to show any appreciable difference between the treated and untreated animals of both groups. All the surviving animals were shown to be heavily infected with L.D. bodies and their spleens were uniformly found to be enlarged. It may thus be concluded that aureomycin in a dose as high as 100-150 mg per kilo body weight per day failed to exert any beneficial effect upon experimental Leishmaniasis in Chinese hamsters.

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The Effect of Protein Depletion upon the Enzyme Activities of Organs.* (18758)

NATHAN MILLMAN.† (Introduced by James B. Allison.)

From the Bureau of Biological Research, Rutgers University, New Brunswick, N. J.

The gross attributes of the syndrome of protein depletion in animals are now generally recognized; perhaps less evident are the underlying metabolic changes. One approach to this problem has been a study of the nitrogen exchange of the body during depletion(1,2). The activities of enzyme systems, which ultimately may dictate the major features of depletion, constitute another approach to the deeper mechanisms involved. Therefore this study was designed to screen some of these systems in rats on low-protein and protein-free diets.

Depletion of animals. Young adult albino rats were housed in self-cleaning cages in an air-conditioned room. The control diet "G" was composed of 18% casein, 68% dextrose, 8% hydrogenated vegetable oil, 4% salts (USP No. 1), and 2% cod liver oil. Low-protein diet "E" contained only 2% casein, while diet "D" was protein-free; in both these cases the dextrose content was increased to substitute for the protein omitted. In addition, the rats were fed orally an adequate daily supplement of pure vitamins, which included the "B" components, para-amino benzoic acid, choline, inositol, 2-methyl-1,4-naphthoquinone and biotin.

The rats were maintained on these diets for varying periods, depending upon when their tissues were analyzed for enzyme activity. Although it was originally planned to examine for a gradual change in such activity with time, it was noted on examination of the data that any changes which did occur were of the same order of magnitude after 3 weeks of depletion as they were later on. For this reason, the depletion values have been grouped for analysis and comparison with the simultaneously measured control values. Tests of significance were performed, where possible, by the 't' test(3). In the determination of enzyme activity maximum effort was directed toward making analyses under identical conditions. Thus strict time schedules were observed for autopsy, treatment of tissue and measurements. Especial care was taken with homogenization of the tissues which was always performed in the same manner(4).

Adenosinetriphosphatase (ATP-ase) of skeletal muscle. Analyses were performed according to the method of Dubois and Potter (5); the adenosine triphosphate was prepared according to Kerr(6). In Table I are re-

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† Present address: Ortho Research Foundation, Raritan, N. J.

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TABLE I.

Enzyme system	Measurement	Diet	No. of Rats	Values (Mean ± S.D.)
Adenosine triphosphatase of skeletal muscle	μg phosphate split/mg dry wt	G. Control	6	40.4 ± 10.9
		E. Low-protein	6	40.2 ± 14.3
		D. Protein-free	4	41.9 ± 10.7
Cytochrome oxidase of liver	μl O_2 used/ hr/mg dry wt	G. Control	5	73.4 ± 25.9
		E. Low-protein	5	62.5 ± 17.5
		D. Protein-free	4	79.4 ± 14.9
Arginase of liver	Arginase units x 10^{-2}/g	G. Control	6	38.1 ± 6.5
		E. Low-protein	4	36 ± 4.1
		D. Protein-free	6	38.1 ± 6.5
	Arginase units x 10^{-2}/total liver	G. Control	6	256.8 ± 48.7
		E. Low-protein	4	196.9 ± 35.4
		D. Protein-free	5	168.6 ± 37.7
Succinoxidase of liver	μl O_2 used/ hr/mg dry wt	G. Control	12	56.2 ± 11.3
		E. Low protein	9	26.8 ± 10.6
		D. Protein-free	10	21.8 ± 13.7

ported the results for animals maintained on the diets from 28 to 58 days. Values are expressed as the micrograms phosphate split from the substrate per milligram dry weight of muscle. There is no apparent difference in ATP-ase activity of muscle with varying levels of protein in the diet.

Cytochrome oxidase of the liver. Cytochrome C was prepared by the method of Keilin and Hartree(7) from horse heart tissue, and standardized spectrophotometrically(8). The p-phenylemediamine method was used to measure activity(9,10). Table I summarizes the results with the three levels of protein feeding, expressed as the microliters of oxygen used per mg weight of tissue per hour. Here again there was no apparent change in activity with diet.

Arginase activity of liver. The liver arginase activity was determined by a modification of the methods of Hunter and Downs(11) and Lightbody(12). Activity was expressed as units according to a standard curve for ammonia liberation and weight of tissue used (13). One unit is taken as the activity yielding 0.34 mg ammonia under the standard conditions of the assay. It is evident from the values in Table I that the arginase activity per gram of liver remains relatively constant, while the decrease in liver weight with depletion is reflected in a reduced total arginase activity. These results may be compared with those of Lightbody and Kleinman(14) who reported some decrease in liver arginase activity on 6% protein diets, and with those of Rosenthal *et al.*(15) who reported as much as a 70% loss in activity after two weeks on protein-deficient diets.

Succinoxidase activity of liver. Measurement of the succinoxidase activity of liver was performed by the method of Schneider and Potter(16). There is a marked decrease in the succinoxidase activity with protein depletion in the rat, as shown in Table I. This effect was already evident after the third week of depletion, when tests were first performed, and may actually occur much earlier than this. The addition of 0.25% methionine

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to the 2% protein diet did not elevate the value in 3 additional animals tested (Mean 26.8 ± 11.7). If the values for each diet are grouped and statistically tested(3), the P values for each depletion group compared to the control group are less than 0.01, indicating significant differences. Potter and Klug (17) have reported that succinate oxidation of liver was decreased on diets high in carbohydrate. Since the high carbohydrate diets contained only 6% casein as protein, there exists the possibility that the observed effect might be due in large part to this low protein diet.

Summary. Rats fed low protein or protein-free diets for periods up to 8 weeks exhibit (1) no change in skeletal muscle ATP-ase activity; (2) no change in liver cytochrome oxidase activity; (3) no change in liver arginase activity per gram of tissue, but a decrease in total arginase units; and (4) a marked decrease in the succinoxidase activity of liver.

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Relation of Protein Nutrition to the Healing of Experimental Wounds.* (18759)

MARTIN B. WILLIAMSON, THOMAS H. MCCARTHY, AND HERBERT J. FROMM.

From the Department of Biochemistry, Graduate School and Stritch School of Medicine, Loyola University, Chicago.

A number of reports have indicated that the level of protein intake has a marked effect on the rate of healing of wounds(1-8). There is, however, little work relating protein metabolism or the effect of amino acids to the healing of wounds(4-6,9,10). It has been shown that methionine will increase the rate of healing of experimental wounds(4), whereas tryptophane, valine and lysine have no significant effect on the rate of healing(10). Since greater nitrogen retention will occur when extra methionine is fed(11,12), it seems probable that the methionine, rather than other essential amino acids, is the limiting factor in the healing process. In fact, injured dogs will retain methionine sulfur and incorporate it into protein, even when a negative nitrogen balance exists(13). Beyond the fact that a negative nitrogen balance appears shortly after wounding(14,15), little seems to be known about protein metabolism during the healing of wounds.

Further study may help elucidate the role of protein metabolism in the healing process. The present paper attempts to relate nitrogen and sulfur metabolism to the rate of healing of experimental wounds.

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