THIS is one of the few meteorological "must" books. Teachers, at least, of meteorology and climatology must keep it close by for reliable reference. Mr. Tannehill, as chief of the Marine Division of the U. S. Weather Bureau, needed to have as full information as practicable of tropical storms in general and of the West Indies hurricane in particular, a need which his official position and the facilities of the Bureau's extensive library enabled him to meet. This information he neither lazily nor selfishly put aside for his private use, but industriously got together for the convenience of the hundreds of others who might want it.

It is a readable book, full of facts, historical and otherwise; and free from tedious theoretical discussions that would have had to be based at best on doubtful assumptions. Logically it begins with a clear description of a tropical cyclone or hurricane as one in the general region of the West Indies is called; of how reports of such a storm are obtained, and how warnings of its approach are issued.

This general discussion is followed by a number of chapters that consider in detail the winds, the barometric pressure, the torrential rains, tidal waves and other phenomena that accompany or are parts and parcels of a typical hurricane. The tracks of many of these storms are given, and their frequency, both annual and monthly, noted.

The last four chapters give the history of all West Indian hurricanes of record, extending from 1493 to 1941. One of these storms wrecked, as history tells us, certain vessels on their way, in 1609, to Jamestown, and inspired Shakespeare to write "The Tempest."

The book contains also a very full and, for students of the subject, an invaluable bibliography of hurricane literature and a good index.

W. J. HUMPHREYS

SPECIAL ARTICLES

COMPLEMENT FIXATION IN RICKETTSIAL DISEASES

THE complement fixation technique has proved adequate for serological separation of the rickettsial agents of endemic typhus,[1,2] "Q" fever[3] and Rocky Mountain spotted fever.[4] The agents of epidemic and endemic typhus previously have not been distinguishable by this method, since cross reactions were obtained with materials from the two closely related diseases.[2,5] It is now possible to prepare rickettsial antigens with which we can differentiate epidemic and endemic typhus antisera. Certain of the results obtained with these new antigens are of sufficient clinical and epidemiological interest to record at this time; the details of the method of preparation of the antigens will be given at a future date.

The method employed in performing the complement fixation test has been described.[4] The epidemic and endemic rickettsial antigens (Breinl and Wilmington strains) are prepared from infected yolk sacs of developing chick eggs and purified so that the diluted antigens contained 0.02 mg N per cc. The epidemic and endemic rickettsial antigens are standardized against convalescent sera of known titre obtained from human beings and guinea pigs recovered from epidemic and endemic typhus. Some cross fixation occasionally occurs, but when it does, the specific antigen always reacted with the homologous serum in a higher titre than with the heterologous serum.

Table I indicates the results obtained on specimens of serum obtained during convalescence in epidemic and endemic typhus and in Brill's disease.

In 43 cases of endemic typhus fever examined 36 gave a positive complement fixation with an endemic rickettsial antigen and a negative fixation with an epidemic rickettsial antigen. In six cases there was some cross fixation, but in every case where this occurred, the titre obtained with the endemic antigen exceeded that obtained with an epidemic antigen.

In 29 cases of epidemic typhus fever 26 gave a positive fixation with an epidemic rickettsial antigen and a negative test with an endemic antigen. In three cases there was some cross fixation, but in all instances where this occurred the titre obtained with the epidemic antigen exceeded that obtained with an endemic antigen.

All the patients included in the group of endemic typhus come from one of two areas in which this type of infection is known to occur, but in which epidemic typhus has not been found. The patients comprising the group of epidemic typhus come, in part, from an area where louse-borne typhus exists and, in addition, individuals are included who had laboratory infections and from whom epidemic strains have been isolated.

It has been observed that the immigrants who contract Brill's disease usually give a history of having had typhus while in Poland or Russia. Only one case

[1] M. R. Castaneda, *Jour. Immunology*, 31: 285–291, 1936.
[2] I. A. Bengtson, *Pub. Health Rep.*, 56: 649–653, 1941.
[3] I. A. Bengtson, *Proc. Soc. Exp. Biol. and Med.*, 46: 665–668, 1941.
[4] H. Plotz and K. Wertman, SCIENCE, 93: 441–442, 1942.
[5] Unpublished data.

TABLE 1

	No. of cases	Epidemic Rickettsial Antigen	Dil. of serum	Endemic Rickettsial Antigen	Dil. of serum
Endemic Typhus					
43 cases	5	negative		4 plus	1:12
	12	negative		4 plus	1:24
	6	negative		4 plus	1:48
	9	negative		4 plus	1:96
	2	negative		4 plus	1:192
	1	4 plus	1:6	4 plus	1:96
	1	4 plus	1:6	4 plus	1:192
	4	4 plus	1:12	4 plus	1:48
	2	4 plus	1:12	4 plus	1:96
	1	4 plus	1:24	4 plus	1:384
Epidemic Typhus					
29 cases	2	4 plus	1:12	negative	
	1	4 plus	1:24	negative	
	1	4 plus	1:48	negative	
	2	4 plus	1:96	negative	
	13	4 plus	1:192	negative	
	6	4 plus	1:384	negative	
	1	4 plus	1:768	negative	
	1	4 plus	1:96	4 plus	1:24
	1	4 plus	1:192	4 plus	1:48
	1	4 plus	1:192	4 plus	1:96
Brill's disease					
23 cases	4	4 plus	1:12	negative	
	2	4 plus	1:24	negative	
	4	4 plus	1:48	negative	
	2	4 plus	1:48	4 plus	1:6
	1	4 plus	1:48	4 plus	1:12
	1	4 plus	1:96	4 plus	1:48
	1	4 plus	1:96	4 plus	1:12
	2	4 plus	1:384	4 plus	1:48
	3	4 plus	1:768	4 plus	1:192
	1	4 plus	1:960	4 plus	1:96
	1	4 plus	1:960	4 plus	1:384
	1	4 plus	1:1436	4 plus	1:192

usually occurs in a family, no vector or reservoir of the virus has been found, and the virus isolated from the blood of the patient has the characteristics observed for the epidemic strain. On the basis of these observations Zinsser[6] advanced the theory that Brill's disease represented a recrudescence of an old attack of typhus fever. Our observations bring serological evidence to substantiate this point of view.

In 23 cases of Brill's disease examined all showed a positive complement fixation with an epidemic rickettsial antigen. In 10 cases there was fixation with an epidemic rickettsial antigen and no fixation with an endemic rickettsial antigen. In 13 cases there was some cross fixation but in all instances where this occurred the titre obtained was higher with an epidemic antigen. The pattern of fixation in this disease resembles that obtained in epidemic typhus fever.

Absorption tests were performed on specimens of serum from Brill's disease where cross fixation had occurred. An endemic rickettsial antigen removed all the endemic antibody with slight effect upon the titre of epidemic antibody. On the other hand, a similar treatment of the serum with an epidemic rickettsial antigen resulted in the removal of both the epidemic and endemic antibody; no selectivity of absorption was observed. These results would indicate that the endemic rickettsial antigen pattern was different from that of the antigenic pattern of the epidemic strain. The removal unselectively of both endemic and epidemic antibodies by the epidemic antigen suggests that the epidemic antigen may be a more complete or complex antigen than the endemic antigen.

The implication of the results obtained in Brill's disease on the epidemiology of typhus fever is great. They would indicate that mild cases of epidemic typhus actually exist in the United States. The disease is not transmitted from person to person in this country simply because the louse vector is not present. Furthermore, these results indicate that one attack of typhus does not confer a lifelong immunity as is generally believed. The virus is probably harbored in the body and when the resistance is lowered the virus multiplies and induces a mild attack of the disease. If these cases should occur in a louse-infested community the disease might readily spread from person to person. The observations on Brill's disease strongly suggest that man serves as the reservoir for epidemic typhus between outbreaks just as the rat does in endemic typhus.

The complement fixation test now provides a tool with which surveys of the prevailing types of typhus in a region can be determined. This procedure has been applied and endemic typhus has been discovered in Jamaica and epidemic typhus in a South American country. These surveys are now being continued in other countries.

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[6] H. Zinsser, *Am. Jour. Hyg.*, 20: 513, 1934.

A STUDY OF CRYSTALLINE BEEF LIVER CATALASE DRIED IN THE FROZEN STATE[1]

INTRODUCTION

THE drying of proteins by the lyophile process is assuming increasing importance in research and in preparing such material as dried plasma or dried pollen extracts for practical use. There is a tendency to assume that in drying a quickly frozen protein preparation by subjecting it to a high vacuum, no change such as denaturation occurs. The following observations show that this is not necessarily true.

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