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**The origin of gastric hydrochloric acid.**

By OLAF BERGEIM.

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Of the many suggestions brought forward with regard to the chemistry of the process by which the hydrochloric acid of the gastric juice is produced, one by Maley<sup>1</sup> has certain things in its favor which cannot be said of the others. This relates to the interaction of disodium phosphate and calcium chloride with the production of hydrochloric acid and tricalcium phosphate. Probably what really takes place when solutions of these are mixed, is the formation of acid Ca phosphate which hydrolyzes rapidly at room temperature to form a basic calcium phosphate and an acid phosphate containing more phosphoric acid than the monophosphate. The latter may be considered to act upon the calcium chloride with production of free hydrochloric acid. Maley showed that free HCl could be dialyzed from such a mixture, which we have confirmed also by distillation with or without the addition of manganese dioxide. In the former case abundant chlorine is liberated. Fatal objections to the theory in its original form are that there is no adequate supply of calcium chloride in the organism for this purpose and that no provision was made for removal of the insoluble triple phosphate which must be formed. The source of chlorine ions can not be other than the NaCl of the blood. It can be shown that NaCl is decomposed by acid calcium phosphate but not by acid sodium phosphate. That acid calcium phosphate can be produced in the body is indicated by facts given in another place.<sup>2</sup> Nuclei contain much Ca and as this is not present in the inorganic form and as nucleins are with difficulty if at all separated from it, apparently it exists in combination with nucleic acids. This being the case and as phosphonuclease has been shown to be present in nearly all tissues the splitting off of acid Ca phosphate presents no great theoretical

<sup>1</sup> Maley, *Zeit. f. physiol. Chem.*, Vol. 1, p. 174, 1877.

<sup>2</sup> This Journal, 1914, Vol. 12, p. 22.

difficulty. This on hydrolysis in the presence of NaCl would yield HCl. That certain of the leucocytes carry the Ca and P for this process is probable as well as that they serve to carry away the basic phosphate which however would be formed in smaller amounts than corresponds to Maley's conception. Assuming (which is not necessarily the case) that all phosphoric acid were split off as acid Ca phosphate we should expect the gastric juice to contain appreciable amounts of acid Ca phosphate and that this might be roughly proportional to the acidity. The former is apparently correct, while the latter appears from the few cases studied, to be probable.

Confirmatory of this view are the findings of high acidity and efficient digestion associated with hyperfunction of pituitary and thyroid and the opposite with hypofunction. Also the decrease of gastric secretion after parathyroidectomy (Keeton<sup>1</sup>), aided by Ca salt administration; and favorable effect on acid secretion in some achylia of parathyroid treatment (Reh fuss<sup>2</sup>). These presumably act by a stimulation of the nucleolysis necessary for acid production or by mobilizing the acid carrying cells. These relations are still being investigated.

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### **Phospho-nuclease as related to phosphorus and calcium metabolism.**

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Studies made in this laboratory of the Ca metabolism in certain ductless gland disturbances have emphasized to us the unsatisfactory nature of the views held with regard to Ca distribution and calcification. In our case of acromegaly<sup>3</sup> with hyperfunction of hypophysis Ca absorption and excretion were marked, the absorption apparently taking place even from the difficulty

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<sup>1</sup> Keeton, *Am. J. Physiol.*, 33, 25, 1914.

<sup>2</sup> Reh fuss, unpublished results from this laboratory.

<sup>3</sup> Bergeim, Stewart and Hawk, *J. Exp. Med.*, XX, 218, 1914.