Rocky Mountain spotted fever (RMSF) in man is rarely acquired by means other than tick bite. Nevertheless, a number of instances have occurred in the past, especially among laboratory workers, in which it was possible to infer that some of these rickettsial infections were transmitted aerogenically (3, 4).

Saslaw and Carlisle have presented incontrovertible experimental evidence that the etiological agent of RMSF, in remarkably small doses, can produce a true airborne infection in monkeys. A point to be emphasized is that a disease naturally transmitted by ticks can also be induced by aerosols of the microorganism. During the past decade or more, it has been demonstrated that a number of classical arthropod-borne diseases can be established in laboratory animals exposed to aerosols of the respective microorganisms; Venezuelan equine encephalomyelitis (6), Rift Valley fever, and yellow fever are a few examples (2).

A question that arises is: do aerosols of these infectious microorganisms play any role in the ecology of the diseases they produce? In analyzing the question, one comes to the conclusion that aerogenic transmission has little, if any, influence on the ecological aspects of the arbovirus diseases mentioned. It is tempting to speculate, however, that the aerosol stability of some of the rickettsiae might be of some importance in determining whether they can also be aerogenically transmitted. It can be shown experimentally that the aerosol stability of the rickettsiae of RMSF and typhus is relatively low, considerably lower, in fact, than that of the rickettsiae of Q fever (unpublished data), which is characteristically transmitted by aerosol in man. It is interesting to note parenthetically that RMSF and Q fever resemble each other ecologically in being involved with the same biotic tetrad—the rickettsiae, the ticks, vertebrates (mainly mammals), and man. The importance of ticks in the maintenance of both diseases in nature is unquestioned; yet, in man RMSF is caused almost
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exclusively by infected ticks, and Q fever is transmitted almost exclusively by aerosols. Thus epidemiological disease patterns may be influenced to some extent by the survival capacity of infectious microorganisms in the airborne state.

Another point of interest concerns the treatment of RMSF with certain antibiotics, which are, without question, highly effective therapeutic agents against the disease. Before the advent of antibiotics, mortality was exceedingly high and RMSF greatly taxed the symptomatic and supportive therapeutic resources available. One can see a dramatic reduction in mortality from approximately 20 to 5% since 1949, the year when antibiotic treatment was first introduced. It is a matter of record also that, with the availability of the highly effective therapeutic agents, the utilization of vaccine has correspondingly decreased—except perhaps for those at great risk. Despite the gradual decrease in the total number of cases reported each year since 1949 in the United States, and the reduction in the case-fatality rate, RMSF continues to be an important disease, especially among children in the South Atlantic States (5). Atwood et al. (1) have presented evidence which indicates that "the true incidence of RMSF is currently much greater than the number of reported cases." One reason for the discrepancies in the statistical data is the wide use of broad-spectrum antibiotics early in the course of many febrile illnesses. It was because of these facts and the almost complete reliance on antibiotics in dealing with this disease that an attempt was made to determine whether the rickettsiae of RMSF could be rendered resistant to selected antibiotics.

Employing the procedures of Weiss and Dressler (7) with some modifications, we exposed rickettsiae of RMSF in continuous passage to erythromycin (73 passages), oxytetracycline (55 passages), and chlorotetracycline (50 passages). Application of high antibiotic concentration to a large number of infected eggs was also attempted to isolate resistant mutants by subsequent passage in eggs injected with the same three antibiotics. In limited experiments, ultraviolet radiation was also employed as a mutagen. Under these kinds of experimental conditions, no anti-

biotic-resistant mutants have been isolated. This is not to be interpreted to mean that these rickettsiae cannot become antibiotic resistant. The matter of mutation rate may be involved—one much lower than $10^{-7}$ or $10^{-8}$. The data do suggest, however, that the chance appearance of antibiotic-resistant strains of RMSF is remote.

Although the danger of the rickettsial diseases has diminished, most of these infections remain widespread, constituting an ever-present threat to human health. RMSF will probably continue to be a problem in the United States, affecting about 200 persons or more annually. The number of cases might, in fact, increase because trends in land use seem to be increasing the amount of area suitable for tick habitation, and because many such areas are being suburbanized (1). Thus, in this country, RMSF merits continuing vigilance and research into methods for its treatment, control, and eventual eradication.

LITERATURE CITED


