

rum are formed from the metabolism of proteins, any gross increase in protein catabolism should be reflected in an increase of serum NPN. The NPN did not rise significantly in disease, however, and the increase that did occur could well be attributed to the effects of cold torpor.

Two other factors, singly or together, could account in great degree for the serum protein decrease. Edema and internal hemorrhage are characteristic of the disease. Since the capillaries break down, transudation of serum protein into edema fluids or loss by exsanguination seem likely. Perhaps hematocrit determinations in conjunction with red cell counts would have been useful here.

The hemoglobin released into the blood through hemolysis could conceivably affect the quantitative serum protein values, especially the total proteins. This effect may be negligible since the total proteins decreased in this disease and the A/G ratios were not significantly altered. It is probable that very little destruction of cells occurs in relation to the total number of cells.

The concentration of globulin is less than that of albumin in the normal frog, and it decreased proportionally with albumin in disease. These findings contrast with the increase in serum globulins which usually occurs in mammalian infections. They support the statement that frogs held in the cold are not too capable of producing globulin-fixed antibodies that combat disease (Bucovaz and Kaplan, *Amer. Jour. Physiol.* 191: 428-30, 1957).

The relative concentrations of sodium, potassium and chloride found in normal frog serum are similar to human values (Gradwohl, *op. cit.*). In red leg disease these ions closely follow the common patterns of electrolyte change reported in human diseases (Moore, *op. cit.*), i.e., potassium increases, but sodium and chloride decrease. This is ascribed to a flooding of the extracellular reservoirs, including the blood, with sodium-free water originating in lysis of cells and in the catabolism of sodium-deficient fat and protein reservoirs. Chloride leaves the blood probably in an attempt to maintain electrolyte balance. There is no good explanation elsewhere of the potassium increase, and nothing can be added on the basis of the data presented in this study.

The exact quantities of components found in normal frog serum will vary somewhat with particular conditions. Different investigators report different values because of (a) the failure to control seasonal variations; (b) the use of insufficient samples; (c) species differences; (d) the amount of protein extractable according to the method used; (e) the difficulty of differentiating healthy animals, and (f) the effect of feeding and of en-

vironmental temperature. In this study, where the factors were held as uniform as possible for both healthy and diseased frogs, the relative differences found are significant.

Summary.—Serum total protein, albumin, alpha globulin, beta globulin, gamma globulin, NPN, chloride, sodium and potassium were quantitatively compared in normal frogs and those with red leg disease, all previously held at 6° C. Diseased animals were naturally infected or else injected with *Pseudomonas hydrophila*.

Serum total protein and each protein fraction significantly decreased in disease. Albumin and total globulin decreased proportionally.

The NPN increased in frogs held in the cold. It was higher in frogs held over two weeks without food in cold torpor than in those held less than two weeks in the same way. This was true for both normal and diseased frogs. The tendency of NPN to rise in disease could be attributed to the effect of cold torpor and not to any metabolic effect of red leg disease.

Sodium and chloride concentrations significantly decreased in disease, while the potassium concentration significantly increased.—L. V. GIBBONS AND H. M. KAPLAN, *Department of Physiology, Southern Illinois University, Carbondale, Illinois*.

THE HELLBENDER, *CRYPTOBRANCHUS ALLEGANIENSIS*, IN ILLINOIS.—The occurrence of the hellbender, *Cryptobranchus alleganiensis* Daudin, in Illinois has been assumed for more than 100 years and the species has been repeatedly credited to the state despite a considerable amount of doubt attached to all of the older records. The acquisition of recent material, which corroborates the presence of this large salamander in Illinois, prompts us to summarize and evaluate all of the previous reports of the species in the state.

The Peoria botanist, Dr. Fred Brendel (*in Gerhard, Illinois as it is: 254, 1857*) first listed the hellbender as an inhabitant of Illinois waters. Davis and Rice (*Bull. Chicago Acad. Sci.* 1(3): 26, 1883) noted in their check list of Illinois amphibians and reptiles that *Cryptobranchus* occurred in the tributaries of the Mississippi River, and Garman (*Bull. Illinois State Lab. Nat. Hist.* 3: 381, 1892) stated, on the authority of Robert Ridgway, that it was found in the Wabash River. Despite the several published reports of its occurrence in Illinois, documented records appeared to be lacking. However, in a canvass of the major museums of the country in the late 1940's by one of us (Smith), a specimen bearing the data "southern Illinois" was located in the collections of the Chicago Academy of Sciences. The

specimen, No. 294, was accompanied by no other details; and, as it had obviously been collected many years before, some doubt could be raised as to the accuracy of the extremely vague locality data.

The senior author distinctly recalls, however, that in 1926-27 a specimen, caught in the Cache River near Ullin, Pulaski County, was kept in the zoological laboratories of Southern Illinois University, where it became rather tame and readily took worms when they were offered to it. She also saw two more specimens from the same locality caught in 1937 by Mr. Charles Mayfield. Unfortunately, none of these was preserved, and the records were not published by the collectors. Goodnight (*Trans. Illinois State Acad. Sci.* 30(2): 301, 1937) and Cagle (*A key to the reptiles and amphibians of Illinois: 2*, 1941) included the hellbender in their respective keys to Illinois amphibians. Cagle (*Amer. Midl. Nat.* 28(1): 172, 1942), evidently unaware of the Chicago Academy of Sciences specimen and the three examples from Ullin, noted that there were hearsay reports from fishermen of Devil-dogs (= hellbenders) in the Big Muddy and Mississippi rivers but that no Illinois specimens were extant in museums.

Cognizant of the desirability for preserved material to corroborate the occurrence of the species in Illinois, we independently made inquiries of commercial fishermen along the Wabash, Ohio, and Mississippi rivers in a concerted effort to obtain additional information. Assertions by Mr. S. H. Eaton of Lawrenceville and Game Biologist O. M. Price of Oblong of having seen hellbenders near the mouth of the Embarrass River in Lawrence County suggested that specimens would be forthcoming eventually; and a short time later Dr. Sherman A. Minton told us (*personal communication*) that he had seen in an Indiana fish hatchery a live specimen, said to have been caught in the Wabash River at nearby Vincennes, Indiana. The other Indiana records, according to

Minton, are confined to the extreme southeastern corner of the state.

More recently two specimens, now in the collections of Southern Illinois University, were secured in the Ohio River. One was taken at Metropolis, Massac County, on April 15, 1956, and a second was caught at Cave in Rock, Hardin County, in June of the same year. A third specimen, collected in the Wabash River near Maunie, White County, in the spring of 1947 and now in the Biology Laboratory at Carmi Township High School, has been made available to us through the courtesy of Mr. John C. Cralley, the biology teacher in Carmi, Illinois. All recent specimens were taken on baited hooks by commercial fishermen.

Data for the three available specimens, listed in the same order as above, are: snout-vent length 267, 285 and 270 mm., total length 418, 433, and 440 mm., diameter of spiracular opening 6.5, 4.5, and 7.5 mm., ratio between spiracular diameter and internarial distance 2.0, 3.5 and 2.2. The two Ohio River specimens are decidedly bluish slate; the Wabash River specimen, a dirty brown. The Metropolis example is minutely flecked with olive, the other two are uniformly colored or obscurely mottled, although the Cave in Rock salamander has rather heavy pigmentation on the lower jaw. The sum of the characters indicates that the Illinois specimens are referable to the eastern subspecies, *Cryptobranchus a. alleganiensis*. The Cave in Rock specimen approaches the Ozarkian race, *C. a. bishopi*, in the rather small diameter of the spiracle and in the extent of the infralabial pigmentation; but in dorsal pattern, one of the more reliable characters, it is assignable to the nominate subspecies.—HILDA A. STEIN AND PHILIP W. SMITH, *Department of Zoology, Southern Illinois University, Carbondale, and Illinois Natural History Survey, Urbana, Illinois.*

REVIEWS AND COMMENTS

THE FISHES OF OHIO WITH ILLUSTRATED KEYS. By Milton B. Trautman. Ohio State University Press, Columbus, 1957: xviii + 683, 172 maps, 7 col. pls., 172 figs.; \$6.50.—Early in the nineteenth century, settlers, pioneers, and homesteaders in

constantly increasing numbers crossed the Appalachians and fanned out into the midlands, intent on wresting a living from this new land. Forests were leveled, prairies plowed, milldams constructed, and animal and plant resources ex-