

TABLE I.  
Hematologic Response of a Case of Sprue Following Administration of Synthetic *L. casei* Factor.

| Date    | Therapy                      | Erythrocytes,<br>millions per mm <sup>3</sup> | Hemoglobin,<br>g per 100 cc | Reticuloocytes,<br>% | Leucoocytes,<br>thousands |
|---------|------------------------------|-----------------------------------------------|-----------------------------|----------------------|---------------------------|
| 9/24/45 | None                         | 1.35                                          | 6.5                         | 2.9                  | 4.32                      |
| 10/ 1   | "                            | 1.56                                          | 6.0                         | —                    | 5.75                      |
| 4       | 15 mg <i>L. casei</i> factor | 1.76                                          | 7.0                         | 3.8                  | 4.85                      |
| 7       | "                            | 1.85                                          | 7.5                         | 3.4                  | 5.55                      |
| 11      | "                            | 2.35                                          | 9.0                         | 11.3                 | 6.00                      |
| 12      | "                            | —                                             | —                           | 15.3                 | —                         |
| 14      | "                            | 2.37                                          | 9.0                         | 9.1                  | 6.25                      |
| 19      | "                            | 3.88                                          | 9.5                         | 4.3                  | —                         |

and pernicious anemia. Gastric analysis revealed free hydrochloric acid after histamine stimulation. Treatment with 15 mg daily of *L. casei* factor was instituted on October 19, 1945. On the fourth day of treatment reticuloocytes had increased to 16.1% from a pre-treatment level of 3.6%. There was definite subjective improvement during this time. Her progress is being followed.

Castle<sup>6</sup> has reported that folic acid administered by mouth is without effect in doses up to 3.6 mg daily in patients with pernicious

anemia, and Watson *et al.*<sup>7</sup> found *L. casei* factor ineffective in the treatment of 8 cases of "refractory anemia." There appear to have been published no previous experiences with this factor in the treatment of sprue.

**Summary.** The preliminary results here presented demonstrate that two cases of sprue have improved markedly following the parenteral administration of synthetic *L. casei* factor. It is reasonable to attribute the observed improvement to a specific effect of the substance administered, although one can not definitely rule out the possibility of spontaneous remissions in these patients.

<sup>6</sup> Castle, W. B., Ross, J. B., Davidson, C. S., Burehenal, J. H., Fox, H. J., and Ham, T. H., *Science*, 1944, **100**, 81.

<sup>7</sup> Watson, C. J., Sebrell, W. H., McKelvey, J. L., and Daft, F. S., *Am. J. Med. Sci.*, 1945, **210**, 463.

## 15155

### Plasma Protein Concentrations in Adrenalectomized Rats Maintained on Sodium Chloride.\*

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Adrenalectomy in the rat is followed by a decrease in serum albumin and an increase in serum globulin concentration.<sup>1</sup> Since adrenalectomized rats lose weight and reduce their food intake, it would appear that the serum protein changes are due to partial inanition in addition to mild cortical insufficiency. Furthermore, the adrenalectomized rat is in nega-

tive nitrogen balance.<sup>2</sup> When 1% sodium chloride is given to adrenalectomized rats as drinking water a body weight increase may be observed, more food is consumed and the negative nitrogen balance is improved.<sup>2</sup> The salt-maintained adrenalectomized rat is not normal in all respects and in this regard examination of the serum protein levels in a small group of rats revealed a subnormal serum albumin.<sup>1</sup> In the present investigation salt-

\* Publication of the Bureau of Biological Research, Rutgers University.

<sup>1</sup> Levin, L., and Leatham, J. H., *Am. J. Physiol.*, 1942, **136**, 306.

<sup>2</sup> Rubin, M. I., and Kriek, E. T., *J. Clin. Invest.*, 1936, **15**, 685.

TABLE I.  
Adrenalectomy and Plasma Protein Concentrations.

| Treatment                      | Body wt<br>Start | Body wt<br>End | Hemato-<br>crit,<br>% | Non-protein<br>N<br>mg/100 cc | Total<br>protein<br>g/100 cc | Albumin<br>g/100 cc | Globulin<br>g/100 cc | A/G<br>ratio |
|--------------------------------|------------------|----------------|-----------------------|-------------------------------|------------------------------|---------------------|----------------------|--------------|
| (14) Adrenalex + NaCl          | 250              | 250            | 44.4±0.4*             | 78.0±4.0                      | 5.97±0.09                    | 3.36±0.09           | 2.61±0.12            | 1.29±0.08    |
| (14) Normal—pair fed           | 247              | 246            | 46.1±1.1              | 72.0±3.6                      | 5.97±0.11                    | 3.46±0.17           | 2.51±0.10            | 1.38±0.11    |
| (20) Normal—fed <i>ad lib.</i> | 235              | 252            | 45.4±0.7              | 54.0±0.8                      | 6.37±0.07                    | 3.86±0.09           | 2.51±0.10            | 1.54±0.10    |

$$^* \text{Mean deviation of the mean} = \epsilon = \sqrt{\frac{\sum d^2}{n(n-1)}}$$

maintained adrenalectomized rats are compared with pair fed and *ad libitum* fed normal rats to determine the effect on (1) body weight change, (2) food consumption, (3) plasma protein concentrations, and (4) organ weights.

Adult male rats of the Long-Evans strain were used at 140-150 days of age. Bilateral adrenalectomy was performed as a one-stage operation and the rats were placed in metabolism cages provided with 1% sodium chloride as drinking water. Two rats were kept in each cage and food intake was measured daily. Normal littermate controls given tap water were either pair fed or permitted *ad libitum* feeding. The experiment was terminated after 20-22 days at which time blood samples for plasma proteins were taken and each rat was autopsied. The manner in which blood samples were obtained as well as the methods of blood analysis used were the same as those reported previously.<sup>3</sup>

The average body weight of the adrenalectomized rats as well as of the pair fed normal rats was unchanged at the end of the 20-day experimental period. On the other hand, the *ad libitum* fed controls gained 17 g during this period (Table I). Food intake appeared to be the factor affecting body weight changes. The appetite of the salt-maintained adrenalectomized rats was subnormal. The effect of food intake on body weight was also reflected in those animals which lost weight. Eight of the adrenalectomized rats lost an average of 17 g despite the sodium chloride and the pair fed controls simulated the effect in an average loss of 13 g.

Food intake of the adrenalectomized rats receiving sodium chloride totaled 279 g per

rat for the first 20 days following the operation. This was subnormal since *ad libitum* fed normals consumed an average 335 g during the same period. Although sodium chloride improves the appetite and consequently the food intake of the adrenalectomized rat our experiments and those of others<sup>2,4</sup> have shown that food intake is still below normal. On the other hand, Groat<sup>5</sup> found food intake to be normal in adrenalectomized rats on sodium chloride.

Examination of the plasma protein concentrations revealed that total protein was significantly lower in adrenalectomized rats on sodium chloride than in *ad libitum* fed control rats. This decrease was due entirely to a decrease in plasma albumin. A decrease in total plasma protein due entirely to a decrease in albumin concentration was also observed in normal rats pair fed with the adrenalectomized rats (Table I). Indeed, the plasma protein levels are a virtual duplication of each other, indicating that the food intake of the adrenalectomized rat on salt is sufficiently subnormal to alter the usual plasma protein levels significantly. Direct comparison of the protein concentrations in these experiments seems permissible since hemocentration was not observed in the adrenalectomized rat. Furthermore, the salt-maintained adrenalectomized rat is reported to have a normal plasma volume.<sup>6</sup>

Sodium chloride supplementation replaces, in part, adrenal cortical function and adrenalectomized rats on salt can manufacture plasma proteins as well as can normal rats,

<sup>4</sup> Wyman, L. C., and tum-Suden, C., *Endocrinology*, 1945, **36**, 340.

<sup>5</sup> Groat, R. A., *Am. J. Physiol.*, 1941, **135**, 58.

<sup>6</sup> Hechter, O., *Endocrinology*, 1945, **36**, 77.

<sup>3</sup> Leatham, J. H., *Endocrinology*, 1945, **36**, 98.

when both consume the same amount of dietary protein. Other adrenal cortical factors seem necessary for an over-all normal protein metabolism. This is further indicated by Winternitz<sup>7</sup> who found that the weight gain of adrenalectomized rats on sodium chloride was largely water and protein whereas pair fed normal rats exhibited an increase in fat but no change in protein. Our data would also suggest that digestibility is essentially normal in salt-maintained adrenalectomized rats although the low gastric secretion, with a low acid and enzyme content, of the adrenalectomized rat is not improved by salt.<sup>8</sup> Hartman *et al.*<sup>9</sup> have reported that the plasma proteins of the adrenalectomized dog are improved by sodium salts but not to the same degree as by cortical extract. Recent clinical studies on patients with Addison's disease reveal that

<sup>7</sup> Winternitz, J. K., Ph.D. Thesis, Yale University, 1942.

<sup>8</sup> Tuerkischer, E., and Wertheimer, E., *J. Endocrinology*, 1945, **4**, 143.

<sup>9</sup> Hartman, F. A., Lewis, L. A., Thatcher, J. S., and Street, H. R., *Endocrinology*, 1942, **31**, 287.

these individuals have a low plasma albumin, in agreement with the results of animal experiments.<sup>10</sup>

The fresh weight of a number of organs was taken at autopsy to determine whether the adrenalectomy and/or the self-imposed starvation influenced organ weight. No significant organ weight differences for the pituitary, thyroid, testes, seminal vesicles, ventral prostate, spleen, kidney, or liver were obtained regardless of the groups compared.

*Summary.* The adrenalectomized rat maintained on sodium chloride for 20 days has a subnormal plasma albumin concentration. Pair fed rats exhibit the same low plasma protein concentrations and the same impaired growth rate. In the replacement in part of adrenal cortical function sodium salts appear to permit the adrenalectomized rat to manufacture plasma proteins in a normal manner although appetite is subnormal. Organ weights are not affected.

<sup>10</sup> McCullagh, E. P., and Lewis, L. A., *Am. J. Med. Sc.*, 1945, **210**, 81.

## 15156

### The Sensory and Motor Axons of the Chorda Tympani.\*

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The gross relations of the chorda tympani are well known and it is accepted that, functionally, it is a mixed motor-sensory nerve. The motor component is composed of preganglionic visceral efferent axons which pass to the submaxillary and associated terminal ganglia<sup>1</sup> and the sensory unit is made up of afferent axons which are distributed to the

taste buds on the anterior two-thirds of the tongue<sup>2,3</sup> and possibly to the lingual mucosa.<sup>2</sup>

Until recently but little information has been available on the morphological types and sizes of axons in the chorda tympani. We have shown<sup>4</sup> that the nerve of the cat contains myelinated and unmyelinated axons. Both varieties of nerve fibers are of small caliber with the myelinated nerve fibers ranging from 1.5 to 6 micra in diameter while the unmyelinated axons are less than 1.5 micra

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<sup>1</sup> Kuntz, A., *The Autonomic Nervous System*, Lea & Febiger, Philadelphia, 1934.

<sup>2</sup> Cushing, H., *Johns Hopkins Hospital Bull.*, 1903, **14**, 71.

<sup>3</sup> Lewis, D., and Dandy, W. E., *Arch. Surg.*, 1930, **21**, 249.

<sup>4</sup> Foley, J. O., and DuBois, F. S., *J. Comp. Neur.*, 1943, **79**, 79.