XIII. THE ASCORBIC ACID CONTENT OF THE INTESTINE OF THE GUINEA-PIG.

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It is now established beyond doubt that certain organs and glands of animals whether susceptible to scurvy or not contain ascorbic acid in higher concentration than most of the other tissues. Thus the anterior lobe of the pituitary, the adrenals and to a lesser extent the liver have been shown by the reducing and by the biological methods to be rich in the vitamin. Harde and Wolff [1934], working with the mouse, and Hopkins [1934], working with the rat, indicated that the small intestine belongs to this group of organs. Giroud and Leblond [1934] found that silver nitrate when injected intravascularly is reduced by the intestine much more markedly in guinea-pigs on a mixed diet than in similar animals on a scorbutic diet, from which they deduce that the intestine of the former animals is also rich in ascorbic acid. The results to be produced confirm this conclusion.

When guinea-pigs are maintained on a scorbutic diet for some days, extracts of their tissues lose the capacity for reducing indophenol rapidly in acid solution. On the other hand, when ascorbic acid is offered *per os* or injected into the blood stream of such animals they acquire again this reducing property [De Caro, 1934]. The implication therefore is that the substance which reduces indophenol in this case at a more rapid rate than the other reducing substances present in the tissues is ascorbic acid.

In Table I are given the ascorbic acid contents, calculated on this basis from trichloroacetic acid extracts, of the alimentary canals of three groups of guinea-pigs. The first group, which was almost if not entirely exhausted of ascorbic acid

Table I.

Group	Days on scorbutic diet	Weight g.	Ascorbic acid injected mg.	Ascorbic acid in small intestine mg.		Ascorbic acid in remainder of alimentary canal mg.	
				Total	Per g.	Total	Per g.
1	7	300	100	3.0	0.30	1.5	0.10
	8	280	100	3.0	0.33	2.0	0.14
	10	300	100	3.0	0.24	2.0	0.12
	10	270	70	2.6	0.15	2.0	0.08
2	7	272	0	0.66	0.04	0.50	0.03
	8	280	0	0.40	0.03	0.25	0.01
	15	395	0	nil	—	nil	—
3	Mixed diet	580	0	5.0	0.25	1.5	0.08
	"	575	0	6.0	0.30	2.0	0.10
	"	615	0	3.5	0.18	1.4	0.10
	"	260	0	2.0	0.20	1.5	0.10

on a scorbutic diet, received 100 mg. of ascorbic acid (synthetic)² by means of an injection into the jugular vein under a local anaesthetic, and the animals were

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² Kindly supplied by Hoffmann-La Roche & Co.

killed two hours later. The second was a control group subsisting on a scorbutic diet, and the third received for a number of weeks a mixed diet containing cabbage *ad lib.* and in addition high doses of decitrated lemon juice *per os*. All the animals were killed by stunning and bleeding. There can be little doubt that the rapid reduction of the indophenol in the case of the injected animals was due to ascorbic acid. It is unlikely that the injected substance has either produced from precursors in the tissues, or has been itself converted into, an inactive reducing substance, especially as it has been shown by biological tests [Johnson and Zilva, 1934] that ascorbic acid passes through the organism without change. The animals in group I were killed two hours after the injection, since it was found that by this time an equilibrium was established in the ascorbic acid content of the intestines of these guinea-pigs. It is seen from the Table that the concentration of the vitamin in the alimentary canal is high, especially in the small intestine. This will be appreciated more when it is stated that the average concentration per g. in the liver of the above guinea-pigs on the mixed diet was 0.25 mg. Furthermore the concentration in the intestine is about the same as that observed by Harde and Wolff for the mouse (0.18–0.37 mg. per g.). These authors state, on the other hand, that the concentrations in the two cases differ appreciably (“sensiblement”) but give no experimental details for the guinea-pig. They are of the opinion that “il y a une différence fondamentale entre l’élaboration des produits réducteurs dans l’intestin du cobaye et de la souris.”

It is perhaps superfluous to add that the above figures (groups 1 and 3) are significant since the titrations were carried out on extracts equivalent to about 2 g. of tissue which usually reduced quickly over 6 ml. of *N*/1000 indophenol in the case of the small intestine. On the other hand the figures obtained in group 2, the control group on the scorbutic diet, are so low that they might be due to very small quantities of ascorbic acid, as given in the Table, or to the presence in higher concentration of “slow” reducing substances such as cysteine.

It therefore emerges from this experiment that when guinea-pigs are on a diet containing ascorbic acid the substance is selectively absorbed by the tissues of the intestinal tract, principally by those of the small intestine. It is above all plain from my results that this accumulation cannot be due to the passage of the vitamin of the ingested food through the gut, since when the ascorbic acid was injected into the blood stream, concentrations of ascorbic acid of an order similar to that obtained with guinea-pigs on a mixed diet were recorded. The guinea-pig, then, resembles the rat and the mouse, which are capable of synthesising ascorbic acid, in concentrating this compound in the same organs and glands, *viz.* the anterior lobe of the pituitary, the adrenals, the liver, the intestine, *etc.* when the vitamin is adequately supplied *per os* or by injection into the blood stream.

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