

A FEW EXPERIMENTS WITH LIQUID AIR.

C. T. KNIPP.

[Abstract.]

Three experiments were given, using the liquid as a refrigerant. (1) The resistance of manganin wire at the temperature of liquid air; (2) the absorption of heat by conduction into the liquid; (3) the action of a Cu-Fe thermostat when placed in the liquid.

(1) The temperature coefficient of manganin wire was found to agree fairly well with that found by Dewar. Cooling the wire to the temperature of liquid air caused it to undergo no permanent change.

(2) By connecting a block of copper through a copper rod to a bath of liquid air the temperature of the block of copper can be reduced to nearly that of the refrigerant. This principle enables any intermediate temperature to be maintained. By this method a connecting rod of copper about $\frac{1}{2}$ sq. cm. in area and 20 cm. long froze a cu. cm. of mercury placed in the block of copper in $6\frac{1}{4}$ minutes.

(3) A Cu-Fe. thermostat was found to be very sensitive, and it was also noticed that the same coefficients hold at the temperature of liquid air.

THE BITANGENTIAL OF THE QUINTIC.

U. S. HANNA.

NOTE ON AN ATTEMPTED ANGLE TRISECTION.

R. J. ALEY.

THE ZOÖLOGICAL SURVEY OF MINNESOTA.

ULYSSES O. COX.

With the establishment of the Geological and Natural History Survey in Minnesota provision was thereby made for collecting and describing the various faunal forms of the State. For a number of years after the survey was established work was done only along geological lines. In 1886 there appeared a list of the Aphidæ of Minnesota, by Mr. O. W. Oest-

hund, and in the following year a synopsis of the same group by the same author. In 1890 there was published a report on the Mammals, by Professor C. L. Herrick. This report can not, however, be considered anything but preliminary, since it was written before any great amount of investigation had been done and it will, no doubt, be superseded later by an enlarged and up-to-date report. In 1892 there appeared a preliminary report on the Birds, by Dr. P. L. Hatch; in 1895, a report on the Copepoda, Cladocera and Ostracoda, by Prof. C. L. Herrick, which is probably final; and in 1897 a preliminary report on the Fishes, by the writer. The first three reports mentioned were issued under the direction of Prof. N. H. Winchell, State Geologist, but the others have been published under the direction of Prof. H. F. Nachtrieb, State Zoölogist, who for the past eleven years has had entire charge of the work of the survey. Every summer for ten years parties have been at work in the various portions of the State collecting material and data for the final reports. During the past three seasons the work has been especially active. In May, 1899, a houseboat, christened the *Megalops*, was built and launched at Mankato, on the Minnesota River, and very successfully floated to Red Wing, on the Mississippi, before the close of the season. A description of the *Megalops* and an account of the first season's trip appears in the Proceedings of the Indiana Academy of Science for 1899. In the summer of 1900, in early June, the *Megalops* was restocked and started from Red Wing on its second season's journey, down the Mississippi. Considerable time was spent on Lake Pepin, as the conditions and fauna there varied greatly from that of the Mississippi River proper. The territory along the Mississippi was quite carefully explored and material collected as far as Brownsville, Minn., which is within a few miles of the southern boundary of the State. Attention was given primarily to the fishes, but much other material was also collected, especially insects, batrachians and reptiles. Near the close of August the *Megalops* was again anchored for the winter, this time at Brownsville.

Early last spring Prof. Nachtrieb purchased for the survey a gasoline launch, and with it towed the *Megalops* back to the head of Lake Pepin, where it was beached and served as a station during the summer. This region is especially rich on account of the variety of conditions. On the one hand there is Lake Pepin, which is about two miles wide and nearly forty miles long. In many places it has fine sandy and gravelly shores and in others there are marshes. It is hemmed in by

high bluffs, which are from two hundred to three hundred feet above the water level, but in places there are low points which extend out from the bluffs into the lake for one-fourth of a mile or more, and on these numerous fishermen are located. Seining, also other forms of netting, is allowed in the lake, so an abundance of material for study can readily be obtained. The water is usually clear and varies in depth from ten to thirty feet.

As is well known, Lake Pepin is simply a remnant of what was once the large glacial Mississippi River. At the lower end of the lake the Chipewewa River empties from the Wisconsin side and carries with it a great



amount of sediment, chiefly sand. This deposit has filled up the bed of the original stream at that point, and consequently dammed it and produced a lake. At all other places along its course what was once the magnificent Mississippi, two to four miles in width, is now narrowed down to one, or at most two or three, small channels and a few bayous. At the upper end of the lake the delta is exceedingly well marked. There are three main channels of the river, several lakes and numerous bayous, some with water connection and others without, during the dry season.

There is water of various depths, marshes, clear pools and all the chief forms of aquatic vegetation that this region of Minnesota affords—in fact, all the conditions that could be desired for an inland laboratory. The region abounds in breeding places for fishes, batrachians and reptiles; many species of mollusks are found in the lake, and the lower forms of aquatic life are everywhere abundant.

Thus it would seem that an ideal spot had been found for a lake laboratory for the University of Minnesota, which it is hoped the authorities may see their way clear to establish there in the near future.

During the past summer Prof. Nachtrieb kept a small party at the head of Lake Pepin in the beached *Megalops*, with which he spent the greater portion of his own time. Large collections were made, among which were many insects, numerous fish stomachs and a quantity of histological material.

During the past summer Prof. Nachtrieb, with an assistant, spent a few weeks on the Lake of the Woods, studying the lake sturgeon, and the writer, with three assistants, put in the entire summer on Lake Vermilion, at Tower, Minn. Lake Vermilion is some forty miles long in one direction, much narrower in the other, but it is not one open body of water, but rather a number of small lakes connected by numerous channels. It is in the heart of what was once an evergreen forest region, and its shores, which are chiefly rocky, border on the granite on the one hand and the very early stratified forms on the other. The water is clear and pure except for the floating forms of aquatic life in midsummer, and it varies in depth from five to forty feet, with possibly a few small areas that are deeper.

We established our camp on Pine Island, about seven miles from Tower. There was no one living within six miles of the place and no facilities for camping except numerous beautiful locations among the pines and the outfit which we carried with us. We erected two tents and from the dilapidated roof of a former homesteader's cabin secured enough boards to make some tables. We also made an excavation in the bank, lined it with slabs split from cottonwood poles, roofed it over with boards and tar paper from the dilapidated cabin, and thus had a very efficient dark room, in which we successfully developed more than three hundred negatives. Our outfit, in addition to the culinary department, consisted of seines, gill-nets, other smaller nets, a canvas boat, microscopes, books, cameras, guns, preserving jars and fluids, and other minor articles. One

member of the party, Mr. J. E. Guthrie, devoted nearly all his time to insects, of which he secured a large collection. Another member of the party gave special attention to leeches, and a third collected and studied the mammals. The writer devoted nearly all his time to a study of the fishes. Collections were made of the species found in the lake and the inflowing streams, and many of the species were dissected and photographed. Attention was also given to a study of the habits of these fishes. From the main camp expeditions were made to all parts of the lake.

We were on the lake about two months and a half, and found the camping method a very satisfactory and pleasant one. The limit of this paper will not permit me to state any of the results of our work, but they will appear later in the forthcoming reports of the survey, some of which are now under way.

CULTURE OF AMOEBA.

A. J. BIGNEY.

Several years ago I presented a paper before this Academy on a new method of obtaining amoeba. This method was as follows: Take some of the green scum from the surface of some ponds and place it aside for a few weeks, during which time great numbers of amoeba will have developed. This scum must be composed mostly of euglena in the resting stage. I have never known this method to fail.

During the past season I have had unusual success with this method of securing them. About the first of September I obtained some of these euglenae and placed them in a wide-mouthed two-ounce bottle and left them on my desk for about two months, at which time I needed them for class use. When I first took this material from the pond there were a few amoeba in the midst of the euglena. When I needed a supply I found them by the hundreds on almost every slide. Frequently there would be so many that they would literally fill the field of the microscope. They were large specimens. It was the largest supply that I have seen reported in this country. It may be that others have had equal success with some other method. We used them for some time and then nearly all the remaining ones went into the resting stage.