

ZOOLOGY

Chairman: W. E. MARTIN, DePauw University

Professor T. M. Sonneborn, Indiana University, was elected chairman of the section for 1942.

ABSTRACTS

The use of statistics in the solution of a biological problem. C. M. LOUITT, Indiana University, and J. J. SAPERO, United States Navy.—Suggestive biological differences between the so-called small and large races of *Entamoeba histolytica* have been reported from time to time. Most, if not all of this work, is essentially invalid because two fundamental questions remain unanswered. These questions are (1) how many races of *E. histolytica* are there? (2) What are the boundary lines between races? The basic papers on the question of the number of races in this species are those of Dobell and Japps and of Malins Smith. The former authors claimed to have demonstrated at least five races while the latter finds only two. Study of the original papers illustrate that the differences in conclusion is related to the statistical problem of sampling. Statistical analysis of the data of these two papers plus similar analysis of original data provide answers to both of our questions. These answers derived by statistical proceedings afford a basis for further biological research.

Social organization in a small flock of domestic sheep. J. P. SCOTT, Wabash College.—Observation of a small flock of ewes of mixed breeds indicates that social organization is largely founded on maternal dominance.

Notes on breeding places of malarial mosquitoes in Tippecanoe County. R. M. CABLE, Purdue University.—Incidental to the collection of mosquitoes for teaching purposes, two potentially dangerous vectors of human malaria have been found breeding in large numbers in Tippecanoe County. Both *Anopheles quadrimaculatus* and *A. punctipennis* breed in the creek just north of the cemetery at Battleground, the larvae and pupae of *A. punctipennis* being especially numerous. One as yet unidentified culicine species also breeds in this stream and the larvae of *Culex territans* have been collected from cans in a dump a few yards from the creek but have not been found in the creek proper. During September and October of the past three years, anopheline larvae have been collected from the creek and in 1940 were found as late as the middle of November. During September, 1941, *A. quadrimaculatus*, generally conceded to be the most dangerous North American vector of human malaria, has been found breeding also in the Wabash River. Un-

usually low water this fall seems to have been favorable for this mosquito. In view of the abundance of potential vectors of malaria, surprisingly few cases have been reported in the Lafayette region. It is very likely, however, that there may have been many cases which did not receive medical attention or in which thorough blood examinations using thick smear technics were not made and the parasites were overlooked.

The abundance of game fish in a small lake. W. E. RICKER, Indiana University.—During the summer of 1941, a complete census of fishing was made on 42-acre Shoe lake, near Warsaw, Indiana. The catch was 11,016 fish weighing 1,924 pounds; of which 9,242 individuals and 1,321 pounds consisted of bluegill sunfish. The abundance of the more important species in the lake was estimated by the Petersen method of marking and releasing fish, then noting their relative abundance among fish caught. In this way the number of bluegills more than 5 inches long was estimated as 24,000; of redear sunfish, 1,700; of yellow bullheads, 140. Other much less reliable estimates were: speckled bullheads, 720; largemouth bass, 660 (over 10 inches); black crappie, 3,700; warmouth sunfish, 70; common sunfish, 150; perch, 380.

The respiration of the sea-cucumber, *Thyone briareus*, as influenced by hydrogen-ion concentration and oxygen tension. WM. A. HIESTAND, Purdue University.—The respiration of *Thyone* is unaffected by variations in the oxygen tension of sea water from that of normal air-water equilibrium to approximately one-seventh normal saturation. Variations of the pH of sea water cause marked variations of the rate of oxygen consumption. This relationship is an inverse one, i. e. less oxygen is used in sea water of low pH values than at high ones, or it may be stated that oxygen consumption is proportional to hydroxyl-ion concentration. A "straight-line" relationship exists over the range of values from pH 5.4 to 8.8. Because of the ability of *Thyone* to continue its consumption of oxygen at a uniform rate until a low tension of oxygen is reached one may conclude that the animal possesses an efficient respiratory system.

A case of the inheritance of environmental effects and its explanation in *Paramecium*. T. M. SONNEBORN, Indiana University.—In races of *Paramecium aurelia*, variety I, that have clones of both mating types I and II, the percentage of clones of type II produced after fertilization = $18.4 + t/0.51$, where t is the temperature during fertilization and the immediately following nuclear reorganization. This relation, based on a study of 1,760 clones at 9 different temperatures, holds through the range 10° to 35° C. After nuclear reorganization is completed, the mating type is strictly inherited through reproduction by fissions; it is then not affected by temperature or other conditions. The temperature effect shows that the inheritance of mating type at fertilization is not governed by genic recombinations. This is also demonstrated (1) by breeding tests which show that the two mating types have micronuclei that are genically identical; (2) by cytological and genetic studies

proving that the two mating types are homozygous for all micronuclear genes as a result of a special type of periodically recurring autogamy. How then do cultures whose micronuclei are entirely homozygous and genically identical come to differ in hereditary mating type? And how does temperature play a role in bringing about this genetic diversity? Combined genetic and cytological study demonstrate that the macronucleus, not the micronucleus, is the location of the determiner for mating type. Yet the diverse macronuclei, determining different mating types, arise from identical homozygous micronuclei. Hence, there must be a mutation commonly occurring during the development of macronuclei from micronuclei immediately after fertilization. In detail, the simplest hypothesis is to assume that there is a micronuclear gene for mating type I which frequently mutates to an allele for mating type II at that stage in macronuclear development. The effect of temperature previously described is in conformity with this hypothesis, for it is well known that the mutation rate increases with rise of temperature. The occurrence of the mutation in a specific direction and at a definite stage in the developmental cycle is in agreement with what is known of some labile genes in other organisms. Further, current experiments have delimited the period sensitive to temperature to the time when the macronuclei are developing from micronuclei, in agreement with the hypothesis. But perhaps the most striking fact in support of the mutation hypothesis is the randomness of occurrence of the assumed mutations, for the two macronuclei that normally arise in the same cell at the same time but from different products of the same fertilization nucleus show the same mutation no more and no less often than expected by chance alone. The preceding results are of significance in three respects. (1) They show that mutation rates can be enormously greater than any hitherto reported, actually approaching 100% under extreme conditions. (2) They suggest that other, possibly all, of the numerous observations on the inheritance of environmental effects in Protozoa may yet be brought into conformity with the rest of modern genetics. (3) They suggest that the differentiation occurring during normal development in higher organisms may be in part a consequence of mutations occurring at definite developmental stages. Our knowledge of labile genes and the phenomena observed in tissue cultures lend support to this view.

Analysis of the mesonephric kidney of the rat embryo by means of intraocular grafts. MEREDITH RUNNER, Indiana University.—Reptiles, birds and mammals have three successive stages in the development of their kidneys while Amphibia have two and fish but one. The work presented is concerned with the second (mesonephric) stage of development of the rat embryo. Embryos used for these experiments were taken from their mothers 11 to 13 days after copulation occurred. The embryonic kidneys were removed and stained with methylene blue so they could be readily seen and handled. The kidneys were then placed on the iris of an adult host through a slit in the cornea by means of a specially devised pipette. Mesonephric kidneys

of the rat apparently do not function in an excretory capacity and are destined to disappear about five days before the rat is born. Experiments have shown that grafted mesonephric kidneys are able to persist as long as 36 days beyond their normal span of existence. This finding has permitted analysis of the structure and function of the grafted mesonephros in relation to intact kidneys both in the embryo and adult. Ability of the mesonephric region of the grafted rat kidney, first, to assume a functional level above that normally attained in the embryo, and secondly, to become structurally and functionally comparable to the adult metanephric kidney, constitutes experimental evidence in favor of the notion of unity of the three kidney primordia. This is in contrast to the classic conception of three discrete organs reminiscent of the situation in adult fish and frogs.

The chick comb for androgen assay. W. R. BRENEMAN, Waterman Institute, Indiana University.—A study was made of 1,218 White Leghorn chicks which were administered testosteronepropionate or testosterone in dosages ranging from 1 to 1,000 micrograms. Cockerels and pullets which were given limited amounts of food (limited diet) gave significant responses to subcutaneous injection but normal diet cockerels had smaller combs than the controls at dosage levels of 25 to 50 micrograms. Administration of 100 micrograms, however, produced a significant growth. This variation was apparently the results of decreased androgen secretion by the animal's own testes which at low dosages more than offset the effect of the injected androgen. Limited diet birds, in contrast, responded as though they were essentially castrates, therefore, the problem of endogenous secretion was eliminated. Injections of androgen into the comb was very efficacious especially when administered on alternate days. A total of 2.5 micrograms produced a comb increase of more than 32 per cent. Chicks caponized at five days given comb injections on alternate days had comb increments of more than 31 per cent at 20 days of age after administration of only one microgram of hormone. Normal diet pullets similarly treated although somewhat less responsive also gave significant increases with as little as one microgram of testosterone-propionate. A short assay method was investigated in which the birds were injected beginning at 12 hours after hatching and autopsied at 80 hours. These animals were kept without food or water and gave positive response to amounts of hormone ranging from 25 to 200 micrograms. The percentage increase, although not as great as in other series, had very low standard errors and the test is worthy of further detailed study.

Reproductive periodicity in the male skink, *Eumeces fasciatus*. ALBERT E. REYNOLDS, DePauw University.—Correlated morphological states and functional conditions of the testis, the epididymis, and the metanephric kidney (sexual segment) are traced through their seasonal variations.

The rat ear as a site for adrenal cortical grafts and subsequent ear-adrenalectomy. ROBERT L. KROC, Indiana University.—Description of

technique of transplantation and discussion of advantages of this site for cortical grafts. Comparison of body weight changes and mortality of over 100 adrenalectomized rats following: (1) Autotransplants to the pinnae and (2) removal of the grafts from rats that survived with weight changes and mortality of control adrenalectomized rats. Transplants were successful in approximately 50% (no salt licks) and 34% (salt licks) of the males. 48% of these two groups died after graft removal as contrasted with 95-100% of the control series. They survived 37% longer than the controls. 7% (no salt licks) and 36% (salt licks) of the females possessed successful transplants and 40% of these died after graft removal and survival periods that exceeded the controls. The marked decrease in mortality after graft removal indicated that more rats possessed accessory cortical tissue than might be concluded from the high mortality percentage obtained with controls. Visibility and the certain removal of all of the graft quickly and with negligible trauma served as the basis for a suggested experimental method that would largely eliminate factors of anesthetics, traumatic shock, post-operative healing, and the uncertain role of accessory cortical tissue from experiments on adrenalectomized rats.

The sexual cycle in *Toredo navalis*. BENJAMIN H. GRAVE, DePauw University.—During the course of its life every individual of this species may change from male to female or from female to male. This change may occur more than once.

The prevalence of pinworm infections among residents of Indiana. WILLIAM HUGH HEADLEE, Purdue University.—Recent investigations by the writer and his associates have determined the incidence of intestinal parasite infections among various groups of residents of Indiana. The pinworm, *Enterobius vermicularis*, was the helminth infection most frequently encountered. The groups examined, the numbers of individuals examined, and the percentage incidences of infection with this parasite were as follows: 1,200 patients of Logansport State Hospital, 1.6; 771 patients of Evansville State Hospital, 7.4; 12 individuals of Terre Haute, 0.0; 87 rural inhabitants of Montgomery County, 0.0; 98 rural inhabitants of Warrick and Pike Counties, 4.1; 63 persons from families who had children under the care of the Evansville Public Health Nursing Association Clinic, 1.6; 147 Purdue Students from the State of Indiana, 0.0; 319 in-patients of the Indiana University Medical Center Hospitals, 6.9 per cent (these 319 patients were from 72 of the 92 counties of Indiana), and 15 others, primarily from Lafayette, 33.3. The above data were obtained primarily from stool examinations made by means of the combined smear and centrifugal concentration methods. When 80 in-patients of Riley Hospital were examined by the perianal scrapings method, 11, or 13.75 per cent were found to be infected with the pinworm. Stools had not been examined from 60 of these 80 individuals. When stools from 258 in-patients from three hospital units of the Indiana University Medical Center were examined, an incidence of 5.0 per cent for this parasite was found. In view of these findings,

and in view of the prevalence of this parasite in appendices removed surgically, it would seem that the entire problem of enterobiasis should be re-evaluated.

A Blue Specimen of the "Green Frog," *Rana clamitans*. HOWARD H. VOGEL, JR., Wabash College.—A large female specimen of the Green Frog, *Rana clamitans*, almost pure blue in color, was demonstrated at the meeting. The frog was in good health, although it had been transported across the country and kept in the laboratory several months. The specimen was collected in a wet meadow near Cooperstown, New York, during August, 1941. The unusual pigmentation of this frog may be due to an absence of the lipophores. A similar variation in this species has been reported by Noble (1931). The New England Museum of Natural History reports a similar specimen in its collection, a green frog with a "baby blue" head. It is hoped that breeding experiments may be attempted between a normal male specimen of *Rana clamitans* and this unusual "blue frog".