

CDC BULLETIN

JULY AUG. SEPT. 1949



**FEDERAL SECURITY AGENCY
PUBLIC HEALTH SERVICE
COMMUNICABLE DISEASE CENTER
ATLANTA, GEORGIA**

CDC BULLETIN

July - Aug. - Sept. 1949

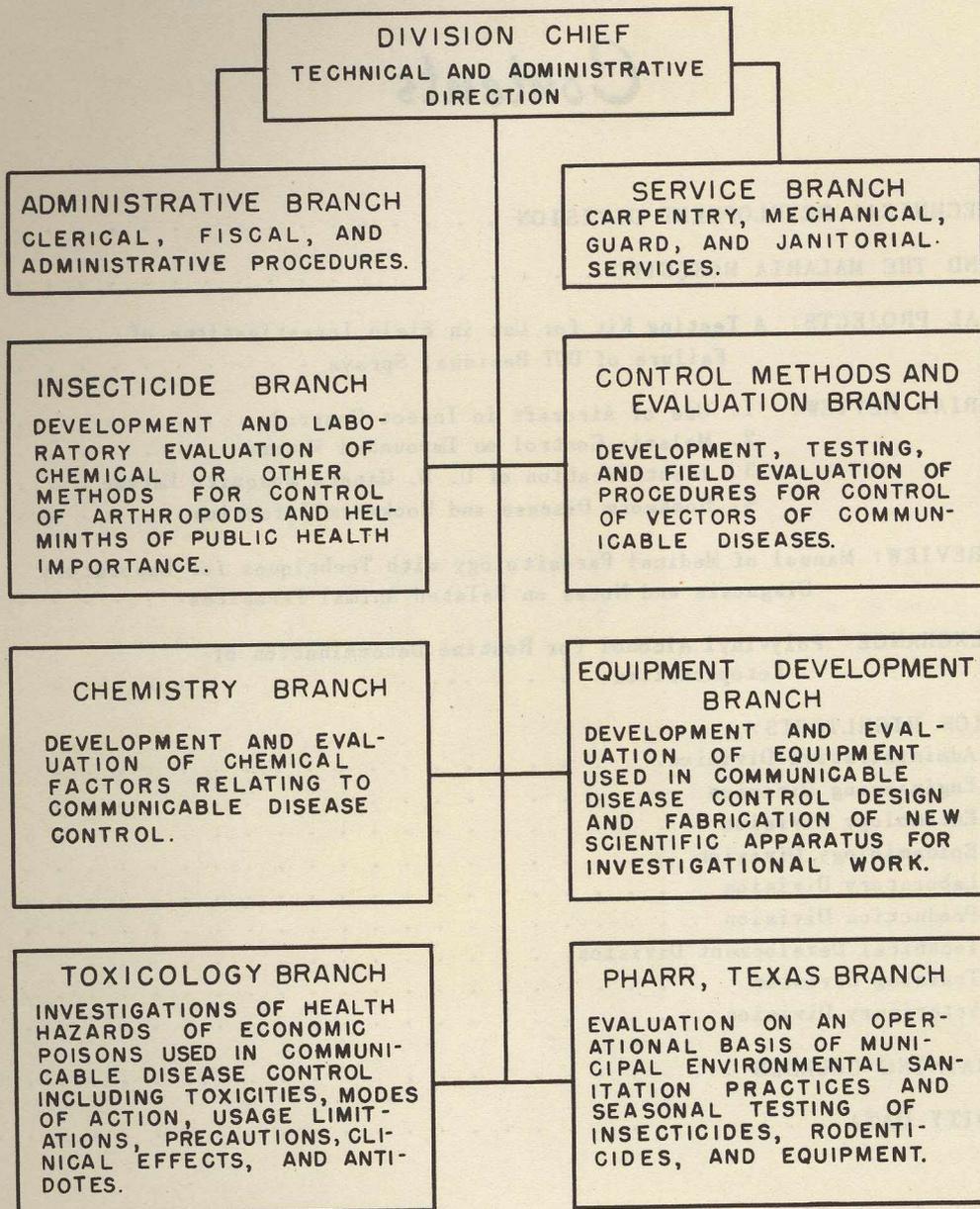
Contents

THE TECHNICAL DEVELOPMENT DIVISION	1
DDT AND THE MALARIA MOSQUITO	13
SPECIAL PROJECTS: A Testing Kit for Use in Field Investigations of Failure of DDT Residual Sprays	14
PICTORIAL REVIEW: 1. Use of Aircraft in Insect Control	16
2. Malaria Control on Impounded Waters	17
3. Identification of U. S. Genera Mosquito Larvae	18
4. Hookworm Disease and Hookworm Infection	19
BOOK REVIEW: Manual of Medical Parasitology with Techniques for Laboratory Diagnosis and Notes on Related Animal Parasites.	20
IDEA EXCHANGE: Polyvinyl Alcohol for Routine Determination of Ectoparasites	21
DIVISION HIGHLIGHTS:	
Administrative Division.	25
Engineering Division	28
Entomology Division	33
Epidemiology Division	37
Laboratory Division	40
Production Division	43
Technical Development Division.	44
Training Division	53
Veterinary Division	56
CDC TRAINING COURSES	60
MORBIDITY DATA	61

Material in this bulletin is not for publication.

FEDERAL SECURITY AGENCY
PUBLIC HEALTH SERVICE
COMMUNICABLE DISEASE CENTER
Atlanta, Georgia

TECHNICAL DEVELOPMENT DIVISION
SAVANNAH, GEORGIA



The

TECHNICAL DEVELOPMENT DIVISION

Samuel W. Simmons - Senior Scientist
Chief, Technical Development Division

The Technical Development Division, situated at Savannah, Ga., is an arm of the Communicable Disease Center responsible for the development of new information, techniques, materials, and equipment to improve present practices in communicable disease control. In addition to new developments, responsibilities also include: an evaluation of current discoveries in this field and the devising of procedures for their practical application; a continuous survey of existing materials, equipment, and procedures to determine if they meet required specifications; and the correction of deficiencies.

Specific problems undertaken usually originate from deficiencies on operational programs, and the various cooperating States are kept informed of usable



development.

The Division at present consists of six technical and two service Branches. With the exception of one Branch, these are housed in Savannah in 15 structures: 2 main buildings, and 13 prefabricated, or similar structures, utilized as shops, animal houses, auxiliary laboratories, and warehouses.

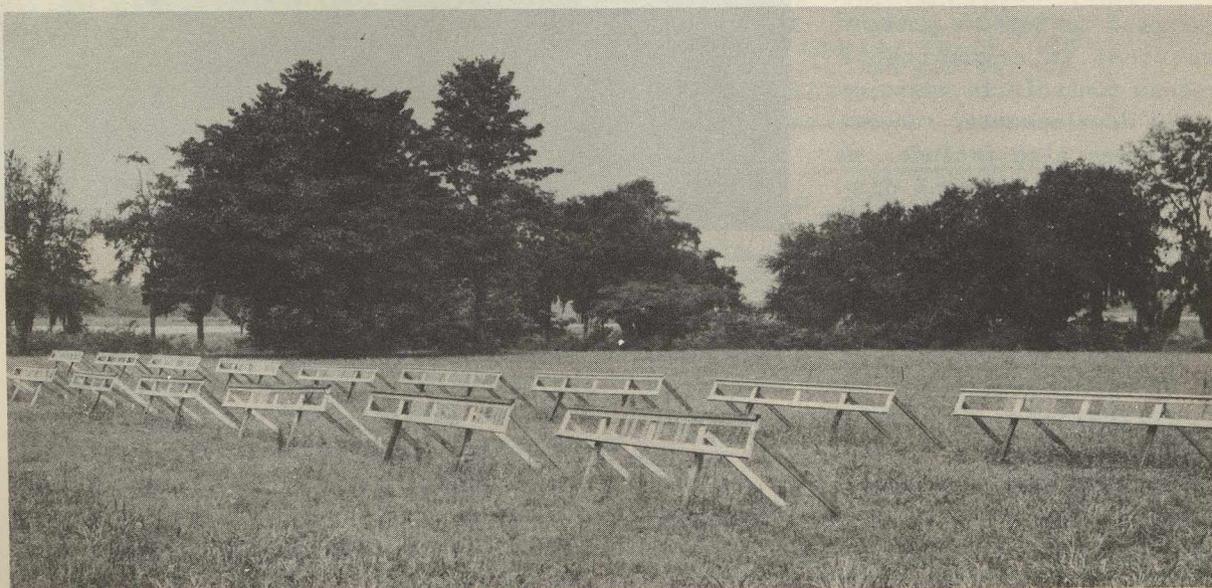
Insecticide Branch

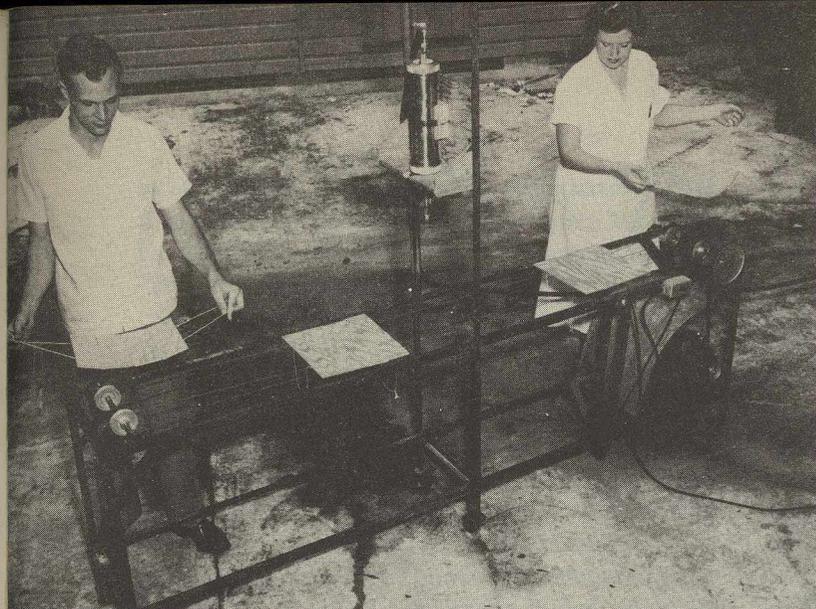
The work of this Branch is essentially a laboratory function. Among its many problems are toxicity, dosage, and residual evaluations of insecticides against both adult and immature forms of various species of mosquitoes, flies, fleas, mites, lice, or other actual or potential arthropod disease vectors. It evaluates the effectiveness of insecticides under various simulated conditions of use, such as residual effectiveness on various types of wall surfaces and under different meteorological conditions. The acquired resistance of certain arthropod disease vectors to various insecticides is a problem of paramount importance and is under investigation. A study of aerosol and residual treatment for airplane disinsectization is under way, and the behavior patterns of arthropods exposed to insecticides and the relation of these to field control have received attention. Laboratory studies on the chemical control of hookworms in the soil are also a

function of this Branch.

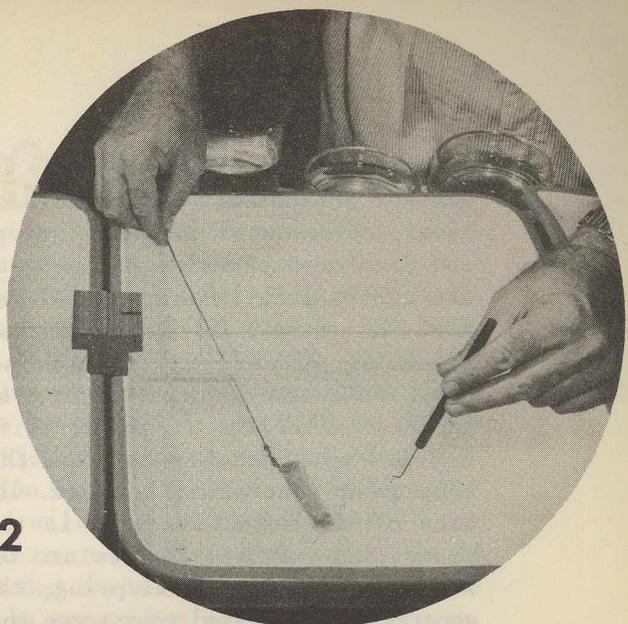
Work with *Anopheles quadrimaculatus* mosquitoes has shown that: (1) Residues of less than 100 milligrams of DDT per square foot were inferior for mosquito control; and residues of more than 200 milligrams per square foot were not as a rule sufficiently better, for interior use, to be economically feasible. Deposits of 200 milligrams gave indications of satisfactory control for 4 months. (2) The type of surface treated affects the final distribution and residual effectiveness of DDT residual deposits. The emulsion or solution sprays may be absorbed in some surfaces and the DDT crystals permanently or temporarily occluded. Linoleum, fresh paint, and some types of adobe represent surfaces of this nature. (3) Grease, smoke, and dust deposits occlude the activity of DDT residual deposits. Dry-cleaning, ironing, and vacuum-cleaning of DDT-treated surfaces, and waxing, shellacking, or brushing treated surfaces all caused decreased

Test panels are exposed in racks to weathering conditions (sun, wind, and rain) for varying periods before determining residual effectiveness.





1

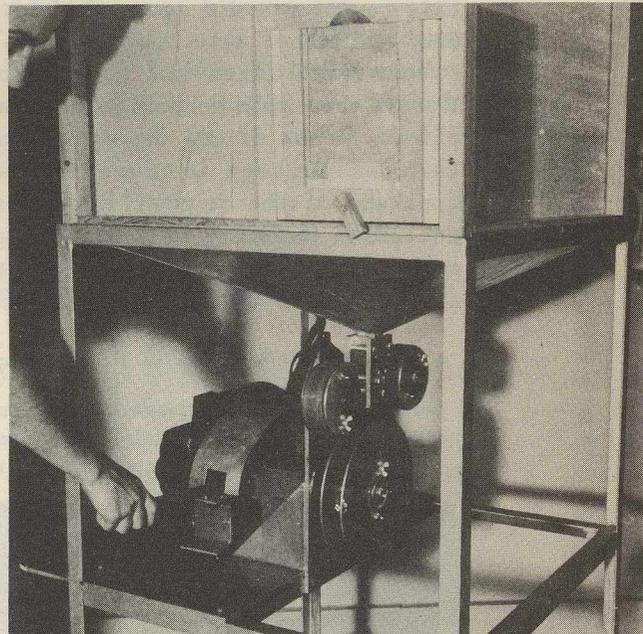


2

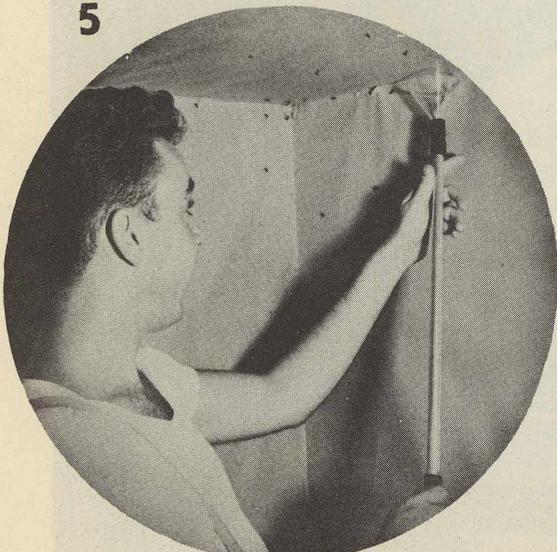
3

TESTING FOR TOXICITY

1. Test panels for evaluation of residual toxicity of different insecticides are prepared on a spray machine which allows rapid production with close control to produce duplicate applications.
2. In testing larvicides, mosquitoes are introduced under a barrier and allowed to rise to surface film. After definite exposure periods they are removed and held for 24 hours to determine mortality.
3. In the study of insecticide resistance, the length of exposure necessary for knock-down is recorded by a machine which catches the affected insects between two layers of scotch tape.
4. In the evaluation of mosquito larvicides, surface treatment of the water with insecticides is applied to one portion of specially constructed pans.
5. In the evaluation of aerosols for disinsecting aircraft, flies are exposed to insecticides in a paper-lined Peet-Grady chamber and after a measured exposure period the flies still active are gathered with an aspirator and held for 24 hours to determine mortality.



5



4



effectiveness of the deposit. (4) Chlordan, benzene hexachloride, pyrethrin combinations, chlorinated camphene (toxaphene*), and dichlorodiphenyldichloroethane (DDD) are not as long lasting as DDT for adult mosquito control. (5) By means of selective kills of 66 percent of each sex, DDT resistance was induced. This resistance appeared after the first selective kill, and did not increase through the three subsequent generations studied. The omission of the selective kill in the fifth generation resulted in a return to normal resistance in their offspring, the sixth generation. Increased resistance to DDT and the methoxy-analogue of DDT was shown, but this resistance did not extend to chlordan, BHC, and DDD.

Work with flies has shown among other things that: (1) Houseflies caused loss of effectiveness of DDT deposits more rapidly than mosquitoes because of mechanical breakage of the crystalline deposits, and occlusion possibly by fecal droppings and regurgitation deposits. (2) DDT-resistant strains of the housefly have appeared in the

field throughout this country. Comparative kills of these flies may be as extreme as 5 percent compared with a 100-percent kill of nonresistant strains under comparable conditions. (3) The blowfly, *Phaenicia pallescens*, appears, in the laboratory, to be harder to kill with DDT residuals than the housefly or the blowfly, *Callitroga macellaria*.

Techniques have been developed for the mass rearing of rat ectoparasites, and for the mass testing of insecticides and acaricides against these forms. Among the many compounds tested several, including benzene hexachloride (10 percent gamma isomer), xanthidrol (100 percent), propionyl valone (50 percent), and 1,4 naphthoquinone (5 percent), have given satisfactory preliminary laboratory kills of *Liponyssus bacoti*. Tests were made with dusts at the rate of 200 milligrams of mixture per square foot of area treated. Due to the lack of knowledge of possible toxic hazards to man, and to the absence of adequate field tests, none of these compounds can, at present, be recommended for operational programs.

*A product of the Hercules Powder Company, Wilmington, Del.

Adult flies are tested against insecticides in a chamber with two sections: in the lower one, the flies contact insecticidal deposits and breathe the fumes; in the upper one, the flies breathe the fumes only. Flies are introduced into the chamber by means of plungers and removed by air currents.



Pharr, Texas, Branch

A field laboratory has recently been established in this Division at Pharr, Tex., in the Rio Grande Valley. Climatic conditions in this area are such that insect activity occurs throughout the year. The major vegetable and fruit harvest occurs during the winter months and is accompanied by heavy fly breeding in the wastes produced. Such conditions will permit the Division to carry on year-round outdoor vector-control activities which are not possible with many species in the Savannah area. This will supplement the work on the Control Methods and Evaluation Branch, and will permit testing on a semioperational basis.

A municipal sanitation study program is under way at the Pharr Branch, and particular attention is directed toward the developing and field testing of practical sanitary procedures detrimental to vermin propagation. The broader effect of proper sanitation on the incidence of filth-borne diseases will receive consideration.

Almost any aspect of work under way at Savannah that needs more extensive field testing can be undertaken at the Pharr Branch. This especially includes the testing on a semioperational basis of insecticides, rodenticides, and equipment used in communicable disease control. In the main, however, environmental sanitation studies are stressed.

Control Methods and Evaluation Branch

This Branch, the Pharr, Tex., Branch, and the Insecticide Branch supplement each other. The Insecticide Branch furnishes information to the Control Methods and Evaluation Branch for field tests of practicability, and semioperational evaluation is conducted at the Pharr Branch as indicated. In addition, problems that arise in the field often initiate further investigational work, which may be undertaken, or referred to the insecticide laboratory, the chemical laboratory, or the Equipment Development Branch.

The control methods and evaluation group tests under field conditions new insecticidal and similar formulations to determine proper dosages, efficiency of kill, and general suitability. They investigate the hazards of chemical control of insects to fish and wildlife, if the chemicals are to be used in a wildlife environment. They, in conjunction with the Pharr Branch, blue-

print operational procedures and suggest organization for operational programs on vector control. Various types of equipment are tested for a biological evaluation of such factors as quantity and area distribution, and particle-size dispersal. This Branch also determines breeding places and field habits of vectors under investigations, and studies environmental control practices, where indicated.

A limited survey of wild animals of the area is carried on for determining ectoparasite infestations.

Some examples of practical accomplishments of this Branch are: (1) Development of operational techniques used in residual house spraying programs for large-scale malaria control. (2) Development of the use of a surface application of 0.05 pound of DDT per acre in fuel oil for control of anopheline larvae when applied as a mist, at the rate of 1 gallon of spray per acre.

TESTING OUTDOOR
SPACE SPRAY FORMULATIONS
FOR FLY CONTROL

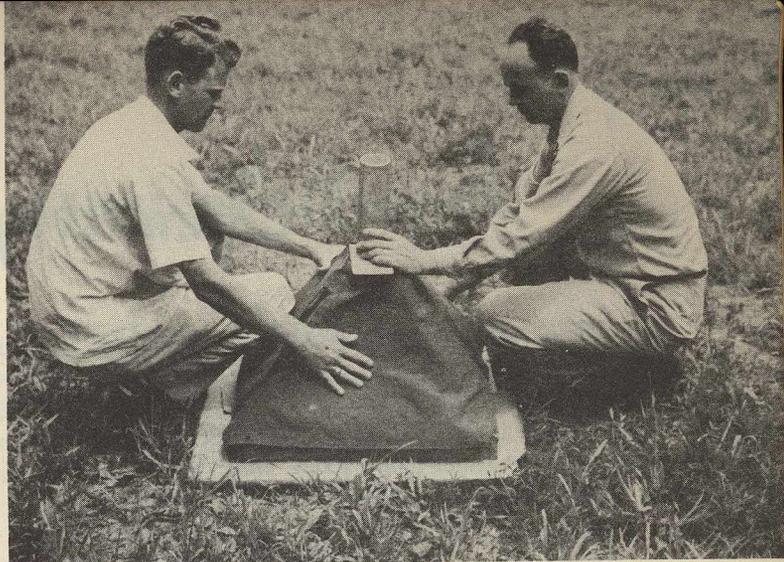


Applying space spray on flies congregated on a bait attractant.

(3) Evaluation for damage to wildlife of the accumulative effect of three consecutive years of routine mosquito larviciding by airplane with DDT in Velsicol NR-70*, applied as both aerosols and sprays at the output dosage of 0.1 pound of DDT per acre. Seventeen to 20 treatments were applied per year, and it was found that environmental fluctuations in test ponds produced more change in the fish population than the use of the DDT larvicides. Observations on practically all forms of terrestrial and aquatic wildlife present in the test areas during the first year, and on terrestrial insects during the first 2 years, revealed no catastrophic kills due to the DDT applications. (4) Heavy dosages of DDT and benzene hexachloride have given relatively long periods of effective control against both anopheline and culicine larvae. When applied as an emulsion at the rate of 1 pound of DDT in 1 or 2 gallons of finished spray per acre, 3 to 5 weeks' control was obtained; 3 pounds of DDT per acre gave 8 to 16 weeks' control; and 1 pound of technical grade benzene hexachloride (10 percent gamma isomer) gave 5 weeks' control.

A water-wettable powder containing 25 percent gamma isomer of benzene hexachloride, applied as a finished spray at the rate of 4 pounds of powder per acre, gave 8 to 12 weeks' control. These heavy treatments are not recommended in areas where fish or other wildlife are of importance. (5) Using animal-baited houses, equipped with window traps to capture escaping mosquitoes, and treated with DDT at the rate of 200 milligrams per square foot, it was found that of the naturally entering *Anopheles quadrimaculatus* which were recovered during the first 4 months after treatment: (a) approximately 59 percent were recovered dead inside the treated building, 11 percent dead in the traps, and 30 percent alive in the traps; (b) approximately 22 percent (53 percent of those escaping the building) survived over 24 hours; (c) 67 percent were able to obtain a blood meal; and (d) only 15.5 percent were able to obtain a blood meal, escape the treated building, and survive for over 24 hours. Similar data obtained on *Mansonia perturbans* showed a slightly larger total survival, but fewer were able to feed, escape, and live for

*A product of the Velsicol Corporation, Chicago, Ill.



⬆ Transferring flies to holding cages for observation to determine 24-hour mortality.

⬅ Trapping flies after spray application.

24 hours. These studies indicate that if the absence of mosquitoes in a DDT-treated building is used alone to measure the effectiveness of the treatment, the apparent control may be somewhat better than that actually obtained. There was, however, an indicated 80 percent reduction in the number of engorged *A. quadrimaculatus* from the treated building, surviving over a 24-hour period, as compared to those from the untreated building. This coincides closely with results obtained from the large-scale residual DDT spraying program in the southern United States, which is considered to have greatly reduced the hazard of malaria transmission. (6) Environmental sanitation studies on the control of fly breeding in urban areas have revealed no important breeding sources, in the city studied, which could not be greatly reduced or eliminated entirely by improved sanitation of a practical nature. Sanitation is strongly recommended as an efficient and practical means of municipal fly control, especially in view of the added benefits of partial control of rats, cockroaches, and other vermin of public health significance, and of the increasing appearance of strains

of flies resistant to DDT and other new insecticides often considered as panaceas for fly control. More extended environmental sanitation studies than are indicated at Savannah are carried on at the Pharr, Tex., Branch.

Field studies on rodent ectoparasites have shown: that 10 percent DDT dust properly applied to rat- and flea-infested premises will ordinarily effect an initial kill of fleas of 95 to 98 percent, and control is usually about 85 percent effective after 4 months. More recent tests have shown: (1) That 5 percent dust is essentially equal in effectiveness. (2) That the use of 5 percent DDT emulsion spray is effective for the control of rat fleas in farm buildings. Sprays are more costly than dusts, but a combined spray-dusting technique may be employed where a combination malaria-endemic typhus control program is desired. (3) That by the proper application to buildings of a 20 percent ANTU, 8 percent DDT dust there was, on the average, only a 50 percent kill of Norway rats but effective control of rat fleas was obtained. ANTU is not considered to be of value against the roof rat, *Rattus rattus*.

Chemistry Branch

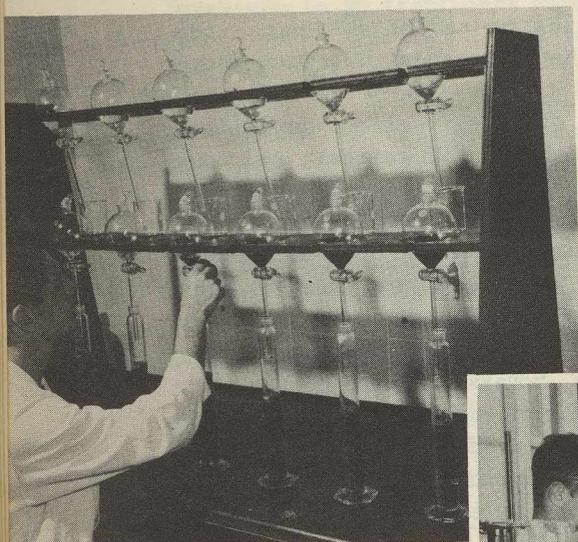
The work of this Branch is mainly of a laboratory nature, but chemical problems arising in the field may be investigated on the spot. To date, the work has been chiefly concerned with insecticides and rodenticides. Included in the problems has been the study of various DDT and other insecticidal formulations for residual adult sprays or mosquito larviciding. Considerable work has been devoted to the testing of commercial solvents, emulsifiers, diluents, and other ingredients of insecticides for suitability on operational programs. Service work of this nature has been heavy and has included the preparation of specifications, based on tests, for the purchase of materials needed in the field. Also materials purchased are tested by the Chemistry Branch for compliance with specifications.

This Branch is engaged in small-scale synthesis of selected new chemical-control agents, and cooperates with the Toxicology

Branch in a limited study of potential antidotes for dangerous rodenticides.

Investigations have shown that volatilization is a factor in the loss of DDT used as a residual spray. Dosages of 200 and 400 milligrams of DDT per square foot applied as a kerosene solution to glass panels showed a loss of 25 percent of the DDT over a 7-month period, at an average temperature of about 26° C. Exposure to ultraviolet light over a period of 4 months at 5° C. caused no appreciable loss.

DDT has also been found to be inactivated by the bottom-mud complex of ponds. After treated waters become nontoxic to mosquito larvae, DDT may be chemically extracted from the mud, where it is inactivated probably by a process of absorption. The recovered DDT has normal toxicity and has been found in sufficient quantities to effect control if it had not been tied up by the mud.



Extracting DDT from a milk sample in connection with the determination of possible contamination of milk by the residual spraying of barns with DDT.



A general view of the chemical laboratory of the Technical Development Division. Left — determining the flash point of a xylene sample; Center — preparing a DDT concentrate; Right — crystallizing a potential new insecticide.



Equipment Development Branch

This is an engineering function of the Division concerned principally with the design and experimental fabrication of equipment needed in communicable disease control. Thus far activities have been limited mainly to studies on insecticidal dispersing equipment, and to the designing of special laboratory apparatus needed by the Division. Investigations involve both hand and power ground equipment, as well as airplane assembly.

Recent developments and improvements in mechanical equipment have included a 4-gallon capacity hand spray can with an oval-shaped filler opening in the bottom, which permits sealing of the lid from the inside. This design provides a positive pressure liquid seal and insures against air leaks around the head gasket.

Constant pressure hand sprayers utilizing concentric tanks for separate air and liquid compartments which permit more uniform application of insecticides have been made. More efficient operation by spray crews also results from the use of the constant pressure apparatus.

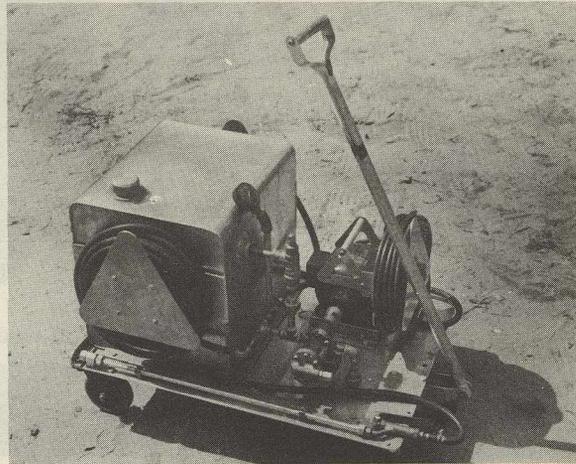
A power sprayer having a 12-gallon capacity tank has been designated as an "Institution Sprayer." Its convenient size and high degree of portability adapt it for use in the indoor spraying of hospitals, prisons, hotels, and other similar structures.

An all-purpose power machine for outdoor spraying, dusting, and misting operations has been designed in a size that will fit onto a ½-ton pick-up truck, and provides for a liquid capacity of 110 gallons. This unit is intended primarily for small, municipal health departments for use in the treatment of streets, alleys, and garbage dumps; but it is also equipped so that it may be used for inside residual applications.

A variety of design changes have been made in shut-off valves, wands, spray

nozzles, and pumps to better adapt them for use with DDT and other new insecticides utilizing xylol or other active solvents.

Ratproofing studies involving the testing of resistance to gnawing and the methodology of use of various types of materials used in ship construction or in the building trades are also centered in this Branch. Insofar as possible, testing is carried out to simulate conditions of use.



Portable power sprayer suitable for treatment of hospitals, warehouses, and hotels with DDT-xylene aqueous emulsion or other insecticides.

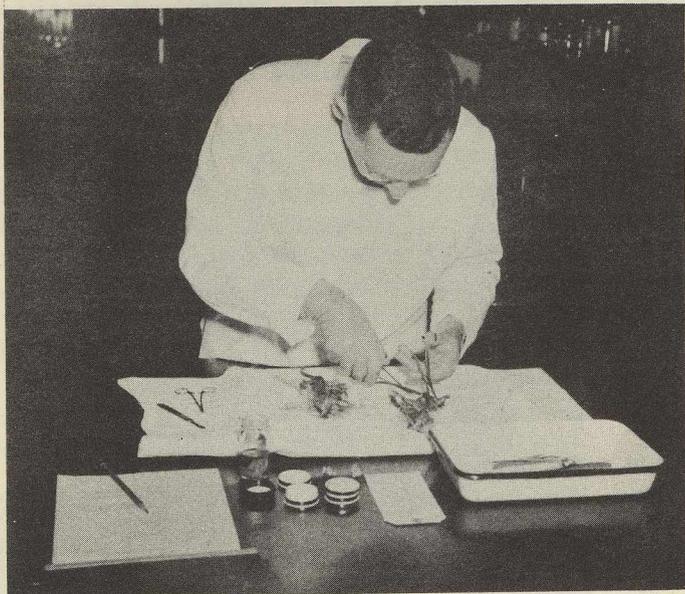
It has been shown that, when repeatedly exposed to wild, caged ship rats, *R. rattus*, aluminum alloys with a Brinell hardness of up to 120, and a thickness of 0.064 inch (14 gauge, American) can be penetrated if any gnawing edge is exposed; and that special asbestos and portland cement boards, formed under pressure, have great resistance to penetration.

Limited tests are occasionally made of various types of guards for use in preventing rats from boarding ships or entering buildings.

Toxicology Branch

There have been few recent developments in the field of public health that have contributed more to the control of human-disease vectors and reservoirs than the discovery and application of new chemical agents. Typhus, plague, certain dysenteries, malaria, and other dis-

eases have bowed to their power. Many new effective chemicals are being synthesized, but their future safe utilization depends upon a comprehensive knowledge of their toxicity to man and animals. Several new effective insecticides are at present being held in abeyance because of lack of toxicological data.



Post-mortem examinations are made of experimental animals to determine any pathology caused by exposure to insecticides.

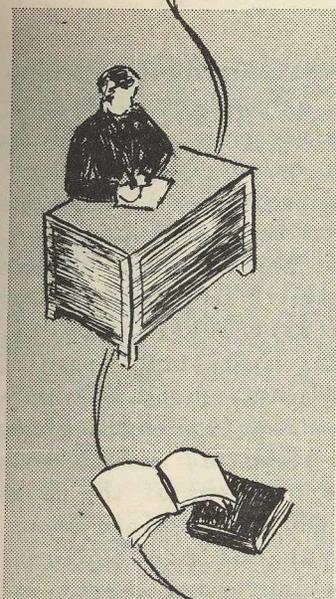
A polarograph is used in the chemical determination of insecticides in connection with toxicological investigations.



The Technical Development Division has recently established a Branch for a study of the toxicology of new chemical agents (solids, liquids, and gases) used in communicable disease control, and plans to undertake work on: (1) the relative toxicities and modes of action to laboratory animals; (2) usage limitations, i.e., conditions under which various chemicals can be safely used in the field, including operational techniques, precautions, and types of programs for which adapted; (3) clinical and laboratory manifestations of authentic cases of accidental human poisoning; and (4) antidotes for important commonly used insecticides and rodenticides. These are long-term investigations but, due to the meager amount of data on the subject, they should contribute some usable information soon after their inception.

Laboratory rodenticide studies are centered in the Toxicology Branch and involve the testing of chemicals for toxicity, dosage, acceptability, hazards, and general effectiveness. Included also are studies on the formulation of liquid and dry baits, emetics, and rat attractants. All rodent work involves observations on the environmental habitat and general ecology of commensal rats.

Administrative Branch



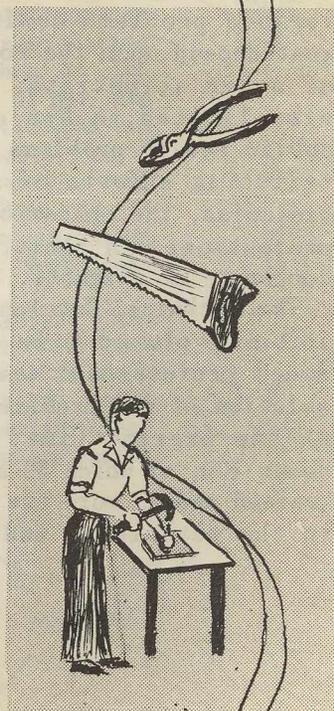
A chief liability in too many laboratories is the necessity for investigational personnel to be burdened with routine administrative duties. A small, efficient administrative unit, well versed in the present-day maze of fiscal procedures and familiar with technical equipment and supplies and their source of procurement, will contribute to the caliber and quantity of research as much as almost any other factor.

The Administrative Branch functions to relieve technical personnel of all except absolutely necessary procedures in the field of procurement, personnel, and all other fiscal matters. It keeps on hand an up-to-date stock of most needed supplies and, under a professional librarian, administers a technical library.

Service Branch

The shop services of this Branch deserve special comment since good shops should be a part of every research establishment. In most investigational work, special apparatus is required; but the ideas for its design often do not materialize because of the lack of shop facilities and experienced wood- and metal-working personnel to fabricate the items. In other instances the scientist, who may be totally inept at shop work, spends many hours or even days fabricating an experimental apparatus, and may even then end with an inferior product.

The shops of this Branch fabricate numerous types of special apparatus required by the various laboratories, including such items as insect and animal cages, traps, exposure chambers, constant temperature and humidity cabinets, Peet-Grady chambers, and numerous other items. In our experience, good shops, both machine and wood, are not only decided economic assets but also necessities to a research laboratory.



Professional Organization

With the advancement of science, its various specialities have become relatively less sharply defined due to their dependence on, and overlapping into, numerous other specialities. There was a time when, for instance, the field of public health and medicine in general was thought to be fairly well covered by the physician; and perhaps it was, since the available knowledge was not too varied and voluminous for a single profession to assimilate. Now medical science has become, through more recent discoveries, the business of the physician, the chemist, the biologist, the engineer, the veterinarian, the bacteriologist, the physicist, the psychologist, the sociologist, and others. Frequently, many of these must contribute their combined efforts toward the solution of even a single well-defined problem. The entomologist can no longer rely on his knowledge of insects to handle the various problems confronting him, but must depend upon the coordinated efforts of other scientists. The engineer is also limited in his ability to solve public health problems without the contributing efforts of the chemist, the biologist, the epidemiologist, and other professions. In short, scientists must cooperate or stagnate.

The Technical Development Division was initially planned to be composed of a balanced professional team suited for the solution of the problems confronting it. At the present time, personnel total about 100, of which 30 are professionally trained and 25 more are at various levels in the technician and subprofessional

categories. The remainder include machinists, mechanics, carpenters, laborers, and other service personnel. The various categories are so balanced that a maximum of the time of professional scientists may be devoted to technical problems.

The professional personnel are trained in four broad scientific fields: (1) biology (entomology, parasitology, biometry, and wildlife); (2) chemistry (organic, pharmaceutical, and analytical); (3) medicine (research); and (4) engineering (sanitary, civil, chemical, and mechanical). Most of the problems of the Division require and get the combined attention of these various professional talents, and the increased amount and caliber of work resulting from this arrangement has been most gratifying. The various sciences needed and the proportion of personnel in each will vary with the type of activity involved. Those listed above are adapted to the present work of the Technical Development Division, but needs of other laboratories may be quite different.

During the late war, close cooperation between individual scientists, governmental institutions, and private research organizations was, through necessity, at an all-time high. This cooperation was beyond question a potent factor in the rapid technological advances attained. It is the individual responsibility of all scientists to prevent any reversion to the narrow professionalism that, unfortunately, has been at times a liability to scientific and social progress.



DDT and the Malaria Mosquito

World Health Organization Newsletter, Number 8, June 1949

Malaria-control methods have been revolutionized since the end of the second World War by the application of techniques developed through wartime studies on the so-called "contact insecticides." The best known of these is DDT. Others are BHC (also known as Gammexane) and Chlordane.

The revolutionary property of contact insecticides is what is called their "residual action," which means simply that they remain deadly to insects for a considerable time. A fly, mosquito, or other insect alighting on a wall that has been sprayed with DDT several weeks earlier will be killed. The chitin, or outer covering of the legs and body of the insect, absorbs the insecticide at the slightest contact, very much as blotting paper sucks up ink. It spreads all over the body and, reaching the nerve centers, causes paralysis and death.

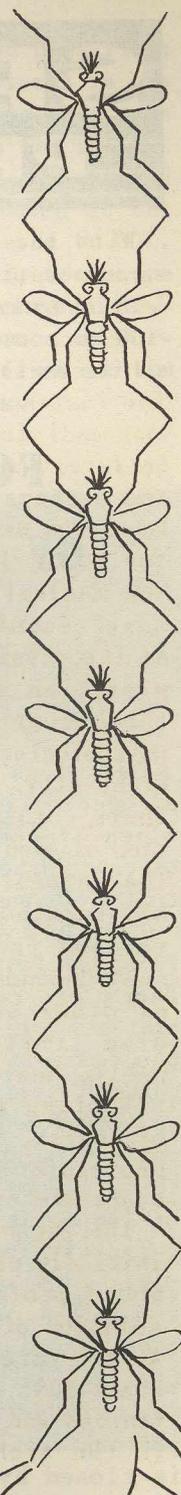
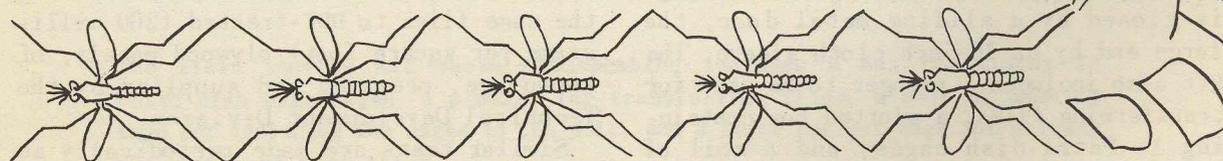
In the years preceding the discovery of contact insecticides, malaria could be kept within bounds in urban areas by "larva control" methods, checking the breeding of mosquitoes through draining operations, and treatment by Paris green and petroleum oils. The cost, however, was high, and in more sparsely populated areas the problem remained unsolved.

Today, in 1949, the outlook is very different. To take two concrete examples, the islands of Sardinia and Cyprus have been almost completely freed from the anopheles (malaria-carrying) mosquito by modern techniques based on DDT. For the first time, it is now possible to envisage a not too far distant future when malaria will have been eradicated throughout the world.

In the meantime, the problem arises of preventing the reappearance of mosquitoes in areas freed of them. There is also a risk of the introduction of anophelines mosquitoes into new regions. These questions were examined last month by the World Health Organization Expert Committee on Insecticides, which held its first meeting in Cagliari, Sardinia. The Committee made detailed recommendations concerning precautions to be taken against the introduction of mosquitoes in ships and aircraft, and other measures that might be given general application for preventing the introduction of anophelines into areas freed of them. It also formulated international standards for the composition and strength of DDT, and standard specifications for spraying apparatus. Such international standards are essential for the effective and economical use of DDT in large-scale operations.

Painstaking inspection and research in airports have established the very real danger of transport of disease-carrying insects in aircraft. Indeed, on one occasion when a U. S. Public Health officer was carrying out experiments during flight, a mosquito was discovered in the act of biting a passenger. Mosquitoes and other insects are frequently unwanted passengers on ships.

The measures now recommended by the Expert Committee will ensure against these risks with a minimum of delay and inconvenience to trade and travel. They provide for aircraft being disinfested, either immediately before leaving their previous port of call, or during flight. Ships will be treated only if, coming from ports in malarious areas, they have no recent disinfestation certificates. Thanks to recent technical improvements, these operations are both cheap and rapid.



SPECIAL PROJECTS

A Testing Kit

FOR USE IN FIELD INVESTIGATIONS OF FAILURE OF DDT RESIDUAL SPRAYS

ROBERT H. McCAULEY, JR., S. A. SAN. (R)

Questions resulting from apparent or alleged failure of DDT to control houseflies frequently require entomological tests to determine the cause of the difficulty. It has been considered that field equipment for testing wild-caught houseflies against operationally sprayed surfaces, in comparison with laboratory-prepared panels, could be used to determine the cause of failure of DDT spray treatments. A field testing kit has been designed and developed in order that the materials and equipment necessary for entomological tests may be made available in a compact mailable package.

The kit is contained in a rectangular plywood box which measures over-all 24 x 14 x 14 inches. A conical plastic screen-wire cage, for holding flies preliminary to testing, is built into the box in such a way that the box takes the place of a supporting frame. The small end of the cage is closed by a sliding metal door, the large end by an 18-inch cloth sleeve. The kit also includes a plunger to be used for transferring flies, a slotted box containing 16 Petri-dish cages, and a roll of

masking tape to be used in holding the test cages against vertical surfaces. These items are held firmly within the kit when the lid is in place and the ends are secured for shipment.

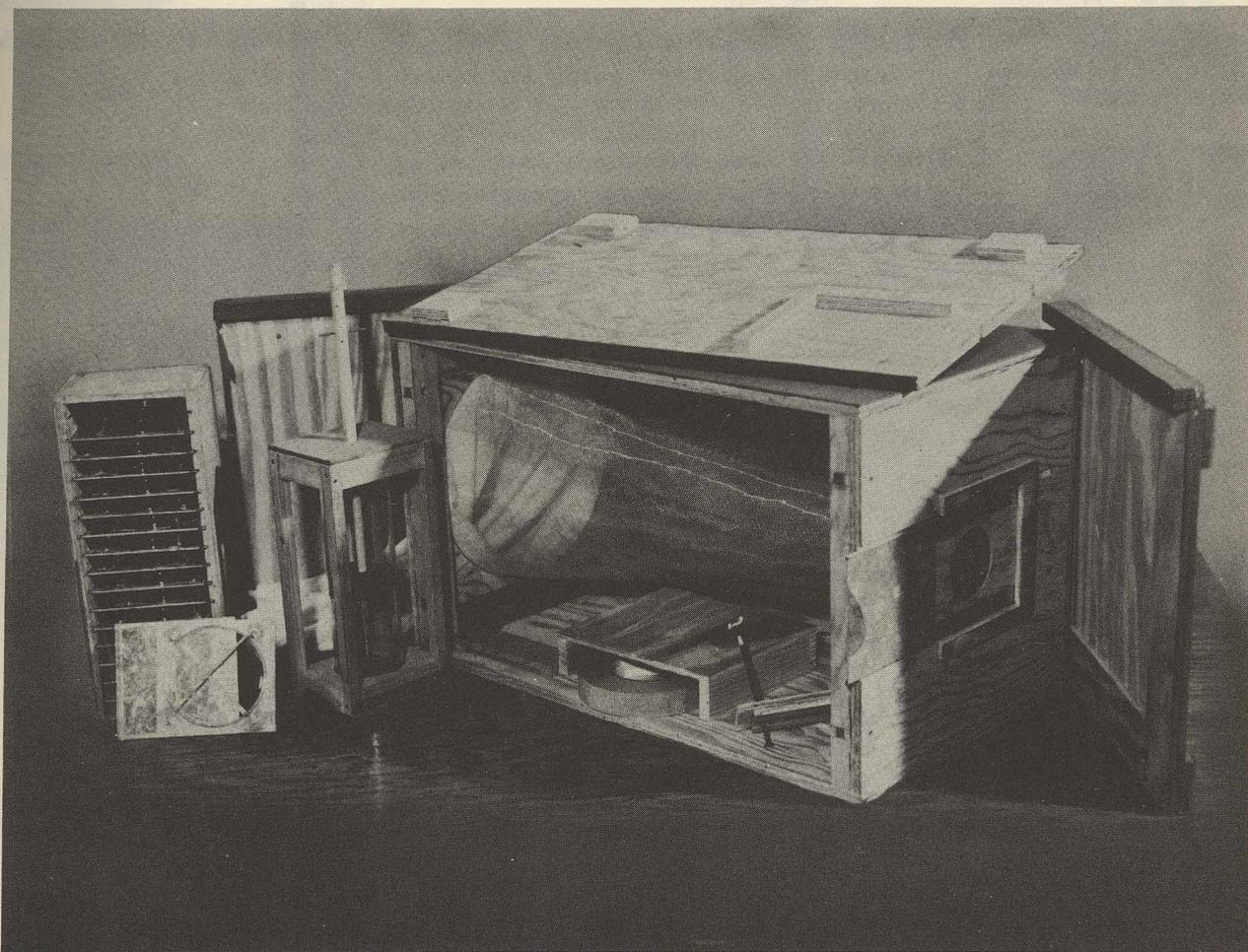
In use, the kit is carried to the site of the complaint where adult houseflies are collected with an insect net as near as possible to the actual premises. After sufficient flies have been placed in the holding cages, about 20 are transferred with the plunger to the Petri-dish cages to be exposed to the treated surfaces in question. These cages are held in place against treated walls with masking tape or other means until a complete knock-down has occurred, or for an hour if total knock-down fails to occur within that time. The time required to obtain 100 percent knock-down (or the knock-down at the end of 1 hour) is noted and compared to similar data obtained simultaneously by exposing the same flies to DDT-treated (200 milligrams per square foot) plywood panels, of known age, prepared and supplied by the Technical Development Division.

Similar tests are made periodically at

the Technical Development Division laboratory using insectary-reared houseflies against panels retained from the lot prepared for distribution to the field. In this manner data are obtained which are made available to field personnel for comparison with their own test results. By making comparative exposure tests between operationally treated surfaces and prepared panels of known history, a check is obtained on the relative effectiveness of the surface in question. A further comparison

between data obtained from wild houseflies exposed to standard treated panels in the field and information from tests made with insectary-reared houseflies at the Technical Development Division should reveal whether the houseflies collected at the site of complaint show resistance to DDT.

It is hoped that use of this technique will be useful to field personnel in distinguishing between the presence of DDT-resistant populations of houseflies and the effect of faulty DDT residues.



The field testing kit shown disassembled includes a box containing 16 Petri-dish wall cages, a plunger for transferring flies, a roll of masking tape for fastening the cages to the wall, and a large conical cage for holding the supply of test flies.

The USE of AIRCRAFT for INSECT CONTROL

PURPOSE

To depict general techniques, materials, and equipment developed in the use of aircraft for mosquito control, and to indicate problem situations where such control may economically and feasibly be applied.

AUDIENCE

Public health personnel and others connected with or interested in larviciding and insect vector control.

CONTENTS

1. Aircraft are used effectively for dusting with paris green, and for spraying and thermal aerosoling with DDT.
2. Dusting is the oldest and at present the least used method of treatment. Plane adaptations for this work consist of dust hopper, wind activated agitator, feed control gate, and Venturi discharge throat.
3. Spraying techniques are being steadily developed. Tank, pump, and discharge nozzles adapt the plane for spraying operations.
4. Thermal aerosoling is at present the most used of the three methods. Basically the aerosoling equipment consists of a tank holding the insecticidal solution, a pump to force the solution through copper lines to spray nozzles in the throat of a Venturi, and an exhaust stack extension in a Venturi where hot exhaust gases break up the insecticidal spray into smaller particles.
5. Preparations for aircraft insect control operations include installing the equipment, securing CAA inspection certificate for air worthiness, calibrating the rate of feed, and determining the size of particles and width of swath.
6. When field surveys reveal excessive mosquito production, the pilot studies flying hazards in the areas both from ground and air, then treats many scattered areas in a single day's operations at a cost far below that of other methods.
7. Appraisal of results is made by means of larvae and adult mosquito counts in the treated area.

AVAILABILITY

Thirty day loan upon request to ...

MEDICAL DIRECTOR IN CHARGE
COMMUNICABLE DISEASE CENTER

605 Volunteer Building, Atlanta 3, Georgia

Produced by

FEDERAL SECURITY AGENCY



PRODUCTION NO.

CDC 4-077.0

RELEASED 1949

MOTION PICTURE

16 mm. Sound

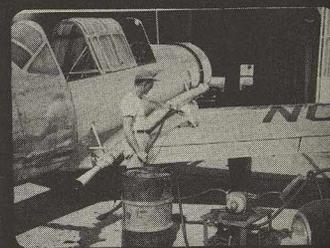
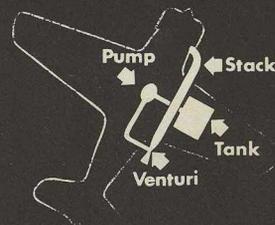
Black & White

Length: 454 Feet

Time: 13 Minutes

GRAPHIC FORM

● Photography



COMMENTS

This film is supplemented by CDC FS No. 5-113 of the same name. 35 mm, sd., B&W, 14 min. 71 frames.

MALARIA CONTROL on Impounded Waters

17

PURPOSE

To record experience for control of malaria on a major impounded water project.

AUDIENCE

Sanitary engineering and management personnel of Federal, State, and local Public Health Service. Other professional personnel interested in malaria control on impounded waters.

CONTENTS

1. PLANNING — Developing a malaria control program for the Kentucky Reservoir.
2. RESERVOIR CLEARANCE — Clearing the reservoir before impoundage.
3. PERMANENT CONTROL MEASURES — Dyking and dewatering, deepening and filling, and restricting land use.
4. EMERGENCY CONTROL MEASURES — House mosquito-proofing, and spraying of premises.
5. RESERVOIR OPERATIONS — Water level management, shoreline maintenance, drift removal, and larviciding.

AVAILABILITY

Thirty day loan upon request to
MEDICAL DIRECTOR IN CHARGE
COMMUNICABLE DISEASE CENTER
605 Volunteer Building, Atlanta 3, Georgia

Produced by

FEDERAL SECURITY AGENCY

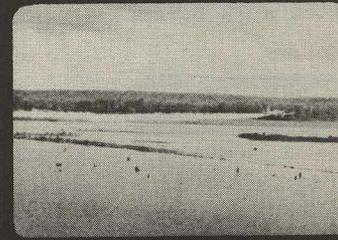


Courtesy of the David J. Sencer CDC Museum

PRODUCTION NO
CDC 4-069.1
RELEASED 1948

MOTION PICTURE
16 mm. Sound
Color
Length: 670 Feet
Time: 19 Minutes

GRAPHIC FORM
● Photography



COMMENTS

A short version of the five chapter film —
MALARIA CONTROL IN THE
KENTUCKY RESERVOIR.

R
E
V
I
E
W
*
*
*
P
I
C
T
O
R
I
A
L
R
E
V
I
E
W
*
*
*
P
I
C
T
O
R
I
A
L
R
E
V
I
E
W

HOOKWORM DISEASE AND HOOKWORM INFECTION

To teach current knowledge of hookworm disease and hookworm life cycle, summarizing older information and stressing diagnosis, treatment, and prevention.

PURPOSE

AUDIENCE

Practicing physicians, medical students, and others whose interests may lie in tropical diseases.

CONTENTS

1. Motivating introduction giving short history of hookworm disease and its meaning in terms of bare feet, poor diets, and chronic blood loss.
2. The worms *Necator americanus* and *Ancylostoma duodenale* are compared. Their habits and injury of their host are shown.
3. Diagnosis of hookworm infection is confirmed by finding hookworm eggs in the feces of the patient.
4. Every clinical case of hookworm disease should be treated with tetrachlorethylene.
5. Prevention of hookworm infection is accomplished essentially by knowing and interrupting the life cycle of the hookworm. This life cycle is delineated in the filmstrip.
6. Steps in hookworm control are to see that all feces are placed in a hole in the ground, that privies are built and used, that septic tanks are constructed, that shoes are worn, that everyone lives with a balanced nutrition, and that knowledge of hookworms is disseminated.

AVAILABILITY

Thirty day loan upon request to
MEDICAL DIRECTOR IN CHARGE
COMMUNICABLE DISEASE CENTER
605 Volunteer Building, Atlanta 3, Georgia

Produced by

FEDERAL SECURITY AGENCY



PRODUCTION NO.

CDC 5-073

RELEASED 1948

FILM STRIP

35 mm. Sound

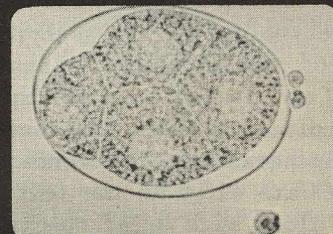
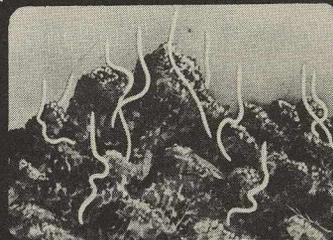
Color

Length: 77 Frames

Time: 13 Minutes

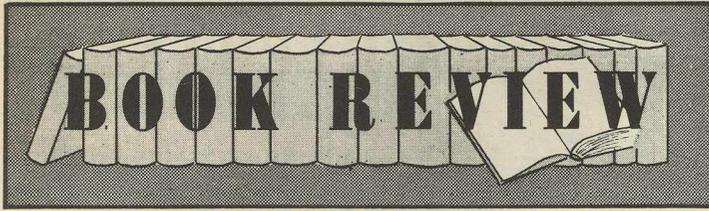
GRAPHIC FORM

- Photographs
- Drawings
- Photomicrographs



COMMENTS

Brief, over-all view of the hookworm situation in the world today.



MANUAL OF MEDICAL PARASITOLOGY

WITH TECHNIQUES FOR LABORATORY DIAGNOSIS

AND NOTES ON RELATED ANIMAL PARASITES

by C. Courson Zeliff, State College, Pennsylvania, 1947, pp. 1-159, Lithoprinted in the U.S.A., Edwards Brothers, Inc., Ann Arbor, Mich.

This manual is primarily a laboratory guide, presenting the morphological details of the organisms and the various diagnostic techniques. The characteristics of the parasites are presented in keys, tables, charts, and illustrations reprinted from other textbooks. Unfortunately, many of the illustrations have lost considerable clarity as a result of being greatly reduced in size. A colored plate is reprinted from the manual by Huff, 1944, erroneously attributed to "Hoff." About one-third of the manual is devoted to laboratory diagnosis and laboratory technique with a wide variety of procedures presented in considerable detail. At the end of this section directions are given for the preparation of solutions, stains, and reagents.

The etymology of the generic and species names of the important parasites is presented and should help to explain some of the complicated names that have been given to human parasites. References to original articles are cited in the text and in footnotes, along with brief conclusions of the authors. At the end of the manual there is a list of the major texts, manuals, and journals devoted to parasitology.



C. Courson Zeliff

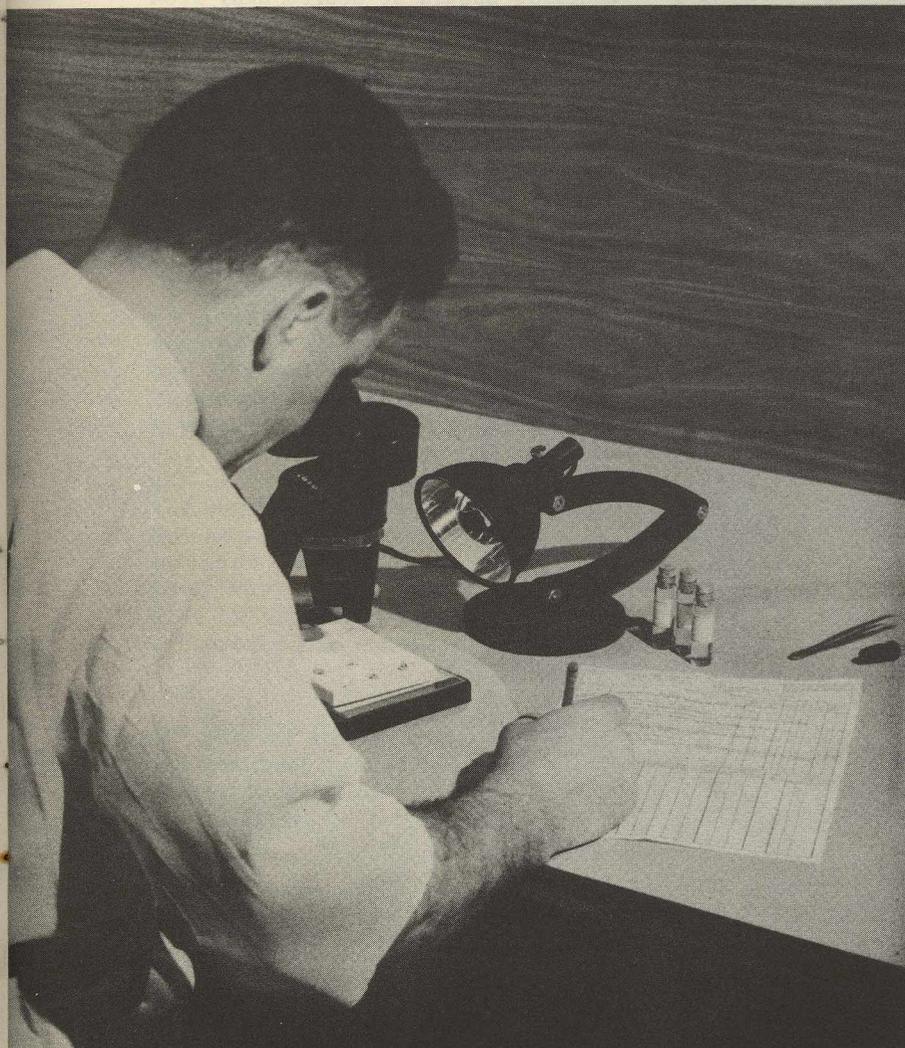
Unfortunately there are numerous typographical errors that detract from the manual. Since this publication is intended to be used in introductory courses in human parasitology, these errors may mislead the student unless the instructor is careful to indicate the corrections.

Dr. M. M. Brooke,
Scientist
i/c Parasitology Branch
Laboratory Division

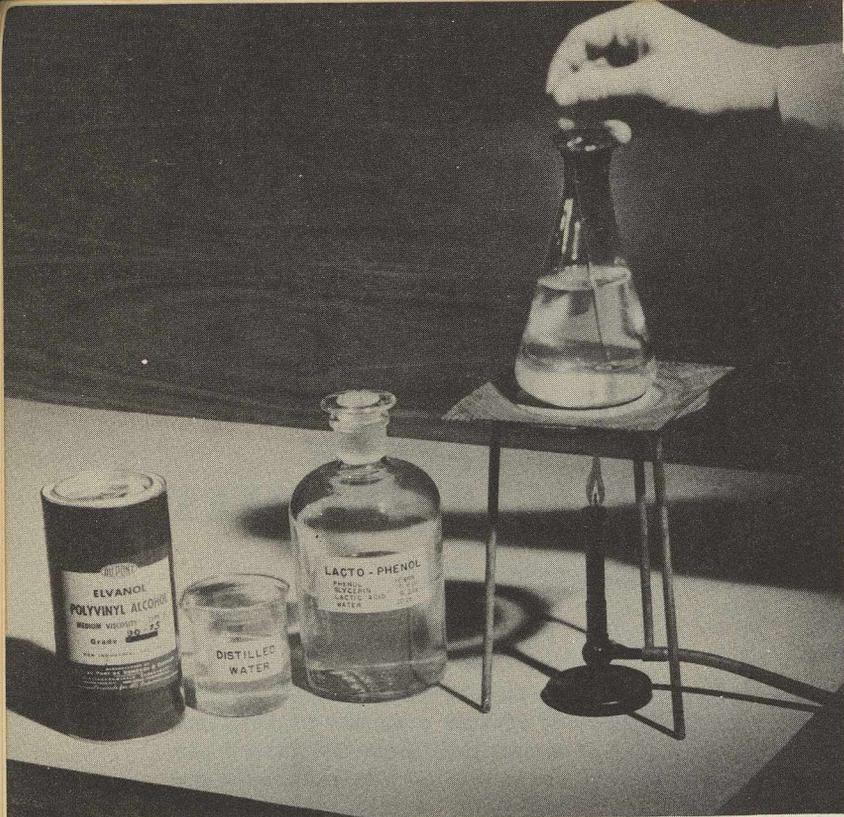


POLY VINYL ALCOHOL FOR ROUTINE DETERMINATION OF ECTOPARASITES

Harry D. Pratt and John E. Lane



A On the cooperative typhus control programs of the Communicable Disease Center and the various State Health Departments, it is relatively easy to determine the ectoparasites commonly collected on domestic rats. The majority of such specimens usually represents only six species of fleas, four species of mites, and two species of lice which have well-marked distinguishing characteristics. Usually it is possible to determine 95 percent or more of the specimens simply by pipetting them out of the vials onto a white porcelain depression plate and examining them with a dissecting microscope. However, as the Communicable Disease Center and State Health Department programs expand to include research and demonstration control programs for such diseases as sylvatic plague and the arthropod-borne encephalitides, a much larger group of ectoparasites is encountered, including many species of fleas, ticks, mites, and sucking and biting lice from a wide variety of birds and mammals. The specific determination of this much larger group of ectoparasites then becomes a more difficult and time-consuming process requiring special mounting techniques.



B Polyvinyl alcohol (PVA) provides a quick, single-solution, semipermanent mounting media for the routine diagnosis of these ectoparasites*. It is made by adding 6.3 grams of PVA** to 35 cubic centimeters of water in a 500 cubic centimeter flask, stirring constantly. When all the PVA has been added, a milky suspension results which will clear up upon heating in a water bath to 75° C. While the solution is still warm, 45 cubic centimeters of Lacto-Phenol*** are added and stirred well. When the solution is cool, it should be stored away from light in a dark bottle.

*Bryn Jones — Impregnating polyvinyl alcohol with picric acid for the simultaneous staining and mounting of Acarina. Proc. R. Ent. Soc. London (A) 21, Pts. 10-12: pp. 85-86 (Dec. 1946).

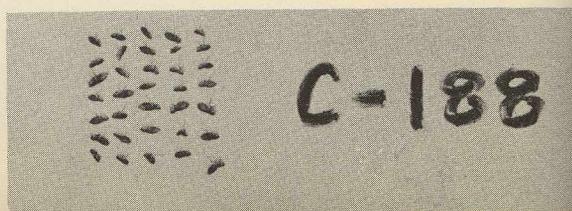
**DuPont "Elvanol" — Medium viscosity — Type B, Grade 90-25. The use of this does not represent an indorsement of the product by the Public Health Service.

***Lacto-Phenol is made by mixing 10 grams of phenol with 10.6 cubic centimeters of glycerin, 8.2 cubic centimeters of lactic acid, and 10 cubic centimeters of distilled water.



◁ C

D
⇩



C The specimens submitted from the field, either in 70 percent alcohol or water, may be mounted directly in PVA-Lacto-Phenol. It is usually easiest to do this by pipetting all the specimens onto a white porcelain depression plate. Then, enough PVA-Lacto-Phenol is spread on the slide to cover an area equivalent in size to the cover glass. The specimens are placed in the smear of PVA-Lacto-Phenol in regular rows with fine forceps or a wire loop mounted in an applicator stick. A cover glass is placed gently on the smear. If the smear is moderately viscous and of sufficient size, very little movement of the specimens will occur beneath the cover glass.

D If the collection is small, as many as 40 or 50 specimens may be mounted on a single slide and the collection data reference number marked with a wax pencil. If the collection is large, it may be necessary to mount the specimens on several slides. The fleas are mounted upside down so that they appear right-side up when seen through a compound microscope.

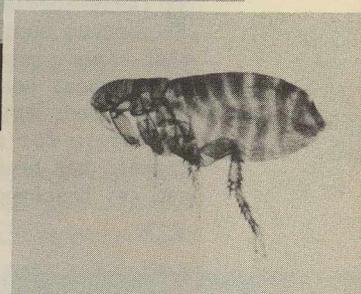
E Many of the specimens, especially the fleas, may be determined as soon as the cover glass has been placed on the smear. Some specimens, such as chiggers or mites, are easier to determine a day or two later after they have been cleared by the action of the PVA-Lacto-Phenol on the slide.

F Specimens which are cleared show the fine detail used in classification, such as the number and arrangement of hairs or combs on fleas. Slides with common species have been stored for months in the laboratory without deterioration, although other slides show a tendency toward clouding or production of air bubbles under the cover glass 3 to 6 months after the slide has been made.

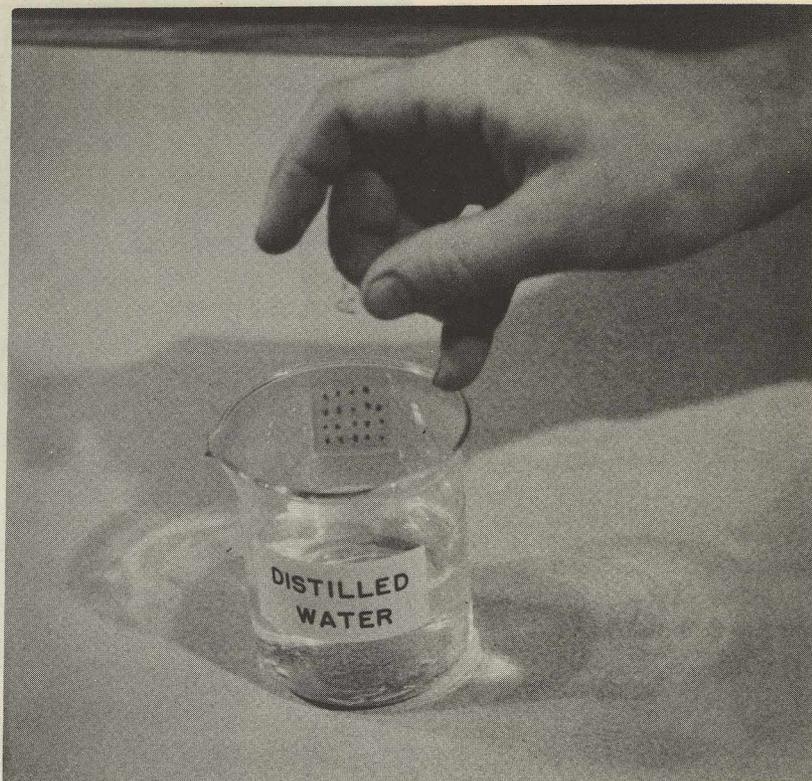


↑
E

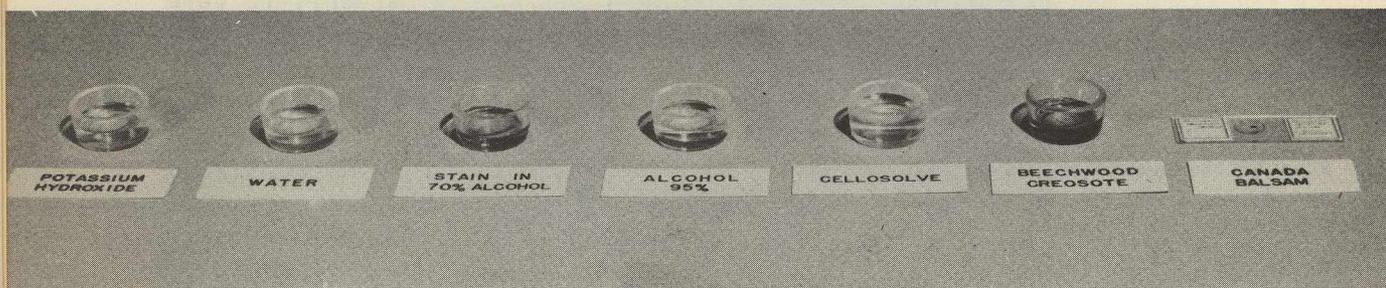
F ⇨



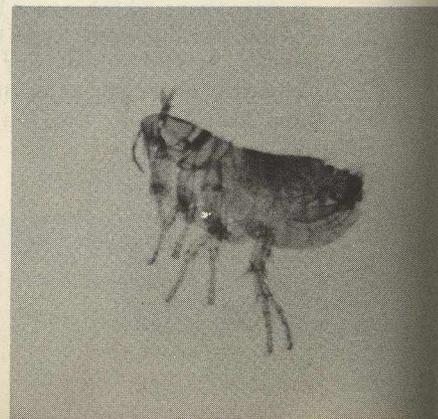
G If rare or unusual specimens are found on slides mounted in PVA-Lacto-Phenol, they may be recovered by soaking the slide in water at room temperature overnight, or in an oven at 65° C. for a few hours. This dissolves the PVA and frees the specimen from the slide.



H These specimens may then be mounted by the usual long method: (1) soak in 5 percent or 10 percent sodium or potassium hydroxide solutions until clear, usually pressing the specimen with a bent needle or fine forceps during this process to expel the dissolved tissue; (2) wash for several hours or a day in water to which a few drops of 15 percent hydrochloric acid has been added; (3) dehydrate in 70 percent alcohol, or in the case of mites and lice, dehydrate and stain for a day or two in 70 percent alcohol to which a few drops of 0.5 percent acid fuchsin has been added; (4) dehydrate further and clear in 95 percent alcohol, (5) cellosolve, and (6) beechwood creosote; and (7) finally mount in Canada balsam.



I Such specimens can be appropriately labeled and stored as a part of a permanent reference or study collection. These slides should show the finer details of hairs and structures used in classifying these ectoparasites.



DIVISION HIGHLIGHTS

JAN - FEB - MAR - 1949

Administrative

Memoranda and administrative letters of general interest were issued by the Office of the Chief regarding the preparation of correspondence for the signature of Central Office officials; the handling of correspondence between CDC and the Regional Federal Security Agency offices; the preparation and processing of Congressional mail; information pertaining to the routing and submission of manuscripts for publication and presentation.

A memorandum was issued March 4, 1949, by the Chief setting forth functions and procedures of the CDC library.

Approximately 100 accident cases were handled during the quarter, 14 of which were reports of accidents which actually occurred during the period.

BUDGET AND FISCAL BRANCH

Final advices of allocation for the fiscal year 1949 were issued to cover fourth quarter activities. A detailed break-down of cost by object for the fiscal years 1948, 1949, and 1950 was furnished the Central Office in connection with the 1950 fiscal year budget. Estimates for the 1951 budget were received from the CDC organizational units, and work was under way on the preliminary estimates.

A procedure has been devised whereby personal service data required for budget purposes may be maintained by use of IBM equipment. The cumulative data for the fiscal year 1949 were compiled and sub-

mitted to the Service Branch to be used in establishing the IBM record. Each pay period the change slips used in the processing of pay rolls will be submitted to the Service Branch for recording.

The retirement records for CDC employees were officially transferred to this office as of January 1, 1949. The transfer of these records necessitates the preparation of a quarterly report of retirement deductions by the 3rd day after the close of the quarter.

Effective with the pay-roll period beginning March 20, 1949, for Civil Service employees, and April 1, 1949, for commissioned officers, the State of Texas pay rolls were decentralized. Puerto Rico, California, Arkansas, and Regional FSA offices, in addition to Texas, are processing pay rolls for CDC employees and maintaining related records.

TECHNICAL REPORTS BRANCH

Editorial Section. Listed below are 33 manuscripts which were edited and cleared for presentation and/or publication. In addition to these, 12 manuscripts were received for clearance.

Those edited and cleared follow:

- Bradley, G. H. and Saylor, L. W. Malaria control through the use of new insecticides as residual sprays against adult mosquitoes.
- Bradley, G. H. The Public Health Service malaria program.
- Bradley, G. H. and Lyman, F. Earle. Recent developments in the antimosquito work of the Communicable Disease Center, U. S. Public Health Service.
- Dow, Richard P. and Maier, Paul P. A conical net for collecting flies.
- Edwards, P. R. and Hermann, G. J. Two new *Salmonella* types: *S. corvallis* and *S. colorado*.
- Elias, Hans. The liver, Part I: Normal histology; Part II: Histopathology of portal cirrhoses.

- Elias, Hans. The mammalian liver reexamined.
- Elias, Hans. The network of bile capillaries in its relation to the hepatic parenchyma.
- Elias, Hans. A reexamination of the structure of the mammalian liver. II. The hepatic lobule and its relation to the vascular and biliary systems.
- Engler, Hershel. Methods of municipal waste disposal in relation to rat control.
- Ewing, William H. The relationship of *Bacterium anitratum* and members of the tribe *Mimeae* (DeBord).
- Ewing, William H. *Shigella* nomenclature.
- Frobisher, Martin. Organized short courses at regional, State, and local levels.
- Frobisher, Martin, Cummings, M. M., and Klein, G. C. Preservation of mycobacteria by desiccation *in vacuo*.
- Furcolow, Michael L. and Ruhe, Joseph S. Histoplasmin sensitivity among cattle.
- Hayes, W. J., Jr. and Simmons, S. W. The benefits and hazards of insecticides to public health.
- Howitt, B. F., Bishop, L. K., Dodge, H. R., and Gorrie, R. H. Recovery of the virus of Eastern equine encephalomyelitis from mosquitoes (*Mansonia perturbans*) collected in Georgia.
- Kohler, Charles E. Filariasis control by DDT residual house spraying, Saint Croix, Virgin Islands -- Part I. Operational Aspects.
- Lyman, F. Earle and Bradley, G. H. Training of entomologists for public health work.
- Miller, S. E. Control of communicable diseases.
- Miller, S. E. Public health aspects of brucellosis.
- Mohr, Carl O., Tiship, Victor, and Good, Newell E. Results of the DDT dusting program for the control of murine typhus fever in the southeastern states.
- Pratt, Harry D., Lane, John E., and Harmston, F. C. New locality records for *Allodermanyssus sanguineus* (Hirst), vector of rickettsialpox (Acarina, Dermanyssidae).
- Quarterman, K. D., Parkhurst, John P., and Dunn, William J. The use of DDT in control programs against the stable fly or dog fly in northwest Florida.
- Reider, Frank. Use of Communicable Disease Center extension service material for state in-service training programs.
- Sherrill, Harry. The role of films in the CDC training program.
- Simmons, S. W. The Technical Development Division of the Communicable Disease Center, U. S. Public Health Service.
- Skaliy, Peter and Hayes, Wayland J. The biology of *Liponyssus bacoti* (Hirst, 1913) (Acarina, Liponyssidae).
- Sumerford, W. T. The chemistry and toxicology of some organofluorine compounds.
- Tierkel, Ernest S., Koprowski, H., Black, J., and Gorrie, Rachael H. Preliminary observations in the comparative prophylactic vaccination of dogs against rabies with living virus vaccines and phenolized vaccine.
- Upholt, William M. Control of other ectoparasites.
- Upholt, William M. The role of chemicals in fly control.
- "Cats, Cheese Lose Out with Nation's Rat Race" -- paper prepared outside CDC for publication in trade papers in which Dr. Carl Mohr is quoted.

Library Section. The following is a list of books recently added to the library:

- Bankoff, George Alexis. The conquest of cancer. 1947.
- Bent, Arthur Cleveland. Life histories of North American gulls and terns. 1947.
- Brown, Esther Lucille. Nursing for the future, a report prepared for the Nursing Council. 1948.
- Fishbein, Morris. Medical writing, the technic and the art. 1948.
- International Congresses on Tropical Medicine and Malaria. 4th., Washington, D. C., 1948.
- Fourth international congresses on tropical medicine and malaria. Abstracts.
- Lapp, Ralph Eugene and Andrews, H.L. Nuclear radiation physics. 1948.
- Lilleengen, Kaare. Typing of *Salmonella typhimurium* by means of bacteriophage. 1948.
- MacKenna, Robert Merttins Bird. Modern trends in dermatology. 1948.
- Mott, Frederick Dodge. Rural health and medical care. 1948.
- National Research Council. Handbook of scientific and technical societies and institutions of the United States and Canada. 5th ed. 1948.
- New York City. Food and Nutrition Committee. Subcommittee on Evaluation of Motion Pictures. Approved films on food and nutrition, 2nd ed. 1948.
- Parker, M. E. Food and plant sanitation. 1948.
- U. S. General Accounting Office. Decisions of the comptroller general. v. 26, 1947-48.
- U. S. National Bureau of Standards. Publications of the National Bureau of Standards. 1948.
- U. S. Public Health Service. National Office of Vital Statistics. Explanation of items on live birth, death, and stillbirth certificates. 1947.

SERVICE BRANCH

Drafting was done on 25 maps; 59 pictorial, organization, and distribution

charts and graphs; 17 forms; 8 mechanical drawings, floor and site plans; 238 lettering lay-outs; and 288 embossographed signs.

Of particular significance in the above were maps of the Pomme de Terre Reservoir area and of the city of South Charleston, W. Va. Also, a mapping project was begun for the Dysentery Vector Control Branch which will include all towns in the south Georgia area of operations.

Many thousands of copies of CDC materials were reproduced—by mimeograph, ditto, multilith, ozalid, and photo copyist. The addition of the photocopying equipment has expanded the services available in this section and has made economically practicable the reproduction of a wide range of material, as well as reducing the outside production of photostats.

A total of 10,350 items was distributed, in addition to the addressing of some 13,200 envelopes, slips, and cards. Changes and additions to mailing lists necessitated the cutting of 550 addressing-machine stencils.

The number of work requests received by the Machine Records Section increased during the quarter. New projects in the planning stage are two mosquito collection surveys and an intestinal parasite survey. Additional Texas fly-grill readings were punched and listed for the Dysentery Control Project. Fly readings for Topeka and Phoenix were punched, and reports were tabulated. Readings for Charleston, W. Va., and Muskogee, Okla., have been punched.

SUPPLY BRANCH

Requests for approval or renewal of 6 headquarters and 10 field leases for the fiscal year 1950 were forwarded to the Central Office. Up to the end of the quarter, 232,305 gallons of xylene, 605,200 pounds of 100 percent DDT, and 4,215 gallons of emulsifier had been purchased from continuing contracts approved earlier in the year.

Special attention was given requisitions for the Alaska project so as to insure delivery by a specified time. To meet the

delivery deadline, it was necessary to purchase from sources where items were immediately available.

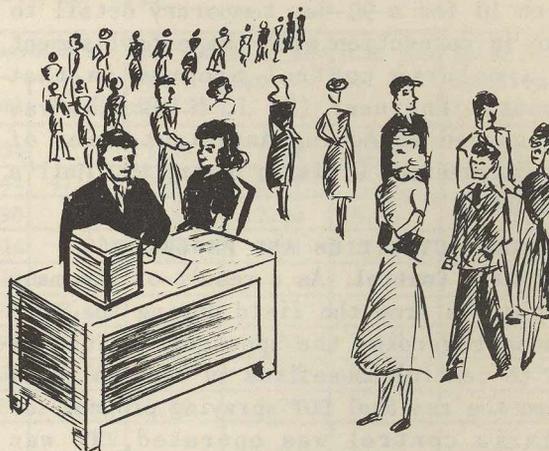
Items surplus to the requirements of CDC which were stored in the Terminal Warehouse and the Headquarters Warehouse have been consolidated at the Terminal Warehouse and counted.

PERSONNEL BRANCH

Five hundred sixty-two requests involving classification determination were processed. A classification survey was made of key positions of the Technical Development Division.

Three work-breakdown questionnaires were completed. These questionnaires, on which field officials may describe content of a job by checking "yes" or "no," are designed to eliminate the writing of narrative job sheets by field operational personnel.

Interviews were conducted with 410 applicants. Twenty appointments were made.



On March 7, the functions of the CDC Board of Civil Service Examiners were merged with those of the Personnel Branch. Hereafter the Personnel Officer will serve as Secretary of the Board. Work was completed on an announcement for examinations for 12 positions in the Production Division, the announcement being made on March 24. At the same time the Bacteriologist

announcement, already opened, was amended to include virus and rickettsial positions for the Laboratory Division. Also, the "portrait" and "commercial" options of the Photographer announcement were closed.

Counseling was given to 32 employees during the quarter.

Personnel instructions were prepared and issued covering procedure for the handling of applications for employment at field stations; the requirement of personal liability insurance for certain CDC employees; the procedure for suspensions; and the new anniversary system of efficiency ratings.

Engineering

Sanitary Engineer L. B. Hall departed on March 10 for a 90-day temporary detail to Iran in connection with the establishment of a malaria control program in that country. Engineer (R) J. H. Bright was designated as Acting Assistant Chief of the Engineering Division during Mr. Hall's absence.

PROGRAM ACTIVITIES AND PROGRESS

Malaria Control. As a result of the many complaints from the field during the 1948 season regarding the apparent failure of DDT to control houseflies in certain areas where the residual DDT spraying program for malaria control was operated, it was decided to incorporate the recommendations of the Technical Development Division for the addition of an adhesive agent to the DDT concentrate into the 1949 season's operations. The adhesive agent recommended is gum rosin, U. S. Standard Water White Grade, and the additional cost per gallon of concentrate amounts to approximately 5 cents. Since sprayed surfaces in the interiors of homes are not exposed to weathering and since the adhesive spray not only increases the cost but also leaves

an objectionable shiny deposit on sprayed surfaces, it was not recommended for use inside homes. However, the new formulation does retain its effectiveness on outside surfaces, such as porches, privies, barn exteriors, etc., even when exposed to sunlight and rainfall and is therefore recommended for such use. Instructions for the preparation and use of the new adhesive DDT spray were incorporated in Manual of Operations, Engineering No. 7, and issued to the field during the quarter. The new formulation will be used extensively during the coming season, particularly in those States which have adopted premises spraying, and will be further tested on the Pharr, Tex., test project of the Technical Development Division.

Desirable sampling, testing, and reporting procedures for DDT and allied chemicals were agreed upon in conference with the Technical Development Division, and none of the chemicals tested thus far have failed to meet specifications. Information as to proper field sampling and shipment of chemicals to Savannah for testing was issued in Manual of Operations, Engineering No. 8.

Consideration has been given to the more extensive field testing of some of the newer insecticides. Since the experimental projects initiated in the field last fall were inconclusive because of the short duration of mild weather after the experiments were started, as well as other factors, it is felt that if such experimental operations are to be undertaken during the coming season it will be desirable to extend the evaluation time and the geographical coverage to more nearly resemble large-scale control operations. The Technical Development Division has recommended the field testing of water-wettable methoxychlor and it is expected that field testing projects using this chemical will be established early this season. Personnel in Tennessee have indicated an interest in an experimental spraying project using methoxychlor and areas in other States may also be made

available for similar projects.

Inquiries were received from several States regarding CDC specifications for chemicals in connection with the purchase and use of such chemicals in State spraying operations. As a result of inquiries from this headquarters, successful bidders on DDT contracts have given assurance of similar price bids on State contracts. The limitations of the concentrate specifications used during the 1948 season have been pointed out to those States desiring to purchase DDT formulations.

The malaria and mosquito control programs in the States of Alabama, Florida, Georgia, Tennessee, Mississippi, and South Carolina were received and detailed reports submitted to the Regional Medical Director of Region 6. Visits were also made to the

CDC malaria program in Texas and to the Savannah laboratory. A discussion of the costs, performance, and efficiency of power equipment in insecticidal and larvicidal operations was presented in March at the meetings of the Florida Anti-Mosquito Association.

Residual spraying operations were under way in nine States during the quarter. Table 1 summarizes these operations.

Typhus Control. In view of the reduction in the human typhus rate since the initiation of DDT dusting for the control of rat ectoparasites in 1945 and because of further anticipated curtailment of funds for the coming fiscal year, a reduction in the number of preapproved counties for typhus control operations for fiscal year 1950 was deemed advisable. The criterion for pre-

Table 1
SUMMARY OF DDT RESIDUAL SPRAY OPERATIONS
January 1 -- March 31, 1949

State	No. Counties	No. House Spray Applic.	Lb. DDT	Operation Man-Hours			Lb. DDT per Applic.	M.H. per Applic.	M.H. per Lb. DDT	Total Spray Applications 7/1/48-3/31/49
				CDC	Local	Total				
Alabama	29	16,830	19,582	23,039	4,054	27,093	1.16	1.61	1.38	45,176
Arkansas	41	6,722	6,498	19,968	21,744	41,712	0.97	6.21**	6.42**	22,991
Florida	6	576	637	560	790	1,350	1.11	2.34	0.90	12,688
Georgia	27	3,675	6,266	1,720	5,314	7,034	1.70	1.91	1.13	59,581
Kentucky	-	-	-	160	1,016	1,176	-	-	-	4,334
Louisiana	-	-	-	3,928	40	3,968	-	-	-	1,206
Mississippi*	18	17,047	15,959	13,286	12,790	26,076	0.94	1.53	1.63	23,042
Missouri*	7	1,368	1,363	680	2,632	3,312	1.00	2.42	2.43	7,783
North Carolina	8	878	950	1,666	781	2,447	1.08	2.78	2.58	43,623
Oklahoma*	-	-	-	320	-	320	-	-	-	10,207
South Carolina	-	-	-	10,240	-	10,240	-	-	-	66,174
Tennessee	-	-	-	384	1,064	1,448	-	-	-	2,821
Texas	1	244	470	708	600	1,308	1.64	5.36**	2.78	37,519
Subtotal Cont. United States	137	47,340	51,725	76,659	50,825	127,484	1.09	2.33	2.13	337,145
Puerto Rico and Virgin Islands	-	1,412	959	828	1,104	1,932	0.68	1.37	2.01	1,590
Grand Total	137	48,752	52,684	77,487	51,929	129,416	1.08	2.30	2.13	338,735

* Through April 2, 1949; all others through March 26, 1949.

** Since this quarter marks the beginning of the residual spraying season, the relatively large number of man-hours shown represents time required for the preparation and distribution of materials and the training of workers.

approval was changed to:

- (1) A total of 50 or more reported cases of typhus during the 5-year period 1944-48; or
- (2) Five or more reported typhus cases during 1948 (through October 31, 1948).

As a result of the application of this new formula, a reduction was effected from 135 counties preapproved for fiscal year 1949 to 109 counties for fiscal year 1950. A revised list of counties preapproved for typhus control was therefore prepared and issued to the field with Typhus Control Memorandum No. 62.

An experimental residual spray program for the control of rat ectoparasites was initiated in Columbia, S. C. Four blocks of the city were selected for the project; the establishments in two blocks will be treated with a 5 percent DDT emulsion at a rate of approximately 200 milligrams per square foot, and the establishments in the remaining two blocks will remain untreated as a check area. The entire area will be trapped prior to treatment in an effort to determine the rat ectoparasite population in the area.

Reviews were made of the programs of typhus and rodent control activities of the States of Alabama, South Carolina, Mississippi, Tennessee, Georgia, and Florida. These reviews were undertaken at the request of the Regional Medical Director of Region 6 and detailed reports were submitted of the programs thus reviewed.

Assistance was rendered to the Region 5 Office in an effort to effect the inauguration of a coordinated rodent control program in the city of Chicago. Although the ultimate decision of the Chicago authorities in the establishment of such a program is as yet in doubt, assistance is being rendered in the training of inspectors already employed by the city in rodent control activities and a junior grade officer was assigned to the Region 5 Office to further assist in this training.

In March, conferences were held with the Region 5 CDC representative, Minnesota

State Health Department officials, and representatives of the U. S. Fish and Wildlife Service and the U. S. Department of Agriculture in an effort to bring about the coordination of the activities of the various Federal and State agencies in rodent control activities in Minnesota.

State CDC typhus control programs in South Carolina, Tennessee, Mississippi, and Texas were visited during the quarter. In Texas, discussions were held with the State Health Department regarding a reduction in the activities of the plague investigations project in west Texas. It was agreed that the project personnel would be reduced by two and that investigations would continue along present lines until July 1, 1949.

Technical assistance was also rendered the Memphis and Chattanooga ratproofing projects during the quarter. Typhus control operations were under way in nine States. Table 2 summarizes the operations.

Fly Control. Detailed arrangements were made with the Training Division for the fly control training course scheduled to be held April 25 to 29. The five fly control project supervisors have been requested to attend the course, which will also be attended by Regional Office representatives and other interested individuals. Training films on the subject of fly control were reviewed and discussions were held with the Production Division regarding preparation of scripts for the remaining fly control films.

Identification and tabulation of last season's fly trap collections were completed at three of the fly control projects and work on these phases of the program is progressing satisfactorily in the remaining two projects. Inclement weather hampered the environmental survey on all projects except the one located in Phoenix, where the survey was completed and detailed arrangements were made for the initiation of spraying operations on April 1. As soon as weather conditions permit, reconnaissance trapping and grill inspections will be started on all projects. Plans for the educational campaign to be carried on in

TYPHUS CONTROL OPERATIONS
Periods 1 to 6 from January 1 to March 26, 1949, inclusive

STATE	ECTOPARASITE CONTROL				SUPER- VISION	EVALUATION		RATPROOFING AND ERADICATION				
	Residual Dusting 5% and 10%					Man- Hours	U. S. P. H. S. M. H.	Other M. H.	Initial Ratproofing			Initial Erad. M. H.
	Counties Reporting	Premises Dusted	Lb. per Premises	M. H. per Premises	Projects Reporting				Estab. Completed	M. H. per Estab.		
Alabama	5	5,758	4.2	0.4	1,488	2,549	1,469	-	-	-	-	-
Arkansas	-	-	-	-	320	480	-	2	64	52.7	1,141	120
Colorado	-	-	-	-	-	1,088	-	1	74	28.6	-	1,040
Florida	3	2,870	2.8	0.5	7,141	730	311	3	73	40.5	8	53
Georgia	31	14,107	2.0	0.4	7,519	2,089	441	3	206	35.6	692	-
Louisiana	5	6,131	2.1	0.4	2,684	749	910	2	48	32.2	328	12
Mississippi	-	-	-	-	1,392	952	464	1	5	13.3	-	-
North Carolina	1	1,714	1.4	0.3	1,664	880	70	6	320	33.1	2,301	531
New Mexico	-	-	-	-	442	-	-	-	-	-	-	-
South Carolina	2	116	1.3	0.9	2,536*	1,178	467	3	66	22.1	87	609
Tennessee	2	485	1.9	0.7	540	164	132	3	120	28.2	520	1,140
Texas	24	8,769	5.4	1.6	9,930	951	100	6	165	52.2	36	-
Utah	-	-	-	-	-	1,448	40	1	-	-	-	-
Virginia	-	-	-	-	681	848	1,080	-	-	-	-	-
Washington	-	-	-	-	-	-	-	1	9	24.2	32	-
Hawaii	2	37	3.0	0.8	198**	484	4,648	-	-	-	-	162
Total	75	39,987	3.1	0.7	36,559	14,590	10,132	32	1,150	37.0	5,145	3,667

STATE	RAT REDUCTION										MAN-HOUR SUMMARY			
	Poison Bait (Food)				Poison Water "1080"			Cyanogas		Sanitary Activities				
	Counties Reporting	Estab. Poisoned	Lb. per Estab.	M. H. per Estab.	Estab. Poisoned	Pints per Estab.	M. H. per Estab.	Lb. Used	Man- Hours	U. S. P. H. S.	Others	U. S. P. H. S.	Others	Total
Alabama	5	5,162	0.6	0.4	1,748***	1.8***	0.3***	2,272	1,018	646	298	5,593	6,677	12,270
Arkansas	-	-	-	-	-	-	-	-	-	-	-	1,280	4,151	5,431
Colorado	-	-	-	-	-	-	-	-	-	-	-	2,048	2,200	4,248
Florida	4	1,466	0.9	0.5	409	1.1	2.0	21	36	1,066	1,497	8,546	8,266	16,812
Georgia	21	28,002	0.8	0.3	303	1.3	1.5	1,583	2,462	-	-	13,911	22,233	36,144
Louisiana	5	7,923	0.4	0.2	832	1.2	0.8	-	-	-	-	6,036	5,135	11,171
Mississippi	16	24,261	0.6	0.2	1,803	0.4	0.6	-	-	24	1,134	3,064	6,815	9,879
North Carolina	4	2,656	0.8	1.0	169	0.2	1.2	257	224	-	-	3,032	16,548	19,580
New Mexico	-	-	-	-	-	-	-	-	-	-	-	442	-	442
South Carolina	-	-	-	-	127	0.4	6.6	-	-	-	-	4,702	2,608	7,310
Tennessee	1	502	0.2	0.4	-	-	-	-	-	24	120	2,914	3,641	6,555
Texas	8	167	1.2	2.6	3,126	0.4	1.2	-	-	-	1,467	19,044	20,678	39,722
Utah	-	-	-	-	-	-	-	-	-	-	-	1,968	440	2,408
Virginia	-	-	-	-	-	-	-	-	-	-	-	1,393	1,216	2,609
Washington	1	1	-	-	-	-	-	-	-	-	-	144	104	248
Hawaii	3	36	22.9	8.4	2	2.0	3.0	53	34	252	1,993	796	7,312	8,108
Total	68	70,176	0.7	0.3	8,519	0.8	1.0	4,186	3,774	2,012	6,509	74,913	108,024	182,937

*An additional 24 man-hours expended in DDT spraying projects.

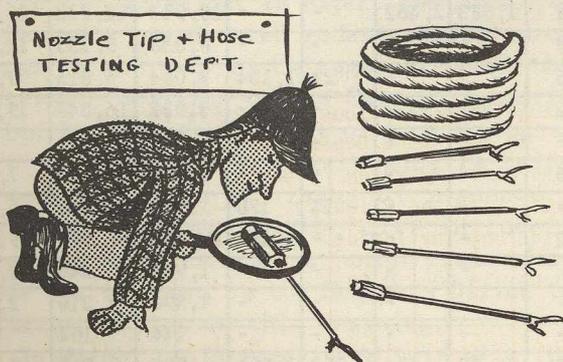
**Man-hours expended in DDT spraying projects.

***Alabama uses arsenic water — not "1080"

all projects were under way and in Charleston and Muskegon, arrangements were made with local authorities for financial assistance in the projects.

Equipment and Construction. Six hundred Hudson 310G spray cans were received and shipped to the field. Orders for sprayer parts for this type of can and for other types of spray cans in use in the field also were received. Because of changes in nomenclature of the sprayer parts and of the difference in certain parts for the 310G can, the Equipment and Construction Branch cooperated with the Supply Branch in the issuance of a supplement to the supply catalog in order to furnish proper identification of the parts in question.

In February, 15,000 feet of xylene-resistant hose were received. Since this hose was received from a different manufacturer than the one supplying such hose in previous seasons, it was deemed advisable to field-test the hose before placing additional orders. Numerous complaints were received from the field regarding the new stainless steel nozzle tips and, upon testing, many were found to be defective. The Procurement Section of the Administrative Division was asked to request the manufacturer to test the remainder of the nozzle tips on order before shipment. If a high percentage of the tips is still found to be defective, a return to the use of brass tips may be in order. A supply of gaskets sufficient to begin spraying operations has been received and shipped to the field.



Installation of equipment and remodeling of space in the Medical and Dental Clinic were completed, as was installation of the recently acquired unitized laboratory furniture for the Pathology Branch at Lawson. Construction of the four metal quonset huts for the Laboratory Division at Lawson was authorized, and work was begun on the first unit. Miscellaneous painting, minor construction, and space renovation activities for headquarters Divisions continued.

Impounded Water Studies. Four reconnaissance and one final malaria survey reports were completed and submitted to the Corps of Engineers. No additional requests for reports were received. It was learned, after submission of the final report in March, that the Corps of Engineers does not contemplate construction of the Osceola Reservoir.

Special Services. At the request of Medical Director K. E. Miller, Sanitary Engineer Director Frank R. Shaw was temporarily detailed to assist in the study of the social and health needs and services of Milwaukee County, Wisconsin. Mr. Shaw's participation in this study will be in connection with the sanitation aspects of the survey. It is expected that the survey will be completed by June 1949.

The second water purification unit was completed and work on the third unit was under way at the end of the quarter. A list of all available sources of liquid chlorine in cylinders was prepared and included in the equipment of each water purification unit. An order was placed for 10 portable canvas water storage tanks for use in disaster aid activities and it is expected that additional units will be obtained in the future.

Preparation of a model mosquito-abatement law was undertaken. Inquiries were made of the various Regional Offices regarding mosquito abatement legislation now in force, and copies of existing laws solicited in order that a model law might be evolved for incorporation in the existing

statutes by those States so desiring such additional legislation.

Parts of the Office of Civilian Defense technical manual, "Waterworks Engineering in Disasters," were reproduced and will be available for distribution to flood disaster areas if need arises.

Entomology

HEADQUARTERS OFFICE

Coincident with the inspection of houses to determine effectiveness of the residual spray applications in keeping houses free of malaria mosquitoes, observations were made on fly abundance in sprayed and unsprayed areas. Summaries of these observations made during the 1948 season, were completed by the Headquarters Office during the quarter. Both inside and outside fly counts were made on premises in unsprayed areas and in areas where (1) premises spraying had been carried out and (2) where only houses and privies were sprayed. In making the fly-density summaries, the houses were grouped by number of flies found: 0, 1-10, 11-50, 51-100, and 100-plus flies. Generally speaking, in States where total spraying of premises was carried on, the percentages of houses having inside and outside fly counts above 50 were significantly smaller than in States where only

houses and privies were sprayed. These data are shown in table 1. The 51-100-flies category is considered to be, roughly, the break between low and high fly densities; and where fly densities higher than 50 occur, premises treatment is considered desirable and more effective.

Due to the number of complaints of fly abundance that probably will be received and the inability of the State CDC Entomologists to handle adequately this increased work load over and above their normal duties, local supervisory personnel

should determine the legitimacy of most complaints. Where circumstances warrant, the State Entomologist should then be called in to make a thorough investigation of the complaint. It is hoped that more consistent results will be obtained from each State by so limiting this investigational work specifically to the State Entomologist.

In the Manual Letter (Entomology No. 17), issued April 1, 1949, specific procedures to follow in investigating complaints are given, and the use of the new Field Fly Testing Kit developed by the Technical Development Division at Savannah is detailed. Probable reasons for inadequate fly control are discussed at some length.

The Division furnished information to the State Board of Health regarding control of leeches in an outdoor bathing area in Mississippi frequented by Boy Scouts. Various methods discussed were: winter pond draining and the subsequent leech kill

Table 1

FLY ABUNDANCE IN SPRAYED AREAS

Extent of Spraying	States	No. of Fly Counts		Percentage of Collections Having Fly Counts in Indicated Density Groups:					
				1 to 30 Days after Spraying				2 Months after Spraying	
				1 - 50 Flies		51 - 100 Flies		51 - 100 Flies	
		Outside	Inside	Outside	Inside	Outside	Inside	Outside	Inside
Entire Premises	Tennessee and Mississippi	1,628	1,692	100.00	100.00	0.00	0.00	2.64	0.65
Houses and Privies	Alabama and Arkansas	3,512	7,891	92.72	96.68	5.30	1.57	6.21	1.51

through freezing (not feasible in Mississippi); liming the bottoms of the drained ponds; and applications of copper sulphate.

MALARIA INVESTIGATIONS BRANCH

Helena, Ark., Station. Blood surveys in the intensive study area (Lake Township) were continued, and the survey films were all reported negative for parasites by the Atlanta CDC Laboratory. Surveys in the colored schools of Phillips County were begun. All 37 colored public schools in Phillips County were visited. Specimens were obtained from 3,634 individuals. To date, 897 smears examined at the Atlanta laboratory have been negative for parasites. During the quarter, 127 blood smears were examined at the station laboratory and all were negative for parasites.

Routine collections of adult mosquitoes from natural resting places in the towns of Helena, West Helena, Marvell, Elaine, and other locations in Lake Township were continued. Eighteen additional adult collecting stations were established.

Mapping work was retarded during the period because of the urgency for entomological investigations and the condition of the roads. The Lake Township intensive-study area will have to be mapped in detail since existing maps are inaccurate and aerial photos of the area are out of date.

Newton, Ga., Station. Regular visits to residents of the experimental area were made by the nurse, and no persons with symptoms suggestive of malaria were encountered. Reports of the examination of 795 blood films collected during the past fall were negative.

An unseasonably warm January and February resulted in a very unusual status in the population of mosquitoes. At no time during the quarter were any of the three common species of *Anopheles* unrepresented at the collection stations. This circumstance reflects abnormal weather conditions, rather than unusual behavior of the mosquitoes.

Studies of length of different larval stages under varied temperature condi-

tions were continued. Progeny of wild-caught and colonized strains of *quadrimaculatus* were compared; preliminary results indicate a difference between the two strains. Optimum temperature for the colonized strain varied from 75° to 78° F., while that of the larvae from wild-caught adults was approximately 85° F. The time of development varied also; the local strain develops 3 to 4 days faster, from egg to adult, than does the colonized strain.

Twenty additional canaries injected with blood from wild birds have been examined with negative results. Blood films from 248 herpetological specimens and 217 mammals were examined.

ENCEPHALITIS INVESTIGATIONS BRANCH

For the past 3 months the unit personnel have been occupied mainly with the analysis of data obtained during the past several summers in Kern County, Calif. A report has been completed by Dr. Reeves for the California State Department of Health on the urban studies conducted in 1948. Dr. McClure is still at work summarizing data on the birds of Kern County which he collected in the 3 years prior to the termination of his observations on April 1, 1949. Mr. Brookman is summarizing information which he collected during the summers of 1946, 1947, and 1948, relative to the biology of *Culex tarsalis*.

During January and part of February a large part of the time was spent studying the wintering habits of mosquitoes. Freezing weather was encountered during part of this period. The aquatic stages of *C. tarsalis* disappeared, or became so scarce that it was not possible to find them, although *Culiseta* larvae were present in large numbers. However, adults were collected in small numbers in shelters. These were deplete females which, when kept in cages in the laboratory, refused to feed on birds, although imbibing sugar water freely. They are long-lived, remaining alive over a month in cages or bobbnet-covered jars. In March, on a trip to Kern County, young *tarsalis* larvae were found

in one of the permanent collecting stations, thus indicating that the annual cycle had started again in this area. Large numbers of engorged females were evident in shelters, although males had not yet appeared.

In the San Francisco laboratory, studies are in progress to determine the optimum medium in which to rear the aquatic stages of *C. tarsalis*. Several lots of this mosquito were fed on a mixture of St. Louis and Western equine virus. After 10 days they were tested for the presence of both viruses. Only Western equine virus was detected, in minimal amounts. Other lots of these mosquitoes remain to be tested.

Two transmission studies with Western equine virus have been made in the mite colony as it exists. A strain of virus originally isolated from *Liponyssus sylviarum* was employed. Mites were allowed to feed on several inoculated chickens, with demonstrated viremia. Although engorged mites were observed, none were found infected at any time.

Tri-color red-winged blackbirds, trapped in Kern County in January and February, were transported to the San Francisco laboratory where they were inoculated subcutaneously with a dilution of Western equine virus. At 24 and 48 hours all mice died from inoculation of all dilutions of blood. Results with this bird are similar to those with house finches and better than those with sparrows and chickens. Many factors, including its habit of nesting in marshy areas, make this bird appear to have epidemiologic importance in California.

Diagnostic serological tests for 1948 are almost complete in the study of human encephalitis in Kern County. One case of St. Louis encephalitis occurred in a 50-year-old male from a rural area outside the Kern Mosquito Abatement District. Onset date was October 3, after the expected active season.

FLY-BORNE DISEASE BRANCH

Principal entomological work carried out in five fly control cities consisted of

identification of the fly trap material collected during the 1948 season. In late March occasional trap collections were made at Phoenix, Ariz., and Topeka, Kans., to determine the onset of fly breeding. Several collections at the Phoenix City dump and rendering works yielded as much as $4\frac{1}{2}$ pints of flies.

A summary was made of the principal species composing the 1948 fly trap collections, and a comparison of the data on the blowfly group in relation to those on the housefly indicates that their relative densities may vary in inverse proportion across the country:

	Blowflies %	Houseflies %	Others %
Troy, N. Y.	85.2	3.7	11.1
Charleston, W. Va.	73.4	18.8	7.8
Muskegon, Mich.	71.2	12.7	16.1
Topeka, Kans.	42.9	44.3	12.8
Phoenix, Ariz.	7.6	91.4	1.0

Preliminary identification of fly trap material was done by the project entomologists, with the Taxonomy Section checking the accuracy of their work and making determinations in the more difficult groups. Rapid identification of flies where there is a great abundance of "green-bottle flies" is difficult.

ECTOPARASITE-BORNE DISEASE BRANCH

In murine typhus studies in 1948, tabulation and analysis were made of the ectoparasite data on rodent examinations and of the results of complement fixation tests on rat sera.

Data available for analysis on effectiveness of 10 percent DDT dust were received from 41 counties in 6 States. Substantial collections of rats also were made in several counties in Florida.

The quantity of data summarized consists of records of ectoparasite identifications from 1,105 rats, and of successful tests of sera from 936 rats. According to dusting periods these were divided into 41 percent from nondusted areas, 42 percent from areas dusted within 6 months, and 17 percent

from areas dusted more than 6 months previous to trapping.

Results of complement fixation tests on rat sera show a slight but statistically insignificant difference in the percentage of rats positive for murine typhus, in favor of dusted areas versus nondusted areas. A total of 367 rat sera from nondusted areas averaged 15.5 percent positive, while 569 rat sera from all categories of dusted areas averaged 14.4 percent positive. When the results from rats from dusted areas are broken down by dusting periods, the following figures are obtained: from areas dusted less than 4 months, 20.3 percent were positive; from 4 to 6 months, only 4.3 percent were positive; and from over 6 months, 14.0 percent were positive. Compared to the preceding three quarters of calendar year 1948 there appears to be no significant trend in the results from either the nondusted or from the dusted areas.

Ectoparasite data on the 1,105 rats examined show that the reduction in the percentage of rats infested by the different groups of ectoparasites in dusted areas as compared to nondusted areas was as follows: for *Xenopsylla cheopis*, 69 percent; for all nonsticktight fleas, 68 percent; for sticktight fleas, 31 percent; and for all mites, 40 percent. However, the infestation rate by the rat louse, *Polyplax spinulosa*, was 36 percent greater in dusted areas than in nondusted areas.

Large-scale use of 5 percent DDT dust for the control of murine typhus was

practiced in six States during 1948. Alabama used 5 percent dust exclusively after June 5, and Georgia used 5 percent dust in nearly all counties throughout the year.

A total of 5,230 rats was examined for ectoparasites from the projects mentioned above during 1948. This is approximately one-half the number examined from 10 percent DDT dusting projects.

Three-fifths of the entire number of rats examined were from Georgia. The Georgia collections were distributed quite uniformly throughout the year, whereas Alabama, which examined the second largest number of rats, collected only 8 percent of those before July 1. Ectoparasite data on the 3,106 rats examined from Georgia show that the approximate reduction in the percentage of rats infested by the different groups of ectoparasites in dusted areas compared to undusted areas was as given in the table below.

These figures appear to indicate good control for the first 90 days, but only slight reduction after that time. Compared to 10 percent DDT dust, which is very effective for the first 4 months and satisfactory up to 6 months, the indications are as follows: 5 percent DDT dust is as effective as 10 percent DDT dust for the first 3 months after application, but loses its effectiveness rather rapidly in the 4th month.

Experimental projects to determine the effectiveness of 5 percent DDT emulsion, in the control of rat ectoparasites and

Species or Group	Reduction in percent rats infested		Reduction in average number per rat	
	Dusted within 6 months	Dusted over 6 months	Dusted within 6 months	Dusted over 6 months
	%	%	%	%
<i>X. cheopis</i>	56	24	83	25
All nonsticktight fleas	60	24	68	None
Sticktight fleas	55	33	62	69
All mites	38	None	49	(Increase)
Lice	17	None	23	44

typhus in rats, were carried on in St. Augustine, Fla., and Opelika, Ala., during 1948. These projects were not intended to be extensive enough to give significant information on the reduction in incidence of human typhus, but were to be judged primarily on their relative effectiveness in the control of rat ectoparasites, and the cost of operations, as compared to DDT dust. The emulsion was applied as a residual spray in the same general types of places as those in which DDT dust is applied for murine typhus control.

Comparison of ectoparasite data from rats trapped in sprayed versus unsprayed areas in St. Augustine from August through December indicates excellent control of nonsticktight fleas, and good control of most of the other ectoparasites. Reduction in the percentage of rats infested by *X. cheopis* was 89 percent, while the reduction in the average number of *X. cheopis* per rat was 97 percent.

Data from Opelika seem to indicate a decided increase in sprayed areas in both the incidence and index of *X. cheopis*, from 3 to 25 percent and from 0.1 to 0.6, respectively. These confusing results appear to be due to unequal sampling.

A DDT dusting program for murine typhus control was carried on in Honolulu, Territory of Hawaii, during calendar year 1948. A total of 306 rats was trapped, 81 percent of which were from undusted premises and 19 percent from premises dusted for periods varying from 2 to 213 days previous to trapping. From these, 302 sera were successfully tested by complement fixation for murine typhus, and 16 rats were examined for ectoparasites. Two hundred forty-five rats from undusted premises proved 4.9 percent positive, and 57 rats from dusted premises proved 3.5 percent positive for murine typhus.

DYSENTERY VECTOR CONTROL BRANCH

Third quarter activities were concerned primarily with tabulation and analysis of data previously collected and with preparations for the coming fly season in the

vicinity of Thomasville, Ga. The equipment remaining at the Pharr, Tex., station was moved to Thomasville early in the quarter, with the exception of a few items necessary for the one epidemiological aide left in Pharr, and deep-freeze boxes for the storage of materials that later would be assayed for polio virus.

A final catalog of the fly collections made for polio-virus studies in Hidalgo County during 1948 was prepared and sent to Dr. Melnick of Yale University. The records of these collections have been compiled for the purpose of making evaluations of the grill technique, especially in respect to the value of the species break-down.

The bacteriology and entomology laboratories, except for the eye-gnat laboratory, were completed and made ready for operations.

Epidemiology

OFFICE OF THE CHIEF

Effective March 10, 1949, Dr. Seward Miller, Chief of the Laboratory Division, was designated Acting Chief of the Epidemiology Division, vice Dr. Griffith E. Quinby, who returned to his previous position as Officer in Charge of Malaria Investigations of the Epidemiology Division.

Dr. Robert Serfling reported for duty on March 18 as Officer in Charge of the Statistical Branch.

In January, the Alabama State Department of Health requested epidemic aid in connection with an outbreak of psittacosis resulting from the handling of pigeons in Birmingham. This call was referred to the National Institutes of Health, and Dr. Dorland J. Davis cooperated with the local and State health officials in establishing the cause and identity of the outbreak. Four cases were originally re-

ported; confirmatory evidence of psittacosis was found in two. Pigeons from the city were examined. Fourteen of 22 sera were positive, and virus was recovered from 3 of 30 pigeons examined thus far. Recommendations were made to the community that all "wild" pigeons should be shunned, and that ill pigeons should not be handled.

MALARIA APPRAISAL

During this quarter morbidity reports for malaria for the entire calendar year became available to the Communicable Disease Center. Significant decreases have occurred in the United States in 1948, as indicated in table 1.

From table 1 it will be noted that attack rates for malaria have been reduced to levels below 10 per 100,000 except in five States. This is particularly noteworthy in view of the fact that this same rate was a critical one applied not to

morbidity, but to mortality rates in the selection of preapproved counties for malaria eradication procedures.

Table 1
REPORTED MALARIA MORBIDITY FOR U. S.
1948

	Rates per 100,000
U. S.	6.9
34 Nonmalarious States	0.4
14 Malarious States	
South Carolina	181.5
Texas	50.0
Arkansas	30.7
Oklahoma	17.5
Alabama	10.7
Mississippi	5.2
Florida	4.7
North Carolina	3.9
Georgia	2.9
Tennessee	2.2
Kentucky	2.1
Louisiana	1.9
Virginia	1.2
Missouri	0.6

Table 2
RECORD OF MALARIA APPRAISAL
January, February, March, 1949

State	Cases Reported	Cases Appraised	Cases Appraised as		
			Positive	Doubtful	Improbable
*Alabama	12	12 (January)	9	2	1
*Arkansas	12	No reports available	—	—	—
Florida	19	—	—	—	—
*Georgia	9	9 (Includes 1 death)	6	3	—
Kentucky	4	—	—	—	—
Louisiana	10	—	—	—	—
*Mississippi	5 (Through Feb.)	1 (January)	—	—	1
Missouri	1 (January from PHM— no weekly reports available from State)				
N. Carolina	8	—	—	—	—
Oklahoma	8	—	—	—	—
*S. Carolina	32**	10 (March only)	3	7	—
Tennessee	2 (Through Feb.)	—	—	—	—
Texas	521	—	—	—	—
13 State Total	643	—	—	—	—

Cases reported are from Public Health Methods for January and from weekly morbidity reports from States; in case of Mississippi, North Carolina, and Tennessee, monthly reports from State Health Departments.

*States with malaria appraisal programs.

**South Carolina State Board of Health, Division of Preventable Diseases, in weekly morbidity report of March 12, 1949, showed 185 cases as total for year to date. In report of March 19, 1949, this total was corrected to 28.

Malaria reports for the entire United States continued their precipitous decline. In South Carolina reports for January, February, and March (table 2) totaled only 32 cases. As compared with 407 cases for the same quarter for 1948 and 467 cases for 1947, it may be concluded that reports even in South Carolina are at an all-time low. On epidemiological grounds, South Carolina followed Alabama in eliminating a large number of apparently spurious reports which had been investigated. As of March 19, South Carolina eliminated 160 cases by correcting their previous reports for the calendar year 1949.

Moreover, since South Carolina has in progress a change in the basic procedures and forms involved in their communicable disease reporting system, it is anticipated that spurious reporting of malaria will diminish even more rapidly in that State. As has been the case previously, none of these cases reported, except imported malaria, have been confirmed by the State Health Department laboratory or other approved laboratory.

Texas alone continued to report substantially large numbers of cases. For the third quarter of 1949, Texas reported 521 cases as compared to 491 for the same quarter of 1948.

LEPROSY

Four nurses attended the 6-week training course in leprosy for nurses of the Communicable Disease Center. This course was held at Carville, La., under the direction of the staff there.

In Mississippi, Dr. Mires of the Communicable Disease Center and Dr. Paul Erickson from the Carville Leprosarium visited a patient at the State Penitentiary at Parchman. The inmate was suspected of having Hansen's disease until seen by Dr. Erickson.

In Alabama another case was seen in consultation by Dr. Wooster and not confirmed as leprosy.

Through the Typhus Control Branch, information was obtained of a naturalized

American of Chinese birth whose case was confirmed as leprosy, in the Chicago area.

VIRUS BRANCH

In an effort to obtain information on the epidemiology of equine encephalomyelitis and histoplasmosis, a team composed of Dr. Quinby, epidemiologist; Mr. Sciple, ornithologist; and Mr. Foote, entomologist, left Atlanta for Ship Island on February 13, 1949. They collected 101 birds and mammals (96 birds of 25 species, plus 5 rats). Sera for Eastern equine encephalomyelitis virus neutralization tests were obtained from 81 birds and 5 rats. Livers and spleens were removed from these animals, and 169 tubes of media were inoculated for histoplasmosis studies. Some 122 thin-film blood smears were made to gain information on the prevalence of avian blood parasites. Approximately 5,000 arthropods (including lice, mites, mosquitoes, and Culicoides) were collected. Laboratory procedures are now under way on the smears, sera, and arthropods.

A Florida gallinule (*Gallinula chloropus cachinnans*), which apparently was suffering from some neurological disorder, was brought into the laboratory where blood for virus isolation was drawn and immediately frozen.

TYPHUS INVESTIGATIONS, THOMASVILLE, GA.

Activities in Decatur County, Ga., where a single county-wide rat poisoning campaign was conducted in the summer of 1946, were terminated during the first month of the present quarter. In Thomas County, the last cycle of dusting with 10 percent DDT was completed July 30, 1947, and the last dusting cycle was completed in Brooks County on September 30, 1947. Surveillance of human incidence, rat incidence, and ectoparasite abundance is being maintained in the two dusted counties to determine the interval of time such factors will remain suppressed as compared to parallel observations in untreated Grady County.

During the past quarter, 47 reports of illness were investigated and 20 human

blood specimens were obtained for complement fixation tests. One probable case of typhus fever occurred in untreated Grady County. Two Brooks County cases that are thought to be typhus fever are pending serological confirmation.

Although the percentage of Thomas County *Rattus rattus* positive to the complement fixation test for typhus has been only slightly under similar figures from untreated Grady County during the quarter, the percentage of positive *Rattus norvegicus* remains considerably higher in untreated areas than in the dusted counties. Of all the rats examined during the report period, 21 percent of those from Grady County were positive, 6 percent from Thomas County were positive, and 1 percent from Brooks County was positive.

Infestation of rats with fleas is remaining suppressed in the dusted areas and to a greater degree in Brooks than in Thomas County. Infestation of Thomas County rats with *Xenopsylla cheopis* has been increasing during the quarter at a more rapid rate than on rats from untreated Grady County. As in percentage positivity trends mentioned above, there is a greater difference between Grady and Thomas Counties in percentage of *R. norvegicus* infested with *X. cheopis* than in infestation levels on *R. rattus*.

There is a continued slight suppression of infestation of rats with the tropical rat mite, *Bdellonyssus bacoti*, in dusted areas as compared to the untreated area. The rat louse, *Polyplax spinulosa*, has a similar degree of infestation in all three counties.

Laboratory

OFFICE OF THE CHIEF

Surveys and Consultations. Program reviews of State public health laboratories were conducted in Florida and Tennessee.

A survey of the laboratories of the city of Philadelphia was also made.

Specimens and cultures received for diagnostic study totaled 21,981 items.

Senior Surgeon E. E. Mandel, formerly Chief of Medicine, U. S. Marine Hospital, Chicago, Ill., has been assigned to the Laboratory Division, and has been placed in charge of the Clinical Pathology Section.

Extension Service. The regular shipments of specimens, keys, and charts sent monthly to 304 laboratories consisted of *Giardia lamblia* cysts, *Endamoeba coli* cysts, hook-worm eggs, *Strongyloides stercoralis* larvae, *Wuchereria bancrofti* microfilariae, and *Trypanosoma cruzi*.

Fourteen loan sets of parasitological material and keys of entomological material were distributed on request of individuals in 12 States. Many of these were used for teaching of students in colleges and laboratories.

There were 243 special shipments of slides, specimens, cultures, and typing sera in answer to requests for particular teaching or research needs.

PARASITOLOGY BRANCH

Methodology Research. Completed studies show that *Trypanosoma cruzi* will remain viable in whole animal blood for several days. For diagnostic purposes, it appears to be practical to mail whole blood specimens over a considerable distance to a diagnostic laboratory.

To begin evaluation of the laboratory diagnosis of amebiasis a temporary laboratory was established in a mental hospital. Various methods of direct examination were evaluated and the findings compared with the results from physical examination and from serological tests. These comprehensive procedures were carried out on 38 patients; the results will be reported later.

During this study it was found that "mass treatment" for amebiasis in four wards had reduced the incidence of *Endamoeba histolytica* from 36 percent in 1945 to 2 percent in 1949.

Three members of the staff visited the

National Institutes of Health reviewing the serological tests for evidence of parasitic disease. Upon their return, preliminary work was begun to make the complement fixation tests for amebiasis and trichinosis available for referral diagnosis at CDC.

Training Courses. The 13th 6-week course in the "Laboratory Diagnosis of Parasitic Diseases" was begun on March 14. There were 21 students from 16 States in the class.

Reference Diagnosis. In this quarter 9,386 tests were performed to examine 8,635 specimens submitted from 24 States.

Among the 8,324 malaria survey blood films examined there was a single positive smear; it was one of 5,463 from South Carolina.

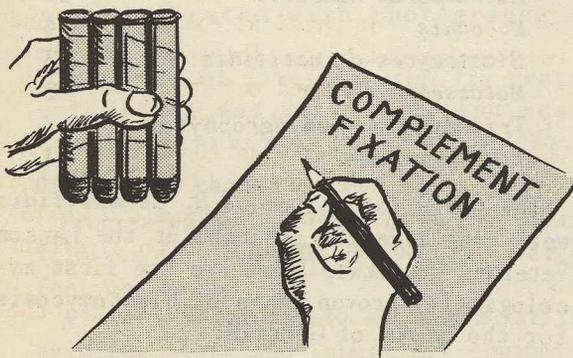
VIRUS AND RICKETTSIA BRANCH

Methodology Research. The characteristics of the encephalomyocarditis virus in guinea pigs have been established with respect to virus transfer, challenge infection, and distribution in the body.

Training Courses. A 2-week course on "Diagnostic Methods for Influenza" for technicians was given March 14 to 28. The course was under the general direction of Miss Howitt and under the direct supervision of Miss Gorrie. Four students, from Alabama, Florida, Iowa, and Louisiana, attended the course.

Reference Diagnosis. A virus obtained from brains of encephalitis patients in Nashville, Tenn., appeared to be herpes.

Viruses, as yet unidentified, were recovered from 3 of 23 fecal specimens and from 3 of 57 nasal or throat washings.



Neutralizing antibodies for Newcastle disease virus were found in 74 of 149 human sera and in 4 of 26 bird sera.

Neutralizing antibodies for Eastern equine encephalomyelitis were found in 1 of 77 animal sera from Georgia, 9 of 84 wild bird sera from Georgia, and 1 of 8 wild bird sera from Louisiana.

Complement-fixing antibodies for lymphocytic choriomeningitis were found in 2 of 3 human sera from Georgia.

BACTERIOLOGY BRANCH

General Bacteriology Section. Preliminary experiments have been completed for the purpose of developing an improved plating medium for the isolation of diphtheria bacilli; improvement of the diphtheria virulence test continued.

Thermometer-disinfection techniques were chosen as the first of a group of studies for investigating the basis of, and developing nursing techniques in, communicable disease.

The first 4-week course in "General Bacteriology" was begun March 28 with 13 students attending.

Single lectures on "Diphtheria" were given at Emory University Medical School and at the Georgia State Health Department.

In Florida lectures were given at the University of Florida and for a Florida State Health Department Review.

Throat cultures were submitted for *Corynebacterium diphtheriae* isolation from seven States and Canada. These cultures totaled 541; 341 pure cultures were tested for virulence. Miscellaneous cultures submitted for identification totaled 19.

Immunology-Serology Laboratories. Studies on the physical factors in the serological diagnosis of brucellosis have been completed and the comparison of methods for antigen preparation has begun.

Histoplasma capsulatum antigens and antisera were supplied from the Mycology Section. The results with these were so satisfactory that large-scale use of the complement fixation test in histoplasmosis was considered to be practicable.

A 1-week course in "The Serological Diagnosis of Rickettsial Diseases" was given February 21 to a class of 15 students from six States.

The Host Preference Laboratory received 4,987 specimens from Arabia, Puerto Rico, Arkansas, Georgia, and South Carolina.

Complement fixation tests for murine typhus with 4,980 rat sera showed 5.3 percent to be positive. Sera from Florida showed 10.8 percent positive. While none of 14 sera from Arkansas or 51 from Virginia were positive.

Human sera for rickettsial diagnosis showed 2 of 69 positive for murine typhus with the complement fixation test; 21 of these specimens were positive in the Weil-Felix test (OX19). From the Thomasville, Ga., survey 213 human sera showed 65 positive for murine typhus, while 2 were positive with spotted fever and rickettsialpox antigen.

An agreement was made with the National Institutes of Health whereby all referral diagnosis in leptospirosis is to be performed by CDC. This service includes blood and urine culture as well as serology.

During this quarter 74 sera were received for study: 3 dog sera gave positive agglutination of *Leptospira canicola*; 1 human serum agglutinated *L. icterohemorrhagiae*.

One complete set of streptococcus typing sera was sent out and six supplemental lots of sera were distributed.

Enteric Bacteriology Section. A new *Salmonella* type, *S. allandale*, was recognized; the antigenic formulas of three additional new types were confirmed at the request of national centers in England and Denmark.

During the quarter 693 cultures were received. Of these cultures, 454 were *Salmonella* (171 human, 283 animal), 142 paracolon, and 66 *Shigella*.

Tuberculosis Section. The comparison of Lowenstein's medium with Petragnini's medium (Frobisher modification) for diagnosis of tuberculosis was completed. A comparison of solid Dubos' medium with

Lowenstein's was begun.

Studies were begun on vitamin C production by tubercle bacilli, photofluorometric assay of streptomycin, and the toxicity for tubercle bacilli of various pH indicators.

Eleven students participated in a training course for laboratory technicians February 28 to March 25. Dr. H. S. Willis presented a lecture on the "Pathogenesis of Tuberculosis."

Routine diagnostic specimens (sputum, gastric fluid, and other body fluids) totaled 923. From six States and Alaska 22 cultures were sent for identification with regard to type. There were 410 cultures submitted for streptomycin sensitivity testing.

Mycology Section. Antigens for the complement fixation test for histoplasmosis were completed and, in conjunction with the serology laboratories, this diagnostic service was made available.

Histoplasmin has been prepared and will be available for distribution as soon as it has been standardized. The production of coccidioidin for skin testing and for serological tests was begun.

No pathogenic fungi have been recovered from wild birds, rodents, or soil samples. These studies will continue, using new procedures for isolation.

A total of 187 specimens (cultures, clinical specimens, slides) were received from 12 States and Canada. From these, 42 pathogenic fungi were identified:

<i>Candida albicans</i>	18
<i>Microsporium Audouini</i>	12
<i>M. canis</i>	4
<i>Blastomyces dermatitidis</i>	3
<i>Malassezia furfur</i>	2
<i>Trichophyton mentagrophytes</i>	2
<i>T. tonsurans</i>	1

The three isolations of *B. dermatitidis* were made from two patients at the Lawson Veterans Hospital. These are the first mycologically proven cases of blastomycosis for the State of Georgia.

In connection with dermatology clinics at Grady Hospital, Atlanta, a regular mycological service was initiated.

CLINICAL PATHOLOGY BRANCH

This Branch was activated and is housed in a building adjacent to the bacteriology laboratories at Lawson Veterans Hospital. A biochemistry laboratory began operations and the Clinical Pathology Section was assigned space for work to begin in the next quarter.

Production

Scripts for all 10 of the proposed motion pictures on rodent control are being prepared. The films, a cooperative project with the Army, will be closely correlated with the "Rat-Borne Disease Prevention and Control" manual.

PROJECT DEVELOPMENT BRANCH

The Branch arranged to produce a series of three films on the epidemiology and control of encephalitis, in cooperation with the George Williams Hooper Foundation.

In January an 8-page insert was completed for publication in "Films in Medicine," sponsored by the American Medical Association, reviewing films and film production facilities in the field of medicine. This insert is, in effect, a progress report — a description of the objectives, production facilities, and procedures of the Production Division. The report, in outline form, is illustrated with photographs and graphics.

A series of five films on fly control activities was initiated, and script research writing is in progress.

PRODUCTION BRANCH

Processing and printing of motion picture film was increased to an average of 12,000 feet per week.

A complete laboratory set was built from existing flats and laboratory equipment.

This set was so constructed that several different laboratory sets might be arranged from the same basic set.

The Sound Department acquired a music-on-disc library. The pictures, "Production and Processing of Oysters" and "Malaria Control on Impounded Water" were re-recorded, including music. These music tracks greatly improved the quality of the productions.

UTILIZATION BRANCH

Film distribution for January 1949 consisted of 161 motion pictures and 251 filmstrips. In February, 209 motion pictures and 300 filmstrips were shipped. Distribution rose in March to an all-time high for CDC of 310 motion pictures, 356 filmstrips, and 8 sets of slides. The total film distribution for the quarter was 1,595, a number which exceeded any previous quarterly distribution by more than 11 percent.

Copies of the CDC Film Catalog and Utilization Guide were sent to approximately 150 requesting agencies during the quarter. Catalog pages describing new CDC films released during the quarter were sent to the 700 or more catalog holders to keep the catalogs up to date. Copies of all film guides that have been completed were sent to users of the corresponding films to improve utilization.

An audio-visual aids course, continuing for 2 weeks, was presented in January for interested Public Health Service personnel. The course featured such topics as "Sources of Visual-Aids," "Projection Techniques," and "Utilization Theory and Procedures."

PRODUCTION PROGRAM FOR THE VENEREAL DISEASE DIVISION, U. S. P. H. S.

"The Horizons of Syphilis" was approved by the Division of Venereal Disease.

PRODUCTIONS RELEASED

Motion Pictures

- 4-046.0 Concrete Ditching for Malaria Control
- 4-083.0 The Sanitary Pit Privy

Filmstrips

- 5-043.1 Vivax Malaria
- 5-102.0 Foot-and-Mouth Disease

Film Guide

- 8-019.0 -- G 5-090.0 Spread and Prevention of Trichinosis
G 5-095.0 Worms in Your Muscles

PROJECTS RELEASED**Photographs**

- 1-021.0 Photographs of Rabbit Virulence Test in Color, Diphtheria Laboratory
1-025.0 Series of Photographs of Bacteriophage Cultures
1-026.0 Photographing of Norway Rats
1-028.0 Photographs of Spray Units
3-002.0 Pin Maps of Public Health Service Trainee Countries
8-017.0 Charts and Maps for Rat Manual

2x2-inch Slides

- 9-027.0 Color Slides of Five Flies
9-028.0 Slides from Filmstrip "Identification of Some Common Sucking Lice"

3/4x4-inch Slides

- 10-018.0 Slides of Tuberculosis Laboratory Equipment, Methods, and Procedures
10-019.0 Slides of Normal and Yellow-Eyed Flies
10-020.0 Slides of Spraying Equipment
10-021.0 Slides of Tuberculosis Control Division, Maps, for T. B. Evaluation Laboratory
10-022.0 Slides of Reported Murine Typhus Cases by States, 1931 to 1947
10-026.0 Slides of Rabbit Kidneys



Technical Development*

INSECTICIDE BRANCH

Investigational Work on Adult Mosquitoes. Laboratory tests with deposits of benzene hexachloride (BHC) of 95 percent gamma isomer content showed that 50-milligram deposits per square foot produced satisfactory mortalities against *Anopheles quadrimaculatus* for approximately 3 months, whereas 100-milligram deposits continued to give high mortalities for 5 months. The characteristic odor was still persistent.

Compound 118 at dosages of 100 to 200 milligrams per square foot gave high mortalities during the first 2 months but was inferior to DDT after the first month.

DFDT, the fluorine analogue of DDT, produced unsatisfactory mortalities at 50 milligrams per square foot. Satisfactory mortalities, as compared to DDT, were obtained for 1, 2, and 3 months, respectively, with deposits of 100, 200, or 300 milligrams per square foot.

Investigational Work on Adult Houseflies. The rapid screening of 72 chemical compounds for insecticidal activity against *Musca domestica* showed that 14 had some activity. These included several analogues of DDT and a number of fluorophenols. The fluorophenols were too volatile to be practical as residual sprays.

BHC containing 95 percent gamma isomer was not so effective against flies as against mosquitoes. Even deposits of 100 milligrams failed to give satisfactory mortalities after 9 weeks.

Compound 118 produced kills which were satisfactory as compared to DDT after 9 weeks and 12 weeks with 100- and 200-milligram deposits, respectively.

The fluorine analogue of DDT was somewhat inferior to DDT at equal dosage rates against houseflies. Apparently the activities of houseflies masked DFDT as well as DDT.

The addition of 2 percent water-white rosin to a 5 percent DDT emulsion did not inhibit the penetration of the DDT into poplar wood. Moreover, under protected conditions, there was no advantage in using 8 milliliters of 2½ percent DDT-finished spray as compared to 4 milliliters of a 5 percent spray on unfinished wood not exposed to weathering. Glass panels sprayed with an emulsion containing 5 percent DDT and 2 percent rosin, but no other emulsifier, still are giving 100 percent mortality of both houseflies and blowflies exposed for 30-minute periods after 5 months of weathering.

A continuation of tests in which various insecticides were used alone or in combination with DDT against highly DDT-resistant houseflies shows deposits from the mixtures of DDT with chlordan or methoxychlor

*Abstracted from Technical Development Division Summary of Activities No. 17, January, February, March 1949.

have produced the longest-lasting residual effectiveness.

Samples of eggs and adult flies have been collected from each of the dairies in Chatham County, Ga. Of 23 strains so isolated, 15 showed considerable DDT resistance, as compared with the insectary strain of flies, while 3 strains showed moderate resistance and 5 had no evidence of resistance.

Studies were begun to determine the rate of increase in insecticide resistance in flies reared in cages in which varying proportions of the available resting surfaces are treated. Colony cages were designed in which varying proportions of the interior could be replaced with treated panels. Panels were treated at the rate of 200 milligrams of DDT, methoxychlor, or an equal mixture of DDT and methoxychlor per square foot. When 1,000 flies were held in a cage with 5 percent of the available resting place treated with DDT, 17.4 percent survived for 10 days. When 5 percent of the available resting surface was treated with an equal mixture of DDT and methoxychlor, only 6.9 percent of the flies survived 10 days. When 5 percent of the available resting surface of the panels was treated with methoxychlor, the survival was 92 percent, and was 30 percent even when 45 percent of the resting surface was treated with methoxychlor. Eggs from each of these colonies are being reared in the insectary, and the adults produced will again be exposed in similarly treated cages.

Investigational Work on Mites. Of 54 chemicals tested in the search for a suitable material for control of the rat mite, *Liponyssus bacoti*, only 6 gave 90 to 100 percent mortality in light-dust rapid-screening tests. In runway tests in the laboratory, a dust containing 3 percent of DDT plus 3 percent of chlordan, and a 10 percent DDT dust have shown the greatest efficiency in eliminating test colonies of the mite.

Relationship between the Physical State and Insecticidal Action of DDT on Solid and Liquid Surfaces. Supersaturated droplets of DDT solutions were found to persist on glass surfaces over 20 weeks with solvents such as cumene, dichlorobenzene, or isopropanol. The crystallization showed little general agreement within a particular chemical group or related groups of solvents. Ninety percent of the solvent may evaporate from the droplets of a 5 percent DDT solution without crystallization of the DDT. The supersaturated droplets were less effective than freshly sprayed droplets. Measurements of the contact angle between a fly's tarsus and test droplets revealed lower wetting power as the droplet aged.

Preliminary data indicate that a small percentage of nonvolatile oil in DDT solutions with volatile solvents will delay crystallization 4 to 8 weeks. Higher concentrations of DDT increase the rate of crystallization. Method of application and type of surface influenced the type of crystal habit, but temperature and the presence of dust nuclei had no influence. The slightest contact disturbance of the droplet, either by means of a needle or brush or by the activity of test insects, induced rapid crystallization.

Considerable difference was noted in the 50 percent knock-down time of houseflies after exposure to equal deposits of DDT from different solvents when tested 4 weeks after spray application.

The residual effectiveness of DDT against houseflies did not show variation with the different crystal habits in preliminary evaluations.

DDT recovered in chemical estimations at periods of 3 or more weeks after initial application to larvicide test pans was of sufficient quantity to produce a 100 percent larval kill, but the surface film had become inactive. With complete dryness, an acetone extraction of a DDT-carbonate film from glass yielded only 0 to 39 percent of the original DDT

3 weeks after the initial application. With incomplete water evaporation, samples tested at 2-week intervals showed a gradual decrease of DDT to about 60 percent of the original quantity over a 6-week period.

Mortality tests with the 4th instar of *A. quadrimaculatus* showed the following:

1. Variation in the residual effectiveness of DDT in different fuel-oil samples with and without a surface-active agent was demonstrated. Fuel-oil-DDT surface films showed an abrupt loss of effectiveness within a 1-day period at approximately 8 days after application. The mortality fell from 100 percent to 20 percent.
2. A 0.6 percent DDT solution in various methylated naphthalenes was effective for about 13 days in the laboratory when applied to the surface of water at the rate of 1 gallon per acre.
3. BHC, toxaphene, methoxychlor, and chlordan gave residual effectiveness inferior to DDT when applied as 0.6 percent solutions in fuel oil and cyclohexanone to the surface of water in test pans at the rate of 1 gallon per acre. Results with DDD were comparable to those with DDT, especially in the fuel oil films. Various combined applications did not show synergistic action.
4. DDT in a hydrocarbon solution was more effective than DDT either as a single large clump of crystals or as scattered fine crystals when applied to the surface of water. With mechanical agitation, the effectiveness of floating crystals was improved but erratic.

Housefly Larvicide Studies. Five milliliters of 5, 3, or 1 percent insecticidal emulsions were sprayed on fly-rearing cultures -1, 1, 3, or 5 days of age, and the comparative effectiveness of different insecticides was measured by the pupal and adult mortalities.

Of 11 insecticides tested, chlordan, insecticide 118, Hepta-Klor, and toxaphene gave excellent mortalities with appli-

cations of 5 milliliters of 5 percent emulsions on 1,000 grams National Association of Insecticide and Disinfectant Manufacturers (NAIDM) medium containing 3-day-old *M. domestica* larvae.

Mortalities of 99 percent or more were secured from applications of a 5 percent chlordan emulsion at rates of 5, 3, and 1 milliliter per 1,000 grams of NAIDM medium, if applied when *M. domestica* larvae were present. Mortalities from treatment of 5-day-old cultures indicated less effectiveness against the pupae. Injections of chlordan 2 inches below the surface of the culture medium were not as effective as topical spray applications.

Ethylene dibromide has shown somewhat higher effectiveness than dichloropropane-dichloropropene as a soil fumigant against *M. domestica* larvae.

Of 11 chemicals tested as fly larvicides, mainly organic fluorine compounds, none showed promise.

DISINSECTIZATION OF AIRCRAFT

In the biological procedure used for the laboratory evaluation of aerosols, the walls, ceiling, and floor of a Peet-Grady chamber are covered with four layers of paper which are stapled so that the successive top layers may be removed when desired. A fresh layer of paper is exposed on the floor for each successive test, whereas fresh layers on the walls and ceilings are provided only once a day. All windows and screens are washed with acetone at the end of each test and the chamber is ventilated. All openings of the chamber are then tightly closed and the temperature of the chamber is adjusted to approximately 80° F. A measured dose (1.08 grams) of the test aerosol is discharged into the chamber for 5 to 10 seconds, after which a sample of test insects is introduced into the chamber through an opening near the lower right front corner. At present, a test sample of insects consists of at least 100 adult *M. domestica* of each sex. Exposure periods are 15 minutes. The knocked-down flies are picked

up and deposited in a collecting storage cage by means of a vacuum-cleaner-type aspirator. A second collection of the remaining active specimens is immediately made in another cage. A sample of non-exposed flies from the same original source is collected in a third cage as a control for natural mortality. All insects are supplied with food and held in a room with constant temperature and relative humidity for 24 hours before the mortalities of each sex are recorded.

The aerosol formulations were mixed in a small pressure mixing tube (aluminum) light enough to permit weighing on an analytical balance. In practice, the insecticidal concentrate is measured into the glass tube by use of a pipette, and the propellant is pumped into the apparatus to the level of a reference mark previously established by weighing.

A dispenser was designed and calibrated to discharge liquified gas insecticide charges of approximately 1 gram into the Peet-Grady chamber and was found to have a maximum variation of 1.85 percent. The insecticide is propelled by gas supplied by a pool, within the dispenser barrel, of whatever propellant is used in the insecticide. Boiling of the insecticide solution during loading and dispensing is prevented by (a) the lowered boiling point of the solution as compared to that of pure propellant which surrounds the insecticide container, and by (b) the retarding action of capillary forces in the insecticide passages as compared to the relatively broad pool of pure propellant. The pure propellant is loaded through a bottom valve to a depth below the lip of the floating test tube, and the insecticide charge is loaded from the mixing tube through a capillary valve to a predetermined and marked depth in the test tube. When necessary, the insecticide may be injected between two charges of freon or air to prevent dilution by condensation, faulty nozzle action, or other objectionable phenomena. A study of

particle-size pattern and distribution, ignoring particles under 1 micron diameter, showed that 87 percent of the droplets were less than 10 microns, and only 0.3 of 1 percent were over 30 microns in diameter. There were some slight differences in the total numbers of droplets deposited on carbon-coated slides placed in the center of each quadrant of a Peet-Grady floor, the range being from 1,788 to 2,052 per square centimeter.

There were approximately 200 drops per square centimeter at the floor level to each drop recovered $\frac{1}{4}$ inch below the ceiling. Because of a tendency of the houseflies to rest on the ceiling, it was decided to modify the test procedure and to release the flies near the floor after the aerosol had been introduced into the chamber, thus forcing the flies to fly up through the aerosol before they could reach the ceiling. This modification greatly reduced the range of mortality results between replications. In the dispenser, replacement of all gaskets contacting the insecticide by permanent seats of metal-to-metal contact has improved uniformity of discharge and consequently particle size and distribution control. The nozzle adaptations have been changed to permit the interchangeable use of nozzles employed in the aircraft dispensers developed at the Naval Air Station, Jacksonville, Fla.

To permit quick comparison of the efficiency of test aerosols, an index has been used which is simply the ratio of the average percent kill of insectary *M. domestica* adults as obtained with the test aerosol for 15-minute periods in a Peet-Grady chamber to that obtained on the same batch of flies with the standard formula G-382. Thus an aerosol with an index greater than 1.00 would be considered more effective than the standard G-382, while one with an index less than 1.00 would be less effective. The addition of 1 percent of the synergist Van Dyck-264 to the standard G-382 formula produced

an index of 1.24. The addition of 2 percent piperonyl butoxide produced an index of 1.25. The substitution of 4 percent piperonyl butoxide for 2 percent lube oil produced even a higher index. The addition of n-propyl isome did not improve the mortality obtained with G-382. The highest index (1.37) has been obtained by the substitution of Sovacide 544G for both the cyclohexanone and lube oil. The use of Velsicol AR60 in place of the cyclohexanone and lube oil as solvents for DDT also gave good results, but the effects of these latter two solvents on plastic materials will have to be determined.

CHEMISTRY BRANCH

Synthesis of New Insecticides. A modification of the Zeidler method was used to prepare 2,2-bis-(1-fluoronaphthyl)-1,1,1-trichloroethane, m. p. 174-5° C. (from 2-methoxy-2-propanol) and 1,1-bis-(p-fluorophenyl)-2,2-dichloro-3-chlorobutane, m. p. 70-1° C. (from 95 percent ethanol). The compounds were tested as residual insecticides against adult houseflies, housefly larvae, and mosquito larvae. Except in one instance both compounds were approximately one-fourth as active against these organisms as is DDT. 1,1-bis-(p-fluorophenyl)-2,2-dichloro-3-chlorobutane approached DDT and DFDT in its activity against mosquito larvae when tested at a concentration of 0.06 ppm and at a 24-hour exposure. The acute toxicity of 1,1-bis-(p-fluorophenyl)-2,2-dichloro-3-chlorobutane was approximately one-third that of DDT in white mice and gave an even lower percentage of mortality in white rats. 2,2-bis-(1-fluoronaphthyl)-1,1,1-trichloroethane was less toxic than 1,1-bis-(p-fluorophenyl)-2,2-dichloro-3-chlorobutane in both species under identical tests. A series of fluorinated phenols failed to produce significant kills when tested as residual insecticides against houseflies. Fresh deposits of fluorinated phenols were very toxic to houseflies.

EQUIPMENT DEVELOPMENT BRANCH

Two exhaust aerosol solvents have been compared to a solution of 20 percent DDT in a methylated naphthalene similar to that successfully used for fly control in Greece in previous years. All tests were made at dawn with 20 percent DDT in solutions exhausted from a PT-17 airplane flying into the wind at 30 feet above ground. Performance tests indicated that the solution containing Sovacide 544B as solvent was the most suitable of the new materials for use in exhaust aerosol equipment. Recovery of DDT at the ground surface was roughly 10 percent of that dispersed.

A microprojector has been built for use in studying the manner in which insects become contaminated with insecticidal materials. It will cast a silhouetted image of small objects contacting liquid surfaces, such as a fly leg against a liquid droplet. Magnification up to 100 times actual size is available, and sketches or tracings may be made from the image cast on any horizontal surface.

In a rubber hose test, immersion of a thiokol-lined, rubber-cased hose in xylol produced considerable cracking and swelling of the outer case. After 9 days' immersion and 2 days' drying, the samples appeared serviceable in spite of splits in the outer covering.

An insect knock-down recorder has been built for use in checking knock-down rates of flying insects in the presence of various insecticides over long periods of time. The insects are deposited between two strips of transparent adhesive cellophane tape moving together at a known rate of speed. The use of transparent tape makes counting and sex identification of houseflies possible without having to take them out of the tape. The apparatus is especially useful in insecticide resistance studies. It does not allow for recovery after knock-down since all insects caught in the tape are killed by the mechanical action of the rollers.

An improved model of the Tiger Rat Guard has been tested on a ship-to-shore mooring line mock-up. Observations indicate that ship rats, *Rattus rattus*, can pass the barrier without too much difficulty.

TOXICOLOGY BRANCH

Toxicity of Chlordan. In an attempt to investigate hazards associated with the use of chlordan as a residual spray for the control of houseflies and mosquitoes, the walls and ceiling of a 6x6x6-foot modified Peet-Grady chamber were sprayed with 200 milligrams of chlordan per square foot. This dosage gives a satisfactory 3-month residual action against flies and mosquitoes. The chamber was aired for 24 hours, and a reasonable amount of ventilation at floor level and in the ceiling was provided thereafter. Twenty-four hours after spraying, 10 albino Norway rats with litters varying in age from 1 to 7 days were placed in the chamber in cages which kept them from contacting the walls or ceiling. The results are shown in table 1. The mortality for young rats in different parts of the experiment ranged from 72 to 100 percent and averaged 80 percent; the mortality of the controls ranged from 14 to 26 percent and averaged 19 percent. No demonstrable effects were observed on adult rats. Among the young rats dying in the experimental chamber, three were observed in convul-

sions, in the course of which they died. No gross pathology different from that seen in check animals was seen in these or other test animals. Intercurrent *Salmonella* infection was involved in at least part of the cases.

It has, thus far, been impossible to find the mechanism of action of the chlordan vapor. It may have been in part indirect through decreasing resistance to intercurrent infection. There is no satisfactory method of chemical analysis for chlordan. The Insecticide Branch attempted to evaluate the concentration of vapor in the experimental chamber by exposing houseflies in cages for periods varying from 15 to 240 minutes. A great reduction in chlordan concentration was evidenced by the 35th day after spraying. When rats which were exposed in the experimental chamber were carefully skinned and the carcasses exposed to adults of the blowflies, *Callitroga macellaria* and *Phaenicia pallescens*, for 24 hours, 50 to 90 percent mortalities were observed. Similar check animals produced only 1 to 6 percent mortalities. The eggs of blowflies hatched on the carcasses of the animals in the test chamber, but the larvae died within 24 hours.

Rodenticide Studies. Wooden bait stations to be attached to the floor and wall with screws, and so designed as to permit

Table 1
Results of Exposing Young Albino Norway Rats
to the Vapors of Chlordan from a Residual Deposit

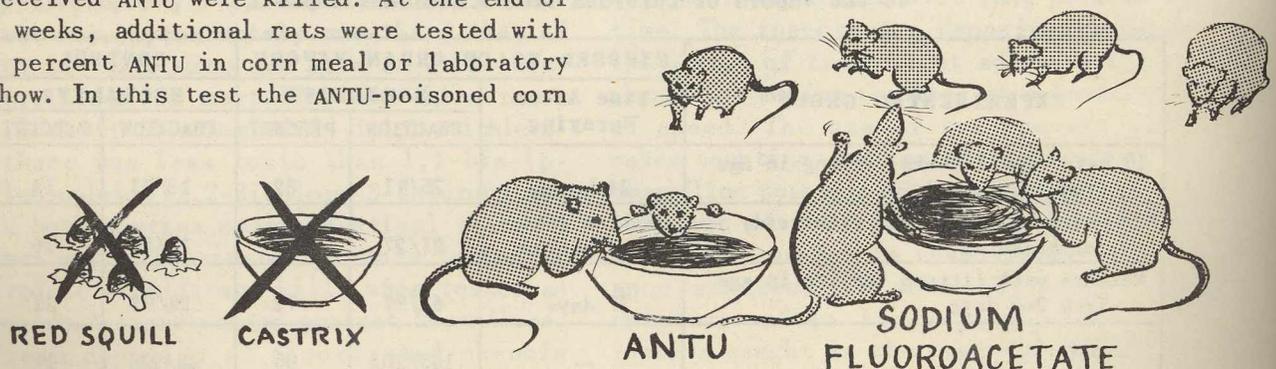
EXPERIMENTAL GROUP	EXPOSED TO CHLORDAN VAPORS		CONTROL		
	Time After Spraying	MORTALITY		MORTALITY	
		FRACTION	PERCENT	FRACTION	PERCENT
10 rats with litters varying in age from 1-7 days	24 hours	75/91	82	13/93	14
10 pairs of additional rats ready for breeding	Entire gestation period	27/27	100	15/58	26
Mothers with litters varying in age from 2-6 days	37 days	63/87	72	20/92	22
TOTAL	—	165/205	80	48/243	19

free access of rats to a 1080 solution without danger to pets or children, were tested in a cafe with heavy rat infestation. Scents obtained from rat droppings and urine were used in the stations for attracting rats. During the 6-week period, only 12 rats were recovered, and 3 others, as indicated by odor, probably were killed. The establishment is still heavily infested with rats. It is not known why the kill was not greater, since dust-tracking tests indicated no avoidance of the bait stations. An explanation may lie in the fact that water was freely available to rats outside the stations. Such permanent stations will be tested under more favorable circumstances.

A series of tests is being conducted to determine what effect the ingestion of a sublethal dose of ANTU by wild Norway rats has upon their acceptance of and intoxication by ANTU poisoned baits at later times. Rats which had survived single feedings of yellow corn meal containing 6 milligrams of ANTU per kilogram of body weight, were held and checked for acceptance of ANTU-poisoned baits after periods of 1 to 2 weeks. In all such tests, each rat was offered a choice of a poison-free bait, and none of them were starved before the testing. In tests conducted 1 week after the sublethal poisoning, 33 $\frac{1}{3}$ percent of the rats were killed by a 1 percent ANTU bait, whether that poison was in corn meal the same as the original bait, or in a laboratory chow. Sixty to 70 percent of the check rats which had not previously received ANTU were killed. At the end of 2 weeks, additional rats were tested with 2 percent ANTU in corn meal or laboratory chow. In this test the ANTU-poisoned corn

meal was poorly accepted and only 14 percent mortality was obtained. The laboratory chow bait was more readily accepted, and produced 67 percent mortality. The laboratory chow bait produced 85 percent mortality among the check rats which had not been previously poisoned. The results are inconclusive as regards the refusal of rats to accept poison after sublethal poisoning but indicate the development of some tolerance to ANTU.

In toxicity tests on white rats, five samples of the rodenticide, castrix (2-chloro-4-dimethylamino-6-methylpyrimidine), obtained from a variety of sources, including two samples which had been purified by washing or recrystallization, exhibited an LD₅₀ of 8.2 to 8.6 milligrams per kilogram when applied by stomach tube. The LD₉₀ appeared to be near 13 milligrams per kilogram as compared to less than 10 milligrams per kilogram for sodium fluoroacetate. Acceptance tests were conducted by providing caged Norway rats with a choice of corn meal containing 0.1, 0.5, and 1 percent, respectively, by weight of castrix or poison-free corn meal. The greatest mortalities from castrix occurred at the 0.5 percent dosage which produced 40 percent mortality as compared to 61.5 percent which was the lowest mortality obtained in similar tests using ANTU as a poison. The odor of the castrix was almost completely removed by recrystallization from ligroin, but it was rapidly regained after storage both in closed containers



and in the poisoned meal. It appears that castrix is inferior to such rodenticides as ANTU and sodium fluoroacetate for the control of domestic rats. Castrix is no more acceptable in the laboratory to rats than is red squill, which is considered to be a relatively safe poison to use.

VECTOR-TRANSMISSION BRANCH

Transmission of Murine Typhus. Studies of the duration of infectiousness of the albino Norway rat for the flea *Xenopsylla cheopis* show that animals infected with typhus by exposure to infected fleas in an open culture were able to infect other fleas after the 5th to 10th day. No transmission was obtained after the 31st day. Another animal infected by abrasion of the equivalent of one infected flea into the shoulder of the animal was able to infect other fleas between the 4th and 7th days. No transmission was obtained after the 23rd day in this case. In comparison, animals infected by intraperitoneal injection of large doses of tunica suspension were able to transmit after the 1st to 5th day but not after the 23rd day.

A focus of murine typhus infection was studied in a colony of white rats in an unused barracks building. Using ectoparasites collected from this colony, 52 of 121 rats injected intraperitoneally with fleas (*X. cheopis*) became positive as shown by complement fixation tests. During the study, samples of dust were collected from around the rat nests and runways. The dust first was micronized into a fine powder, aged, and then it was inoculated by the following methods:

- (1) The shoulder region of the rat was abraded and dust was sprinkled into it.
- (2) Two cubic centimeters of a supernatant fluid resulting from a mixture of normal saline and dust was injected intraperitoneally.
- (3) Test animals were exposed for 5 minutes to dust whirling in a sealed Waring blender.
- (4) Test animals were placed in glass jars which contained bedding material contaminated with dust.
- (5) Test animals were given food contami-

nated with dust. Negative results were obtained in all of the 23 tests. The fact that extensive testing of these dust samples, collected in a limited space with an abundant population of fleas proven to be infected, produced no positive results is strong evidence against the importance of dust as a reservoir of typhus. These experiments do not bear on the possible transmission of murine typhus by fresh flea feces contained in dust. Apparently, at least in mild winters around Savannah, the transmission of typhus through the rat-flea cycle may continue throughout the season.

EFFECTS OF ROUTINE MOSQUITO LARVICIDING ON FISH

During the past 4 years, extensive investigations have been pursued to determine the effects of routine manual and airplane applications of DDT and other mosquito larviciding on fish and fish food organisms, as well as other elements of the biota.

The work on fishes, delayed to await identification and evaluation of catches, has only recently been summarized and presented in detail for the first time.

Manual Application. The Hudson rotary duster and a dust mixture consisting of 1 part DDT and 99 parts of pyrophyllite were selected for the routine studies. This dust was used at the rate of 10 pounds per acre, giving a dosage of 0.1 pound of DDT per acre. In other tests, dosages as high as 0.4 pound per acre were used. Air pressure hand sprayers were employed for the dispersion of solutions and emulsions. Emulsions were sprayed uniformly over the surface of the ponds at the rate of 15 gallons per acre and at dosages of 0.05 to 0.2 pound of DDT per acre. These were made by adding 1 gallon of a solution consisting of DDT, emulsifier, and fuel oil or some other solvent to 14 gallons of water. Solutions were applied at rates of 0.5 to 2 gallons per acre and dosages of from 0.025 to 2 pounds of DDT. Routine treatments were made at weekly intervals.

All ponds were seined prior to treatment to determine the species of fish present and their relative abundance. Observations for the detection of dead fish were made in untreated check and treated ponds just before use of the larvicide and 24 and/or 48 hours thereafter. After treatment, the ponds were seined or the fish poisoned to ascertain the remaining population.

Tests on coastal plain ponds with a number of DDT solvents indicated that some were much more toxic to aquatic organisms than others. Of 15 solvents tested, propyl alcohol, ethyl alcohol, and acetone were less toxic than kerosene, which in turn was less toxic than No. 2 fuel oil when the application rate was 1 or 2 gallons per acre. Velsicol NR-70 was the most toxic solvent tested. Neither it nor No. 2 fuel oil was felt to be a desirable solvent for DDT to be used at the higher dosage. Although DDT-kerosene solutions are somewhat less toxic than DDT solutions in No. 2 fuel oil, these differences are probably not significant enough to justify changes in large-scale operations if applications are at the rate of 1 gallon per acre or lower. Routine treatments with 1 gallon per acre of fuel oil alone caused no observed fish harm over a period of 14 weeks. At 1 gallon per acre, Velsicol NR-70 was the only one of the solvents tested to be ruled out on a toxicity basis.

Stable DDT emulsions were much more toxic to amphibians, fishes, the larger crustacea, and several orders of aquatic insects than were DDT solutions or dusts, and therefore, DDT emulsions are not recommended for larviciding in areas with a wildlife problem. A single application of 0.4 pound per acre of DDT in solution killed some fish. Single applications which did not exceed 0.1 pound per acre did not kill fish. Routine applications of dusts at 0.1 pound per acre are probably safe to aquatic organisms. Routine applications of DDT solutions at 0.1 pound per acre of

shallow waters resulted in serious fish kills after the 10th application, but the type of pond, particularly the nature of its bottom, greatly influenced the effects of the treatment. Thus, such treatments are not recommended for malaria control where fish are important. No dead fish were observed in ponds routinely treated at 0.025 pound per acre. In small shallow ponds, 0.05 pound of DDT dust per acre applied routinely has killed some fish. For adequate malaria control, oil solution applied at dosages of 0.05 pound DDT and 1 gallon of solution per acre or dusts applied at 0.1 pound of DDT per acre are generally recommended. Aquatic vegetation is not noticeably inhibited by such treatment.

Airplane Application. Deep ponds sprayed by airplane using five conventional nozzles at the output of 0.1 pound DDT per acre received 50 to 80 percent of the output at water level, whereas those treated by means of an exhaust Venturi thermal aerosol generator received only 10 to 12 percent of a similar output dosage. Population studies made before treatment and at the close of each year's series of 15 to 17 treatments over a period of 3 years on the same ponds disclosed no significant decrease in the persistent fish population, nor any unusual change in its composition attributable to either type of treatment.

Comparative Effects of DDT, DDD, Chlordan, and Toxaphene. All insecticides studied are toxic to fish if used in large doses. The type of pond or water, vegetation, organic material, and silt or turbidity greatly influence the severity of toxic action of DDT on fishes. Crabs, crayfish, and some other invertebrates are considerably more sensitive to DDT than are fishes. Among the fishes, some of the Centrarchidae, especially the bluegill and the flyer, are first to be affected. The blue-spotted sunfish seems to be quite resistant, while the eel was the most resistant of the fishes studied. Although top-minnows were among the first fish to

be killed, they continued to be present during the period of treatment and were in evidence when most other fish had been eliminated. At routine dosages of 0.1 pound per acre, DDD, chlordan, and DDT were toxic to fish, especially in shallow ponds. At 0.05 pound per acre, DDT was more toxic than chlordan or DDD. Toxaphene was very toxic to fish, giving complete kills at 0.2 and 0.1 pound per acre after two and three applications in deep ponds. Thus, it is believed to be too toxic to fish to be used as a mosquito larvicide where fish are important. Toxaphene is as toxic or more toxic to fish than is rotenone and may prove useful as a substitute for it in fish management work.

Training

FIELD TRAINING

Cincinnati, Ohio. The first 3-week advanced training course for State bacteriologists primarily concerned with water or milk analyses or food utensil examinations began March 21. Sixteen persons were enrolled for this course. Plans were completed and a schedule drawn up for an advanced training course for sanitary engineers in stream pollution abatement programs to be conducted from April 25 to May 6.

The office moved into its new quarters at 1014 Broadway on March 15. A lecture room was equipped and a laboratory sufficiently equipped to conduct the chemical work for the April 25 course.

Columbus, Ga. The sixth 12-week field training course for sanitarians was started at Columbus on February 7, with 16 trainees enrolled, 2 of whom were from Alaska.

Three Muscogee County Health Department conferences were attended by staff members and trainees from this station.

The senior training officer spent the week of January 3 in Louisville, Ky.,

assisting in the plans of training courses in the State of Kentucky.

Staff members from this station aided in a foodhandlers school in Gainesville, Fla., during the week of February 20. They also spent 2 days with the Macon City-County Health Department, Macon, Ga., observing the sanitary program there.

Denver, Colo. Remodeling of the quarters at this new station was completed in January. They were occupied the first week of February.

A meeting of the Rocky Mountain Training Center committee was held on January 19 to ascertain type of training needed, type of trainees to be recruited, date of the first course, how trainees should be recruited, field training facilities to be used, and availability of professional personnel for field trips and lectures. The first 12-week training course for sanitarians was scheduled April 4 to June 24.

On March 28, the advisory committee of the Training Center met to review the proposed course schedule and applications for training. It was tentatively decided to offer two 12-week courses for sanitarians and to utilize the intervening months between spring and fall courses for special short courses.

Savannah, Ga. A course for public health educators began March 22 and will continue through May 28. Three trainees were enrolled for the course, two from North Carolina College and one from the University of North Carolina.

Two local health department educators assumed partial responsibility for the field trainees as part of a program to train them as training supervisors.

The training officer worked with the New York State Health Department staff in the planning of a training program for apprentice public health educators and for field training for graduate students assigned from a school of public health. A discussion of health education philosophy and techniques was given by the training officer to 14 trainees from the Florida

State Training Center, Gainesville, Fla.

Topeka, Kans. A 3-month environmental sanitation training course for sanitarians was held during the period January 10 to April 2. Certificates were issued to four trainees from Canada and four from the United States.

A 1-week course on milk and food sanitation was conducted at Wichita, Kans., for sanitarians employed by the Wichita City Health Department, January 31 to February 4. A 1-week course on milk sanitation was held at Minneapolis, Minn., during the period March 21 to 25. There were 29 sanitarians registered for the course.

The Training Center, the Kansas State Board of Health, and Region 7 are cooperating in presenting a study of environmental sanitation for the course, "Institutional Management," at Kansas State College, Manhattan, Kans.

The Center assisted the Oregon State Board of Health in developing a uniform system of records.

The Topeka Field Training Center moved on March 12 to the Central Building, 700 Kansas Avenue. Additional quarters are maintained at Hillcrest and will be utilized for demonstration equipment.

Troy, N. Y. The fourth 12-week field training course for sanitary inspectors at Troy began February 28 with four trainees enrolled.

Professor Bradley of the University of Massachusetts and Mr. Robertson of the Massachusetts State Health Department met with the training officers of this station on March 14 and 15 to arrange the syllabus for the course for sanitarians to be held at Amherst during the coming summer. Final plans for the 1-week course for sanitary inspectors to be held at Amherst, Mass., during the week of May 2 also were made.

Mr. J. F. O'Brien, senior training officer, resumed his duties at this station after having completed his work for a master's degree in public health at the University of Michigan.

A member of the training staff visited

several health departments in the States of New York, Massachusetts, Connecticut, New Jersey, and Pennsylvania to determine their training needs.

State Field Training — Cooperative Enterprises. Personnel of the Insect and Rodent Control Branch conducted a 5-day field training course at New Orleans, La., during the week of February 21. The program was attended by 21 sanitarians. This was the fifth program of this type which has been given in cooperation with the Louisiana Public Health Training Center.

HEADQUARTERS TRAINING

Insect and Rodent Control. The eighth field training program in "Rat-Borne Disease Prevention and Control" was presented during the period March 14 to April 8. This course was attended by 11 men from the States of Georgia, Illinois, and New York, and the CDC Typhus Branch in Atlanta. One trainee was from the Chinese Ministry of Health. Six additional men from the Orkin Exterminating Company attended portions of the course.

An insect-control training course was arranged for six entomological inspectors from the South Carolina malaria control program during the period January 3 to 21. In addition to the six men mentioned above, this course was attended by two newly appointed men from the Engineering Division. An increase in student interest and participation was accomplished by assigning trainees current publications to be read and discussed before the class.

A second insect-control course was arranged during the period January 31 to February 9 for a group of 15 malaria control supervisors from Georgia. It was also attended by two trainees from the CDC Engineering Division.

A 1½-day course in rat control was conducted in Chicago in cooperation with the CDC representatives in the Chicago Regional Office and the CDC Engineering Division, Typhus Branch. It was attended by 125 employees of the city of Chicago.

Training Public Health Personnel from Foreign Countries. Special observation and training courses were arranged for 14 foreign public health personnel who visited the Training Division during the quarter. They came from the following countries:

China	2	Germany	5
England	1	Italy	2
France	1	Peru	1
Guatemala	1	Sweden	1

Housing Sanitation. Two courses in "Appraisal Method for Measuring the Quality of Housing" were given during the periods January 10 to February 15 and March 14 to April 15. The first course was attended by three trainees, the latter by two.

Personnel from the Housing Sanitation Section participated in two seminars on the health aspects of housing held at Amherst, Mass., March 9, and in Boston, Mass., March 11. The seminars were conducted by the Massachusetts Department of Public Health for personnel of the Environmental Sanitation Section of the State Health Department.

The housing survey conducted by the Public Health Service in conjunction with the Donora, Pa., smog investigation was completed.

The Housing Section participated in a series of five seminars on the general subject of housing and health held for graduate students in public health, sanitary engineering, and city planning at the University of North Carolina, Chapel Hill, N. C. The section also participated in a conference with the city officials at Durham, N. C., on the subject of housing and blight elimination; and in a housing seminar in Atlanta, Ga., conducted by the Georgia State Health Department on March 15.

Orientation. A special orientation course for 19 nursing consultants from the regional and central offices was conducted during the period March 21 to 23.

Special observation and orientation schedules were arranged for 14 public health personnel from six States interested in CDC activities and training programs and procedures.

OTHER HEADQUARTERS ACTIVITIES

Special Assignments. During January, Dr. Elmer Hill completed his tour of duty at Thomasville, Ga., and proceeded to his new field training assignment in the Office of Professional Training, New York State Department of Health, at Albany. He will work closely with Dr. Franklyn Amos, who is in charge of training for the department. After suitable orientation he will work on the development of field training for health officers.

Early in February, Sanitary Engineer William Gibson completed his consultant-ship and became a training officer in environmental sanitation. He was assigned to the State of North Carolina Health Department. The State has stationed him at the School of Public Health, Chapel Hill, as one of the four members of the field training staff.

At the request of Dr. Underwood, State health officer of Kentucky, a preliminary study of resources and facilities for establishing a field training center in Louisville was made by Sanitary Engineer Spangler.

Expansion of Services. During March, conferences were held with Dr. Hilleboo, Dr. Amos, and Dr. Van Volkenburgh at Albany, N. Y., to discuss and agree upon an enlarged field training program for public health personnel in New York State. An agreement was reached upon a plan to continue the Troy-Rensselaer Training Center and to assign an official to work with the Bureau of Environmental Sanitation at Albany as training officer for all types of environmental sanitation training utilizing all the resources of the State. A request was made for assignment of a training officer in health education at a later date.

Arrangements were consummated with representatives from the University of Massachusetts and the State Health Department of Massachusetts to give field training in the Amherst area, an 8-week course, during July and August, serving sanitarian graduates from the University of Amherst.

The Chief of the Training Division, accompanied by Dr. Vonderlehr, visited Harrisburg and Pittsburgh, Pa., on March 8 to 9 to discuss with Dr. Thomas Parran, Dean of the School of Public Health, University of Pittsburgh, Dr. Vaux, State health officer, and Dr. Alexander, city director of health, the possibilities of establishing a regional field training center at Pittsburgh. On the basis of the preliminary negotiations, it appears likely that such a station can be developed to assist the State of Pennsylvania, the city of Pittsburgh, and the States in the Pennsylvania region with field training activities. Housing, food, and milk sanitation were pointed out as the most pressing questions demanding attention.

At the request of the Regional Medical Director, Public Health Service, Region 3, preliminary arrangements were made March 29 to 30 with the Maryland State Health Department to extend assistance in the establishment of a State field training center in Prince Georges County, Md. A survey of the local health department was to be made during April, and it was anticipated that a training officer would be assigned, after July 1, to assist the State in organizing the center until such time as State personnel can be trained to carry on their own program.

Training Materials. Members of the Insect and Rodent Control Branch are acting as technical consultants to the Production Division in the preparation of a filmstrip entitled, "1080, a Rodenticide for Professional Use," and two motion picture series, one on the control of rat-borne diseases, and the other on community fly control. The series on rat-borne diseases is being prepared jointly by the Public Health Service and the Army.

The Housing Sanitation Section is working with the Production Division on a film on how to measure the deterioration of buildings.

Preliminary plans are being worked out with the Production Division by the chief

of the Special Services Branch for a filmstrip concerning the activities of the Training Division.

The text and illustrations for the manual, "Rat-Borne Disease Prevention and Control," were completed and submitted to the Technical Reports Branch.



Division personnel participated in a sanitation symposium in Washington, D. C., and the National Rural Health Conference in Chicago. Representatives were also present at the Illinois Veterinary Public Health Clinic, which was the first of its kind held in the United States. New activities included the assignment of a veterinary officer to California to study Q fever in sheep, assistance to the Florida State Board of Health in an investigation of creeping eruption, and to the Division of Industrial Hygiene for an anthrax study. Arrangements were made with the Iowa, South Carolina, and Washington Health Departments to inaugurate veterinary public health programs.

Rabies. In January Dr. Tierkel went to Memphis, Tenn., to evaluate the emergency rabies control program for 1948, review plans for a similar program in 1949, and make recommendations for a permanent long range program for consideration in the Tennessee Legislature.

The results of the 1948 voluntary vaccination campaign were phenomenal. A steady decline in rabies cases and human antirabic treatment ensued during the months of May, June, and July. The last case of rabies was reported on July 22, 1948. There was not a single case in the city or county from that day until March 10, 1949.

Plans were made for another vaccination campaign April 9 to 14, 1949. Dr. Tierkel reviewed a proposed bill for permanent con-

trol in Shelby County under consideration by the State Legislature.

Pseudorabies. Three dogs were inoculated subcutaneously with three different strains of pseudorabies virus. One milliliter of 10 percent infected brain material in normal inactivated rabbit serum-saline was injected into each dog. The history of the three strains is as follows:

The RIMR Strain was obtained in 1947 from the Rockefeller Institute for Medical Research in the form of a glycerinated infected rabbit brain. It was given three intracerebral mouse passages, then one intracerebral dog passage. The dog brain material used for inoculum titered intracerebrally in mice at an LD_{50} of $10^{-3.00}$ on the date of injection.

The Dothan Strain was isolated from a cow brain specimen received at this laboratory for diagnosis from the Dothan Branch Laboratory of the Alabama State Health Department in October 1947. The inoculum used consisted of the 5th mouse brain passage of this virus, and titered intracerebrally in mice at LD_{50} of $10^{-4.45}$ on the date of injection.

The Florida Strain was isolated from a dog brain specimen received at this laboratory for diagnosis from the Florida State Health Department Laboratory in October 1948. The inoculum used consisted of the second mouse brain passage of this virus, and titered intracerebrally in mice at an LD_{50} of $10^{-4.33}$ on the date of injection.

The dog inoculated with the Florida Strain was the only one to show clinical evidence of infection. On the morning of the 5th day following inoculation the dog was down in a position of right lateral recumbency. There was a rapid fibrillar twitching of left hindleg which developed into clonic spasm. The right hindleg was rigid except for occasional flexion and extension. The temperature was 105.9° F., pulse 260, respiration 120. The flank around the site of inoculation was denuded of hair, and was raw, edematous, and inflamed. When handled, he was able to arise

and stagger a few steps before collapse. Differential white blood count: segmented cells 91 percent, lymphocytes 8 percent, monocytes 1 percent. There was a strong shift to the left on the Schilling index with many band cells and an occasional nuclear smudge.

Effect of Penicillin on the Titer of Pseudorabies Virus. A brief investigation was initiated to determine the effect of the addition of penicillin on the titer of pseudorabies virus.

The Florida Strain, second mouse brain passage of pseudorabies virus, was tested in a diluent of 10 percent normal inactivated rabbit serum-saline. Tenfold dilutions were made, ranging from 10^{-1} through 10^{-5} . Each tube of virus dilution was then divided into equal parts. To each dilution tube of the first set (A), 500 units of penicillin (Buffered Crystalline Penicillin G Sodium—Lederle, having 20,000 units in each milliliter of saline diluent) were added per milliliter of suspension. Nothing was added to the second set of dilution tubes (B).

Both sets of dilutions were placed in the refrigerator for 18 hours. They were then left at room temperature for 20 minutes before being inoculated in 0.03 milliliter amounts intracerebrally into 3-week-old mice.

Results of mouse titration showed an LD_{50} end point of $10^{-3.60}$ for suspension A (penicillin treated) and value of $10^{-3.50}$ for suspension B (untreated), showing that there was no significant difference in the titer of the two suspensions.

Tissue Immunity in Rabies. An experiment designed to determine the possible presence of specific tissue antibodies against rabies virus was performed using the *in vitro* neutralization technique on the brains of 14 immunized and exposed dogs. The brain neutralized very little of the virus as compared with robust antibody levels in the sera of the same dogs. It is intended to repeat this study using variations in technique.

Effects of Post-mortem Autolysis on Rabies Street Virus and Negri Bodies. Studies were continued on post-mortem autolysis effects on rabies street virus and Negri bodies. The knowledge of the status of the virus and inclusion bodies in the brains of animals which have been dead for some time is of importance in the diagnosis of rabies.

Eight guinea pigs were inoculated intracerebrally with stock dog brain street virus. Within 20 days, seven of the eight had died. Their brains were removed and found to be Negri positive. Three of these brains were placed in the incubator at 37° C. and four in the refrigerator at 5° C. to study the effects of different temperatures on the virus and inclusion bodies. Smears stained with Sellers' stain were made daily on the brains in the incubator, beginning on the 5th day. Also, 10 percent penicillin-treated suspensions were made and inoculated intracerebrally into mice. Following is a report on the microscopic appearance of the smears up to and including the 9th day of incubation of brains:

5th day: All cellular elements intact but degenerated; Negri bodies present but slightly swollen.

6th day: Further degeneration of cellular elements; Negri bodies present.

7th day: Cytoplasm of neurons severely degenerated and strongly acidophilic. Karyorrhexis present. Negri bodies have lost their distinct border and are swollen.

8th day: All nuclei still distinct; cytoplasm fragmented. Glial elements intact. Negri bodies seem to have lost some of the basophilic internal structure.

9th day: Cellular elements unchanged from 8th day. Difficult to distinguish between cytoplasmic fragments and Negri bodies. Unsatisfactory for microscopic diagnosis.

Rabies Control in the Field. The rabies programs in the field were concentrating their efforts on major foci in Texas, Florida, Georgia, New York, New Jersey,

Ohio, and Indiana. In Texas Dr. Young was able to bring the Austin epizootic under control with persistent efforts and cooperation of the health authorities and veterinarians. The Dallas and Austin programs have combined immunization and licensure into one operation at the rabies clinic. The fee, which is paid at the clinic, covers both immunization and licensure. In Colorado two cases of rabies appeared in Adams County. The problem was handled immediately through consultations and a recommended control program for the tri-county area in which it occurred. The rabies problem in Indiana and Ohio continued to be critical. Plans were made early in the year to inaugurate control programs in local health departments. Aid from local district veterinary societies was solicited as well as from the State associations. These groups have agreed to carry the fight for a program in every enzootic area. The Florida State Board of Health inaugurated laboratory services for veterinarians in regard to animal diseases communicable to man. One of the services was the routine use of the mouse inoculation test. Since January 1, 1949, the mouse inoculation test has been completed on 44 animal brain specimens. These tests have resulted in an increase of 13.6 percent in positive specimens as shown in table 1.

Brucellosis. The Indiana study completed two townships in February and March, one a swine raising area and the other a dairy cattle center. Representatives of the U. S. Bureau of Animal Industry, Indiana State Board of Health, and Purdue University, and the State veterinarian worked together as a team with the local veterinary practitioners to make the study possible. The National Institutes of Health have contributed funds to assist the State laboratory in handling the human sera samples. The percent of human reactors in the swine raising county was 1.25 percent; and in the dairy cattle area, it was 3.26 percent.

The Wisconsin investigations under the State Board of Health in cooperation with

Table 1
RESULTS OF MOUSE INOCULATION TESTS FOR RABIES
IN FLORIDA

January 1 to April 1, 1949

Brain Specimens		Direct Microscopic Examination			Mouse Inoculation Tests				Percent Increase in Positives
Type	No.	Negative	Unsatisfactory	Atypical Inclusions	Negative	Positive			
						Direct Microscopic Negative	Atypical Inclusions On Direct	Unsatisfactory for Micro.	
Dog	31	24	2	5	25	3	2	1	19.35%
Cat	11	10	0	1	10	-	1	-	9.09%
Cattle	1	1	-	-	1	-	-	-	-
Squirrel	1	1	-	-	1	-	-	-	-
TOTAL	44	36	2	6	37	3	3	1	13.64%

the Children's Bureau have followed only culture-positive cases. Twenty-eight cases are under study, of which six are children. This latter point is not in accord with previous surveys of children. Most surveys have found few or no cases in children.

The ring test for determining the presence of agglutinins in milk has been used with success in Michigan and Minnesota. The test is being studied in Florida as to its relative efficacy compared with whey and serum agglutination tests. If this test continues to be as effective as it has been to date, it will be invaluable to local health departments in brucellosis control activities.

Q Fever. Q fever studies in Texas, Montana, and California continue to uncover new facts about the disease. In Texas the disease is enzootic in all the counties below San Antonio and as far west as Laredo. Evidence of the infectious agent in raw milk was further confirmed. Dr. A. B. Rich of San Antonio has been able to produce an acute mastitis followed by a fibrosis such as is found in any case of infectious mastitis.

In California studies continued on the level of complement-fixing antibodies in different types of cattle, on the mode of transmission among cattle, and the inci-

dence of Q fever in sheep and goats. A small study on the susceptibility of cats and their ectoparasites is being pursued.

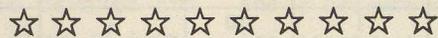
The Veterinary Unit at the Rocky Mountain Laboratory reported that the duomycin (aureomycin) therapy experiment on cattle infected with Q fever by intramammary infusion was unsuccessful. Three days after treatment ended, all quarters were shedding the *Coxiella burnetii*. The experimental therapy by intravenous routes was not successful either. Current studies are on the transmission of disease in cattle. An agglutination or absorption test is also being investigated. Such tests would have marked advantage over the complement fixation tests. A study of maculatum disease in sheep was started. This is a disease which to date has been found only in ticks in nature. A report on listerellosis in Utah was approved for publication from this unit. Studies on cattle which have drunk from tularemia-contaminated streams (confirmed by guinea pig inoculation) did not show any antibody reaction except for a trace in one at 1.40.

The Public Health Laboratory in Florida reports that 13 *Salmonella* types have been isolated from 3,000 samples submitted by veterinary practitioners. In one kennel of 60 dogs, 20 were positive. On numerous

occasions, more than one type have been isolated from individual dogs. In some cases five different types have been found in one animal. Two types of *Salmonellae* were also isolated from rats. A number of chickens have been found with *Salmonella pullorum* present.

Creeping Eruption. During the third quarter an investigation of creeping eruption was begun. This was requested as the result of an epidemiological survey made

by the Florida State Board of Health in which it sent out 1,100 postal cards asking physicians how many cases they had treated in the past 6 months. There were 550 replies stating that they had treated 8,000 cases and that many others did not come to their attention. Arrangements have been made to obtain intestinal samples from dogs destroyed at various dog pounds throughout the State to determine where the heaviest incidence is located.



CDC Training Courses

Listed below are training courses, sponsored by Divisions of the Communicable Disease Center, to be held in the near future. Further information on the courses may be obtained from the *Bulletin of Field Training Programs*, issued by the Training Division.

TRAINING DIVISION

1. **FIELD SURVEY AND EVALUATION METHODS IN HOUSING SANITATION**, September 19 to October 21 and November 14 to December 16, 1949. Five weeks. Atlanta, Ga.
2. **RAT-BORNE DISEASE PREVENTION AND CONTROL**, September 19 to October 14, 1949. Four weeks. Atlanta, Ga.
3. **ADVANCED TRAINING FOR BACTERIOLOGISTS IN CHARGE OF LABORATORIES FOR WATER AND MILK ANALYSES AND FOOD UTENSIL EXAMINATIONS**, October 17 to November 4, 1949. Three weeks. Cincinnati, Ohio.
4. **ENVIRONMENTAL SANITATION FIELD TRAINING**, September 19 to December 9, 1949. Twelve weeks. Columbus, Ga.
5. **ENVIRONMENTAL SANITATION FIELD TRAINING**, September 19 to December 9, 1949. Twelve weeks. Troy, N. Y.

LABORATORY DIVISION

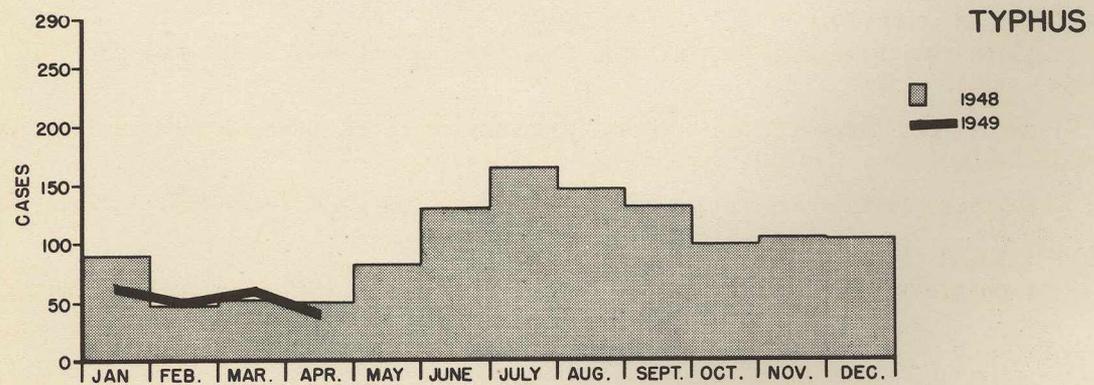
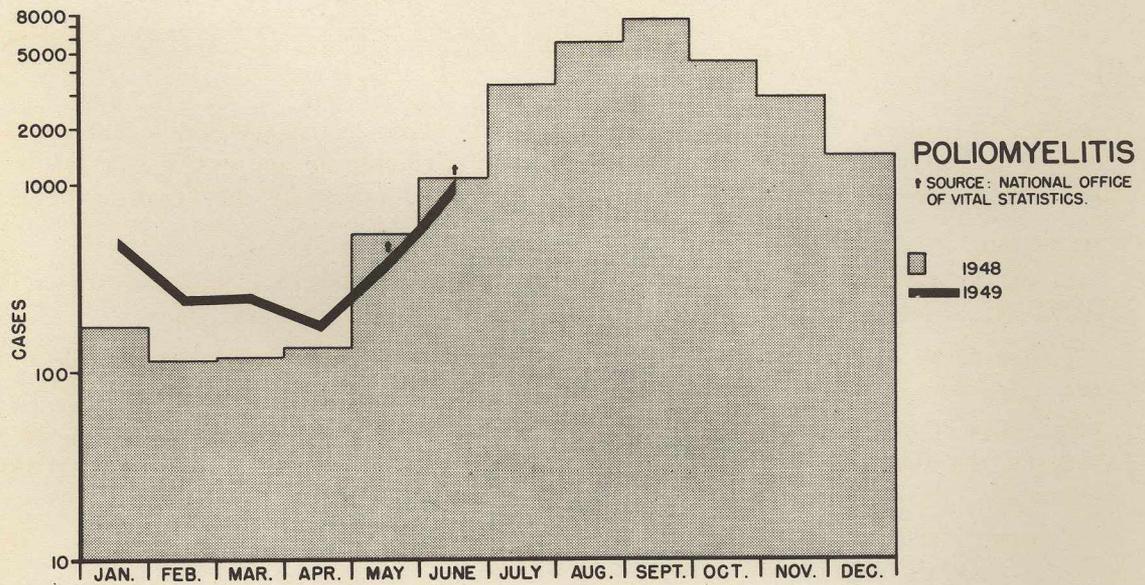
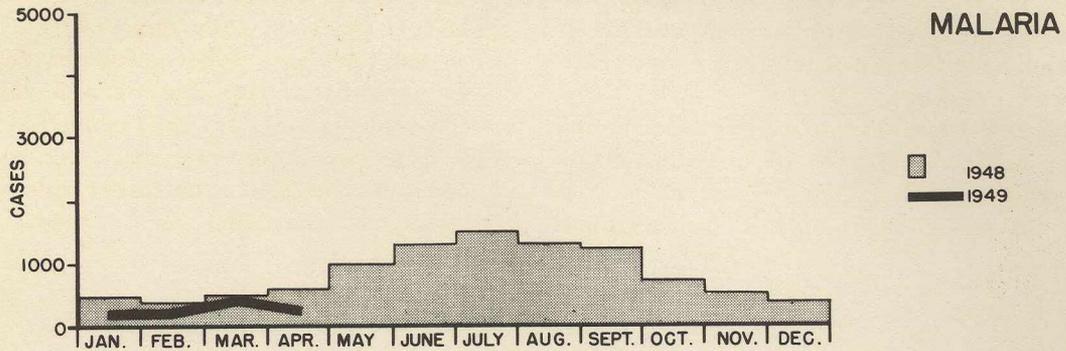
1. **LABORATORY DIAGNOSIS OF PARASITIC DISEASES**, September 12 to October 21, 1949. Six weeks. Atlanta, Ga.
2. **LABORATORY DIAGNOSIS OF BACTERIAL DISEASES, Part II, General Bacteriology**, October 31 to December 2, 1949. Five weeks. Atlanta, Ga.
3. **ADVANCED ENTERIC BACTERIOLOGY**, December 5 to 16, 1949. Two weeks. Atlanta, Ga.

VETERINARY PUBLIC HEALTH DIVISION

1. **LABORATORY DIAGNOSIS OF RABIES**, November 14 to 18, 1949. One week. Atlanta, Ga.

MORBIDITY TOTALS FOR THE UNITED STATES * MALARIA, POLIOMYELITIS, TYPHUS

1948 - INCOMPLETE 1949 - AS REPORTED



FSA PHS CDC ATLANTA, GEORGIA

* DATA FROM TABULATIONS BY PUBLIC HEALTH METHODS, USPHS
DATA ARE TENTATIVE AND INCOMPLETE

