is interesting to note that the Japanese have, on the other hand, followed the example set by Germany and that their remarkable success in the introduction of western medicine is to be attributed, in no small measure, to the continued influence of the Imperial University Medical Schools on premedical education and especially upon research in the sciences fundamental to medicine.

In concluding this review, attention may be called to a noteworthy feature of the contributions, namely, to the cooperation of foreigners and Chinese. Long may this friendly association continue! In the four volumes under consideration, which represent the initial achievements of the enterprise (so far as they have been published), it is naturally chiefly a matter of the teacher working side by side with his Chinese student, although some of the more mature Chinese have already made important discoveries alone. Let us hope that in the years to come the tendency to work together, once happily initiated, will continue. The reviewer confidently believes that when experienced and fully trained Chinese and foreigners will join hands in united effort, fortified as they are by their peculiar heritages and intellectual endowments, a new force will be brought into medicine, and that mysteries will give way which have long baffled the best minds of England, France and Germany, indeed of all the nations of the west, laboring alone. That this new combination should act in one of the greatest of oriental cities, in an environment rich in intellectual and artistic achievement and altogether different in character from that which has fostered the advancement of science along certain lines in the west, is another factor which may be productive of surprising results. The future is full of promise, and there is a chance that the Peking Union Medical College may contribute, as few other institutions are privileged to do, toward the purpose of the Rockefeller Foundation, namely, "the welfare of mankind throughout the world."

E. V. COWDRY

THE ROCKEFELLER INSTITUTE

SPECIAL ARTICLES

EFFECT OF FREEZING AND THAWING ON THE BACTERIOPHAGE[1]

GENERALLY speaking, there are two conceptions as to the nature of the bacteriophage: (1) a living organism and (2) an enzyme. Its transmissibility in series favors the former view, while its "growth" curve and certain of its described physical and chemical properties would appear to class it among the latter.

Temperatures at or slightly below the freezing point are stated to be uninjurious to this lytic substance, but so far as the writer has been able to determine, the effect of repeated freezing-thawing has not been studied.

A bacteriophage active for *Staph. muscae* (Glaser), and another lytic for a human strain of *Bact. coli* were used. Heating at 60° C. for forty-five minutes inactivated the former, whereas the latter was only partially destroyed at this temperature. Using standardized procedures, the lytic titers of the two were very constant.

One cc quantities of the phages were frozen in small, sterile, cotton-plugged tubes on a freezing microtome with CO_2 gas. The cap of the freezing box was first unscrewed and the gas outlet covered with a piece of wire gauze to prevent the small tubes from resting in it. Over the small tubes was inverted a large test-tube, four and one half inches by one and one quarter inches, with a hole in the bottom of sufficient size to permit the escape of gas. CO_2 freely expanding in this chamber quickly lowered the temperature to a point where solid CO_2 was produced, approximately $-78°$ C.

The two phages were frozen and rapidly thawed ten, fifteen and twenty successive times, yet when titrated the titers never varied from those of non-frozen portions run as controls. Even when diluted ten thousand times with bouillon and then subjected to the freezing process for fifteen times no deleterious effect was to be noted on the staphylococcus phage.

By way of contrast, the following figures are given, indicating the numbers of a twenty-four hour old bouillon culture of *Bact. coli* which failed to survive after the first, tenth and fifteenth freezing, respectively: 16 per cent., 86 per cent., 94 per cent.

The results would indicate the bacteriophage to be something other than a viable organism, unless it constitutes an exception to the generally accepted rule that repeated freezing-thawing is injurious to living cells.

E. S. SANDERSON

THE ROCKEFELLER INSTITUTE,
PRINCETON, N. J.

[1] From the Department of Animal Pathology of The Rockefeller Institute for Medical Research, Princeton, N. J.

THE RELATION OF MOISTURE CONTENTS OF WOOD TO ITS DECAY

EARLY in 1920, the senior writer began a comprehensive study of the relation of the moisture contents—or air-moisture balance—of wood to its decay and of woody plants to disease. During the past two years, the junior writers have been engaged in working out certain phases of both problems in collaboration with the senior writer.