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Amino-acid Content of the Blood Following Intravenous Injection of Hydrolyzed Casein.

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The ability of the body to utilize amino-acids injected intravenously in the rapid regeneration of serum protein was indicated in a recent paper in the PROCEEDINGS.¹ The importance of parenteral administrations of nitrogenous nourishment to patients unable to take food by mouth is obvious. Previous experiments on the intra-

¹ Elman, R., PROC. SOC. EXP. BIOL. AND MED., 1937, **36**, 867.

venous injection of a mixture of amino-acids have been reported by Van Slyke and Meyer,² by Henriques and Anderson,³ and others. The observations hereby recorded concern the disappearance rate of amino-acids injected intravenously at two different rates. They were made on dogs fasted for 48 to 72 hours, but allowed water *ad lib.* In each experiment the volume of the amino-acid solution injected equaled 3.5% of the body weight of the dog and consisted of hydrolyzed casein, 5%, in 5% glucose-Ringer's solution. The hydrolyzed casein was soluble in water, gave no precipitate with tungstic acid, and was not anaphylactogenic for guinea pigs. The results of the first group of experiments are represented in Fig. 1; the solution was injected slowly, *i. e.*, at the rate of 0.2 cc. per kilo of dog per minute. These animals had all been bled 3.5% of their body weight and the same volume of Ringer's solution replaced $\frac{1}{2}$ hr. before the injection of amino-acid solution was started. Thus, a 10-kg. dog received 350 cc. during a period of 175 minutes. Samples of jugular blood were taken immediately at the conclusion of the injection, and at 15- to 75-minute intervals. In the second group of experiments, represented in Fig. 2, 3.5% of the body weight of the dog was bled; the same volume of 5% amino-acids in 5% glucose-Ringer's solution was then immediately injected in one massive dose. A sample of jugular blood was taken immediately after replacement, and at intervals up to 3 hours later. Few symptoms followed the injection in each group and all animals survived the procedure without evidence of any toxic effect. Control samples of blood from the intact fasting dog revealed a relatively uniform content of amino-acids. Thus, in 10 dogs the following values were obtained (the numbers represent mg. % of amino-acid nitrogen): 5.4; 4.1; 5.1; 5.6; 4.6; 6.2; 5.9; 6.7; 5.4; 5.0—which average 5.3. The Folin colorimetric method, as described by Hawk and Bergeim,⁴ was used for the determination of amino-acid nitrogen. Excellent checks were obtained within the normal range. The higher values here reported are probably not so accurate, but since inferences are drawn from relative, not absolute changes, such errors are not significant. The determinations were made on serum after centrifugalization of the clotted blood. The amino-acid solution was prepared from casein by acid hydrolysis; it was generously supplied by Mead, Johnson and Company. In most of the experi-

² Van Slyke, D. D., and Meyer, G. M., *J. Biol. Chem.*, 1913, **16**, 197.

³ Henriques, V., and Andersen, A. C., *Z. f. Physiol. Chem.*, 1913, **88**, 357.

⁴ Hawk, P. B., and Bergeim, O., *Practical Physiological Chemistry*, Tenth Ed., 1931, Blakiston, Philadelphia, p. 427.

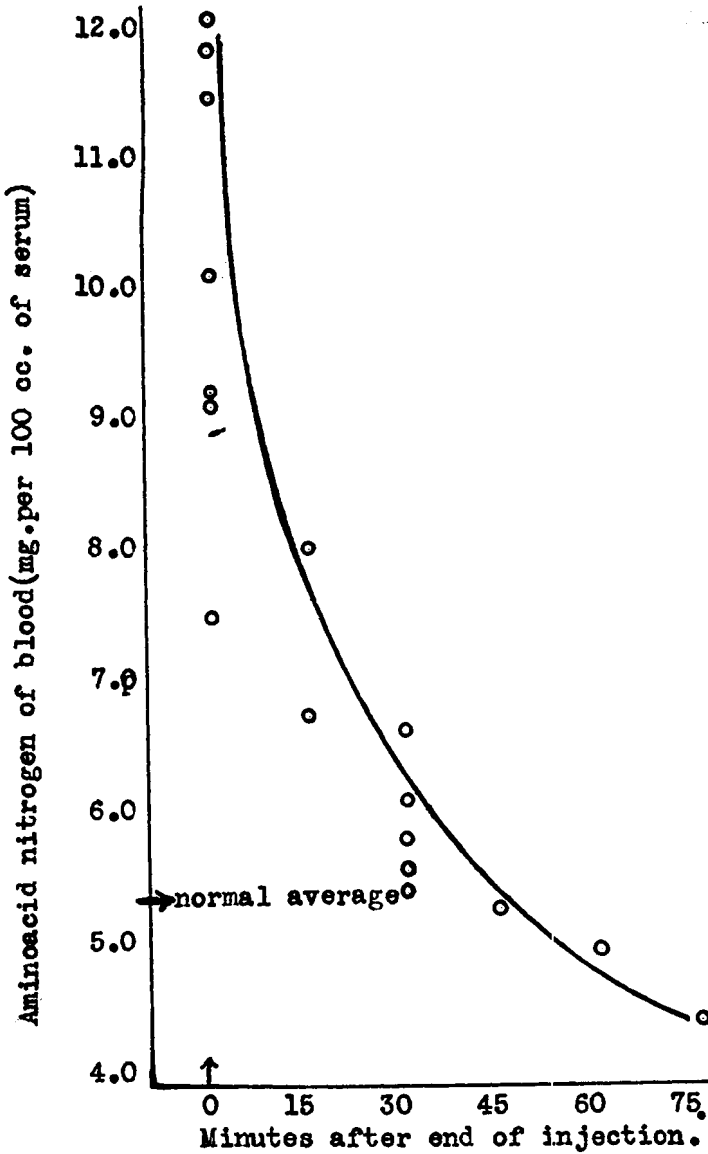


FIG. 1.

Rise and fall of amino-acids in the blood after a slow injection. After bleeding and replacement with Ringer's solution, the amino-acid solution (3.5% of the body weight) was injected intravenously at the rate of 0.2 cc. per minute per kg. of body weight. Six dogs.

ments here reported, 2% tryptophane was added to the product before making up the solution.

Conclusion. After a relatively slow, intravenous injection of 5%

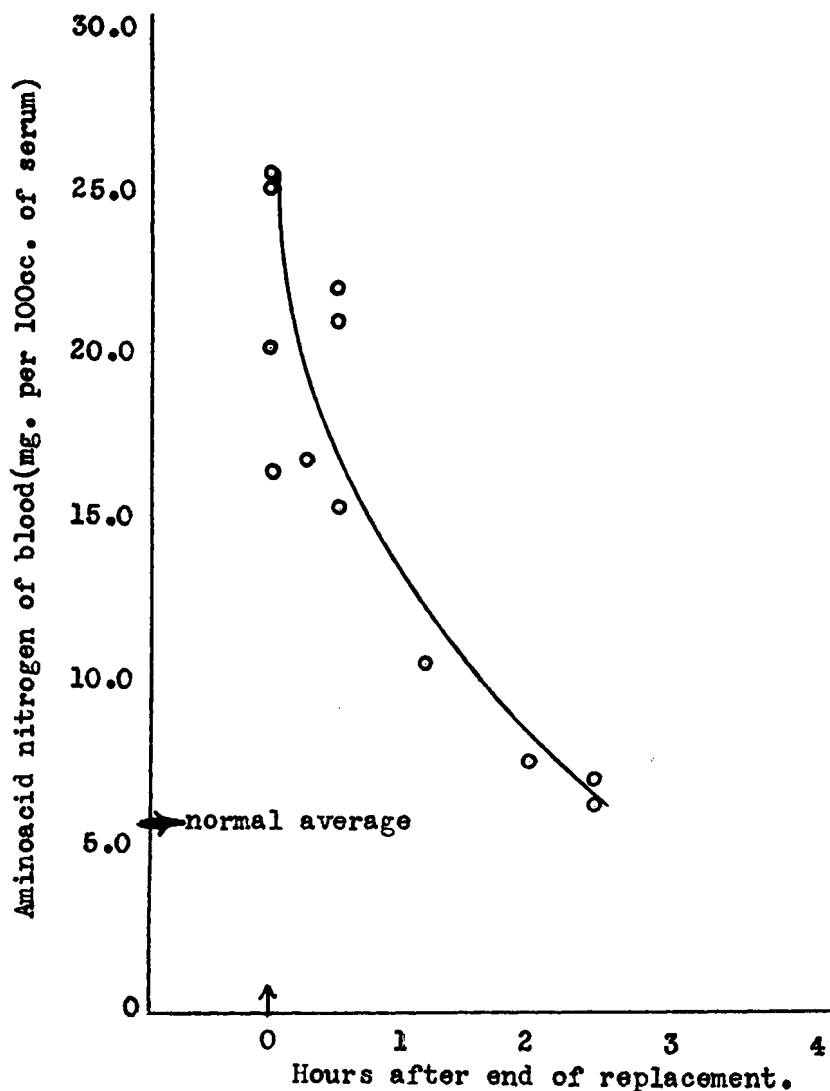


FIG. 2.

Rise and fall of amino-acids in the blood after a rapid (massive) injection. The same amount of amino-acid solution (3.5% of body weight) was given immediately after bleeding the same amount. Four dogs.

amino-acid solution, the concentration of amino-acids in the serum rises, but falls rapidly within 30 minutes to the normal level. After a massive intravenous injection, the value rises much higher but returns to normal within 2½ hours. The range of the amino-acid nitrogen concentration of the serum of 10 fasting dogs extends from 4.1 to 6.7, with the average at 5.3 mg. %.