rat. The absence of choline oxidase in the liver of the guinea pig does not increase the toxicity of choline. Dimethylethanolamine, which is not metabolized by choline oxidase in the liver, appears to be more toxic than choline in both animals. Dimethylethanolamine is metabolized much slower than choline, for it can be detected in the tissues of rats following the administration of large quantities(8). On the other hand, after similar doses of choline were given, neither free nor combined dimethylethanolamine could be detected in the tissues of the rat. This difference in metabolism of dimethylethanolamine may help account for its increased toxicity.

Summary. 1. The toxicity of choline and dimethylethanolamine in the guinea pig and the rat has been compared. 2. There is very little difference in the toxicity of choline or dimethylethanolamine in the guinea pigs and rats. However, dimethylethanolamine appears to be the more toxic.

1. Hodge, H. C., and Goldstein, M. R., PROC. SOC. EXP. BIOL. AND MED., 1942, v51, 281.

2. Hodge, H. C., *ibid.*, 1944, v57, 26.

3. Neuman, M. W., and Hodge, H. C., *ibid.*, 1945, v58, 87.

4. Handler, P., and Bernheim, F., *J. Biol. Chem.*, 1942, v144, 401.

5. Humoller, F. L., and Zimmerman, H. J., *Am. J. Phys.*, 1953, v174, 199.

6. Bernheim, F., and Bernheim, M. L. C., *Am. J. Phys.*, 1938, v121, 55; Handler, P., PROC. SOC. EXP. BIOL. AND MED., 1949, v70, 70.

7. Du Vigneaud, V., Chandler, J. P., Simmonds, S., Moyer, A. W., and Cohn, M., *J. Biol. Chem.*, 1946, v164, 603; Artom, C., and Cornatzer, W. E., *ibid.*, 1948, v176, 949.

8. Artom, C., in McElroy, W. D., and Glass, B., *Phosphorus Metabolism*, v11, 203, Johns Hopkins Press, 1952.

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Effect of ACTH on Distribution of Plasma Proteins of Patients with Pulmonary Tuberculosis. (20979)

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(Introduced by Smith Freeman.)

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Vaughan and coworkers(1) have shown that both ACTH and cortisone therapy depress fibrinogen and gamma globulin levels in the blood of patients with active rheumatoid arthritis and scleroderma. Reiner(2) likewise has shown that these agents increase albumin concentration, but decrease gamma globulin in sera of patients with *disseminated lupus erythematosus*. Studies reported in this communication describe the changes which occur in the electrophoretic pattern of the plasma proteins of tuberculous patients following administration of ACTH. The results will be shown to be similar to that described in(1,2).

Material and methods. Clinical material. Heparinized plasma samples were obtained from 11 patients hospitalized for pulmonary tuberculosis. These samples were generally obtained before, at 2-week intervals during, and after treatment with ACTH. ACTH was generally administered in divided doses intramuscularly each 6 hours. Seventy-five to 100 mg were generally given at onset of treatment, and then the amount was gradually tapered to 20 mg daily before being discontinued.

Electrophoretic fractionation. Diagrams were obtained under nearly the same experimental conditions in order to make comparisons possible. The plasma was diluted 1-6 with veronal buffer solution, pH 8.6, ionic strength 0.1; electrophoresis was conducted in the standard 11 ml cells of the Klett apparatus. Ten milliamperes of current were passed until separations were satisfactory; this was generally about 3 hours. Enlarged tracings were made of anode pattern photographs and per cent of total plasma proteins deter-

TABLE 1. Electrophoretic Distribution of Serum Proteins in Normal and Pulmonary Tuberculosis Patients.

Avg and probable error of mean result	Total protein (g %)	A/G ratio	Relative % of total proteins					
			Albumin	Alpha 1	Alpha 2	Beta	Gamma	Fibrinogen
For 12 normal men	6.94±.05	1.38	5.40±.6	4.6±.19	12.4 ±.62	9.8±.56	12.5± .63	6.6±.19
For 11 untreated tuberculosis patients	7.00±.17	.62	32.7 ±.84	8.6±.39	13.00±.45	12.3±.49	20.3±1.01	13.9±.37

mined(3). Total proteins were determined by the conventional Kjeldahl method using a nitrogen factor of 6.25.

Results. Table I presents the average values obtained on the 11 patients before treatment as compared to those of 12 normal adults. The values obtained are similar to those reported by Seibert *et al.*(4) for tuberculous patients. The albumin value and A/G ratios of the tuberculous patients are definitely less than normal and there is an increase in gamma globulin. In addition, fibrinogen and alpha 1 globulin values of the patients with active tuberculosis are approximately double those of the normal individuals. Our results differ from those of Seibert *et al.*(4) in that we were unable to demonstrate a significant increase in the alpha 2 globulin.

Table II shows the values obtained on the 11 patients during hormone treatment. The average increase in albumin was from 32.7% to 40.8%. The average fall in fibrinogen was from 13.9% to 9.8%. Gamma globulin likewise fell from 20.3% to 14.3%. The values for the alpha 2, and beta globulins, although not distinctly abnormal from the beginning, appeared to be variable. Although the alpha 1 globulin level was initially considerably higher, the changes brought about by therapy were not consistent so that the net average change was small.

Plasma of patients receiving large, prolonged dosages of ACTH sometimes showed rather rapid changes in certain of the components. Table III illustrates the changes obtained with patient F. W. during a course of therapy. It may be noted that within one week after the start of therapy, the albumin increased from 34.9% to 41.3%, while fibrinogen decreased from 13.2% to 8.4%. On the other hand the gamma globulin and total protein did not change appreciably. This is in agreement with Vaughan *et al.*(1): fibrinogen levels are more readily affected by treatment than gamma globulin levels. It is also evident that reduction or cessation of ACTH treatment resulted in reversion of the protein fractions to values similar to those noted in the control samples. Le Maistre *et al.*(5) have likewise shown that cessation of hormone administration caused gamma globulin values to rise to initial values by the end of 4 weeks.

TABLE II. Effect of ACTH on Albumin, Fibrinogen, and Gamma Globulin of 11 Pulmonary Tuberculosis Patients.

	Albumin			Fibrinogen			Gamma globulin		
	Control	Peak	Change	Control	Peak	Change	Control	Peak	Change
	29.2	44.7	+15.5	16.8	10.3	−6.5	15.8	10.2	− 5.6
	30.9	43.8	+12.9	13.1	8.2	−4.9	22.8	9.0	−13.8
	32.6	37.8	+ 5.2	14.2	11.6	−2.6	25.2	16.8	− 8.4
	25.9	27.7	+ 1.8	15.2	15.0	− .2	19.8	20.3	+ .5
	33.8	39.1	+ 5.3	10.0	9.1	− .9	29.2	24.5	− 4.7
	39.2	40.8	+ 1.6	15.7	8.9	−6.8	11.9	7.8	− 4.1
	34.0	42.6	+ 8.6	12.6	10.0	−2.6	20.2	8.2	−12.0
	27.4	30.7	+ 3.3	14.3	12.4	−1.9	20.6	21.6	+1.0
	38.8	48.6	+ 9.8	13.0	6.6	−6.4	17.0	10.3	− 6.7
	33.2	45.3	+12.1	14.6	8.2	−6.4	24.4	15.7	− 8.7
	34.9	47.2	+12.3	13.2	8.0	−5.2	16.2	12.6	− 3.6
Avg	32.7	40.8	+ 8.04	13.9	9.8	−4.0	20.3	14.3	− 6.3

TABLE III. Electrophoretic Distribution of Plasma Proteins in Pulmonary Tuberculosis before and after ACTH Therapy. (Last patient, Table II.)

Date	ACTH admin., mg/day	Albumin, %	Fibrinogen, %	Gamma globulin, %	A/G ratio	Total protein, g %
8– 8–49	Control	34.9	13.2	16.2	.67	6.72
9–11	100					
12–15–18	75	41.3	8.4	16.0	.82	6.65
19–25	100	43.2	9.4	14.2	.91	5.86
9–12–15		47.2	8.0	12.6	1.05	6.62
16–22	75					
23	25					
24–26	0	35.4	14.6	13.6	.86	5.91

Summary. 1. Albumin level and A/G ratio of pulmonary tuberculosis patients are reduced from normal value. 2. Levels of gamma globulin, fibrinogen, and alpha 1 globulin are considerably higher than those of normal individuals. 3. ACTH depresses the gamma globulin and fibrinogen, and raises the albumin values and A/G ratio toward normal levels. Gamma globulin is less susceptible to immediate changes than the latter two components. 4. Cessation or reduction of ACTH therapy brought about a reversion of protein fractions to values similar to those noted in control samples. 5. Values for alpha 1, alpha 2, and beta globulins appeared to be variable under the influence of ACTH.

1. Vaughan, J. H., Bayles, T. B., and Favour, C. B., PROC. SOC. EXP. BIOL. AND MED., 1951, v76, 274.

2. Reiner, M., *ibid.*, 1950, v74, 529.

3. Tiselius, A., and Kabat, E. A., *J. Exp. Med.*, 1939, v69, 119.

4. Seibert, F. B., Seibert, M. V., Atno, A. J., and Campbell, H. W., *J. Clin. Invest.*, 1947, v26, 90.

5. Le Maistre, C. A., Tompsett, R., Muschenheim, C., Moore, J. A., and McDermott, W., *ibid.*, 1951, v30, 445.

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Effect of Dietary *Clostridia* upon Growth-Promoting Responses of Penicillin.* (20980)

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Elam *et al.*(1) reported that penicillin greatly reduced the total number of *Clostridia* present in the intestinal tract of the chick and that small amounts of the antibiotic inhibited the growth of *Clostridia* isolates *in vitro*. Jacobs *et al.*(2) later reported that antibiotics (directly or indirectly) stimulated growth by reducing the total number of *Clostridia* in the intestinal tract of the chick and that the antibiotics may be ineffective in stimulating growth in a clean environment where the *Clostridia* population was low. Kiser *et al.* (3) reported that a number of *Clostridia* were

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