Public Health Reports

Vol. 66 • JULY 20, 1951 • *No. 29*

Public Health Problems in Alaska

The diverse and often unique natural features of the Territory of Alaska, and the importance of its invaluable natural resources in view of increasing world problems, created the need for evaluating the current status of Alaskan research. As a result, the first comprehensive Alaskan Science Conference was held in Washington, D. C., November 9 to 11, 1950, under the auspices of the National Academy of Science-National Research Council.

The objectives of the conference, as stated in the published proceedings, were "to stimulate wider interest in research relating to the Alaskan area and to explore ways and means by which those who are engaged in field research in Alaska can be of greater assistance to each other and by which the results of their investigations may become more widely known and available to those who are planning future research in Alaska."

The conference suggested means of achieving these objectives: (1) To review the status of scientific research in Alaska; (2) to appraise the major requirements for future research; and (3) to explore ways and means of developing new facilities and coordinating the existing ones.

As a permanent organization in Alaska, with a resident staff devoting full time to basic research on health and related biological problems, the Arctic Health Research Center sought to provide current information for scientists who had conducted earlier investigations in Alaska on an expeditionary basis. Staff members of the Center hoped, as well, to provide orientation for those individuals contemplating future research in Alaska.

The presentation of formal papers by members of the Alaska Health Research Center staff in the conference sections of Public Health and Medicine, Physiology, Health Problems of Alaskan Eskimos, Aleuts, and Indians, and Research Facilities in Alaska, constituted the Center's major tangible contribution to the conference. Abstracts of the papers have appeared in the Proceedings of the Alaskan Science Conference, Bulletin of the National Research Council, No. 122, April 1951. The complete papers are presented in this issue of PUBLIC HEALTH REPORTS.

Problems of Alaskan Eskimos, Indians, Aleuts

By Jack C. Haldeman, M.D., ***Medical Officer in Charge***

In this brief review of public health problems in Alaska, I will necessarily have to confine my remarks to some of the more important problems which confront us. Perhaps the greatest value of the Alaskan Science Conference lies in pointing out some of the many gaps in our scientific knowledge with the hope that ways will be suggested in which the various scientific groups may cooperate. Acquisition of needed information requires the concentrated and coordinated efforts of scientists skilled in many fields. I regret that time does not permit specific reference to the many contributions to public health in low temperature areas which have been and are being made by these investigators.

Any attempt to analyze public health problems in Alaska is handicapped from the start by the lack of reliable vital records. Despite their limitations, however, such data as are available may be utilized as indications of general trends.

The evidence from existing records, even allowing for a margin of error, points to causes of death, and therefore to conditions of life in low temperature areas, which show quite different patterns than are found in temperate climates. One may expect to find in low temperature areas almost all the diseases found elsewhere, except those peculiar to the Tropics. However, the incidence, the methods of transmission, the epidemiological patterns, as well as the clinical picture of disease in low temperature areas all show distinctly different characteristics.

According to available data, diseases spread through the respiratory tract are among the major health problems of the Eskimo, Aleut, and Indian. These diseases account for approximately 50 percent of all deaths among this population group.

Tuberculosis is the major killer in Alaska. In 1946, it was reported as the cause of death on 43 percent of all death certificates for Indians, Eskimos, and Aleuts in Alaska, more than 10 times as often as in the United States as a whole. Of the approximately 130,000 people in Alaska, more than 5,600 are listed in the tuberculosis register of the Department of Health as actual or suspected cases of tuberculosis. In addition, there are more cases of bone tuberculosis under one roof in the Orthopedic Hospital near Sitka, Alaska, than in any other spot on the North American Continent.

Communicable Disease Epidemics Severe

The dramatic and terrifying nature of epidemics of common communicable diseases has been noted by many observers in their historical accounts of early explorations. In 1938, I observed a whooping cough outbreak in the lower Kuskokwim delta area which affected literally every man, woman, and child in many villages. A measles epidemic along the Yukon River impressed me with its severity and the high proportion of adults affected. Within the last month a whooping cough outbreak at Wainwright, an Eskimo village of approximately 150 inhabitants, resulted in nine deaths. As this paper was being prepared, epidemics of poliomyelitis, meningococcus meningitis, typhoid fever, and whooping cough were present in the Territory.

It is somewhat paradoxical that the low temperature areas of the world, although they contain the fewest people per square mile, are plagued with those major health problems usually associated with overcrowded living conditions. Even in the spacious North it is not uncommon for an Eskimo family of 12 to be living in a single 9- by 9-foot hut in order to conserve heat. The attack rate of diseases spread directly from person to person is understandably high under such conditions, whether the population sample is taken from the slums of a Stateside metropolis or from an Eskimo village.

Diseases spread chiefly through discharges of the intestinal tract, although less frequently reported as the immediate cause of death, represent a major cause of morbidity in Alaska.

Outbreaks of gastroenteric diseases are frequent, particularly in the spring when the melting ice and snow expose and redistribute the well-preserved refuse of the long winter months. A diverse group of pathogenic organisms has been isolated during these outbreaks, but relatively little is known regarding the effects of low temperatures on the epidemiology of these diseases or on the morphological, biochemical, and pathogenic characteristics of the individual causal agents.

It would appear that the incidence of syphilis is lower in Alaska than was previously thought. However, morbidity reports of the Alaska Department of Health indicate that once syphilis is introduced into a village, it frequently assumes epidemic proportions.

Other papers will review the public health importance of broad fish tapeworm infection, hydatid disease, trichinosis, and phlyctenular keratoconjunctivitis. Additional public health problems are presented by the existence in the Territory of tularemia, botulism, brucellosis, and rabies.

The unusual epidemiological pattern of communicable diseases in Alaska, coupled with the relatively simple and stable background of the Eskimo people, offers the investigator interested in the natural history of disease an unusual opportunity for study and original research.

Two other major health problems in Alaska, aside from the communicable diseases, are accidents and nutritional deficiencies.

Accidents Take High Toll

A preliminary analysis of records of violent and accidental deaths in Alaska indicates some fruitful areas for study by anthropologists, sociologists, and public health workers. Accidents, alcoholism, suicides, and homicides, as a group, accounted for 32 percent of the deaths among the white population and 13 percent among the nonwhite population during the 5-year period ending in December 1949. By comparison, in 1948, only 9 percent of all deaths in the United States as a whole were attributed to these causes.

Aircraft accidents were the major cause of accidental death in Alaska; accidental drownings ranked second, and fires and burns third. Excessive cold, which might be expected to rank high as a cause of fatalities, is of minor importance among both white and nonwhite residents.

Alcoholism was reported as the immediate cause of death among the white population 20 times as often in Alaska as in the States, and 8 times as often among the nonwhite group.

There is much food for thought, and a challenge for some investigator, in the fact that deaths by suicide occurred three times as often among white residents in Alaska as in the States; yet among other races the suicide rate appeared to be lower than in the States. On the other hand, it may surprise some of you to learn that in Alaska, where practically everyone uses and has ready access to firearms, the homicide rate was only twice that of the States.

Nutritional Status Unknown

Turning for a moment to nutrition, we find that dietary habits differ greatly in various areas of Alaska.

From the point of view of diet, there may be said to be three different population groups in the Territory: (1) The group composed largely of Indians, Aleuts, and Eskimos, who, by reason of custom or isolation and necessity, still eat primarily native foods; (2) a larger group who supplement native foods with considerable amounts of food imported from the States; and (3) the remainder of the Alaskan population, including some Indians, Aleuts, and Eskimos, who depend almost entirely on imported foods for their nutritional requirements.

The true nutritional status of the first group is essentially an unknown quantity, since little information is available on the composition of the foods which its members customarily eat. One can only speculate, therefore, on the possible relation of this particular diet to such factors as: (1) Any increase or decrease in the size of the Indian and Eskimo populations; (2) the physical stature and development of the individuals included in this group; and (3) the incidence of disease such as tuberculosis, heart disease, eye conditions, anemia, and dental caries among its members.

A considerable proportion of Indians and Eskimos belong to the second group, a large part of their diet being composed of imported foods. Because of low incomes and the relatively high cost of imported foods, their diets contain a high proportion of foods which represent a cheap source of calories, such as refined cereals and sugars. The nutritional picture of this group, insofar as it is known, is not an encouraging one. The actual nutritional status of its members has not been sufficiently well determined, however, to indicate in what specific ways it can be improved.

Basic Issues Untouched

The question of major causes of nonfatal illness in Alaska can only be answered after further study. At present, we cannot give a factual answer even to the frequent query, "Are colds more common in low-temperature areas than in temperate climates?" There is a definite need for a relatively large-scale morbidity survey in Alaska, taking into account the geographic, ethnologic, and economic characteristics of the Territory and covering a cross section of the population large enough to yield reliable results.

Over and above specific problems, such as disease control, accidental deaths, and nutritional needs, there are many basic issues affecting the health of the Eskimos, Indians, and Aleuts upon which we have not touched. The relation of man to his physical environment in low-temperature areas has been the subject of considerable discussion at this conference. Man cannot adopt the physiological techniques of arctic animals which make them relatively independent of temperature. But he can and does create a favorable environment for himself through the provision of suitable clothing, housing, sanitary facilities, and the control of biting insects. Much has been learned and much remains to be learned from the Alaskan Eskimo and Indian regarding practical methods of overcoming adverse environmental influences. They have generally ignored the provision of sanitary facilities and such measures as insect control. Even if insect control were not of public health importance, it would be regarded as essential to civilized living by white residents.

Little scientific information is available concerning basic differences in racial pathology among the white, Indian, Eskimo, and Aleut populations. For example, we have no way of knowing whether the high tuberculosis mortality rate among the latter groups should be attributed simply to a higher degree of racial susceptibility or to a combination of factors, such as exposure to massive doses of tubercle bacilli in crowded living conditions, poor nutrition, recurrent gastroenteric diseases, and parasitism. What diseases existed among the Eskimos and Indians prior to the coming of the white man? It would seem that here are but a few of the areas where the public health worker and the anthropologist could cooperate in worth-while research.

The administrative development of public health practices in temperate climates has resulted in a fairly uniform pattern based upon the concept of local health services provided by full-time well-trained public health workers. Health services in temperate areas generally utilize techniques in the control of disease best suited for application where there are concentrations of people and emphasize those public health problems of greatest importance in temperate climates. In low temperature areas, however, the public health problems are radically different; social, geographic, and climatic factors make the application of conventional public health techniques difficult and often impractical. The development of new techniques in public health administrative practice more suitable to the area involved is urgently needed.

Unique Research Opportunity

In the course of this discussion, an attempt has been made to indicate broad areas where basic information is lacking, and where research and investigation in the fields of public health and medicine is most urgently needed. However, I would be neglecting my duty if I did not stress the special advantage of Alaskan research as a means of enriching scientific knowledge which should be equally applicable in all climates and to all races. The extreme variations in health problems and environmental factors in low temperature areas permit scientific measurements which bring into sharp relief many basic facts less readily observable in more temperate climates.

Where could the investigator find a better opportunity for conducting long-term studies on the relation of high-fat diet to chronic diseases than among Eskimo groups subsisting principally on Arctic Sea mammals? In what other area can communities be found where dental caries is practically unknown, while adjacent settlements show an extremely high incidence of the disease?

Circumpolar Aspect of Disease

The concept that many animals and plants are commonly distributed throughout polar regions has been recognized in biology for many years. However, the application of the concept of circumpolar distribution to disease and health problems has been slow in evolving. Since the polar area is bounded by the more or less contiguous land masses of three continents—North America, Asia and Europe—it is possible that, through the ages, diseases may have traveled from village to village in Northern Europe, across Asia to Alaska and Canada in much the same fashion as have the circumpolar animals and plants. The barriers which the Atlantic and Pacific oceans have presented to the transmission of disease in temperate areas have not existed in the Arctic.

In all polar areas there are also basic similarities in the relationships of man to his environment. From the standpoint of public health, perhaps the most important of these are: (1) the crowded living conditions; (2) the generally primitive state of sanitary facilities; (3) the intimate relations of arctic people with their own forms of domesticated animals and other animal and insect vectors of disease; and (4) the similarity of social patterns among native inhabitants of the Arctic. For these reasons, it will not be surprising if, as a result of future investigations, the medical and public health problems of low temperature areas present a more uniform picture than that seen in temperate and tropical climates.

It has been repeatedly pointed out that low temperature areas are destined to play an increasingly important role in our national economy and defense. It is our job, therefore, to gather the scientific information needed to bring true knowledge of these areas into sharp focus as rapidly as possible. It is only logical that research and investigation should precede, insofar as possible, the forced economic development of low temperature areas in order that there will be a minimum of waste in time, effort, and money and in order that the most effective use will be made of the human and other resources in these areas.

Control of Alaskan Biting Insects

By Charles S. Wilson, *Control Entomologist*

In many parts of Alaska, outdoor insect control is so necessary for civilized living that the small home builder may be as willing to pay 50 to 100 dollars for spray equipment as he is to buy a kitchen sink. It is small children who suffer most. After the long confinement of the winter, they will not stay inside and look at the summer sunshine through a cabin window, and they will not play wearing gloves and head net or smeared with repellent that burns the eyes and lips.

The monetary costs and total time lost because of biting insects in Alaska can only be roughly estimated, but many contractors believe that they are considerable. Umiat affords an extreme example but one fairly typical of conditions on the Arctic Slope. In Umiat

953080—51——2

where wells are being drilled, tractors overhauled, and the other activities of a base camp are being carried on, Blanton counted mosquitoes landing at the rate of 70 per minute on the back of a woolen glove (*1*). Such attack rates are particularly important in northern areas where maximum insect activity occurs during the only periods when many kinds of outdoor work are possible.

Neither Umiat nor any other single place is typical of all Alaska. A map of the Territory placed on a map of the United States of similar scale, extends from the Atlantic to the Pacific coast and from almost the northern to the southern borders. When it is considered that this great, sprawling Territory includes four large mountain ranges and that its precipitation varies in different regions from a few inches to 17 feet annually, it does not seem unreasonable to expect to find nearly as many types of environments as there are in the whole of the United States. Much of this country is undeveloped and presents no immediate demand for insect control, but wide distribution of human activities, from Point Barrow to Ketchikan, presents so many problems in insect control that careful selection must be made among them.

Alaska Insect Project

There was a surprisingly good background of information available when the entomology section of the Arctic Health Research Center was organized in 1949, even though organized and sustained research had not started until 2 years before that time. Part of this information resulted from the Navy work at Umiat (*2*), but most of it came from the investigations of the Alaska insect project (*3*). This cooperative project, supported by the armed services and governmental agencies concerned with development of Alaska, was started in 1947 and has operated each season since then. Under the direction of Dr. Travis, its roster has, at one time or another, included the names of many of the men who are important in work on biting insects. In fact, most of the entomologists of the Arctic Health Research Center received their first Alaskan experience with the insect project.

It is not possible to summarize here all of the information that was available in the spring of 1949. The important insects were then considered to be mosquitoes, black flies, punkies or no-see-'ums, and horseflies. Reconnaissance studies by Dr. Frohne of our staff have since shown that snipe flies should be added to the list as close competitors with the punkies and of more importance than horseflies. The latter are slow biters, chiefly important as pests of livestock and as possible transmitters of tularemia.

There are so many gaps in our knowledge of the black flies, punkies, and snipe flies that it is difficult to make generalizations about their control. In many places the black flies are more hated than mosquitoes. The reactions of many people to their bites are more severe and are sometimes disabling. DDT is very effective in clearing the larvae from the streams, but it has not been used because of the danger to fish and to fish food. The studies of the Alaska mosquito project and of Mr. Sleeper of our staff indicate that a safe but effective dosage level exists. Development of field methods for applications within that narrow margin is to be started next season. The punkies at Valdez were found by Dr. Williams, also of our staff, to breed only in a narrow strip of sedge that is covered daily by high tides. We plan to attack this species by using herbicides on their plant cover, but we doubt that this method will be effective on other and more widely distributed species that probably breed in bogs. The larvae and breeding places of the snipe flies are still unknown, so control measures must be directed against the adults.

Wide Range in Conditions

For convenience, we usually divide Alaska into six regions when discussing the problems of insect control. Two of these, the Aleutian Chain and the high mountains, need little attention. Each of the other four has a fairly distinct set of problems and conditions. Southeastern Alaska is a country of isolated settlements and small but varied environments. It has nearly all of the pest species that occur in the Territory, but their breeding places are usually so restricted that specialized methods of control could be economically used if adequate surveys were available.

The Cook Inlet country, which includes Anchorage, the Matanuska Valley, and part of the Kenai Peninsula, is a sort of middle ground in which the environments are larger and less varied than in southeastern Alaska but much more varied than they are in the interior. Part of this region is fairly well populated, allowing use of control measures that would not be economically feasible in the southeast. Single large-scale mosquito larvicide applications can probably be used to advantage near Anchorage and in the Matanuska Valley when the necessary surveys have been made and the organizations developed for their application.

It is in the great interior valleys that one begins to find what mosquito infestations can be. Black flies and punkies are present in many places, but they are likely to go unnoticed among the mosquitoes. Since mosquitoes breed nearly everywhere, reinvasion of an area cleared by destruction of adults or larvae may be expected from all sides. That they migrate at very high speeds was dramatically shown by Blanton's experience while working with 100-square-mile blocks. Invasion to the center occurred within 3 days of the first heavy emergence in outside areas and within 2 weeks after the adults were killed on the same large block later in the season.

Military Area Control

Area control is being used, however, as a practical routine procedure for the protection of the large military bases. The technique was brought to its present high degree of development by the work of the Alaska insect project (*4*). Each season, a spray team is designated by the Alaska Command and a C–47 is equipped for its exclusive use. Blocks of 25 to 35 square miles, centered on the areas to be protected, are sprayed at intervals of 7 to 10 days, three to seven treatments being required for the season. The rate of application is one-half pint of 20 percent DDT per acre, the swath width is 1,000 feet and the mass mean diameter is given as 136 microns. Obviously, a program such as this can only be used where many people are living in a small area and where the necessary organization has been established. Area spraying has also been tried on the Arctic Slope and rejected as impractical. The pressure of insect population is so great and migration is so rapid in that region that reinvasion is likely to take place within a few hours after spraying.

Factors in Mosquito Control

The significant factors that distinguish Alaskan mosquito control may be summarized as follows:

1. The important mosquitoes may be considered to produce but one brood each year although successive thawing of pools and successive maturation of species may extend the season.
2. The classical method of mosquito control by drainage is ineffective in the interior where the pools are underlaid with ice and impractical in the dense growth of the southeastern coast.
3. Even though there is but one brood per year, the combination of long-flight range and great pressure of insect population makes it impossible, in the interior valleys and on the Arctic Slope, to obtain control by a single treatment of an area of reasonable size.
4. Single treatments, probably by use of larvicides, may be effective in the regions of restricted breeding found in the mountains and near the coast. The greatest obstacle to the use of this type of control is the difficulty of making adequate surveys.

Develop Aerosol Spray Units

With drainage and larviciding practically eliminated from mosquito control practice at this time, the Arctic Health Research Center has concentrated on development of the use of fine airborne sprays for destruction of the adults. The first objective was to find methods for protection of small installations such as camps, lodges, and homesites. An aerosol spray apparatus was developed that consists essentially of a series of more or less stationary aerosol dispensers placed so as to allow the insecticide to drift over the areas to be protected (*5*).

The dispensers are operated by compressed air and are connected by hose lines to a compressor. The nozzles are of the simple "flit-gun" type but contain a special feature that causes them to produce droplets of very nearly the optimum size range, 2 to 40 microns in diameter.

The units can usually be set up at a cost of between 50 and 100 dollars. They have found rather wide acceptance among the groups for which they were intended and modifications have been used in other situations. Towns, contractors, and large road camps often have mobile air compressors to operate jack-hammers. Multiple nozzles of the type used on the aerosol dispensers are mounted on booms connected to these large air compressors, and available equipment is used to accomplish for $100 a job which would require $1,400 to $1,800 with commercial equipment.

Both the aerosol units and the spray booms depend on local destruction of adult insects and consequently require very little technical knowledge or community organization for their operation. The Arctic Health Research Center is continuing development of these nontechnical methods of control in a study of nozzles that will produce the necessary small droplets with a minimum use of air or other force. As a supplementary study, we are starting development of spray equipment that will be suitable for use by the bush pilots of Alaska.

Work With Small Plane Equipment

The reasoning behind our work on the airplane equipment is as follows:

1. The military spray team is getting very good results with one-half pint of 20 percent DDT per acre, applied in 1,000-foot swaths and with an m. m. d. of 136 microns.
2. It is only the airborne droplets that are effective for destruction of adult flying insects. Sixty-micron droplets falling 20 feet per minute, for example, are unlikely to strike many mosquitoes when the plane is flying 1,000-foot swaths.
3. Calibrations indicate that less than 2 percent of the solution being sprayed in the present program is in droplets of aerosol sizes.
4. The low sun of the northern summer "nights" provides many hours of almost ideal spraying conditions so that fine sprays can be effectively utilized.

Dispersion of practically all of the insecticide solution in 2- to 40-micron droplets should permit a great reduction in the rate of application and a great increase in effective swath width. Released from the limitations of small pay load and narrow swath width, small planes would become practical for mosquito control. Utilization of locally based planes should, by allowing more frequent spraying, permit the treatment of smaller areas and secure better timing.

Any local spraying done by bush pilots will have to be incidental to their other work. The short insect season and the volume of the business will not permit a high degree of specialization. Consequently, we are attempting to test and develop spray equipment suitable for the monoplanes now in use. In order to be acceptable, this spray equipment must not only deliver between 1 and 2 gallons per minute in aerosol-size droplets, but it must also be so quickly and completely demountable as to allow the pilot to spray at night and fly a clean and unencumbered plane in the morning. Even slight interference with performance of the airplane is objectionable in Alaska where there is a high premium on pay load and danger of icing on over-mountain trips.

The active interest of the local operators will be utilized in development of designs for removable tanks and fittings that are suitable for as many as possible of the local types of airplanes. The Arctic Health Research Center will undertake the testing and design of nozzles, development of spraying techniques, and determination of the range of practical application. A small wind tunnel is being built for use in preliminary studies of nozzle performance and for determination of droplet size without the errors that occur in outdoor settling of aerosol sprays. An airplane is to be chartered in the spring and used for surveys and preliminary tests of field methods for black fly control, as well as for testing equipment and spraying techniques.

REFERENCES

(*1*) Blanton, F. S., Travis, B. V., Smith, Nelson, and Husman, C. N.: Control of adult mosquitoes in Alaska with aerial sprays. J. Econ. Ent. **43**: 347–350 (1950).

(*2*) Jachowski, Leo A., Jr., and Schultz, Carlos: Notes on the biology and control of mosquitoes at Umiat, Alaska. Mosquito News **8**: 155–165 (1948).

(*3*) Progress Report of the Alaska Insect Control Project for 1947: Interim Report No. 0–128; ibid. 1948: Interim Report No. 0–137; ibid. 1949: Interim Report No. 0–139.

(*4*) Blanton, F. S., Husman, C. N., Travis, B. V., and Wilson, C. S.: Control of Alaskan mosquito adults by aerial sprays. J. Econ. Ent. **42**: 106–109 (1949).

(*5*) Wilson, Charles S.: Aerosol spray units for control of biting insects. Mosquito News, **10**: 51–54 (1950).

Sewage and Waste Disposal Problems

By E. K. Day, *Senior Sanitary Engineer*

Low temperatures and the resulting conditions are the principal factors which distinguish the problem of sewage and waste disposal in arctic and subarctic areas from the same problem in temperate climates. Biological and chemical reactions are retarded and physical changes occur in the environment, all of which must be taken into consideration in the design and operation of facilities for the collection, treatment, and disposal of sewage and other wastes.

The principal reason for emphasizing proper treatment and disposal of sewage and wastes in any area, regardless of temperature variations, is, of course, for the prevention of disease transmission. Although the epidemiological picture is not sufficiently complete to show the direct relationship of specific outbreaks of enteric infections in the arctic and subarctic to improper methods of sewage and waste disposal, it is logical to assume that they play essentially the same role as in temperate climates. This conclusion can be strongly supported by the incidence and distribution of such infections in low temperature areas.

Space will not permit detailed coverage of all the problems involved in sewage and waste disposal in low temperature areas. Since both community and single premise systems present major problems, each will be discussed with emphasis only on those factors which appear to be most significant in the Alaskan situation.

To date, the design and construction of a workable and economically feasible sewage collection system has been one of the major problems of community sewage disposal in permafrost areas. Population increases in recent years are making apparent the need of investigative work on treatment processes and rates of recovery of arctic streams. The essential problem in single premise sewage disposal is the final disposition of the waste materials.

Community Systems Studied

In the light of our present knowledge, we believe that the solutions of most of the problems involved in community sewage collection systems depend largely and simply on the application of known engineering principles to modify conventional design and operating practices. This conclusion is supported by the successful operation of at least one system in the permafrost area of Canada and by the results of careful analysis of the difficulties experienced in the operation of the one existing system in the permafrost area of Alaska at Fairbanks. Although it is a near perfect example of how not to build a sewage collection system for operation in low temperature areas, the Fairbanks system has proved very useful for study of trouble spots. Data obtained on this system will be used as a basis for discussion of some of the factors which appear most significant in relation to operating a conventional collection system in a low temperature area. First hand observations to date indicate that the most important factors involved in preventing freezing in collection systems are depth of cover, rate of flow, and grade of sewer line, all capable of control by good engineering.

Ground temperature studies indicate that throughout much of the permafrost area, at depths of 8 feet or more, temperatures do not vary greatly throughout the year and fall only a few degrees below freezing. Careful observations made over the period of a year on the Fairbanks system indicate the significance of heat losses from the sewers on frost penetration. Temperatures adjacent to the sewers were found to be only slightly below freezing even at depths of 5 feet or less.

Many laterals in the Fairbanks system have no more than 5 feet of cover and some have 4 feet or less. There is every reason to believe that an increase of cover to a minimum of 8 feet or more would result in a considerable decrease in the temperature differential between the sewage and the soil surrounding the sewer lines which, in turn, would result in decreased heat losses and less likelihood of freezing.

There are 105 dead-end laterals in less than 14 miles of sewers in the Fairbanks system. In many cases there are no more than four or five contributors and sometimes less to a line. This condition, together with lack of a water distribution system and inadequate private water supplies, results in little or no flow at times. The reason for freezing difficulties under these circumstances is obvious.

The majority of grades checked during maintenance work by the city furnish velocities of 1 to 1.5 feet per second in 6-inch pipe, with other grades running less. These are somewhat below the recommended velocities of 2 to 3 feet per second and do not provide the necessary self-cleansing action. As a result, deposits accumulate in the lines, flows are retarded, and freezing is promoted.

Ground temperatures and other pertinent data have been obtained including (1) sewage temperature; (2) temperature of air in the lines; (3) outside air temperature; (4) analyses of soils at test points; (5) characteristics of sewer lines; and (6) information concerning contributing population.

Many other factors will, of course, need careful investigation, including the relative suitability of various types of pipe with relation to transmission of heat and resistance to damage by freezing, effect of soil compaction, location of lines to take advantage of snow cover, loss of heat through manholes and house vents, effect of turbulent flow on heat losses from sewage, and so on.

Utilidors, although successfully operated in military and other government installations, do not appear to be economically feasible for less compact communities or residential areas in Alaska. Costs per linear foot of various types of concrete utilidors, based on United States prices but not including utilities, were estimated from $35.30

to $40.70 by Hyland and Mellish in 1948. Based on a cost factor of 3, which was valid in May 1948, in the Fairbanks and Nome areas but which has since increased, costs would range from $105.90 to $122.10 per linear foot, or from $5,295 to $6,105 in all, for constructing such a system for 50-foot lot.

In addition to economic disadvantages, there are obvious health hazards involved in having sewer lines and water lines in the same enclosed system. That utilidors serve as an ideal nesting place for rats, permitting easy access between buildings, has also been pointed out.

Treatment Processes Adaptable

At present, treatment of sewage does not constitute a critical problem in Alaska. As populations increase, however, the discharge of raw sewage into natural water courses will become a more significant health problem. Thus, the need for investigative work to provide a basis for design of treatment facilities suitable for low temperature operation becomes apparent. Primary treatment will probably be adequate in most of Alaska for some time because of relatively small concentrations of population and the availability of large bodies of water for final disposal. Therefore, applicability of primary treatment processes, including sedimentation and sludge digestion and disposal, should be given priority in the investigative program.

The common treatment processes all appear capable of adaptation to arctic and subarctic use. The optimum temperatures for most treatment processes are relatively high as compared with temperatures at which sewage could be expected to reach treatment facilities in arctic and subarctic areas. The problem in these areas, therefore, resolves itself to one of economics, involving a comparison of the cost of adding and conserving heat and the cost of constructing treatment facilities to operate at less efficiency.

Rates of biochemical stabilization and bacterial die-away rates in arctic streams may have considerable bearing on the degree of treatment necessary in some cases. Studies are needed to determine the effects of such factors as heavy ice cover during much of the year, effect of heavy loads of silt and organic matter, and the effect of heavy pollution loads due to thawing of winter accumulation during the spring breakups.

Single Premise Methods

Single premise disposal methods are important in Alaska since it is estimated that approximately 75 percent of the 130,000 people in Alaska are still dependent on single premise methods of sewage disposal. With some modifications, most of the common methods used in the temperate climates have been used in Alaska. However,

953080—51——3

their effectiveness and safety are sometimes impaired by the effects of low temperature on the chemical and biological processes and on the physical state of materials involved.

Although there are many aspects of the problem, involving esthetics, economics, and physical comfort, as well as public health, the greatest problem appears to be that of satisfactory final disposal. The usual methods of subsurface disposal, including conventional disposal fields, seepage pits, or cesspools, are not generally suitable in areas underlain with permafrost, especially if the active layer is relatively thin. Adequate leaching action cannot be obtained and the entire system is likely to freeze during the winter. The formation of frost mounds, a result of freezing of entrapped water, is an indication of what is likely to occur when subsurface disposal of wastes is attempted. This, in many cases, precludes the use of a water carriage system.

Pit and surface privies are not satisfactory in permafrost areas. Leaching action does not occur because of the frozen ground. During the summer the pits are likely to be filled with water, and in the winter all deposits remain frozen. In addition to the sanitation hazards involved, lack of heat and the resulting physical discomfort makes the use of privies impractical.

Because of the economics as well as the technical problems involved, the box-and-can system, or modifications thereof, is, at present, the most common method of sewage disposal for single dwellings in the Alaskan Arctic. Although not particularly desirable from the esthetic standpoint, it is probably the most practical system for isolated single dwellings and small villages in the permafrost area.

Final Disposal Big Problem

According to custom, a can or other receptacle is generally used within the dwelling and later dumped on the ground surface outside, usually close by, producing disagreeable and unhealthful conditions during the spring thaw. In some small communities, the receptacles are emptied into barrels or other containers and later hauled to some point outside the community and dumped on the ground surface. Frequently, the distance from the community is not sufficient to eliminate either the nuisance or the health hazard. In coastal communities the filled containers are placed on the ice during the winter to be carried away in the spring.

In the larger communities where the box-and-can system is used, scavenger services are usually provided, either by the municipality or by private operators. Frequency of collection varies from twice weekly to weekly, or at even longer intervals, the collection fee varying with the frequency of collection. After collection, the excreta is hauled to a relatively isolated spot outside the community and dumped. In coastal areas it is sometimes dumped on the beaches, and tidal action is depended upon to wash it away. In one instance where this method was observed, the excreta were being dumped at a point at least 10 feet above high tide. Obviously, dumping on the ground surface or beaches, as practiced in nearly all instances where this system is used, is not desirable from the public health or esthetic standpoint.

Chemical toilets are not extensively used in Alaska. Their use as a modification of the box-and-can system would do much to eliminate the health hazard if not the nuisances which result from unsatisfactory disposal methods.

Incineration should be considered as a means of final disposal although the possibilities are greatly limited by lack of locally available fuel in much of the arctic area.

In those portions of the Territory which are not underlain with permafrost, the problem of single premise sewage disposal does not differ greatly from that in the colder areas of the United States. Septic tanks with subsurface disposal fields appear to present the best possibilities. However, prolonged periods of subfreezing temperatures with the resulting deep frost penetration necessitate special precautions to prevent freezing. The conventional subsurface disposal field has not been used and its limitations are not known.

Four experimental tanks have been installed at the University of Alaska, and observations will be made to study the effects of (1) siphon discharges; (2) snow cover; (3) soil compaction; and (4) traps to prevent heat losses through house stacks, as well as the need and economics of heating both tanks and disposal fields.

Industrial wastes, at the present time, do not constitute a major public health problem in Alaska. There are approximately 160 fish canneries, operating on a seasonal basis in the Territory, which constitute the major industrial waste problem. Generally, the wastes are deposited on the beaches or tide flats near the plants for removal by tidal action. Most of the canneries are located in relatively isolated areas, and almost without exception large volumes of water are available for dilution. Some local nuisances do occur. The development of the pulp industry in southeastern Alaska is significant mostly because of its possible effect on fish life.

Provision is made for the adequate control of receiving waters by the Alaska Water Pollution Control Act adopted by the Territorial legislature in 1949.

Garbage Disposal a Nuisance

Garbage disposal is generally unsatisfactory throughout the Territory. The usual method is by dumping and burning. Along the coast garbage is often dumped on beaches to be carried away by tide action. In the portions of Alaska where permafrost does not exist, the garbage-disposal problem does not appear significantly different than in the colder areas of the United States.

In the permafrost areas incineration appears to offer the most promise. However, the cost of this method would be relatively high because of the small quantity of combustible material.

Grinding and disposal with sewage could be the solution in larger cities.

Summary and Conclusions

1. The public health significance of sewage and waste disposal in arctic and subarctic areas is essentially the same as in temperate climates.
2. The design and construction of economically feasible and workable sewage collection systems is still the major problem of arctic and subarctic areas, but can be solved by strict adherence to good engineering design practices.
3. Most of common sewage treatment methods are adaptable to use in arctic and subarctic areas.
4. The design of sewage collection and treatment facilities should consider the relative economy of the addition and conservation of heat beyond that necessary to prevent freezing and the construction of larger facilities to provide treatment at lower efficiencies.
5. Studies of arctic streams to determine rates of biochemical stabilization and bacterial die away are essential to determine the degree of treatment necessary.
6. Modification of the box-and-can system still shows the greatest promise for single premise disposal in permafrost areas, septic tanks with subsurface disposal in other areas.
7. Industrial wastes do not now constitute a major public health problem.

Biotic Interrelationships of Helminth Parasitism

By Robert Rausch, *Senior Assistant Scientist*

Biotic interrelationships in Alaska have so far suffered little from man's attempts to improve upon nature. As a result of these favorable circumstances, biological investigation in Alaska offers unusual opportunity for elucidating problems which can no longer be approached in the more populated parts of North America. One is very fortunate to have the opportunity of working under these conditions, since present trends indicate that Alaska is soon to go by the way of the great wildernesses which once existed in the United States and Canada.

The following observations and conclusions are based upon the autopsies of more than 4,000 Alaskan birds and mammals, supplemented by field studies over much of the Territory. These observations are further substantiated by about 6,000 additional autopsies which I completed in the United States and Canada during the 8 years preceding the Alaskan work. This background work allows direct comparison of arctic conditions with those in warmer regions and contributes to the understanding of helminth parasitism in Alaska.

Parasites Found in Alaska

Certain general conclusions may be drawn in regard to occurrence of worm parasites in Alaska. It is evident that cestodes comprise the most abundant and varied group in both migratory and nonmigratory birds and, to a lesser degree, in mammals. Trematodes are relatively uncommon, particularly in arctic regions, although a few species occur commonly in marine mammals. We assume that the comparative lack of snail intermediate hosts, particularly in the more northern regions, contributes largely to this situation. One rarely finds these parasites even in such birds as loons and ducks, usually heavily infected with trematodes farther south. Strigeid trematodes are rare, although farther south, in the United States and southern Canada, they occur commonly in various aquatic and predatory birds. Parasitic nematodes are often numerically abundant, but the number of species is relatively small. In both arctic and subarctic regions, the diversity of species is much less than that found at lower latitudes. Certain genera are completely lacking, although they may comprise the major part of the helminth fauna of the same host farther south.

We have evidence that birds nesting in arctic regions, but wintering much farther south, are usually infected by cestodes while on the breeding grounds as nestlings or nonflying immatures. We have observed this especially among ducks and among other water birds such as gulls. Earlier observations on birds in the central and western United States support the conclusion that helminth infections are obtained essentially before migration takes place.

One of the factors which contributes to the interest of studies of this type in Alaska is the occurrence of a considerable number of mammals which are circumpolar in distribution. Comparisons can be made of the parasites of a given host on both continents, and this may lead to information of zoogeographical significance. As an example, some of the parasites of microtine rodents, such as *Heligmosomum costellatum* Dujardin, *Hymenolepis horrida* (von Linstow), and *Paranoplocephala omphalodes* (Hermann), may be cited. These, with several other species, have been recovered from Alaskan voles and lemmings and are well-known Eurasian species, never having been reported from North America. Some earlier work in the Rockies (*5*) disclosed the presence of *H. horrida* and *H. costellatum* in voles in the subalpine zone. I have also recovered specimens of *H. horrida* from *Microtus ochrogaster* from the Great Smoky Mountains in Tennessee. This would seem to indicate that such parasites are relict forms, isolated in various southern mountain masses.

Although such parasites are found over much of Alaska, even in the lower, timbered country, they appear so far to have been unable to exceed the limitations of alpine and subalpine conditions farther south in the temperate regions of the continent. Observations to date indicate that *P. omphalodes* is limited to Arctic Alaska; however, it cannot be considered an arctic species, since it occurs southward well into Europe. This species may be a relatively recent invader from Eurasia and, so far, is limited to microtine rodents recently invading North America from the other continent—that is, *Microtus miurus* and other voles of the *Stenocranius* group, and *Microtus oeconomus* (*6*)—none of which has extended its range in North America beyond Alaska and northwestern Canada.

In microtine rodents and in many other mammals as well, we have collected helminths of species occurring farther south in Canada and the United States. However, we also have found several species which are new to the fauna of both North America and Eurasia (*2, 10, 13, 14, 15, 18, 19*). Some of these may occur in Siberia also, but this is unknown at present.

Survive Arctic Climate

The arctic climate does not necessarily have the effect on helminth parasites that one might expect, even though the complexity of their life cycles might lead to the conclusion that they would be vulnerable to climatic extremes. In fact, the evidence we have to date would indicate that many of the species occurring much farther south are able to exist very successfully under arctic conditions. For example, the tapeworms *Parnoplocephala infrequens* Douthitt and *Andrya primordialis* Douthitt occur commonly in the Arctic. We have taken the former, which has also been recorded from Siberian rodents, from as far north as Point Barrow, and we have specimens of the latter from Prince Patrick Island, north of latitude 75° N. Both species occur commonly over the United States. Other species found commonly much farther south, such as *Andrya macrocephala* Douthitt and *Syphacia obvelata* (Rudolphi), occur in Arctic and sub-Arctic Alaska, and in Siberia. We have recovered both species from as far south as Mexico City, where they occur in *Microtus mexicanus*.

Observations on the parasites of lemmings during the time of cyclic high population density (*9*) bear out earlier conclusions that, for microtine rodents, at least, there is no increase of worm parasites accompanying a great increase in host numbers (*12*).

Trichinosis in Marine Mammals

Some phases of the epizootiology of forms having much public health significance are not understood. It has been established that trichinosis is found in marine mammals, including the white whale and various seals, but the mode of transmission to them is completely unknown. The feeding habits of marine mammals, according to our present knowledge, would seem to preclude any opportunity for infection with *Trichinella spiralis,* since they are known to eat only fishes and various marine invertebrates, none of which can be infected with this parasite, as far as is known. We have thought that such animals might consume infected lemmings or other small rodents, which often gain entrance to the sea, particularly during times of cyclic high populations (*3*). Thus, the infection might be transmitted directly, or indirectly by the consumption of fishes which had fed upon infected lemmings. However, the examination of hundreds of such rodents has failed to disclose a single infection. It should be kept in mind, however, that a very small percentage of the population could be infected and still allow a considerable actual number of infected individuals. At times, lemmings reach such a high population density along the Arctic Coast that a few hundred would not be an adequate sample. We propose to study this situation more thoroughly during the next lemming high, expected during the spring of 1952.

It is possible that the strain of *Trichinella* found in the Arctic differs somewhat from that farther south in its ability to withstand low temperatures. We have no controlled observations on this as yet, but field observations would seem to bear out this impression. We expect to study the problem further this year, under both laboratory and natural conditions. Since much of the meat eaten by the Eskimos is first stored in cellars excavated from the permanently frozen soil, it seems desirable to determine the effect of such conditions on the survival of *Trichinella* larvae.

Trichinosis in the human population of Alaska represents a definite public health problem. Our observations so far seem to indicate that human infections may be contracted through the consumption of the flesh of marine mammals, which furnishes the bulk of meat consumed and is frequently eaten raw. Little pork or meat from other animals which might transmit trichinosis is available. The only carnivorous animals which might be involved would be the polar bear and the arctic grizzly (*Ursus richardsoni*), both of which are obtained from time to time. It is the general custom of the Eskimos along the Arctic Coast to cook the flesh of bears.

The high prevalence of trichinosis infection in polar bears, as reported in the literature and on the basis of personal observations, would seem to support the hypothesis that they become infected from eating seals—their most important food source. The high prevalence seen also in land carnivores appears to be a direct result of natural predatory habits (*1*). Thorburg, Tulinius, and Roth (*17*) have discussed trichinosis in marine mammals in Greenland.

The Eskimos on Saint Lawrence Island depend almost exclusively upon the flesh of sea mammals for food, to a degree considerably greater than is now the case along the Arctic Coast of Alaska. The rarity of the polar bear and the absence of any other land mammal which is used for food would indicate that trichinosis here is transmitted also by sea mammals to man. I have observed numerous trichinosis infections among the Saint Lawrence Island dogs, which are also fed largely upon the flesh of walrus and various species of seals. It is possible that dogs might become infected from consuming infected carcasses of the arctic fox, although in view of present information this would seem unlikely.

Speciation on the basis of morphological characters of tapeworms of the genus *Diphyllobothrium* is impossible for Alaskan forms. This precludes any concept of host specificity and prevents any attempt at the control of human infections from an epidemiological standpoint. We are conducting life cycle and animal infection studies in an attempt to clarify these problems.

Tapeworm Infections

The interrelationship of man-dog-ruminant (i. e., caribou and moose) in Arctic Alaska contributes much to the possibility of human *Echinococcus* infection. On the mainland the epidemiological pattern is typical. However, the importance of small rodents (*Microtus*) as intermediate hosts of this parasite is not understood. The fact that these voles serve as the predominant intermediate host on Saint Lawrence Island and our failure to find infected animals of the same and closely related species on the mainland is of unusual interest (*11*). Two factors may be considered: either we are dealing with two species of parasite, both of which infect man, or the situation is greatly affected by the population dynamics of the fox and rodent hosts. As is well known, arctic rodent populations are in a constant state of fluctuation, so that they differ each given year within the approximately 4-year cycle period. Also, where two or more species of small microtine rodent (e. g., *Lemmus*, *Dicrostonyx*, *Clethrionomys*, and *Microtus*) occur together, their cycles usually are not in phase. Thus, while a given species may be very abundant, others in the same region may be very rare. This requires long-term investigation of each species, and adequate material for study is only obtainable under these conditions. There has been considerable controversy in the past regarding speciation of *Echinococcus*. According to the work of Henschen and Bircher (*4*), in Europe, at least two species are clearly recognizable. We have yet to eliminate this possibility, particularly by means of experimental infections. Another point of much interest is the apparent rapid growth of these *Echinococcus* cysts in the rodent intermediate host. According to presently available information, the usual life span of voles of the genus *Microtus* is believed to be only about a year. This does not seem to be in accord with the usual concept of the rate of development of the *Echinococcus* cyst. We expect to clarify these points by experimental work.

If conditions in Alaska are allowed to remain relatively unchanged in regard to biotic interrelationships, there should be opportunity for the clarification of various public health problems of considerable importance in more northern climates. Such work as outlined in this paper is only possible under conditions of an undisturbed ecology.

REFERENCES

(*1*) Brandly, P. J., and Rausch, Robert: Preliminary report on trichinosis in Alaska. Arctic **3:** 105–107 (1950).

(*2*) Dubois, G., and Rausch, Robert: Troisieme contribution a l'etude des strigeides (Trematoda) Nord-Americains. Bull. Soc. Neuchat. Sc. Nat. **73:** 19–50 (1950).

(*3*) Elton, C.: Voles, Mice, and Lemmings. Oxford, 1942, 496 pp.

(*4*) Henschen, C., and Bircher, R.: Zur Epidemiologie, Pathologie und Chirurgie des *Echinococcus alveolaris*. Bull. Schweiz. Akad. d. med. Wissensch. **1:** 209–224 (1945).

(*5*) Kuns, M., and Rausch, Robert: An ecological study of helminths of some Wyoming voles (*Microtus* spp.) with a description of a new species of *Nematospiroides* (Heligmosomidae: Nematoda). Zoologica **35:** 181–188 (1950).

(*6*) Rausch, Robert: Notes on microtine rodents from the Brooks Range, Arctic Alaska. J. Wash. Acad. Sc. **40:** 133–136 (1950).

(*7*) Rausch, Robert: Notes on the distribution of some arctic mammals. J. Mammal. **31:** 464–466 (1950).

(*8*) Rausch, Robert: Studien an der Helminthenfauna von Alaska. IV. *Haploparaxis galli* n. sp. ein Cestode aus dem Schneehuhn, *Lagopus rupestris* (Gmelin). Ztschr. Parasitenk. **15:** 1–3 (1951).

(*9*) Rausch, Robert: Observations on a cyclic decline of lemmings (*Lemmus*) at Point Barrow, Alaska, during the spring of 1949. Arctic **3:** 166–177 (1951).

(*10*) Rausch, Robert, and Locker, Betty: Studies on the helminth fauna of Alaska. II. On some helminths parasitic in the sea otter *Enhydra lutris*, (L.). Proc. Helm. Soc. Washington. **18:** 77–81 (1951).

(*11*) Rausch, Robert, and Schiller, E. L.: Hydatid disease (*Echinococcosis*) in Alaska, and the importance of rodent intermediate hosts. Science **113:** 57–58 (1951).

(*12*) Rausch, Robert, and Tiner, Jack D.: Studies on the parasitic helminths of the North Central States. II. Helminths of voles (*Microtus* spp.). Preliminary report. Am. Midl. Nat. **41:** 665–694 (1949).

(*13*) Schiller, E. L.: Studies on the helminth fauna of Alaska. I. Two new cestodes from Sabine's gull, *Xema sabini*. J. Parasitol. (in press).

(*14*) Schiller, E. L.: Studies on the helminth fauna of Alaska. III. *Hymenolepis kenaiensis* n. sp. a cestode from the greater scaup (*Aythya marila nearctica*) with remarks on endemicity. Trans. Am. Microbiol. Soc. (in press).

(15) Schiller, E. L.: Studies on the helminth fauna of Alaska. VI. The parasites of the emperor goose (*Philacte canagica* L.) with the description of *Hymenolepis philactes*, n. sp. J. Parasitol. **37**: 217–220 (1951).
(16) Schiller, E. L.: Cestoda of anseriformes of the North Central States. Am. Midl. Nat. (in press).
(17) Thorborg, N. B., Tuliuius, S., and Roth, H.: Trichinosis in Greenland. Acta path. Microbiol. Scandinav. **25**: 778–794 (1948).
(18) Tiner, J. D., and Rausch, Robert: Two new *Syphacia* (Nematoda: Oxyuridae) and observations on the inner circle circumoral papillae in North American species of the genus. Nat. Hist. Misc. No. 57, pp. 1-6, 1950.
(19) Van Cleave, H. J., and Rausch, Robert: A new species of the acanthocephalan genus *Arhythmorhynchus* from sandpipers of Alaska. J. Parasitol. **36**: 278–282 (1950).
(20) Van Cleave, H. J., and Rausch, Robert: The acanthocephalan parasites of eider ducks. Proc. Helm. Soc. Washington. **18**: 81–84 (1951).

Phlyctenular Keratoconjunctivitis Among Alaskan Indians and Eskimos

By Milo H. Fritz, M. D., and Phillips Thygeson, M. D., *Ophthalmologists**

A high prevalence of corneal scars among Alaskan Indians and Eskimos was first noted by Mould (*1*), who attributed them to epiblepharon, and later by Fritz (*2*) and by Fields (*3*), who showed that they were due almost entirely to past or present phlyctenular keratoconjunctivitis. In the summer of 1949, a study by Fritz, Thygeson, and Durham (*4*) showed that scars attributable to phlyctenulosis were demonstrable in 35 percent of the children in the summer school at Mount Edgecumbe, in 45 percent of the patients in the Orthopedic Hospital, and in 25 percent of the patients in the Tuberculosis Sanatorium (see table 1). Since these school children and patients had come to Mount Edgecumbe from all parts of Alaska, the study threw into sharp relief the importance of the problem of phlyctenulosis in relation to vision throughout the Territory. In 1950, a series of etiologic and therapeutic studies were undertaken by Thygeson and Fritz, and the following report summarizes the results to date of the two summers' work.

Clinical Picture

The active disease among Alaskan Indians and Eskimos was characterized by acute attacks of keratoconjunctivitis of which the principal lesion was the focal reaction known as the phlyctenule. The phlyctenules tended to occur in crops with the heaviest localization at the limbus, but widespread involvement of the cornea and con-

*Dr. Thygeson is Clinical Professor of Ophthalmology, University of California Medical School, San Francisco, Calif. Both Dr. Thygeson and Dr. Fritz are consultants of the Arctic Health Research Center.

Table 1. *Prevalence of phlyctenulosis in Alaskan Indians and Eskimos, 1949–50*

Group	Number of examinations		Phlyctenulosis					
			Number				Percent	
			Active		Inactive			
	1949	1950	1949	1950	1949	1950	1949	1950
Mount Edgecumbe School[1]	404	508	10	4	133	124	35.4	25.2
Orthopedic Hospital, children, Mount Edgecumbe	66	63	1	2	29	25	45.4	42.9
Patients in Tuberculosis Sanatorium, Mount Edgecumbe	146	116	2	4	55	41	39.0	38.8
Sheldon-Jackson School, Sitka		134		0		20		14.9
Hydaburg, general population		198		1		20		10.6
Angoon, general population		168		2		44		27.4
All groups	616	1,187	13	13	217	274	37.3	24.2

[1] 1949 summer school; 1950 winter school.

junctiva was also common. The attacks varied in severity and duration: mild attacks tended to clear spontaneously within 10 or 15 days, and more severe attacks tended to last 2 or 3 weeks or longer. In a few chronic cases, recurring showers of phlyctenules kept the disease active for several months or longer. Blepharitis, as evidence of secondary bacterial infection, occurred in some 18 percent of the phlyctenulosis series. There were many more cases, however, including some of the most severe, in which there was no history of blepharitis and no evidence thereof. The majority of active cases occurred in females, but no significant sex difference was noted in the series of inactive phlyctenulosis cases (table 2).

The inactive cases of phlyctenulosis displayed characteristic scars involving most commonly the periphery of the cornea at the limbus but also, in many instances, the pupillary area itself. Visual acuity in children with corneal scars, as a group, was definitely inferior to that in children with unscarred corneas (table 3 and chart). There were a number of children whose visual acuity had been reduced to 20/200 or less. No other important cause of corneal scarring was

Table 2. *Prevalence of phlyctenulosis in selected groups of Indian and Eskimo children, 1949–50*

Group	Number examined	Phlyctenulosis		
		Number		Percent
		Active	Inactive	
Mount Edgecumbe School, 1949:				
Male	206	2	62	31.0
Female	198	8	71	39.9
Mount Edgecumbe and Sheldon-Jackson School, 1950:				
Male	356	3	79	22.9
Female	286	1	65	23.1

observed. There were a few scars from trauma and one case of trachoma but no instances of scarring related to epiblepharon or trichiasis.

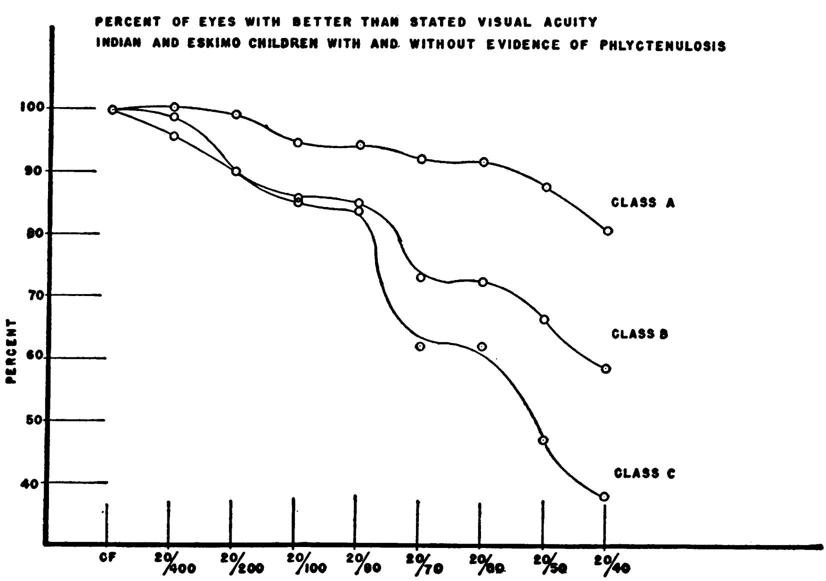
Table 3. *Number of eyes with specified visual acuity and percent with better than specified visual acuity; Indian and Eskimo children with and without evidence of phlyctenulosis*

Visual acuity	Number of eyes			Percent of eyes with better than stated visual acuity		
	Class C [1]	Class B [1]	Class A [1]	Class C	Class B	Class A
Count of fingers	1	2	0	99.0	99.0	100.0
20/400	1	7	0	98.0	95.5	100.0
20/200	9	12	2	89.1	89.5	99.0
20/100	5	6	9	84.2	86.5	94.5
20/80	1	3	0	83.2	85.0	94.5
20/70	22	24	5	61.4	73.0	92.0
20/60	0	1	1	61.4	72.5	91.5
20/50	15	14	8	46.5	66.5	87.5
20/40	9	14	14	37.6	58.5	80.5
Above 20/40	38	117	161			
Total	101	200	200			

[1] Class A: No evidence of past or present phlyctenulosis.
B: Evidence of active or inactive phlyctenulosis.
C: Evidence of phlyctenular scars involving the pupillary area.

Prevalence

The slit-lamp and corneal microscope were used in examinations for active and inactive phlyctenulosis among Alaskan Indians and Eskimos. As seen in table 1, the percentage of individuals showing scars from phlyctenulosis varied from a low of 10.6 percent in the general population of Hydaburg to a high of 45.4 percent in the patients in the Orthopedic Hospital in the summer of 1949.



The findings in Alaska appear to parallel those of native populations of northern Canada and Greenland. In Canada a cooperative study between the University of Alberta and the Canadian government is under way, and a preliminary survey of the native population of the Mackenzie River basin has already demonstrated a high prevalence of the disease in that area.

Etiology

The cause of phlyctenulosis has not yet been established with certainty. The theory receiving most support at the present time postulates that the disease is not an etiologic entity but a bacterial allergy, most commonly attributed to the products of the tubercle bacillus. In support of this theory, our studies have contributed the following items: (1) All cases with active phlyctenulosis showed positive tuberculin reactions and X-ray evidence of active or inactive tuberculosis; (2) a comparative study of the populations of two villages—Hydaburg with a low tuberculosis rate of 3 percent, and Angoon with a high tuberculosis rate of 17.7 percent—showed a parallelism between the prevalence of the two diseases; (3) the prevalence of phlyctenulosis was twice as high among the Eskimo school children from northwestern Alaska, in whom the tuberculosis rate is high, as among the Indian children of southeastern Alaska, in whom the tuberculosis rate is relatively low; and (4) cortisone applied topically was extraordinarily effective in aborting acute attacks of the disease.

Attacks of acute phlyctenulosis were seen in Indians and Eskimos with active pulmonary tuberculosis and with active bone or joint tuberculosis, and in clinically well individuals with X-ray evidence of old healed primary tuberculosis and positive skin reactions. In general, the most destructive eye lesions were seen in children with active bone and joint tuberculosis, but badly scarred corneas also occurred in children and adults with no active systemic tuberculosis. The mechanism by which an acute attack of phlyctenulosis is unleashed is still uncertain, but the following two possibilities have been under study: (1) An activated tuberculous focus may liberate antigenic products into the bloodstream; and (2) a secondary bacterial infection may have the nonspecific effect of bringing circulating tuberculous antigens to the conjunctiva as a result of nonspecific vessel dilation. The effect of epidemic Koch-Weeks bacillus conjunctivitis and pneumococcus conjunctivitis in exciting acute attacks in susceptible children has been observed repeatedly by us in the United States. In our Alaskan series, chronic bacterial infection, such as blepharitis, could not be shown positively to be an exciting factor, although among Mount Edgecumbe and Sheldon-Jackson school children in 1950, the prevalence of blepharitis in phlyctenulosis cases was 18 percent (27/148) as compared with only 1 percent (6/494) in non-phlyctenulosis cases.

The bacteriological findings from each eye of nine cases of active phlyctenulosis observed in 1949 follow:

Case No.	Right eye		Left eye	
	Activity	Flora	Activity	Flora
1	–	Normal flora	–	Coagulase-positive staphylococci; diplobacilli.
3	+	Coagulase-positive staphylococci	–	Coagulase-positive staphylococci.
11	–	do	–	Normal flora.
17	+	Alpha hemolytic streptococcus	–	Do.
31	+	Normal flora	–	Coagulase-positive staphylococci.
41	–	Coagulase-positive staphylococci	+	Do.
52	–	do	+	Normal flora.
97	–	do	–	Coagulase-positive staphylococci.
105	–	do	–	Do.

The above findings may be compared with the flora from conjunctivae and lid margins of 98 cases of inactive phlyctenulosis studied at the same time. Half of these, 49, had normal flora, and 40 of them had coagulase-positive staphylococci present. Eight of the latter and nine other persons harbored one of the following other pathogens: pneumococci, 8; *H. influenzae*, 3; diplobacilli of Morax-Axenfeld, 2; γ hemolytic streptococcus, 3; and nonhemolytic streptococcus, 1.

Activation of a tuberculous focus as a cause of acute attacks was suggested by the elevated sedimentation rates in acute cases as compared with the rates in inactive cases; but if activation occurred it was insufficient to produce obvious clinical signs such as fever. The importance of establishing the cause of acute attacks is apparent, and our studies are continuing.

Therapy

Up to the present time there has been no way of aborting attacks of phlyctenulosis. The favorable effects of tuberculin desensitization, antituberculous dietary regime, and topical application of antiseptics for the control of secondary infection are well known but never have been dramatic. In view of the results obtained with cortisone in allergic diseases, a trial with the hormone seemed to be indicated, particularly in view of the typical occurrence of phlyctenulosis in acute, self-limited attacks.

A total of 14 cases of active phlyctenulosis was treated with topical applications of cortisone, 12 with drops and 2 by subconjunctival injection. The results in each case were dramatic, the inflammation subsiding within 24 hours in mild cases and within 48 hours in more severe cases. In two cases the activity of the disease was approximately equal in both eyes; cortisone instilled in the right eyes only, aborted the attacks in these eyes within 48 hours, while the control eyes continued in full activity until treated in turn with cortisone 10 days later. In two cases with chronic phlyctenulosis which had been active for several months, cortisone was equally effective. The cortisone studies are being extended but the preliminary results would seem to suggest that a practical means of controlling acute attacks of the disease, and thus of preventing corneal scarring, may have been found. Full control of the disease, however, must await elimination of tuberculosis from the population.

REFERENCES

(*1*) Mould, Ward L.: Corneal opacities in the Alaskan Eskimo. Arch. Ophth. **24**: 972–974 (1940).

(*2*) Fritz, Milo H.: Corneal opacities among Alaska natives. Alaska's Health. **5**: (1947).

(*3*) Barnett, Harry E., Fields, Jack, Milles, George, Silverstein, George, and Bernstein, Arthur.: Medical conditions in Alaska. J.A.M.A. **135**:500–510 (1947).

(*4*) Fritz, Milo H., Thygeson, P., and Durham, D.: Phlyctenular keratoconjunctivitis among Alaskan natives. Am. J. Ophth. **34**: 177–184 (1951).

(*5*) Thygeson, P., and Fritz, Milo H.: Cortisone in the treatment of phlyctenular keratoconjunctivitis. Am. J. Ophth **34**: 357–360 (1951).

Climatic Adaptation in Arctic and Tropic Animals

By Laurence Irving, *Biologist*

The few species of resident arctic mammals and birds encounter environmental temperatures as low as −50° C. while preserving body temperatures around +37° C. In wide areas of the Tropics, common environmental temperatures of around +30° C. give a gradient between the body and environment of only 7°, which is in sharp contrast with the gradient of about 90° which arctic animals must sustain.

Measurements of the rate of heat transfer through pieces of skins from 18 arctic and 16 tropic mammals showed that they had in common an insulating value that varied with the fur thickness. The skins approximated the efficiency of any good insulator equally thick and containing a large proportion of trapped air. Among arctic animals insulation increased with the animal's size to a maximum at the weight of a 5-kilogram fox and did not change among the larger forms. We know that arctic foxes and larger animals do not need to seek shelter from the coldest arctic weather, but the smaller ones avoid

NOTE: This material summarizes the results of experimentation in the Arctic Research Laboratory, Point Barrow, and in the Canal Zone Biological Area. *See* Scholander, Hock, Walters, Johnson, and Irving, Biol. Bull. **99**: 225–271 (1950).

extreme cold more or less in nests or burrows. Among tropical animals the insulation is not large, but it is measurable and larger than in some small arctic species.

The basal metabolic rate in various environmental temperatures was determined by open circuit methods in six species of arctic mammals and in three birds, and in six tropic mammals and two birds. In the literature other records were found for 13 species of domesticated and wild mammals and 7 birds. No data for man was found adequate for valid comparison with other animals.

Study of this data showed that it might be formulated according to the law of cooling, as

$$\Delta T = K \times H \times I$$

in which ΔT is the difference between body and environmental temperature, K is a constant of the dimensions used, H is the heat production of metabolism, and I is the insulation. Arctic animals as large as foxes withstood experimental temperatures to −30° C. without changing metabolic rate. From visual observation of foxes at −60° C. they were unaffected by cold. According to theory and observation, the well-insulated arctic animals can preserve body temperature by only basal metabolic rates at temperatures around −60° C. They can, while in the same fur, also endure +30° C. Since metabolism remains constant over this range of temperature, insulation operates as the variable concerned in arctic adaptation, and it is not only large but adjustable to wide changes in the temperature gradient which arctic animals may encounter.

Many tropical mammals increase their metabolism as temperature falls below +25° C. and show signs of suffering from cold below +20° C. Their insulation is not only small but also correspondingly inflexible. In fact, as would be expected from theory, tropical animals appear frequently to suffer from minor decreases of their environmental temperature, whereas arctic animals with their great and highly adjustable insulation are quite oblivious to extremes of arctic cold.

The metabolic rates of the arctic and tropic animals vary with size according to the familiar relation $H = K \times W^{3/4}$. Warm-blooded animals of all climates thus have a common scheme of basal metabolism which is not adaptive in rate to the temperature of their environment. Body temperature of warm-blooded animals, excluding hibernators, is also nonadaptive. The only adaptive system in the animal economy of basal heat production is the insulation.

The remarkable adjustability of insulation shown by the wide range of temperatures accepted by arctic animals indicates that the insulation referred to is physiologically variable and is not simply that of dead skin and inert fur. The fact that the complex of physical and physiological devices, which this discussion designates as insulation, varies as a single factor shows that the component devices vary in size together. These views will be useful in the analysis, now in progress, of the interesting physiological mechanisms involved in the adjustment of animals to cold. It is expected that an inclusive description of the widely differing capacities of animals to withstand cold will point out experimentation for a critical definition of what degree and kind of adaptation to cold man possesses.

Facilities and Opportunities for Research at the Arctic Health Research Center

By Jack C. Haldeman, M. D., ***Medical Officer in Charge***

Our pattern of organization differs from that of many research activities in Alaska in that the work is largely carried out by a staff resident in the Territory devoting full time to investigation. Anchorage was selected as a base of operations, since it is a principal transportation center and offered the best opportunity for renting and converting suitable space for laboratory facilities as well as for obtaining housing for our personnel. We hope eventually to move our activities to College, Alaska, to a site which has been donated to the Federal Government for the purpose by the University of Alaska.

The recruitment of our professional staff has not been as difficult as anticipated, possibly because of the unparalleled opportunities for research in the area. I believe, however, that living conditions satisfactory for normal family life must be made available if any organization is to engage successfully in long-term basic or developmental research in low-temperature areas. I would also like to stress the importance of having a well-trained administrative staff. Problems relating to the acquisition of supplies and equipment, rental of space, contracts, personnel and fiscal actions are difficult and unique in Alaska, and if inefficiently handled, can cripple and demoralize the scientific staff.

Soon after our program was established in 1948, we were fortunate in being able to rent a building containing approximately 9,000 square feet which could be converted for laboratory bench research. This building is now equipped with stainless-steel laboratory furniture, and the acquisition of modern scientific equipment has been given first priority in the initial stages of the program. Walk-in refrigeration and incubation space is provided, as well as deep-freeze units. Supporting scientific services provided in this building include the care and breeding of small laboratory animals, media making, and dishwashing. The administrative staff is located in a building next door. The entomological laboratory, entomological shop, instrument shop, arctic animal house, and storage facilities occupy space at four other locations in the Anchorage area.

Our staff is accumulating considerable first-hand knowledge of the Territory, particularly of the northern and comparatively unknown sections. Staff members have also learned how to travel in these areas with a minimum of discomfort, delay, and expense. To conduct biological surveys is not our primary function, but, as accurate information on biological backgrounds is essential, our staff members have acquired knowledge in the natural history and distribution of Alaskan mammals, birds, insects, animal parasites, and fresh-water crustaceans.

At this point, we would like to offer our experience and knowledge of Alaska as a means of assisting our Stateside colleagues in preparing for field trips in these areas. We would also like to offer the consultative service of our scientific staff and, within present physical limits, the use of our facilities.

The opportunities for profitable collaboration may best be illustrated by a brief description of the specific scientific areas in which we have experience, and a general description of our facilities and equipment.

In physiology, we have a staff of four scientists trained in comparative physiology and experienced in arctic field studies. Equipment is available for research relating to the natural adjustments of animals to cold. Measurement of respiratory metabolism at controlled temperatures in warm-blooded animals of various sizes is carried on by open circuit systems. Temperature of the body and skin is measured by means of thermocouple equipment. For studying one phase of the interesting problem of how cold-blooded animals manage to survive in an arctic climate, oxygen consumption is measured at controlled temperatures by the use of various sized Scholander respirometers. A cold test room, with an inside diameter of 3 by 3 by 5 feet, provides regulation of temperatures ranging from $+35°$ C. to $-55°$ C.

Our biochemistry and nutrition studies are carried out by a staff of three biochemists and one physiologist. In the biochemistry laboratory, special equipment is available for food analysis, clinical chemistry, enzyme chemistry, and for the study of tissue respiration, as well as more general facilities for other biochemical specialties. Limited facilities for organic syntheses and biochemical preparations have been provided. We have specialized equipment for the microdetermination of blood constituents important in assessing human nutrition. Suitable facilities for experiments in small animal nutrition are available.

The scientific personnel responsible for animal-borne disease studies include three members. Their combined training and experience encompasses veterinary medicine, general parasitology, helminth taxonomy, and, to a certain extent, mammalian taxonomy and pathology. The laboratory is equipped with autopsy facilities and the other apparatus necessary for parasitological investigations. An artificial digestion apparatus is available for recovery of trichina larvae from animal tissue. Other equipment includes a rotary and a freezing microtome, aquaria, and a dark room for macro- and microphotography.

The entomological and insect control activities are staffed by an entomologist, an aquatic biologist, an entomological engineer, and an insect control specialist. The entomological laboratory contains an insectary and an insect collection. The entomological shop contains equipment necessary for the development and construction of special types of equipment for Alaskan insect control operations.

Two bacteriological laboratories are maintained. One is devoted to the study of the biological aspects of water supply and sewage disposal and the other to the study of infectious diseases. Space is provided for a branch laboratory of the Alaska Department of Health, which, in turn, makes available for our special investigations specimens submitted to it for routine diagnostic work.

Engineers engaged in environmental sanitation studies are using a pilot well and experimental septic tank installations located on the ground of the University of Alaska. Facilities operated by the city of Fairbanks and the Air Force at Ladd Field are also being utilized.

The hospital facilities of the Alaska Native Service have been freely used in our studies, as well as facilities of the Arctic Research Laboratory at Barrow and the Aeromedical Laboratory at Fairbanks.

The establishment of a research library was considered an essential step in the development of the Center in view of the current lack of library resources in the biological fields in the Territory. Although emphasis has been placed on the acquisition of bibliographic aids, the library receives and circulates approximately 200 different scientific periodicals as well as a weekly list of library accessions. Through active participation in the formative stages of project development, our librarians have been able to anticipate needs for specific reference material and to obtain needed publications, microfilms, and photostats with a minimum lapse of time. Needless to say, the facilities of the library have been used extensively by visiting scientists and other individuals and organizations.

A very important supporting service to our investigative program is the instrument shop. This unit is equipped to do all ordinary metalwork, such as turning, cutting and welding, small wood and plastic work, and sheet metalwork of limited size. It is also equipped for the small and high precision metalwork required in the construction of instruments. The facilities of the Civil Aeronautics Administration shop have been generously made available to us for heavy machine work.

An animal house, erected on the outskirts of Anchorage, contains a collection of native animals under conditions approximating their natural habitat. Those now on hand include such hibernators as black bears, marmots, and ground squirrels, and, in addition, red and blue foxes, tree squirrels, porcupines, weasels, geese, conies, and Eskimo dogs. Even the Norway rat, which has unfortunately demonstrated its adaptability to life near the Arctic Circle, is represented. The capture of native animals has been a problem of considerable magnitude. Some were obtained through cooperation of officials of the Fish and Wildlife Service, others as a result of our own trapping.

In determining the status of animal-borne diseases, the help of expert Eskimo observers of wild life has been particularly useful. In most of the biologically significant areas of the North, we have established contact with individuals who, at our request, will in the course of their normal hunting and trapping, preserve the particular parts of animals needed in our studies. Through their cooperation, our program has been accelerated and extended far beyond expectations and beyond the limits of our own physical capacity.

Incidence of Disease

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Reports From States for Week Ended June 30, 1951

There was a 60-percent increase in the number of cases of poliomyelitis for the current week (341) as compared with the previous week (211), all sections of the country contributing in varying degrees to the increase. The number of cases reported for the same week in 1950 was 389, and in 1949, 481. The region showing the largest numerical increase from the previous week was the West South Central which had 106 cases for the current week as compared with 61 for the previous week. Since the seasonal low week late in March, 1,619 cases have been reported as compared with 2,047 last year, and 2,270 in 1949.

Of the 12 cases reported in the New England States, 7 occurred in Massachusetts and 5 in Connecticut. The Middle Atlantic States showed an increase of 10 cases from the previous week. In the East and West North Central and Mountain regions, the increase was slight. In Illinois the number of cases reported increased from 8 for the week ended June 23 to 17 for the current week, 8 of which were in Cook County.

In the South Atlantic region, 45 cases were reported for the current week and 18 for the previous week. Twenty-eight of the 45 occurred in Georgia and Florida. The East South Central States showed a slight increase from the previous week—29 as compared with 25. However, in Alabama there was a decrease from 18 to 14 cases.

The increase in the number of cases in the West South Central region occurred principally in Texas, 33 cases being reported last week and 62 for the current week. Likewise, in the Pacific States, the increase from 31 cases last week to 54 for the current week was was confined principally to California where the numbers were 28 and 48, respectively.

In Texas, poliomyelitis cases have been concentrated in Nueces County and, more recently, in the adjoining county of San Patricio. The large cities have also contributed a large proportion. In Louisiana, where 22 cases (16 paralytic) were reported for the current week, 13 were in Shreveport. In Alabama, 8 of the 14 cases reported were in Birmingham.

Q Fever

Dr. T. O. Carver, Idaho Department of Public Health, reports preliminary results of an investigation of 16 cases of Q fever from an area around Gooding. Most of the patients have been associated with the sheep industries. Diagnosis in the 16 cases was confirmed by complement fixation tests performed at the Public Health Service Rocky Mountain Laboratory at Hamilton, Mont. Further studies of the disease in sheep and dairy cattle in the area are in progress.

Infectious Hepatitis

Dr. L. M. Schuman, Illinois Department of Public Health, has reported 43 cases of infectious hepatitis in a small rural community in Illinois. Three or four cases were reported in May, but investigation revealed that cases have been occurring since December 1950. Most of the persons affected were children attending a single school. Sanitary facilities of the school did not appear to be associated with spread of infection. None of the 11 adults affected had any association with school cases, directly or indirectly. Many families in which cases occurred owned dogs but none of the animals had any evidence of illness. The cases were mild with no fatalities, but the clinical picture was typical of infectious hepatitis.

Comparative Data For Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5 year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5 year median 1945–46 through 1949–50	Cumulative total for calendar year—		5 year median 1946–50
	June 30, 1951	July 1, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	------	4	2	(1)	(1)	(1)	(1)	39	24	28
Diphtheria (055)	52	58	86	27th	4,878	7,338	10,872	1,971	3,067	4,514
Encephalitis, acute infectious (082)	22	22	11	(1)	(1)	(1)	(1)	447	366	236
Influenza (480–483)	407	299	265	30th	129,688	148,462	148,462	115,146	137,878	127,599
Measles (085)	8,544	7,940	8,006	35th	465,120	284,538	552,242	436,419	265,409	517,296
Meningitis, meningococcal (057.0)	59	72	50	37th	3,408	3,192	3,080	2,447	2,279	2,108
Pneumonia (490–493)	677	1,102	(2)	(1)	(1)	(1)	(1)	42,312	55,309	(1)
Poliomyelitis, acute (080)	341	389	362	11th	1,619	2,047	2,029	2,832	3,178	2,368
Rocky Mountain spotted fever (104)	20	22	22	(1)	(1)	(1)	(1)	130	168	175
Scarlet fever (050)[3]	652	487	780	32d	66,650	54,756	78,604	40,959	38,317	56,060
Smallpox (084)	------	------	------	35th	15	43	66	7	23	45
Tularemia (059)	9	15	27	(1)	(1)	(1)	(1)	348	511	514
Typhoid and paratyphoid fever (040,041)[4]	71	94	98	11th	685	912	962	1,120	1,422	1,447
Whooping cough (056)	1,270	2,289	2,152	89th	[5]60,948	90,721	81,382	[5]39,346	69,205	50,116

[1] Not computed.
[2] Data not available.
[3] Including cases reported as streptococcal sore throat.
[4] Including cases reported as salmonellosis.
[5] Addition: West Virginia, week ended June 23, 34 cases.

Rabies

The first case of human rabies in Texas since 1948 occurred in a border county in June. The victim, a boy, was bitten 2 months prior to onset of symptoms. No antirabies vaccine had been given. Eight laboratory confirmed cases in animals have been found in the vicinity since January 1.

Gastroenteritis

Dr. D. H. Stevens, Maine Commissioner of Health and Welfare, has reported an outbreak of food poisoning in Lewiston. Twelve persons who ate Italian sandwiches were affected. Specimens of sandwiches made up from the original batch of ingredients were found to contain *Streptococcus viridans* and *B. coli.* None of the food handlers showed evidence of infection.

Dr. Patricia Husson, Erie County (New York) Health Department, reported 8 cases of afebrile gastroenteritis in 10 people attending a birthday party in Buffalo. The average incubation period was 32 hours. The vehicle was thought to be a frosted layer cake bought from a bakery. No fault was found in preparation or handling of the cake, and laboratory examination of the leftover cake and of the stools of one patient did not reveal pathogens.

Psittacosis

Dr. J. F. Mahoney, New York City Commissioner of Health, reports the occurrence of two cases of psittacosis.

Reported Cases of Selected Communicable Diseases: United States, Week Ended June 30, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	**52**	**22**	**407**	**8,544**	**59**	**877**	**341**
New England	**3**	**1**	**1**	**785**	**2**	**25**	**12**
Maine	3	-	1	52	1	3	-
New Hampshire	-	-	-	4	-	2	-
Vermont	-	-	-	102	-	-	-
Massachusetts	-	1	-	526	1	-	7
Rhode Island	-	-	-	28	-	3	-
Connecticut	-	-	-	73	-	17	5
Middle Atlantic	**6**	**5**	**6**	**2,551**	**11**	**87**	**23**
New York	3	2	[1] 5	1,395	5	45	17
New Jersey	-	3	1	655	4	19	3
Pennsylvania	3	-	-	501	2	23	3
East North Central	**5**	**6**	**7**	**1,070**	**12**	**101**	**39**
Ohio	2	-	-	369	4	-	3
Indiana	1	-	3	30	1	4	-
Illinois	-	-	2	434	5	48	17
Michigan	1	6	2	237	2	49	9
Wisconsin	1	-	-	-	-	-	10
West North Central	**1**	-	**14**	**581**	**3**	**64**	**18**
Minnesota	1	-	2	17	-	2	2
Iowa	-	-	-	326	-	-	2
Missouri	-	-	1	94	2	2	-
North Dakota	-	-	10	52	-	45	5
South Dakota	-	-	-	22	-	-	-
Nebraska	-	-	-	12	-	-	3
Kansas	-	-	1	58	1	15	6
South Atlantic	**9**	**1**	**166**	**920**	**16**	**76**	**45**
Delaware	-	-	-	36	-	-	3
Maryland	1	1	3	271	3	17	1
District of Columbia	-	-	-	30	-	15	1
Virginia	3	-	160	317	3	31	3
West Virginia	1	-	-	53	1	-	2
North Carolina	4	-	-	84	2	-	6
South Carolina	-	-	2	21	4	6	1
Georgia	-	-	1	70	1	7	13
Florida	-	-	-	38	2	-	15
East South Central	**9**	**6**	**1**	**130**	**5**	**46**	**29**
Kentucky	-	-	-	33	1	6	2
Tennessee	1	-	-	42	2	-	5
Alabama	5	4	-	48	2	29	14
Mississippi	3	2	1	7	-	11	8
West South Central	**11**	**2**	**26**	**599**	**4**	**192**	**106**
Arkansas	-	-	14	68	1	13	9
Louisiana	1	-	1	9	-	27	22
Oklahoma	2	-	11	35	-	11	13
Texas	8	2	-	487	3	141	62
Mountain	**4**	-	**160**	**466**	**1**	**28**	**15**
Montana	-	-	3	118	-	-	-
Idaho	-	-	-	81	-	-	-
Wyoming	-	-	-	70	1	3	-
Colorado	1	-	115	30	-	10	2
New Mexico	-	-	-	23	-	4	5
Arizona	3	-	42	70	-	11	8
Utah	-	-	-	74	-	-	-
Nevada	-	-	-	-	-	-	-
Pacific	**4**	**1**	**26**	**1,442**	**5**	**58**	**54**
Washington	-	-	6	70	-	-	4
Oregon	1	-	11	295	1	20	2
California	3	1	9	1,077	4	38	48
Alaska	-	-	-	-	-	-	-
Hawaii	1	-	-	20	-	-	-

[1] New York City only.

Reported Cases of Selected Communicable Diseases: United States, Week Ended June 30, 1951—Continued

[Numbers under diseases are International List numbers, 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [1] (040,041)	Whooping cough (056)	Rabies in animals
United States	**20**	**152**		**9**	**71**	**1,270**	**112**
New England		**70**			**1**	**29**	
Maine		2				4	
New Hampshire		[2] 2				2	
Vermont							
Massachusetts		58			1	19	
Rhode Island		3					
Connecticut		5				4	
Middle Atlantic	**1**	**152**			**13**	**101**	**4**
New York		[2] 98			4	45	4
New Jersey		17			2	31	
Pennsylvania	1	37			7	25	
East North Central	**1**	**166**		**2**	**10**	**219**	**21**
Ohio		37			5	36	1
Indiana		4				16	12
Illinois	1	34		2	3	42	2
Michigan		73				64	6
Wisconsin		18			2	61	
West North Central	**1**	**29**		**1**	**1**	**61**	**26**
Minnesota		7				7	3
Iowa		4				9	7
Missouri		14			1	7	16
North Dakota		3				9	
South Dakota						6	
Nebraska	1	1				4	
Kansas				1		19	
South Atlantic	**10**	**40**		**2**	**4**	**124**	**18**
Delaware						1	
Maryland		9				8	
District of Columbia		3				3	
Virginia	3	2		1		62	4
West Virginia		[2] 3			2		3
North Carolina	4	16				18	
South Carolina		1				6	5
Georgia	3	3		1	2	8	6
Florida		[2] 3				18	
East South Central	**1**	**24**		**1**	**7**	**72**	**18**
Kentucky		3			2	14	5
Tennessee	1	[2] 11			2	27	8
Alabama		5			1	19	4
Mississippi		5		1	2	12	1
West South Central		**13**		**2**	**16**	**519**	**23**
Arkansas				2	3	55	
Louisiana		2			1	6	
Oklahoma		2			5	25	
Texas		9			7	433	23
Mountain	**5**	**16**		**1**	**7**	**51**	**1**
Montana	2				1	7	
Idaho	1	2			2		
Wyoming						9	
Colorado	1	2			2	10	
New Mexico					1	4	
Arizona		2			1	21	1
Utah	1	[2] 10		1			
Nevada							
Pacific	**1**	**142**			**12**	**94**	**1**
Washington		9				15	
Oregon		9			1	4	
California	1	[2] 124			11	75	1
Alaska							
Hawaii							

[1] Including cases reported as salmonellosis. [2] Including cases reported as streptococcal sore throat.

Psittacosis: Indiana, 1 case; New York City, 2 cases. *Rabies in man:* Texas, 1 case.

FOREIGN REPORTS

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently. A table showing the accumulated figures for these diseases for the year to date is published in the PUBLIC HEALTH REPORTS for the last Friday in each month.

Cholera

Burma. There were only 2 cases of cholera reported in Mergui for the week ended June 23, 1951, compared with a high of 47 for the week ended May 12. Seven cases were reported in Moulmein for the week ended June 23, as compared with eight for the previous week.

Smallpox

French West Africa. During the period June 1–10, 1951, 116 cases (7 deaths) of smallpox were reported. The incidence was located chiefly in Sudan and Upper Volta.

Indochina. During the week ended June 23, 1951, smallpox was reported in ports of Viet Nam as follows: Haiphong 26 cases, Hanoi 16, and Nam-Dinh 16.

Indonesia. For the week ended June 16, 1951, seven cases of smallpox were reported in Surabaya, Java, and one case was reported in Pekalongan.

Tanganyika. During the week ended May 19, 1951, 79 cases (20 deaths) of smallpox were reported in Tanganyika. The number of cases dropped to 19 during the following week.

Typhus Fever

Portugal. During March 1951, 24 cases of typhus fever were reported in Portugal compared with 4 for February.

Yellow Fever

Brazil. One fatal case of jungle yellow fever was reported on April 27, 1951, in Rochedo County, Mato Grasso State.

Gold Coast. One suspected case of yellow fever was reported May 28, 1951, in Obosumasi about 18 miles east of Nsawam.

The three suspected cases reported for the week ended April 28, 1951, in Aboadzi, Sekondi, and Tarkwa have been confirmed.

Peru. One fatal case of jungle yellow fever was reported April 14, 1951, in Tingo Maria, Huanuco Department, and on April 17, one fatal case was reported in Pucallpa, Lerto Department.