

*Summary.* Electrically induced convulsions produce a hyperglycemia in the normal, a hypoglycemia in the adrenalectomized rat, and no change in blood sugar in adrenalectomized-vagotomized animals. This is interpreted to mean that the convulsions excite both the sympathetico-adrenal and vago-insulin systems. The effect on the former predominates over that on the latter. If a normal animal the vagi are cut below the diaphragm and therefore the secretion of insulin can no longer be controlled by the vagus, it is found that the hyperglycemic response is greater than in control animals in which the vagi are intact.

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## Blood Volumes in Hypertensive Partially Nephrectomized Rats.\*

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Most clinical investigators have found no parallelism between hypertension and blood volume.<sup>1</sup> Dogs with experimental renal hypertension produced by the Goldblatt procedure<sup>2</sup> have normal cardiac output<sup>3</sup> and normal blood volume.<sup>4, 5</sup> Griffith and Ingle<sup>6</sup> believe that they have demonstrated an increased blood volume in hypertensive partially nephrectomized rats.

In the present study it is shown that the blood volume is not a factor in the maintenance of an increased blood pressure in partially nephrectomized rats.

*Methods.* Male rats of Wistar strain, subjected to partial nephrectomy,<sup>7</sup> after a period of 3 to 4 months following operation, were

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<sup>1</sup> Fishberg, A. M., *Hypertension and Nephritis*, Lea and Febiger, 1939.

<sup>2</sup> Goldblatt, H., Lynch, J., Hanzal, R. F., and Summerville, W. W., *J. Exp. Med.*, 1934, **59**, 347.

<sup>3</sup> Freeman, N. E., and Page, I. H., *Am. Heart J.*, 1937, **14**, 405.

<sup>4</sup> Holman, D. B., and Page, I. H., *Am. Heart J.*, 1938, **16**, 321.

<sup>5</sup> Gibson, J. G., and Robinson, R. W., *PROC. SOC. EXP. BIOL. AND MED.*, 1938, **39**, 497.

<sup>6</sup> Griffith, J. Q., and Ingle, D. W., *PROC. SOC. EXP. BIOL. AND MED.*, 1940, **44**, 538.

<sup>7</sup> Chanutin, A., and Ferris, E. B., Jr., *Arch. Int. Med.*, 1932, **49**, 767.

used as experimental animals. Only those partially nephrectomized rats showing the presence of hypertension, as judged by the tortuosity and dilatation of the carotids, were studied. Intact animals of the same age were used as controls.

After anesthetization with an intraperitoneal injection of sodium pentobarbital, blood volumes were determined by a modification of the dye method of Gibson and Evans<sup>8</sup> and Gibson and Evelyn.<sup>9</sup> A 1% aqueous solution of Evans blue (T-1824) was injected into the jugular vein through a hypodermic needle. The amount of dye injected varied between 0.2 and 0.3 cc depending on the weight of the animal. The dye was measured in a serological pipette connected to the needle by means of a rubber tube and a 3-way metal stopcock. After 10, 20, 30, and 40 minutes following the injection of dye, approximately 0.2 cc of blood was collected from the cut tail at each sampling in a capillary pipette. After the blood clotted, the pipette was sealed and centrifuged and .02 cc of the dyed serum was diluted with 1.5 cc of distilled water. The photometric densities were determined with the micro attachments of the Evelyn photoelectric colorimeter and the results were extrapolated as described by Gibson and Evans.<sup>8</sup> Distilled water was used as the blank for the colorimeter since there was no difference in the center setting after diluting the serum 75 times, even when hemolysis was present. A drop of blood was collected in a machine-drawn capillary tube and the relative concentrations of corpuscles and plasma were measured. In order to prevent clotting, a weak solution of heparin was drawn through the tubes which were then dried.

The following formulae<sup>9</sup> were used for calculating the total and plasma blood volumes:

$$P.V. = \frac{M K \times 100}{L \times 75}$$

and

$$B.V. = \frac{P.V.}{100 - \text{Hematoerit}}$$

where P.V. = plasma volume, M = mg of dye injected, K = constant, L = photometric density, 75 = dilution factor, and B.V. = blood volume.

*Results.* The individual data for total blood volume, plasma and red cell volumes in the intact and partially nephrectomized rats are shown in Fig. 1.

*Intact Rats.* The average data and their standard deviations for

<sup>8</sup> Gibson, J. G., 2nd, and Evans, Wm. A., Jr., *J. Clin. Invest.*, 1937, **16**, 301.

<sup>9</sup> Gibson, J. G., 2nd, and Evelyn, K. A., *J. Clin. Invest.*, 1938, **17**, 153.

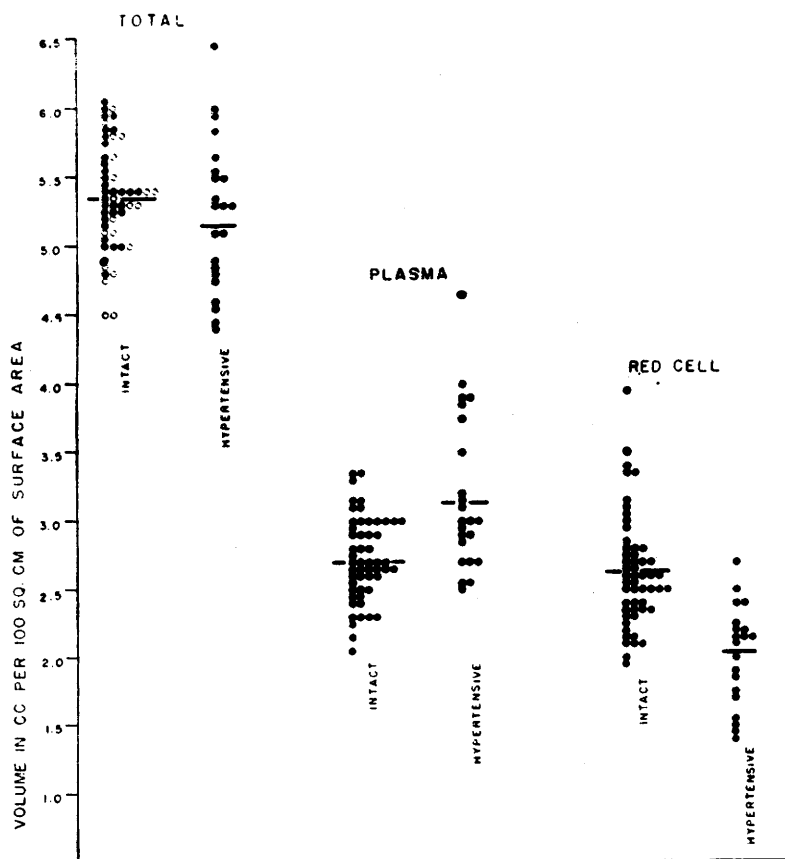


FIG. 1.

Individual blood volumes in intact and hypertensive rats. Open circles denote females.

53 male and female rats are as follows: blood volume,  $5.37 \pm 0.41$  cc; plasma volume,  $2.71 \pm 0.09$  cc; and red cell volume,  $2.66 \pm 0.41$  cc per 100 sq cm of body surface area. Blood volume expressed in terms of surface area is more constant than is obtained on the basis of body weight and is not affected by the size or sex of the rat. The average values for these same rats expressed as cc per 100 g of body weight are as follows: blood volume,  $7.98 \pm 0.85$ ; plasma volume,  $4.08 \pm 0.49$ ; and red cell volume,  $3.90 \pm 0.73$ .

The average value for 20 intact female rats was 5.32 cc per 100 sq cm of body surface as compared with a value of 5.43 cc for male animals. The individual distribution for males and females is shown in Chart 1.

*Hypertensive Rats.* The average data and their standard deviations for 21 partially nephrectomized rats are as follows: blood

volume,  $5.16 \pm 0.55$  cc; plasma volume,  $3.13 \pm 0.57$ ; and red cell volume,  $2.03 \pm 0.41$  cc per 100 sq cm of surface area. A comparison of these values with those of the intact rats shows no significant difference for the total blood volumes. There is, however, an appreciable increase in the plasma volume and a corresponding decrease in the red cell volume, due to the anemia developed in these animals.<sup>7</sup>

*Comment.* The results obtained in this work for intact rats are similar to those reported by Went and Drinker.<sup>10</sup> These workers, using a micro-dye method obtained an average total blood volume of 7.4 cc per 100 g of body weight and 5.1 cc per 100 sq cm of surface area.

Griffith and Ingle<sup>6</sup> recently reported that hypertensive partially nephrectomized rats showed an increase in total blood volume, which would appear to be contrary to the findings reported in this paper. On inspection of their procedure for estimating blood volume,<sup>11</sup> it appears that they neglected to take the red cell volume into consideration and the values reported by them probably represent plasma volumes. In the present experiments, the increased plasma volumes in partially nephrectomized rats agree with the reinterpreted data of Griffith and Ingle.

*Summary.* Plasma and total blood volumes were determined in 33 normal male and 20 normal female rats. In the hypertensive partially nephrectomized rat, the plasma volume was increased, the red cell volume decreased and the total blood volume remained unchanged. It is concluded that hypertension is not associated with increased blood volumes in these experiments.

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### Relationsip of Moscow 2 Virus of Equine Encephalomyelitis to Rabies.

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The virus designated as the Moscow 2 strain by Vichelessky and coworkers<sup>1</sup> was placed by them in the group of neurotropic agents

<sup>10</sup> Went, Stephan, and Drinker, C. K., *Am. J. Physiol.*, 1929, **88**, 468.

<sup>11</sup> Griffith, J. Q., and Campbell, R., *Proc. Soc. Exp. Biol. and Med.*, 1937, **36**, 38.

<sup>1</sup> Vichelessky, R. S., Naskov, A., Soukhof, M., and Montovine, V., *Rec. méd. vet. l'École d'Alfort*, 1935, **3**, 357.