

an equal volume of 10% trichlor acetic acid, mixing, and heating to 95°. The filtered urine may then be tested.

When testing for pentose in urine, the urine (0.1 cc.) and benzidine solution (0.5 cc.) is brought to vigorous boiling. The mixture is cooled under tap water and 1 cc. of distilled water is added. In the presence of pentose a pink to red color is shown immediately, whereas if pentose is absent the mixture has a yellowish brown color.

This color test is also given by vitamin B₂ (riboflavin), by the yellow oxidation enzyme of Warburg and Christian, and by nucleic acids owing to the ribose content of all of these compounds. It is negative, however, with gum arabic since this pentosan is not hydrolyzed by the benzidine-acetic acid solution. The test is highly specific for pentoses.

9657 P

Direct Effect of Adrenal Cortical Hormone upon Blood Pressure in Shock Induced by Intestinal Manipulation.

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The writers¹ have repeatedly called attention to the slow but steady decline in blood pressure which occurs in adrenalectomized dogs after withdrawal of cortical hormone, and have pointed out that following administration of hormone to animals prostrate from adrenal insufficiency the rise in arterial pressure from shock levels to normal is one of the first and most dramatic changes observed during recovery. The fall in pressure is not a terminal event but is one of the earliest changes from normal exhibited by the animal not receiving hormone.

During the past year we have performed 4 different types of experiments on adrenalectomized dogs, the results of which show that the cortical hormone exerts a direct effect upon blood pressure which is distinct and separable from the action of this hormone upon blood volume, and fluid and electrolyte distribution. Table I gives the essential data obtained from a representative case in one type of

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¹ Swingle, W. W., Piffner, J. J., Vars, H. M., Bott, P. A., and Parkins, W. M., *Science*, 1933, **77**, 58; *Am. J. Physiol.*, 1934, **108**, 428.

experiment in which intestinal stripping was used to induce shock. Dogs lacking adrenals do not spontaneously raise their lowered blood pressure or recover from this treatment.²

Seven active, vigorous, adrenalectomized dogs kept for one year in the laboratory on maintenance doses of cortical hormone, were used. The hormone was withheld 18 hours previous to use in the experiments. The animals were in normal health, at peak weight, and revealed no deviations from normal in their blood and urine chemistry, water balance and arterial pressure. They were etherized and a portion of the small intestine vigorously stripped through the fingers for 20-30 minutes. The dogs recovered rapidly from the anesthetic and their activity and vigor appeared undiminished. However, within the ensuing 6-12 hours the arterial pressure declined to shock levels—40-50 mm. Hg. When the dogs were at the point of collapse they were injected intravenously with 3 cc. per kg. body weight of hormone. The arterial pressure slowly but steadily rose and attained the normal level within 36-48 hours. All shock symptoms disappeared and activity and vigor returned. Arterial pressure increases of as much as 5-10 mm. Hg. per hour were not infrequently observed during the first hours following hormone injections.

Study of the serum Na, Cl and K showed negligible changes in concentration of these electrolytes. In general the Na and Cl tended to increase slightly and the K to fall. About one-half of the dogs did not show hemoconcentration or loss of extracellular fluids, when in profound shock. Three animals exhibited moderate concentration of the blood in the terminal stages, but in no case was disturbance of fluid or electrolyte balance adequate to account for the vascular collapse.

Hypertonic saline (20 cc. of a 20% solution intravenously) also restored the arterial pressure of these animals to normal but the effect was temporary compared to the lasting effect of hormone.

We do not know the locus of action of cortical hormone upon blood pressure. However, it may not necessarily be through the mediation of the nerve endings but may be directly upon the musculature of the vascular system. This point is now under investigation. Overdosage effects, either in intact or adrenalectomized dogs, have not been observed despite use of massive doses of hormone.

Hoskins and Fierman³ have described a prolonged pressor effect

² Swingle, W. W., and Parkins, W. M., *Am. J. Physiol.*, 1935, **111**, 426.

³ Hoskins, R. G., and Fierman, J. H., *Endocrinol.*, 1937, **21**, 119.

TABLE I.
Direct Effect of Cortical Hormone on Blood Pressure.

Date	Time, hours	Blood pressure, mm. Hg.	Pulse, min.	Serum Sodium per liter, m.-eq.	Serum			Red cell volume, %	R.B.C., mil.	Remarks
					Serum Chloride per liter, m.-eq.	Potassium per liter, m.-eq.	Hemoglobin, gm. %			
9/23/37	9:00 a.m.	101	84	141.6	109.8	5.9	10.8	35.1	6.24	Normal
"	10:30-43									Intestine stripped
"	11:00 a.m.	110	192							Inactive
"	2:20 p.m.	88	176							Listless, lethargic
"	4:20 "	67	160							Shock, extract*
"	6:00 "	42	148	145.0	112.6	5.5	11.3	38.0	6.62	Improvement
9/24	10:00 a.m.	84	112							Strong, active
"	10:00 p.m.	92	100							Normal
9/25	11:00 a.m.	106	88	145.5	115.2	5.4	10.5	35.3	5.31	Normal

*3 cc. per kg. extract injected intravenously at 6:00 p.m. 9/23, 1.5 cc./kg. intraperitoneally at 11:00 p.m.—1.5 cc./kg. intraperitoneally at 10:00 a.m. and at 10:00 p.m. on 9/24/37. Food and water withheld during course of this experiment.

following oral administration of glycerine extracts of adrenal cortex to human patients. Recent work on experimental hypertension indicates that the cortical hormone is concerned with blood pressure.^{4, 5}

The observation that cortical hormone has a direct effect upon blood pressure of adrenalectomized dogs which is separable and distinct from its functional control of the internal fluid and electrolyte balance of the body, in no way invalidates the earlier conclusions based upon the hormone's "salt-water" action, as offering a rational explanation of many of the phenomena occurring in adrenal insufficiency. The 2 effects of the hormone when considered together, adequately explain the circulatory collapse of adrenal insufficiency.

9658 P

Agar Slant Tissue Cultures of Typhus Rickettsiæ (Both Types).

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For some time the writers have been engaged in efforts to obtain typhus fever Rickettsiæ cultures on a scale sufficiently large to permit vaccine-production. While the X-rayed-rat technic, elsewhere published by one of the writers with Castaneda,¹ is entirely adequate for vaccine-production with the murine strains, it has consistently failed with the classical European type. Tissue-culture vaccine-production would undoubtedly be the most practical method of producing vaccines on a large scale against the European disease, and the effectiveness for immunization of formalin-killed tissue-culture organisms has already been demonstrated, both by Kligler and Aschner² and by one of the writers with Macchiavello.³

Work done on the physiology of Maitland cultures by one of the writers with Schoenbach⁴ indicated that whereas virus agents mul-

⁴ Goldblatt, H., *Ann. Int. Med.*, 1937, **11**, 69.

⁵ Jeffers, W. A., Lindauer, M. A., and Lukens, F. D. W., *PROC. SOC. EXP. BIOL. AND MED.*, 1937, **37**, 260.

¹ Zinsser, H., and Castaneda, M. R., *PROC. SOC. EXP. BIOL. AND MED.*, 1932, **29**, 840.

² Kligler, I. J., and Aschner, M., *Brit. J. Exp. Path.*, 1934, **15**, 337.

³ Zinsser, H., and Macchiavello, A., *J. Exp. Med.*, 1936, **64**, 673.

⁴ Zinsser, H., and Schoenbach, E. B., *J. Exp. Med.*, 1937, **66**, 207.