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University of Minnesota January 18, 1939

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Tulane University January 31, 1939

SOUTHERN CALIFORNIA

California Institute of Technology December 28, 1938

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**Analyses of Gastric Mucosa and Pancreatic Gland Tissue of
Dog for H₂O, Na, K, Cl and PO₄.**

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In conjunction with some experiments previously reported by us¹ on gastric and pancreatic secretion, studies were made of the inorganic composition of the gastric mucosa and the pancreas of 12 dogs. The animals were anesthetized with amytal or ether and the organs removed during life. The stomach was carefully washed with water and blotted dry, and the gastric mucosa was peeled off from the muscularis. The pancreas was dissected free from connective tissue and a sample taken. Five gram quantities of each were

¹ Ingraham, R. C., and Visscher, M. B., *J. Gen. Physiol.*, 1935, **18**, 695.

used for analysis. The tissues were dried to constant weight at 105°C. Separate samples were wet ashed with superoxyl for the several analyses. Sodium was determined after removal of PO_4 by $\text{Ca}(\text{OH})_2$ by the Barber and Kolthoff² method, potassium by the Breh and Gaebler,³ chloride by the Van Slyke,⁴ and total phosphate by the Fiske and Subbarow⁵ methods. The collected data are shown in Table I.

TABLE I.
Summary of Analyses of Gastric Mucosa and Pancreas.

	Gastric Mucosa					Pancreas				
	H ₂ O %	Na %	K %	Cl %	PO ₄ % as P	H ₂ O %	Na %	K %	Cl %	PO ₄ % as P
	Dry wt.					Dry wt.				
1	79.8	1.362			1.037	74.2	0.499			1.278
2	79.9	1.120			1.146	72.5	0.507			1.391
3	80.0	1.471			1.323	74.3	0.592			1.827
4	78.9	1.060			1.019	73.6	0.601			1.271
5	81.2	.992			1.216	71.2	0.522			1.171
6	80.6	1.011			1.004	73.7	0.512			1.326
7	80.8	1.011	0.901	1.021		73.8	0.599	1.068	0.659	
8	80.4	1.020	1.064	1.209		74.6	0.580	1.389	0.848	
9	81.8	0.988	1.092	1.088						
10	80.3	0.876	1.026	0.949		75.0	0.572	1.610	0.305	
11	80.7	0.794	1.227	0.940		75.8	0.529	1.426	0.568	
12	81.6	1.087	1.120	1.112		76.5	0.455	2.005	0.500	
Mean values:										
Gastric Mucosa						80.5	1.066	1.072	1.053	1.124
Pancreas						74.1	0.543	1.500	0.560	1.377

Several important and large differences between the two tissues are evident. The gastric mucosa contains significantly more water, sodium and chloride than the pancreas. In the cases of these 3 components, there was no overlapping of values in the 2 tissues, and there can be little doubt about the significance of the differences. The pancreas contained in every instance more potassium than did the gastric mucosa of the same animal, but there was some overlapping of values between individuals. There was no significant difference in phosphate content between the two tissues.

It is interesting to note that no regular correlation exists between the composition of the tissues and their secreting functions. The gastric glands secrete chloride and contain a higher general percentage of this element than does the pancreas. The pancreas, however, is a sodium secreting organ, but contains less of this element in absolute

² Barber, H. H., and Kolthoff, I. M., *J. Am. Chem. Soc.*, 1928, **50**, 1625.

³ Breh, F., and Gaebler, O. H., *J. Biol. Chem.*, 1930, **87**, 81.

⁴ Van Slyke, D. D., *J. Biol. Chem.*, 1923, **58**, 523.

⁵ Fiske, C. H., and Subbarow, Y., *J. Biol. Chem.*, 1925, **66**, 375.

percentage than does gastric mucosa, although the ratio of sodium to chloride is greater in the pancreas. Correlations of gland composition and secretory activity must be made with great caution, because it is very likely that the inorganic components of the secretions are derived directly from the blood.

The tissues from animals 8, 9, and 10, were taken after intense histamine and secretin stimulation of the stomach and pancreas, while the remainder were from untreated animals. There are no obvious differences in values obtained from the stimulated glands as compared with the controls. In view of the inherent variability, it is, of course, not impossible, although it seems unlikely, that a larger series might demonstrate a difference. It is obvious, however, that whatever alterations might occur must be relatively small because the sodium figures are rather constant in pancreas and the chloride in gastric mucosa.

These analytical data are presented mainly to show the range of figures found in normal dogs, and to call attention to the differences in composition of the 2 glandular structures, since we were able to find no satisfactory comparative analyses in the literature. Nencke and Simonowski,⁶ Guntzner,⁷ and Juchler⁸ have analyzed for water and chloride. The first named workers found the gastric mucosa to be richer in chloride than the pancreas, in which we confirm them, but their absolute values are much lower than ours for both tissues, and we believe them to be in error. The absolute figures given by the two other workers are nearer to those obtained in this study but those investigators worked with only one tissue. There may be other published values for the composition of these tissues in papers whose titles do not indicate such studies.

Summary. Analyses have been made of the water, sodium, potassium and phosphate content of gastric mucosa and pancreas. The results are presented from analyses of tissues from 12 animals.

⁶ Nencke, M., and Schoumaro Simonowski, E. O., *Arch. f. exp. Path. u. Pharm.*, 1874, **34**, 313.

⁷ Grützner, P., *Neue Untersuchungen über die Bildung und Ausscheidung des Pepsins*, Breslau, 1875.

⁸ Juchler, Theo., *Z. f. Biochem. u. Biophys.*, 1912, **14**, 347.