The Complement Fixation Test

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The use of the complement fixation reaction in the diagnosis of disease was first introduced by Bordet and Gengou in 1901. With serums from individuals suspected of having typhoid fever, combined with typhoid antigens, they were able to demonstrate positive fixation of complement in cases of typhoid fever. Since that time the complement fixation reaction has been widely used as an aid in the diagnosis of bacterial, viral, parasitic, fungal, and rickettsial diseases.

While the test is relatively simple to carry out, the technique is somewhat more complicated than those of the agglutination or precipitation tests and, as a result, are more subject to error. The following reagents are used: (1) specific antigen, either in suspension or in a soluble state; (2) heat-stable antibody (patient's serum); (3) complement (fresh serum from normal animals, usually the guinea pig); (4) sensitized red cells (sheep or human hemolytic systems are usually used). All reagents must be carefully tested for hemolytic and anticomplementary activity and the amounts to be used must be carefully adjusted. The proper controls should always be included.

The test is performed in two phases involving two different reactions. The first phase consists of an antigen-antibody mixture to which complement is added. Complement will not be "fixed" in the presence of either antigen or antibody alone, or in the mixture if the antigen and antibody are not specifically related and, therefore, do not combine. If an antigen and its specific antibody are present, they will combine and the complement will be anchored to the combination and removed from the solution. Fixation may take place at 37° C. for 1 hour, at room temperature for several hours, or at ice-box temperature overnight. Procedures using ice-box temperature are considered most sensitive as a rule. In determining the exact temperature and time for fixation, the rapid deterioration of complement at the higher temperatures must be taken into consideration.

The exact mechanism of the combination of complement with antigen-antibody mixtures is not known. Presumably, an invisible precipitin reaction occurs between antigen and antibody. Experiments have shown that the rate and degree of combination of complement depend on the size of the particles present; and it is probable that the physical state of the surfaces of the particles also is of importance.

Since the particles, or precipitate, formed by the antigen-antibody combination on which complement is absorbed are invisible to the naked eye, and since fixation of complement is not seen, an indicator must be added to demonstrate the presence or absence of free (unfixed) complement. For this purpose a hemolytic system (sensitized cells) is used. Addition of the cells constitutes the second phase of the test. The mixtures are held for 1 hour at 37° C. If complement has been fixed by the specific antigen-antibody combination, no hemolysis will result during incubation; if complement is left free, hemolysis will result. The former is a positive reaction, while the latter is a negative reaction. Some serums show partial or incomplete fixation of complement, which results in partial hemolysis after addition of the sensitized cells.

The complement fixation reaction for the diagnosis of syphilis was first introduced by Wassermann in 1906. He used extracts of the livers of stillborn infants as antigen, since large numbers of spirochaetes were present and it was impossible to grow the spirochaete in artificial media. It was later found that extracts of normal livers and other organs gave equally good results. For many years an alcoholic extract of the lipoids of beef hearts has been generally used as antigen for this test. Therefore, the Wassermann reaction is not basically an application of the principle of the fixation of complement by a specific antigen-antibody combination. It may be regarded as an application of this technique to the detection of the reaction between the lipoid "antigen" and the "reagin" in syphilitic serum. It is not known whether the syphilitic "reagin" is a true antibody, but experiments have shown that it definitely combines with the lipoid "antigen." It is entirely distinct from the *Treponema* immobilizing substance, which appears to bear a definite and specific relation to immunity to syphilis.

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While the use of the Wassermann reaction in the diagnosis of syphilis has been largely replaced by various types of flocculation tests, the principle of complement fixation is now widely used in the diagnosis of such diseases as the psittacosis group of viruses, lymphogranuloma venerum, murine and epidemic typhus, Q fever, amebiasis, histoplasmosis, and some others.

Community Fly Control Operations - Oklahoma, 1950

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From a small beginning in 1949, when several cooperative community fly control insecticidal projects were operated in Oklahoma, a comprehensive over-all plan of promotion and operations has been developed. In the conception of a plan for State-wide development of these activities, promotional policies have been based upon a realistic acceptance of public interest in the spectacular nature of insecticidal control. This interest has been deliberately fostered as a direct means of focusing attention on community and individual premises environmental conditions. Spot maps indicating number of fly attractants and breeding sources found in reconnaissance sanitary surveys have been effectively used in promotion of premises sanitation and improvements in garbage collection and disposal.

FLY CONTROL TRAINING COURSE

Local health departments were selected as the logical agency for handling detailed promotion and technical supervision of local operational activities. In order to develop the interest of local health department sanitation personnel, and to better qualify them for technical direction of proposed local activities, a Fly Control Training Course was organized with the cooperation of Training Services Headquarters, CDC, and The School of Public Health, University of Oklahoma. The course was conducted at the Extension Study Center, University of Oklahoma, Norman, Okla., May 8-11, 1950. Approximately 50 certificates were issued for attendance at the training course. These included, in addition to county sanitarians, one sanitary engineer from the State Department of Health, six students from the University School of Public Health, two representatives from Arkansas CDC Activities, and one county health officer.

1950 FLY CONTROL OPERATIONS

Full-scale development of planned 1950 operations was somewhat complicated by excessive rainfall during July and August. It was anticipated that chemical insecticidal operations would not begin until the latter part of June or until early July when equipment would be available from the DDT Malaria Eradication residual spray program. Approximately 20 towns were either operating or in the process of beginning operations at the close of the fiscal year. Official weather reports showed 23 days of rainfall during July, and these general rains continued into August. This unseasonable weather not only interfered with operating projects but also served to reduce fly populations so that much of the need for extensive chemical insecticidal operations was obviated.

Despite these difficulties, a sufficient number of projects were operated to gain experience and develop refinements of procedure to formulate more comprehensive plans for full future projection of the activity on a State-wide basis.

PROMOTIONAL PROCEDURES

An outstanding factor in formulating promotional plans for this activity has been the lack of necessity for developing public interest and demand. Rather, the problem has been to channel existing interest in chemical control into public

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