

scopic preparations. Enlargement and distortion from normal shape were the most frequent abnormalities. Such changes were not found by Gardner⁶ in meningococci.

Summary and Conclusions. Meningococci are readily killed by penicillin in nutrient broth at 37°. This meningococcidal action is markedly increased by fresh serum of man, rabbit, guinea pig and mouse, due to a heat-labile component, presumably complement. The meningococcus therefore is an unsuitable microorganism on which to test human sera for their content of penicillin by the bacteriostatic method commonly employed. The presence of inactivated serum, however, fre-

quently reduces the activity of penicillin on meningococci in broth.

Penicillin fails to kill meningococci in a non-nutrient medium (gelatin-Locke's solution) at 37° and in nutrient broth at ice box temperature, two conditions unfavorable for their growth. These findings lend support to the notion, already expressed by others, that penicillin acts on bacteria only in an environment which promotes their multiplication.

Penicillin causes a certain degree of lysis of meningococci actively growing in broth.

Meningococci in broth containing concentrations of penicillin just below the level of bacteriostasis develop enlarged forms which suggest an inability to complete the normal process of fission.

⁶ Gardner, A. D., *Nature*, 1940, **146**, 837.

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Effect of High Protein (Meat) Diet on Mortality from Surgical Shock Due to Repeated Hemorrhage.*

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A high protein diet consisting of horse meat *ad libitum* was given to dogs later subjected to repeated hemorrhage according to a standardized technic previously described.¹ A definitely beneficial influence was observed as compared with animals not so prepared. Although there is a considerable literature on the effect of diet on the regeneration of serum protein from the low concentrations produced by non-fatal hemorrhage, we could find no studies on the influence of the preceding dietary regime on an acute fatal bleeding.

Experimental Procedure. Fatal surgical shock was produced by the removal of 10 cc per kilogram of body weight each hour through puncture or cannulization of the femoral artery, under local anesthesia. The supine position was maintained during the entire

procedure. Mongrel dogs were used weighing from 7 to 12 kg. Four groups of experiments were performed as follows:

Group 1 consisted of 14 animals who had been on a non-protein diet² for 4 of 5 weeks; during the fourth week various forms of protein were given by mouth to determine their effects on serum protein regeneration. The average caloric intake was 50 per kilo per day.

Group 2 consisted of 10 animals who had been on a "normal" ration of Purina chow for periods of 1 to 3 weeks before the experiment. The approximate proportions of protein, fat, and carbohydrate in the Purina chow are 4, 1, and 9 respectively. The average caloric intake was not measured in the group.

Group 3 consisted of 10 animals given an *ad libitum* horse meat diet for a period of 3 weeks before the experiment was carried out. The amount of meat consumed daily in this

* Aided by a grant from the Commonwealth Fund.

¹ Elman, R., and Lischer, C. E., *Ann. Surg.*, 1943, **118**, 225.

² Sachar, L. A., Horvitz, A., and Elman, R., *J. Exp. Med.*, 1942, **75**, 453.

TABLE I.
Survival Periods After Hemorrhage.

Hours	No. surviving							Avg survival hr
	0	1	2	3	4	5	6	
Depleted	14	14	14	9	2	0	0	3.3
Normal	10	10	10	7	6	0	0	3.7
3 wks horse meat	10	10	10	10	8	0	0	4.5
5 " " "	10	10	10	10	9	5	0	4.9

and the next group averaged 10% of the body weight. No other food was ingested. Analysis of the meat showed a content of about 20% protein ($N \times 6.25$) and 4% fat. The average caloric intake was 120 per kilo per day.

Group 4 consisted of 10 animals given the same diet as in Group 3 for a period of 5 weeks before the experiment.

Experimental Findings. The data observed are described in Table I. It will be observed that the average survival time was but 3.3 hours in animals who had been previously on a non-protein regime, that the figure was 3.7 hours in the "normal" group, but that the animals on horse meat for 3 weeks survived 4.5 hours, whereas those on the same diet for 5 weeks survived 4.8 hours. That these averages are significant can be appreciated by consulting the number of animals actually surviving at each hour.

Comment. It seems clear from the evidence herein presented that dogs on a high protein diet consisting entirely of horse meat for 3 and 5 weeks are able to withstand significantly

greater loss of blood than those not so prepared. While it is possible that the beneficial effect of the horse meat diet may be due to high protein content, some other factor or factors may have been responsible for the results. For example, experiments have been described³ indicating the beneficial effect of thiamine in hemorrhage; however, horse meat has been reported as containing very little thiamine.⁴ Regardless of the explanation, there would seem to be a practical inference from these experiments, *i.e.*, that the ingestion of a high protein diet of meat might be advisable as a prophylactic measure in patients in whom severe repeated blood loss may be expected.

Summary. Dogs given an *ad libitum* diet of horse meat for 3 and 5 weeks before repeated fatal hemorrhage are able to withstand a larger amount of blood loss than those on a "normal" or on a non-protein diet.

³ Govier, W. M., *J. Pharm. and Exp. Therap.*, 1943, **77**, 40.

⁴ Pyke, Magnus, *Biochem. J.*, 1940, **34**, 1341.

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Muscle Pain, Tendon Reflexes, and Muscular Coordination in Man.*

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The muscular action resulting from cortical innervation is greatly modified by afferent impulses. This is demonstrated by the inability of a monkey to use the hand after denervation of its posterior roots.¹ Moreover, distinct effects may be exerted on the cerebral cortex not only when the normal afferent impulses are absent, but also when they are

increased as shown by observations of Uchtomsky.² It appeared, therefore, not un-

* Aided by a grant from the National Foundation for Infantile Paralysis, Inc.

¹ Mott, F. W., and Sherrington, C. S., *Proc. Roy. Soc.*, 1895, **57**, 481.

² Cf. Ulfand, J. M., *Pföger's Arch.*, 1925, **208**, 87.