behaves like an autonomic ganglion whereas the effector end is cholinergic. From these experiments it cannot be determined whether receptor and effector ends are different anatomically and physiologically or all the ramifications of the postganglionic cholinergic sweat and adrenergic pilomotor fibers serve as receptors as well as effector ends.

The question arises as to whether this axon reflex mechanism plays a rôle in physiological responses to external cutaneous pilomotor and sweat stimuli. The primary confinement of these cutaneous responses to the area surrounding the point of stimulation, and their secondary unilateral and bilateral expansion seem to indicate that primary axon reflexes are followed by long spinal reflexes.

Summary. Localized sweat secretion can be elicited by intradermal injection of drugs with nicotine-like action. This effect is accomplished through a peripheral axon reflex mechanism which is easily differentiated experimentally from the direct muscarine action of acetylcholine on the sweat glands.

10860

Reduction of Dehydroascorbic Acid in the Stomach and Small Intestine.*

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In view of the fact that a portion of the Vitamin C intake of animals and man may be in the form of dehydroascorbic acid,[1-4] it is of interest to know whether the unstable reversibly oxidized form can be utilized efficiently, and whether there is a significant degree of reduction to ascorbic acid in the intestinal tract. It is clearly recognized that dehydroascorbic acid is effective as an antiscorbutic

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2 Reedman, E. J., and McHenry, E. W., *Biochem. J.*, 1938, **32**, 85.

3 Tressler, D. K., *et al.*, *Food Research*, 1938, **3**, 133, 311, 403, 409.

4 Fujita, A., and Ebihara, T., *Biochem. Z.*, 1937, **290**, 201; Fujita, A., and Sakamoto, T., *ibid.*, 1938, **297**, 10.

agent,[5-8] but there has been wide variation in the results from different laboratories regarding (a) the protective dosage required and (b) the relative utilization when administered by ingestion and injection.

The tendency toward irreversible decomposition of dehydroascorbic acid[9, 10] is such that utilization from the intestinal tract would be greatly influenced by (a) the low pH range of the stomach contents, (b) a rapid reduction to ascorbic acid by the contents of the intestinal tract, and (c) the rate of assimilation from the intestinal tract, followed by, or coincident with, reduction to the stable form. Biological assays carried out in our own laboratory[11] indicate that dehydroascorbic acid is nearly as effective antiscorbutically as ascorbic acid when administered with sufficient care, either orally or parenterally. The time factor in manipulating the reagents, pH of reagents, and the condition of the animals no doubt all have an important bearing upon the results of such assays.

In a previous communication[12] the reduction of dehydroascorbic acid by guinea pig tissues was studied in detail, with the conclusion that diffusible and fixed sulfhydryl compounds were responsible for nearly all of the reducing action, without the interposition of enzymic activity. The products of protein digestion have also been shown to exert a protective action toward the reduced form of the vitamin.[13]

From the data in Table I it is evident that the contents of the small intestine may bring about a rapid reduction of small amounts of dehydroascorbic acid at pH 7.2. The effective blocking action of iodoacetate indicated again that sulfhydryl groups were responsible for most of the reducing action.

The guinea pigs used were 600 to 800 g in weight, maintained on the standard Sherman diet (rolled oats, bran, butter fat, and heated milk powder), supplemented with spinach until 3 to 4 days before their use for reduction tests. The contents of the stomach and small intestine were removed rapidly at the designated time and made up to standard volume with 0.1 M McIlvaine buffer. Aliquot samples were placed in Thunberg tubes, evacuated, and allowed to stand

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TABLE I.
Reduction of Dehydroascorbic Acid by One-third of Contents of the Small Intestine.
Anaerobic, 37.5°, pH 7.2, 2 mg of dehydroascorbic acid added, values expressed in each case as mg of ascorbic acid.

Time min	Titration equivalent of intestinal contents alone mg	Titration value in the presence of iodoacetate and dehydroascorbic acid mg	Intestinal contents and added dehydroascorbic acid mg	Reduction by contents of intestine %
5-6	.089	.101	.164	3.8
	.081	.127	.254	8.7
	.116	.138	.278	8.1
	.155	.129	.308	7.2
	.193	.139	.303	5.5
Avg	.127	.127	.261	6.7
8-10	.089	.101	.228	7.0
	.081	.289	.289	10.4
	.116	.138	.312	9.8
	.112	.125	.363	12.5
	.155	.179	.385	11.5
	.193	.167	.414	11.1
	.075	.083	.343	13.4
Avg	.117	.155	.333	10.8
30	.089	.101	.317	11.4
	.090	.156	.400	15.5
	.086	.128	.285	9.9
	.060	—	.339	13.9
	.124	—	.332	10.4
	.161	—	.444	14.2
	.155	.179	.434	13.9
	.193	.167	.524	16.5
Avg	.119	.146	.384	13.2

at 37.5° for 30 min., with and without added iodoacetate. Iodine-oxidized dehydroascorbic acid (2 mg) was added from the overhang, the total volume being 11 cc. Control tests were run with dehydroascorbic acid alone, and with the intestinal contents alone, and the corresponding corrections made for the data in Table I. The titrations were made with 2,6-dichlorophenolindophenol, using 2% metaphosphoric and 8% trichloracetic acid, as outlined in earlier publications.[14]

Stomach contents at their natural pH, approximately 2.2, did not exert an appreciable reduction (<0.5% in 30 min.). When the pH of the stomach contents was raised to 7.2, however, the reducing

[14] Bessey, O. A., and King, C. G., *J. Biol. Chem.*, 1933, **103**, 687; Musulin, R. R., and King, C. G., *J. Biol. Chem.*, 1936, **116**, 409.

action was approximately one-third that of the contents of the small intestine, on a comparable total solids basis.

In biological tests involving analyses of stomach and intestinal contents at frequent intervals after feeding dehydroascorbic acid, there was no evidence of a marked change in the stomach—neither reduction, decomposition, nor absorption was evident. In the small intestine, studied in one-third length segments, absorption and reduction were too rapid and irregular to follow satisfactorily with consistent quantitative data. The results with the stomach and intestine were in agreement, however, with the *in vitro* studies of reduction and stability, and also with the assay findings regarding antiscorbutic activity.

10861 P

Preferential Mottling of the Enamel of Rat Molars.

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Cox, Matuschak, Dixon, and Walker[1] produced mottled enamel in rat molars by daily individual feedings from birth of relatively high doses of fluorine to suckling rats. The first two molars, which normally are extruded at 19 days, were affected; the third molars, which appear on the thirty-fifth day, were apparently normal.

Miller[2] has shown that the development of dental caries is inhibited by 250 p.p.m. of sodium fluoride or 500 p.p.m. of calcium fluoride in a caries-producing ration fed to rats 28 days old. His ration was based on coarse rice.

In a confirmatory study of Miller's finding a ration of corn meal 66, whole milk powder 30, alfalfa meal 3, and sodium chloride 1 was fed to rats weaned at 21 days. Two groups, 22 and 23 rats, respectively, made up of litter mates, were used. One group had 250 p.p.m. of sodium fluoride in the ration. All were sacrificed after 8 weeks.

On examination of the teeth before they were sectioned, it was found that the enamel of the third molars of 19 out of 22 rats that had received added fluorine showed a faint diffuse milkiness. None

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[2] Miller, B. F., PROC. SOC. EXP. BIOL. AND MED., 1938, **39**, 389.