the money for the building was raised and given to the college. The museum is open to the public and contains about half the teaching exhibits of the department of zoology, including 225 mounted birds (New Jersey), 90 bird skins (native and exotic), skeletons of vertebrates, preserved materials, anatomical models and common invertebrates and smaller vertebrates of the state.

DISCUSSION

A POSSIBLE MEANS OF CUTTING DOWN THE MOSQUITO POPULATION

LAST July, while operating a large electric resistance heater enclosed in the fire-brick structure used for spraying quartz to form a mirror blank, Mr. A. L. Ellis called my attention to the circumstance of myriads of what seemed to be mosquitoes dead and resting on the broad domed top surface and in crevices in the top of the furnace. This demanded an explanation, and the following is taken from a memorandum that was made:

Mr. Ellis has called my attention to the fact that during the operation of the furnace in spraying the 60-inch quartz disk recently, great numbers of what appeared to be mosquitoes have fallen on the top of the dome which covers the furnace in which the spraying is going on. The total number of these insects which have met their deaths above this furnace seems to be many thousands; undoubtedly a great lot of them have been blown away. On collecting some of the corpses which are abundant on top of the furnace, especially in the cracks, I have tried to determine the sex of these insects, whether they are females or males. This raises another question. If the insects found are males, why do they appear at the furnace in such large numbers? There is a possible answer which may or may not be true. The electric devices near the furnace produce a fairly strong three-phase 60 cycle hum, pervading all the space around it. Can it be possible that this hum represents the hum of the female mosquito and serves an an attraction for the males which gather where the noise is prevalent? If this were the case, then we should be able to account for the vast numbers of these creatures which have come to their deaths in approaching the furnace, and furthermore, and more important, there may be pointed out some way of getting rid, to a large extent, of the mosquito population. Certainly, if the male can be drawn to a spot and cooked, then the egg-laying power of the female would be curtailed, and we shall have a great diminution in the mosquito population, provided the above reasoning is in accordance with fact and provided devices are developed to produce a three-phase 60 cycle hum where mosquitoes are bred and spread about, with means for destroying the mosquitoes which are so attracted. They may be burned, or drowned, or shocked, or cooked.

ELIHU THOMSON

(July 14, 1931.)

The mosquito season passed, and there are now no such insects for further experiments. Let me add that where the event in which the foregoing was based took place was at the River Works (Saugus River) of the General Electric Company at Lynn, Massachusetts. Southwest of the works is an extended area of marsh land, much of it covered with pools, either due to rains, or to overflow at high tides from the sea.

Recently, in telling of the above suppositions of mine to Professor George H. Parker, of Harvard University (Department of Zoology), he kindly confirmed my guesses by saying that only the female mosquito sings or produces its characteristic note when flying, and that the males are provided with bushy antennae projecting from the head on each side, and that these are the organs of hearing, whereby the male recognizes the presence of the female somewhere near.

Now, the three-phase 60 cycle hum of the heaters in the furnace—a sort of third harmonic to the 60 cycle rate—is to my ear an exact representation of the noise one hears as a female mosquito visits one in the night, and one endeavors to crush the annoying creature by a slap of the hand on the side of the face where the pest appears to be ready to draw blood from the victim of its attentions. The fact that the note from the furnace is individual (a single note) and that its reach must be great on account of the size of the furnace itself, the object from which it emanates, would account for the multitude of males which flew towards it from the marsh land during the period of operation of the furnace.

The insects evidently hovered for some time over the warm roof of the furnace itself, and were thus gradually desiccated and fell thereon.

Can the whole race of them be thus decimated or extinguished by proper utilization of these principles?

It is notable that, in spite of the great swarm of insects, there were no reports of bites from the men employed in the furnace house. The males do not bite. The females do so, in attempting to secure nutrition for the nourishment and development of the eggs which they proceed to lay in the stagnant pools. It is easy to organize an electro-magnetic "hummer" which, at small expense of energy, can spread over a large space the peculiar hum, and attract the males; perhaps also repelling the females. Various ways of trapping the males may be suggested, as they need not be desiccated or cooked to get rid of them.

It should be added that I was informed by Dr. Parker that some efforts at attraction of male mos-

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.