quitoes by producing a musical note as near as possible to that given out by the female insect itself as a lure to a trap had been made, as he remembered, but I have no further knowledge of this effort as to its effectiveness.

ELIHU THOMSON

GENERAL ELECTRIC COMPANY,
LYNN, MASSACHUSETTS

THE NEED FOR A NEW EXPERIMENTAL APPROACH IN IMMUNOLOGY

THIS is an age of skepticism in immunology. By degrees the top-heavy superstructure of immunological truths (?) has been crumbling under the attack of the more liberal-minded workers, who are seeking to rationalize the cult of immunology in the light of chemical investigation. With the knowledge gained in the study of the protein molecule, its antigenic properties, its property of altered specificity and the part that haptenes play in altering this specificity, as well as the possibility of synthesizing antigens that will react specifically with antisera prepared from "natural" antigens; these and other trends in the more recent investigations in this field spell the doom of the older ideas, and lead the way for the final abandonment of the ornate concepts and terms that have dominated the subject and throttled any rationalistic advance up to this time.

No better evidence need be adduced to show the error of the older concepts of this branch of science than the repeated clinical failures with therapeutic agents prepared according to the established immunological theories. Even the long-suffering clinicians have ceased to clutch at the therapeutic straws that the immunologists have from time to time cast forth on the sea of hypothesis and look askance instead at any new therapeutic agent with an immunological background. In this they have recently been joined by the literary fathers of the profession,[1] so that at present the general question is "what is wrong with immunology?"

To one who is not an immunologist, a relatively simple answer offers itself at once. It may be briefly expressed by the single word—overspecialization. From a subject that originally centered about disease processes in animals or plants it has gradually developed until now it largely ceases to consider the disease and concerns itself instead with a very intensive investigation of the disease-producing agent and its various manifestations. Thus it has ceased to be the fashion to study the disease in its entirety and to substitute instead a finer and apparently more fruitless study of the alleged agent of causation of the disease. The immensity of this potential error is appalling. What if these diseases that in the main show such clear-cut clinical manifestations as to enable the clinician to constantly classify them, should be caused by agents other than those that are now credited to them! Think of the wasted immunological endeavor of recent years, if time shows that scarlet fever as it is clinically manifest, is due not to a single strain of streptococcus, but rather as recent workers are inclined to believe, to any one of a number of strains provided beforehand with a suitable environment and therefore producing a specific type of toxin. Contrast this with the greater progress that might have been made if the investigation of this disease had been conducted along lines controlled by fundamental biological facts, the chief of which being the close interrelationship between disease producing agents and their environment. How uneasy must Sydenham, Jenner, Pasteur and Koch rest when they view our repeated attempts to replace observation and experimentation *in vivo* by methods *in vitro*! One of the greatest assumptions that over-specialization in the field of immunology has sanctioned is that the test-tube is analogous to the living host. This has been a considerable handicap to progress and has led to more wasted effort than any other single factor. Fortunately the view-point is already changing and evidence is rapidly accumulating to show what an important influence the host exerts in the fundamental biological characteristics of the invading organism in cases of infectious disease. Witness the recent work of Veblen[2] who on growing certain organisms like *Streptococcus viridans* and *Bacillus typhosus* for several generations in dilute horse serum is able to demonstrate agglutination of these organisms in high dilution with an anti-horse rabbit precipitin serum, the organisms losing at the same time their ability to agglutinate with specific bacterial agglutinating sera.

In order therefore to depart from the unbiological lines of investigation that this subject has followed in the past, it is suggested that the time seems now ripe to chart and follow another line of research; one that will above all give adequate consideration to the behavior of the host in the process of attack from the invading agent. Promise of success in the light of such an attempt is not lacking. Already there is accumulated evidence to show that the cellular aggregate that goes to make up the organs and tissues of the invaded host has something to contribute toward influencing the biological nature of the invading agent. The recent work of Laidlaw and Dunkin[3]

[1] Editorial in *Journal* of the American Medical Association, Vol. xciii, p. 1890.

[2] Veblen, *Soc. Exp. Bact. and Med.*, 27: 204, 1929.

[3] P. P. Laidlaw and G. W. Dunkin, *J. Comp. Path. and Therap.*, 41: 1, 1928.

suggests that the virus of distemper when "hybridized" with the tissue of the dog (splenic pulp) is a distinct immunological entity from the same virus hybridized with the tissue (splenic pulp) of the ferret.

In this new approach due consideration should be given to the fundamental biological laws. For example no essential difference should be recognized as existing between the rapidly growing invading organism and the equally rapid growth and development of the cells of the host during the height of invasion. Just as the bacterial agents in process of their metabolism produce certain agents injurious for the host, it is likely also that those cells of the host at the site of invasion produce metabolic products that are injurious to itself. If these bacterial products by virtue of their nature as proteins, are able to lead to the production of specific interacting substances demonstrable by certain physico-chemical phenomena, *e.g.*, agglutination and precipitation, then it might be equally true that certain toxic products of the invaded cells of the host, by virtue of their protein nature, or, as likely, by their ability to act as haptenes to the main protein radicle involved in the chemical reaction, would lead also to the production of certain specific substances interacting either with the composite antigen or with the haptene group derived from the host cells.

If this newer conception be correct, then recovery from infectious disease is due to the development of neutralizing substances to the foreign proteins in the tissues and blood of the infected individual which result not only from the invasion and growth of the bacterial invader but also from the cellular destruction in the host. Such foreign proteins from the host being antigenic for the same species is not just a hypothetical possibility, as it has already been demonstrated by Landsteiner[4] to be true in the case of homologous tissue protein (serum albumin) treated with formaldehyde, nitrous oxide and other chemical agents.

Thus it seems altogether desirable that future investigations dealing with the production of therapeutic agents in diseases of bacterial origin, should develop along lines directed at establishing conditions similar to those that govern the interaction between the invading organism and the host, such as for example the production of the essential features of the disease in lower animals, followed by the utilization of such material from the involved tissue as a composite antigen to be used in the production of antisera. It is to be hoped that future experimental evidence will show that such antisera contain readily available neutralizing substances directed at the dual toxemic products of both bacterial and tissue destruction that result in the course of these bacterial infections.

THEODORE J. CURPHEY
HERMAN B. BARUCH
UNIVERSITY AND BELLEVUE HOSPITAL MEDICAL COLLEGE,
NEW YORK, N. Y.

[4] Landsteiner and Jablous, *Z. Immunitat.*, 20: 618, 1914.

RUMBLING CLOUDS AND LUMINOUS CLOUDS

A BRIEF description of two rather unusual cloud phenomena which have come to my notice may be of some interest. One of these was observed from the east shore of a narrow bay of Cache Lake in Algonquin Park, Ontario, on an early morning during the latter part of July of this year. It was a chilly morning and the sky was completely overcast with clouds. My attention was attracted by a rumbling sound coming from the west, such as heralds the approach of a heavy thunder storm. As I watched, a very long, low, narrow, tenuous cloud, resembling a squall cloud, appeared above the trees on the opposite shore, moving at right angles to its length. The continuous, rumbling noise, now grown remarkably loud, seemed to come unmistakably from this cloud, whose cross-sectional diameter was only about 200 feet. The cloud passed overhead eastward and was not followed by the expected rain storm. The cloud apparently marked the meeting place of two oppositely directed currents of air that differed in temperature. It seems almost incredible, however, that so much sound could have arisen from the agitated air alone, and yet this seems to be the only plausible explanation of its origin. I steadfastly looked for small lightning flashes in the cloud and saw none, although they would have had to come in rapid succession to produce the persistent sound which was heard. The noise could not have come from the rattle of hail because the cross-section of the cloud was too small to give time for hail formation; and in any case no hail fell.

The other cloud I wish to describe was a solitary, brightly luminous, cumulus cloud which I saw on a clear summer night at Hutchinson, Minnesota, some thirty-five years ago. The cloud had a horizontal diameter of about a third of a mile and a thickness of about one fourth of that distance. It rose majestically from the eastern horizon, shone with a uniform, steady, vivid, whitish light and passed directly over the town. When the cloud was overhead a great shower of insects descended to earth covering the ground all around to the number of about 50 to 100 per square foot. These insects proved to be a species of hemiptera and were non-luminous. They had apparently been induced to take wing by the bright object in the sky. I have been at some loss to account