CCLXXXI. THE BEHAVIOUR OF *L*-ASCORBIC ACID AND CHEMICALLY RELATED COMPOUNDS IN THE ANIMAL BODY. THE INFLUENCE OF GENERALISED ETHER ANAESTHESIA ON THEIR URINARY EXCRETION.

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(Received August 30th, 1935.)

IN a recent communication [Zilva, 1935] evidence was produced showing that when compounds of the ascorbic acid series, *i.e.* *L*-ascorbic acid, *D*-arabo-ascorbic acid, *D*-galacto-ascorbic acid, *D*-gluco-ascorbic acid, *L*-gluco-ascorbic acid, were injected into guinea-pigs previously depleted of vitamin C, only the antiscorbutically active members were "fixed" by their tissues. In addition there was an indication that a quantitative relationship existed between the degree of activity and the amount "fixed", since the tissues of the animals injected with *L*-ascorbic acid showed a higher content than those of guinea-pigs treated with *D*-arabo-ascorbic acid (activity 1/20th of that of *L*-ascorbic acid). Furthermore, the amounts of the above compounds excreted by the kidney varied inversely with their antiscorbutic activity.

The present results not only confirm the above observation but reveal a new factor underlying the main phenomenon. In the first investigation the compounds were injected either by the intracardiac or intraperitoneal route without an anaesthetic or intravenously under a local anaesthetic (novocaine). No significant differences were observed in the urinary excretions of the respective compounds injected in either of these ways. The following results show, on the other hand, that when ether is employed as a general anaesthetic during the intravenous injection the amount excreted in the urine is increased.

In Table I the figures obtained by the use of the general anaesthetic are compared with those obtained in the experiments of the first communication when no anaesthetic or a local one was used. The assessment of the purity of the compounds and their concentration in the urine was made by titration with indophenol in each case. The difference in the urinary output was most marked with the "fully active" *L*-ascorbic acid and rather less marked with the "partially active" *D*-arabo-ascorbic acid—the output of the former being doubled when the intravenous injection was performed under the general anaesthetic. The effect of this anaesthesia was less evident when the "inactive" *D*-gluco-ascorbic acid or *D*-galacto-ascorbic acid was injected. The influence of the general anaesthesia thus becomes less with the diminished antiscorbutic activity of the compounds used.

It is of interest to note, nevertheless, that the use of the general anaesthetic did not prevent the "fixation" of the vitamin in the tissues. This is seen from Table II which shows that the quantitative distribution of *L*-ascorbic acid in the body after its injection into vitamin C-depleted guinea-pigs under these

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Table I.

Local, or no anaesthetic				General anaesthetic (ether)			
Wt. of animal g.	Scorbutic diet days	Quantity injected mg.	Excreted in urine during 24 hours mg.	Wt. of animal g.	Scorbutic diet days	Quantity injected mg.	Excreted in urine during 24 hours mg.
<i>l</i> -Ascorbic acid							
272	7	50	13	330	7	50	18
300	5	50	13	320	7	50	25
300	6	50	12	335	7	50	23
295	6	50	13	290	6	50	26
280	7	50	13	250	6	50	26
292	20	50	14	310	6	50	21
295	20	50	11	300	6	50	26
295	8	50	10	315	6	50	22
				300	6	50	25
				345	6	50	25
				310	6	50	24
Average			12				24
<i>d</i> -Arabo-ascorbic acid							
275	6	45	14	330	10	50	22
285	7	45	16	320	10	50	26
335	6	55	17	290	6	50	22
300	6	55	19	305	6	50	32
310	6	45	19				
350	6	45	10				
275	6	50	15				
305	7	50	19				
Average			16				26
<i>d</i> -Gluco-ascorbic acid							
300	6	55	20	320	8	50	33
305	6	55	26	305	7	50	30
290	6	55	39	305	7	50	37
310	7	55	34	300	8	50	29
270	6	50	30	345	8	50	31
300	7	50	26	360	8	50	38
275	7	50	26				
Average			29				33
<i>d</i> -Galacto-ascorbic acid							
325	6	50	25	340	9	50	28
315	6	50	28	332	9	50	35
300	6	50	23	360	9	50	24
290	7	50	26	285	8	50	35
280	7	50	21	325	8	50	33
				270	8	50	37
Average			25				32

Table II.

Compound injected	Quantity injected mg.	Wt. of animal g.	Scorbutic diet days	Quantity found										Pituitary	Excreted in urine during 24 hours mg.
				Small intestine		Large intestine		Liver		Adrenal	"Carcass"				
				mg./g.	Total mg.	mg./g.	Total mg.	mg./g.	Total mg.		mg./g.	Total mg.			
<i>l</i> -Ascorbic acid	50	290	6	0.20	2.2	0.17	1.7	0.28	2.8	1.5	0.06	8.3	++ ++	26	
	50	300	6	0.21	2.3	0.16	1.7	0.25	2.5	1.0	0.06	10.4	++ ++	26	
	50	315	6	0.26	3.1	0.15	1.6	0.27	3.5	1.4	0.03	5.1	++ ++	22	
	50	310	6	0.18	2.4	0.10	1.2	0.22	2.4	0.3	0.04	6.4	++ +	24	

conditions was even of a somewhat higher order than that observed when no anaesthetic or a local one was employed [cf. Zilva, 1935]. The higher excretion by the kidney under ether anaesthesia cannot, therefore, be due to deficient "fixation" in the body.

As previously mentioned the quantities of the various compounds voided in the urine were calculated from their indophenol titration figures. *l*-Ascorbic acid is excreted in the urine unchanged by human beings under normal conditions [Johnson and Zilva, 1934] and this is most probably also the case in animals with *l*-ascorbic acid and its related compounds when no general anaesthetic is employed during the injection. The possibility of an abnormal metabolism of these substances when ether is employed as an anaesthetic must, however, be borne in mind, although this appears at the moment to be improbable. An investigation which is now under way will, it is hoped, elucidate the significance of the influence of the general anaesthesia described above. The object of this note is to supplement the previous communication on the subject.

REFERENCES.

- Johnson and Zilva (1934). *Biochem. J.* **28**, 1393.
Zilva (1935). *Biochem. J.* **29**, 1612.