plasmin, blastomycin, and fractions 1, 2, 3, and 4 from histoplasmin have been compared. The antigenic content of each solution was not determined by weight. Specified dilutions of each fraction were made, however, and employed throughout the series of tests. This served to standardize the amount of reacting substance present in each antigenic solution. Fraction 1 "undiluted" represents a 1:20 concentration of histoplasmin; fractions 2, 3, and 4 "undiluted," approximately 1:50 concentrations of histoplasmin. Some of each fraction was known to have been lost during the purification process.

Histoplasmin, blastomycin, and fraction 1 gave positive precipitin tests with serum obtained from both groups of rabbits. These antigens were therefore nonspecific. Fractions 2 and 3 appeared more specific for antibodies stimulated by *H. capsulatum*, since in low dilution they reacted with serum obtained from all the *H. capsulatum*-inoculated rabbits but with serum obtained from only 1 of the *B. dermatitidis*-inoculated rabbits. Fraction 4 reacted in low dilution with 4 out of 7 sera from the *H. capsulatum*-inoculated rabbits but failed to react with any of the sera obtained from those inoculated with *B. dermatitidis*.

It is of interest to note that the presence of antibodies in fractions 2, 3, and 4 was of short duration, being demonstrable for a period of not more than 3 weeks. Antibodies to histoplasmin and blastomycin, on the other hand, could still be demonstrated in some of the rabbits 9 weeks after injection.

Skin tests were performed on 5 rabbits injected with *H. capsulatum* and the 3 rabbits injected with *B. dermatitidis* which were still living 9 weeks after inoculation. Fractions 1 and 2 were not specific for *H. capsulatum* when used in 1:100 or a 1:1,000 dilution, as they gave positive skin reactions in both groups of rabbits. Fraction 3 gave negative results in all the rabbits when used in a 1:100 dilution.

Fraction 4 in a 1:10 dilution gave positive reactions in 4 out of 5 of the rabbits injected with *H. capsulatum* and negative results in the remaining 2 animals injected with *B. dermatitidis*. This would indicate that fraction 4 is the most specific of the fractions, since these 2 rabbits had reacted positively to one or more dilutions of fractions 1 and 2.

The 3 normal rabbits reacted negatively to all the antigens when injected intradermally.

The results of the studies presented above indicate that precipitin tests may be of value as an aid in the diagnosis of histoplasmosis and blastomycosis. Fractions obtained from the broth filtrate of the mycelial phase of *H. capsulatum* give more promise of being specific for *H. capsulatum* infections than the broth filtrate itself.

A more detailed account of the work presented here will be published at a later date.

References

1. Davis, B. J. *J. inf. Dis.*, 1911, **8**, 190.
2. Dulaney, A. D. *J. Immunol.*, 1930, **19**, 357.
3. Van Pernis, P. A., Benson, M. E., and Holinger, P. H. *J. A. M. A.*, 1941, **117**, 436.

The Occurrence of Temperatures Unusual to American Lakes[1]

Curtis L. Newcombe

Cranbrook Institute of Science, Bloomfield Hills, Michigan

John V. Slater

Wayne University, Detroit, Michigan

Lake waters are known to exhibit two major temperature characteristics of primary ecological significance. One of them is the existence of seasonal changes characterized by surface-bottom mixing in the spring and fall seasons, with intervening periods of relatively stable thermal conditions. The second widely occurring phenomenon, known since the work of Simony about 1850, is the rapid decrease in temperature throughout an intermediate water layer, termed the *thermocline* by Birge in 1897. Above the thermocline is a layer called the *epilimnion* that usually extends to a depth of about 12–24′ or more below the surface, while below it is the *hypolimnion* layer in which the water, under normal conditions, is disturbed only during the spring and fall seasons by the surface-bottom mixing of the waters of the lake.

The morphological, metabolic, and physical-chemical properties of different lakes are directly related to variation with respect to these two dominant characteristics. This paper describes briefly three departures from the temperature conditions that usually exist in lakes. They are as follows: (1) a measurable increase in temperature from the top to the bottom of the hypolimnion; (2) the permanent stagnation of the hypolimnion throughout the year; and (3) the prolonged existence of the upper limit of the epilimnion to within about a foot or two of the surface.

Observations were made at Sodon Lake, Oakland County, Michigan (Bloomfield Township, Sect. 20; lat. 42° 19′, long. 83° 17′) during the period May 1947–May 1948. The first record of a temperature increase in the hypolimnion in this lake was made on May 22, 1947, by Stanley A. Cain and the senior writer. Since that time an intensive study has been made of the dominant physical and chemical properties of this lake in an effort to associate the unusual thermal properties of the water layers with related phenomena.

Sodon Lake is a small, ice-block lake from 50′ to 60′ in maximum depth and 5.7 acres in area at the surface, 3.2 acres within the 20′ depth contour, and 1 acre within the 40′ isobath. The volume development of the lake is 1.21, indicating that the basin closely approximates a cone.

Considerable protection from wind action is afforded by the surrounding wooded hillsides and, to a lesser ex-

[1] We are indebted to Gustavus D. Pope for the use of his lake and for numerous other courtesies. Acknowledgment is also made to S. A. Cain and F. T. Knapp for cooperating with the senior writer on several occasions in taking temperature records.

tent, by the red maple-tamarack swamp forest which occupies the shore zone. The littoral area out to a depth of about 12′ is covered with a dense growth of *Chara* including some Potomogeton and white and yellow water lilies. Beyond the 12′ contour there is some *Nitella* and bottom-growing moss of the genus *Fontinalis*. In this area there are very few benthic animals and in the greater depths, rich in hydrogen sulfide, practically no signs of animal life.

Throughout all months of the year there is a slight increase in temperature from the 30′ level, near the upper part of the hypolimnion, to the bottom. In winter and early spring the increase is from a range of 39.2–39.7° F at 30′ to one of 39.9–41.1° F at the bottom level. By midsummer the water at the 30′ level has warmed up slightly to, on the average, about 40.4° F, and there is possibly a slight increase in the temperature of the water immediately above the bottom to about 40.5–41.1° F. The amount of thermal change from the top to the bottom of the hypolimnion varies at any one time from a few tenths of a degree to 1.6° F. Any seasonal variation in the temperature of the waters below 35′ is at best only a matter of tenths of a degree Fahrenheit and difficult to define with certainty, using a Foxboro thermometer. The slight thermal gradient increasing toward the bottom, and the relatively great stability of the bottom temperatures is illustrated in Fig. 1. The fall and spring overturns in 1947–48 did not penetrate below 30–35′. Depths of around 30′ represent ecotone levels that are seemingly the meeting points of shallow and deep-water thermal influences. The particular fall season will determine the distance below the 30′ depth that cold, surface water conditions may penetrate. Likewise, factors operating in the hypolimnion will probably vary from year to year with respect to their influence on the temperature of the waters near the 30′ level. The upper limit of the hypolimnion ranged from about 16′ in late May 1947 to 29′ on November 22, just preceding the complete disappearance of the thermocline.

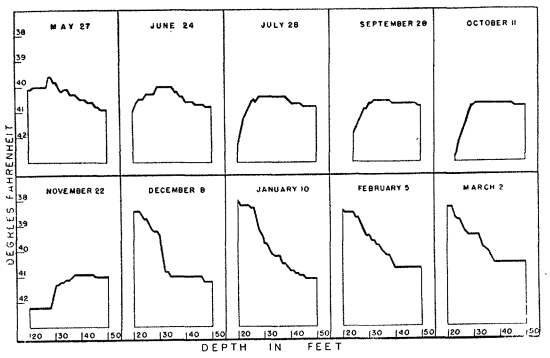

FIG. 1. Monthly variations in the extent of the temperature inversion in Sodon Lake, Oakland County, Michigan, during 1947–48.

The third unusual condition found in Sodon Lake is the existence of the thermocline within 1′ or 2′ of the surface during a prolonged period. The lower limit of the thermocline dropped from a depth of about 16′ in late May to around 25′ in early September. The decrease in temperature from the top to the bottom of the thermocline was approximately 19° F in late May and from 36 to 42° F during August and early September. The magnitude of the average drop in temperature per foot of increase in depth throughout the thermocline ranged from 1.2 to 2.2° F during the period May 27–September 22, 1947. Below 30′ the temperature range was from 39.4° F, the lowest temperature at the 30′ level, to about 41° F, which was the highest bottom-water temperature.

Two other comparable instances of temperature inversion, known as dichothermy, have been reported in American lakes, one being Fayetteville Green Lake near Syracuse, New York, studied by Eggleton (*1*), and the other, Lake Mary, Wisconsin, observed by Juday, Birge, and Meloche (*2*). In Europe and Asia the temperature inversion phenomenon has been reported for a number of lakes in Austria, Germany, and Japan (*3*).

References

1. EGGLETON, FRANK E. *Ecol. Monogr.*, 1931, **1**, 231–352.
2. JUDAY, C., BIRGE, E. A., and MELOCHE, V. W. *Trans. Wisc. Acad. Sci. Arts Let.*, 1935, **29**, 1–82.
3. YOSHIMURA, SHINKICHI. *Proc. imp. Acad. Tokyo*, 1937, **13**, 316–319.

On the Origin of Virus Phosphorus[1]

FRANK W. PUTNAM and LLOYD M. KOZLOFF[2]

Department of Biochemistry, University of Chicago

Knowledge of the biological precursors of virus nucleic acid and protein is essential to the understanding of the mode of virus reproduction. Bacteriophages infect an autonomous host cell of well-elucidated metabolic pattern and viable on synthetic medium and thus offer very suitable systems for isotope tracer studies of the origin of virus constituents and of the extent to which these are directly derived from the host.

The isolation from broth lysates of purified *Escherichia coli* bacteriophage T_6r^+ with normal infectivity but containing radioactive phosphorus has already been reported (*3*). Isotope studies described in this paper demonstrate that when phage is propagated in bacteria maintained in a chemically defined medium, the medium itself can be the ultimate source of 70% of virus phosphorus. The remaining virus phosphorus is derived directly from the bacterial host, chiefly from some P fraction other than low-molecular-weight, acid-soluble compounds.

For these experiments the phage was harvested in the

[1] This research was aided by a grant from the National Foundation for Infantile Paralysis.

[2] We are indebted to D. Gordon Sharp, of the Department of Surgery, Duke University School of Medicine, for the electron microscope and ultracentrifuge investigation, and to E. A. Evans, Jr., University of Chicago, for aid and encouragement in this work.