THE INSTITUTE REPORT

From the

VETERINARY VIRUS RESEARCH INSTITUTE

Cornell University, Ithaca, New York

October, 1960 Volume 10

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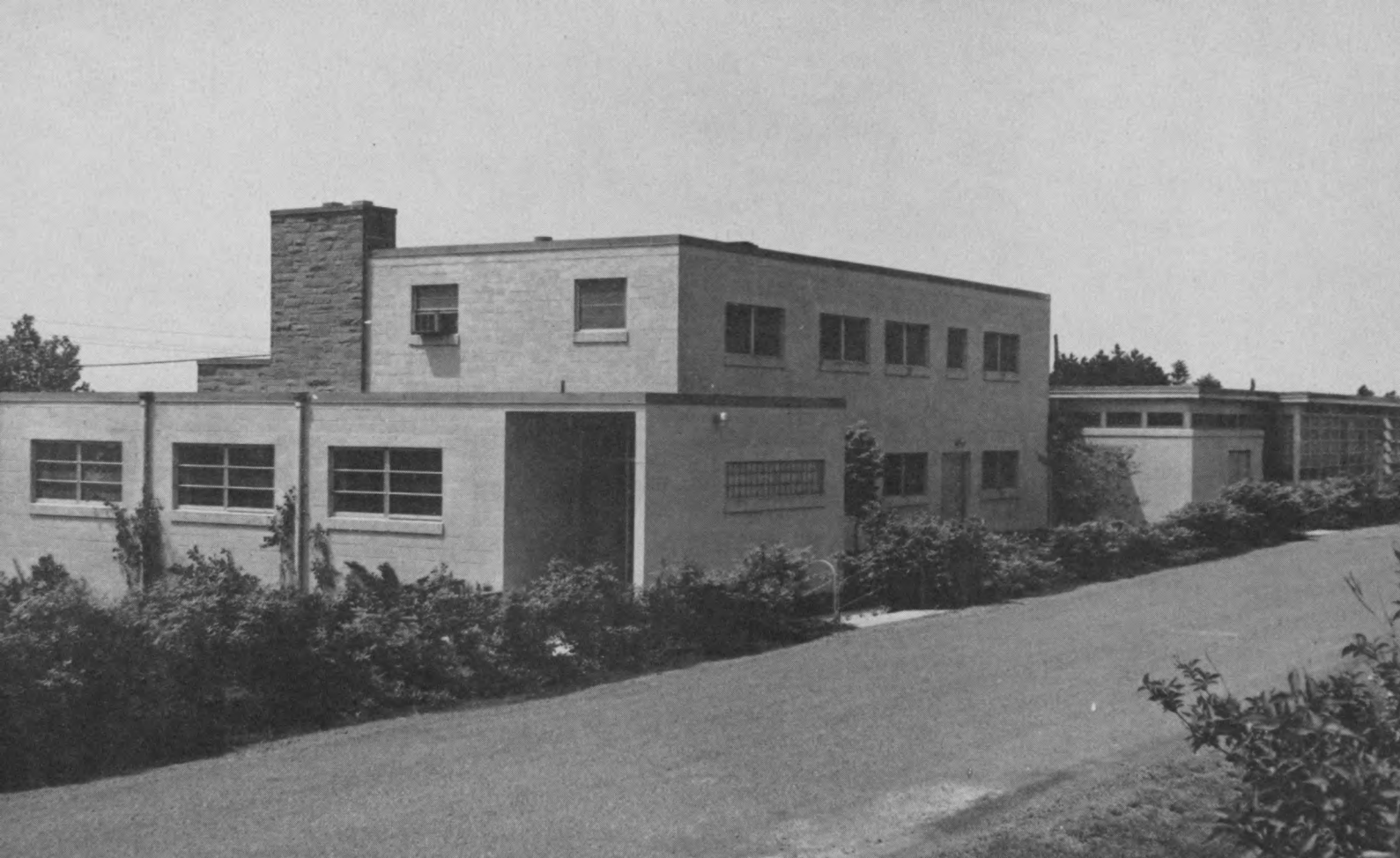

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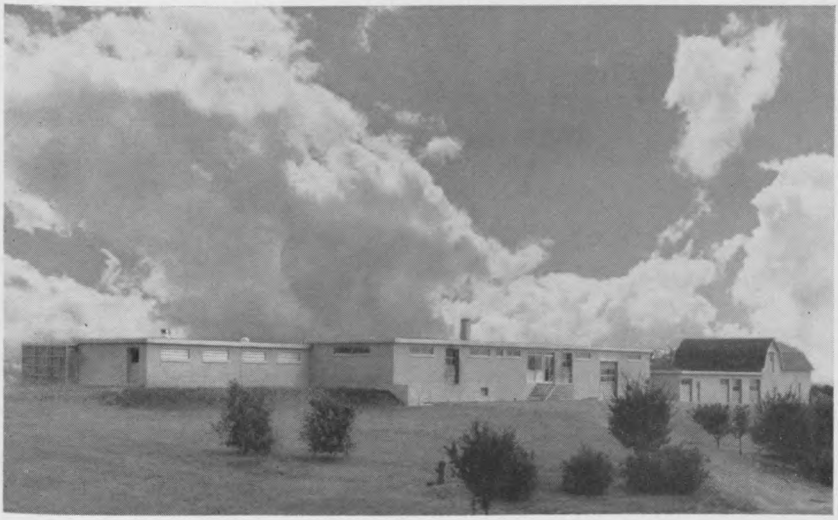
THE INSTITUTE REPORT

THE INSTITUTE REPORT is planned this year for our tenth anniversary celebration. It will consist of a brief review of the history, purposes, and accomplishments of Cornell's Veterinary Virus Research Institute during its first decade. None of these would have been possible without the encouragement and support received from our donors. We are grateful to each one of the persons whose contributions make our work possible. Our Institute Report is prepared specifically for these donors.

As with any new undertaking, there has been a period of organizing; of building, as funds became available, suitable housing for animals and laboratories for the research staff; of slowly, and with infinite care, establishing and rearing our important, disease-free colonies of animals, including cattle, swine, and dogs; of developing new methods, materials, and ideas and then of trying to explain these to the persons who could use them; of teaching; of trying to select and train for the future suitable young workers of vision and talent.

We feel we have a smoothly functioning, well-staffed scientific organization, that, in its second decade of operation, with suitable encouragement and sufficient funds, should be able to produce much information concerning infectious diseases.



VIRUS RESEARCH INSTITUTE STAFF

General Institute Staff

JAMES A. BAKER, B.S., M.S., D.V.M., Ph.D., Director of the Institute and Professor of Virology

JAMES H. GILLESPIE, V.M.D., Assistant Director of the Institute and Professor of Bacteriology (on sabbatic leave, 1960-61, at University of California, Berkeley, California)

Administration

DUDLEY BAKER, (Mrs. James A. Baker), Editor of Publications*

CLARENCE G. BRADT, B.S. (Professor Emeritus of Animal Husbandry), Consultant in Dairy Cattle Disease Development

JOYCE M. FREEMAN, Secretary to the Director

MARGARET HARDESTY, Bookkeeper

MARJORIE D. LANGER, Secretary

JOSEPH D. MINOGUE, B.S. (Associate Director, University Development), Consultant, Day Hall

HADLEY C. STEPHENSON, B.S., D.V.M. (Professor Emeritus of Veterinary Therapeutics and Small Animal Diseases), Veterinary Consultant

Maintenance

CHARLES BAILOR, Animal Technician

ROBERT DAVENPORT, Maintenance Assistant

GEORGE KIGER, Custodian

CREIGHTON LUSK, Technical Assistant

ELDON MEAD, Farmer

CHARLES MUNCH, Sr., Animal Technician

CLARENCE RAYMOND, Technical Assistant

LYLE RAYMOND, Foreman

CARL SEARS, Experimentalist

FRANK SEARS, Building Maintenance Supervisor

EDSON WHEELER, Senior Animal Technician

MICROBIOLOGY LABORATORY

LE ROY COGGINS, B.S., M.S., D.V.M., Graduate Assistant

SYLVIA GOULD, R.N., Laboratory Technician

BARBARA JOHNSON, Histological Technician

PETER H. LANGER, V.M.D., Ph.D., Research Associate

KATHLEEN MADDEN, B.Sc., Laboratory Technician

VIVIAN MORGAN, Laboratory Assistant

CAROLE SCHULTES, B.S., Laboratory Technician

BEN E. SHEFFY, B.S., M.S., Ph.D., Associate Professor of Nutrition, Caspary Fund (Returned July 1, 1960, following a year at Cambridge University with Guggenheim Fellowship)

ELIZABETH WHEELER, Laboratory Assistant

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*Mrs. Baker was appointed to this position in 1951 and has served since that time without salary, as a personal contribution to the Institute.

CORNELL RESEARCH LABORATORY FOR DISEASES OF DOGS

LELAND E. CARMICHAEL, A.B., D.V.M., Ph.D., Director and Research Associate

Daynemouth Division

(Provided by Colonel and Mrs. Lee Garnett Day)

BARBARA HILDRETH, B.A., Laboratory Technician
BARBARA PAKKALA, Laboratory Technician

Giralda Division

(Provided by Mrs. Geraldine Rockefeller Dodge)

FRANCES BARNES, A.A.S., Laboratory Technician
LOIS PAGETT, R.N., Laboratory Technician
JOAN THOMPSON, D.H., Laboratory Technician
MARGARET WERTZ, R.N., Laboratory Technician

Distemper Evaluation Laboratory

(Operating Funds Provided by the American Kennel Club)

DOUGLAS S. ROBSON, B.A., M.A., Ph.D., Statistical Consultant

Cooperating Staff

These veterinarians and scientists in various parts of the United States are contributing much time and effort, without compensation, in order to help secure the necessary information on which to base a program to conquer distemper.

Uncas T. Crocker, D.V.M., Monticello, Florida
John W. Dillehay, D.V.M., Chicago, Illinois
John Gilmartin, B.S., M.S., Norwich, New York
Gilbert N. Haigler, D.V.M., St. Louis, Missouri
Victor Heiman, B.S., Ph.D., Waverly, New York
Walter D. Martin, Jr., D.V.M., Albany, Georgia
R. W. Mellentin, B.A., Kankakee, Illinois
Robert Mosier, Waverly, New York
William O. Reece, D.V.M., Chicago, Illinois
Clarence C. Sapp, Jr., D.V.M., Albany, Georgia

HISTORY OF THE INSTITUTE, 1950-1960

FORMATION AND DEVELOPMENT

On September 20, 1950, the Executive Committee of the Board of Trustees of Cornell University voted to establish, in connection with the New York State Veterinary College, a new unit to be known as the Veterinary Virus Research Institute. Formation of the Cornell Research Laboratory for Diseases of Dogs was approved as a section of the Institute and was planned to become the first permanent research center in the world for study of diseases of dogs.

The Institute was given permission to use approximately half of the former Veterinary Experiment Station buildings and land on Snyder Hill, about two miles from the Cornell campus. A gift to Cornell of an adjoining section of land made possible a new road, graded so that it could be kept open in winter.

BUILDINGS, FACILITIES, AND ESTABLISHMENT OF DISEASE-FREE COLONIES OF ANIMALS

In establishing our first colonies of disease-free animals necessary for analytical work and accurate evaluation, in addition to breeding stocks of small laboratory animals, such as mice, rabbits, and guinea pigs, we were given, through the cooperation and interest of Dr. Carl TenBroeck and Dr. E. W. Smillie, what was in the opinion of many scientists, the most valuable herd of cattle in the world. This famous disease-free herd was started originally at the Rockefeller Institute for Medical Research by Dr. Theobald Smith, one of Cornell's most noted graduates, and one of America's first great scientists, whose precise and methodical work with Texas fever of cattle was one of the great events in medical research. At birth, the calves were caught in sterile sheets, then transferred to and reared in disease-free surroundings. By unceasing precautions, these cattle are kept free of infectious diseases, and they are the only such disease-free herd in the world.

After suitable quarters were prepared here, the Rockefeller herd was brought to Cornell in 1950. Now they are maintained at the Institute, with a barn and pastures, behind a double security chain fence to prevent accidental infection. The herd is cared for, as are all of the other animals at the Institute, with every effort to prevent infection. Attendants wear special disease-free clothing. Feed is grown especially for this herd on fields kept free from manure, which might transmit infectious organisms.

Also in 1950, a gift from the Gaines Dog Research Center allowed us to build the now famous Cornell disease-free kennel. The building itself is surrounded by a strong security fence, to keep out stray animals or persons that might transmit disease. This perimeter fence is about 30 feet from the

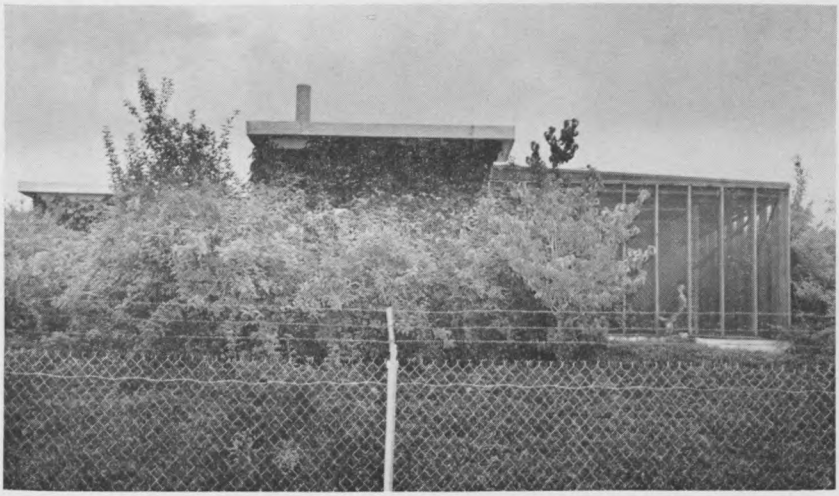
building and has only one gate. Here all supplies are unloaded. Only authorized personnel may enter the building.

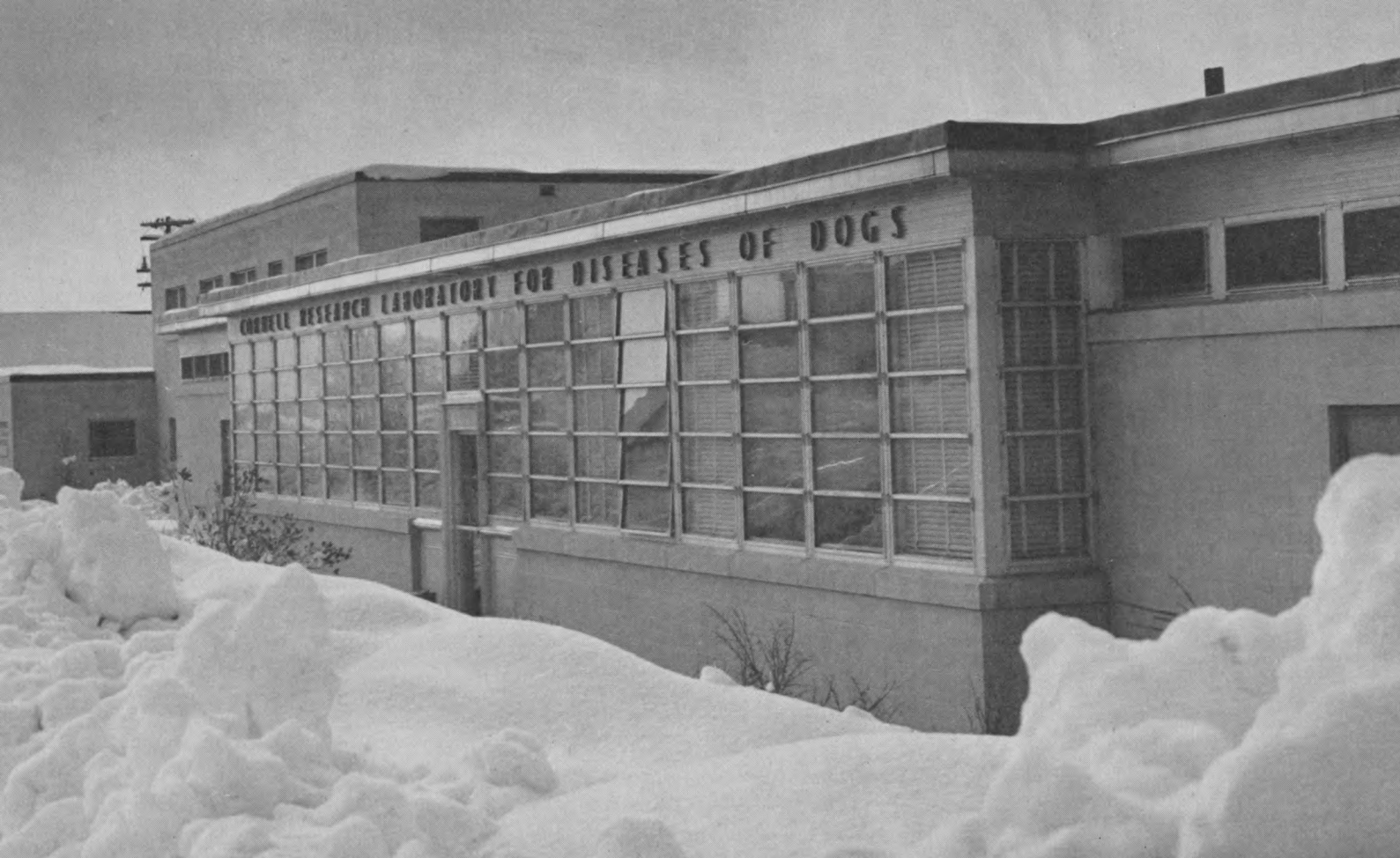
Before coming into contact with the dogs, special precautionary measures regularly are taken in order to help prevent entry into the kennel of disease germs that might cling to hands, clothing, shoes, or other articles. The kennel entryway contains a special dressing room, where clothing from outside must be left, before entering a shower bath. After leaving this shower, one then puts on special clean clothing, kept always inside the building and laundered there. There are coveralls, boots, rubber gloves, and caps. These time-consuming precautions, of course, are to protect the dogs from any possible exposure to organisms that might be brought in from outside.

Canned milk, food, and other supplies always are left at the outer entry gate, and all containers first are sterilized in a formaldehyde solution before being taken into the building.

Pure-bred beagles have been selected for this kennel, because they are a small, short-haired, sturdy, and happy breed. Through swinging gates, all of the dogs have free access back and forth to outside runs whenever they wish exercise, fresh air, or sunshine. Their entire runway is screened, to prevent annoyance or possible contagion from insects, birds, or rodents. Pens and runs are cleaned each day with hot water under 75 pounds' pressure.

Warm, quiet rooms for whelping are separated from those of the other beagles. Our original breeding stock first was taken by hysterectomy and then hand-reared to maturity. These adult animals and their descendants now are allowed to breed and have their litters naturally.




CORNELL RESEARCH LABORATORY FOR DISEASES OF DOGS

In January, 1951, the Cornell Research Laboratory for Diseases of Dogs was dedicated officially. It contains, in addition to individual study units, two main laboratory sections, the Daynemouth Division, given by Colonel and Mrs. Lee Garnett Day, and the Giralda Division, given by Mrs. Geraldine Rockefeller Dodge.

The greatly appreciated gift of approximately 5,000 trees and shrubs, by Mr. and Mrs. William Flemer, Jr., of Princeton, New Jersey, has added much to the natural beauty of our location, overlooking Cayuga Lake.

In 1952, the Institute added a new maintenance building, where tractors, snow plow, truck, mowers, and tools are stored.

In 1955, the Microbiology Laboratory, given by Colonel and Mrs. Lee Garnett Day and Mr. John M. Olin, was built.

In 1958, the Control Laboratory began operation. This important building was constructed with funds from the United States Public Health Service and with matching funds from the Institute.

Building funds and grants for specific research have been received from the U.S. Army, the U.S. Navy, and the U.S. Public Health Service, as well as from industrial concerns and interested individuals.

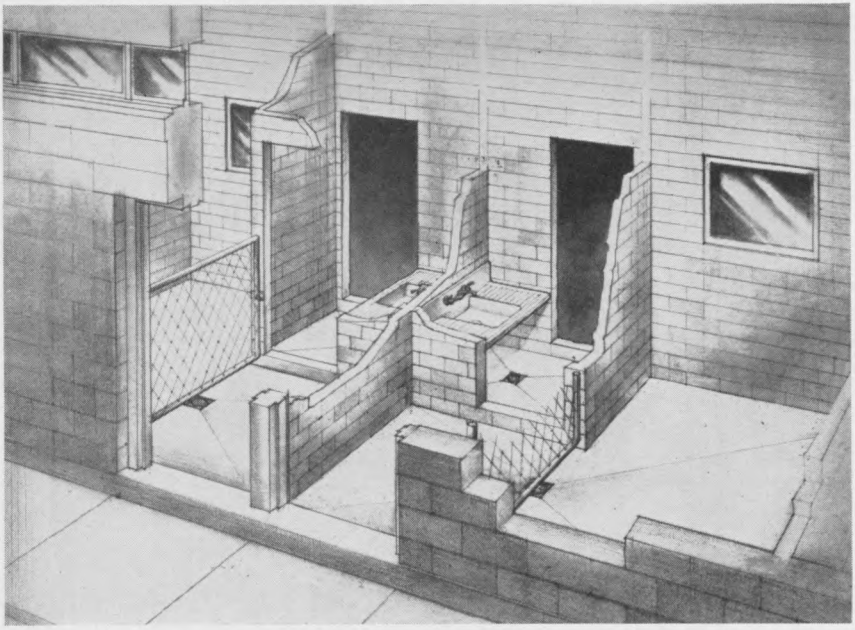
Unusually generous grants, and continuous encouragement, have been received from Colonel and Mrs. Lee Garnett Day, Mrs. Geraldine Rockefeller Dodge, Mr. R. L. Ireland, Mr. John M. Olin, and Mr. Richard Tift.

A special research grant from the American Kennel Club has allowed establishment and operation of the Distemper Evaluation Laboratory. Here was developed the Distemper Nomograph, the first such nomograph in the science of immunology.

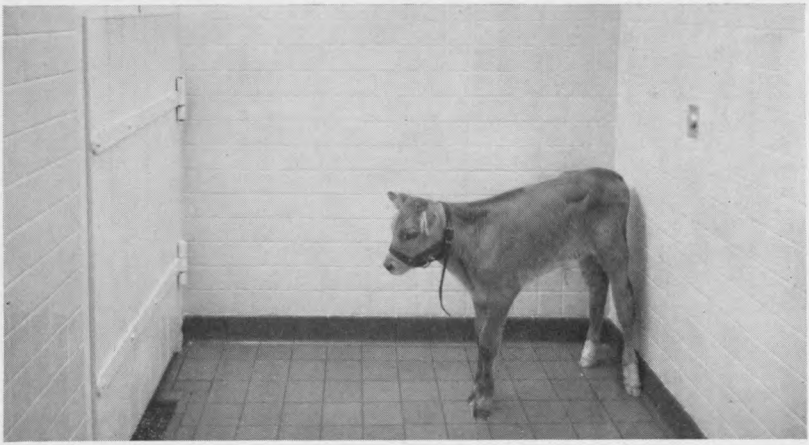
A generous unrestricted grant from the Caspary Foundation allowed us to establish our first endowed professorship.

All of the laboratories and facilities of the Institute have been planned carefully. Incorporated into their design are isolation units, air-blocks to prevent cross convection, special hoods, and other arrangements that careful workers consider necessary for uncontaminated work with viruses and other living, infectious organisms.

Each of our twenty units for study of individual diseases is self-contained. In the entry room, in addition to a scrub sink, are kept sterile coveralls, rubber boots, gloves, and caps, to cover as effectively as possible outer clothing, hands, and hair, and shoes, so that workers will not take organisms from the outside into the units. A second small room with sink and running water is used as a diet room for food preparation, while a third room of each unit is used for animals being studied. All of the units are made of glazed tile and are cleaned each day with hot water under pressure.



Architect's drawing of individual units.



A calf from the Rockefeller herd in one of the individual units.

PURPOSES OF THE INSTITUTE

Originally, we stated our objectives as: "To prevent loss from infectious diseases in animals. Towards this end, basic research is conducted upon organisms which cause disease in order to increase knowledge concerning their nature, means of spread, and methods whereby their spread can be controlled. A secondary objective of the Institute is the training of workers in the field of Virology. Determined by the amount of laboratory space available, a limited number of graduate students and visiting investigators are accepted."

ACCOMPLISHMENTS OF THE INSTITUTE

All work at the Institute is planned to be of value in the eventual understanding and control of diseases. Studies are made on various phases of epidemiology and immunology. The Institute's scientifically designed units, disease-free animal colonies, and staff of well trained scientists already, during the past ten years, have made possible accurate study, followed by clarification of a number of complex problems.

Many more of our original objectives than we would have thought possible ten years ago already have been accomplished. Infectious organisms have been isolated, studied in detail, and described at scientific meetings or in various journals. Scope and nature of the work are indicated by the list of 118 publications from the Institute staff.

RESEARCH FOR THE CONTROL OF DISEASES IN DOGS

Our studies for dogs have concerned primarily the diseases most prevalent in the United States. First, an analysis was made to determine which diseases were the most important.

Ten years ago, no specific vaccines were available for infectious canine hepatitis or leptospirosis of dogs. Today, distemper virus, infectious canine hepatitis virus, and all three of the most common leptospiras in dogs can be recognized and identified serologically. Standardized antigens now are available for such studies. Each disease is recognized as a separate, well defined condition, requiring its own antigenic vaccine for protection.

CANINE DISTEMPER

Almost 100 per cent incidence of this air-borne infection is found wherever dogs are found. So-called "hard-pad disease" and encephalitis, sometimes seen after distemper, were described by some workers as caused by one or two additional viruses, and additional vaccines against them were suggested.

"Hard-pad" strains we studied proved identical with the distemper virus commonly found throughout the United States. A good distemper vaccine, therefore, would protect against these conditions, if received before exposure to distemper.

Encephalitis was studied carefully and was found caused by distemper virus which had reached and damaged brain cells. Puppies ordinarily recover from uncomplicated distemper, eventually, but no cure has been found possible for dogs with severe brain damage. Prevention of such encephalitis is one of the main reasons for vaccination of puppies just as soon as possible after colostral protection has faded and before exposure to virulent disease can occur. This time now can be determined by the Distemper Nomograph.

Studies were made comparing distemper virus with measles virus, which sometimes causes similar encephalitis in children. These two viruses are not identical.

INFECTIOUS CANINE HEPATITIS An incidence of 50 per cent was found for this disease. A strain of the virus was isolated and studied. The typical disease picture was studied, then described, as it occurs singly, in combination with distemper, or after distemper. In our studies kidney damage was found even more significant than the earlier stage of liver infection, hepatitis, which gave this disease its name. The method of spread utilized by this virus was found similar to that of leptospiras, in which organisms localize in the kidneys and pass out in urine that is infectious for susceptible animals. The relationship of kidney infection to subsequent nephritis and kidney disease in older dogs seems probable.

DUAL INFECTION FOUND Dogs were found with viruses of both distemper and infectious canine hepatitis at the same time, as well as with either disease preceeding the other. Except for laboratory-induced infection of mice, such dual infection with two different viral diseases was considered impossible because of "interference phenomena."

FIRST DUAL LIVE VACCINE FOR ANIMALS The first dual-purpose live vaccine for animals was made, tested, and described. With similar vaccine, dogs can be protected against both diseases with one injection. Many dogs in our laboratories have been protected by this vaccine.

In addition, since January 1, 1959, vaccine made and tested at the Institute according to our published methods, has been sent to a number of veterinarians, in many sections of the United States. These veterinarians are cooperating with our Distemper Evaluation Laboratory in testing the effectiveness and duration of this vaccine, when used, in actual field conditions, on puppies from kennels of dogs bred and reared for all of the various purposes for which dogs are commonly reared, such as hunting and other sports, field trials, dog shows, commercial breeding for sale, for medical, pharmacological, or nutritional research, or as pets in the home.

All of these puppies were vaccinated according to our Distemper Nomograph. Serum samples were taken for study, from each mother before whelping and from each puppy before and after vaccination. Of these different puppies vaccinated with our vaccine, by ten different veterinarians in different parts of the country, all but six of the 403 puppies became immune, an average of 98.8 per cent.

IMMUNIZATION PROGRAM We have planned, tested, and then reported a program whereby all dogs can be given similar successful vaccination against distemper and infectious canine hepatitis, provided the vaccines and methods used are efficient.

(a) Modern standards were developed, and the methods published, by which various batches of vaccines or serums can be tested by easily read laboratory tests, which show whether or not there is present:

In vaccines: sufficient amount of virus to immunize.

In serums: number of antibodies to give immediate protection.

We have recommended the adoption of modern standards, and some companies already have adopted them, as a forward step in consistent production of better vaccines. We cannot recommend the use of any vaccine or serums which are not so standarized.

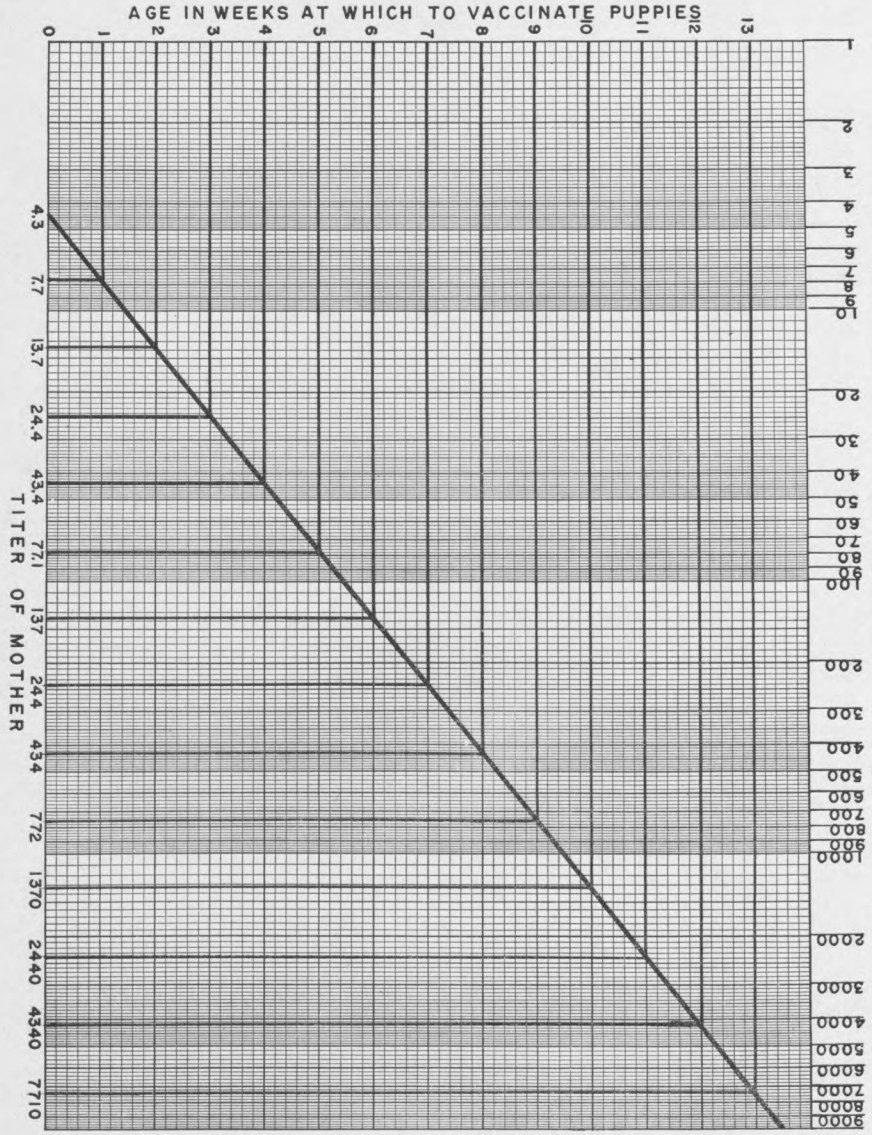
(b) Proper use of vaccine: the proper age to vaccinate young puppies depends upon the mother's immunity. The proper age now can be determined before the puppies are born by use of the Distemper Nomograph.

(c) Serological service, by which immunity can be checked, as revealed by antibodies in blood serum. For various reasons, some animals do not or cannot develop immunity, or lose it rapidly. It is well to know this as soon as possible, so that, if necessary, vaccination can be repeated. We recommend such a blood test, if possible, about one month after each vaccination to determine if immunity has developed.

(d) No vaccine that we have tested gives permanent immunity in every case after one injection. The duration of immunity varies in each individual. Therefore, an annual serological test, to determine whether or not revaccination for distemper is needed, is recommended in connection with an annual physical examination of each dog. If a serological test is not possible, then each dog should be revaccinated routinely once a year, if live vaccine is used, or every six months with killed vaccine.

For the past two years, independent serological and Distemper Nomograph service for dogs has been available, for a laboratory fee, from the Diagnostic Laboratory of the New York State Veterinary College, Cornell University, Ithaca, New York. We hope eventually to see similar serological and Nomograph service made available more generally throughout the United States.

THE DISTEMPER NOMOGRAPH



Protection is obtained during the first 24 hours of life from ingestion of colostrum, or the first milk after birth of young. This provides antibodies of all the infectious diseases to which the mother is immune. If a vaccine is given while colostral protection is still present, it cannot establish immunity.

LEPTOSPIROSIS Of the many types of leptospiras known, three were found most commonly in dogs:

Leptospira canicola is most prevalent in dogs; 10 per cent to 25 per cent are infected.

Leptospira icterohemorrhagiae is most prevalent in rats; 2.5 per cent dogs are infected.

Leptospira pomona is most prevalent in cattle and swine; 1.5 per cent dogs are infected.

Different types of leptospiras do not immunize against one another. All are infectious for man, although not diagnosed commonly. All dogs routinely should be vaccinated against *L. canicola,* the most prevalent form found in dogs. Dogs that hunt rats should be protected also against the rat form, while dogs that run with cattle or swine, or in pastures or ponds used by these animals, should have protection against *L. pomona,* in addition.

A vaccine against leptospirosis was developed for dogs at the Institute.

A treatment was described to eliminate leptospiras in the urine of carriers of this disease.

HAND-REARED PUPPIES Successful rearing was accomplished of orphaned puppies or puppies which could not nurse their mother. A nutritious, easily prepared diet, similar to that of the mother's milk, was prepared and fed three times daily. Our methods have been described fully in a publication on this subject, and free copies may be obtained upon request.

PUPPY INCUBATOR MADE A puppy incubator was developed with the help of Mr. John M. Olin. Sufficient heat, near that of body temperature, proved one of the most important factors for health in the early days of life, because chilling of the baby puppy is nearly always fatal.

STUDIES OF COLOSTRUM Studies showed that puppies absorbed colostral protection only during the first 24 hours of life, although colostrum is secreted by the mother for several days.

Puppies are born with about 3 per cent of the mother's antibody titer, received *in utero.* This disappears by the time the puppy is two weeks old, if it has received no additional antibodies from colostrum, and at that time the puppy can be vaccinated successfully.

HEALTHY DOGS We have developed and used methods for rearing healthy dogs, free from infectious diseases. Our methods and kennel plans have proved useful to many other institutions and individuals who breed and rear large numbers of dogs.

DEFINED NUTRITION Nutrition is being studied in relation to resistance to disease, antibody formation, and quick recovery from disease.

DURATION OF IMMUNITY Three years have been completed of a study of duration of immunity found after recovery from distemper and after various types of vaccines.

RESEARCH FOR THE CONTROL OF DISEASES IN CATTLE

Recently, the importance of work here on infectious diseases of dairy cattle was recognized by more than thirty leading milk marketing cooperatives, who have expressed a wish to support further studies. Valuable cooperation has been received from veterinarians in field tests of new combined vaccines we have made for cattle, in which one injection immunizes against several diseases. This is an important economic consideration for owners of livestock. At present, many thousands of animals may be left unvaccinated because of time and labor costs involved merely in assembling herds of livestock for vaccination. Combined vaccines, in which one injection will give protection against many diseases, should prove of great value to more efficient production of livestock.

In addition to general problems of abortion, calf losses, and pneumonias, detailed studies have been made on specific diseases, as indicated below.

LEPTOSPIROSIS With the first strain isolated in the United States from cattle, and transferred since that time in fertile eggs each five days, the first vaccine against this disease was made, tested, and described. Characteristics of the disease and its means of spread were studied. The first antigen for laboratory diagnosis of this disease was made.

VIRUS DIARRHEA OF CATTLE A strain was grown from cattle in New York State and compared with strains from other localities. We have made a vaccine, which after laboratory tests, is being field-tested for the second year.

INFECTIOUS PUSTULAR VAGINITIS AND INFECTIOUS BOVINE RHINOTRACHEITIS By careful serological studies, viruses from these two apparently different diseases of cattle were compared and found identical. As shown by the names originally selected, this one virus can affect different tissues of the body.

SHIPPING FEVER A virus related to Parainfluenza 3 has been isolated and is being studied.

A MASTITIS OF CATTLE Preliminary work, now entering its second year, is being conducted on an agent isolated at the Institute from cows with a mastitis.

MIYAGAWANELLA BOVIS The first strain of this organism in the United States was isolated at the Institute from cattle in New York State, and found to be a member of the psittacosis-lymphogranuloma group. It can cause inapparent, unrecognized infection in some animals, while others, especially young calves, may be severely affected. Resistance to the disease seems related to colostral protection.

RESEARCH ON THE CONTROL OF DISEASES IN SWINE

DISEASE-FREE PIGS The Institute's disease-free pig colony has proved important in studies of diseases of swine. The method used here for producing disease-free pigs is simple but accurate. It has been used also in field studies on farms in New York State, to determine whether it would be practical for veterinarians and farmers interested in such disease-free animals for the commercial production of swine. Plans of our disease-free building and methods used here have been described to workers in other states, in which swine production is of great economic importance. Agricultural engineers have expressed much interest in this subject.

TRANSMISSIBLE GASTROENTERITIS This baffling viral disease of swine has been studied carefully for many years here. The virus has been grown in tissue culture, but thus far the disease still proves resistant to vaccination.

HOG CHOLERA After earlier preliminary reports, in 1951 the work was described to the AVMA concerning our development of the first attenuated vaccine effective against hog cholera, following transfer and attenuation by our alternation technique in rabbits of this hitherto host-specific virulent virus. A number of commercial companies now produce attenuated hog cholera vaccines, and the majority of states gradually have outlawed the old method of simultaneous vaccination with fully virulent virus and serum.

According to USDA reports, "Hog cholera has declined markedly in the last ten years. In 1951 the USDA condemned 8,237 swine carcasses with hog cholera; in 1959 the number was only 1,748." But losses from this one disease still are estimated as costing $50,000,000 each year, since only one-third of all pigs produced are vaccinated. The folly of such a policy is being

recognized in some large areas this year, in which the mortality rate in unvaccinated herds is 100 per cent.

Our first important discoveries with colostrum from immune and nonimmune mothers were with hog cholera research. Hundreds of colostrum samples from sows have been taken and studied since that time, and analytical studies still are being made on the mechanism and substances which can provide this protection.

LEPTOSPIROSIS Studies similar to those described for cattle have been made and reported on this important disease of swine. In some parts of the country the disease seems enzootic in swine, and they should, therefore, not be allowed to mingle with cattle, in which the disease may be even more severe and costly.

MISCELLANEOUS STUDIES

FISH As yet unpublished studies have been made from time to time, using axenic fish, completely free of bacteria or other organisms. As described many years ago in the original paper, living baby fish are removed from the mother with a sterile pipette, and then are reared in germ-free water, and are fed germ-free food.

DEER AND OTHER WILD ANIMALS Studies, as yet unpublished, have been made upon wild animals, as they became available, especially to determine the incidence of leptospiras, and the possibility that dogs, cattle, and other domestic animals might become infected from this source.

CATS A member of the psittacosis-lymphogranuloma group of organisms, *Miyagawanella felis,* was isolated first from kittens from Ithaca, and has been studied here. The disease, which causes a pneumonitis in cats, is found all over the United States. A vaccine, which reduces markedly the severity of this disease, was made.

RESEARCH AND WORK FOR MORE EFFECTIVE VACCINES

Nowhere has there been a greater source of misunderstanding, bewilderment, anger, and heartbreak, as well as severe economic loss, than in the use of vaccines that, for various reasons, did not and could not immunize.

Vaccines must be properly made with proper standards, properly distributed, properly handled at all times, and properly given by the proper method at the proper time.

Biological and pharmaceutical products are of great importance to the

health of animals and also to the establishment and maintenance of cordial relationships between veterinarians and their clients and between commercial companies and their clients.

At the specific request of supporters of the Institute, we have studied and discussed many of the problems connected with making, testing, and using effective vaccines. Hundreds of specimens of organisms have been sent to scientists in this country and abroad. Scientists from many different commercial companies have been trained for varying periods of time in our laboratories at the Institute. Methods have been published and reports given at scientific meetings. Problems have been discussed with representatives of industry, with veterinary groups, and with the various governmental agencies concerned with licensing vaccine producers, in attempts to have more modern and efficient methods understood and adopted.

Although we have not been interested primarily in developing vaccines as such at the Institute, laboratory work in handling and studying various infectious organisms has resulted in attenuation of many valuable strains suitable for vaccine production.

Recently the interesting fact has been pointed out to us that since World War II, almost every new vaccine produced in this country, as well as many vaccines produced in other countries of the world, for the prevention of infectious diseases in mammals other than man, was originated by staff members of our Institute, or by former members or persons who were trained here or received their instructions and vaccine strains from organisms that we have isolated, purified, modified, and kept alive for this useful purpose by continuous serial passage year after year.

Some of these vaccines developed and studied at the Institute by our staff members include:

1. Canine distemper,
2. Infectious canine hepatitis,
3. The first combined live vaccine for animals, using distemper and infectious canine hepatitis in a dual vaccine,
4. A vaccine for leptospirosis of dogs,
5. A vaccine for feline pneumonitis,
6. The first hog cholera vaccine attenuated by rabbit passage,
7. The first vaccine for leptospirosis of cattle,
8. The first vaccine for virus diarrhea of cattle,
9. An experimental vaccine for a mastitis of cattle, that is still being studied,
10. Various combinations of the above vaccines for cattle.

TEACHING AND TRAINING

We have organized and taught the first virology courses in a veterinary college. Graduate and postgraduate scholars have been trained here in the first tissue culture laboratory used in a veterinary college. At the present time, some of these men trained at Cornell are the only ones in their respective countries who can conduct work of this sort.

In the fields of virology and immunology, there have been trained at the Institute nine candidates for the Ph.D. degree and five for the M.S. degree, while some of the postgraduate scholars and fellowship holders have included one stationed here by the United States Army, one by the United States Navy, as well as many other students from the United States, a Commonwealth Scholar from England, a Rockefeller Foundation Scholar from Peru, three students holding fellowships from Canada, one from Korea, two from Switzerland, two from India, one from Iran, and three from Turkey.

FUTURE DEVELOPMENT OF THE INSTITUTE

We hope to be able to continue studies that can contribute to better health and the prevention of diseases. Much needs to be learned, and many wish to be taught.

Within a very short time the veterinary scientist will be responsible for more efficient production of livestock and other animals necessary to the welfare of the world and to the world economy. The United Nations Food and Agriculture Organization recognizes that today two-thirds of the world's population suffers from chronic hunger and starvation, especially in regard to sufficient protein intake. This is considered a primary cause of the misery and attendant political unrest in countries so affected. And this potential increases as the world's population increases, at the rate of 120,000 each day. While cities are steadily growing larger, the numbers of food producers are decreasing rapidly in nearly all sections of the world.

Somehow, more and more food will have to be produced, by fewer people, for many more people. Certainly this will have to be done much more efficiently and without the unnecessary losses from infectious diseases prevalent today. In the United States alone losses from diseases of livestock are estimated to cost the incredible sum of $3,000,000,000 each year. Intelligent application of effective vaccines could prevent much of this loss. But at the present time, many owners of animals state that they cannot afford vaccination. We hope that with better understanding, with improved vaccines, and with more economical combined vaccines, these owners will realize that they cannot afford *not* to have protection from vaccines. We hope to continue studies on the development of new vaccines and proper methods for their use. We wish to continue research, using newer techniques now available in tissue

culture, electron microscopy, and fluorescent antibody studies, on the relationship between infectious organisms and their hosts at the internal cellular level.

Recently the Institute has added a special unit with equipment for fluorescent antibody studies. In the Microbiology Laboratory, office space is being remodeled in order to add more isolation booths for special research. In the Cornell Research Laboratory for Diseases of Dogs, the former offices of both Daynemouth and Giralda Divisions recently have been remodeled into additional laboratories, while the former entrance lobby has been converted into a central office. Present facilities now have been expanded to their utmost, because overcrowding in a virus laboratory can be fatal to accurate work.

During the past year many of you were pleased to read an announcement that the United States Public Health Service has approved a grant to Cornell of $137,000 for construction of additional facilities at the Institute in order to expand tissue culture and biochemical laboratories, provided we can supply additional matching funds. We have until next June to do this.

Such additional facilities, with an increased staff, would of course allow additional work, teaching, and training, if sufficient additional funds could be provided to cover the increased costs. But whether or not the new building is provided, we anticipate an exceedingly busy and interesting future, with continued worthwhile accomplishments from the Institute.

We have enough information available to conquer distemper, and that remains one of the primary goals of the Cornell Research Laboratory for Diseases of Dogs. We wish to continue serological studies that have been in progress for some years so that a Hepatitis Nomograph, similar to that for distemper, can be developed.

We hope to continue important studies, already begun, in the prevention of disease through methods other than by vaccination. Observation shows that, with nearly all infectious diseases, individual variations in immunity are found. This easily can be recognized, for instance, in influenza epidemics, during which some individuals may die, some recover after serious illness, some show only slight evidence of disease, while others have no visible ill effects, yet all have been exposed alike to the same virulent virus. Obviously, conditions operating at cellular level within each individual can determine whether he dies or lives, and how sick he may become. The individual who does not become sick is resistant, not always because of previous exposure and development of antibodies, but because of factors that we term "nonspecific." Discovery of these factors would be an important contribution to health and long life. Work in this direction has been under way at the Institute for some years, and already there is some promise of success in the future. Perhaps some of these exact answers will be found and analyzed during the next decade of work at the Institute.

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