol.*, 1928, **65**, 77.