CXIII. METABOLISM IN TETANY.

By ISIDOR GREENWALD.

*From the Department of Chemistry, New York University and
Bellevue Hospital Medical College.*

(Received April 8th, 1932.)

IN a paper published about a year ago Morris, Watson and Morris [1931] made a number of curious statements regarding the work of others and reported some very astonishing results of their own.

Since it seems likely that this paper will only add to the present confusion in the literature, it seems necessary to offer the following remarks.

No attention has been paid to the work of several others [Roos, 1895; Ver Ecke, 1898; Underhill and Saiki, 1908; Greenwald, 1911] on chlorine and creatinine metabolism. Moreover, the references to the other experiments of the present writer are nearly entirely erroneous. Morris, Watson and Morris wrote (page 795): "Greenwald [1922] found a decreased retention of phosphorus during the latent stage following parathyroidectomy and a marked increase during the active period. Recently Greenwald [1929] concluded. . . . The increase in blood-phosphorus he attributed to a breakdown of lipoids and proteins containing phosphorus."

The first reference is to a paper which does not deal with this subject at all, and the statement does not correctly represent the results obtained. A very marked retention, not a decreased retention was observed, and this retention was frequently continued into the active period.

The second reference is also erroneous. There is no such reference in the paper cited. In another paper, Greenwald and Gross [1923] wrote (page 226): "The concentration of phosphate in the plasma is kept at its normal level or even above that by the phosphate derived from the metabolism of proteins, phosphatides, *etc.*" This, quite obviously, refers to the usual, normal metabolism of these substances and not, as the language employed by Morris, Watson and Morris would seem to indicate, to an abnormal catabolism of lipoids and proteins.

In examining the experimental results reported by Morris, Watson and Morris one notices, immediately, the omission of the *minus* signs before the figures for nitrogen retention on the second, third and sixth lines of Table IV (page 792). These are obvious typographical errors.

The remarkable retentions reported for Cats 3, 4 and 5 deserve some consideration. Cat 3 retained 3.0 g. of nitrogen out of 3.9 g. fed; Cat 4, 2.65 g. out

of 3.53 and Cat 5, 1.80 g. out of 2.61. I do not recall that retentions of such magnitude have ever before been recorded. Certainly they should not be published without drawing specific attention to them.

Apparently, the composition of the food fed to these cats was extremely variable, for, on comparing Tables I, IV and V, one notes an utter lack of relation between the changes in the intakes of nitrogen, chlorine, phosphorus and calcium. An extended analysis is neither necessary nor advisable, but some attention might be paid to the results reported for Cat 3.

	Nitrogen	Phosphorus	Calcium	Chlorine*
Normal	3.90 g.	0.293 g.	0.203 g.	0.707 g.
Active	0.71	0.110	0.057	0.676

* The figures have been rounded off.

The statement is made (page 787) that "the cats received oatmeal porridge and milk." The first explanation for the discrepancies in the reported intakes of the various elements would be that the oatmeal and milk were not ingested in the same proportions on the different days. However, it also appears that the composition of the milk and the oatmeal varied considerably.

Dr S. Morris has kindly sent me the results of some analyses of milk performed "recently." (Date of letter, Dec. 4, 1931.)

Milk	Nitrogen	Phosphorus	Calcium	Chlorine
I	0.5451	0.3109	0.1120	0.1406
II	0.4914	0.3206	0.1175	0.1420
III	0.4298	0.3104	0.1151	0.1349
IV	0.5550	0.3105	0.1253	0.1484

Assuming that these figures represent the nature of the variations in the composition of the milk that occurred during the experiment on Cat 3, certain calculations are of interest. Thus, during the "normal" period, the 0.203 g. of calcium ingested, even if it came entirely from milk, could have been accompanied by no more than 0.99 g. of milk-nitrogen. This amount of milk must have brought with it at least 0.238 g. chlorine. This means that a minimum of $3.90 - 0.99 = 2.91$ g. of oatmeal nitrogen was accompanied by a maximum of $0.707 - 0.238 = 0.469$ g. of chlorine: a ratio of N:Cl that was at least 6.2.

During the "active" period, however, the 0.057 g. of calcium, if it were derived entirely from the milk, would have been accompanied by at least 0.213 g. of nitrogen and by no more than 0.072 g. of chlorine. This means that a maximum of $0.71 - 0.21 = 0.50$ g. of oatmeal-nitrogen was accompanied by a minimum of $0.676 - 0.072 = 0.604$ g. of chlorine, giving a ratio of N:Cl that was no more than 0.83. Even if it be assumed that no milk was consumed the ratio of N:Cl was still only 1.05. It is perfectly obvious that the porridge fed on this "active" day was much more heavily salted than that fed on the "normal" day.

The values for the chloride content of the milk employed in these calculations are those sent me by Dr S. Morris. They are considerably higher than

those usually accepted. However, the use of the more generally accepted values, 0.07 to 0.10 % chlorine, only makes the discrepancies more marked.

Examination of the data for calcium and phosphorus intake discloses still more remarkable discrepancies. The ratios of phosphorus to calcium intake reported by Morris, Watson and Morris were in the order given in their Table V: 1.24, 1.46, 2.38, 0.97, 1.38, 1.18, 1.44, 1.20, 1.93, 1.44, 1.41, 1.51, 1.35, 1.22. In every case these ratios are lower than the ratios of phosphorus to calcium of milk according to the analyses sent me by Dr Morris, and, in every case but two, they are lower than the more usual figure of 1.7. Since any intake of oatmeal could only have raised this ratio to a value greater than that obtaining in milk, it is obvious that the analyses or the calculations employed in the paper under consideration were extremely inaccurate.

REFERENCES.

- Greenwald (1911). *Amer. J. Physiol.* **28**, 103.
—— and Gross (1923). *J. Biol. Chem.* **56**, 217.
Morris, Watson and Morris (1931). *Biochem. J.* **25**, 786.
Roos (1895). *Z. physiol. Chem.* **21**, 19.
Underhill and Saiki (1908). *J. Biol. Chem.* **5**, 225.
Ver Eecke (1898). *Arch. Internat. Pharmacodynamie*, **4**, 81.