adays for killing coyotes." The writer has seen only one of these in recent years, and the status is difficult to determine. The badger is somewhat disliked by cowboys because horses may step into its holes with serious results. The prairie dog is nearly equally dangerous, and this rodent increases when the badger is absent. It has been practically extirpated over most of the plains area, in part due to the value of its fur. Similar processes have reduced the hawks and owls of the Great Plains along with all the other flesh-eaters. Many are likely to disappear completely unless some special means is taken to preserve them. When one reads Sweetman's book on "Biological Control of Insects," he wonders why this idea was not extended to control of rodents in grassland areas. A large undisturbed area would afford opportunity for the study of natural biological control of rodent outbreaks and would quite possibly eliminate the constantly recurring exhaustive and dangerous application of poison. For this purpose, an area of natural plains grassland not overgrazed by large animals is essential.

The life histories, water relations and competition of grasses is also in need of extended investigations. The facts of the origin and original habitat of the species occurring as pests under agricultural conditions often throw much light on causes of outbreaks. For example, the pale western cutworm, a pest of cultivated grain, originally lived about the dust wallows of the bison and spread to plowed fields, where similar conditions occurred. This fact was discovered by the Canadian entomologists, who had opportunities to observe natural conditions superior to those afforded in the United States. All these problems require long-time observation on lands where wildlife is managed on a hands-off basis.

V. E. SHELFORD
UNIVERSITY OF ILLINOIS

ANAPLASMOSIS AMONG DEER IN THE NATURAL STATE

OVER a period of years, sporadic outbreaks of anaplasmosis have been reported from various cattle ranches in the foothill areas near Mt. Hamilton, California. The source of the infection was never definitely established, but at one ranch, particularly, the suspicion arose on more than one occasion that the disease was transmitted mechanically through the bleeding and vaccination of the herd, although the aseptic precautions with which these procedures were carried out would seem to preclude that possibility.

Since no hunting was allowed on the above-mentioned ranch, the deer roaming the vicinity increased to the point of becoming a nuisance, and permission for their destruction was requested of the State Division of Fish and Game. The request granted, Mr. Gordon True, Jr., of the Fish and Game Division, inquired whether the writers would be interested in investigating the possibility of carriers among these deer and kindly obtained ticks and samples of blood from them at the time the animals were killed. He also reported the deer to be *Odocoileus hemionus columbianus* (Richardson), commonly spoken of as Columbian blacktail or coast deer. Professor W. B. Herms and Dr. D. E. Howell, of the Division of Entomology and Parasitology at the University of California, identified the ticks from the deer as *Dermacentor occidentalis*.

On July 25, 1939, 10 cubic centimeters of pooled blood from five deer were inoculated into a young cow, 217. Three days later, 5 cubic centimeters of pooled blood from two other deer were inoculated into the same cow. Smears prepared from the blood before it was pooled showed a very few typical-looking marginal bodies or Anaplasma in three deer.

Beginning on the seventeenth day following the second injection, the blood of 217 was examined at weekly intervals. The examination on the forty-second day after the second inoculation revealed a few bodies, and from this time on, the blood picture progressed in the manner characteristic of anaplasmosis; that is, the marginal bodies became increasingly plentiful, anisocytosis appeared, followed by regenerative red cell changes; namely, polychromatophilia, punctate basophilia and nucleated red corpuscles. Typical symptoms developed, such as emaciation, quickened pulse and respiration, some drooling from the mouth and slight discharge from the nose. Recovery was fairly rapid.

Neitz and du Toit's report of 1932[1] on the transmission of anaplasmosis to antelopes was supplemented by that of the writers[2] the following year, proving that deer become carriers following inoculation of infective blood and suggesting that, in the natural state, they afforded a potential reservoir of the infection. The experiment here described establishes this possibility as a conclusive fact.

Since *D. occidentalis*, the tick infesting the deer used in this experiment, has already been incriminated[3] as a biological agent responsible for the spread of anaplasmosis, the logical assumption is, therefore, that ticks probably were the sole means of contact between the cattle on the ranch previously mentioned and the deer inhabiting that area.

WILLIAM HUTCHINS BOYNTON
GLADYS M. WOODS
UNIVERSITY OF CALIFORNIA, BERKELEY

[1] P. J. du Toit, Twelfth International Veterinary Congress, III: 325, 1934.

[2] William Hutchins Boynton and Gladys M. Woods, SCIENCE, 78: 559–560, 1933.

[3] William Hutchins Boynton, William B. Herms, D. E. Howell and Gladys M. Woods, *Jour. Amer. Vet. Med. Asn.*, 88, n.s., 41: 500, 1936.