

after treatment with carbon dioxide. Increase in viscosity with nitrogen is shown in Table II.

Variations of the hydrogen ion concentration do not seem to affect the viscosity of the abnormal cells (Table III).

Carbon monoxide reacts with hemoglobin in much the same way as oxygen although a far more stable compound, carbon monoxide hemoglobin, is formed. Murphy and Shapiro⁶ found that exposure of cells from a subject with sickle cell anemia to carbon monoxide apparently prevented their sickling. In order to confirm this, cells which had the sickling tendency were treated with carbon monoxide and studied in the viscosimeter. The sickling process was inhibited by this treatment as it was no longer possible to produce viscosity changes with carbon dioxide

or nitrogen (Table IV).

Tomlinson and Jacob⁷ report an inhibition of sickling by repeated washings and by the addition of cyanides to sickle cell blood. It could not be demonstrated by the viscosimetric method that repeated washings inhibited the sickling tendency (Table V). The addition of cyanide or the use of various anticoagulants showed no influence on the sickling tendency as viscosity changes could still be demonstrated after their use (Table VI).

Summary. A viscosimetric method is described for the study of the sickling tendency of red cells from subjects with sickle cell disease. This method does not differentiate between sickle cell anemia and sickle cell trait. Data are compared with observations of other investigators.

⁶ Murphy, R. C., and Shapiro, S., *Ann. Int. Med.*, 1945, **23**, 376.

⁷ Tomlinson, W. J., and Jacob, J. E., *J. Lab. and Clin. Med.*, 1945, **30**, 107.

16604 P

Studies of Typhus Fever in Peiping by the Complement Fixation Test.

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Recently, the complement fixation reaction in typhus fever, first studied by Castaneda,¹ has been refined so that not only typhus may be differentiated from other rickettsial diseases such as Rocky Mountain Spotted Fever,² but may itself be classified according to epidemic or murine nature.³ Inasmuch as we have been interested in the etiology of typhus fever in this area, and have reached certain tentative conclusions based on the studies of the biology of the rickettsia strains locally isolated,⁴ we wish now to use the

complement fixation test to complete our studies. Unfortunately so far, owing to the scarcity of clinical cases seen in the past year, the number of sera examined has been small. But the results seem to be sufficiently consistent to warrant a preliminary report at this time.

Method and results. The antigens used in the present study, kindly supplied by the Lederle Laboratory Division of the American Cyanamid Company,⁵ consist of washed rickettsial bodies. The method of complement fixation test is that of Kolmer's modified by reducing all ingredients to one-half the volume of the regular method. Sera were

¹ Castaneda, M. R., *J. Immunol.*, 1936, **31**, 285.

² Bengtson, I. A., *Am. J. Pub. Health*, 1945, **35**, 701.

³ Wishart, F. O., and Malcomson, M. E., *Canad. Pub. Health J.*, 1946, **37**, 369.

⁴ Liu, W. T. *et al.*, *Am. J. Hyg.*, 1942, **35**, 231.

⁵ We are indebted to Dr. R. B. Watson, of the International Health Division of the Rockefeller Foundation for securing these antigens.

obtained from patients suffering from clinical typhus fever⁶ some of which have been preserved by the lyophile process. Any serum showing anticomplementary action was treated by the method of Faran.⁷ It was found that all except one gave positive reaction to both antigens, with titres mostly above 1:320, and one reaching as high as 1:20,480. Among these, 5 sera showed the same titre for both antigens, while 14 sera from 10 patients showed a higher titre to the epidemic antigen: 4 with a 2-fold difference, 4 with 4-fold difference, 5 with 8-fold difference and one positive only to epidemic antigen at titre 1:640.

Comment. The results of the present study by means of complement fixation test agree with a similar study, carried out by one of us (N.C.C.) in the spring of 1946

when epidemic and murine vaccines served as antigens. In that study, 9 patients with 15 samples of sera gave clear cut positive complement fixation reaction with one or both of the antigens. Seven patients with 10 sera gave stronger reaction to the epidemic, one gave equal titre, while another one gave higher titre to the murine antigen. These findings seem to suggest that the strains of rickettsia causing human infections in the past 2 years, whether in the autumn or in the spring, are largely of the epidemic type. This is in contrast to our previous results when the biological study of the organisms tended to classify them as murine type. In order to reconcile the above differences, further study will be made with perhaps absorbed sera. These will be continued when sera from fresh typhus cases will be available.

⁶ We are indebted to Dr. Y. W. Yih, of the Hospital of the National Pei Ta Medical School for 4 of the sera tested.

⁷ Faran, A., *J. Lac. Clin. Med.*, 1946, **31**, 1037.

⁸ Bengtson, I. A., *Pub. Health Rep.*, 1947, **61**, 1379.

16605

Isometric Relaxation Period of the Left Ventricle in Normal Subjects and Patients with Mitral Stenosis.

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Differentiation of a split second sound from reduplication of this sound is important; the latter is consequent to loud snapping of the mitral leaflets in mitral stenosis while the former has a variety of causes, the most common of which is asynchronous closure of the aortic and pulmonic valves. Important information bearing on this problem may be afforded by study of the duration of the period of isometric relaxation of the left ventricle, for this period is the interval between closure of the aortic valve and opening of the mitral. Several attempts have been made to measure this period in normal subjects by means of arterial and venous tracings¹ or by observation of roentgenological tracings (electroky-

mograms).² The phonocardiogram has been used, thus far, for measuring this interval only in patients with mitral stenosis.³ Errors due to delay in the transmission of the *v* wave from the right heart to the neck or asynchronism between right and left ventricles cannot be avoided in studies based on mechanical methods; similarly, inaccuracies due to the influence of position and motion phenomena may be present in roentgenological tracings. However, the phonocardiogram gives a virtually instantaneous recording of the vibration due to valvular movements and is

² Randak, E. F., Boone, B. R., Ellinger, G. E., and Oppenheimer, M. J., *Fed. Proc.*, 1948, **7**, 97.

³ Margolies, A., and Wolferth, C., *Am. Heart J.*, 1932, **7**, 443.

¹ Burstein, J., *Am. J. Phys.*, 1923, **65**, 158.