3425

Hydrogen ion Concentration and Carbon Dioxide Content of Blood of Parathyroidectomized Dogs.

W. F. WENNER AND EDWARD MUNTWYLER. (Introduced by W. W. Swingle.)

From the Zoological Laboratory and the Biochemical Laboratory, State University of Iowa.

In recent years research in experimental and clinical tetany has led to the view that tetany occurs when the reaction of the blood shifts to the alkaline side. The fact that acid producing salts such as $CaCl_2$ and NH_4Cl causes the tetany symptoms to disappear, and the serum calcium to rise supports this view. Wilson, Stearns and Thurlow[1] report that the pH of the blood on the first day of tetany ranges from 7.6 to 7.75, and that the ingestion of 0.1 to 0.5 gm. of HCl brings relief. Grant[2] states that the symptomatic cure of infantile tetany by the use of NH_4Cl is strong evidence in favor of the view that there is an alkalosis in this condition. Freudenberg and György[3] maintain that tetany is the result of a decrease in ionized calcium, coincident with an increase in phosphate, brought about by a change in the reaction of the blood toward the alkaline side.

Drucker and Faber,[4] on the contrary, found that the pH values and the alkali reserve are no greater when tetany is manifest than when it is cured.

Hastings and Murray[5] determined the CO_2 combining power and CO_2 content in four parathyroidectomized dogs. They report only a slight drop. Measurements of the H ion concentration of the blood by means of a potentiometer were made on a different set of parathyroidectomized dogs. Their measurements were made at room temperature that varied considerably. After applying a temperature correction, calculated by Michaelis, they obtained a pH 7.45 for normal.

With this conflicting evidence it was decided to determine simultaneously the pH and CO_2 content of the plasma and calcium content of the serum. Hydrogen ion concentrations were determined electrometrically, using a Clark electrode and a constant temperature chamber whereby a constant temperature of 38° C. was maintained. Van Slyke's water jacketed, fine bore apparatus,[6] graduated to .01 cc., was used for determining the CO_2 content. Clark and Collip's[7] modification of the Kramer and Tisdall method for calcium determination was employed.

The following table gives the readings of 3 dogs that had been receiving treatment, but at the time were in violent tetany. The remaining 3 animals received no medication. These dogs were bled from the left ventricle before operation and at periods thereafter, when they showed faint symptoms of tetany, and later, when tetany became more marked.

TABLE I.

Animal	Date	Time	pH	CO_2 content vol. per cent	Serum Ca. mgm. per 100 cc.	Remarks
Dog A	Nov. 22		7.38	49.4		Violent tetany
Dog B	Nov. 22		7.41	40.		Violent tetany
Dog C	Nov. 22		7.37	38.1		Violent tetany
Dog 1	Nov. 30	1:00 P. M.	7.40	39.		
Adult		3:00 P. M.				Thyroparathyroidectomy
female	Dec. 1	9:45 A. M.	7.40	43.8		Normal
	Dec. 2	10:10 A. M.	7.36	34.3		Slight muscle tremors
	Dec. 3	9:25 A. M.	7.35	34.3		Faint muscle twitching
	Dec. 4					Slight tremors
	Dec. 5	2:00 P. M.	7.46	43.8		Marked tetany
						Very spastic
						Respiration normal
	Dec. 6					Found dead in cage
9 kilos	Nov. 30	1:00 P. M.	7.40	42.8		
Dog 2		3:30 P. M.				Thyroparathyroidectomy
Adult	Dec. 1	10:00 A. M.	7.40	45.7		Normal
female	Dec. 2	10:20 A. M.	7.40	47.3		Depressed, no muscle tremors
8.5 kilos	Dec. 3	9:20 A. M.	7.29	31.5		Violent tetany hyperpnea, salivation
		9:30 A. M.				Convulsions. Artificial respiration for 2 min.
		9:35 A. M.	7.09*	26.8		Recovered. Respiration normal, tremors disappeared
	Dec. 4-6					No tetany
	Dec. 8					Died in convulsions
Dog 3	Dec. 20	10:45 A. M.	7.38	43.	11.2	
Adult		2:30 P. M.				Thyroparathyroidectomy
male	Dec. 21					Normal
12 kilos	Dec. 22	9:30 P. M.	7.41	40.9	6.4	Slight twitching
	Dec. 23	8:30 A. M.	7.39	38.1	6.1	Hyperpnoea, very spastic
	Dec. 24	1:30 P. M.	7.29	33.4	6.1	Depressed. No muscle twitching, Hind legs paralyzed. Intestinal hemorrhage
	Dec. 25	3:00 P. M.				Died

* This low pH was probably due to the large amount of lactic acid produced during convulsions. The low CO_2 was probably caused by a lack of oxygen.

From these results it is obvious that a condition of alkalosis does not exist at any period following parathyroidectomy in dogs. The

fall in CO_2 is not accompanied with a corresponding change in the pH, except in the case of dog 2, where the CO_2 content fell from 31.5 volumes per cent before convulsions to 26.8 volumes per cent after convulsions and the pH dropped from 7.29 to 7.09.

[1] Wilson, D. W., Stearns, T., and Thurlow, M. DeG., *J. Biol. Chem.*, 1915, xxiii, 89.

[2] Grant, S. B., *Arch. Int. Med.*, 1922, xxx, 355.

[3] Freudenberg, E., and György, P., *Klin. Wchnschr.*, 1922, i, 222, 410.

[4] Drucker, P., and Faber, F., *J. Biol. Chem.*, 1926, lxviii, 57.

[5] Hastings, A. B., and Murray, H. A., Jr., *J. Biol. Chem.*, 1921, xlvi, 233.

[6] Van Slyke, D. D., and Stadie, W. C., *J. Biol. Chem.*, 1921, xlix, 1.

[7] Clark, E. P., and Collip, J. B., *J. Biol. Chem.*, 1925, lxiii, 461.

3426

Metabolic Rate Differences in Amblystoma Larvae.

O. M. HELFF.

From the Osborn Zoological Laboratory, Yale University.

Variations in the growth rates of homoplastic and heteroplastic grafts on Amphibia have been observed by many workers. Harrison,[1] for example, noted the retardation and acceleration of heteroplastic grafts in Amblystoma larvae. Differences in the metabolic rates existing between species would seem to afford a partial explanation, at least, for such results. Tests were designed, therefore, to determine the metabolic rates of 81 Amblystoma larvae involving 4 species of Amblystoma, and the strain commonly spoken of as "Axolotl."

The metabolic rates were based on the oxygen consumption for 4 hours, as determined by the Winkler method. All tests were run at 20° C., while all other factors affecting the metabolic rate, such as food and activity, were controlled. An abbreviated resumé of the results follows:

10 *A. punctatum* averaged a 46.9 per cent higher rate than 10 *A. tigrinum.*

12 *A. punctatum* averaged a 47 per cent higher rate than 12 *A. tigrinum.*

10 *A. punctatum* averaged a 24 per cent higher rate than 10 *A. jeffersonianum.*