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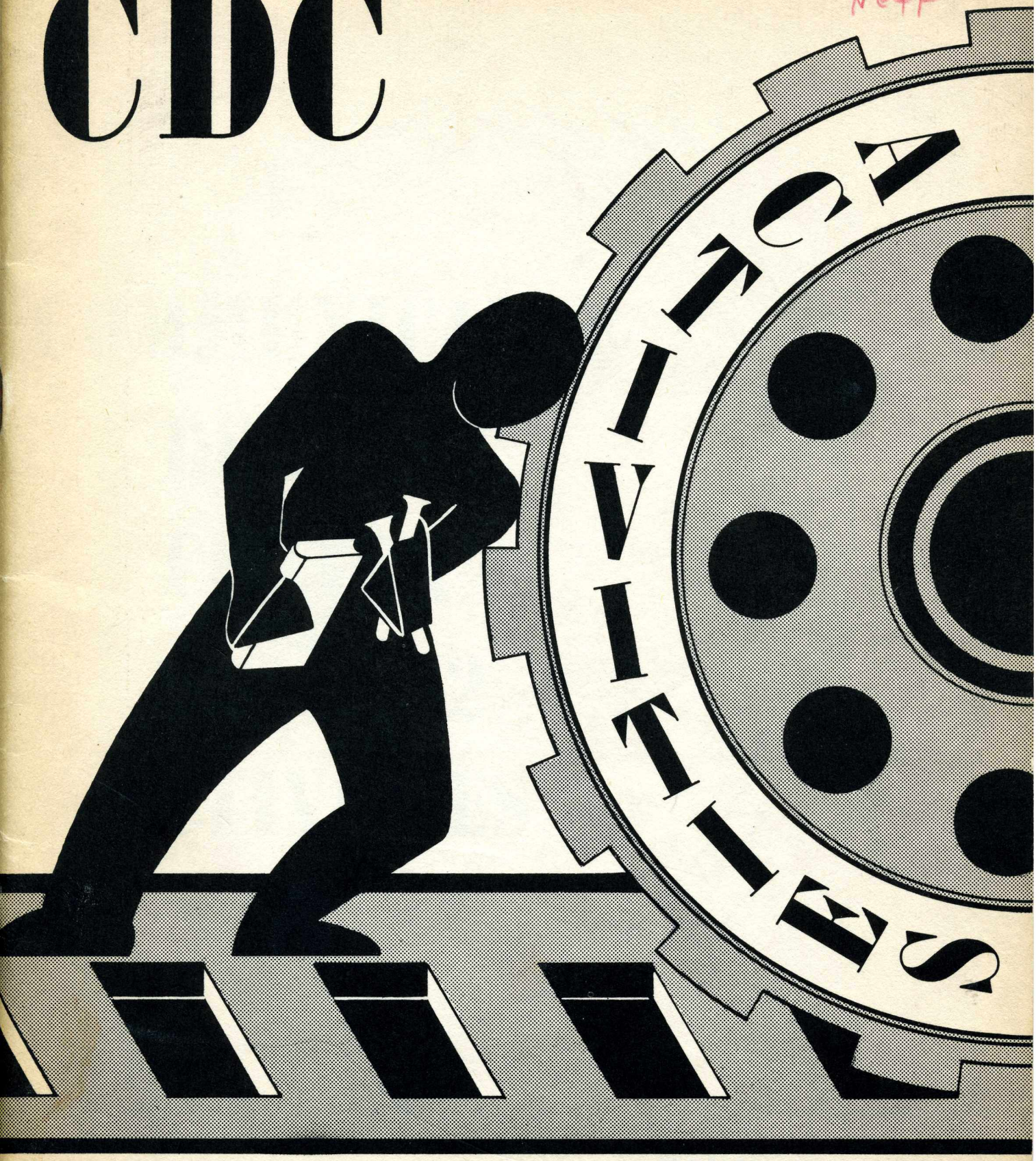

1951

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
COMMUNICABLE DISEASE CENTER
ATLANTA, GEORGIA

1952

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COMMUNICABLE DISEASE CENTER 1951-1952 ACTIVITIES

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
COMMUNICABLE DISEASE CENTER
ATLANTA, GEORGIA

Courtesy of the David J. Sencer CDC Museum

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Foreword

This is a summary of major activities of the Communicable Disease Center during the fiscal year 1952. In its preparation there has been conscious effort to omit details, to emphasize composite end results, and to bring the varied activities of the several components into common focus. The information presented was abstracted from basic reports prepared by the headquarters units and from other official sources.

Many of the projects dealt with were carried on in cooperation with other agencies. In some instances the CDC was the principal participant and in others its contribution was relatively minor.

In the interest of clarity, and as an aid to those unfamiliar with the CDC and its operations, the integrated summary report is divided into two general parts: (1) General Activities, and (2) Activities Directed Toward Specific Diseases or Problems. This is not a precise grouping, nor is the list of items under the respective headings a complete catalog of activities undertaken during the report period. Rather, the intent is to indicate in general terms the scope, nature, and interrelationships of activities carried on in different areas of public health by the combined staff of the CDC.

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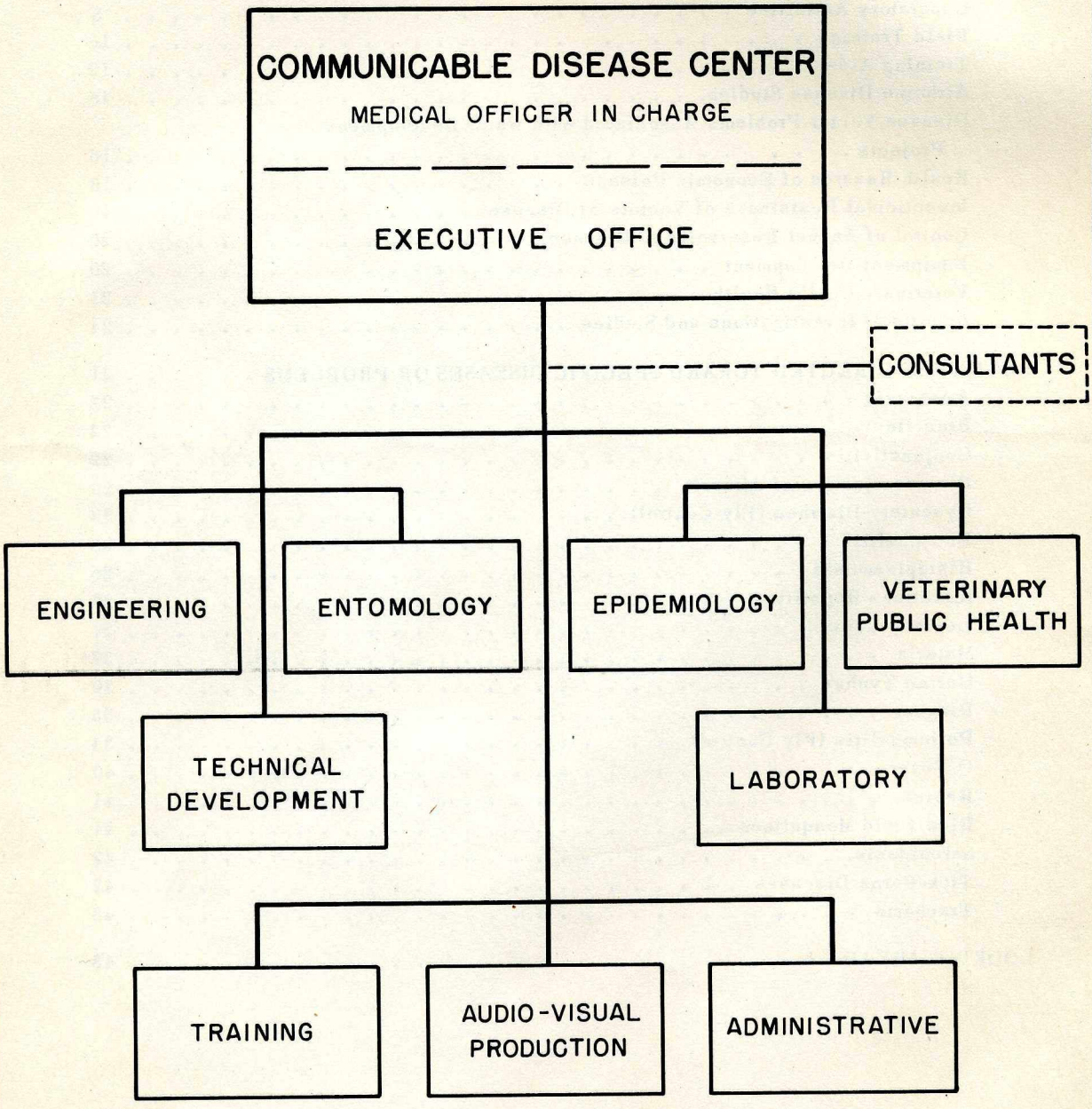
HEADQUARTERS ORGANIZATION



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INTRODUCTION

The Communicable Disease Center, a component of the Bureau of State Services of the U. S. Public Health Service, operates on a Nation-wide basis. Its primary responsibility is to assist States and Territories to develop and implement increasingly effective methods and techniques for the diagnosis, prevention, and control of communicable diseases. Headquarters and major facilities are located in the Atlanta, Ga., area. Specialized installations are maintained near Savannah, Ga., Montgomery, Ala., Thomasville, Ga., Newton, Ga., and San Francisco, Calif. In addition, field training centers, research projects, investigative study stations, and other types of field installations are operated in a number of places in different parts of the country, including Alaska, Hawaii, and Puerto Rico.

The accompanying chart shows the structure of the headquarters organization at the beginning of fiscal year 1952. During the year, this structure was changed by the adoption of a plan of reorganization which entailed: (1) combining the Engineering and Entomology Branches to form a new Branch, Vector Control and Investigations; (2) integrating Veterinary Public Health Branch into the Epidemiology Branch; (3) merger of Audio-Visual Production Branch and the Training Branch into a realigned Training Branch*; and (4) deactivation of Midwestern CDC, Kansas City, and reassigning its activities to other units of the CDC.

The reorganization, based on a study of the CDC by the Division of Administrative Management of the Bureau of State Services, resulted in: (1) reduction in the number of Branches from 10 (including Midwestern CDC) to 6**; (2) a regrouping of closely related activities within a single Branch; and (3) adoption of functional lines as the basis of organization. The latter two results are more meaningful, perhaps, than the physical consolidation and rearrangement of Branch structures. However, increased administration and management efficiency resulted from the reduction in Headquarters Branches, and provided machinery for more effective coordination of relationships with outside agencies.

Most of the activities engaged in by the CDC involve cooperation with other public health agencies, particularly State and local health departments and the staffs of Public Health Service (FSA) Regional Offices. Cooperation with State and local health departments is fostered by teamwork relationships, encompassing all types of joint undertakings, which are strengthened by: (1) detailing members of the CDC staff to State and local health departments to serve as specialists and to reinforce their capacity and competence in public health matters; (2) loaning States experienced training officers to assist in the operation of training centers; (3) joining in cooperative studies of problems of particular interest to one or more States; (4) conducting program reviews of State Health Department Public Health Education programs in Region VI and State laboratories and otherwise assisting States in raising the performance standards of their laboratories; (5) furnishing epidemiologists, and other specialists when needed, to assist in the investigation of epidemics and comparable situations; and (6) providing training opportunities, in both field and laboratory, for State and local public health personnel.

Liaison with Regional Offices is maintained by assigning a representative of the CDC to the staff of the PHS Regional Medical Directors. These representatives work with State and local health agencies in attacking problems within the scope of CDC responsibility.

The size and makeup of the staff of the CDC, which includes professional, subprofessional, administrative, custodial, and protective personnel, varies somewhat from season to season. During 1952, it ranged between 1,200 and 1,300. Table 1 shows, by categories, professional personnel on duty at the end of the fiscal year.

*Formally consummated September 16, 1952.

**Number of Branches reduced to five by combining Vector Control and Investigations and Technical Development Branches, January 1953.

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Table 1

COMMUNICABLE DISEASE CENTER PROFESSIONAL PERSONNEL BY CATEGORIES, Fiscal Year 1952

Category	Number
Engineers	67
Sanitarians	78
Entomologists	23
Scientists	46
CDC Specialists*	48
Educationists	13
Biologists	5
Bacteriologists	33
Physicians	60
Chemists	7
Dentists	1
Veterinarians	22
Nurses	15
Statisticians	6
Parasitologists	2
Physicists	1
Mycologists	4
Total	431

*Motion picture; rodent control; malaria control; typhus control; fly control.

Inasmuch as activities are directed toward the overall task of helping States do a better job of protecting the people against the hazards of communicable diseases, they are modified to meet new problems and are reoriented to conform to changes in policy and to changes in the capacity of States to operate unassisted. In the area of malaria eradication, for example, the CDC no longer participates appreciably in the operational phase. Withdrawal from this activity started a number of years ago, and has proceeded in parellel with the decline in indigenous malaria transmission and the increasing competence of States in the operation of malaria control programs. However, there remains a residue of malaria in the formerly endemic areas, and the CDC continued during 1952 the support of surveillance and prevention operations inaugurated in 1951. Although withdrawal from murine typhus control work is not yet as pronounced as in malaria control, more and more the CDC is concentrating its efforts on demonstrations, consultation services to States, and support of training programs for State and local personnel. This trend now embraces all categories of activities and is being accelerated in the areas of laboratory services, epidemiologic investigations and studies, and field training. Many of the recent realignments and procedural changes attending major alterations in organizational structure were inspired by, and are the byproducts of, added emphasis on research-type activities and less on control operations.

In the broad sphere of administration and management, the task of coordinating the many administrative details and supporting services associated with the Center's diverse staff is centralized in a compact administrative unit under a single director.

GENERAL ACTIVITIES

Although all activities of the CDC are interdependent and are integrated into a single program, some deal almost exclusively with the application of existing knowledge, methods, techniques, and procedures, while others primarily concern specific diseases or problems where further research is necessary in order to provide effective preventive and control measures. Often, however, there is considerable carryover. In some instances, the use of existing information yields a fair degree of control, at least temporarily, which affords protection pending the completion of protracted investigations and research. Similarly, research directed toward specific diseases and problems frequently uncovers information that contributes to the improvement of existing methods and procedures that already are reasonably effective.

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ADMINISTRATION AND MANAGEMENT

Incrusted in each undertaking and accomplishment of the CDC is the seldom recognized contribution of the director of administration and management and his staff of specialists. The tools with which members of the professional staff work, the supplies and equipment at their disposal, the clerical workers upon whom they lean so heavily, and the innumerable services required to keep their projects functioning are procured, warehoused, distributed, and maintained by the management and administration staff of the Center. This same staff, insofar as laws and regulations permit, performs for the professional personnel fiscal accounting and machine records analysis of statistical data, accomplishes the publication program of the CDC, provides drafting services, maintains a motor base, operates a medical and dental clinic, negotiates for space, recruits personnel and maintains personnel records, and renders assistance in the improvement of organization and management methods. These and many other invisible ingredients of end products furnished by the administrative staff free professional workers from time-consuming details, giving them greater freedom and more time to invest in scientific inquiry.

During 1952, budget and fiscal specialists maintained accounts comprising 8 appropriations, 39 allotments, and 250 allocations. Each month, summary reports were furnished to the central office in Washington and detailed reports were issued to each allocation unit. In personnel and recruitment, records were maintained on some 1,300 positions, desk audits were made, position descriptions were prepared and jobs classified, and studies were made by a newly established Organization and Classification Review Unit. In addition to routine procurement, warehousing, and distribution of supplies and materials, withdrawal from operational programs entailed the orderly transfer of some 800 automotive vehicles and an assortment of spraying equipment and materials. The task was handled through the central administrative office without disturbing operational personnel. Amalgamation of the CDC Bulletin, previously published monthly, with other Public Health Service publications necessitated a reorientation of the CDC's publication program. This, too, was directed by the administration and management staff without burden to the professional staff or major disruption of publication services. The CDC Progress Report was inaugurated as a medium for dissemination of operational information useful in program administration, and an informational memorandum (monthly) was instituted as a means of keeping field personnel advised of current developments concerning policy and programs.

Two ceremonies for the presentation of length-of-service awards were held during December. Awards were made to 146 employees for services ranging from 10 to 20 years. Two cash awards, one for $150 and one for $55, were made to employees for making suggestions for improvement in methods and procedures.

EPIDEMIC INTELLIGENCE SERVICE

The Epidemic Intelligence Service was established to accelerate the development of a corps of trained medical epidemiologists immediately available for assignment to States requesting aid in investigations of natural outbreaks of disease, and to serve as the nucleus of an epidemiologically trained staff that may be called upon in the event an external enemy should employ biological warfare. In July 1951, 21 Public Health Service medical officers, recruited for the purpose, were assigned to the CDC for a period of intensive training in epidemiology, biostatistics, and public health administration. Upon completion of a training course in Atlanta, each was assigned to field work. Some were detailed to State or local health departments, others to Public Health Service field stations, and a few to laboratories engaged in work emphasizing the epidemiologic approach. All assignments included provisions for adequate supervision in field work, and all officers were accorded opportunities to develop their respective skills.

Eleven additional officers have been recruited for assignment to this activity, and it is anticipated that still another group will be added in 1953.

During the past year, the Epidemic Intelligence Service participated in 24 epidemic investigations

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requested by 18 State health departments (table 2). In addition, assistance was rendered in conducting studies of 181 epidemic situations for which special epidemic aid funds were not allocated. Of some 40 categories of illness represented in the 205 outbreaks, those encountered most frequently were infectious hepatitis, poliomyelitis, histoplasmosis, gastroenteritis, encephalitis, typhoid fever, leptospirosis, and influenza. Significant single cases of 35 other diseases occurring in lesser frequency included such entities as malaria, smallpox, anthrax, keratoconjunctivitis, psittacosis, diphtheria, atypical pneumonitis, serum hepatitis, and Colorado tick fever.

In addition to responding to requests for epidemic aid, officers of the Epidemic Intelligence Service engage in planned epidemiologic studies of diseases of national importance. Many of these studies are under the aegis of the CDC; others are cooperative projects with universities and laboratories where the epidemiologic approach can be employed to advantage. They also carry on surveys, as time permits, and other activities compatible with the program of the PHS field station or health department to which the participant is assigned.

Table 2

EPIDEMIC AID INVESTIGATIONS

Epidemic	Date Investigation Begun
Suspected Encephalitis Richmond, Va.	July 1951
Enteric Disease, SS Taurinia Charleston, S. C.	August 1951
Poliomyelitis Shreveport, La.	August 1951
Poliomyelitis Memphis, Tenn.	August 1951
Infectious Mononucleosis Danville, Va.	October 1951
Poliomyelitis Odessa, Tex.	October 1951
Poliomyelitis Rye, Colo.	October 1951
Infectious Hepatitis Whitfield County, Ga.	October 1951
Poliomyelitis Wheatland, Wyo.	November 1951
Rabies North Dakota	December 1951
Hepatitis Tuba City, Ariz.	January 1952
Pulmonary Disease Boulder, Mont.	January 1952
Infectious Hepatitis Windham, Ohio	January 1952
Diarrheal Disease (Consultation) Enteric Infection Winfield, Kans.	January 1952
Hepatitis Rockport, Mo.	January 1952
Psittacosis Florida	January-March 1952 (continuing)
Influenza-like Disease Little Rock, Ark.	February 1952
Infectious Hepatitis Harlan County, Ky.	February 1952
Typhoid Fever Trinidad, Colo.	February 1952
Undiagnosed Disease Henniker, N. H.	March 1952
Leptospirosis Virginia	March 1952
Anthrax Ohio	March 1952
Poliomyelitis Texas	June 1952
Suspected Smallpox Missouri	May-June 1952
Rabies Texas	May-June 1952

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LABORATORY ACTIVITIES

Laboratory facilities of the CDC include installations devoted to enteric bacteriology, special bacteriology, serology, tuberculosis, diphtheria, streptococcus, nursing research, parasitology, mycology, virus and rickettsia, and clinical pathology. All are employed in the support of CDC projects and in assisting in the improvement of laboratory diagnostic proficiency and general performance in public health laboratories throughout the country. Some of the approaches used are: (1) consultation services to State and local laboratories; (2) refresher training for laboratory personnel; (3) review of State and local laboratory programs; (4) reference diagnostic services; and (5) methodology research.

Although the several laboratories primarily are concerned with a particular specialty or area of activity, the work of each is integrated into a common pattern and is geared to the overall program of the combined laboratories.

CONSULTATION SERVICES

During fiscal year 1952, laboratory program reviews were performed for 24 States, the District of Columbia, and Alaska. Sanitary bacteriology practices at Shepherd Air Force Base, Tex., were evaluated. In addition, reviews were made of 27 branch laboratories in 8 States. Members of the combined staff of CDC laboratories served as referees for intrastate parasitological evaluation programs carried on by the State health departments of Louisiana, Maryland, and Texas. A member of the parasitology laboratory staff served in Korea as a consultant to the Enteric Disease Commission in connection with studies of dysentery among military personnel and prisoners of war.

LABORATORY TRAINING

Thirteen regularly scheduled training courses were offered at laboratories at Chamblee, Ga., and Montgomery, Ala. Subjects included and affiliation of student trainees are indicated in table 3. Figure 1 shows the geographic distribution of 1952 registrants.

Field training courses were offered in Alabama, Oregon, Texas, and Washington. Members of the staffs of various laboratories participated in teaching activities at a number of universities and gave a course in mycology for the American Academy of Dermatology and Syphilology at Chicago. The student parasitological extension service, a valuable adjunct to the more formal training, was resumed.

DIAGNOSTIC SERVICES

The several laboratories carried on diagnostic activities in three major areas:

(1) Reference diagnostic work on difficult or unusual specimens submitted by or through State health departments, by other health agencies, and by Federal laboratories of other institutions.

(2) Epidemic aid diagnosis dealing with specimens submitted in the course of investigations and during epidemics or significant outbreaks of a particular disease.

(3) Diagnoses involving specimens submitted in connection with CDC-supported operational programs or demonstration projects.

Table 4 indicates the nature and scope of diagnostic services rendered by the respective laboratories.

Diagnostic work, in varying quantity and nature, is pursued in other areas and in other relationships by most of the laboratories. The CDC, for example, is the National Depository for Malaria Slides, which entails laboratory examination of submitted slides that are considered to be positive or are controversial. The diphtheria laboratory received strains of *Corynebacterium diphtheriae* from many parts of the country, and the examination of these strains yielded considerable new knowledge concerning the types of organisms prevalent in different localities. Of special interest was an outbreak of diphtheria near Kansas City, Mo., that was due exclusively to the *minimus* strain. Diagnosis work of the streptococcus laboratory included: (1) serologic and biochemical identification of alpha, beta, and gamma-type streptococci, and of *Hemophilus* organisms; (2) antibiotic sensitivity tests; and (3) referral of specimens for antistreptolysin determination. The special bacteriology laboratory maintained reference diagnostic services (1) for identification of bacterial cultures not referable to other CDC laboratories, and (2) for leptospiral serology; the latter constituted the major part of the 1952 workload in this laboratory. Some 400 miscellaneous bacterial cultures were received for identification. In the enteric laboratory, 258

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Table 3

TRAINING COURSES PRESENTED BY LABORATORY BRANCH, FISCAL YEAR 1952

TYPE OF TRAINING COURSE	STUDENTS							
	State, County, City Health Dept.	U. S. Public Health Service	Other Federal Organi-zations	Hospitals	Universities	Foreign Students*	Other	Total
Laboratory Diagnosis of Bacterial Diseases								
Parts 1 and 2	13	11	26	12	–	8	–	70
Directors' Courses	7	–	15	3	1	3	–	29
Laboratory Diagnosis of Parasitic Diseases								
Parts 1 and 2	6	7	44	5	–	4	2	68
Directors' Courses	2	1	13	2	–	1	–	19
Laboratory Diagnosis of Bacterial Diseases, Enteric Bacteriology	8	10	7	7	–	5	1	38
Special Problems in Enteric Bacteriology	2	–	–	–	–	–	–	2
Laboratory Diagnosis of Tuberculosis**	12	2	13	6	–	3	–	36
Directors' Courses	–	–	4	4	–	3	–	11
Laboratory Methods in Medical Mycology								
Parts 1 and 2	16	12	33	20	1	2	2	86
Directors' Courses	3	–	7	1	–	1	–	12
Laboratory Diagnosis of Virus Diseases	6	–	2	1	7	4	1	21
Directors' Courses	1	–	6	–	1	2	–	10
Virus Isolation and Identification Techniques – special students	–	–	–	–	–	3	–	3
Laboratory Diagnosis of Rabies***	5	2	7	–	1	4	–	19
Identification of Medically Important Arthropods	1	8	2	–	1	–	–	12
Phage Typing of *Salmonella typhosa*	1	–	–	–	–	–	–	1
Typing of *Corynebacterium diphtheriae*	–	–	–	–	–	1	–	1
Microbiology for Public Health Nurses***	11	2	1	1	1	–	–	16
TOTAL	94	55	180	62	13	44	6	454

* Foreign students represented Argentina, Belgian Congo, Belgium, Canada, Ceylon, Denmark, Ecuador, Germany, Haiti, India, Israel, Italy, Mexico, Peru, Thailand, and Yugoslavia.

** Courses given in cooperation with the Division of Chronic Disease and Tuberculosis.

*** Courses given in cooperation with Epidemiology Branch, Communicable Disease Center.

Table 4

SUMMARY OF DIAGNOSTIC SERVICES
FISCAL YEAR 1952

Laboratory	Number of Specimens Examined		
	CDC	Non-CDC	Total
Parasitology	103,203	10,513	113,716
Mycology	12	2,034	2,046
Diphtheria	525	1,504	2,029
Special Bacteriology	13	2,505	4,397*
Streptococcus**	75	946	1,021
Serology	6,987	11,854	18,841
Enteric Bacteriology	519	5,392	5,911
Tuberculosis	2	5,128	5,130
Virus and Rickettsia	2,300	2,846	5,146
Totals	113,636	42,722	156,358

*Includes 1,879 examined at Phoenix Field Laboratory.

**Distributed 9,599 ml. of typing serum.

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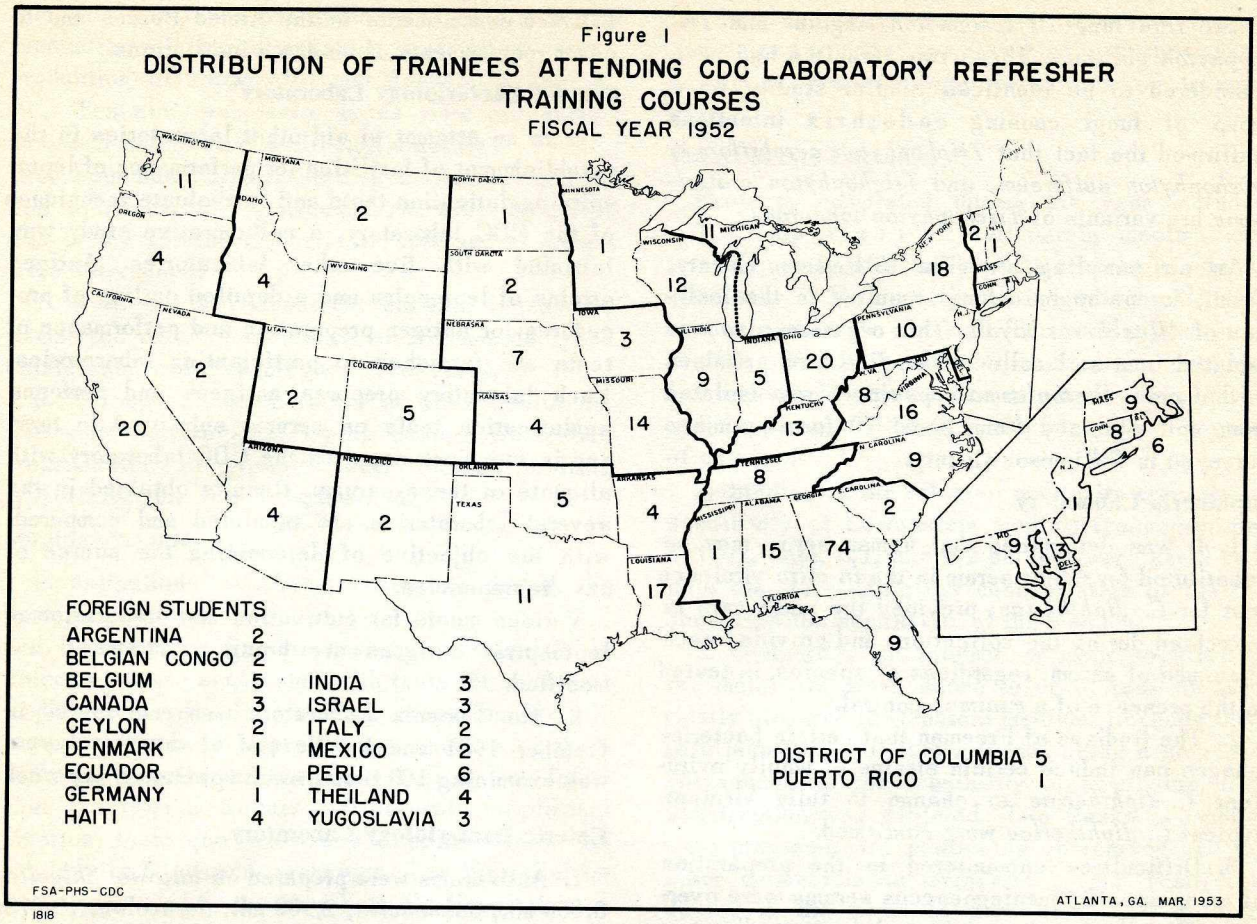

cultures of *Salmonella typhi* and 146 cultures of *Salmonella paratyphi* B were subjected to phage typing.

INVESTIGATIONS, STUDIES, AND RESEARCH

The several laboratories, independently and cooperatively, engaged in investigative studies and research developed out of reference diagnosis work, knowledge of the subject, and imagination of investigators. Activities in this area during 1952 were so numerous and touched upon so many problems as to preclude cataloging them in a summary report. Some involved long-range studies in areas of particular interest to a particular laboratory, and others were joint undertakings by teams representing the combined laboratories.

Projects pursued by the respective laboratories during the past year included, but were not confined to, the following:

Parasitology and Mycology Laboratories

1. Studies of intestinal parasite techniques: (a) PVA fixative technique as (1) shipping method, (2) staining of cultured protozoa, and (3) causes of precipitation in certain samples; (b) concentration procedures for stool specimens.

2. Cultivation of intestinal protozoa: (a) use of antibiotics; (b) testing of sodium azide as a preservative; and (c) effects of autoclaving under varying conditions.

3. Application of surface active agents in parasitological diagnostic procedures.

4. Cytochemical studies on amebae.

5. Analysis of current opinion on diagnosis of amebiasis.

6. Control of amebiasis in mental institution by therapy.

7. Amebiasis survey of World War II veterans at Lawson VA Hospital.

8. Studies on dysentery among Korean prisoners of war.

9. Serology of parasitic diseases.

10. Studies on arthropods of medical importance.

Nutritional and physiologic studies of several dermatophytes, conducted in the mycology laboratory, led to the clarification of the taxonomic status

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of two rare fungi: *Trichophyton megnini* and *Trichophyton gallinae*. These two parasites had been considered to be identical. Similar studies on a group of fungi causing endothrix infections reaffirmed the fact that *Trichophyton cerebriforme*, *Trichophyton sulfureum*, and *Trichophyton crateriforme* are variants of *Trichophyton tonsurans*.

An air sampling study in Williamson County, Tenn., for pathogenic fungi resulted in the isolation of *Allescheria boydii*. This organism also was isolated from soil collected on five farm premises in that area. *Histoplasma capsulatum* was isolated from soil obtained from 10 of 70 farm premises surveyed in Williamson County.

Diphtheria Laboratory

1. It was determined that human serum may be substituted for rabbit serum in the *in vitro* virulence test for *C. diphtheriae*, provided the same care is exercised during the collection, and provided each specimen of serum, regardless of species, is tested in the presence of a *minimus* control.

2. The findings of Freeman that certain bacteriophages can induce certain strains of wholly avirulent *C. diphtheriae* to change to fully virulent typical *C. diphtheriae* were confirmed.

3. Difficulties encountered in the preparation of group-specific meningococcus serums were overcome. Distribution through State laboratory directors started during March, and reports from users indicate satisfactory results.

4. In spite of many problems yet to be solved, progress was made in the preparation of pneumococcus typing serums.

Streptococcus Laboratory

1. Representative strains of all types and species of *Streptococcus* and *Hemophilus* organisms were lyophilized as needed for the maintenance of an adequate stock for distribution.

2. Extracts of 13 groups and 41 types of Group A streptococci were maintained for use of the CDC and for distribution.

3. Work continued on efforts to determine a simple method for developing and maintaining streptococcus cultures in a condition satisfactory for use in serologic typing tests.

4. With the cooperation of other laboratories, various dehydrated media were compared with the standard streptococcus medium which is difficult to prepare and is subject to considerable variation between batches.

5. The serum production program was expanded to meet commitments to the Armed Forces and to cover requirements of research institutions.

Special Bacteriology Laboratory

1. In an attempt to aid other laboratories in the establishment of facilities for performance of leptospira agglutination tests and to evaluate techniques of the CDC laboratory, a collaborative study was initiated with five other laboratories. Antigen strains of leptospira and a detailed outline of procedures for antigen preparation and performance of tests are furnished to participating laboratories. Each laboratory prepares antigens and performs agglutination tests on serums submitted to them and in turn each supplies the CDC laboratory with aliquots of these serums. Results obtained in the several laboratories are tabulated and compared, with the objective of determining the source of any discrepancies.

Various media for cultivation and preparation of leptospiral antigens are being evaluated and modified.

2. The Phoenix Laboratory was reactivated in October 1951 and by the end of the fiscal year was examining 100 rectal swab specimens per week.

Enteric Bacteriology Laboratory

1. Antiserums were prepared as follows: *Shigella*, 8,000 ml.; *Salmonella*, 2,900 ml.; paracolon, 16,375; *Klebsiella*, 4,950; *Escherichia coli*, 12,025 ml. The *Shigella* and *Salmonella* serums were mainly diagnostic, and were produced for distribution to State laboratories. Most of the paracolon serums were produced as a result of research activities of the laboratory. In addition, 580 ml. of *S. typhi* and 140 ml. of *S. paratyphi* B typing phages were produced, giving the laboratory adequate supply of typing bacteriophages to cover emergency needs, should there be disruption of supply lines from the international center.

2. Work on classification and taxonomy of the Bethesda group was completed during the year. When satisfactory screening serums for the organisms have been prepared, diagnosis in this group should prove less difficult.

3. Work on the serologic typing of *E. coli* cultures was continued. Serums were prepared for all of the recognized K (heat labile somatic) antigens so that all of the serums necessary for the recognition of previously described *coli* types are now at hand. Several new *coli* groups were discovered.

4. Tests of the efficacy of chlorophyll as an adjuvant in the production of antiserums indicated

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that this substance has little or no effect in the production of O and capsular agglutinins in the production of *Salmonella* and *Klebsiella* serums.

5. Ten new *Salmonella* types were recognized and their antigenic constituents determined.

6. Four new *Shigella* serotypes were recognized and their antigenic relationships to other shigellae and to the various *Escherichia coli* and O groups were determined.

7. Work on the *Klebsiella* capsule types was completed and the incidence of 58 capsule types established in the studies was completed.

8. Through the cooperation of State health departments and regional typing centers, interstate transmission of typhoid fever through visiting typhoid carriers was demonstrated.

Serology Laboratory

Investigational studies carried on during the year included:

1. Complement fixation test for amebiasis*: In order to become acquainted with tests for amebiasis employed in other laboratories, approximately 100 serums were used in preliminary surveys of three different complement fixation tests. It was found that the regular Kolmer 100 percent complement fixation technique was less sensitive than the Bozicevich 50 percent technique. The Micro-Kolmer technique, used by the New York VA Hospital, was found to be fairly satisfactory and to have the advantage of requiring small quantities of material.

2. Complement fixation tests for fungus diseases: Requests for diagnostic services for histoplasmosis, blastomycosis, and coccidioidomycosis increased over the previous years, particularly in the case of histoplasmosis.

The evaluation of various *Histoplasma* antigens continued**.

3. Febrile agglutination antigens: Slow progress is being made on the Weil-Felix study; however, considerable data have been accumulated and a report is being prepared.

4. Rickettsial serology: Work in this area, involving the testing of rodent and human serums for typhus appraisal and control studies, is proceeding as a part of epidemiologic studies. The use of rickettsialpox antigen as a control for nonspecificity of the typhus antigen was discontinued after all tests with rat serums were negative.

A liver extract, prepared according to a method for isolating catalase, was shown to improve greatly and to speed the growth of recently isolated fastidious *Brucella abortus* strains on tryptose agar.

Tuberculosis Laboratory

Projects completed during the year included:

1. Comparison of Wallenstein medium with Lowenstein-Jensen medium with respect to relative efficiency in the isolation of tubercle bacilli from routine pathologic material. The results of a study of 375 culturally positive specimens indicate that Lowenstein-Jensen medium detected more positive specimens and yielded a slightly higher average of colonies.

2. Studies on the effect of malachite green on the sensitivity of Lowenstein medium (concentrations of 0.02, 0.05, 0.1, and 0.2 percent were used) indicate that increasing the concentration of the dye decreases the sensitivity of the medium.

3. Ordinarily, no attempt is made to sterilize the malachite green added to each flask of aseptically prepared Lowenstein medium. Because there is a possibility of this material being a source of contamination, the feasibility of employing heat-sterilization was explored. Two flasks of medium were prepared, one containing autoclaved and the other nonautoclaved malachite green. Tests conducted in the usual fashion, using 100 tubes of each type of medium, indicated no statistically significant difference in the number of colonies detected as between autoclaved and nonautoclaved malachite green.

4. Two experiments were completed in connection with efforts to determine whether phenol red is toxic for small numbers of tubercle bacilli under the conditions normally encountered when it is used in the adjustment of the pH of sediments prior to culture by incorporation in the digesting agent. Under this procedure, designed primarily for expediency, tubercle bacilli exposure to the indicator is 30 minutes to 1 hour longer than would be the case if the material were added just prior to neutralization. In both experiments, slightly higher colony counts were obtained by adding the phenol red separately just prior to neutralization.

5. A comparison of Peizer's medium with modified Lowenstein's medium for the primary isolation of tubercle bacilli from sputum showed the Lowenstein to be more sensitive than the Peizer.

6. Observations during the year indicate that the hemagglutination reaction in tuberculosis, in its present form, is neither specific nor sensitive

*See page 22.
**See page 26.

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enough for routine use.

7. Studies on the response of cortisone-treated white mice to various mycobacteria tended to confirm the work of other investigators, namely, that cortisone appears to enhance the spread of experimental tuberculosis infection following the inoculation of normally virulent strains of mycobacteria, but does not affect avirulent acidfast bacilli.

A number of other projects already in progress were continued and new ones were initiated.

Nursing Research Laboratory

Studies on the disinfection of thermometers, oral and rectal, in the nursing research laboratory were concluded during the year with the following findings:

A. Oral Thermometers

Thermometers contaminated with tuberculosis sputa, to which known cultures of *C. diphtheriae* were added, were successfully decontaminated by the following consecutive steps:

(1) Wiping the thermometers with cotton moistened with a solution of equal parts of 95 percent ethyl alcohol and tincture of green soap.

(2) Rinsing thermometers to remove soap.

(3) Immersing thermometers in 0.5 percent to 1 percent iodine in either 70 percent ethyl alcohol or 70 percent isopropyl rubbing alcohol for 10 minutes.

B. Rectal Thermometers

Tests on rectal thermometers showed that:

(1) Oily substances such as mineral oil and petrolatum are undesirable as lubricants from a bacteriological viewpoint.

(2) Water-soluble lubricants and jelly made from mild soap were satisfactory lubricants.

(3) The most effective cleaning procedure tested was wiping the contaminated thermometers with a solution of equal parts of 95 percent ethyl alcohol and tincture of green soap.

(4) A variety of disinfectants were effective against coliform organisms if the lubricants and wiping procedure recommended above were used.

FIELD TRAINING

Improving existing field training methods and techniques, and collaborating with the States in the development of new ones, continues to be one of the important activities of the CDC. Although other approaches are employed, primarily effort is focused on: (1) cooperation with States in the operation of regional field training centers; and (2) bolstering the training capacity and competency of States by loaning them training officers and training aids.

During the past year, exclusive of Atlanta, the CDC participated in the operation of training centers at Amherst, Mass.; Bloomington, Ill.; Buffalo, N. Y.; Columbus, Ga.; Pittsburgh, Pa.; and Topeka, Kans. The Buffalo center was relocated at Yonkers, N. Y., near the end of the year, and in this new location it will serve New Jersey as well as the metropolitan area of New York. More than 1,000 trainees were served by regularly scheduled courses at these regional centers (table 5), and some 500 others were enrolled in decentralized courses (table 6) conducted through the centers.

Experienced training officers were assigned on loan to California, North Carolina, and Oklahoma. Officers previously on duty in South Carolina and New York were retained in their respective assignments. In addition, training officers were detailed to conduct short training courses in such subjects as environmental sanitation, insect and rodent control, milk sanitation, and others oriented to the needs in the respective States.

Field training in various aspects of housing was expanded as State and local health departments manifested increasing interest in this relatively new area of field training.

For several years, the CDC has provided field training in a number of subjects for public health personnel from other countries. This program was reorganized somewhat during the past year, the objective being to accommodate groups through scheduled classes rather than on an individual basis, as so often happened in previous years. In all, 134 trainees from 41 different countries re-

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ceived field training in one or more phases of public health. Ninety of the 134 were served through the Atlanta center.

In 1952, for the first time, the CDC offered a course in training methods. This course is patterned to meet the needs of persons already engaged in training activities. Response was most favorable and arrangements are being made to accommodate a limited number of State training officers in future courses.

Table 5

REGULARLY SCHEDULED TRAINING COURSES

Name of Course Location of Center	Fiscal Year 1951		Fiscal Year 1952	
	Times Given	No. of Trainees	Times Given	No. of Trainees
Environmental Sanitation				
Amherst, Mass.	4	63	3	30
Bloomington, Ill.	2	22	1	11
Buffalo, N. Y.	3	54	2	39
Columbus, Ga.	1	16	2	28
Denver, Colo.	3	26	2	8
Pittsburgh, Pa.	2	22	4	43
Topeka, Kans.	1	18	2	17
Sanitary Engineering				
Columbus, Ga.	2	27	1	10
Topical Short Courses				
Amherst, Mass.	4	81	6	158
Bloomington, Ill.	2	10	5	35
Buffalo, N. Y.	–	–	1	4
Columbus, Ga.	2	9	5	14
Denver, Colo.	3	83	8	189
Topeka, Kans.	2	84	2	55
Hygiene of Housing				
Atlanta, Ga.	4	5	5	18
Syracuse, N. Y.	10	46	3	4
Insect and Rodent Control				
Atlanta, Ga.	13	136	8.	152
Bloomington, Ill.	1	25	1	22
Training Methods and Aids				
Atlanta, Ga.	–	–	2	14
Human Relations				
Atlanta, Ga.	–	–	2	33
Orientation				
CDC Personnel	6	84	4	61
Senior Veterinary Medicine Students, University of Georgia	–	–	3	46
Professional Students Summer Employment	–	–	1	27
Total	65	811	73	1,018

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Table 6
DECENTRALIZED TRAINING COURSES

Name of Course Location of Training	Fiscal Year 1951		Fiscal Year 1952	
	Times Given	No. of Trainees	Times Given	No. of Trainees
Environmental Sanitation				
Louisville, Ky.	-	-	1	5
Phoenix, Arix.	-	-	1	12
Topical Short Courses				
Kansas City, Mo.	-	-	1	10
Sylvan Lake, S. Dak.	1	75	-	-
Boise, Idaho	1	17	-	-
Spearfish, S. Dak.	1	43	-	-
Spokane, Wash.	1	30	-	-
Seattle, Wash.	1	70	-	-
Green Bay, Wisc.	1	33	-	-
Bismarck, N. Dak.	1	18	-	-
Hygiene of Housing				
Norman, Okla.	-	-	1	20
Buffalo, N. Y.	-	-	1	7
Milwaukee, Wisc.	-	-	1	55
Louisville, Ky.	-	-	1	58
Corpus Christi, Tex.	-	-	1	7
Oakland, Calif.	1	11	-	-
Charleston, S. C.	1	53	-	-
Lancaster, S. C.	1	50	-	-
Denver, Colo.	1	79	-	-
Insect and Rodent Control				
Boston, Mass.	1	34	-	-
Kansas City, Mo.	1	28	-	-
Montgomery, Ala.	1	25	-	-
Fort Jackson, S. C.	1	75	-	-
Chapel Hill, N. C.	1	18	-	-
New York, N. Y.	1	26	-	-
Washington, D. C.	1	24	4	126
Hartford, Conn.	-	-	1	26
Concord, N. H.	-	-	1	18
Providence, R. I.	-	-	1	20
St. Louis, Mo.	-	-	3	77
New Orleans, La.	2	21	3	54
Total	20	730	21	495

TRAINING AIDS

The CDC produces and makes available to users a variety of training aids, audio-visual and other types. Table 7 shows the number and type of major productions completed and released during 1952. Work was carried to varying stages of completion on 25 motion pictures, 24 filmstrips, and 11 slide series. These productions, plus the accumulation of productions completed previously, are made available to training centers, State and local health departments, schools of public health, various Federal agencies, medical schools, and other organizations or agencies engaged in the promotion of public health. Distribution to users is made through a film library on a short-term and on a long-

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Table 7

MAJOR PRODUCTIONS RELEASED DURING FISCAL YEAR 1952

13 MOTION PICTURES (16 mm)

Title	Color	Black and White	Running Time (Min.)
Sanitary Storage and Collection of Refuse	x		19
Milk and Public Health		x	11
Drilling a Well by Percussion Method	x		6
Laboratory Control for Milk Sanitation		x	9
Sampling Raw Milk		x	7
Infectious Hazards of Bacteriological Techniques Part I - The Inoculating Needle		x	10
Mosquito Prevention in Irrigated Areas	x		7
Community Fly Control Series Biology of Domestic Flies		x	9
Development of Job Information*	x		11
You Can be Safe from X-Rays		x	10
The Field Representative**		x	22
The Receptionist**		x	11
The Claims Supervisor**		x	14

19 FILMSTRIPS (35 mm)

Title	Color	Black and White	Frames
Epidemiology of Brucellosis Part I	x		86
Collection of Blood Specimens for Serological Examination	x		69
Infectious Hazards of Bacteriological Techniques Part V - The High Speed Blender	x		81
Infectious Hazards of Biological Techniques Part VI - The Centrifuge	x		84
Mosquito Prevention in Irrigated Areas	x		76
Use of Warfarin in Rodent Control	x		54
Community Fly Control Series Biology of Domestic Flies	x		82
Collection of Fecal Specimens	x		54
Collection of Sputum Specimens	x		54
Laboratory Diagnosis of *Trichophyton* Infections Part I - Ectothrix	x		77
Laboratory Diagnosis of *Trichophyton* Infections Part II - Endothrix	x		59
New Techniques for Rearing Blood-Sucking Insects		x	31
Identification of Some Common Fleas		x	59
Collection of Specimens from Eye, Nose, and Throat	x		45
Basic Laboratory Training Part I - GS-1 Meets the Laboratory	x		90
Basic Laboratory Training Part II - Handling and Use of Glassware	x		81
Recognition of Domestic Rodent Signs	x		57
Disinfection of Clinical Thermometers Part I - Oral Thermometers	x		67
VDRL Tests for Syphilis*		x	100

2 SLIDE SERIES (2 in. x 2 in.)

Title	Color	Black and White	Number of Slides
Insects of Importance to Public Health in the U. S.	x		37
Substandard Dwellings and Environment (Exteriors)	x		80

*Not distributed by the CDC.
**Produced for Social Security Administration, Bureau of Old-Age and Survivors Insurance.

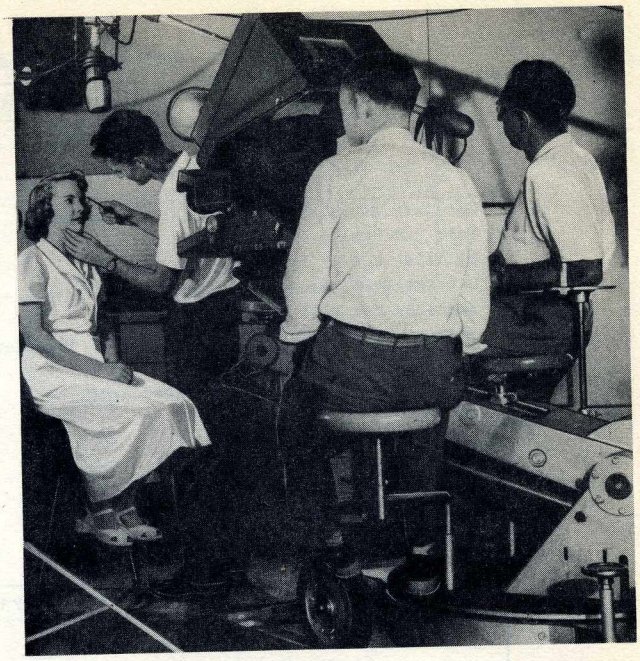
Courtesy of the David J. Sencer CDC Museum

term loan basis. Figures 2, 3, and 4 show by years the number of films loaned, number of showings, and combined audience served. Figure 5 indicates the distribution of films among the several categories of users.

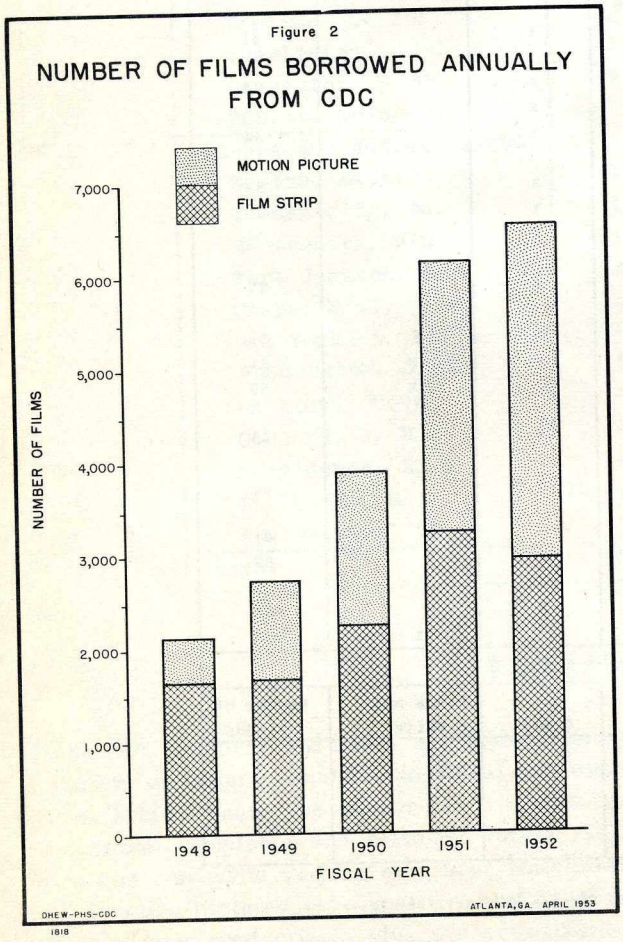
In the production of training aids, priority is given to the requirements of the CDC and its training programs. However, many projects are undertaken in cooperation with other public health agencies. A number of productions have been executed for other Federal agencies on a reimbursable basis.

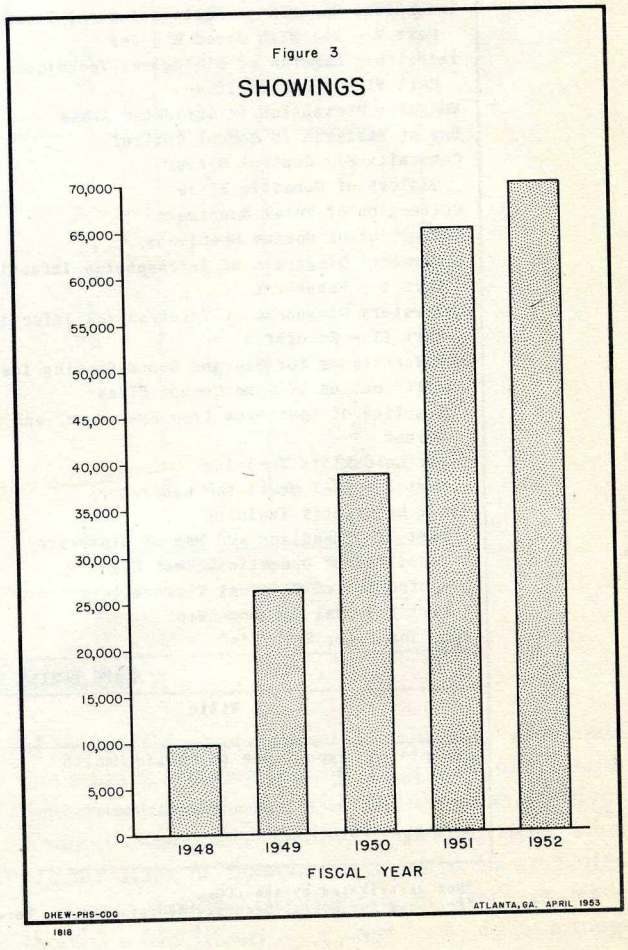
As part of a continuing effort to improve the utilization of training aids and to evaluate the effectiveness of old and new productions as training aids, users are provided guides and each using agency is requested to submit a review of each film used. This program has yielded valuable information for guidance in the planning of new productions.

The CDC also produces training manuals, lecture outlines, flip charts, pictorial keys, graphic materials, and digests of source and information data as part of its program in support of training.



Camera crew and make-up technician staging a scene for a motion picture training film. Interior scenes of this kind are set up and photographed in CDC studios at Atlanta.





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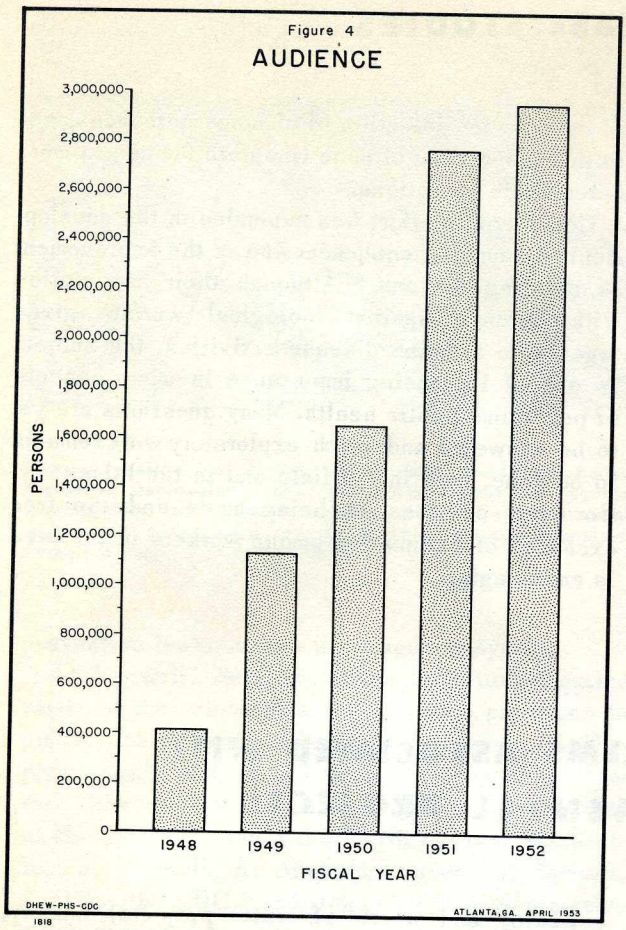

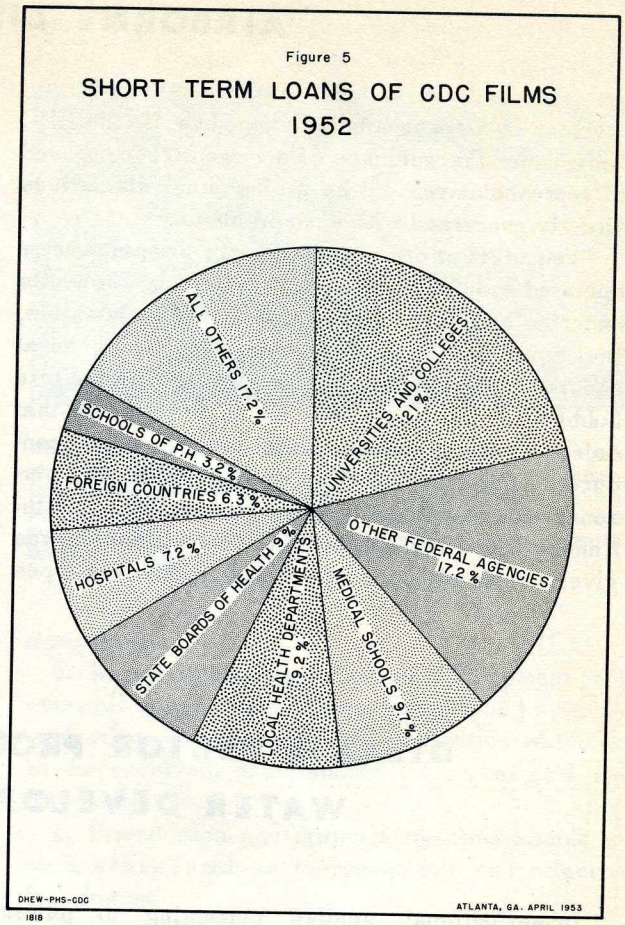

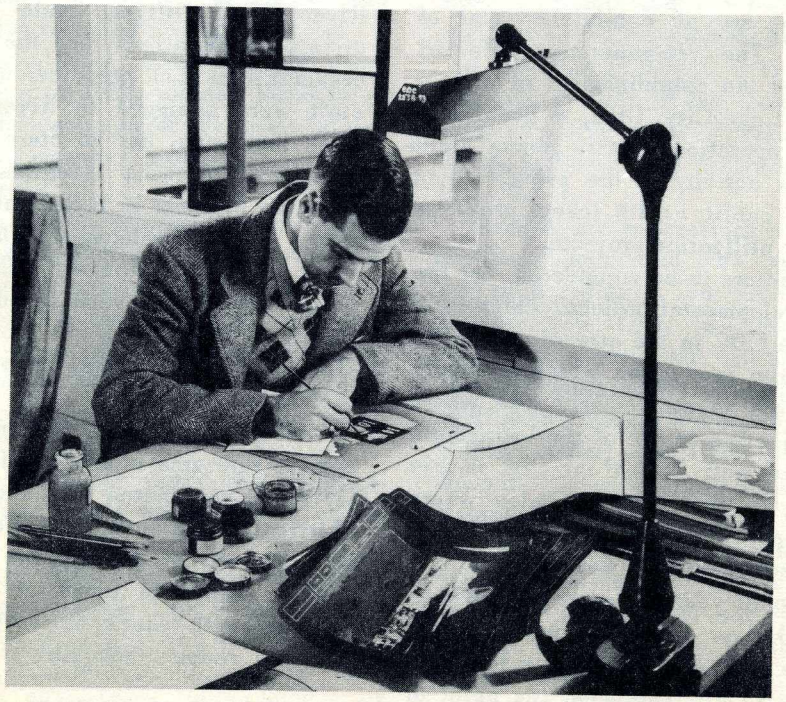

Graphic material used in audio-visual productions of the CDC is prepared by members of the graphic section.

Courtesy of the David J. Sencer CDC Museum

AIRBORNE DISEASE STUDIES

Airborne disease studies carried on by the CDC were under the guidance of a committee composed of representatives of the professional disciplines directly concerned with such problems.

When different types of air samplers were operated side by side in the Savannah, Ga., area under as nearly comparable conditions as possible, the Shipe air sampler produced higher bacterial counts from extramural air than did the sieve, Folin bubbler, or settling plates which followed in that order of effectiveness. Other studies were conducted under the direction of CDC laboratory personnel at Chamblee, Ga., Montgomery, Ala., and the Kansas City Field Station. First consideration was given to the problems of evaluating different types of devices for detection of airborne pathogens, and to the assembling of base line data for use in more determinate operations.

Considerable effort was expended in the development of sampling equipment and in the improvement of existing devices.* Although their association with defense against biological warfare gives urgency to airborne disease activities, the subject is one of increasing importance in many aspects of peacetime public health. Many questions are yet to be answered and much exploratory work remains to be done, both in the field and in the laboratory. However, progress is being made and the free exchange of information among workers in the area is encouraging.

DISEASE VECTOR PROBLEMS ASSOCIATED WITH WATER DEVELOPMENTAL PROJECTS

Investigational studies pertaining to public health insect problems connected with water resources development are an established part of the CDC program. The reorganization effected during 1952 included the establishment of a field organization at Salt Lake City, Utah, to coordinate and direct expanded operations in this general field. The purpose of this activity is the prevention or minimization of public health insect problems stemming from water utilization projects.

There are other factors to be considered, but the aspect of water developmental projects which is of chief concern to the CDC is the attending problem of increased mosquito production which is nearly always present. This is particularly true where irrigation is the objective or one of the byproducts of the project. Hence, activities of the CDC in this field are centered in the Western States where irrigation is practiced widely and where large water developmental projects are under way.

Work during the past year included: (1) investigative projects; (2) river basin programs; and (3) cooperative studies with, and assistance to, State health departments. In all instances, the point of emphasis was cooperation with the sponsors, builders, and users of water projects, namely, Bureau of Reclamation, U. S. Corps of Engineers, River Basin Offices, State health departments, private organizations, and the various agricultural organizations and agencies. Members of the CDC staff were assigned to River Basin Offices, in some instances, and to State health departments, in others, to make investigative studies of the mosquito problem in areas encompassed by a projected water development. They prepared evaluations of the situation and submitted to the appropriate authorities recommendations designed to eliminate or minimize the mosquito hazard nearly always attending dams, reservoirs, and irrigation operations.

Generally speaking, problems of immediate concern in this area of activity fall into two classes: (1) those associated with the actual construction of irrigation projects; and (2) those related to water use. As between the two, the second is perhaps of greater import in terms of mosquito production; however, with respect to new projects, much can be done to reduce mosquito production by building

*Page 20., Equipment Development.

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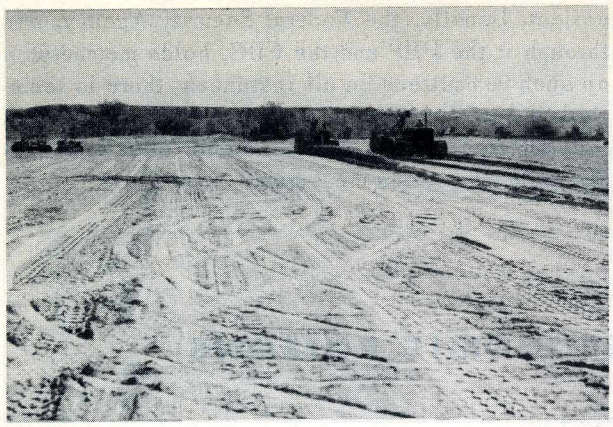
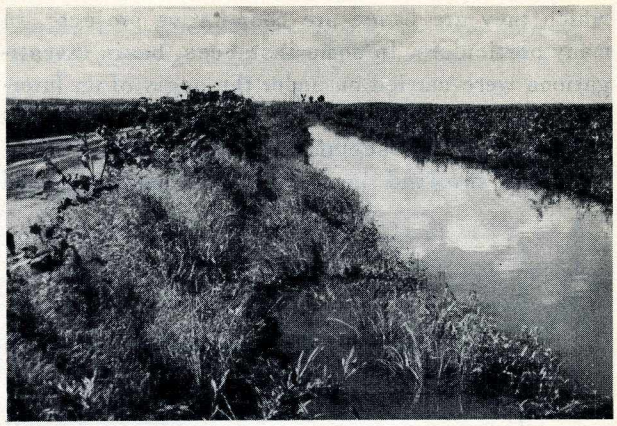


Proper leveling and grading of irrigated fields eliminates numerous depressions that would hold water and avoids wasted water and damaged land by providing uniform distribution of water over the land. (Photograph — Angostura Irrigation Project, South Dakota).



Waste water from irrigated fields is frequently drained into roadside ditches where it becomes ponded, thereby forming ideal mosquito-breeding places. The drainage system should provide for the safe disposal of any excess surface runoff from all irrigated fields. (Photograph — Mirage Flats Irrigation Project, Nebraska).

preventive features into the irrigation system.

At Mitchell, Nebr., a three-phase investigative study of the relationship of irrigation practices to public health insect problems is in progress. One phase deals with an old irrigation project at Minatare, a second with a new irrigation development at Mirage Flats, and a third with the seepage problem at Mitchell. At Angostura, near Hot Springs, S. Dak., the CDC is participating in a cooperative study designed to uncover conditions, causes, and situations responsible for mosquito production and to delineate effective remedial measures.

These and other studies, some old and some started in the spring of 1952, yielded information that prompted the following major recommendations for the prevention of mosquito problems associated with irrigation projects:

1. The irrigation project drainage system should be designed so as to facilitate the proper disposal of excess water from irrigated fields.

2. Where soil and geologic conditions are favorable for the development of seepage areas, lining or other treatment of canals to prevent seepage will eliminate extensive prolific mosquito-breeding habitats.

3. Insofar as circumstances permit, the irrigation system on each farm should be designed "to fit the land."

4. All lands to be served by gravity irrigation should be leveled and graded. This is particularly true of pastures, low-grade land, and heavier lands, where unleveled land leads to ponding of water and other situations favorable to the breeding of mosquitoes.

5. In the construction of water development projects, all natural drainageways should be preserved and, where large quantities of irrigation water are to be received, they should be enlarged and improved.

6. Distribution and drainage systems should be so maintained as to insure full and effective functioning.

7. Large overflow areas, which are sources of mosquito production, can be prevented by improvements in water management practices.

8. Intelligent application of water, notably avoiding the use of too much water, is one of the most effective ways of minimizing the production of mosquitoes, and it pays economic dividends as well.

Surveys and evaluations of mosquito and allied problems associated with basin-wide projects are now progressing in four major basins: (1) the New England-New York; (2) the Arkansas-White-Red; (3) the Missouri; and (4) the Pacific Northwest. The following individual reports have been issued: Preliminary Report — Kennebec River Basin; Preliminary Report — St. Lawrence River Basin States; Mosquito Investigations in the Republican River Basin; Mosquito Records from Missouri River Basin States; Mosquito Investigations in the James River Basin; Mosquito Problems in Irrigated Areas and Their Prevention; and Preliminary Report on Public Health Insect Control, Penobscot River Basin, Maine.

These reports and the investigative studies upon

Courtesy of the David J. Sencer CDC Museum

which they are based are cooperative projects, in many particulars. In some instances, basin investigations were carried on under the aegis of an Interagency Committee, a coordinating instrument composed of representatives of all interests and agencies involved in a particular developmental project. Usually, the Federal Security Agency, and through it the PHS and the CDC, holds membership on such committees. In all instances, there is teamwork in the gathering of data concerning the insect problem and in the translation of this data into mosquito prevention measures.

HEALTH HAZARDS OF ECONOMIC POISONS

During the past year, emphasis was placed on field evaluation of hazards actually existing in areas where economic poisons are used extensively in agriculture. Attention also was given to the hazards associated with the use of the common insecticides in the control of insect vectors of disease.

Determination of the amount of DDT residue on apples and pears grown in the vicinity of Wenatchee, Wash., indicated that there was a tendency for different types of fruit to retain different residues following uniform exposure. In general, the application of liquid formulations of DDT resulted in heavier residues than did dust applications. DDT residues were directly proportional to the amount of DDT applied. Residues on most of the fruits examined were less than 3 p.p.m. DDT, although a few apples had between 4 and 6 p.p.m. DDT.

Clinical studies in Wenatchee included the analysis of DDT in human fat from 73 individual cases. The range of values of recovered DDT plus its liquidation product extended from 0 to 25 p.p.m. in individuals with no clear history of high occupational exposure. Recent improvements in chemical analytical techniques have shown that a large portion of this stored material is not DDT but presumably is the harmless metabolic product, DDE. This discovery is of considerable significance. If the human body is able to convert small amounts of DDT to the nontoxic DDE, then the hazards resulting from the continuous ingestion of small amounts of DDT with food or from chronic exposure may be much less important than has been postulated by some workers. In any event, continued search in the Wenatchee area, where intensive agricultural use of DDT is practiced, so far has failed to uncover any case of poisoning attributable to DDT.

A survey has shown that in the Wenatchee area, the seasonal application of parathion averages nearly 4 lb./acre of apple or pear trees. The value of air samples taken as close as possible to the faces of workers indicated that workers were exposed to concentrations of parathion averaging 2.3 μg./l. of air during loading operations, as compared to about 0.5 μg./l. during orchard spraying and during mixing operations inside a commercial plant. Among 262 study cases followed during the spraying season, those living outside of the fruit-growing area showed average red cell and plasma cholinesterase values which compared closely with the normal values reported by others. Mixing plant personnel showed a very marked depletion of their cholinesterase values during spray season. Commercial and part-time applicators showed smaller but significant depletions during the season. A study of blood samples taken from mixing plant personnel indicated that the depletion of red cell cholinesterase was gradual and the recovery likewise was gradual (fig. 6). In spite of the fact that some occupationally exposed personnel showed a marked depletion of cholinesterase values, the only near-fatal cases found were associated, not with long-standing exposure, but with gross carelessness.

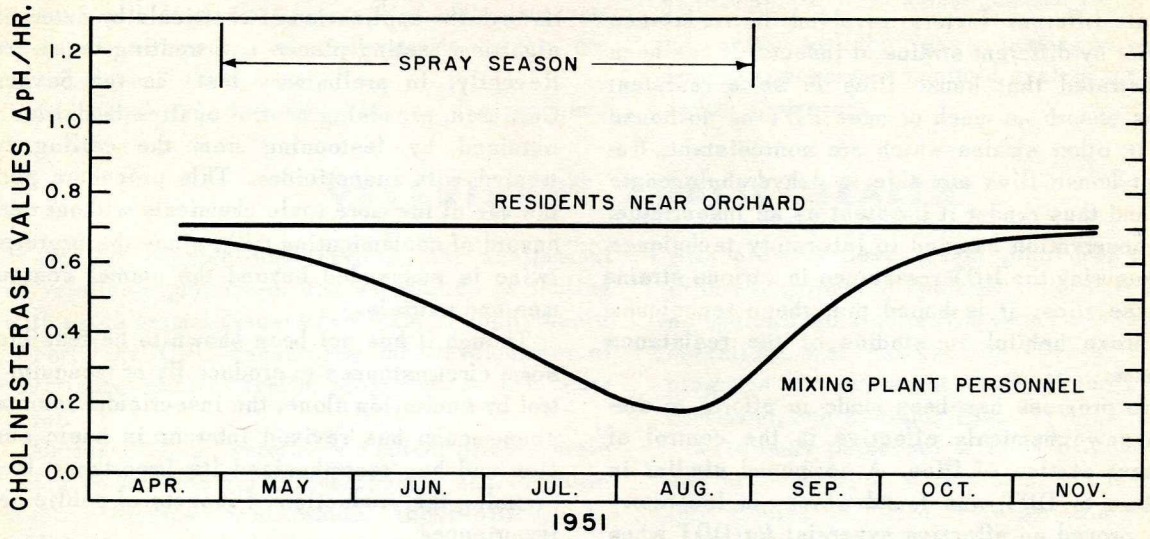
Results obtained by exposing rats to repeated sublethal dermal dosages of dieldrin followed by a challenge dosage of 400 mg./kg. indicate that rats develop a small but definite tolerance to dieldrin. Physiological studies, dermal application using dieldrin, showed that livers of chronically poisoned rats were significantly heavier than those of unpoisoned controls.

Repeated dermal application of DDT (355 doses or more of 2.5 percent emulsion applied at rates of 40 and 80 mg. DDT/kg./day) produced marked liver disease in rats, but apparently recovery from the

Courtesy of the David J. Sencer CDC Museum

FIGURE 6

Effect On Red Blood Cell Cholinesterase Activity Resulting From Relatively Heavy Occupational Exposure To Parathion



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disease is possible. Definitely irreversible alterations such as liver cell necrosis or cirrhosis could not be demonstrated. The bromsulphthalein liver function test showed a poor correlation with liver pathology.

Dogs were fed parathion until a marked depletion of cholinesterase was observed and then were allowed to recover before a repeated exposure; the test was carried through four poisoning cycles. No evidence of tolerance to parathion was found except that the cholinesterase values maintained plateaus in the face of continued dosage. Some tendency toward decreased resistance was indicated by the increasing time necessary for red blood cell cholinesterase regeneration after the first cycle.

INSECTICIDAL RESISTANCE OF VECTORS OF DISEASE

The development of strains of insects resistant to chlorinated hydrocarbons has now become a public health problem of more than ordinary importance. It complicated the control of house flies and pest mosquitoes during 1951, and during 1952 many other insects showed a varying degree of resistance to DDT. The situation was perhaps most acute in Korea, where the UN forces were unable to control body lice among prisoners of war with conventional DDT powder. Similar difficulties were encountered in Egypt. Several species of mosquitoes in various parts of the world are reported to have manifested resistance to DDT. Some evidence has been gathered which indicates that *Anopheles quadrimaculatus*, vector of malaria in the United States, may be developing resistance to some degree in parts of the Nation.

During 1952, laboratory studies showed that the blow fly, *Phaenicia pallescens*, when exposed to various residual deposits of dieldrin, manifested some increase in resistance to dieldrin in the F_1 and F_2 generations. Laboratory tests established that house flies in the Charleston, W. Va., Pharr, Tex., and Yuma, Ariz., areas have developed a high degree of resistance to dieldrin. Most of these strains already were resistant to DDT.

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Since house flies were the first species to develop a marked degree of insecticidal resistance, and since they are easy to work with in the laboratory, they continue to be used as the primary experimental organism. Some evidence has been accumulated which indicates that there may be several different factors involved in resistance behavior by different strains of insects. It has been demonstrated that house flies in some resistant strains absorb as much or more DDT as do house flies in other strains which are nonresistant. Resistant house flies are able to dehydrohalogenate DDT and thus render it impotent as an insecticide. This observation has led to laboratory techniques for measuring the DDT resistance in various strains of house flies; it is hoped that these techniques may prove helpful in studies of the resistance problems.

Some progress has been made in efforts to discover new chemicals effective in the control of resistant strains of flies. A compound similar in structure to DDT was found which, in laboratory tests, proved an effective synergist for DDT when used against flies. Other materials, particularly chlorinated chalcone, also showed a certain degree of synergism. Work on this phase of the insecticidal resistance problem is being continued.

Studies on fly habits indicate that it may be possible to improve the degree of control of flies through the application of chemicals by determining nighttime resting places and treating those areas. Recently, in preliminary tests in the Savannah, Ga., area, promising control of flies in dairies was obtained by festooning from the ceiling twine treated with insecticides. This procedure permits the use of the more toxic chemicals without serious hazard of contaminating milk, since the impregnated twine is suspended beyond the normal contact of men and animals.

Though it has not been shown to be feasible in some circumstances to produce fly or mosquito control by sanitation alone, the insecticidal resistance phenomenon has revived interest in basic sanitation and has reemphasized its importance in suppressing the production of insects of public health importance.

CONTROL OF ANIMAL RESERVOIRS OF DISEASE

Laboratory tests indicate that the mongoose, important host and vector of rabies in Puerto Rico, is naturally resistant to warfarin. Of compounds tested, the most promising in poisoning the mongoose were sodium fluoroacetate at 80 mg./kg. of body weight and thallium sulfate at 60 mg./kg. of body weight. Barium carbonate, strychnine, ground glass, red squill, ANTU, zinc phosphide, and arsenic trioxide all were found unsatisfactory.

Continuous residual treatment of nonratproofed establishments (in Savannah, Ga.) with warfarin at a concentration of 0.05 mg./gm. of bait provided good rat control for 2 years. In laboratory tests with the sodium salt of warfarin (concentration of 0.005 percent), roof rats were killed between the 7th and 23d days. In general, Norway rats given a choice of poisoned and poison-free water survived only half as long as roof rats; house mice survived approximately three times as long as Norway rats. Wild Norway rats avoided cornmeal containing more than 0.003 mg. of Aminopterin per gram of cornmeal, but at that concentration they died after consuming an average of 0.5 mg. of Aminopterin per gram of body weight. In laboratory studies, house mice forced to pass through runways dusted with 10 percent DDT dust were killed by an average of 25 exposures. With 50 percent DDT, the mean number of exposures required to kill mice was 11. In simulated field tests with mice, treatment with 10 percent DDT resulted in 50 percent mortality in 2 weeks, and almost complete control in 4 weeks. In comparable tests, 50 percent DDT gave 97 percent mortality within 2 weeks.

EQUIPMENT DEVELOPMENT

Major activities in this area during the year involved the development and improvement of devices for the detection of airborne pathogens. A membrane filter air sampler was modified to reduce weight, improve stability, reduce corrosion, and provide an inlet hose nipple. A plain flat baffle at the top of the sampling tube was found to be effective in reducing wetting of the filter mem-

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brane when the tube contained 20 ml. of water.

A fly-tagging device was constructed by means of which it is possible to attach markers of 1-inch nylon thread to 25 flies in a single operation. Using the device, it is possible to locate anaesthetized flies mechanically over the thread in such a way that a small droplet of glue applied with a ratchet-operated micrometer glue dispenser sticks the thread to the fly's thorax.

An animal exposure chamber was designed and constructed for use in evaluating respiratory toxicity of economic poisons.

A precision aerosol dispenser was developed for aircraft disinsectization studies where accurate measurement of dosages of insecticides was essential. In this same general field, the CDC cooperated with the Navy in testing an experimental automatic-reservoir manifold system for disinsectization of aircraft.

VETERINARY PUBLIC HEALTH

Through consultation services, the assignment of veterinary personnel, and assistance in dealing with acute animal disease problems of public health import, the CDC encourages the development of veterinary public health programs at the State level.

During 1952, 17 veterinary medical officers were assigned to State health departments and/or investigative studies in 11 States. These officers, in addition to conducting surveys and helping States with program development problems, participated in investigations of epidemic situations and carried on specialized studies. Assistance in rabies control operations was extended to 18 States, including programs in cantonment zones of the Fourth Army Command, San Antonio, Tex.

Veterinary personnel of the CDC, independently and in cooperation with others, carried on laboratory studies and field investigations pertaining to animal diseases transmittable to man.

REPORTS OF INVESTIGATIONS AND STUDIES

One of the continuing activities of members of the professional staff of the CDC is preparing reports of studies and investigations for publication in scientific journals and/or for presentation before learned societies. Of 210 papers prepared this past year, 131 were for publication and 79 for presentation. These papers are in the nature of reports on field investigations, laboratory research, and other activities carried on by the CDC, and are listed in the Bibliography of Scientific Publications issued annually by the Bureau of State Services of the PHS.

ACTIVITIES DIRECTED TOWARD SPECIFIC DISEASES OR PROBLEMS

Diseases falling within the scope of the CDC's responsibility include a number that cannot be effectively diagnosed, prevented, or controlled until existing knowledge concerning them is expanded. Accordingly, in parellel with the application of known techniques and knowledge in the control of communicable diseases, the CDC carries on studies, field investigations, and laboratory research, singularly and in concert, intended to provide new information that will permit more effective attacks against diseases not responsive to present control methods. Often this search for new information proceeds concomitantly with control operations, since with respect to certain

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diseases, existing procedures are sufficiently effective to warrant their use pending the development of more comprehensive and specific measures. Likewise, application of existing information under varying conditions in the field often points up approaches that open the door to new techniques and improved control methods.

Some of the activities in this general category pursued during 1952 are listed below. Only summaries of undertakings and accomplishments in the respective areas are presented. More detailed reports of major studies and investigations are recorded in papers prepared for publication.

AMEBIASIS

In laboratory studies, preliminary surveys with approximately 100 serums were made of three different complement fixation tests for amebiasis*, the purpose being to become acquainted with tests used in other laboratories.

Amebiasis antiserum prepared in rabbits by the CDC parasitology laboratory developed high titer, but was unsatisfactory because it also reacted with "t" antigen. Antiserum prepared in rabbits in the CDC serology laboratory also developed satisfactory titer but reacted with the ameba antigen, supposedly because of the "t" fraction in the ameba antigen.

Other activities in this area included: (1) amebiasis survey of World War II veterans at Lawson VA Hospital; (2) control of amebiasis in inmates of mental institutions by therapy; and (3) analysis of current opinion on diagnosis of amebiasis.

BRUCELLOSIS

The first study in the CDC laboratories of the tube agglutination test for brucellosis was completed in 1950. In 1951, various factors which affect the plate agglutination test were studied. During the past year, certain aspects of the problem were restudied and reports of findings were prepared for publication.

A study of factors concerning the *Brucella* blocking effect is being continued, as is one on the optimum temperature for incubation of the *Brucella* agglutination test with human serum in comparison with bovine serum. The Weil-Felix study is proceeding and a report of findings is scheduled for issuance during the ensuing year. Some 115 complement fixation positive serums have been studied.

Serums tested for brucellosis included: experimental, 473 human and 88 cow; routine, 177 human and 216 cow.

CONJUNCTIVITIS

By making physical examinations and taking case histories of a sample population of 486 persons in Barwick, Ga., at 2-week intervals, 91 cases of conjunctivitis were detected. Of the 486 persons, 210 were Negroes, 211 were males, and 178 were 0-14 years of age. Based only on history of reported sore eyes, 36 cases agreed so well in distribution by color, sex, age group, and month of onset with cases established by diagnostic criteria that they were added to the 91, making the final total 127. Forty-three percent of the children under 15 years of age were affected. Attack rates were highest among children under 10 years, with no significant difference between males and females and white and Negro.

Measurement of the prevalence of eye gnats, as well as of conjunctivitis, has been established on a reasonably firm basis as a result of studies completed during 1952.

Inasmuch as accumulated evidence indicates a close correlation of the prevalence of gnats and reported cases of sore eyes, larviciding has been advocated as a means of controlling the infection. A half-acre plot was sprayed with benzene hexachloride at the rate of 5 lb. of gamma isomer per

*See page 9.

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acre. Recovery cages placed on the test plot and on a check plot of equal size, both harrowed the same day, caught 2 and 446 *Hippelates pusio*, respectively. After a second harrowing (about a month later), 4 *H. pusio* were captured from the treated plot and 202 from the check plot.

In August 1951, investigators studying encephalitis in the Greeley, Colo., area observed a group of acute conjunctivitis cases. Similar outbreaks were encountered in Delta, Colo., Neosho, Mo., and the Kansas City area. Many of the cases entailed general systemic infection with conjunctivitis; sometimes keratitis, with or without vesicular pharyngitis, was present. Investigation of these outbreaks produced evidence suggesting at least six etiologically different infections. For the want of a better nomenclature, the epidemic was reported under the name of keratoconjunctivitis.

DISINSECTIZATION OF AIRCRAFT*

For a number of years, the CDC has collaborated with the Division of Foreign Quarantine in studies designed to develop more effective and practical methods for precluding the spread of vectors of disease by aircraft. During 1952, tests were made of various formulations and techniques by investigators in quest of more satisfactory insecticides and methods of employing them. After preliminary tests, using military planes and commercial airliners during training flights in the Miami, Fla., area, a field station was established in San Juan, Puerto Rico, for more extensive tests under routine commercial flight conditions.

Tests using house flies indicated that residual deposits of lindane at 200 mg./sq. ft. applied to the baggage compartment of passenger aircraft provide effective insect control for a period of 3 to 5 weeks after treatment. A 5-percent DDT wax emulsion applied to the passenger compartment of a DC-3 failed to kill free-flying test flies during 40-minute exposure. A lindane formulation in a high-pressure aerosol produced 99 percent mortalities of free-flying female house flies when applied at the rate of 7 gm. of the formulation per 1,000 cu. ft. Tests with aerosols have been conducted only when passengers were absent. There are some indications that noninjurious and passenger-acceptable aerosols may be feasible, and work is proceeding in that area. Attention also is being given to the possibility of employing automatic equipment for releasing aerosols in manner and quantity sufficient to disinsectize some types of planes.

DYSENTERY-DIARRHEA (FLY CONTROL)

The programs established in Arizona, Kentucky, New Mexico, and Texas in 1950 were continued through fiscal year 1952. These States rank highest in the Nation in enteric infection mortality rates, and the project cities are representative in the respective States.

Proceeding from the established premise that effective fly control yields appreciable reduction in dysentery-diarrhea attack rates, progress was registered in each of the States in achieving fly control and in utilizing CDC-sponsored projects as an incentive for establishing locally sponsored community-wide fly control programs in satellite cities. In each instance, sanitational improvement was emphasized as the first essential to satisfactory fly control, with insecticides playing a secondary but important role in the sound overall approach. Operational instructions, for example, specify elimination of privies, inauguration of twice-a-week garbage collection, removal or sanitization of fly-producing animal pens, replacement of open dumps with sanitary landfills, and educa-

*Activities related to diphtheria are treated in the laboratory section of this summary (page 8).

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tional sanitation campaigns to enlist public support of fly control as a community effort.

Acceptable levels of fly control were attained at a majority of the project cities (fig. 7). The Fly Control Packet, a composite of technical and promotional data and information on community fly abatement, was effectively employed in the enlistment of the cooperation of civic groups, organizations, and public agencies in a concerted attack on public apathy. In nearly every instance, the response was encouraging.

In Texas, 19 cities initiated locally sponsored fly control programs based on techniques demonstrated at CDC-sponsored projects in that State (fig. 8). Six local projects have been launched in Kentucky.

A major factor in the success of the projects and in the expansion of the program into locally sponsored fly control operations was the initiation of fly control training schools and seminars.

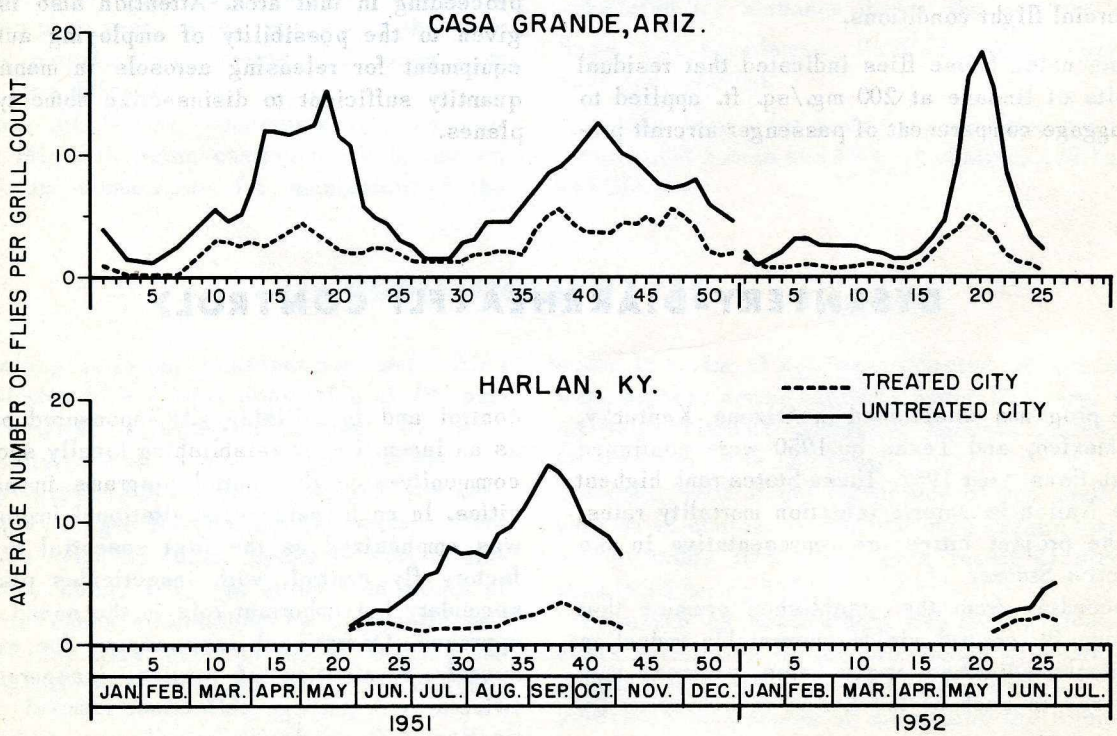
Diarrheal Disease Studies

The initial phase of a comprehensive study to determine the effects of fly control on the prevalence of diarrheal diseases in an area of moderate morbidity (south Georgia) was concluded. Effective fly control was maintained from August 1949 to September 1950 (principally by application of insecticides). Epidemiologic measurements of *Shigella* infections and of reported diarrheal disease morbidity during this period reflected a significant reduction in the areas where fly control was practiced as compared with noncontrol areas. Evaluation studies (made after flies developed a degree of insecticidal resistance that resulted in loss of control) revealed that diarrheal disease prevalence rates had returned to the pretreatment level. These results conform substantially to those found from an earlier study in Pharr, Tex., where diarrheal disease morbidity rates were high.

Pending the development of new materials and/or methods, and thereby re-establishment of fly control through chemical means, attention was turned to tests of the effectiveness of excluding flies from human feces and of maximum sanitation as fly control measures in rural areas. Bored hole privies

Figure 7

FLY DENSITIES IN TWO DEMONSTRATION DYSENTERY-DIARRHEA FLY CONTROL CITIES



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were installed in place of 200 inadequate privies in a town and are being evaluated in terms of species of flies breeding and feeding in them, and in relation to the prevalence of *Shigella* infections. In another town, where resistance of house flies to insecticides is high, sanitation in barns and animal shelters is being practiced as a means of controlling flies, and thereby controlling *Shigella* infections.

Rectal swab cultures, some 7,000 in number, were collected at monthly intervals from children under 10 years of age, for the isolation of *Shigella* and *Salmonella* organisms. Histories of illness due to diarrheal disease in these families also were collected and approximate trends were demonstrated in the culture survey. Some study was made, too, of a method of taking culture material directly from privy pits. This method could be of value as an epidemiologic tool.

ENCEPHALITIS

Although primarily diseases of domestic and wild birds, the encephalitides are the cause of large outbreaks of illness in man and in horses in this country and elsewhere. Mosquitoes have been incriminated as principal vectors, but the natural history of the bird-mosquito-bird cycle remains obscure. The complexity of the cycle of infection and the presence of many potential sources of infection where vectors are abundant make it important that knowledge of the encephalitides be augmented.

The CDC is assisting the Hooper Foundation of the University of California in investigative studies being pursued in Kern County, Calif. Data from these studies support the thesis that mosquitoes, particularly *Culex tarsalis*, are vectors of encephalitis, and that vector control in areas of high endemicity may influence the incidence of infection.

At Greeley, Colo., the CDC is sponsoring multiprofessional studies directed toward: (1) a careful description of outbreaks of encephalitis in the western United States; (2) the discovery of the natural repositors of the virus during nonepidemic and "off season" periods; and (3) an elucidation of possible transmission cycles which maintain the virus in nature.

No epidemics of encephalitis were reported in this area during fiscal year 1951, and a search for cases in Colorado, Kansas, and Missouri was unproductive. In the summer of 1951, studies were undertaken with the immediate objective of determining the number of infections with Western equine or St. Louis virus in man, horses, mosquitoes, birds, and mites, as compared with the number in other years; another objective was to attempt to demonstrate that infection may occur in birds without the intermediation of mosquitoes. To this end, the following specimens were collected and laboratory tested:

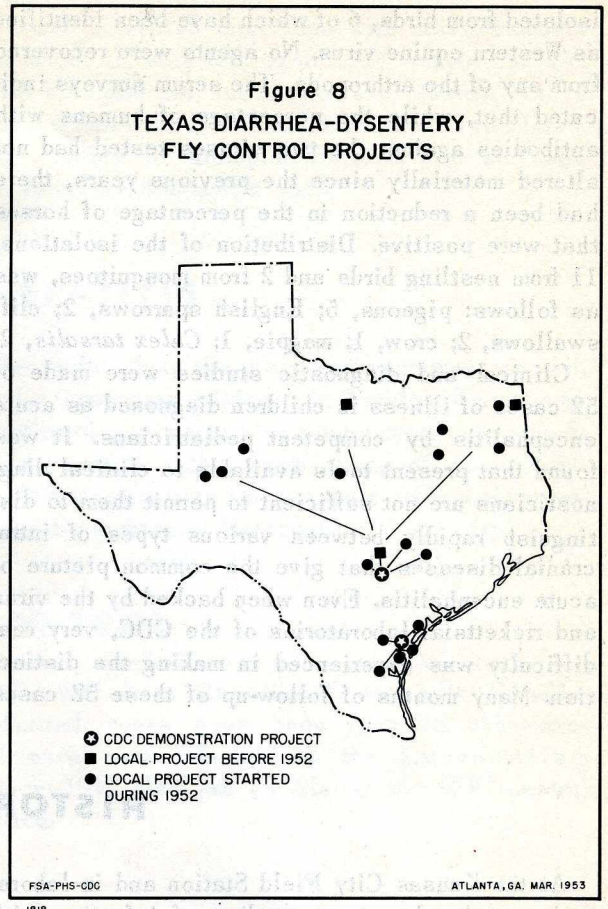

Figure 8
TEXAS DIARRHEA-DYSENTERY FLY CONTROL PROJECTS

For Virus Isolation	
Nestling birds' blood	658
Mosquitoes	14,000
Mites	22,000
Other arthropods	1,544
For Antibody Studies	
Human serums	320
Horse serums	351
Nestling bird serums	728

Laboratory reports show that 13 agents were

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isolated from birds, 6 of which have been identified as Western equine virus. No agents were recovered from any of the arthropods. The serum surveys indicated that, while the percentage of humans with antibodies against the two viruses tested had not altered materially since the previous years, there had been a reduction in the percentage of horses that were positive. Distribution of the isolations, 11 from nestling birds and 2 from mosquitoes, was as follows: pigeons, 5; English sparrows, 2; cliff swallows, 2; crow, 1; magpie, 1; *Culex tarsalis*, 2.

Clinical and diagnostic studies were made of 52 cases of illness in children diagnosed as acute encephalitis by competent pediatricians. It was found that present tools available to clinical diagnosticians are not sufficient to permit them to distinguish rapidly between various types of intracranial diseases that give the common picture of acute encephalitis. Even when backed by the virus and rickettsial laboratories of the CDC, very real difficulty was experienced in making the distinction. Many months of follow-up of these 52 cases revealed that the majority of those first diagnosed as encephalitis were not in fact due to any type of viral infection.

Studies in CDC laboratories revealed that many mosquitoes are capable of transmitting Eastern equine encephalitis virus, including the following species previously unreported as having this capability: *Psorophora ferox, Psorophora confinnis, Psorophora howardii, Psorophora ciliata, Mansonia pertubans, Culex restuans, Culiseta melanura,* and *Orthropodomyia signifera. C. melanura* and *O. signifera*, whose feeding habits were hitherto unknown, were found to take avian blood. *C. melanura* has been taken naturally infected.

Large quantities of arthropods were collected for virus determination and considerable effort was devoted to further studies of the relationship of irrigation to virus isolation.

At the request of the University of Kansas Laboratory, the CDC extended assistance in the investigation of bovine encephalomyelitis in herds in Kansas, Missouri, and Oklahoma.

HISTOPLASMOSIS

At the Kansas City Field Station and in laboratories at headquarters, studies of infection with *H. capsulatum* were continued along lines established during the preceding year. Field tests with the molecular filter membrane resulted in the demonstration of tuberculate spores of *H. capsulatum* in river water collected in Williamson County, Tenn., opening the question of the role of streams in the distribution of this fungus. The possibility of human infection from contaminated drinking water also is posed. In cooperative studies with the Tennessee Department of Public Health, *H. capsulatum* was isolated 11 times from soil obtained from 10 of 70 farm premises in Williamson County. The technique used for isolation was an indirect one utilizing mice, and on the basis of preliminary evaluation, it appears to be remarkably efficient.

Methodology research has indicated that antibiotics have little or no inhibiting effect on the growth of *H. capsulatum*. More than 1,900 complement fixation tests were performed in clinical studies of suspected infections, and 13,000 skin tests were made during field studies of immunity status in different geographic areas.

Out of 420 serum samples and 400 clinical specimens examined, *Histoplasma* was recovered 23 and 7 times, respectively.

In Jackson County, Iowa, examination of members of the immediate family of a fatal case of histoplasmosis showed all to be ill with the disease or to give positive skin reaction. More than a third of the cattle of the victim's family were positive reactors to *Histoplasma*. A skin test survey of 2,800 school children in the immediate community showed a relatively low overall sensitivity, but there were small areas in which a high proportion of individuals tested showed sensitivity to the histoplasmin used. Near one of these areas of high skin sensitivity, *H. capsulatum* was isolated from the soil in a cave.

Until recently, it was thought that histoplasmosis did not occur in epidemic proportions of significance. During the year, studies were made of 12 localized outbreaks which yielded evidence that histoplasmosis may occur as an epidemic disease of considerable severity.

Work on the evaluation of various *Histoplasma* antigens is being carried forward. In a continuation of studies of strain differences, four representative strains were selected for comparison of rela-

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tive antigenicity when tested with routine histoplasmosis-suspected serums. The age of the culture which is optimum for histoplasmin production was studied on two different media, using three soil strains in comparison with a strain from a human infection.

Other activities concerned with histoplasmosis included: (1) skin testing of 8,400 school children with histoplasmin, tuberculin, and blastomycin, in cooperation with Cincinnati, Ohio, health agencies; (2) studies of histoplasmosis in animals; and (3) reference diagnostic work.

INFECTIOUS HEPATITIS

Of the more than 40 categories of illness represented in the 200 outbreaks studied by members of the Epidemic Intelligence Service, infectious hepatitis occurred the most frequently (19 outbreaks). Gamma globulin was used in an outbreak in Atcheson County, Mo. A study initiated in Booneville, Mo., the preceding year was pursued, and a suspected epidemic in Wichita, Kans., was confirmed and control measures were prescribed. In connection with investigations of an outbreak in Arizona, sanitary surveys were made and recommendations made at Moencopi and Tuba City.

LEPROSY CONTROL

A central registry of leprosy cases for California, Louisiana, and Texas has been completed at the CDC in Atlanta. Cases recognized in Florida, whether admitted to Carville Leprosarium or not, have been included in the central registry. In other States only Carville-admitted cases have been included. Abstracts of each case admitted to the Leprosarium since 1921 also are on file at the CDC central office.

MALARIA

In line with predetermined plans, the CDC continued to withdraw from active participation in operational phases of the Federal-State malaria eradication program. Residual spray operations were carried on in 13 operational States through State and local support, however, and the CDC supplied necessary technical guidance. Surplus automotive equipment and limited amounts of excess materials were provided as the CDC shifted its main interests toward surveillance and prevention. Fiscal year 1952 residual spray activities are summarized in table 8. Entomologic evaluation indicated that 99.5 percent of sprayed houses were maintained free of malaria mosquitoes, compared with 89.9 percent of unsprayed houses.

Surveillance and prevention teams operated in 13 States throughout the year. The composition of teams assigned to the respective States varied somewhat, with epidemiologic specialists predominating. Appraisal of reported malaria and typhus cases, particularly the former, was the major activity of these teams. The upward trend in reported cases of malaria, first noted soon after the beginning of the repatriation of servicemen from Korea, continued during the year (fig. 9). Table 9 shows results of appraisals of malaria completed in the first half of the fiscal year. As indicated, States (eight) outside of the traditionally malarious region reported significant numbers of malaria cases, seemingly from civilian sources. However, epidemiologists of six of these States concluded after investigation that most of such cases were military personnel or veterans infected in Korea prior to their discharge. In California, for example, appraisals of 258 reported cases which occurred during 1951 resulted in evidence indicating that only 4 of the 258 represented primary cases of indigenous origin.

The CDC cooperated with the Texas State Department of Health in an investigation of malaria among Mexican Nationals who have entered this country along the Rio Grande Valley. Of 125 blood smears collected through June 30, 1952, 5 were found to be positive for malaria.

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Table 8

SUMMARY OF THE RESIDUAL SPRAY PROGRAM FOR FISCAL YEAR 1952

STATE	No. Counties	SPRAY APPLICATIONS				Pounds of Insecticide Per Application	MAN-HOURS			Man-hours per Application
		Premises	Lb. DDT	Lb. Chlordan	Other		CDC	Local	Total	
Alabama	8	12,327	10,839	745	-	0.94	528	10,784	11,312	0.92
Arkansas	24	31,110	43,639	10,659	-	1.75	-	57,191	57,191	1.84
Florida	9	2,109	1,693	2	-	0.80	-	1,961	1,961	0.93
Georgia	16	37,707	21,191	2,615	-	0.63	32	28,936	28,968	0.77
Kentucky	12	6,244	8,221	2,383	-	1.70	-	13,044	13,044	2.10
Louisiana	10	7,897	7,376	-	-	0.93	704	2,925	3,629	0.46
Mississippi	8	17,998	9,059	6,066	-	0.84	1,240	16,534	17,774	0.99
Missouri	5	2,350	1,416	-	-	0.60	368	3,429	3,797	1.62
North Carolina	22	49,996	10,498	832	339	0.23	270	21,098	21,368	0.43
Oklahoma	-	-	50	-	-	-	-	40	40	-
South Carolina	46	77,290	36,403	12,839	-	0.64	-	58,887	58,887	0.76
Texas	25	23,885	11,914	-	-	0.50	3,244	21,265	24,509	1.03
Total	185	268,913	162,299	36,141	339	0.74	6,336	236,094	242,480	0.90

In accordance with the recommendation of the National Malaria Society, the CDC is serving as the National Depository for Malaria Slides. Over 500 blood films were submitted to the Depository during fiscal year 1952.

Searches for human malaria were continued by periodic visits to study areas in the vicinity of the Newton and Manning stations. In the Newton area, 69 persons were found to have some symptoms attributable to malaria but evidence accumulated through visits, usually at monthly intervals, to approximately 1,100 residents of a 40-square-mile area failed to establish a clinical diagnosis of malaria, and all blood films obtained were negative. No malaria parasites were found in examinations of approximately 1,000 blood films collected monthly from residents of the experimental area of the Manning station, adjacent to Santee-Cooper Reservoir.

The continued negligible transmission of malaria

Figure 9

MALARIA MORBIDITY BY WEEKS
1952

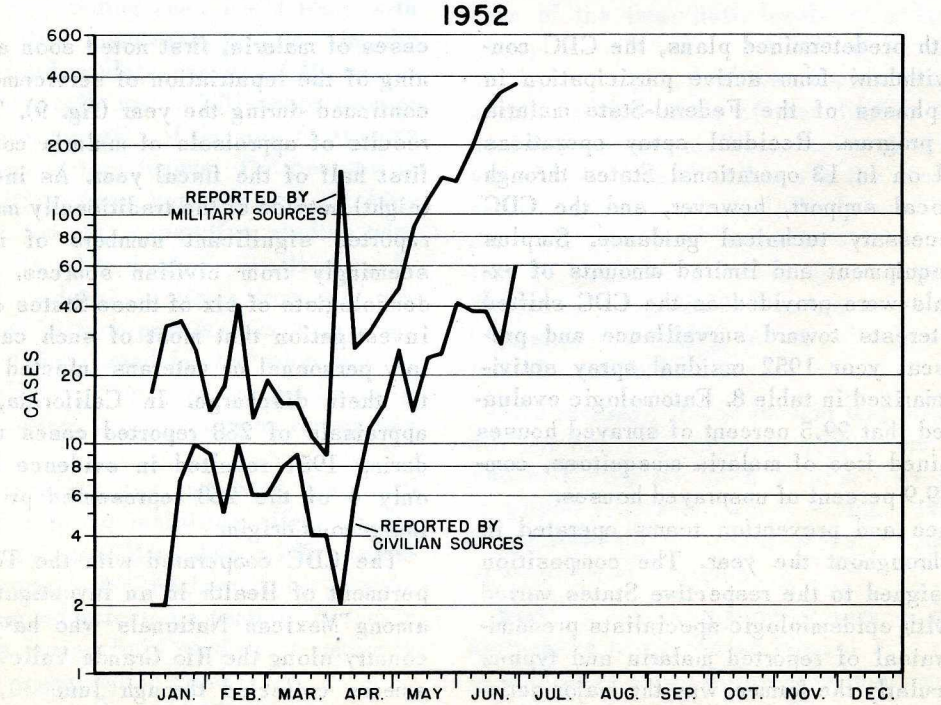

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Table 9

MALARIA MORBIDITY AND APPRAISALS
January-June 1952

STATE	Morbidity Reported to NOVS*		APPRAISAL OF 1952 REPORTS					APPRAISAL OF OLD REPORTS				
	From Civilian Sources	From Military Sources	Total	Positives** Local Origin	Positives** Foreign Origin	Presumptives*** Local Origin	Presumptives*** Foreign Origin	Total	Positives** Local Origin	Positives** Foreign Origin	Presumptives*** Local Origin	Presumptives*** Foreign Origin
Alabama	8	5	17		9			7				
Arkansas	7	86	96		94			123	1	116		
Florida	3	18	4		1		2	5			5	
Georgia	6	321	32		31			820		473		
Louisiana	1	193	197		189		2	0				
Mississippi	15	0	15		13			2		1		
South Carolina	12	137	58		48		1	155	1	151		1
Tennessee	0	31	49	1†	31		6	7				2
Texas	102	117	5		4		1	4		4		
Subtotal	154	908	473	1	420	0	12	1,123	2	745	5	3
Other States	257	1,323	187	1†††	15		169	258	6††	222	2	23
Total	411	2,231	660	2	435	0	181	1,381	8	967	7	26

*Provisional NOVS Data through June 28, 1952.
**Confirmed by blood smear.
***Clinically consistent malaria not confirmed by blood smear.
†Relapse.
††Two relapses of previous infections.
†††*P. malariae*, primary or relapse after 40 years of freedom from attack.

in the United States, which further minimized the likelihood of significant recurrence of primary infection, prompted the CDC to reassess and reorganize its malaria investigations program. Accordingly, stations at Helena, Ark., and Manning, S. C., were discontinued. The Newton, Ga., station, oldest of the three and the most productive in malariometric information, was continued and studies there were expanded to include the natural history of other parasitic diseases involving invertebrate animals as alternate hosts. During the year, the transition prerequisite to the undertaking of expanded studies at the Newton station was accomplished.

The general purpose of this reoriented program is: (1) to provide information that will contribute toward maintenance of freedom from diseases of this type that have been of public health importance in the United States; (2) to provide training facilities in methods of studying and controlling these diseases; and (3) to maintain a cadre of personnel informed in methods of survey and investigation, and generally familiar with current work on these diseases.

Other activities pursued at the Newton station included: (1) observations on abundance of *Anopheles*; (2) studies of factors responsible for the recession of malaria; (3) studies related to interpretation and evaluation of field observations such as (a) relative density of different anopheline larval instars in breeding places, (b) effect of temperature on development of *Anopheles* ova, and (c) relation of microenvironment to occurrences of mosquitoes; (4) studies related to transmission of malaria; and (5) studies on filariasis.

MURINE TYPHUS

Operations during fiscal year 1952 are summarized in table 10. Participation by the CDC was on the same basis as in previous years, but its total contribution was less. For the first 6 months of 1952 (January through June), 88 cases of typhus were reported, compared with 174 for the same period in 1951. Appraisal of 39 of the 88 cases reported through June 1952 (table 11) indicated 11 as confirmed by complement fixation tests and consistent clinical and epidemiologic histories. This downward trend in reported cases has been continuous during the past several years (fig. 10).

Reports from field operations show a marked reduction in the presence of rats in both rural and

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Table 10

TYPHUS CONTROL ACTIVITIES BY STATES, FISCAL YEAR 1952

	ALA.	ARK.	FLA.	GA.	LA.	MISS.	N. C.	S. C.	TENN.	TEX.
MAN-HOURS										
State and Local	41,377	9,584	25,989	99,237	16,946	5,040	51,934	10,118	21,609	73,016
U.S.P.H.S.	9,647	1,884	7,034	17,088	4,793	2,391	4,482	1,941	1,848	15,893
Total	51,024	11,468	33,023	116,325	21,739	7,431	56,416	12,059	23,457	88,909
PERCENTAGE OF TOTAL MAN-HOURS										
State and Local	81	84	78	85	78	68	92	84	92	82
U.S.P.H.S.	19	16	22	15	22	32	8	16	8	18
TYPE OF ACTIVITY										
Administration and Supervision										
State and Local	8	2	13	7	13	20	1	34	1	6
U.S.P.H.S.	1	6	14	9	6	12	3	16	4	9
Surveys		8				1			3	3
Inspections	3	2			1		1	8		5
Investigations		1				1				
Evaluation	22	11	8	3	12	20	4	26	2	8
Training and Educational Activities	2	10	12	26	2	4	1	1	3	12
Anti-rat Sanitation		39	9	3		9	12	2	9	13
Residual Dusting	16		5	13	30	1	6	2		12
Poisoning	48	6	30	32	35	26	47	2	13	23
Ratproofing		6	5	6			21	7	54	9
Ratproofing Maintenance		8	1			1	3	2	11	
Leave and Miscellaneous		1	3	1	1	5	1			
Total	100	100	100	100	100	100	100	100	100	100
UNITS OF WORK										
Number of Meetings	8	50	50	67	8	4	7	1	9	89
Number in Attendance	32	429	5,035	3,734	18	100	89	24	109	1,139
Number Refuse Control Surveys										3
Number Persons On-job Training		40	23	260		12	27	1	6	786
Average Man-hours per Trainee		6	32	3		36	4	176	16	44
Cities with Ratproofing Projects		1	3	1			5	1	2	3
Number Premises Ratproofed		57	110	156			401	5	480	224
Number of Poisoning Projects	11	2	14	27	8	10	17	2	3	60
Establishments Poisoned	33,318	1,751	10,716	59,707	37,760	10,808	51,951	935	3,514	19,590
Number of Dusting Projects	9		7	4	8	3	7	4	1	26
Total Premises Dusted	24,886		3,497	27,402	21,339	46	6,977	234	20	17,522

urban areas, indicating the accumulated effects of rat reduction activities. In Corpus Christi, Tex., a survey showed that only 15 of 304 premises inspected had rat infestation. Evaluation studies confirmed field observations that the ratio of rat-free premises is increasing annually. During the 18-month period, January 1951 to June 1952, one or more rats from 3,435 rural premises in 9 Southern States and 25 premises in Hawaii were bled and tested for typhus antibodies. Of 57 counties wherein premises were inspected, only 8 showed 20 percent or more of premises having rats exhibiting positive complement fixation reactions. Rats were taken from 20 or more premises in each county. No rats with positive fixation reactions were found in 18 of 57 counties.

In a survey of the typhus potential in the three South Carolina counties encompassed in the Savannah River Atomic Energy Commission project, only 2.7 percent of premises tested yielded rats showing positive complement fixation reactions.

During the year, a typhus eradication demonstration project was inaugurated in Geneva County, Ala. The primary objective of this undertaking is to determine the economic feasibility of eradicating typhus on an area-wide basis by the application of methods and techniques now is common use. The project is a cooperative one with the CDC supplying supervisory personnel and technical guidance, the county furnishing operational labor, and the State health department sharing in the overall direction of the program. Established operational procedures contemplate:

(1) Pretreatment surveys to determine the degree of rat infestation and prevalence of typhus antibodies in rats.

(2) Treatment of rat-infested premises, employing warfarin poisoning, DDT dusting, antirat sanitation, harborage removal, and appropriate inspection and enforcement techniques.

(3) Posttreatment surveys to determine the degree of effectiveness of the treatment operations

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Table 11

TYPHUS MORBIDITY AND APPRAISAL

January - June, 1952

State	Morbidity Reported To NOVS*	Appraisals of 1952 Reports			Appraisals of Old Reports		
		Number	Positive**	Presumptive***	Number	Positive**	Presumptive***
Alabama	9	10	5	0	119	27	2
Arkansas	0	3	0	0	2	0	2
Florida	6	3	0	2	9	5	2
Georgia	11	2	2	0	2	2	0
Louisiana	3	0	0	0	0	0	0
Mississippi	6	17	2	1	2	1	1
South Carolina	2	2	1	0	1	1	0
Tennessee	3	2	1	1	0	0	0
Texas	43	0	0	0	0	0	0
Sub-total	83	39	11	4	135	36	7
Other States	5	-	-	-	-	-	-
Total	88	39	11	4	135	36	7

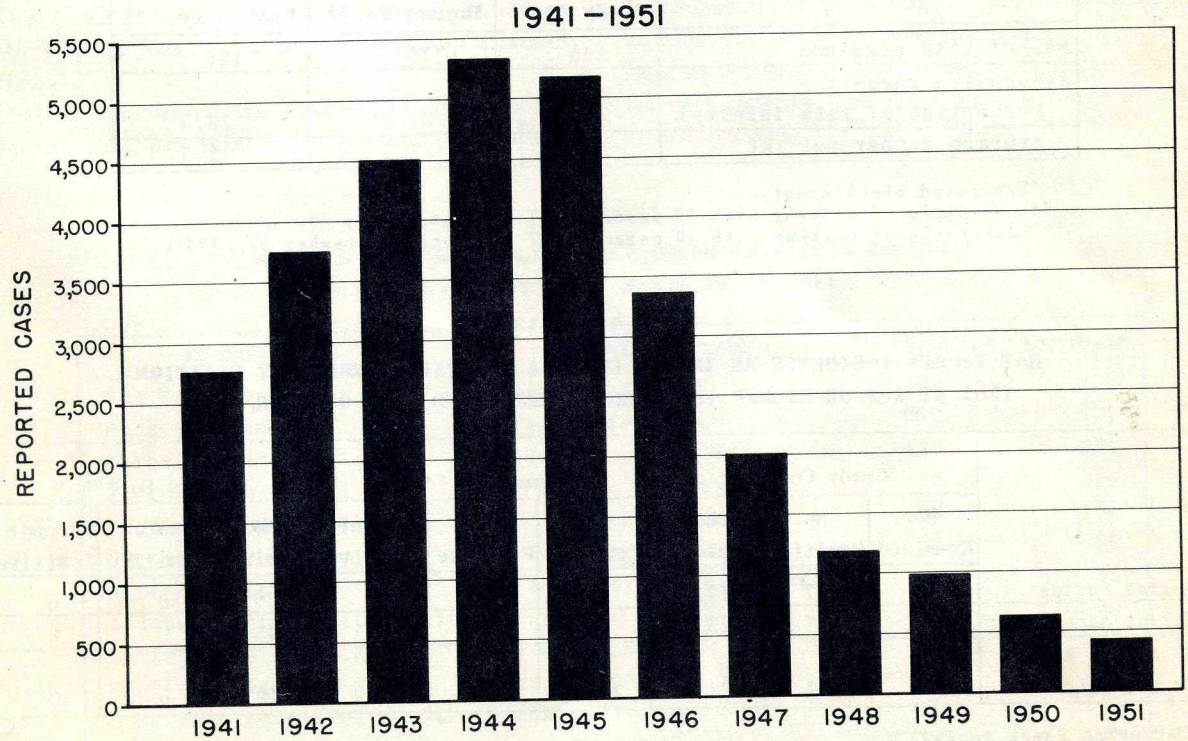
*Provisional data through June 28, 1952.

**Clinically consistent, laboratory confirmed.

***Clinically consistent typhus, not confirmed by complement-fixation test.

Figure 10

ANNUAL TOTALS OF REPORTED MURINE TYPHUS FEVER CASES IN THE UNITED STATES 1941-1951



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and to ascertain the remaining amount of infestation.

(4) Re-treatment and re-evaluation of those premises found to be rat-infested after the initial control cycle.

Early in the fiscal year, a rat and rat ectoparasite study project was inaugurated with the overall objective of probing more exhaustively the ecology of rats and rat-borne diseases, particularly murine typhus. As presently planned, the study encompasses six interrelated topics: (1) constant surveillance for human cases of endemic typhus in the tri-county (Brooks, Grady, and Thomas) study area in southwest Georgia; (2) ecologic studies of both rats and murine typhus in rural areas; (3) continued evaluation of the results of the 1946-1947 typhus control program in Brooks and Thomas Counties (tables 12 and 13); (4) rat ectoparasite studies, including the evaluation of complement fixation tests for endemic typhus antibodies; (5) an attempt to determine through rickettsial isolation studies the importance of the various ectoparasites in the study area as carriers of typhus; and (6) studies to determine if it is possible that a permanent arthropod typhus reservoir may exist in fleas without the necessity of fleas acquiring infectious blood meals from infected rats.

In addition to assisting in the operation of programs specifically designed to control typhus, the CDC cooperates with State and local health departments in general rodent control activities, particularly rat surveys, demonstrations on how to conduct surveys, and rat reduction operations. During the past year, activities of this category were carried on in the District of Columbia and 19 States, namely, California, Colorado, Idaho, Illinois, Indiana, Kentucky, Maine, Maryland, Minnesota, New Jersey, New Mexico, Ohio, Oklahoma, Oregon, Rhode Island, Utah, Virginia, Washington, and West Virginia. The major contribution of the CDC was the assignment of rodent control specialists to assist in educational activities, help train

Table 12

ECTOPARASITE ABUNDANCE OF ALL RATS FOR AUGUST, SEPTEMBER, AND OCTOBER, 1951

	Grady Co.*	Thomas Co.**	Brooks Co.***
No. of rats examined	145	119	128
Xenopsylla cheopis: Percentage of rats infested	55.2	25.2	29.7
Average number per rat	4.8	1.0	1.7

*Untreated check county.
**Last cycle of dusting with 10 percent DDT completed July 30, 1947.
***Last cycle of dusting with 10 percent DDT completed September 30, 1947.

Table 13

RAT TYPHUS INCIDENCE AS INDICATED BY A POSITIVE COMPLEMENT FIXATION TEST AT 1:4 OR HIGHER FOR AUGUST, SEPTEMBER, AND OCTOBER, 1951

	Grady Co.*			Thomas Co.**			Brooks Co.***		
	No. Examined	No. Positive	Percent Positive	No. Examined	No. Positive	Percent Positive	No. Examined	No. Positive	Percent Positive
Rattus rattus	40	7	17.5	22	0	0	76	0	0
Rattus norvegicus	105	27	25.7	90	1	1.1	43	0	0
R. rattus and *R. norvegicus*	145	34	23.5	112	1	0.9	119	0	0

*Untreated check county.
**Last cycle of dusting with 10 percent DDT completed July 30, 1947.
***Last cycle of dusting with 10 percent DDT completed September 30, 1947.

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local and State rodent control personnel, and to provide guidance in carrying out rodent surveys. This is in conformance with the concept that, basically, rodent control is the responsibility of State and local authorities and the role of CDC is one of providing technologic information and temporary reinforcement in the form of trained personnel.

PLAGUE

There were no cases of human plague reported in the United States during 1952. The disease is endemic in wild rodents in 15 Western States, however, and the occasional occurrence of epizootics in domestic rodents impels public health workers to remain on the alert.

In New Mexico, where several sporadic cases of human plague occurred in 1949-1950 and the incidence of the disease in wild rodents during the past few years has been rather high, a marked decrease in rodent population has been noted, but no specimens positive for plague were recovered from rodents or their ectoparasites.

Laboratory examinations for the presence of plague, tularemia, and Rocky Mountain spotted fever were made of 133,000 ectoparasites from 29,000 rodents and 2,700 drags (on ground or inside of burrows). The San Francisco, Calif., Laboratory made the examinations.

The CDC is supporting field investigations at Santa Fe, N. Mex., and in the Hamakua District of Hawaii.

Studies concerning the ecology of rodent-borne diseases that are infectious to man, particularly of sylvatic plague, are being stressed at Santa Fe. A portion of the municipal airport has been selected for intensive study of the mammal range. Permanent trap sites have been established. Trapped mammals are examined in the laboratory, and a record is entered of weight, sex, and other characteristics. Ectoparasites are removed and identified. Each mammal captured is given a mark by which it can be recognized on subsequent captures. Some information on mammals captured is shown in table 14 and the seasonal abundance of the more common species of fleas is recorded in table 15.

The objectives of the study in Hawaii are: (1) to develop a method of wild rodent flea control and its application to rural situations in the Hamakua District; (2) to determine the feasibility of extensive wild rodent ectoparasite control in rural areas; (3) to determine whether wild rodent control and wild rodent ectoparasite control may be successfully combined in a single operation under field conditions; and (4) to evaluate ectoparasite control both in terms of reduction of fleas, mites, and lice on wild rodents, and upon the incidence of plague in wild rodents.

Table 14

MAMMALS CAPTURED JULY 1951 THROUGH JUNE 1952 AT THE AIRPORT STUDY AREA, SANTA FE, N. MEX.

COMMON NAME	SCIENTIFIC NAME	INDIVIDUALS	CAPTURES
Ord Kangaroo rat	*Dipodomys ordii*	416	2,132
Pocket mouse	*Perognathus flavus*	300	721
Large Kangaroo rat	*Dipodomys spectabilis*	128	853
Field white-footed mouse	*Peromyscus maniculatus*	75	350
Spotted ground squirrel	*Citellus spilosoma*	58	154
Grasshopper mouse	*Onychomys leucogaster*	39	92
Harvest mouse	*Reithrodontomys megalotis*	32	45
Audubon cotton-tail rabbit	*Sylvilagus audubonii*	30	60
White-throated pack rat	*Neotoma albigula*	41	231
Small-footed pack rat	*Neotoma micropus*	29	180
True's white-footed mouse	*Peromyscus truei*	20	142
Total		1,168	4,960

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Table 15

PERCENTAGE OF MAMMALS INFESTED WITH THE MORE COMMON SPECIES OF FLEAS
AIRPORT STUDY AREA, SANTA FE, NEW MEXICO

Mammals and Associated Fleas	1951			1952					
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
Citellus spilosoma									
Thrassis pansus	54	-	-	-	-	-	71	59	38
Dipodomys ordii									
Meringis nidi	1	17	18	23	22	19	17	5	0
Meringis parkeri	20	12	5	4	5	9	14	10	3
Dipodomys spectabilis									
Meringis nidi	0	46	88	91	90	79	83	24	0
Meringis sp.	94	77	54	29	40	80	96	96	98
Neotoma albigula									
Orchopeas sexdentatus	38	9*	-	0*	33*	24*	53	73	60
Neotoma micropus									
Orchopeas sexdentatus	-	-	-	46*	52*	63*	72	85	93
Onychomys leucogaster									
Monopsyllus exilis	44*	-	-	-	-	-	31*	0*	54
Perognathus flavus									
Meringis jamesoni	27	19	17	7	11	6	18	2	7
Peromyscus maniculatus									
Monopsyllus wagneri	45	7*	18*	5	4	8	14	26	31
Orchopeas leucopus	17	7*	33*	32	32	34	36	34	35
Peromyscus truei									
Monopsyllus wagneri	38*	0*	-	5*	20*	17*	20	28*	40*
Orchopeas leucopus	54*	25*	-	15*	20*	39*	60	61*	40*
Sylvilagus audubonii									
Cediopsylla inaequalis	-	-	-	-	-	-	83*	30*	69*
Hoplopsyllus affinis	-	-	-	-	-	-	58*	40*	81*

*Percentage based on collection from 10 to 20 examinations of this species of mammal. All other percentages based on more than 20 examinations.

The work program, not all of which was completed during 1952, included: (1) field investigations to determine the residual effect of DDT powder on wild rodent ectoparasites; and (2) studies on the ectoparasite fauna of rat burrows and nests.

POLIOMYELITIS (FLY CONTROL)

The composite study of poliomyelitis and the possible role of flies in its transmission, which was initiated in five representative cities in 1948 and curtailed to two in 1951, was continued in Charleston, W. Va., and Phoenix, Ariz. As in previous years, the operational phase of the program encompassed the accomplishment of fly control through a combination of sanitation and use of chemicals. The epidemiologic phase included: (1) repetitive morbidity surveys in selected areas of project cities; (2) clinical and epidemiologic investigations of each reported and suspected case of poliomyelitis; (3) follow-up study by medical and nurse epidemiologists with the objective of identifying mild and inapparent forms of poliomyelitis infections, and attempting to differentiate them from other types of diseases; and (4) determination of the importance of environmental factors, including flies, familial contacts, and reservoirs of virus.

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Operational Phase

In Phoenix, surveys revealed that a 50-percent reduction had been effected in the prevalence of animal shelters within the city from 1949 to 1952. Packinghouse wastes and lawn trimmings, major sources of fly production, were eliminated by the regulated disposal of vegetable wastes and the initiations of a special collection to handle lawn trimmings during the spring season. These and other improved sanitational practices, supplemented with insecticides, provided a high degree of fly control in Phoenix (fig. 11). The resistance problem, which is of rising importance in most fly control operations, was encountered at Phoenix, and limited field tests were made in quest of insecticides effective against resistant strains. Principal findings were: (1) paradichlorobenzene at the rate of 2 ounces of crystal per garbage can killed existing fly larvae and prevented reinfestation for approximately 7 days; (2) space sprays of activated pyrethrum yielded superior results to those obtained with DDT-DMC (7.5 – 1 ratio) at a lower per unit cost; and (3) water-wettable dilan at dosages of 100 mg./sq. ft. provided 4 to 6 weeks effective fly control in small animal shelters.

In Charleston, as in Phoenix, a combination of improved sanitation and judicious use of chemicals provided satisfactory fly control. The extension of garbage collection service to areas not previously served proved helpful, and was made possible without extra cost following a survey of local garbage handling practices. At Charleston, for the second consecutive year, grill counts remained below two within the treated area (fig. 12). During the latter part of the 1951 fly season, the onset of resistance in the house fly population was noted. Tests indicated that resistance was pronounced in those blocks which had received repeated applications of dieldrin during the 1950 and 1951 seasons.

Fly specimens and sewage samples for virologic analysis were collected in both Charleston and Phoenix (table 16). Collection of cockroaches for the same purpose was instituted in August 1951. Results to date include two isolations of poliomyelitis virus from roaches in the Phoenix area, one from the tropical roach, *Supella supellectilium*, and one from the American roach, *periplaneta americana*.

Analysis of fly trap collections in Charleston during 1951 revealed that the four major species in that area that season were: *Phaenicia caeruleiviridis*, *Phaenicia pallescens*, *Phaenicia sericata*, and *Phormia regina*. At Phoenix, *Musca domestica*, *Phaenicia sericata*, *Phormia regina*, and *Callitroga macellaria* constituted prevalent species, with *M. domestica* predominating.

Biologic studies on the prevalent domestic flies were conducted in both cities. Larval surveys showed garbage stored in containers to be the major positive breeding source. Nearly 50 percent of the infested samples collected were derived from this substrate (tables 17 and 18).

A series of studies on the dispersion habits of common domestic flies was initiated in 1951. Such information is essential in the measurement of the influence of fly movement as it relates to fly-borne disease transmission, and in designing effective fly control programs. Flies were collected at problem sites, marked with radioisotopes and dyes, liberated at point of capture, and recaptured with traps placed at varying distances from the release point in accordance with an orderly pattern. Results of the study in the Phoenix area are summarized in figure 13. One point this study emphasizes is that there is substance in the frequently

Table 16

VIROLOGIC FLY AND SEWAGE COLLECTIONS
POLIOMYELITIS INVESTIGATIONS-FLY CONTROL PROJECTS
JANUARY-DECEMBER 1951

Quarter	Charleston, W. Va.		Phoenix, Ariz.		Total Collections	
	Fly	Sewage	Fly	Sewage	Fly	Sewage
1. January-March	0	210	140	72	140	282
2. April-June	282	426	299	224	581	650
3. July-September	408	448	338	324	746	772
4. October-December	340	288	204	288	544	576
Yearly Total	1,030	1,372	981	908	2,011	2,280

Courtesy of the David J. Sencer CDC Museum

Figure 11

Fly Grill Densities In The Treated City Of Phoenix, Arizona, As Compared With Those In The Untreated Cities Of Mesa And Tempe. Based On A 3-Week Moving Average.

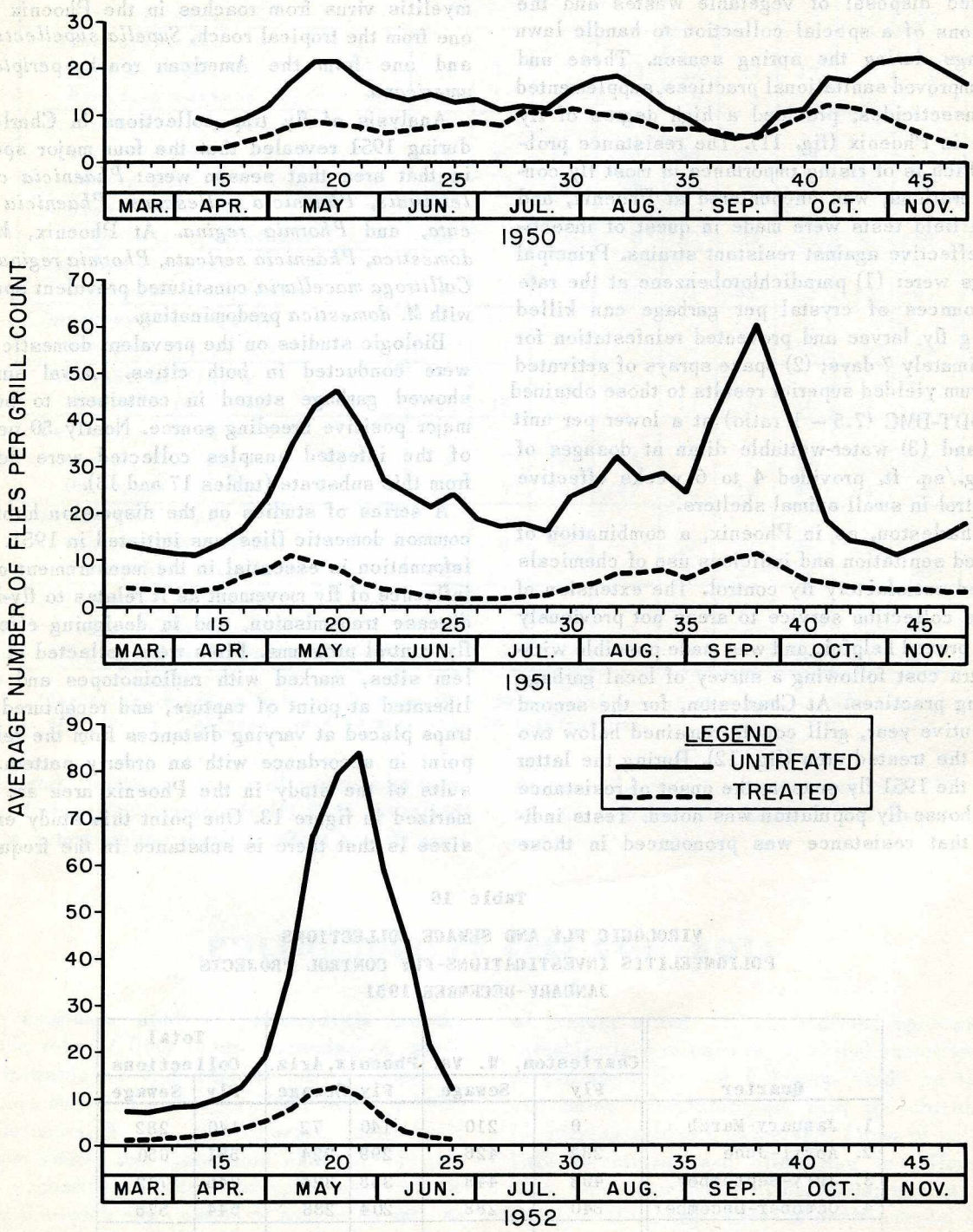

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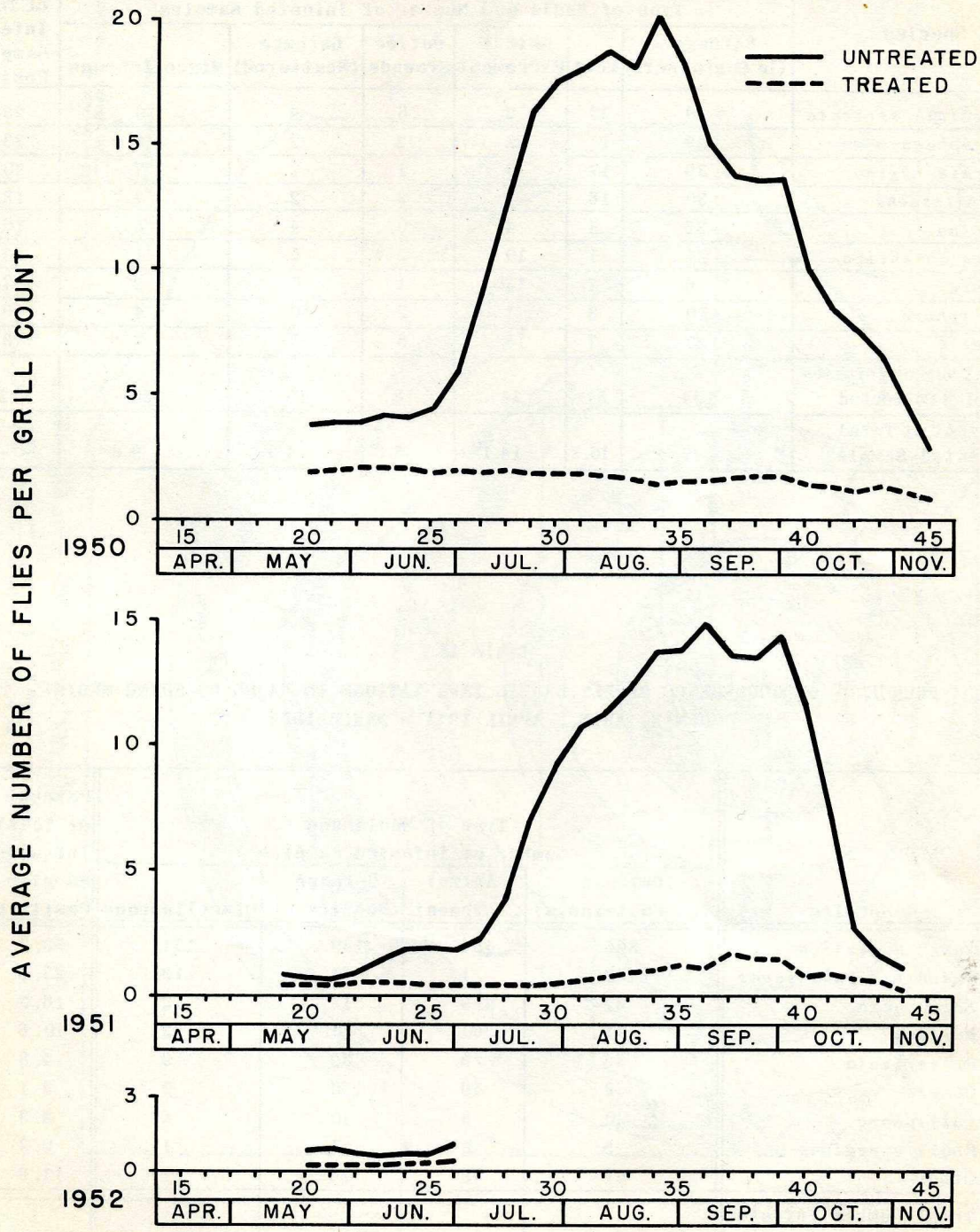
Figure 12

Fly Grill Densities In The Treated City Of Charleston, W. Va., As Compared With Those In The Untreated Cities Of Dunbar And St. Albans. Based On A 3-Week Moving Average.



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ATLANTA, GA. APR., 1953

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Table 17

FREQUENCY OF OCCURRENCE OF FLY LARVAL INFESTATIONS IN MAJOR BREEDING MEDIA
CHARLESTON, WEST VIRGINIA, JUNE - NOVEMBER, 1951

Species	Type of Media and Number of Infested Samples						Percent of Total Infested Samples Positive
	Garbage (in Containers)	Meat	Animal Excrement	Coffee Grounds	Garbage (Scattered)	Miscellaneous	
Phaenicia sericata	49	18	2	6	4	9	28.2
Sarcophaga	29	11	22	2	2	6	23.1
Phormia regina	36	17	0	1	2	7	20.2
P. pallescens	30	18	1	2	2	4	18.3
Muscina	35	3	4	0	4	5	16.3
Musca domestica	24	1	10	2	5	1	13.8
Ophyra	6	2	13	1	0	2	7.7
Calliphora	10	3	1	2	0	4	6.4
Other	20	7	13	5	7	7	18.9
Total Number Infested Samples Collected	154	51	44	18	15	30	312
Percent of Total Infested Samples	49.4	16.3	14.1	5.8	4.8	9.6	-

Table 18

FREQUENCY OF OCCURRENCE OF FLY LARVAL INFESTATIONS IN MAJOR BREEDING MEDIA.
PHOENIX, ARIZ., APRIL 1951 - MARCH 1952

Species	Type of Media and Number of Infested Samples				Percent of Total Infested Samples Positive
	Garbage (in Containers)	Animal Excrement	Garbage (Scattered)	Miscellaneous	
Musca domestica	365	454	149	171	53.7
Phaenicia pallescens	462	1	64	13	25.5
Sarcophaga	62	259	13	12	16.3
Muscina	91	60	41	33	10.6
P. sericata	56	5	32	9	4.8
Ophyra	3	59	0	3	3.1
Calliphora	30	3	10	6	2.3
Phormia regina	5	0	1	1	0.3
Other	61	79	26	81	11.6
Total Number Infested Samples Collected	813	776	264	268	2,121
Percent of Total Infested Samples	38.3	36.6	12.4	12.6	-

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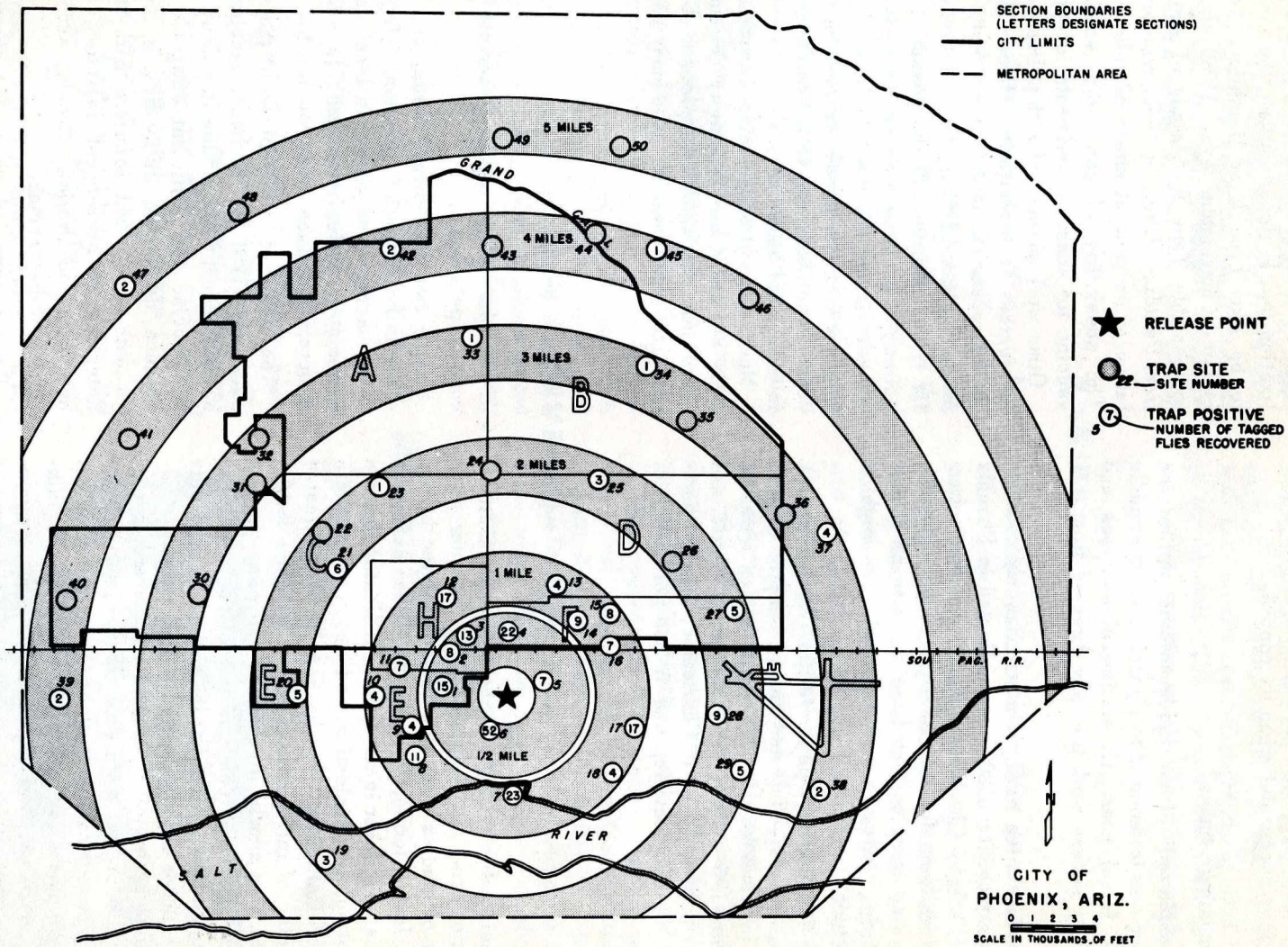
Figure 13

HOUSE FLY DISPERSION STUDIES

PHOENIX, ARIZONA — SEPTEMBER 1951



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made observation that fringe area fly-breeding sources contribute materially to the city fly population, and that such breeding must be controlled to achieve successful urban fly control.

Epidemiologic Phase

Headquarters of the epidemiologic part of the program was transferred to Phoenix near the middle of the fiscal year. All statistical analyses and morbidity survey work are now directed from this point.

Blood samples were collected in study areas of each project city; 1,200 were collected in Phoenix and 1,300 in Charleston. Stool specimens from young children for the isolation of poliomyelitis virus also were collected, at the rate of 50 per month in Phoenix and some 65 per month in Charleston.

The incidence of poliomyelitis reached a peak in August 1951. Reported cases, subject to revision by findings of follow-up studies, were: in Phoenix, 195 – 49 paralytic, 108 nonparalytic, and 38 not poliomyelitis; in Charleston, 44 – 24 paralytic, 15 nonparalytic, and 5 not poliomyelitis.

In laboratories of the CDC, poliomyelitis viruses were isolated from stools collected during the epidemic in Platt County, Wyo., in 1951. By neutralization test in tissue culture, the virus was found to be like Type I, or Brunhilde. Another strain isolated (Torrington, Wyo., 1950) also was found to resemble Type I. A study of serum collected from Paulding, Ohio, in 1950, resulted in the isolation of an unusual strain of poliomyelitis virus. The possibility of using this strain for killed vaccine for animal experiments is being explored.

Other work associated with poliomyelitis studies in progress in laboratories of the CDC concerns: (1) improvements in the tissue culture technique for propagation of virus, for isolation of virus, and for typing viruses; (2) the possibility of growing poliomyelitis viruses in mouse tissue instead of monkey tissue; (3) the inhibitory effect of poliomyelitis virus on mouse sarcoma; and (4) the presence of poliomyelitis virus neutralizing substance in animal and human serum.

Much information is being accumulated, and as it is evaluated and laboratory determinations are fitted into the composite picture, it is believed new light will be thrown upon many unclear points.

Q FEVER

Considerable evidence concerning this rickettsial infection was accumulated during the year as a result of studies supported in some degree by the CDC. In California, for example, rather extensive studies on Q fever in sheep have indicated that the richest source of infection, at least in the northern part of California, may be heavily contaminated placentae of infected animals. It has been demonstrated that newly discharged placentae contain an extremely high concentration of the rickettsia, and it has been shown that the rickettsia are widely distributed in the air shortly after parturition.

A long series of experiments conducted in connection with the resistance of the causal agent of Q fever, *Coxiella burnetti*, to heat indicated that the agent is resistant to temperatures ordinarily used in pasteurization. However, temperatures only slightly higher, around 145° F., appeared to provide a wide margin of effectiveness in the control of *C. burnetii* in market milk.

The California program also includes a definitive vaccine study, the ultimate goal of which is to determine if the use of a vaccine will yield control of Q fever in its natural reservoir in the dairy cattle population.

Using two State-owned herds, one infected and one relatively free of infection, a laboratory evaluated vaccine was tested in local dairy animals. Some 500 cattle, adult milking and dry cows, heifers, and calves were inoculated.

The objective of this phase of the study was to ascertain: (1) if the candidate vaccine constituted a safe product for injection into dairy cattle; (2) if the vaccine had sufficient antigenic qualities to produce detectable antibodies in the cattle in amounts that might interfere with the serologic detection of subsequent infection; and (3) the optimum concentration, dosage, and route of injection of the vaccine.

Results recorded show: (1) abortions did not follow vaccination, even in dry cows very near term; (2) systemic reactions following vaccination were not evident, even when the more concentrated suspensions were used; and (3) local tissue reactions were observed following the injection of

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the more concentrated suspension into adult animals, albeit these reactions were not serious; no tissue breakdown occurred and they disappeared within 3 to 14 days. Serum antibody titers were produced in practically every animal, young and old, receiving the vaccine. A control group exhibited no serum antibody over the test period. Vaccination of animals showing previous infection titers failed to give rise to any increased antibody levels. The vaccine did not alter the *Brucella* titers of any of the cows, nor did it appear to interfere with a tuberculin test subsequently applied to 150 of the animals. The subcutaneous route gave as good or better titers as did other routes tried.

RABIES

A long-term study of the relative efficacy of four types of rabies vaccine, initiated in 1950, is nearing completion. Four groups of dogs, each including about 64 animals, were immunized with one of the following vaccines: (1) commercially prepared Semple vaccine; (2) ultraviolet inactivated vaccine; (3) benzene extracted calcium acetate precipitated and washed vaccine, as prepared by Dr. Karl Habel; and (4) avianized living virus vaccine. A fifth group of animals served as a control.

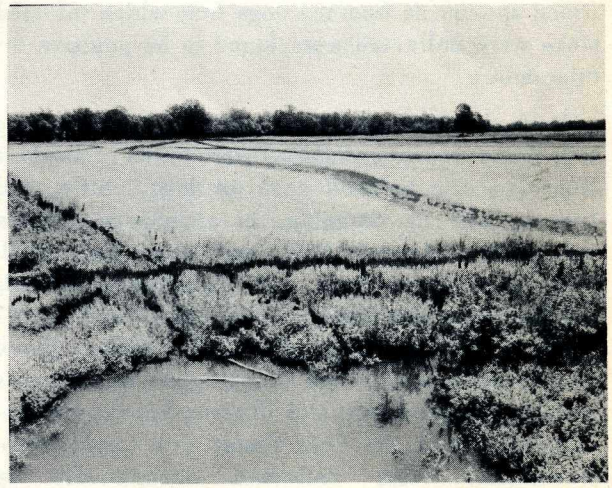
The animals have been under daily observation since date of immunization, and blood specimens for neutralization tests have been collected at 6-month intervals. At the end of 2 years, half of the dogs in each test group were challenged with a virulent street rabies virus. Five months after the challenge, none of the vaccinated dogs had developed rabies while 55 percent of unvaccinated dogs challenged at the same time had succumbed. These data indicate that all of the vaccines are efficacious in preventing rabies for at least 2 years following the immunization process.

Other activities pertaining to rabies carried on during the year included studies of the role of the mongoose in rabies transmission in Puerto Rico, and of methods of mongoose control. Earlier investigations demonstrated that the mongoose played an important role in spread of rabies in that area, and that it was practicable to control the disease by controlling the mongoose population. Field and laboratory tests carried on during 1952 produced considerable information pertaining to the ecology of the mongoose. In field studies, thallium sulfate was found to be an effective poison in reduction operations, and sun-dried fresh fish was labeled the preferred bait. Using this combination in Puerto Rico, satisfactory mongoose control was obtained at a cost of about 16 cents per acre.

RICE FIELD MOSQUITOES

In a number of areas, particularly sections of Mississippi and Arkansas, irrigation practices associated with the growing of rice encourage the production of prodigious numbers of mosquitoes. In some localities, the pest mosquito populations reach the point where the economic existence of the community is threatened, and marked changes in recreational habits are necessary.

Through a field station at Cleveland, Miss., the CDC has joined with the Mississippi State Board of Health in an attempt to find a practical solution to the rice field mosquito problem. Aside from the fact that insecticidal resistance is developing in some areas where pest mosquitoes abound, there are physical factors which make control through the application of chemicals difficult. Ground equipment cannot negotiate flooded rice fields, and the rice plant itself lessens the effectiveness of



Irrigation of rice fields by sections should be designed to facilitate the proper disposal of excess water.

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dusts and sprays applied from the air. Insecticides suspended in irrigation water are prone to settle to the bottom before the slowly moving water spreads to all sections of the field. Moreover, in many instances, the process of flooding consumes a number of days, since flooding is by sections. This sometimes operates so that mosquitoes are produced in successive waves as the flooding proceeds from one section to another.

In field studies it has been found that mosquito breeding in small landlocked ponds may be prevented for as long as 12 months by applying dieldrin at the rate of 1 lb./acre. However, dieldrin at this rate is destructive of nearly all aquatic life. Technical benzene hexachloride, on the other hand, applied at the rate of 1 lb./acre was not destructive of aquatic life, but neither was it as effective against mosquitoes for as long as dieldrin; several applications a season are required to give effective mosquito control.

Although preliminary studies at the Cleveland Field Station produced no ready-made answer to the rice field mosquito problem, work is continuing and some promising leads have been developed.

SARCOIDOSIS

During World War II, some 350 cases of this disease were recognized among American servicemen. Preliminary analysis of epidemiologic data accumulated from these 350 cases indicated a remarkable geographic localization to the southeastern United States. Other studies suggested that cases may be geographically associated with areas where the predominant soils are of related types. A member of the Epidemic Intelligence Service devoted a considerable share of his energy to confirming and extending this hypothecated relationship.

TICK-BORNE DISEASES

In cooperative investigations of tick-tularemia in Arkansas, four lots of infected lone-star ticks (*Amblyomma americanum*) were taken, one from dogs and three directly from shrubbery by dragging. Blood specimens from the dogs from which infected ticks were collected were found to be positive for tularemia.

Both the lone-star tick and the American dog tick (*Dermacentor variabilis*) were taken in numbers from domestic animals such as dogs, cattle, and horses, and by dragging. In abundance studies during June-August 1951 and April-June 1952, collections from drags and domestic animals totaled: lone-star ticks, 11,209 adults and 22,417 nymphs; American dog ticks, 8,238 adults. Three additional species – the blacklegged tick (*Ixodes scapularis*), the rabbit tick (*Haemaphysalis leporispalustris*), and the Gulf Coast tick (*Amblyomma maculatum*) – were collected occasionally by special methods.

The American dog tick is relatively common in the northern and central sections of the State and also in a north-south tier of counties, consisting in part of high lands in the eastern part of the State. The lone-star tick appears to be more common in the northwestern sections of the State; none were found in the high lands in the eastern section where many dog ticks were taken.

In Arkansas, where 456 human cases associated with tick bite were recorded during 1947-1950, the distribution of tularemia in humans is closely correlated to the abundance of lone-star ticks.

In addition to supporting the Arkansas investigations, during 1952 the Plague Laboratory in San Francisco, Calif., made tests for the presence of tularemia and/or Rocky Mountain spotted fever on specimens received from CDC-supported surveys in Virginia and Georgia. Final results are not yet available in many of these cases.

Rocky Mountain spotted fever, contrary to implications of the name, occurs more frequently in the South Atlantic States than in the Rocky Mountain area.

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TRACHOMA

A number of years ago, this infection was widespread through the Appalachian region and more recently has been a problem among American Indians. Although now less common, the disease still occurs in areas of Kentucky, Missouri, and Tennessee. A study has been started at Rolla, Mo., to gather thorough epidemiologic data, which it is anticipated will provide a basis for more extensive studies of etiology and for the application of methods of control.

LOOKING AHEAD

The Communicable Disease Center is responsible for assisting States in the control, prevention, and diagnosis of communicable diseases. The foregoing summary of accomplishments and undertakings pursued during fiscal year 1952 indicates how the CDC has responded to this challenge and with what success.

The average length of life in this country has increased 3 years since 1941, 8 years since 1930, and 21 years since 1900. The number of reported cases of notifiable diseases has decreased materially during the past few years, and the burden of accumulated information is that the Nation's health is better than at any time in history.

Despite these strides, which the CDC has helped to bring about, the battle against communicable diseases is far from won. Thousands suffer today from preventable diseases, and more thousands do not receive the health protection which society is equipped by present-day knowledge to provide.

Thus, the work of the Communicable Disease Center is unfinished, its mission unfulfilled, and its claim to support undiminished.

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