Further Resolved, that the Secretary of the Virginia Academy of Science transmit this action to the California Society for Medical Research.

Following the meeting there were two field trips, one for biology and one for geology. The academy will meet next year in Danville, Virginia, during the first week-end in May.

E. C. L. MILLER,
Secretary

THE TENNESSEE ACADEMY OF SCIENCE

FOR the convenience of members residing far from Nashville one of the meetings of the academy each year is held in East or West Tennessee and in the springtime in order to favor field trips. The spring meeting of 1938 was held on May 6 and 7 in Knoxville. Three fourths of the members attending the meeting were from East Tennessee. The program of papers was limited to Friday, the second day, Saturthe state. In addition to the general sessions on Fripapers were by representatives of thirteen schools of day, being reserved for field trips. Four fifths of the day, there was in the afternoon a symposium on the "Biology of the Great Smoky Mountains National Park" by A. J. Sharp, Stanley A. Cain, H. M. Jennison and A. C. Cole, of the faculty of the University of Tennessee, and Arthur Stupka, Willis King and Charles S. Grossman, of the National Park Service.

The Knoxville Science Club was host at a luncheon during the noon hour at the Andrew Jackson Hotel. Bowen S. Crandall, of the Division of Forest Pathology, United States Department of Agriculture, presided, and Dr. C. D. Sherbakoff, of the Department of Plant Pathology, University of Tennessee Agricultural Experiment Station, spoke on "Genetics." In the evening the academic dinner was held at the Andrew Jackson Hotel. Dr. H. H. Walker, of the Department of Public Health, University of Tennessee, introduced by President Shaver, delivered an illustrated address on "Natural Color Photography."

Three field trips were offered for Saturday: (1) All-day biological field trip to Ramsey Cascade, Greenbrier, Great Smoky Mountains. (2) Half-day field trip to Norris Dam and vicinity. (3) All-day geological field trip.

Trip No. 1 was taken by twenty-two persons under the guidance of Arthur Stupka, park naturalist. The last 2.5 miles was covered by walking through an undisturbed forest of great beauty, in which many trees of great size were observed, notably the tulip poplar and the black cherry. The waterfall is regarded by some as the most spectacular in the Great Smoky Mountain National Park area.

For Trip No. 2, the announcement was made that the activities of the Wild Life Division would be inspected under the leadership of Dr. A. R. Cahn, and the engineering features of the dam would be discussed by N. W. Dougherty. One may surmise that the announcement was intended to dodge questions socialistic, economic, chemical, physiological, political suggested to the curious by the Norris village, stored energy of the dam, the dead fish in the waters of the lake and the minerals underneath.

Trip No. 3 was taken by a group of ten under the leadership of Berlen C. Moneymaker, of the Tennessee Valley Authority. A drive of eighty miles brought them by way of Tellico Plains, noted in the history of the Cherokees, and over the Unaka Mountains to the dam under construction in the Hiwassee River twenty-two miles below Murphy, North Carolina. While the lake formed, having a short line of 150 miles, will not be so large as the Norris reservoir, the dam will have an approximate heighth from the lowest excavation to the roadway across it of about 300 feet, the highest of a dam anywhere, one of the geologists informed me. There remains yet to the Tennessee Valley Authority adjustment with the owners of the value of the original water power, of the many tracts of land that will be overflowed and the unseen but prospective minerals underneath. The Ducktown Basin through which the party next passed was formerly a flourishing forest. Now it is a desert of about twenty square miles, blasted, denuded, corroded by the gases formed in the manufacture of copper, for a number of years allowed to escape into the air. The metamorphic geology along the Ocoee River, the Parksville Dam and the Cartersville fault were objects of interest to the geologists on their way from Ducktown down the Ocoee to Benton and back to Knoxville by Etowah and Athens.

JOHN T. MCGILL,
Secretary

SPECIAL ARTICLES

ANAPHYLAXIS IN THE LIVERLESS DOG, AND OBSERVATIONS ON THE ANTICOAGULANT OF ANAPHYLACTIC SHOCK

THE recognition of the important rôle of the liver in the phenomenon of anaphylaxis in the dog dates from the observations of Manwaring.[1] The most characteristic feature of canine anaphylaxis is the tremendous engorgement of the liver. While some investigators consider the hepatic changes to represent the most

[1] W. H. Manwaring, *Zeits. Immunitätsforsch.,* 8: 1, 1911.

obvious aspect of a generalized reaction involving a number of different tissues, no one has been able to demonstrate, satisfactorily, any of the typical symptoms of anaphylaxis in the dog after exclusion of the liver. Indeed, because of this lack of success and the obvious involvement of the liver in the intact animal, it has been almost universally agreed that anaphylactic shock in the dog is not possible in the absence of the liver. We (E. T. W. and J. M.) have been able to show conclusively that anaphylactic shock can be elicited in sensitized dogs from which the liver has been completely removed.

The dogs used in these experiments were sensitized to horse serum by subcutaneous injection of 5 ccs of serum to which 1 per cent. alum had been added 24 hours earlier. Six weeks were allowed to elapse between the injection of this sensitizing dose and the shock dose of 20 ccs of normal serum. Encouraged by the marked success obtained in sensitizing guinea-pigs to ragweed pollen extracts after the addition of alum,[2] we hoped to induce in dogs by a similar preliminary treatment of antigen a more uniform high degree of sensitization than by methods usually employed. All animals so far sensitized in this manner have shown very pronounced shock.

The liver of one of these dogs was removed in a single operation.[3] Later, when serum was injected into this animal, there was a marked fall in blood pressure (sharply from 108 mms Hg to 50 mms Hg, followed by a further gradual decline) with a concomitant increase in urinary bladder tone. The animal died 55 minutes after removal of the liver and 30 minutes after the shock dose of serum. Nothing was found to indicate that death was not due primarily to anaphylactic shock. As a control an equal amount of the same stock of serum was injected into a normal dog without causing any change in blood pressure or bladder tone.

We (E. T. W. and L. B. J.) have investigated the changes in the coagulability of the blood of dogs during anaphylaxis and also in peptone shock. Use has been made of the recently discovered fact,[4] which has been confirmed in this laboratory, that protamine combines quantitatively with heparin; 1 mgm of protamine inhibits approximately 33 units of heparin. At intervals after the administration of the shock dose, samples of blood have been removed from the exposed femoral vein and titrated at 37° C. with 0.5 ccs of solutions containing amounts of protamine (salmine) varying from 0.001 to 0.1 mgms, the end point of the titration being the smallest amount of protamine which will reduce the coagulation time of 0.5 ccs of the sample to that of blood samples taken prior to shock. The anticoagulant of anaphylaxis or peptone shock was completely inhibited by protamine. Representative results are presented diagrammatically in Fig. 1. The results

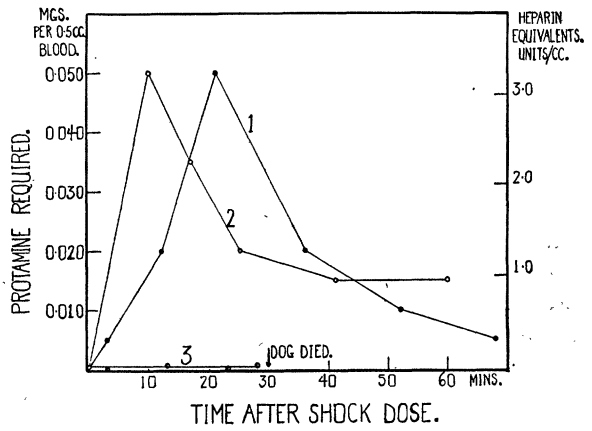

FIG. 1. 1, Anaphylactic shock under ether anesthesia; 2, Peptone shock (0.3 g./kilo.) without anesthesia; 3, Anaphylactic shock of hepatectomized dog under ether anesthesia.

shown in Curves 1 and 2 are in general accord with those of other workers who have estimated the antithrombin titre of the blood of the dog in anaphylaxis[5] and peptone shock.[6] Blood samples of shocked animals, untreated with protamine, remained uncoagulated at 37° C. for more than two days, except those taken from the shocked liverless dog; there was no change in the clotting time of the blood of this animal, (Curve 3). Clearly this result points to the liver as the source of the anticoagulant liberated during shock of the intact dog. It is of interest to note that the heparin titre of the blood of the animal in the experiment illustrated by Curve 1 would account for a liberation of at least one third of the average amount of heparin which can be extracted, by one method,[7] from normal dog liver.

The significance of these findings on present conceptions of anaphylaxis and of the physiological status of heparin will be discussed when they are presented in detail elsewhere.

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[2] A. H. W. Caulfeild, M. H. Brown and E. T. Waters, *Jour. Allergy*, 7: 451, 1936.

[3] J. Markowitz, W. M. Yater and W. H. Burrows, *Jour. Lab. and Clin. Med.*, 18: 1271, 1933.

[4] E. Chargaff and K. B. Olson, *Jour. Biol. Chem.*, 122: 153, 1937.

[5] H. Eagle, C. G. Johnston and I. S. Ravdin, *Bull. Johns Hopkins Hosp.*, 60: 428, 1937.

[6] A. J. Quick, *Am. Jour. Physiol.*, 116: 535, 1936.

[7] A. F. Charles and D. A. Scott, *Jour. Biol. Chem.*, 102: 431, 1933.