The animal was first carefully modelled upon a one-ninth scale.

Tylosaurus was a very powerful sea swimmer, propelled chiefly by the lateral motions of the body and tail. The caudal fin was a broad expansion along the dorsal line. The proportions can be precisely determined. The fore and hind paddles were similar in action and played a subsidiary part in guiding the animal, but were effective in the less rapid motions of the body. The indentation of the paddle border between the 4th and 5th fingers is upon Williston's authority. The nuchal fringe is also from this author's recent description of *Platecarpus*. The epidermal scaly covering is from Chancellor Snow's account of the *Tylosaurus proriger* covering. The expression of the top of the skull resembles that of *Varanus*, but in other points there is a wide departure from the Varanoid type.

The facts derived from this skeleton do not strengthen Baur's extreme opinion as to the intimate connection of this type with the Varanidæ. Besides the secondary degenerate adaptation to marine life shown in the girdles and appendicular skeleton, there are certain fundamental differences in the basioccipitals and ribs, in fact in all parts of the skeleton. These differences fully balance or overweigh the likenesses, which have long been dwelt upon by Cuvier, Owen and Baur, between the Mosasaurs and Varanoids, and do not even justify the assertion that the Varanidæ and Mosasaurs sprang from a common stem. The Mosasaurs are a very ancient marine offshoot of the Lacertilia, retaining certain primitive and generalized Lacertilian characters and presenting a few resemblances in the skull to the Varanoids; they are very highly specialized throughout for marine predaceous life, and constitute a distinct subdivision of the order Lacertilia.

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THE INDIANA UNIVERSITY BIOLOGICAL STATION.

THE advantages of biological stations for purposes of research and instruction have had many advocates in recent years.

"There can be little doubt" says Parker, "that the study of zoology is most profitably as well as most pleasantly begun in the field and by the seashore, in the zoological garden and the aquarium." "The establishment of biological stations has done more to advance the study of zoology than any other one thing in this generation," says Conklin. "Certain desiderata are evident," adds Kofoid, "more biological stations, so that the conclusions arrived at in one locality may be extended and corrected in a score of others; and finally some biological Froebel, who shall demonstrate the disciplinary and cultural value of ecology as a field of biological instruction and establish a standard for others to imitate. In their work we may look for the happy combination of the sympathetic observation of the old-time naturalist, the technical skill and searching logic of the morphologist, and the patient zeal and ingenuity of the experimental physiologist, a combination, let us hope, that shall unlock not a few of the secrets of the world of life."

"It is unquestionably true that the tendency within recent years" says Ward "has been to make the university trained scientist a laboratory man, unacquainted with work out of doors and among living things. * * * Thus, both through the influence of the investigators in the case of those stations which do not carry on directly any educational work, and through the teaching of those which do conduct summer instructional courses, new life will be instilled into the teaching of natural history throughout our country."

The Biological Station of the Indiana University was planned with a well defined object in view, the study of the variation of

the non-migratory vertebrates in some unit of environment. The station was to be located on a lake which would present well circumscribed boundaries within which the conditions were supposed to be nearly uniform at any time and from season to season. Here large numbers of all the non-migratory vertebrates were to be collected, their characteristics tabulated and compared with similar series from other lakes. We were, in short, to conduct a statistical inquiry into evolution.

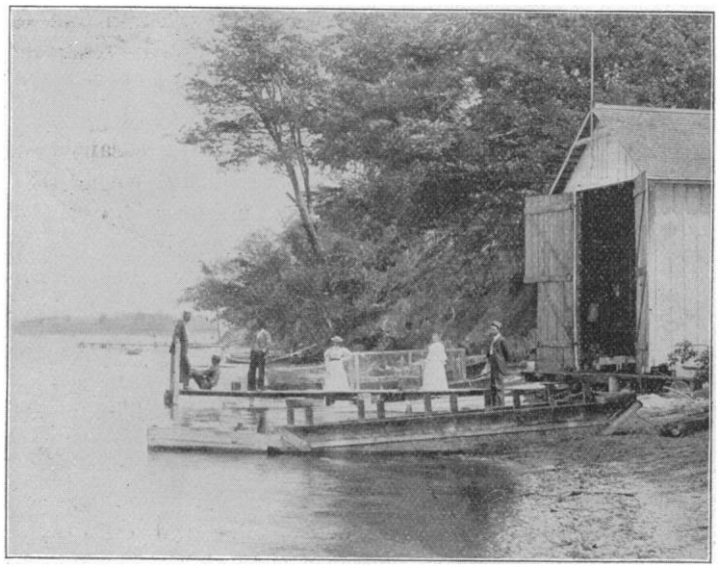

Fig. 1. The Biological Station During its First Year at Turkey Lake.

Fig. 2. The Station During Succeeding Years at Turkey Lake.

For the work in hand many of the lakes were available. Our location was therefore determined by the finding of an old boat-house suitable for a laboratory on the shore of Turkey Lake.

For the first year the trustees of the university granted the use of the apparatus of the zoological department provided the station would in no way be an expense to the university. After the first year the trustees provided generously for the permanent equipment of the station. To help defray expenses a number of courses of instruction were offered for a few students.

Certain restrictions reduced this number to 91 during the present season. The large increase in the number of students kept us more than busy to provide for their increasing needs, but the collection of the material for the study of variation was not neglected.

At the end of the fourth year the station was moved to Winona Lake where the facilities for caring for the increasing number of students are much better. Two buildings were erected and given to the station by the Winona Assembly and Summer School. They are situated in the angle where Cherry Creek enters Winona Lake,

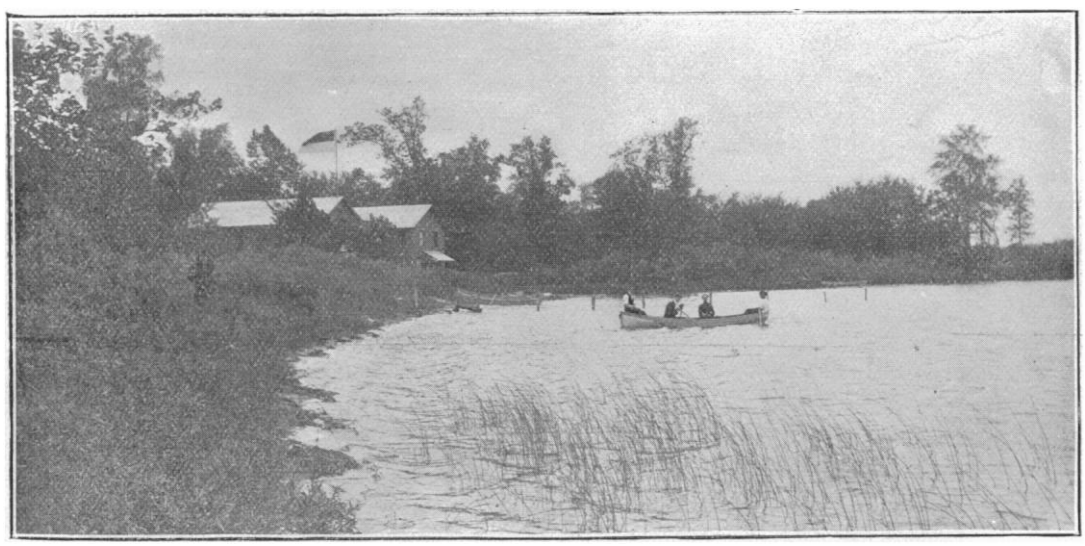

FIG. 3. The Environment of the Biological Station at Winona.

It was expected that there would be about ten in the party the first year, but there were nineteen.

The conditions for biological work, coupled with camp life on a fine lake, five miles from the nearest village and free from university lecture-hour appointments, proved so attractive that during the second summer the number of students rose from nineteen to thirty-two, and in the third to sixty-three, and in the fourth to 103, representing eight States.

eighteen miles from the original location. They are surrounded by a great variety of natural conditions of water, woods, swamps and meadows. The buildings are 20 by 45 feet. One or both will be lengthened to 60 feet during the winter.

The special feature in the construction is the cement floors of the ground story. This arrangement makes the tables on these floors nearly independent of people moving in any part of the buildings. On one of these floors there are private laboratories,

the lake survey laboratory and the office of the director. The lower floor of the second building is given to embryology and bacteriology. The notable feature of this floor is the (accidentally) constant temperature closet of the bacteriological laboratory. This is simply a pit beneath the stairway surface midway between the two buildings. From this we get a flow of about 5,000 gallons per day. The water is received in a small tank and this is tapped by pipes leading to each floor of the buildings where there are small pitcher pumps. The overflow from the receiving tank leads into a

Fig. 4. The Buildings of the Station from the Mouth of Cherry Creek.

about a foot deep and cemented. The temperature without the use of ice did not vary more than 1° from 20 centigrade during the entire summer. The upper floor in one building is given to elementary zoology and that of the other to botany. We have small sheds for incubators away from the buildings to avoid the danger of fire. The bacteriological kitchen and the lecture room are separate tents. The most urgent need of the station is a building for general lectures and for embryology.

The water supply deserves mention. Artesian water was struck 75 feet below the larger steel tank with covers. This tank is used for experiments with blind fishes. The overflow from this leads into pools constructed for experimental work.

The springs about Winona Park flow in part into decorative pools. These will be used for the experiment in rearing cave animals in the light. One of them about thirty feet long is now inhabited by an experimental colony of blind Amblyopsis where their habits can be observed without the restrictions imposed by the conditions found in a cave.

In recognition of the fact that "the

teacher who has no time for research rapidly becomes an ineffective and uninspiring teacher, and that overteaching defeats its own ends," the instruction should be in the nature of a guiding, the giving not of a string of recipes, but of sound principles enabling the student to work out his own salvation.

Since, wherever he may go, the student must adapt himself to his environment, it is the plan to catch what we can and study what we catch rather than to follow fixed courses. The facilities for catching, however, are very favorable. We have the lake in front of us, the woods behind, the creek on one side, and a meadow on the other. Here the entire day of the student is given to collecting and exploring expeditions, lectures and laboratory work.

During the past summer courses of instruction have been given in zoology, botany, cytology, bacteriology, embryology, and survey methods. As soon as the necessary buildings can be secured, courses in neurology and comparative psychology and physiology will be added.

The department of instruction is self-sustaining, but facilities for research are still limited and here is an opportunity for some public spirited citizen.

"Research in all directions, in fact, meets with such reward that it should be sustained by all persons who desire to encourage the progress of knowledge. But the rich men of our country do not discriminate between this function and that of teaching. They found universities with princely liberality, but research has to struggle with poverty of means and deficiency of time. Great libraries are founded, but the work in the laboratory from which issue the books which create libraries receives comparatively little substantial encouragement. * * * Initiative and discovery are the conditions of progress, and no better service could be rendered to humanity than the creation of opportunities for their activity."

C. H. EIGENMANN.

SCIENTIFIC BOOKS.

Alaska and the Klondike. By ANGELO HEILPRIN. New York, D. Appleton & Co. 1899. 8°, pp. X, 315, illustrations and maps.

Professor Heilprin has given us a book which is a combination of personal travel and adventure, with statistics, a synopsis of mining laws, and other data interesting to the traveller or miner. With these, which do not especially concern the readers of SCIENCE, are some observations on the physical geography and geology which are deserving of consideration.

The author started from Skaguay by the White Pass route, July 30, 1898, arriving at Dawson, August 6th, and leaving on the 20th of September, for the outside world by the same route. The general geology of this region had previously been studied by McConnell, Dawson, Spurr, Russell and others, whose observations may be found recorded in the publications of the Dominion and United States geological surveys.

Professor Heilprin found the summer climate not unpleasant, and, *mirabile dictu*, encountered no mosquitos in the mining region. So his survey of the geological conditions was not interfered with by annoyances which disturbed the philosophic calm of most of his predecessors in the same field.

He notes conditions which confirm the opinions held by previous explorers as to the probable existence of large bodies of fresh water over much of the present placer region. The well-known bed of volcanic ash which extends for hundreds of miles along the Upper Yukon a little below the present surface of the ground, is believed by him to have been deposited in water. In the alluvium above and below it he noticed fresh water shells in a fossil state, a feature which has been observed in many places lower down the river. Though these deposits are entirely compatible with the hypothesis of the existence of an extensive lake in the region, they cannot be adduced in proof of it, since the small summer pools which are