**Veterinary medical science and human health : veterinary activities of agencies of the United States Government in relationship to functions performed by State and local governments, private groups, and intergovernmental organizations / Prepared for the Committee on Government Operations, U.S. Senate and its Subcommittee on Reorganization and International Organizations (pursuant to S. Res. 347, 85th Congress, and S. Res. 42 and 255, 86th Congress).**

87th Congress
1st Session } COMMITTEE PRINT

# VETERINARY MEDICAL SCIENCE AND HUMAN HEALTH

## VETERINARY ACTIVITIES OF AGENCIES OF THE UNITED STATES GOVERNMENT IN RELATIONSHIP TO FUNCTIONS PERFORMED BY STATE AND LOCAL GOVERNMENTS, PRIVATE GROUPS, AND INTERGOVERNMENTAL ORGANIZATIONS

PREPARED FOR THE

COMMITTEE ON GOVERNMENT OPERATIONS
UNITED STATES SENATE

AND ITS

SUBCOMMITTEE ON REORGANIZATION AND INTERNATIONAL ORGANIZATIONS
(PURSUANT TO S. RES. 347, 85TH CONGRESS, AND S. RES. 42 AND 255, 86TH CONGRESS)



AUGUST 10, 1961

Printed for the use of the Committee on Government Operations

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## LETTER OF TRANSMITTAL

U.S. SENATE,
*August 10, 1961.*

Hon. JOHN L. MCCLELLAN,
*Chairman, Senate Committee on Government Operations,*
*Senate Office Building, Washington, D.C.*

MY DEAR MR. CHAIRMAN: For the information of the subcommittee and of the Senate, there is submitted herewith a publication entitled, "Veterinary Medical Science and Human Health."

This is the 11th in a series of publications issued by this subcommittee as part of its international health study. The 10 previous publications in the series are listed on page v.

Each of these publications has been developed by the staff at my request in cooperation with various authorities. Our purpose has been to fulfill the survey mission which the Senate conferred upon us. The original resolution which authorized the study was Senate Resolution 347, 85th Congress (as extended by S. Res. 42 and 255, 86th Cong.). Senate Resolution 347 provided for a complete study—

*** * * of any and all matters pertaining to international health research, rehabilitation and assistance programs * * * and * * * the coordination of programs related to international health.**

Under rule XXV of the Standing Rules of the Senate, the Committee on Government Operations is entrusted with the responsibility of—

**Budgeting and accounting measures other than appropriations * * ***
**Studying intergovernmental relationships * * * between the United States and international organizations of which the United States is a member.**

The print was compiled with the assistance of numerous official and private authorities, working at our invitation, with the Agricultural Research Service of the U.S. Department of Agriculture.

Its publication by the subcommittee is not intended to convey policy conclusions by the subcommittee itself; rather, it is intended to provide a factual framework for the subcommittee's future review.

With kindest wishes, I am,

Sincerely yours,

HUBERT H. HUMPHREY,
*Chairman, Subcommittee on Reorganization*
*and International Organizations.*

## PUBLICATIONS ISSUED BY SUBCOMMITTEE IN INTERNATIONAL HEALTH STUDY

### Committee Prints

Committee Print No. 1 (S. Rept. 160, 86th Cong.) was entitled "International Medical Research—A Compilation of Background Materials" (117 pp.). It set forth highlights of international research contributions in most of the major fields of disease, in addition to fulfilling other background purposes.

Committee Print No. 2 was entitled "Statutory Authority for Medical and Other Health-Related Research in the U.S. Government—The Basis for International Cooperation" (66 pp.). It contained the texts of the legal authority for medical research efforts by diverse agencies of the U.S. Government.

Committee Print No. 3 (S. Rept. 161, 86th Cong.) was entitled "The Status of World Health—In Outline Text and Chart" (81 pp.). Within it were presented charts on the incidence of certain major diseases throughout the world.

Committee Print No. 4 was entitled "The United States and the World Health Organization—Teamwork for Mankind's Well-Being" (145 pp.). It represented a personal report of the chairman of the subcommittee on the subject of WHO, based upon his conferences with the organization's officials and other authorities in Europe and on subsequent review.

Committee Print No. 5 (S. Rept. 1009, 86th Cong.) was entitled "Cancer—A Worldwide Menace; Some Facts and Figures on Its Incidence in the United States and Abroad" (40 pp.). It presented text and charts on the patterns of occurrence of malignant neoplasms in different countries of the world.

Committee Print No. 6 was entitled "Patterns of Incidence of Certain Diseases Throughout the World—Opportunities for Research Through Epidemiology" (54 pp.). It summarized epidemiological leads on important chronic and degenerative diseases in various nations. These leads, if followed carefully, may provide insight in the chain of discovery as to the cause and cure of maladies.

Committee Print No. 7 was entitled "The National Science Foundation and the Life Sciences" (96 pp.). It described domestic and international activities of the National Science Foundation and, principally, its work in the life sciences.

Committee Print No. 8 (S. Rept. 1038, 86th Cong.) was entitled "Rehabilitation of the Disabled in Thirty-Seven Countries of the World—Domestic Programs and International Activities in Technical Assistance" (153 pp.). It summarized activities in rehabilitation carried on in the United States and in other nations by official and

nongovernmental organizations. The account of the official work abroad included assistance rendered by U.S. Government, foreign government and intergovernmental organizations.

Committee Print No. 9 was entitled "Health in the Americas and the Pan American Health Organization—Program of the Pan American Health Organization of the World Health Organization in the Americas" (105 pp.). It presented a summary of activities of this intergovernmental organization. This includes its activity as regards communicable diseases, specific health problems, environmental sanitation, health services and facilities, coordination of research, health manpower as well as PAHO's possible future role.

Committee Print No. 10 was entitled "Radiation Research in the Life Sciences" (175 pp.). It summarized information on the magnitude, organization, and distribution of programs in fields such as radiation biology, genetics, toxicology, protection, detection and measurement, education and training, as well as in environmental radiation, agricultural application, and related fields.

## Hearings

Hearings—Part I (310 pp.): Transcript of testimony by medical experts in Washington, D.C., in July 1959 and of discussions in Western Europe in November–December 1958 on long-range trends, opportunities and challenges in international medical research.

Hearings—Part II—Appendix (443 pp.): Exhibits from official sources—U.S. Government agencies, intergovernmental organizations, and foreign nations as regards international health cooperation.

Hearings—Part III—Appendix (490 pp.): Similar exhibits from nonofficial sources—deans of American and foreign medical schools, winners of the Nobel Prize, officers of professional medical organizations, and others, as regards international health teamwork.

"Coordination of Activities of Federal Agencies in Biomedical Research" (251 pp.): Testimony given in Washington in August 1960, together with 69 exhibits, on teamwork of Federal organizations supporting life sciences research, particularly in the management of information on current projects.

## Report

Senate Report 142, 87th Congress, Part I (316 pp.): It contained a series of policy conclusions by the Committee on Government Operations on coordination of Federal biomedical research. The bulk of part I consisted of an agency-by-agency description and itemization of health-related expenditures.

# CONTENTS


| | Page |
|---|---|
| Letter of transmittal | III |
| Publications issued by subcommittee in International Health Study | V |
| Statement by Hon. Hubert H. Humphrey | XI |
| Findings | XVII |
| Part I. Summary of the nature and significance of veterinary medicine | 1 |
| Section 1. Definition and scope | 1 |
| Section 2. Summary of groups involved | 1 |
| Section 3. Summary of the interrelationship of animal and human health | 5 |
| A. Advancement of health of animals | 5 |
| B. Advancement of health of man | 11 |
| 1. Protection of man from zoonoses | 12 |
| 2. Research and laboratory animals | 13 |
| 3. Research, regulation and food supply | 15 |
| Part II. Veterinary medical activities supported by U.S. Government and by State and local governments | 19 |
| Section 1. Federal organizations and their expenditures | 19 |
| Section 2. Survey of who is doing what and where in research | 26 |
| Section 3. The work of specific units | 28 |
| A. Animal Disease and Parasite Research Division, Agricultural Research Service | 28 |
| B. Experiment stations and veterinary science departments of land-grant colleges and State universities | 42 |
| C. Entomology Research Division, Agricultural Research Service | 45 |
| D. National Institutes of Health, U.S. Public Health Service | 51 |
| E. Communicable Disease Center, Public Health Service | 57 |
| 1. Zoonoses research | 57 |
| 2. Veterinary Public Health Laboratory | 68 |
| F. Radiological health | 71 |
| G. Air pollution research in the Public Health Service | 73 |
| H. National Academy of Sciences—National Research Council | 74 |
| I. Fish and Wildlife Service, Department of the Interior | 78 |
| Section 4. Veterinary medical education | 79 |
| A. Introduction | 79 |
| B. Colleges of veterinary medicine | 81 |
| C. Veterinary medical licensure | 86 |
| Section 5. Veterinary food hygiene | 87 |
| A. Introduction | 87 |
| B. Meat Inspection Division, Agricultural Research Service | 89 |
| C. Poultry Division, Agricultural Marketing Service | 94 |
| Section 6. Animal disease prevention, control, and eradication | 95 |
| A. Introduction | 95 |
| B. Role of the private practicing veterinarian | 98 |
| C. State animal disease control agencies | 102 |
| D. Animal Disease Eradication Division, Agricultural Research Service | 103 |
| E. Animal Inspection and Quarantine Division, Agricultural Research Service | 117 |
| Section 7. Military veterinary medicine | 119 |
| A. Introduction | 119 |
| B. The Veterinary Corps of the Army and Air Force, Department of Defense | 120 |
| Section 8. Veterinary public health | 138 |
| A. Introduction | 138 |
| B. Veterinary public health at the local, State, and Federal levels | 140 |
| C. Food hygiene in the Public Health Service | 142 |
| D. Veterinary public health programs in the Communicable Disease Center | 144 |

| | Page |
|---|---|
| Part III. National veterinary medical organizations of the United States | 153 |
| Section 1. Introduction | 153 |
| Section 2. The American Veterinary Medical Association | 155 |
| Section 3. Specialty boards | 160 |
| A. American Board of Veterinary Public Health | 160 |
| B. American Board of Laboratory Animal Medicine | 161 |
| C. American College of Veterinary Pathologists | 162 |
| Section 4. U.S. Livestock Sanitary Association | 162 |
| Section 5. National Assembly of Chief Livestock Sanitary Officials | 164 |
| Section 6. Association of Deans of American Colleges of Veterinary Medicine | 164 |
| Section 7. Association of State Public Health Veterinarians | 165 |
| Section 8. Conference of Public Health Veterinarians | 165 |
| Section 9. Animal Care Panel | 166 |
| Section 10. Zoo Veterinarians Association | 167 |
| Part IV. Veterinary medical drugs and biologicals | 169 |
| Section 1. Introduction | 169 |
| Section 2. Animal Inspection and Quarantine Division, Veterinary Biologics Control, Agricultural Research Service | 171 |
| Section 3. Veterinary Medical Branch, Food and Drug Administration | 172 |
| Section 4. Veterinary Biological Licensees Association | 175 |
| Part V. Organizations active in veterinary medicine in the international sphere | 179 |
| Section 1. Introduction | 179 |
| Section 2. International Cooperation Administration | 182 |
| Section 3. Foreign Agricultural Service | 184 |
| Section 4. Foreign Research and Technical Programs Division, ARS | 188 |
| Section 5. Food and Agriculture Organization | 190 |
| Section 6. World Health Organization | 196 |
| Section 7. Pan American Health Organization | 202 |
| Section 8. World Veterinary Association | 204 |
| Section 9. Pan American Congress of Veterinary Medicine | 206 |
| Section 10. International Office of Epizootics | 207 |
| Section 11. United Nations Educational, Scientific and Cultural Organization | 209 |
| Section 12. National Veterinary Establishments in Foreign Countries | 210 |
| Section 13. The international challenge | 216 |
| Part VI. Observations on veterinary medical research | 221 |
| Section 1. Organization, financing and goals of veterinary effort | 221 |
| Section 2. Management of information on veterinary science | 227 |
| Appendix A. Veterinary medicine—list of indexing and abstracting journals | 234 |
| Appendix B. The Veterinary Bulletin | 234 |
| Appendix C. Veterinary medicine libraries | 235 |
| Section 3. Veterinary medical education and international research and assistance | 238 |
| Indexes | 245 |
| 1. Contributors | 245 |
| 2. Abbreviations | 245 |
| 3. Selected subjects and individuals | 246 |

## FIGURES


| *Number and title* | Page |
|---|---|
| 1. Principal sciences in veterinary medicine | 2 |
| 2. Principal sciences in agricultural science | 3 |
| 3. Interrelationship—veterinary and human medicine | 11 |
| 4. What cattle supply man | 18 |
| 5. Human health products from animals | 18 |
| 6. Achievements made possible by a basic research discovery | 29 |
| 7. USDA veterinary research | 30 |
| 8. Veterinary education in the United States | 42 |
| 9. Atomic research breakthrough | 48 |
| 10. Virus encephalitides | 65 |
| 11. Practicing veterinarian—protecting man and his animals | 99 |
| 12. Farmer-veterinarian cooperation—the foundation of U.S. animal health | 100 |
| 13. Supporting forces behind the practicing veterinarian | 100 |
| 14. Highlights in the fight—United States vs. Animal Diseases | 105 |
| 15. Transmission of brucellosis from animals to man | 107 |
| 16. Brucellosis-undulant fever | 108 |
| 17. Tuberculosis reactors | 110 |
| 18. International cooperation—Mexico-United States aftosa eradication | 113 |
| 19. Health activities performed by veterinarians | 140 |
| 20. Some transmissible diseases common to man and animals | 146 |
| 21. Age-group distribution of human rabies deaths | 147 |
| 22. Rabies | 149 |
| 23. Principal sylvatic rabies areas of the United States | 150 |
| 24. AVMA membership and total veterinarians | 158 |
| 25. ICA veterinary medical aid 1952–59 | 183 |
| 26. Foot-and-mouth disease or rinderpest | 187 |
| 27. Some major animal diseases of the world | 197 |


## TABLES


| | |
|---|---|
| 1. Obligations for USDA and related veterinary activities, Federal and non-Federal funds, fiscal year 1960 | 22 |
| 2. Other agencies' obligations in veterinary medicine, fiscal year 1960 | 23 |
| 3. USDA veterinary medical research: Estimated obligations and projects, fiscal years 1960 and 1961 | 24 |
| 4. Veterinary research supported by other Federal granting agencies, fiscal year 1960 | 24 |
| 5. Epidemiological aspects of some of the zoonoses | 58 |
| 6. Veterinary colleges in the United States | 82 |
| 7. Preprofessional training of first-year veterinary students, 1958–59 | 83 |
| 8. Estimated annual livestock and poultry losses in the United States, 1942–51 | 106 |
| 9. Reported cases of rabies in the United States, 1946, 1956, and 1958 | 148 |
| 10. Foreign veterinarians in U.S. training programs arranged by Foreign Research and Technical Programs Division, Agricultural Research Service, 1956 to 1959: by countries | 188 |
| 11. Research on animal diseases supported overseas under Public Law 480 | 189 |

## STATEMENT

### By Hon. Hubert H. Humphrey, Chairman, Subcommittee on Reorganization and International Organizations

---

This study is probably the first of its kind ever issued by a committee of the Congress. It is a Government-wide review of the relationship of veterinary medical science to human health.

As such, it is of deep significance to the well-being of every citizen of our land, as well as peoples throughout the world.

Paradoxically, a layman, at first glance, might consider this report as "outside the scope of his own health."

The layman might think of veterinary medicine "as a matter of interest only to the farmer," for example, or "only to the owner of a household pet."

Actually, veterinary medical science is part and parcel of biology and medical science as a whole. The history of the progress of man's battle against disease is rich with illustrations of that fact.

Some of the greatest chapters in the annals of biomedical discovery have had their genesis in the field of veterinary medicine. Consider the unforgettable episodes of Robert Koch and the discovery of anthrax bacillus; Louis Pasteur and the treatment of rabies; Theobald Smith, F. L. Kilborne, Cooper Curtice and the finding of the tick as the carrier of cattle fever. These and many other historic landmarks are part of the legacy of scientific research as a whole.

From these and earlier origins dating as far back as 3000 B.C. and Hammurabi's Code has arisen today's flourishing science of veterinary medicine. It is to the exploration of this particular field of scientific endeavor that this print is devoted.

#### $65 MILLION OF U.S. SPENDING

While the research phase is highlighted herein, it is shown within the broad perspective of activity in veterinary medicine as a whole.

Approximately $65 million a year are spent by the Federal Government in activities of a direct veterinary nature.

Additional resources of America's taxpayers are expended for veterinary activities on the part of State and local governments.

#### COMMITTEE'S RESPONSIBILITY UNDER RULES OF SENATE

Our subcommittee's objectives are quite specific and arise out of the mandate given to us by the Senate.

The mandate is threefold:

A. It arises principally from the responsibility of the Committee on Government Operations under the Standing Rules of the Senate. Rule XXV states that to this committee—

> * * * shall be referred all proposed legislation, messages, petitions, memorials, and other matters relating to the following subjects:
> (A) Budgeting and accounting measures, other than appropriations.
> (B) Reorganizations in the executive branch of the Government.
> (2) Such committee shall have the duty of
> * * * * * * * *
> (B) studying the operation of Government activities at all levels with a view to determining its economy and efficiency;
> * * * * * * * *
> (D) studying intergovernmental relationships between the United States and the States and municipalities, and between the United States and international organizations of which the United States is a member.

### MANY OFFICIAL ORGANIZATIONS INVOLVED

Because of the scope of this mandate, this committee is in a unique position to survey Government-wide activities in veterinary medicine, both domestically and on the international scene.

The fact is that these activities are so broadly distributed among so many official instrumentalities that only within a comprehensive jurisdiction such as that of our committee can a sufficiently broad-gaged view be taken.

Specifically, this print describes how the resources of America's taxpayers are expended in veterinary medical activities within (*1*) the U.S. Department of Agriculture and (*2*) the Department of Health, Education, and Welfare as well as within intergovernmental organizations of which we are a member, such as (*1*) the Food and Agriculture Organization, (*2*) the World Health Organization, and (*3*) the Pan American Health Organization.

### MANDATE UNDER SENATE RESOLUTION

B. Our second source of authority consists of a specific authorization in the form of Senate Resolution 347, 85th Congress (as extended by S. Res. 42, 86th Cong.), which authorized a study of "any and all matters pertaining to international health research, rehabilitation and assistance programs."

It is clear that no such study could be complete without detailed references to veterinary medicine.

Earlier publications in our subcommittee's series have already briefly touched upon this field, as will be indicated hereinafter. Several future publications may also refer to it. But it is this print which represents our principal effort to discharge our responsibility for description of the role of veterinary medicine in international health.

### STUDY OF INTERAGENCY COORDINATION

C. Our third source of authority is Senate Resolution 255, sections 1–4, 86th Congress. It extended the authority of the International Health Study to January 31, 1961, and broadened the scope to

coordination of agency domestic activities as well. The resolution provided:

*Resolved*, That the Committee on Government Operations, or any duly authorized subcommittee thereof, is authorized under sections 134(a) and 136 of the Legislative Reorganization Act of 1946, as amended, and in accordance with its jurisdiction specified by rule XXV of the Standing Rules of the Senate—

(a) to complete its study of worldwide health research, assistance, and rehabilitation matters; and

(b) to examine, investigate, and make a complete study of any and all matters in scientific and other fields where there may be indications of a need for (a) improved budgeting, accounting, and other managerial practices on the part of agencies of the U.S. Government; (b) strengthened cooperation and coordination among Federal agencies; (c) effectiveness of international organizations of which the United States is a member; and (d) avoidance of Federal duplication of private responsibilities and activities.

Accordingly, this print seeks to develop answers to such questions as:

"Is there sufficient coordination between (*a*) the larger Federal organizations active in veterinary medicine; (*b*) those so engaged and others active almost exclusively as regards the health of man, (*c*) U.S. governmental and intergovernmental groups, etc.?"

### CURRENT LEGISLATIVE AUTHORITY

The present authority for review of interagency problems was provided by Senate Resolution 26, 87th Congress. It directed the Committee on Government Operations to study problems of "interagency coordination, economy and efficiency" through January 31, 1962.

### IMPORTANCE OF REVIEW OF STATE, LOCAL, PRIVATE WORK

It was clear from the very outset of the subcommittee's review that the activity of the Federal Government as such does not stand alone in this field, any more than it does in any other field, directly or indirectly, relating to human health. Basically, medical science in the American system of private enterprise is carried on through the private profession of medicine. Veterinary medical science is no exception.

This report, therefore, devotes a considerable effort toward describing the pertinent work, the accomplishments, the cooperation, from that vast segment of veterinarians, acting as individuals and through organizations—in private life, as well as in State and local governments.

Only by this broad description, we feel, can veterinary medical research and assistance be shown in their full and proper context.

### BASIC OUTLINE OF PRINT

The pattern of organization of this print becomes clear, therefore.

Part I defines our field and summarizes its scope and significance.

Part II initially tells the "Federal story," and then proceeds to relate the role of State and local endeavor.

Part III concentrates on the role of the veterinary medical profession as such.

Part IV continues on the private phase of veterinary science by describing the role of the veterinary medical drug and biological industry.

Part V turns to the international scene—our principal focus under Senate Resolution 347, 85th Congress.

Part VI presents certain personal observations based upon expert communications to the subcommittee.

Following this statement is my summary of the principal findings in the publication.

### BACKGROUND REPORT FOR COMMITTEE

It should be carefully noted that, in accordance with the custom of the subcommittee in connection with committee prints, it is not our purpose to attempt to offer definitive subcommittee conclusions, as such. Rather, it is the purpose of a print of this nature to compile evidence and observations as background for future subcommittee review and decision.

### LIMITATION IN OUR JURISDICTION

Necessarily, the committee has not in the past intruded, and would not now or in the future intrude, upon those phases of responsibility which reside separately under the rules of the Senate in the Committee on Agriculture or in the Subcommittee for the Department of Agriculture of the Committee on Appropriations.

Accordingly, we will not now, nor later, attempt to suggest optimum levels of appropriations. In some instances, individual contributors to this volume have reported to us, in response to our invitation for frank suggestions, that, in their expert judgment, a problem of inadequate funding exists. In these instances, we so relate their judgment herein. But neither the Department of Agriculture nor this committee attempts to evaluate such comments.

The subcommittee has neither the jurisdiction, the time nor the staff with which to attempt a detailed fiscal evaluation. This publication represents but one of a score of medically related topics which we are studying. For all of this work we have but a single professional staff member—the project director, assisted by a small editorial-clerical staff. We could not, therefore, attempt to do more than survey, describe, and relate. Analysis in great depth would not be feasible under the circumstances.

It is not surprising, of course, that men who have dedicated their lives to the veterinary (or any other) profession may feel that more resources should be made available to it, or to some particular phase in which they are personally engaged. Theirs is but one viewpoint, however, and neither this nor any other committee of the Congress could fail to take note of others' viewpoints, particularly as to competitive needs for the finite amount of resources which can be made available.

I, personally, regard with sympathetic interest the suggestions of the various experts, but my personal views and those of other subcommittee members, as individuals, cannot be construed as the formal opinion of the subcommittee, itself.

## NATURE OF PRINT

The print is a composite presentation as regards contents and authorship. It would have to be such; no one source, however competent, could have attempted within the few brief man-months which were available for its preparation to do justice to this vast subject matter.

Here, we see the past, present and a little of the future of veterinary medical science, the role of Federal, State, and local governments, of intergovernmental organizations, and of professional instrumentalities.

So vast is this scope that one relatively small publication could not attempt to do more than touch briefly upon these subjects. We believe, however, that in this relatively limited treatment we may provide a useful reference tool for our committee, for the Senate, for the Congress and the American people.

## PROCEDURE IN COMPILATION OF PRINT

The individual sections of the report were essentially prepared by a great many contributors who are listed in a separate index. (See p. 245 ff.)

Responsibility for the overall compilation and for preliminary editing of the individual presentations, as conveyed by contributors, was vested in the Agricultural Research Service of the Department of Agriculture. At the invitation of the subcommittee, ARS, as we shall hereinafter often refer to it, graciously took on the responsibility for this relatively formidable undertaking. Commendable cooperation was extended to ARS by all of the various contributors.

The subcommittee is deeply appreciative to each and every individual or organization who helped to make the report possible. We are particularly grateful to Mr. Kenneth Haines of the Agricultural Research Service, and to C. D. Van Houweling, DVM, Assistant Administrator of ARS, who was personally responsible for the task in cooperation with our project director, Mr. Julius N. Cahn.

For assistance in editing this report, appreciation is expressed to Mr. Taft Fieman and Mrs. Virginia Lundblad, both of whose temporary services had been made available by the National Institutes of Health for general work of this nature.

The burden for this publication primarily rested upon the Agricultural Research Service, however, and it rose effectively to the challenge.

It is ARS, for example, which is responsible for the series of charts which we believe constitute an invaluable asset to the report.

Since final editing of the contents of the report was the work of the subcommittee staff, the individual contributors and ARS are not responsible for decisions of phraseology or interpretation.

## ADDITIONAL ACKNOWLEDGMENTS

Our listing in the index, commencing on page 245, of the many contributors who provided material for us does not begin to express our

appreciation to them. It is difficult to single out a few who have been particularly helpful. But at the risk of omitting several to whom special thanks should be expressed, we would nonetheless like to acknowledge the cooperation of: Martin Kaplan, VMD, Chief, Veterinary Public Health Section, Division of Communicable Diseases, World Health Organization, with whom we first conferred in Geneva in November 1958; Brig. Gen. J. A. McCallam, VMD, AVMA, Washington Representative; James H. Steele, DVM, Chief, Veterinary Public Health, Communicable Disease Center, Bureau of State Services, U.S. Public Health Service, Atlanta, Ga.; J. G. Hardenbergh, VMD, long a leader in the American Veterinary Medical Association; E. E. Wedman, DVM, Animal Disease Eradication Division, Agricultural Research Service, U.S. Department of Agriculture; Foster Mohrhardt, Librarian, U.S. Department of Agriculture, and numerous others.

It might be noted that, unfortunately, because of the pressure of other subcommittee obligations, publication of the print was delayed. The passage of time has inevitably meant that some of the statistics herein are not as current as we would wish. The fundamental validity of the compilation is, however, we believe, unaltered. Indeed, impressive evidence which has come to the attention of the subcommittee since the original manuscript was completed confirms anew the significance of the volume.

## FINDINGS

The chairman of the subcommittee reports the following findings of fact and judgment. These findings are based upon his personal study and that of the subcommittee staff.

**1. The U.S. Government is spending sums in the order of $65 million a year for veterinary medical science.**

### TWO PRINCIPAL FEDERAL DEPARTMENTS INVOLVED

**2. The Federal agencies engaged in this effort are, principally, the Department of Agriculture and, to a lesser extent, units of the Department of Health, Education, and Welfare.**

**3. Veterinary-medical activities by both Departments have received high commendation from experts in the United States and in other countries who have conveyed their reactions to the subcommittee.**

### OTHER AGENCIES WITH PROGRAMS

**4. The number of other agencies of the U.S. Government involved directly and indirectly in veterinary medicine is larger than might generally be realized.** It includes, for example, small but significant activities on the part of the Atomic Energy Commission (in terms of study of radiation effects), the National Science Foundation (basic research), the Department of Interior's Fish and Wildlife Service (pesticide-wildlife relationships), and other agencies.

### THE AMERICAN VETERINARY PROFESSION

5. There are about 21,000 veterinarians in the United States. A 1958 study revealed that about two-thirds are in private practice, and the remaining one-third are in Government, teaching, research, and commercial activities. A large number of those in private practice give some time to Government activities such as tuberculosis and brucellosis testing, local meat and milk inspection, and rabies control clinics. **The Federal Government is the largest employer of veterinarians; most of these are in veterinary agencies related to agriculture, followed by those in the Defense Department and public health research.** Most State universities have a veterinary teaching and research staff. These are estimated to account for about 5 percent of the veterinarians. A small number of veterinarians carry on research in private industry.

**6. The profession of veterinary medicine is worthy of the admiration and the appreciation of the people of the United States and of other nations.** It has been characterized by high ideals. Its professional societies have made constant efforts to improve their service to man through advancing the health of the animal population.

7. **Veterinary medicine plays a particularly important role in the well-being of the people of the United States in maintaining high sanitation standards to insure wholesome and safe food of animal origin.** Most meat, poultry, and milk inspection come under veterinary inspection.

ECONOMIC SIGNIFICANCE OF VETERINARY PROTECTION

8. **Veterinary medicine is an indispensable guardian of a vast industry in the United States.** Annual livestock and poultry production in the United States is said to exceed 100 million cattle, of which about 25 percent are dairy animals, 110 million pigs, 30 million sheep, and a million or more goats. Poultry production is now exceeding 2 billion broilers; in addition, there are about 400 million laying hens and more than 100 million turkeys raised annually. The value of these animals and their products approaches $50 billion. Cash receipts from livestock products alone in 1959 were $18.8 billion.

In addition to the livestock cited above, many animals are kept for recreational purposes as well as providing companionship for man. These include 3 million or more horses and ponies, 30 million dogs, 30 million cats, and 15 million birds. It is impossible to place any value upon these animals, but the protection of their health is the responsibility of veterinary medicine.

9. **There is a long and fruitful history of collaboration between the Federal and State Governments in the advancement of veterinary science.**

10. **In an age of high-speed transportation of man and animals, Federal and State Governments are confronted with the rising challenge, once disease breaks out, of combating its quick spread across State lines, or, in the case of diseases abroad, their introduction into the United States.**

11. **Wherever scientifically possible and economically feasible, it has been found desirable to eradicate an animal disease in the United States rather than merely to control it.** Eradication, however, requires fullest Federal, State, public, private, professional-layman cooperation and ceaseless vigilance against reintroduction of disease.

12. **Despite successes in the eradication and control of exotic diseases in the past (foot-and-mouth disease, contagious pleuropneumonia, Texas fever, fowl plague), great challenges to veterinary medicine persist.** This is reflected in the fact that animal and poultry diseases and parasites cost the Nation over $2.7 billion annually.

VETERINARY MEDICAL RESEARCH

13. **Veterinary medical research is an indispensable element of research in problems of human health.** Veterinarians have contributed countless valuable discoveries which have, by accident or design, proved applicable sooner or later in improving the health of man. No artificial boundary can or should be maintained between study of the processes of life as they relate to humans or animals. Nature is a unity. Science is a unity.

14. **Veterinary medical research is supported by the U.S. Government, in the 1961 fiscal year in direct amounts believed to be in excess of $13 million.** The Agricultural Research Service and the National Institutes of Health are the two foremost sources of research support. Both have records of outstanding achievement. Important research of a public health character is also carried on by the Communicable Disease Center of the Public Health Service.

15. **Considering the fact that the U.S. Government spent in the 1960 fiscal year an estimated three-fourths of a billion dollars for all types of biomedical research, the proportion allocated for veterinary medical research appears comparatively low.** Or, stated differently, the U.S. Government has hardly begun to capitalize on the opportunities for cross-seeding of research in what may be termed, for lack of a better term, comparative medicine.

16. **No man can estimate the contribution which strengthened studies of comparative pathology alone might make in terms of science's future ability to prevent and overcome diseases of man and animals.** There is reason to believe that excellent opportunities exist for gaining knowledge from studies of cancer and cardiovascular diseases in animals, as well as the aging process.

17. **Veterinary medical research has paid for itself manifold, both tangibly and intangibly, to the people of the United States.** In terms of direct economic savings (based upon losses which would have otherwise occurred), sums many times the costs of research have been conserved. In the tax revenue alone which has been made available because of avoidance of taxpayers' economic losses, the Federal Government has been repaid many times its investment in research.

18. **Cooperation between the research studies of Colleges of Veterinary Medicine and Colleges of Veterinary Medical Science can pay immense additional dividends for fulfillment of their respective and mutual missions.** Interdisciplinary training is, however, increasingly necessary there and among other research laboratories.

19. **Perhaps no single illustration of the interrelationship of research in animal and in human health is more significant than that involving the study of viruses.** In this one field, which cuts across a broad gamut of fields including genetics and the basic processes of life, man may uncover knowledge which he can now only dimly perceive and which may profoundly alter disease diagnosis and therapy.

One phase of the virus problem is seen in the suspected relationship between influenza in swine and the historic pandemic of 1918-19 which swept the world and killed 15 to 20 million human beings.

20. **One of the most important and growing phases of veterinary medicine is its service toward healthy, uniform laboratory animals, for these represent indispensable elements in biomedical research.** The laboratory animal industry is itself today valued in the magnitude of $250 million.

### COOPERATION AMONG FEDERAL AGENCIES

21. **Cooperative relationships which have existed between the Department of Agriculture and the Public Health Service should**

**continue to be strengthened and developed.** Similar relationships should also be developed between other agencies where veterinary medicine is making contributions, such as the Atomic Energy Commission, the National Aeronautics and Space Administration, and the Defense Department.

ANIMALS-IN-SPACE

22. **The multibillion dollar Federal expenditure for man-in-space experiments hinges in considerable part on the research role of animals-in-space.** A sound extrapolation of data on animals requires an intimate knowledge of the animals, themselves, which can come only from veterinary science.

NASA research must draw, in turn, upon knowledge of animals developed by other agencies, if needless duplication is to be avoided. The other agencies have much to learn from NASA pioneering in techniques and instrumentation. An example of the latter is provided in microminiaturized telemetering equipment which monitors and transmits animals' reactions during space trip.

LONG-RANGE, COORDINATED, CREATIVE RESEARCH

23. As indicated in the expert report of the Agricultural Board, National Academy of Sciences-National Research Council, progress in veterinary medicine could be strengthened through "closer coordination in planning research programs."

**The taxpayer's interest can best be advanced by research which proves successful. To best assure success, there must be available the right amount of resources over a necessary period of time.**

Poorly funded, short-range, scatter-shot research programs may, and probably do, prove far costlier than their converses. As the Agricultural Board indicated:

> Support * * * given to a needless repetition of inadequate research projects does not solve disease and pest problems. Repetition of inadequate research is wasteful. Neglecting research just because it may be long term and expensive is false economy.

24. **The essential challenge in veterinary, as in all other types of research, is to stimulate individual creativity.** An environment is essential in which innovation is encouraged. This requires wide freedom for basic research, absence of fear of job insecurity and availability of modern equipment and facilities.

MANAGEMENT OF RESEARCH INFORMATION

25. **The improved organization of information on prepublication, and especially postpublication research, is essential for progress in veterinary medicine.** This means use of the most advanced methods for translation, storage, abstracting, indexing, and retrieval of scientific data, generated at home and abroad. It also means strengthened cooperation between libraries and other communication systems.

The U.S. Department of Agriculture Library has already rendered notable contributions to veterinary and other branches of science. But it and other information facilities could greatly enhance their service if more resources were available for advanced systems and dissemination of data.

VETERINARY BIOLOGICAL INDUSTRY

26. **The branch of the American pharmaceutical industry which is devoted to veterinary drugs and biologicals has played an important role in the advancement of the health of the animal population of the United States and of other nations.**

NEEDS OF VETERINARY MEDICAL COLLEGES

27. **As with all science, the future of this discipline is determined by the skill of its manpower and by the adequacy and effectiveness of their undergraduate and postgraduate training.** The Nation's 18 veterinary medical colleges are probably the most advanced in the world. They themselves would, however, be among the first to concede the problems which they face in competing with other professions for today's and tomorrow's students and in meeting the needs of today's and tomorrow's veterinary medicine. Scholarships and fellowships should be provided for veterinary medicine as they are being provided for other branches of medicine. Otherwise, we will find that the best students will be attracted to other areas of medicine. In addition, adequate career incentives are an indispensable ingredient toward attracting and retaining high-caliber individuals.

POLICY PROBLEMS CONFRONT PRESIDENT, CONGRESS

28. **The executive and legislative branches are confronted with significant policy problems as regards veterinary medical science. These problems concern the choice of how much resources should be made available—not merely for 1 fiscal year, but on a longer range basis, 5 years or 10 years and by whom (Federal and State Governments, private sources).** The decisions can be made only by careful estimates of national needs and requirements, based upon the most expert judgment available from all competent sources.

Veterinary medical science is in flux. The animal population is changing; the Nation's food habits are evolving along new lines. Old problems give way to new challenges. Yesterday's facts will not suffice for tomorrow's projections.

29. **Experts report specifically that across-the-board shortages exist in veterinary medicine—in private practice, public service, education and research.** Possible Federal participation in remedial action to cope with the shortages can and should be effected while bearing in mind the problem of shortages which exist in other fields and by carefully estimating future needs.

30. **The widely reported problem of inadequate and obsolescent facilities for veterinary education, training, and research likewise requires broad-gaged review by the Nation's foremost experts and by policy echelons of Government.**

INTERNATIONAL COOPERATION IN VETERINARY ASSISTANCE

31. In many areas of the world, agriculture is the principal source of income. Its livestock and products constitute a large part of this

income. In the underdeveloped areas livestock is the principal form of capital assets. These animals not only provide food and fiber, but are a source of power, fertilizer, and even fuel. **Veterinary medical technical assistance through the International Cooperation Administration is important in helping the emerging areas to raise their living standards.**

Rising population totals make particularly necessary increases in availability of nutritious elements, such as proteins.

32. **The Food and Agriculture Organization and the World Health Organization are playing valuable roles in veterinary technical assistance both for advancing animal health and protecting human health.**

33. **Veterinary medicine has played an important role in protecting the health of American servicemen stationed throughout the world.** It has also provided valuable assistance to many countries in reestablishing livestock production. Its role in protecting the health of servicemen overseas has increased with the recognition of new veterinary public health problems.

### INTERNATIONAL COOPERATION IN VETERINARY RESEARCH

34. **As in all other fields of science, the United States is deeply indebted to foreign veterinary and other scientists for outstanding contributions to veterinary medicine.**

35. **Excellent opportunities are available through programs now underway involving support of research overseas in animal diseases relating to livestock production and public health through use of Public Law 480 funds accruing from sale of U.S. farm products.**

36. **The success of international collaboration will hinge, as in other sciences, on closer agreement in disease nomenclature and on increasing standardization of research methods, biologicals, and other factors.**

37. **A significant program for coordinated veterinary medical research throughout the world has been developed by WHO experts. It has been delayed by the inadequacy of funds to date.** The relatively small sums involved could have a tremendous multiplier effect in value achieved.

# PART I. SUMMARY OF THE NATURE AND SIGNIFICANCE OF VETERINARY MEDICINE

## Section 1. Definition and Scope

Veterinary medicine is that branch of medical science that deals with the health and well-being of animals, especially domestic animals.

The disciplines of study within veterinary medical science are inevitably akin to those of other branches of medical science, in addition to being distinctive in certain respects. A chart (fig. 1) depicts "Principal Sciences in Veterinary Medicine."

The relationship between veterinary medical science and the vast domain of agricultural science is in turn depicted within the chart which follows (fig. 2), "Principal Sciences in Agricultural Science."

It is the veterinarian's relationship with the health of man which is the principal interest of this publication. In recent times, veterinary science has shown increasing interest in this relationship, particularly as regards the role of diseases of animals in connection with the health of human beings.

It is a paradox of modern science that while ours is an age of scientific specialization, the specialized fields more and more find areas at the outer edges of their research which overlap one another. The skills of different disciplines are required therefore to be joined in effective teamwork if science is to realize the vast opportunities which the thrust of discovery is opening up.

This is as true of veterinary medicine as it is true of other branches of medical science.

## Section 2. Summary of Groups Involved

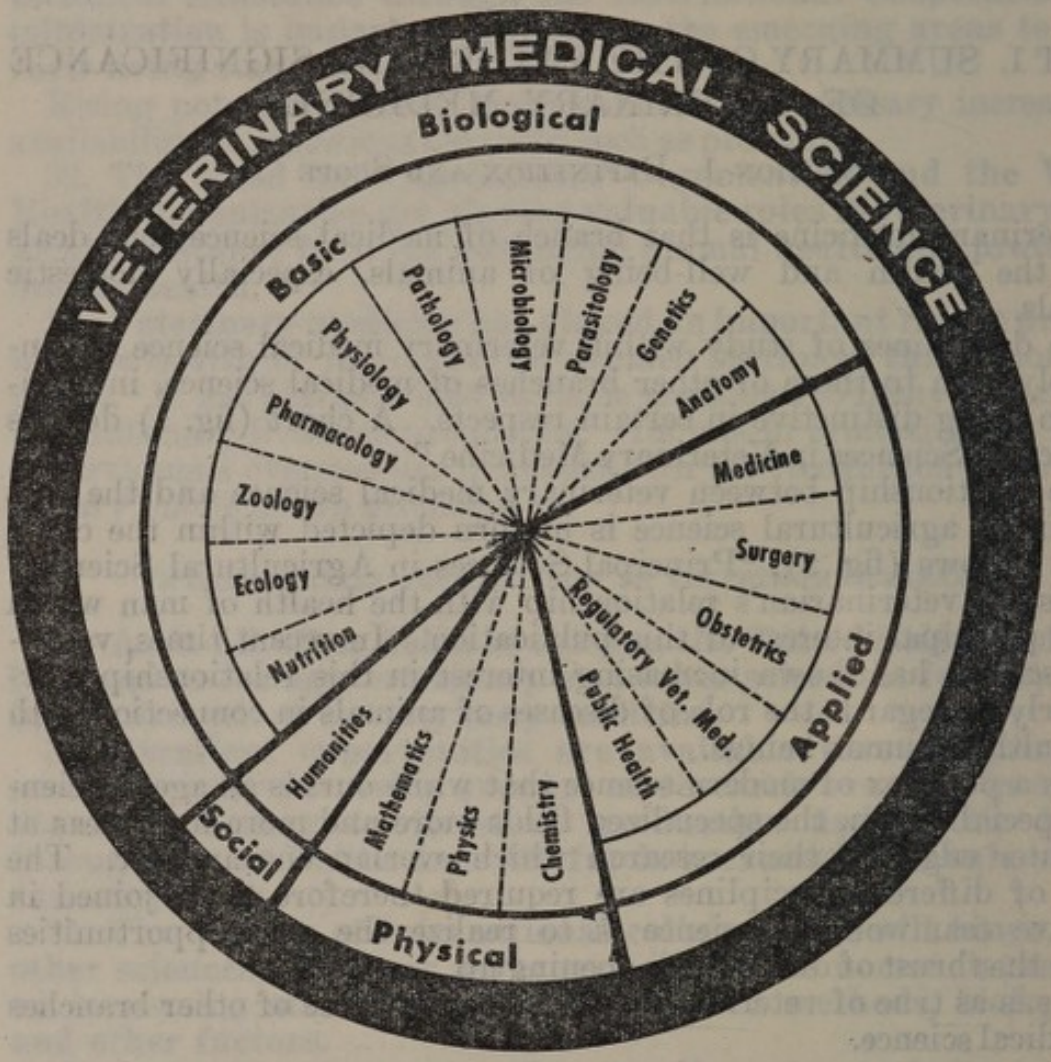
Active in veterinary medical science are a great many individuals and organizations, in public and private life, on the local, State, national, and international scene. The substantive sections of this volume relate the roles of these respective individuals and groups.

A summary of some of the principals involved would show the following:

*Practicing veterinarians.*—More than 21,000 veterinarians in the United States are engaged in some aspect of veterinary medicine. Of these, 14,000 are in private practice, concerned with the maintenance and improvement of the health of more than 300 million animals and 2.5 billion birds. On a simple basis of animal population and numbers of veterinarians, this represents a ratio of 1 veterinarian for every 200,000 domestic animals and birds.

The veterinarian in private practice is the first recourse for U.S. livestock and pet owners when illness strikes their animals. He treats sick and injured animals, prescribes measures for keeping animals healthy, examines animals, and issues health certificates needed

# PRINCIPAL SCIENCES IN VETERINARY MEDICINE




## DISCIPLINES OF STUDY

anatomy
animal husbandry
atomic medicine
bacteriology
biochemistry
biometrics
botany
clinics
embryology
endocrinology
epidemiology
genetics
hematology
histology
humanities
immunology
inorganic chemistry
jurisprudence
mathematics
medical entomology
mycology
nutrition
obstetrics
organic chemistry
parasitology
pathology
pharmacology
physics
physiology
preventive medicine
radiology
regulatory veterinary medicine
rickettsiology
surgery
therapeutics
toxicology
veterinary public health
virology
zoology

FIGURE 1

# PRINCIPAL SCIENCES IN AGRICULTURAL SCIENCE

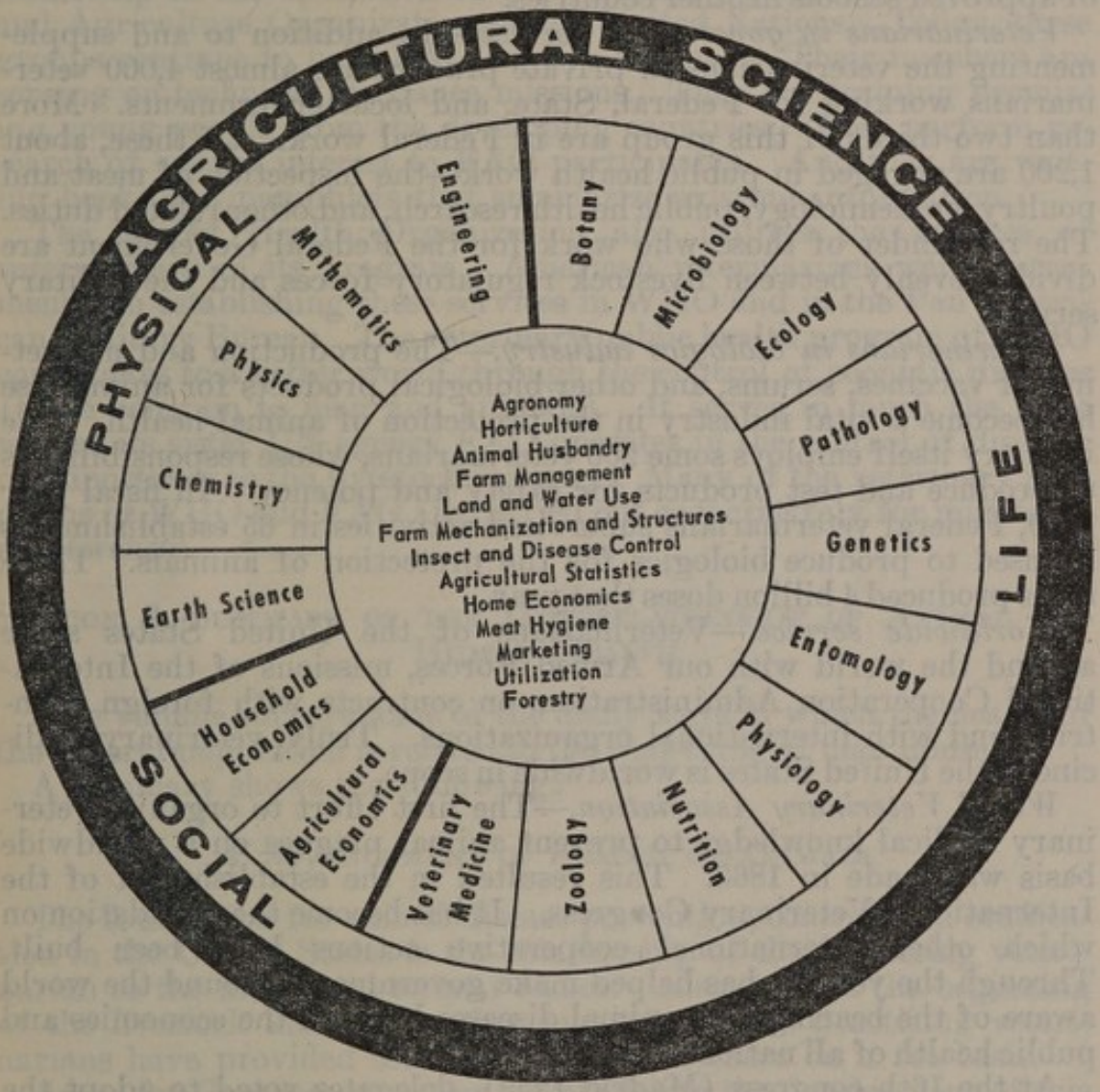



FIGURE 2

for animals moving in interstate and international traffic. Usually he is the first to observe symptoms of animal diseases that may be a threat to the Nation's welfare.

Veterinarians in private practice share in the burden of large-scale eradication efforts.

*Research workers.*—About 1,000 veterinarians are engaged in either full- or part-time research and are essential members of research teams. Many of them also are teachers. They investigate not only animal diseases, but to a lesser extent, human diseases. A few are active in the newest research dealing with medical problems of the atomic age and man's efforts to conquer space.

*Teachers of veterinary medicine.*—Eighteen schools and colleges of veterinary medicine in the United States employ more than 700 veter-

inarians for teaching. Many are instructors or graduate assistants who take graduate work on a part-time basis. Faculties train students to practice veterinary medicine and conduct research. All veterinarians, whether in private practice or with the colleges and public agencies, are graduates of recognized schools of veterinary medicine. Most of them are trained in the United States. Some are graduates of approved schools in other countries.

*Veterinarians in government service.*—In addition to and supplementing the veterinarians in private practice are almost 4,000 veterinarians working for Federal, State, and local governments. More than two-thirds of this group are in Federal work. Of these, about 1,200 are engaged in public health work—the inspection of meat and poultry, epidemiology, public health research, and other related duties. The remainder of those who work for the Federal Government are divided evenly between livestock regulatory forces and the military service.

*Veterinarians in biologics industry.*—The production and marketing of vaccines, serums, and other biological products for animal use has become a vital industry in the protection of animal health. The industry itself employs some 200 veterinarians, whose responsibility is to produce and test products for safety and potency. In fiscal year 1959, Federal veterinarians supervised activities in 65 establishments licensed to produce biologics for the protection of animals. Those firms produced 4 billion doses that year.

*Worldwide service.*—Veterinarians of the United States serve around the world with our Armed Forces, missions of the International Cooperation Administration, on contracts with foreign countries, and with international organizations. Truly, veterinary medicine of the United States is worldwide in scope.

*World Veterinary Association.*—The first effort to organize veterinary medical knowledge to prevent animal plagues on a worldwide basis was made in 1863. This resulted in the establishment of the International Veterinary Congress. It has become the foundation on which other international cooperative actions have been built. Through the years it has helped make governments around the world aware of the bearing that animal diseases have on the economies and public health of all nations.

At the 16th congress (Madrid 1959), delegates voted to adopt the name World Veterinary Association and to affiliate 15 international associations of veterinary specialists with the WVA. This gives the World Veterinary Association a broad scientific base. They also designated 1963 the World Animal Health Year. This will provide the opportunity for all the nations participating to prepare reviews of their advances in the past 100 years and to contemplate the problems of the future.

*American Veterinary Medical Association.*—In the United States, as in other highly industrialized countries, veterinary organizations have joined other forces to build systems for the exchange of knowledge, for the advancement of science, and for putting the findings of research to use.

The American Veterinary Medical Association, formed in 1863, has set the profession's goals for education, research, and service. Three out of four U.S. veterinarians are among its members, as are nearly 1,500 veterinarians in Canada.

*U.S. Livestock Sanitary Association.*—This organization, established in 1897, has pioneered in showing how Federal, State, and municipal officials could work together to control livestock diseases for the benefit of man.

*Contributions to United Nations.*—AVMA and USLSA, along with related groups in the United States and in other countries, provided leadership in the formation of the veterinary program of the Food and Agriculture Organization of the United Nations. Today, these groups continue to help FAO achieve its goals. Their members are serving on technical assistance missions. They are training promising young people from the developing countries. They perform research of special interest to FAO participants. And they are writing books and pamphlets that summarize existing information.

The World Health Organization also utilizes the services of veterinarians in its program. American veterinarians were instrumental in establishing these services in WHO and in the Pan American Sanitary Bureau. The veterinary public health program of WHO contributes to a better world through the control of zoonotic diseases (those common to man and animals). It serves in much the same way as its sister UN agency FAO operates in the control of diseases of importance to the livestock industry. Many of the veterinary programs of WHO and FAO are carried out cooperatively for maximum effectiveness.

## Section 3. Summary of the Interrelationship of Animal and Human Health

This volume surveys some of the many ways in which the health of the general population is related to the well-being of man himself.

A summary shows the following:

### A. ADVANCEMENT OF HEALTH OF ANIMALS

The foundation for animal disease prevention, control, and eradication in the United States is the relationship of the practicing veterinarian to the individual animal owner. Almost from the beginning of the livestock industry in this country, private practicing veterinarians have provided services to animal owners on a fee basis.

*Areas for Government action.*—Paralleling the development of this private practice, however, was the growing awareness that there are some functions in regard to the prevention, control, and eradication of animal diseases that the individual practitioners and individual owners cannot perform. They are not in position to prevent the introduction of diseases into the United States from other lands. They are usually unable to cope with the carelessness of a neighbor. They are helpless when wild animals harbor and spread infectious diseases from one area to another. And they are helpless against mechanized transport—when diseases may be spread through shipment of infected animals by air, sea, or land vehicles.

Recognition of these areas in which the individual owner and practicing veterinarian are limited and not in a position to act led to the establishment of State and Federal regulatory agencies and to the first national livestock disease eradication program.

*Bureau of Animal Industry created.*—The Bureau of Animal Industry of the U.S. Department of Agriculture was created in 1884 to work with the States in the extirpation and suppression of animal diseases. This action was taken primarily to relieve and prevent embargoes that were being enacted against entry of U.S. livestock and meats into other countries. The presence of diseases that were known to be spread by the animals, or meats from such animals, was cited as reason for these trade restrictions.

*Pleuropneumonia wiped out.*—Contagious bovine pleuropneumonia was the first disease attacked cooperatively by the BAI and the State livestock disease control agencies. This disease was introduced at a port in Brooklyn in 1843. It spread quickly to nearby eastern seaboard States. It moved westward with the settlers and the new and growing livestock industry. Foreign embargoes threatened the life of this industry. It was at that point that the Federal Government and the States acted together. Pleuropneumonia in cattle was wiped out in 1892, and has been kept out ever since.

The success of this program underscored three important conclusions:

1. That foreign diseases should be kept out;
2. That eradication of a dangerous animal disease is better than living with it; and,
3. That control of a contagious disease cannot be handled by individuals working independently.

*Cattle tick fever next target.*—Other diseases—or pests—were attacked in turn. The next major assignment for the BAI was to find the cause of cattle fever and eliminate it. Farmers were the first to suspect the cattle tick; research proved the connection in 1893. Although Dr. Carlos Finlay of Cuba had expressed the theory in medical circles in 1881, this discovery was the first demonstration that diseases could be transmitted from one warm-blooded animal to another by an insect vector—in this case, the tick. In 1894 the mosquito transmission of malaria was proven. A few years later the transmissibility of yellow fever to man via the mosquito was demonstrated by Reed and his associates.

With discovery of the role of the tick as a carrier, control of the disease became possible. Methods were developed for dipping the cattle to destroy the ticks, and so to stop the spread of the disease. Tick fever (piroplasmosis) has been eradicated from cattle in this country, except for a small buffer area along the Mexican border.

*Exclusion—first goal.*—The United States has been successful in preventing some of the most serious exotic diseases of animals around the world from gaining a foothold in this country.

A key to this success is the inspection and quarantine of animals and poultry coming to the United States. During fiscal year 1959, U.S. veterinarians inspected more than a million domestic animals, such as livestock and pets, and including more than 12,000 birds at ports of entry. Refused entry were 24,000 animals, including almost 22,000 livestock animals and 2,000 birds.

Nearly every year, port inspectors intercept cattle carrying tick fever, scabies, brucellosis, and tuberculosis, and horses with dourine and glanders. In recent years, several shipments of fowl, afflicted with Newcastle disease of a highly lethal type, have been intercepted at ports of entry.

The major targets for this strict inspection, of course, are foot-and-mouth disease, rinderpest, Rift Valley fever, and other damaging diseases that do not exist in this country.

*Foot-and-mouth disease kept out.*—Through strenuous inspection measures the United States is now free of foot-and-mouth disease. This has been achieved by a willingness to wage a full-scale war on the disease whenever it appeared and by constant alertness in guarding ports and borders against the entry of suspect animals and livestock byproducts.

Foot-and-mouth disease, perhaps the most dreaded plague of livestock, entered the United States in 1870. It has gained entry 8 times since then, the most recent invasion being in 1929. Years ago it was decided that it must not be allowed to gain a foothold. In every instance, it has been wiped out with the forces of the Federal and State Governments working together. It has been kept out, now, for 30 years.

In the past 14 years the United States has cooperated with Mexico and Canada to eradicate foot-and-mouth disease from the North American Continent. The major struggle was in Mexico where joint forces were on duty for 8 years. It was necessary to slaughter nearly a million animals to stamp out the disease.

*Eradication is basic philosophy.*—When exotic animal diseases do gain entrance into the United States, efforts of both public and private veterinarians are directed toward their control. In the case of diseases known to be eradicable, a cooperative program is instigated, usually with slaughter of infected and exposed animals. This method of attack has proved successful with foot-and-mouth disease on nine different occasions. More recently it proved its value in the eradication of vesicular exanthema. This philosophy is based on the fact that when it is possible to wipe out a disease, it is more economical to do so than to continue to live with it and suffer continuing losses.

Eradication of vesicular exanthema, a virulent and costly disease of swine, was announced in November 1959. This disease raises serious concern because it is not readily distinguishable from foot-and-mouth disease and could easily mask the presence of that scourge. It was contained, through State and local action, within the confines of one State for nearly 30 years. Then suddenly it slipped past the barriers and appeared within a few months in 42 States and the District of Columbia. A vigorous campaign during the past decade, including the passage of laws requiring the cooking of garbage fed to swine, resulted in the elimination of the disease.

*Screwworm eliminated in Southeast.*—The most recent all-out campaign against a livestock threat was that in the Southeast to eliminate the screwworm. The screwworm fly plants its eggs in the open wounds of living animals. As the pupae develop, they feed on the wound. The larvae burrow into the flesh and, in the case of severe infestation, bring on the death of the animal.

New techniques, involving the use of atomic radiation to sterilize laboratory produced flies, were employed to eradicate this pest. The native screwworm flies, mating with sterile flies, produced eggs that would not hatch. The regular release of millions of sterile flies to mingle and mate with native wild flies brought successive reductions in the native fly population and its apparent disappearance. Inspec-

tions are still going on to make certain that no flies remain in the area.

*Other gains.*—While not yet eradicated, bovine tuberculosis and brucellosis, after vigorous campaigns, have been brought to a low point. Reservoirs of infection still exist. Continued testing and retesting are essential to eliminate the last remnants of the diseases. This success has been made possible with the support and active help of local practicing veterinarians.

*Success due to public and private cooperation.*—These various campaigns have been successful through an essential combination of governmental actions, State and Federal, with voluntary private forces—the practicing veterinarian and the producer.

When diseases do not lend themselves to eradication, efforts are directed toward the development of programs for their control. Practicing veterinarians are given the tools available—vaccines, serums, quarantines, or whatever measures may be found to be effective—to aid the livestock producer or the pet owner in preventing the occurrence and spread of these diseases. Programs affecting livestock producers are carried on cooperatively by State and Federal livestock disease control agencies.

*Immunization—tool for control.*—Immunization is one of the most potent weapons in the control of animal diseases. Pasteur led the way for widespread use of this tool in his research on anthrax, rabies, and other animal diseases. Pasteur, Koch, and others interested in veterinary medicine demonstrated that germs may lie in a dormant state, resistant to weather for long periods, only to become active again and cause disease. This phenomenon was shown in anthrax, a devastating disease of cattle occurring in France at that time. Later, in 1880, a method of immunization was developed by Pasteur, providing a new tool for the control of it and other infectious diseases of animals.

The fight in this country against rabies, one of the most feared diseases in the animal domain, is a case in point. The development of an effective vaccine made possible a nationwide program of rabies control. This program was sponsored by the veterinary divisions of the State health departments and the U.S. Public Health Service. It was facilitated by a standardized vaccine potency test and mass immunization procedures for dogs and other pets. This program was further strengthened by the development of an effective modified live virus vaccine that immunizes dogs for more than 3 years.

*Veterinary biologics.*—A striking advance in the past 25 years can be seen in the use of chick embryos for growing viruses used in vaccines. The vaccines can now be produced from viruses grown in quantity in eggs and at only a fraction of the cost required to prepare vaccines from animal tissues.

The first license of a biologic from chick embryos was issued in September 1939. The vaccine protected horses from sleeping sickness. Information gained in the production and use of this vaccine paved the way for other veterinary vaccines and for the preparation of vaccines for human use. Among those now widely used are vaccines for yellow fever, Rocky Mountain spotted fever, epidemic typhus, and influenza.

During the past 10 years, modified live virus vaccines in many instances have replaced once widely used inactivated virus vaccines,

not only in rabies, but also in canine distemper, hog cholera, and respiratory diseases of poultry. Experience has shown that such potent vaccines can be safely used to control some of the most serious and costly animal diseases.

The progress toward eventual eradication of bovine brucellosis that has been made in the past 5 years rests in part on the widespread adoption of calfhood vaccination. The vaccine used—Strain 19—is a variant of the organism causing bovine brucellosis. This strain protects without causing the disease. More than 6 million calves are now vaccinated annually. This is more than half of the heifer calves retained for breeding each year.

Practicing veterinarians play an important and essential role in carrying out large-scale immunization programs. Their job takes on added significance in the case of animal diseases that are transmissible to man.

*Safety assured.*—All veterinary biologics and the firms that produce them are licensed and inspected. The products are guaranteed to be safe and potent and labeled accurately as to care, use, and limitations.

The care with which these products are checked is evidenced by the fact that in 1959 nearly 93 million doses of the 3.9 billion doses produced were condemned and destroyed because they did not meet prescribed standards. This enforcement of these standards promotes the farmers' confidence in the safety of the biologics used in the treatment of their animals.

*Economic benefits.*—The history of the prevention, control, and eradication of animal diseases justifies the philosophy of "exclusion and eradication" that has guided the U.S. Department of Agriculture. Economic studies in England and France reveal that it costs England no more to slaughter animals infected with foot-and-mouth disease, and keep their herds healthy and disease-free, than it costs France to retain its vaccination program. Consequently, France still incurs the additional loss and liabilities of living with the disease.

It cost the U.S. Government 5 years' work and $1.5 million to eradicate contagious pleuropneumonia. It is impossible to estimate what the annual and accumulated costs might have been had this disease been allowed to continue unchecked.

Eradication of the screwworm in the Southeast cost under $10 million in State and Federal funds. Prior to the campaign, this pest was causing livestock producers of that area an estimated annual loss of $20 million.

However, to evaluate properly the economic importance of preventing, controlling, and eliminating losses from animal diseases and pests, the losses must be put in perspective.

*Losses total $2.7 billion a year.*—From 55 to 60 percent of the income from farm marketing is derived from animals and animal products. Estimated annual losses to the Nation from animal and poultry diseases and parasites are believed to exceed $2.7 billion.

This heavy loss—about 15 percent of potential production—occurs in the United States, generally regarded "as the safest place in the world to raise livestock." The livestock industry remains extremely vulnerable to widespread losses from infectious and contagious diseases because of modern factors which provide conditions favorable to epidemics—such conditions include the increased concentration of

livestock on farms and the ability to move animals easily and quickly by modern transportation—air, rail, motor, and water vehicles. Havoc could be wrought on the livestock industry by diseases that might gain entrance into this country. Some of the diseases that are endemic in the United States could do the same if allowed to go unchecked.

*Economic benefits of animal research.*—It is of course obvious that a healthy livestock population is essential to the livestock industry and to the agricultural economy. Livestock and poultry industries have been made possible and profitable as a result of animal disease and parasite research.

Diagnostic tests for pullorum disease of poultry, which in the 1920's caused the death of at least 20 percent of chicks and decimated large broods, were essential to the development of the broiler industry. Large-scale broiler production—representing a billion-dollar industry—would have been impossible without this test which pointed the way to control of this killer. The broiler industry, which did not exist 30 years ago, now ranks 10th in importance as a source of cash receipts from farm marketings.

*Other savings.*—Another important research discovery may have long-range effects for the poultry industry. Poultry breeders have found that certain lines of laying hens carry resistance to the avian leukosis complex, a transmissible cancerous disease that kills 10 percent of the Nation's laying hens each year.

Livestock breeders are just beginning to look to the possibilities of genetic resistance to parasites and diseases. As research uncovers new facts in this area, the livestock industry can hope to gain from its findings.

Historically, one of the most notable examples of the direct effect on livestock income is the case of discovery of the tick as the carrier of cattle fever. Although this research 68 years ago cost the Government $65,000, it saves cattlemen an estimated $60 million a year today.

*Veterinary entomology.*—Almost all of the procedures employed today for the control of pests of livestock in the United States have resulted from research by the entomologists, veterinarians, and other scientists working on livestock pests.

This research has involved two approaches: (1) The study of the life history, habits, and development of pests in relation to environment as a basis for control through cultural and management practices; and (2) the development of insecticides or repellents that are safe to apply to animals and that will destroy or prevent the attack of the pests.

Major emphasis at present is on the development of effective, safe, and low-cost insecticides to destroy insects on animals or in their natural breeding places. New attention is being given to biological methods of control, including the cultivation of natural enemies of such pests and the use of atomic energy.

The eradication of the screwworm in the Southeast illustrates a combination of entomological research and application of the use of atomic energy to produce sterile male flies. A series of laboratory and field experiments, beginning in 1950, on the use of gamma radiation for control of the screwworm, ranks as one of the unique developments in recent years in the biological sciences (see p. 45 for additional data on veterinary entomology).

*Other pests vulnerable.*—Of special significance is the fact that the sterile-male method may be applicable to other insects such as mosquitoes, which are carriers of many human and animal diseases, as well as certain crop pests.

Although the screwworm eradication program was undertaken primarily as an economic aid to the livestock industry in the Southeast, a side benefit is its contribution to public health. It eliminates the possibility of infection in man, which occurs in fresh wounds.

### B. ADVANCEMENT OF HEALTH OF MAN

Veterinary medicine provides specific benefits to human health in three major ways:

1. Removal of sources of exposure or infection to man through eradication or control of those animal diseases transmissible to man.
2. Development of preventives or treatments for animals that can be adapted for use in human cases.
3. Food hygiene programs that protect the consumer against foodborne diseases.

A summary of the many ways in which the D.V.M. (Doctor of Veterinary Medicine) and the M.D. (Doctor of Medicine) interact is seen in the form of a chart (fig. 3), "Interrelationship—Veterinary and Human Medicine."

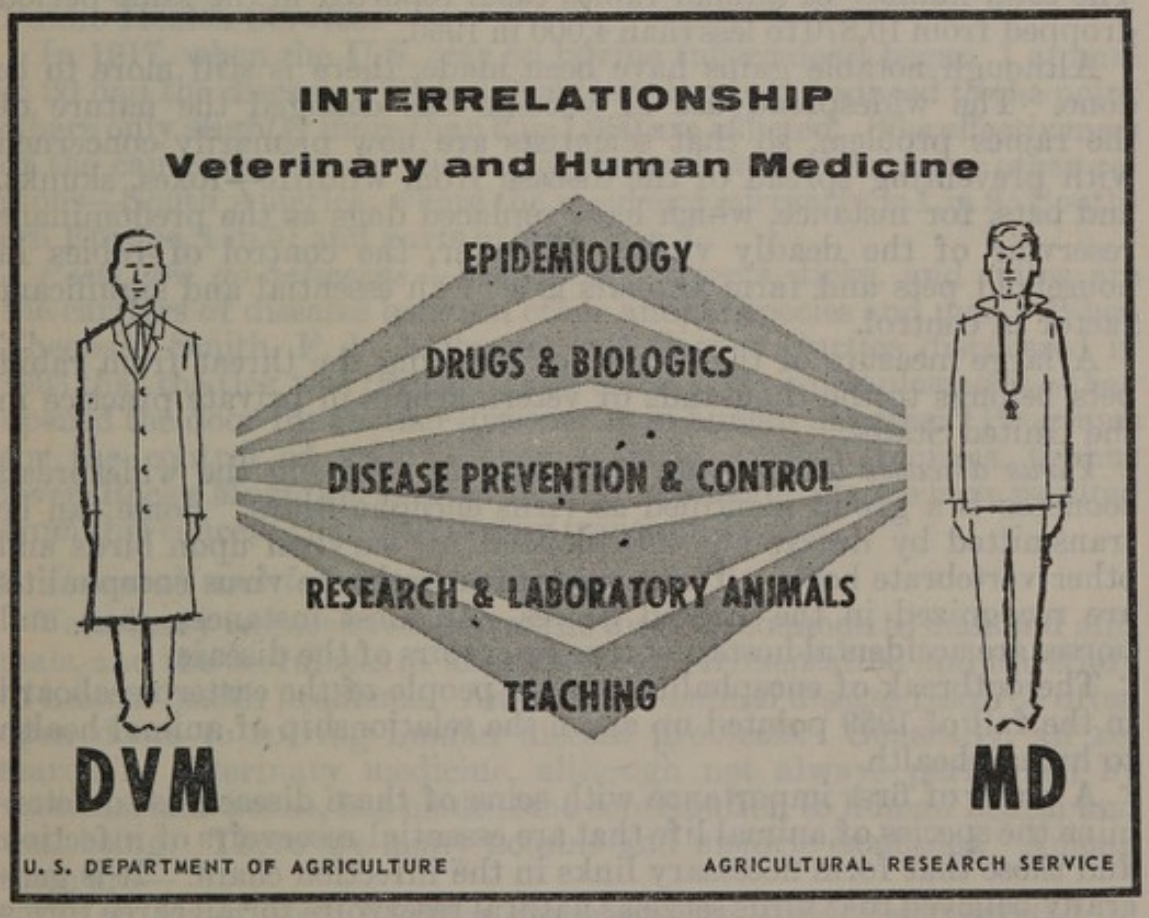



FIGURE 3

*1. Protection of man from zoonoses*

There are more than a hundred zoonoses—animal diseases that may be transmitted to man. As any one of these is eliminated, a source of disease for man is also eliminated.

Veterinary research has provided new knowledge of tuberculosis, brucellosis, sleeping sickness, hookworm disease, leptospirosis, and other diseases transmissible to man from animals.

It was veterinary research that established a common identity for the three types of brucellae responsible for brucellosis in cattle and swine and Malta fever in goats. Man can contract all three types. At one time in recent years, brucellosis—or undulant fever as it is generally known in man—was considered the most important of all of the zoonoses. As a result of research contributions and control programs for bovine brucellosis, the number of human cases reported in 1959 was about one-seventh of the known cases a decade ago.

In the case of hookworm, for example, treatment developed by Dr. Maurice C. Hall for use in animals was found to be effective in treatment of the disease in man.

*Rabies.*—Rabies is one of the first animal diseases known to be transmissible to man. Research-developed vaccines and a nationwide program of rabies investigation and control have paid off in contributions to human health, too. Human deaths from rabies from 1946, when the program was begun, to 1960 dropped from 22 to 2. The total number of animal rabies cases reported in the same period dropped from 10,870 to less than 4,000 in 1960.

Although notable gains have been made, there is still more to be done. The widespread use of vaccine has changed the nature of the rabies problem, so that scientists are now primarily concerned with preventing spread of the disease from wildlife—foxes, skunks, and bats, for instance, which have replaced dogs as the predominant reservoir of the deadly virus. However, the control of rabies in household pets and farm animals is still an essential and significant factor in control.

A large measure of the credit for reducing the threat from rabid pets belongs to the thousands of veterinarians in private practice in the United States.

*Virus diseases attack man and animals.*—Among the widespread zoonoses is a group identified as virus encephalitides. Some can be transmitted by insects but they depend for survival upon birds and other vertebrate hosts. Three types of insectborne virus encephalitis are recognized in the United States. In most instances, man and horses are accidental hosts, not true reservoirs of the disease.

The outbreak of encephalitis among people of the eastern seaboard in the fall of 1959 pointed up again the relationship of animal health to human health.

A point of first importance with some of these diseases is to determine the species of animal life that are essential reservoirs of infection and those that form necessary links in the infection chain. It is generally believed that birds serve as natural reservoirs for all three forms of virus encephalitis. In temperate climates, virus encephalitis is a seasonal disease. It flares up during the summer. One of the puzzles that must be solved is the identification of hosts in which the virus

overwinters. One possibility is that it is brought into the country each year by birds migrating from the tropics.

Strong evidence that the virus is widespread can be seen in results of studies of western equine encephalitis, one of the three types. It has been recovered from 20 species of birds and 6 species of wild animals, as well as most of the common domestic birds and animals.

*Flu—A common enemy.*—The close relationships that pathogens of other animals have to man is illustrated in a disease called swine influenza. Dr. Richard E. Shope of the Rockefeller Institute, who has made significant contributions to the animal virus infections including influenza, has postulated this theory on the interrelationship of human and animal diseases. He and others have shown that swine influenza was probably transmitted from man to animals in the summer of 1918. Other investigators have also shown that the swine influenza virus was the same agent that caused the great 1918 human influenza pandemic.

*Tuberculosis.*—The organism causing bovine tuberculosis, found in all cattle-raising countries of the world, is responsible in some places for 65 percent of clinical, peripheral lymph node tuberculosis in man. It also is responsible for 50 percent of tuberculosis of the skin, 25 percent of tuberculous meningitis and miliary disease, 20 percent of tuberculosis of the genito-urinary organs and the skeletal system, from 1 to 6 percent of the pulmonary disease in people. In the United States, during the past 5 years there have been fewer than 10 human cases directly attributable to cattleborne tuberculosis, according to the U.S. Public Health Service.

In 1917, when the U.S. war on bovine tuberculosis began, 1 animal in 20 had the disease. Today, incidence has been reduced to the point where only slightly more than 2 in 1,000 are afflicted. The effectiveness of the campaign can be shown by contrast with data from other regions—South America, where the incidence currently is 1 in 8; Southern Europe, 1 in 5; and parts of Asia, 1 in 7.

*Pests are go-betweens.*—Frequently, insects, ticks, and mites are the carriers of diseases between other animal species and man. When Theobald Smith, F. L. Kilborne, and Cooper Curtice discovered in 1893 that the tick was the carrier of cattle fever—piroplasmosis—they opened the door for further discoveries in human diseases. Programs for the control of yellow fever, malaria, trypanosomiasis, typhus fever, Rocky Mountain spotted fever, and bubonic plague have resulted from this concept that insects may transmit disease.

*2. Research and laboratory animals*

Veterinary research recognizes the diseases common to man and animals, and the usefulness of animals for experimentation and the study of human health problems. Advances in animal disease research often open doors to solving human disease problems. Generally, all research in veterinary medicine, although not always performed by veterinarians per se, has made some contribution to human health and well-being. There are many notable and historic examples. Among them are—

1. Proof that bacteria cause disease—first demonstrated in Koch's research on anthrax in cattle;

2. Immunization by vaccine—discovered in Pasteur's research on anthrax, rabies, and other animal diseases;

3. Proof that insects can transmit disease by serving as intermediate hosts—first demonstrated by Kilborne, Curtice, and Smith in research on cattle-tick fever;

4. Evidence that certain animal diseases are caused by viruses—discovered by Loeffler and Frosch in research on foot-and-mouth disease; and

5. Proof that fertilized eggs can be used to grow viruses for study and vaccines—first demonstrated by Rous and Murphy in research on fowl sarcoma virus.

These are only a few examples from many instances in which research on diseases of animals has paid unexpected and far-reaching returns in better medical care for man.

*Promise of veterinary research.*—The promise of veterinary science was underlined in October 1959 when the American Cancer Society granted the U.S. Department of Agriculture $100,000 to intensify research on avian leukosis, a cancerous disease of chickens.

Prompting the grant was a record of sound progress in this research during the past 20 years. The findings show that this cancer type is virus-caused; it can be transmitted to chicks; and chicks can be immunized against it.

There is no evidence to show that poultry cancers can be transmitted to man. But like cancers in man they are characterized by uncontrolled cellular growth. More knowledge of poultry cancer may supply new approaches in both theory and techniques for dealing with questions that now bar progress in studies of human cancer.

*Cardiovascular research.*—More recently the National Institutes of Health provided a grant of $1,100,000 to the University of Pennsylvania's School of Veterinary Medicine for research on cardiovascular disease. Current popular concern with all aspects of heart and circulatory problems of health suggest a wide interest in findings from this and similar studies elsewhere.

*Management of laboratory animals.*—Some 37 million animals—mice, rats, rabbits, guinea pigs, monkeys, dogs, and cats—are used each year. They are the tool with which scientists screen cancer-causing and anticancer activity in chemicals, measure the effects of radioactivity, study the reactions of a living organism in space.

The procurement, inspection, and management of laboratory animals are placing increasing responsibilities on veterinary medicine. The veterinarian can be of invaluable help to other scientists in the planning and conduct of research with animals. He can advise on species to be used, select healthy strains, and recommend procedures for humane care. Deep public interest in such humane care has been manifest to the Congress and to State and local governments.

The veterinarian can, moreover, skillfully prepare animals for research, administer anesthesia, provide on-the-spot clinical observations of reactions of the animals, and make post mortem examinations.

More than that, the veterinarian's broad knowledge of a wide variety of biological disciplines equips him to act as primary investigator in research with laboratory animals. His education gives him an understanding of anatomy, physiology, histology, chemistry, bacteriology, pharmacology, medicine, and food hygiene. He is in position to recognize and study diseases in man which occur naturally in animals and to give scientists in human medicine the results of his observations.

*Economic value.*—Laboratory animals, valued at $250 million, constitute a vital resource of medical and other biological research. They must be as painstakingly calibrated and standardized as the most sensitive instrument.

Losses of laboratory animals from disease and malnutrition can have an impact far beyond that of the animals' replacement. The losses can mean setbacks in scientific efforts in which millions of dollars are invested.

The small laboratory animals, such as mice, rats, hamsters, and guinea pigs provide an ideally economic field for testing laboratory findings in many different areas—nutrition, genetics, diseases, and biologics. They complete a life cycle and produce new generations in a short period of time.

*Quality research animals.*—Veterinarians working in the commercial breeding of laboratory animals are contributing much to the availability of better experimental animals. A high quality of research animal, in turn, will lead to greater gains in human and veterinary medicine. The improvement of health in test animals guarantees a more uniform and stable research tool for investigators of human health.

*3. Research, regulation and food supply*

Americans enjoy a high level of animal protein in their diets because of the successful prevention, control, and even eradication of the most devastating animal diseases. Even with the high standards of veterinary service available here, however, it is estimated that in the United States diseases claim one animal in every five produced.

Bovine brucellosis claims its major toll in a loss of milk production and in calf losses through fetal deaths and abortions.

Reduction in the incidence of bovine tuberculosis alone has had a noticeable effect on the meat supply. In the twenties, between 50,000 and 70,000 cattle a year were condemned during meat inspection for tuberculosis. Last year, fewer than 250 cattle were condemned for this disease.

One of the reasons for keeping foot-and-mouth disease out of this country is that it is so destructive of livestock production. It is not always fatal; it usually kills only 1 out of 10 animals it strikes, but it damages the others so that they are no longer productive. Although the disease is rarely transmissible to man, it robs him of animals valued for both food and income.

*Vital role of protein.*—Research in human nutrition tends to support the vital role of animal protein in good health.

There are many ways by which to gage a country's nutrition supply. One standard is per capita consumption of red meat. The U.S. record high for recent years was in 1956, when consumption rose to 166.7 pounds a person. Production that year was 28.1 billion pounds. Total red meat production in 1960 will probably set a new high, a little above the 1956 mark. More meat could be added to the Nation's food supply if animals and poultry now lost to diseases and pests could be saved.

The task of assuring bountiful supplies of meat and other livestock products becomes more complicated each year as populations grow and standards of living rise. Dr. Byron T. Shaw, Administrator of the

Agricultural Research Service, estimates that by 1975 a population of 230 million people in the United States will require an increase in livestock production equal to 16.3 billion pounds more red meat, 1.1 billion pounds more chicken meat, 22 billion quarts more milk, and 20 billion more eggs.

*World needs.*—World requirements for meat are also going up. The Foreign Agricultural Service reports that meat consumption is rising in most areas of the world. In comparison with the 1951–55 average, 1958 consumption was up 32 percent in the U.S.S.R., 26 percent in Eastern Europe, 22 percent in Australia and New Zealand, 20 percent in Western Europe, and 10 percent in North America.

Although world food production is rising as improved techniques are put to use, the world's meat supply is still considerably below world needs. These needs increase as world population, now going up at the rate of 40 to 50 million people each year, continues to expand.

*Food control programs.*—Veterinary medicine has set standards for safe, wholesome products of animal origin and has supplied the personnel to enforce the standards.

Over the past 50 years, wholesome, high quality products of animal origin have become commonplace in the United States. Clean, pasteurized milk, fresh eggs, and safe, wholesome meat products are marketed in every village and town.

Food in tin cans was once greatly feared by housewives as a source of food poisoning or of botulism. In the 1920's, a veterinary scientist in California, Dr. K. F. Meyer, headed a canning industry-Public Health Service team that made history in its research on botulism. Their findings on canning methods, including pressure cooking, made possible the modern food canning industry, and prevention of this deadly toxin killer in both commercially and home-canned foods. Since 1925, cases of botulism from commercially canned foods have been extremely rare.

*Meat inspection.*—The Meat Inspection Service has helped to hold the market at home by providing a base of confidence for the buying public.

Consumers in the United States can buy meat and meat products with confidence that they are clean and unadulterated. Since 1906, these products have been rigorously inspected on the basis of steadily rising standards.

Since the establishment of Federal meat inspection service in 1907 the amount of meat inspected by U.S. veterinarians has increased every year. In 1960 almost 100 million red meat animals, constituting 17.5 billion pounds of meat, were inspected by the U.S. Meat Inspection Service. This constitutes approximately 80 percent of the red meat production in the U.S. Most of the remaining 20 percent is under some form of State or local inspection.

Measured by the total Federal inspection load, only a fraction was condemned—only 24 out of each 10,000 animals and only 26½ pounds of each 1,000 pounds of meat and meat food products. But considered altogether, the condemnations add up to a sizable investment in safe and wholesome meat—240,000 animals and 26.5 million pounds of meat and meat food products. Each working day in 1959, inspectors condemned more than a million pounds of meat and meat products, including poultry.

*Government responsibilities.*—A first responsibility of the Meat Inspection Service is to eliminate meat animals found to be affected with diseases or conditions that make them unfit for food. Many of these diseases are transmissible to man. To do this, the veterinarians conduct rigid ante mortem and post mortem examinations of the animals and carcasses. They remove all diseased, unsound, or otherwise unwholesome meat and meat food products for use as food. They supervise the preparation of meat and meat food products to assure cleanliness and to guard against the use of harmful preservatives and other questionable ingredients. They supervise the marking of meats to show that they are "U.S. Inspected and Passed" and check the labeling to prevent false and deceptive statements.

In addition, these veterinarians and their assistants inspect meat and meat food products offered for import into this country and examine meat and meat food products purchased by the Government. They guard against residues in meat resulting from the treatment by or exposure to drugs, biologicals, pesticides, and growth-promoting substances. Under recently passed legislation, they also determine acceptable methods for humane slaughter of meat animals.

*Military veterinarians.*—Adequate, wholesome food supplies are assured our Armed Forces in locations all over the world by the military veterinary services. Through their efforts, locally procured dairy, meat, and vegetable products are used safely every day by U.S. troops. The provision of fresh milk on a worldwide basis for American troops is a specific instance where the military veterinarian influences the nutritive standards.

Veterinarians are also used with regular medical officers to correlate animal diseases which are encountered with human diseases. He relieves the medical officer of many environmental health problems.

*Conclusion.*—Throughout this volume are recorded other interrelationships between the well-being of man and animals.

Two such facets are indicated in the charts which follow this page: figure 4—"What Cattle Supply Man" and figure 5—"Human Health Products From Animals."

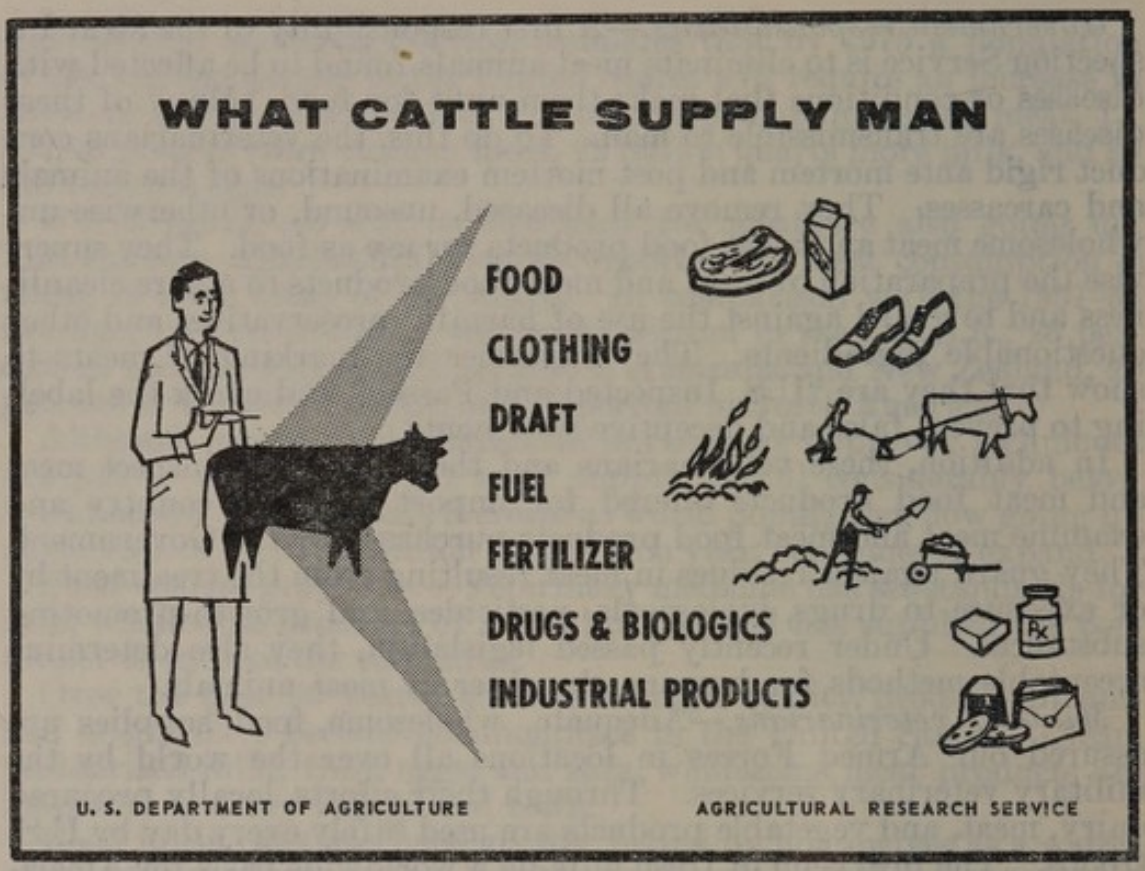



FIGURE 4

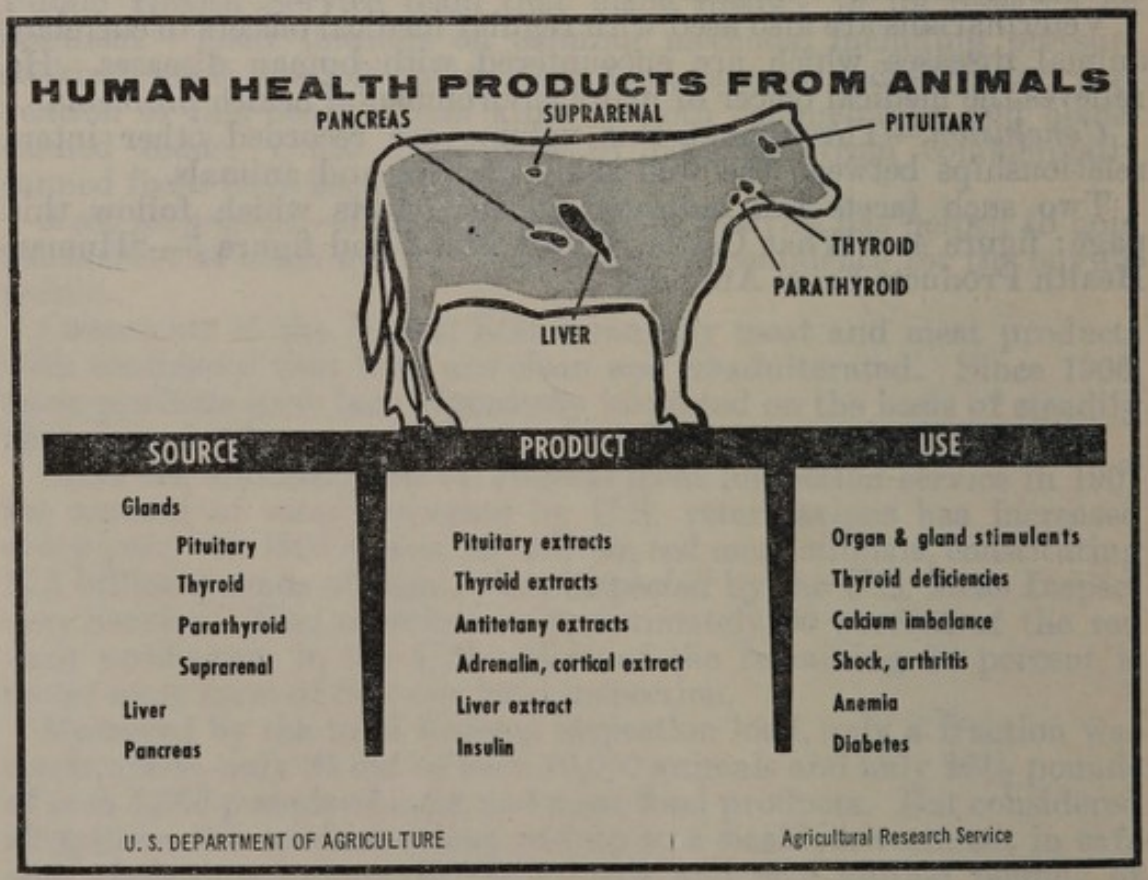



FIGURE 5

# PART II—VETERINARY MEDICAL ACTIVITIES SUPPORTED BY THE U.S. GOVERNMENT AND BY STATE AND LOCAL GOVERNMENTS

## Section 1. Federal Organizations and Their Expenditures

Of primary interest to this committee are the activity and expenditures of agencies of the U.S. Government.

Numerous departments, agencies, divisions, bureaus, centers and laboratories of the Federal Government are involved, directly and indirectly, in veterinary medicine. To a lesser extent, they are involved in veterinary medical research.

*Organizations.*—The principal Federal organization thus engaged, is of course, the U.S. Department of Agriculture. The work of its Animal Disease and Parasite Research Division is the principal focus of review in this publication.

Another Federal department directly involved is the Department of Health, Education, and Welfare and, in particular, the U.S. Public Health Service. Of the latter's component organizations, two, in particular, engage the attention of this publication, the National Institutes of Health and the Communicable Disease Center in terms of their direct and indirect interest in veterinary medical research. In addition, the Food and Drug Administration has a Veterinary Medical Branch which supervises veterinary drugs and food additives.

Two other departments are referred to herein, albeit necessarily more briefly: the Department of Defense (in connection with the Veterinary Corps of the Army and the Air Force), and the Department of the Interior (in connection with the Fish and Wildlife Service).

In oversea activities, the International Cooperation Administration is directly involved in veterinary technical assistance programs.

*Statutory authority.*—The second committee print, issued on February 25, 1959, by this subcommittee, was entitled "Statutory Authority for Medical and Other Health-Related Research in the U.S. Government—the Basis for International Cooperation."

On pages 37 and 38 that print included the texts of the various statutes whereby the Department of Agriculture is empowered to support research.

As a ready reference, these paragraphs are reproduced at this point.

### Department of Agriculture

#### ANIMAL DISEASES

*Disease investigations*

**In order to promote the exportation of livestock and/or live poultry from the United States the Secretary of Agriculture shall make special investigation as to the existence of pleuropneumonia, or any contagious, infectious, or communicable disease, along the dividing lines between the United States and for-**

eign countries, and along the lines of transportation from all parts of the United States to ports from which livestock and/or live poultry are exported, and shall, from time to time, establish such regulations concerning the exportation and transportation of livestock and/or live poultry as the results of said investigations may require. [May 29, 1884, c. 60, § 4, 23 Stat. 32; Feb. 2, 1903, c. 349, § 1, 32 Stat. 791; Feb. 7, 1928, c. 30, 45 Stat. 59; U.S.C. 21:112.]

*Research laboratories and contracts*

The Secretary of Agriculture is authorized to establish research laboratories, including the acquisition of necessary land, buildings, or facilities, and also the making of research contracts under the authority contained in section 427i(a) of title 7, for research and study, in the United States or elsewhere, of foot-and-mouth disease and other animal diseases which in the opinion of the Secretary constitute a threat to the livestock industry of the United States: *Provided*, That no live virus of foot-and-mouth disease may be introduced for any purpose into any part of the mainland of the United States except coastal islands separated therefrom by waters navigable for deepwater navigation and which shall not be connected with the mainland by any tunnel, and, except that the Secretary of Agriculture may transport said virus in the original package across the mainland under adequate safeguards, and except further, that in the event of outbreak of foot-and-mouth disease in this country, the Secretary of Agriculture may, at his discretion, permit said virus to be brought into the United States under adequate safeguards. To carry out the provisions of this section, the Secretary is authorized to employ technical experts or scientists without regard to the Classification Act of 1949, as amended: *Provided*, That the number so employed shall not exceed five and that the maximum compensation for each shall not exceed $19,000 per annum. There is authorized to be appropriated such sums as Congress may deem necessary; in addition, the Secretary is authorized to utilize in carrying out this section, funds otherwise available for the control or eradication of such diseases. [Apr. 24, 1948, c. 229, 62 Stat. 198; amended Oct. 28, 1949, c. 782, title XI, § 1106(a), 63 Stat. 972; July 31, 1956, c. 804, title I, § 119, 70 Stat. 742; July 31, 1958, 72 Stat. 454; U.S.C. Supp. 21: 113a.]

*Cooperation with Mexico in control and eradication of foot-and-mouth disease and rinderpest*

For purposes of section 114b–114d of this title [sections relating to cooperation with Mexico in control and eradication of foot-and-mouth disease or rinderpest], funds appropriated pursuant thereto may also be used for * * * the construction and operation of research laboratories, quarantine stations and other buildings and facilities. [Feb. 28, 1947, c. 8, § 2, 61 Stat. 7; amended Aug. 3, 1956, c. 950, § 3, 70 Stat. 1033; U.S.C. Supp. 21:114c.]

*Cattle grub research*

In order to protect, promote, and conserve livestock and livestock products and to minimize losses, the Secretary of Agriculture, either independently or in cooperation with States or subdivisions thereof, farmers' associations, and other organizations and individuals, it [sic] is authorized to increase and intensify research and investigations into problems and methods relating to the eradication of cattle grubs and to undertake measures to eradicate these parasites. [June 16, 1948, c. 477, § 1, 62 Stat. 458; U.S.C. 21:114e.]

*Use of foreign currencies.*—Also published in that print was the statutory authorization for the use for health-related purposes of foreign currencies generated by sale of U.S. farm products overseas. Its text (under which programs of veterinary research, among others, are supported overseas) follows:

USE OF FOREIGN CURRENCIES FOR HEALTH RESEARCH

Notwithstanding section 724 of title 31 or any other provision of law, the President may use or enter into agreement with friendly nations or organizations of nations to use the foreign currencies which accrue under this subchapter (sales of surplus commodities for foreign currencies) for one or more of the following purposes:

* * * * * * *

(k) to collect, collate, translate, abstract, and disseminate scientific and technological information and to conduct and support scientific activities overseas including programs and projects of scientific cooperation between the United States and other countries such as coordinated research against diseases common to all of mankind or unique to individual regions of the globe, but no foreign currencies shall be used for the purposes of this subsection (k) unless specific appropriations be made therefor.

[Agricultural Trade Development and Assistance Act of 1954, P.L. 83–480, c. 469, title I, 104, 68 Stat. 456; par. (k) added by Mutual Security Act of 1958, P.L. 85–477, § 502(1), 72 Stat. 261; 7 U.S.C. Supp. 7: 1704.]

*1961 statutory authorization.*—There follow pertinent excerpts from the statutory authorization for activities by the Department of Agriculture for the 1961 fiscal year. These excerpts are limited solely to those activities which are primarily veterinary in character. Other provisions of the law (not reproduced herein) authorize other USDA programs, e.g., grants to State experiment stations, to the Foreign Agricultural Service, et cetera, which are only to a limited extent veterinary in character.

### *Excerpts of Public Law 86–532*

Plant and animal disease and pest control: For operations and measures, not otherwise provided for, to control and eradicate pests and plant and animal diseases and for carrying out assigned inspection, quarantine, and regulatory activities, as authorized by law, including expenses pursuant to the Act of February 28, 1947 (21 U.S.C. 114b–d), $52,236,000, of which $1,500,000 shall be apportioned for use pursuant to section 3679 of the Revised Statutes, as amended, for the control of outbreaks of insects and plant diseases to the extent necessary to meet emergency conditions: *Provided*, That no funds shall be used to formulate or administer a brucellosis eradication program for fiscal year 1963 that does not require minimum matching by any State of at least 40 per centum;

Meat inspection: For carrying out the provisions of laws relating to Federal inspection of meat, and meat-food products, and the applicable provisions of the laws relating to process or renovated butter, $21,562,000;

Special fund: To provide for additional labor to be employed under contracts and cooperative agreements to strengthen the work at research installations in the field, not more than $1,000,000 of the amount appropriated under this head for the fiscal year 1960 may be used by the Administrator of the Agricultural Research Service in departmental research programs in the fiscal year 1961, the amount so used to be transferred to and merged with the appropriation otherwise available under "Salaries and expenses, Research."

#### DISEASES OF ANIMALS AND POULTRY

Eradication activities: For expenses necessary in the arrest and eradication of foot-and-mouth disease, rinderpest, contagious pleuropneumonia, or other contagious or infectious diseases of animals, or European fowl pest and similar diseases in poultry, and for foot-and-mouth disease and rinderpest programs undertaken pursuant to the provisions of the Act of February 28, 1947, and the Act of May 29, 1884, as amended (7 U.S.C. 391; 21 U.S.C. 111–122), including expenses in accordance with section 2 of said Act of February 28, 1947, the Secretary may transfer from other appropriations or funds available to the bureaus, corporations, or agencies of the Department such sums as he may deem necessary, to be available only in an emergency which threatens the livestock or poultry industry of the country, and any unexpended balances of funds transferred under this head in the next preceding fiscal year shall be merged with such transferred amounts: *Provided*, That this appropriation shall be subject to applicable provisions contained in the item "Salaries and expenses, Agricultural Research Service."

*Statutory authority for other agencies.*—In the second committee print earlier referred to, broad statutory language was reprinted which empowers various other Federal agencies to engage in veterinary-related activity. For example, the authority for the Public Health Service is set forth therein, including the broad powers of the National Institutes of Health. Specific references to veterinary research, as such, are not found therein, nor are they found in the appropriation laws enacted by the Congress for the various departments and agencies over and above USDA.

Similarly, relatively few administrative budgets of agencies outside USDA contain readily identifiable line items for veterinary research or regulation.

*Difficulty of assembly of Government-wide financial total.*—In the light of the above, it is difficult to establish comprehensive and definitive estimates for Government-wide expenditures for veterinary medicine.

The subcommittee has sought in most previous instances of its review of various Federal scientific activities to attempt such Government-wide estimates. This is somewhat more difficult in this instance, particularly because veterinary medicine, as such, is a line-item objective only, by and large, of USDA and to a limited extent the Department of Health, Education, and Welfare. Elsewhere, veterinary medicine and research are merely a byproduct of other activities, e.g., of radiation research by the Atomic Energy Commission.

*USDA budget for veterinary activities.*—If one were to attempt to list USDA–State obligations for veterinary activities, the following table might serve as a partial reference tool. It cannot be regarded as a definitive statement for the reasons outlined in the preceding paragraphs.

TABLE 1.—*Obligations for USDA and related veterinary activities, Federal and non-Federal funds, fiscal year 1960*

[In thousands]

| | 1960 obligations | |
|---|---|---|
| | Federal | Non-Federal |
| Research: | | |
| Animal husbandry (avian leukosis) | $251 | (1) |
| Animal disease and parasite | 7,061 | (2) |
| State experiment stations | 1,578 | 5,306 |
| Total, research | 8,890 | 5,306 |
| Animal disease and pest control: | | |
| Animal disease control and eradication | 23,414 | 26,941 |
| Animal inspection and quarantine | 1,655 | ---------- |
| Total, animal disease and pest control | 25,069 | 26,941 |
| Meat inspection | 21,124 | ---------- |
| Grand total | 55,083 | 32,247 |

[1] Covered by State experiment stations, non-Federal funds.
[2] Federal-grant funds.

The subcommittee attempted to determine what State and local expenditures were, as indicated by the column "Non-Federal." But the second column remains incomplete because statistics have not been compiled by any source for this particular purpose.

With regard to meat inspection, it might be estimated that around 80 percent of the commercial slaughter is under Federal inspection. The remaining 20 percent which is under State and local inspection would presumably require an expenditure of approximately one-fifth of the amount of the cost of Federal inspection.

Finally, it may be noted that in addition to the funds appropriated by the Congress for Federal meat inspection, a total of $5 million is paid by the inspected packers and other agencies to cover costs of overtime, inspection and for inspection specification compliance or special services.

The subcommittee also endeavored to ascertain the level of financial support for veterinary education in the United States. A recent survey indicated that for 17 of the 18 schools, financial resources available to them for the 1959–60 fiscal year was $13.3 million. By estimating the amount available to the 18th (nonreporting) school, it is believed that a total of $14 million for the 18 institutions was available.

*Other principal agency expenditures.*—Major identifiable expenditures which are veterinary in nature on the part of other Federal departments and agencies are listed in the following table.

TABLE 2.—*Other agencies' obligations in veterinary medicine, fiscal year 1960*

| | |
|---|---|
| Department of Defense: | |
| Department of the Army | $608,358 |
| Department of the Air Force | 4,892,000 |
| Department of Health, Education, and Welfare | ---------- |
| Communicable Disease Center: | |
| Veterinary public health program (demonstrations, consultation, laboratory aid, and epidemic investigations) | ---------- |
| 1. Rabies control with focal points at Atlanta, Ga., Las Cruces, N. Mex., and Poynette, Wis | 276,600 |
| 2. Control of other diseases of animals transmissible to man such as brucellosis, leptospirosis, ringworm, creeping eruption, and anthrax | 203,950 |
| Arctic Health Research Center: Research and investigations into prevalence, mode of infection, and control of diseases of animals transmissible to man under conditions peculiar to arctic and subarctic regions | 70,078 |
| National Institutes of Health: | |
| 1. Animal hospital, care and quarantine of certain laboratory animals | 313,334 |
| 2. Large-scale production of small animals used in medical research | 560,346 |
| 3. Comparative pathology section, research aimed at detection and identification and control or eradication of animal diseases at National Institutes of Health | 62,295 |

*Veterinary medical research grants.*—Since the subcommittee is primarily interested in research, as such, the following tables are presented. They indicate dollar volume and project totals of research respectively, in the U.S. Department of Agriculture-State programs and in other programs (notably those of the National Institutes of Health).

TABLE 3.—*USDA veterinary medical research, estimated obligations, and projects, fiscal years 1960 and 1961*

| | Estimated obligations | | Number of projects | | | |
|---|---|---|---|---|---|---|
| | 1960 | 1961 | Intramural | | Extramural | |
| | | | 1960 | 1961 | 1960 | 1961 |
| Agricultural Research Service: | | | | | | |
| Animal diseases and parasites | *Thousands* $6,927 | *Thousands* $8,206 | 112 | 110 | 4 | 5 |
| Animal husbandry | 448 | 474 | 16 | 16 | 1 | 1 |
| Agricultural Marketing Service | 18 | 18 | ---------- | ---------- | 1 | 1 |
| State experiment stations, Federal-grant | 1,578 | 1,610 | ---------- | ---------- | 271 | 275 |
| Total | 8,971 | 10,308 | 128 | 126 | 277 | 282 |
| Reported | 9,000 | 10,300 | ---------- | ---------- | ---------- | ---------- |

NOTE.—The 7 extramural contracts are with colleges of veterinary medicine or a related function in a university.

TABLE 4.—*Veterinary research supported by other Federal granting agencies, fiscal year 1960*

The following projects concern animal diseases, including poultry, and deal with animal physiology and nutrition. These data include only those presently active and covered by the Bio-Sciences Information Exchange:

| Source of grants | Number of projects | Amount |
|---|---|---|
| National Institutes of Health | 211 | $3,055,422 |
| Other Federal agencies | 36 | 731,938 |
| Total | 247 | 3,787,360 |

To these figures, we may add the total of private research projects to the extent they are registered with the Bio-Sciences Information Exchange:

| Source of grants | Number of projects | Amount |
|---|---|---|
| Non-Government (private foundations) | 30 | $431,466 |
| National total | 277 | 4,218,826 |

*Larger fiscal significance of veterinary research.*—The preceding tables do not encompass the genuine fiscal significance of veterinary medical research to the U.S. Government. Nor would the tables convey such significance even if there could be added other more isolated expenditures of an indirect veterinary research character in other Federal agencies.

It is the indirect significance of veterinary medicine and veterinary medical research which involves larger financial outlay by the U.S. Government and a still larger significance in nonfiscal terms.

For the basic fact is that veterinary knowledge and know-how plays an important role in an incalculable proportion of Federal biomedical

research which is carried out—not for the health of animals, but basically for the health of man himself.

Thus for the 1960 fiscal year, the Congress provided $590 million to the National Institutes of Health and some $185 million for eight other agencies for biomedical research. (The latter sum is over and above the pertinent amount appropriated to USDA.)

In this Government-wide total of perhaps three-fourths of a billion dollars, no man can calculate the considerable extent to which the results of the research may hinge upon the soundness of extrapolation of findings on experimental animals to man himself.

If the scientific process is to be efficacious, a norm must always be plotted for the animals. But, how can there be determined what is normal in a monkey, a mouse, or a guinea pig unless there is sufficient knowledge about the nature of the animal and of its behavior? Then, too, if, for example, a virus is being studied in man, there is no telling where the trail of the virus may lead—perhaps, from man to animal to man or from insect to animal to man or in a variety of other permutations.

Study of viruses appears to be leading to study of life itself, of the gene, for example, and the process of cell reproduction. The crucial behavior of human, animal, and plant hereditary units is not divisible into three compartments; it is a unity.

Meanwhile, if man learns about man from animals and insects, man can also apply what he learns from such research to animals and insects. A myriad of pharmaceuticals and biologicals from tranquilizers to antibiotics were developed basically for man but have found significant use as regards animals.

*Getting value from research.*—In the light of factors mentioned above, it becomes difficult, if not impossible, to arrive at a universally acceptable dollar total of what constitutes indirect veterinary type expenditures among Federal agencies which have no line-item outlay of this nature. Two different individuals with two different viewpoints, as to what constitutes research and regulation for animal health, as contrasted with such activity for human health, would undoubtedly arrive at entirely different totals. Since so many arbitrary definitions and accounting decisions would be required, we have not attempted to make a definitive Government-wide estimate.

The basic fact is that neither Federal scientific research nor health-oriented regulation lend themselves to easy classification, fiscalwise or sciencewise. What is important is that, regardless of how such activity may be labeled and classified, the taxpayers receive $1 (or more) in value for every Federal dollar expended. It is to the review of this latter goal that the publication is basically directed. While we cannot analyze the expenditure in depth, we can and do endeavor to illuminate the situation by descriptive data, which is assembled in this broad way for the very first time, we believe.

*Significance to American economy.*—Throughout this report, the various contributors presented estimates, at the subcommittee's invitation, as to the economic significance of particular research.

It would be well to note at this point these facts which underline the economic value of the animal population, itself, and the products it yields:

1. On January 1, 1960, the total value of livestock and poultry on U.S. farms was $16.2 billion.

2. For 1959, total cash receipts from farm marketings from livestock and livestock products were $18.8 billion. This represented 55.9 percent of total farm cash receipts (the other 44.1 percent deriving from crops). Of the livestock percentage, cattle and calves represented 22.7 percent (of receipts from all commodities), dairy products, 14 percent, and hogs, 8.6 percent.

*Intangible savings from research.*—There is still another phase appraising the value of veterinary medical research and of veterinary medicine itself. The significance of this phase is not in the slightest reduced because it resides in intangible values; indeed, its significance is heightened.

This is the case not merely as regards veterinary medicine, but as regards all of medicine, both preventive and curative.

An illustration may serve to underline this fact. One can estimate that the economic cost of rabies in the United States is $5 million a year, but one cannot put a dollar sign on the cost to a single family where a child has been bitten by a dog, which may or may not prove rabid. Five to ten percent of the victims of dogbites do have to take antirabies vaccine. But who can compute the cost of the human anguish which is involved?

Nor can there be expressed in dollars and cents the compassion which man feels for animals themselves and toward prevention of needless pain and premature death among them, wholly aside from their economic significance.

The millions of owners of dogs and cats in our country do not view their animal friends as an industry, although economists naturally may in counting expenditures for household pets.

To the dog owner or cat owner, however, the valued services of the veterinarian are reckoned in far more than monetary ways.

The organization of veterinary public health in States and cities across the country is more than a public disbursement in dollars and cents, it is a contribution to intangible values, as well.

## Section 2. Survey of Who Is Doing What and Where in Research

Research conducted or supported by Federal agencies receives principal attention within this volume. However, significant veterinary research has been conducted in many other laboratories and by many organizations. Research is a vital part of the program of every veterinary college, of the veterinary science departments of land-grant colleges and State universities, of drug and biological companies, and of private foundations. (See Colleges of Veterinary Medicine, p. 85; and Veterinary Biological Licensees Association, p. 175.) A few local and State health departments and some State departments of agriculture conduct active animal disease research programs. Some practicing veterinarians study diseases that are widespread in the animal populations they serve.

### FEDERAL ACTIVITIES

The Animal Disease and Parasite Research Division of the Agricultural Research Service of the U.S. Department of Agriculture

conducts the Nation's most extensive veterinary research program. Its laboratories at Beltsville, Md., investigate many phases of diseases of domestic animals. Some of these research projects will be expanded and moved to the National Animal Disease Laboratory at Ames, Iowa, which began operation in 1961. The new laboratory will investigate animal diseases now present in the United States. Parasitology research will continue to be centered in laboratories at Beltsville. Facilities at the Plum Island (N.Y.) Animal Disease Laboratory represent the U.S. first large-scale attempt to provide research protection against imported animal diseases. Priority has been given to research on foot-and-mouth disease.

In addition to operating its own laboratories, the Animal Disease and Parasite Research Division conducts research under contract with many colleges and universities.

The Entomology Research Division of ARS, in its laboratories at Beltsville's Agricultural Research Center and other locations, studies insects, mites, and ticks of veterinary importance.

The Communicable Disease Center of the U.S. Public Health Service has within its organization a rabies research laboratory, a Veterinary Public Health Laboratory to study bacterial diseases, and special units which are concerned with animal-borne encephalitis, ringworm, and parasites. Plans are now being made for the expansion of these activities, some of which will become a part of a Comparative Medical Research Center.

The USPHS carries on veterinary research in such fields as air pollution, radiological health, comparative pathology, and other studies in cardiovascular, degenerative, and infectious diseases. The Arctic Health Research Center investigates animal and human diseases as they relate to Arctic environment. Its animal hospital at NIH in Bethesda investigates new clinical and surgery approaches to aid animals victimized by accidents or crippling diseases.

The Patuxent (Md.) and Denver (Colo.) Wildlife Research Centers of the U.S. Department of the Interior conduct research on wildlife diseases. The NIH, Rocky Mountain Laboratories at Hamilton, Mont., have carried on special studies of diseases of nature, including those found in animals, for many years, which started with Rocky Mountain spotted fever 40 years ago.

Military veterinarians conduct research on animal diseases transmissible to humans, in addition to their work as members of research teams investigating human diseases and problems of artificial environments.

### NATIONAL ACADEMY OF SCIENCES

An estimated 37 million small animals, plus poultry and other birds, are used in the United States each year for research, laboratory instruction, and testing.

The Institute of Laboratory Animal Resources, National Research Council–National Academy of Sciences, aids researchers in obtaining the kind and quality of experimental animals they need.

(Veterinarians in the National Institutes of Health and the Walter Reed Army Medical Center have also played a major role in the development of pathogen-free colonies of experimental animals.)

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## Section 3. The Work of Specific Units

This section describes the work of the principal organizations engaged in veterinary medical research activity.

### A. Animal Disease and Parasite Research Division, Agricultural Research Service

The Animal Disease and Parasite Research Division of the Agricultural Research Service in the U.S. Department of Agriculture is charged with research activities in the field of animal diseases and parasites. It was officially born in 1954, through successive reorganizations within the Department.

*Early Veterinary Division.*—In the 1870's and 1880's, the welfare of the relatively small population of the United States was threatened by serious animal disease outbreaks. People were concerned about the economic impact of diseases and the threat of insufficient meat in their diets—not the transmission of disease from animals to humans. Prompted by the public need for research knowledge of animal diseases, the Department of Agriculture established a Veterinary Division on May 1, 1883. Its purpose was the investigation of animal diseases—specifically, contagious bovine pleuropneumonia, Texas (cattle tick) fever, hog cholera, and fowl cholera. Dr. D. E. Salmon, a veterinarian, was named head of the Division.

*Bureau of Animal Industry formed.*—The next phase in the development of the Division was an act of Congress establishing the Bureau of Animal Industry on May 29, 1884, "to prevent the exportation of diseased cattle and to provide the means for the suppression and extirpation of pleuropneumonia and other contagious diseases of domestic animals."

Research on animal diseases preceded other veterinary activities of the Federal Government by 5 years. The BAI was subsequently charged with both research and control of animal diseases and parasites. The gradual growth of the human and animal populations in the United States, accompanied by the inevitable increase in diseases and parasites affecting animals, brought a gradual expansion of the Bureau's responsibilities and activities.

*Many veterinary fields represented.*—Dr. Salmon was appointed Chief of the newly formed Bureau. He named three capable scientists as research members of his staff—Dr. Theobald Smith, Dr. F. L. Kilborne, and Dr. Cooper Curtice. These men were the "original four" of the present ADP Division. An interdisciplinary group, they represented the fields of both human and veterinary medicine. Dr. Smith, the assistant to the first chief of the animal disease research organization, was a doctor of medicine, who later gained world fame for his studies in comparative medicine.

Mention of the names of Drs. Smith and Kilborne inevitably recalls to the minds of scientists one of the great chapters of biomedical research. It was their early work on Texas fever which led to control of the disease and to a fundamental research discovery, that ticks and insects could spread infectious diseases. The far-reaching effects of this new knowledge opened the doors to research on malaria, typhus, and other insect-borne diseases of man and animals. See chart "Achievements Made Possible By A Basic Research Discovery" (fig. 6).

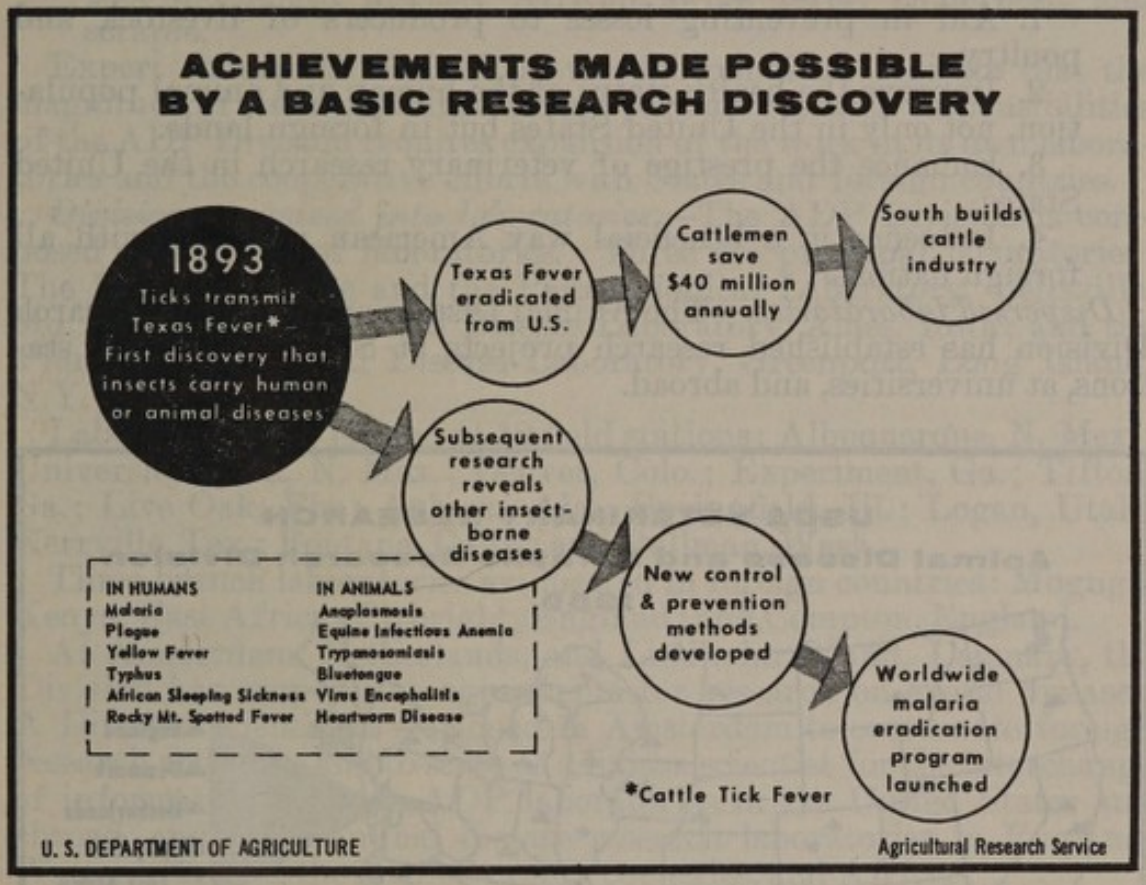


FIGURE 6.

*National, regional diseases investigated.*—As the organization expanded, professional personnel from disciplines in the fields of parasitology, bacteriology, virology, mycology, and pathology were welded into one large division. ADP Division research in the field of veterinary medicine is directed, as it has been from the beginning, toward animal disease and parasite problems which are either national or regional in scope. Many diseases of animals present problems of spread and control that transcend the capacities of the individual States and threaten the public welfare. Studies are also conducted here and abroad to prepare the Nation to cope with exotic animal diseases that might gain entrance into the United States.

Foremost among animal diseases that originally caused national concern were contagious pleuropneumonia and Texas fever in cattle. BAI scientists studied these diseases and others such as tuberculosis, hog cholera, anthrax, blackleg, brucellosis, fowl cholera, and many parasitic diseases.

*Research results applied.*—Results of research are published and disseminated for the welfare of the animal industries of the United States and of the world. In many instances, as previously referred to, the scientific discoveries in veterinary medicine have been applied in human medicine and have contributed directly to the health of man. Veterinary research in the United States has helped veterinarians and other scientists over the world control and eradicate animal diseases and parasites.

*Research goals.*—Veterinary research on animal diseases and parasites in the ADP Division of the Department of Agriculture is designed specifically to—

1. Aid in preventing losses to producers of livestock and poultry.
2. Improve the health status of the human and animal population, not only in the United States but in foreign lands.
3. Enhance the prestige of veterinary research in the United States.
4. Influence in a beneficial way American relations with all foreign nations.

*Dispersed laboratories.*—The Animal Disease and Parasite Research Division has established research projects at State experiment stations, at universities, and abroad.

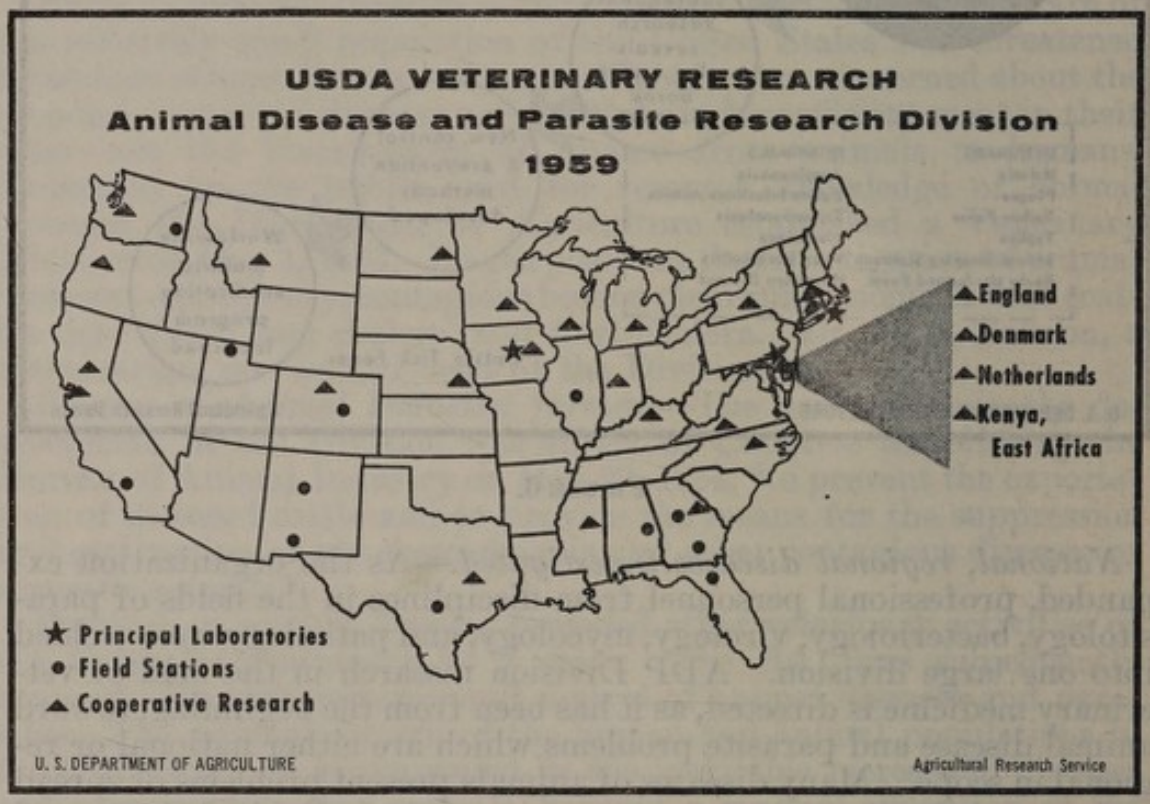


FIGURE 7

Factors which influenced the utilization of widely dispersed laboratories include:

1. The multiplicity of disease problems arising from greatly expanded meat food animal production, which makes it physically impossible to conduct the necessary research on serious and costly animal diseases and parasites at one laboratory.
2. The lack of sufficient personnel and adequate facilities in the ADP Division.
3. The desirability of conducting some research in the geographic areas where the disease under investigation is most prevalent or enzootic in nature.
4. The desirability of conducting research in foreign countries on some enzootic diseases which are of mutual concern to the United States.
5. The desirability of American scientists working with foreign scientists who have know-how and established laboratories for the investigation of certain diseases and parasites, such as

foot-and-mouth disease, African swine fever, rinderpest, and scrapie.

Expert comments received by the subcommittee indicate that the magnitude of the animal disease and parasite research responsibilities of the ADP Division requires expansion of the work in its own laboratories and the cooperative efforts with States and foreign countries.

*Division organized into laboratories.*—The ADP Division is composed of a group of laboratories. Three are principal laboratories: The Director's Office and the Parasitological Laboratory, Beltsville, Md.; the National Animal Disease Laboratory, Ames, Iowa; and the Plum Island Animal Disease Laboratory, Greenport, Long Island, N.Y.

Laboratories are located at 12 field stations: Albuquerque, N. Mex.; University Park, N. Mex.; Denver, Colo.; Experiment, Ga.; Tifton, Ga.; Live Oak, Fla.; Auburn, Ala.; Springfield, Ill.; Logan, Utah; Kerrville, Tex.; Fontana, Calif.; and Pullman, Wash.

Three branch laboratories are located in foreign countries: Muguga, Kenya, East Africa; Pirbright, England; and Compton, England.

At Amsterdam, Netherlands, and Lindholm Island, Denmark, the Division has cooperative agreements for research on exotic diseases. A Division scientist is stationed in Amsterdam to coordinate foreign research activities and to serve as a liaison scientist for the interchange of information between ADP laboratories in the United States and abroad, and other animal disease research laboratories in England, Western Europe, the Mediterranean countries, and Africa.

Cooperative research is also underway at 28 State experiment stations throughout the United States.

*Twenty-seven diseases studied.*—The ADP Division includes veterinary scientists, their colleagues from various other disciplines, and technical personnel of greatly diversified training and specialties. They are presently conducting research in ADP laboratories on 27 disease conditions of livestock and poultry. Diseases of fur animals are included. The disease conditions represent infectious and contagious diseases caused by viruses, rickettsia, bacteria, or fungi. Many of them, such as tuberculosis, ornithosis (psittacosis), leptospirosis, swine erysipelas, brucellosis, and salmonellosis, are of particular significance because they affect both animals and man.

*Noninfectious diseases.*—ADP scientists are investigating noninfectious diseases of national and international significance. Prominent among these are bloat in ruminants, livestock poisoning by plants, and the effects of radioactive fallout on cattle. Obviously, the study of radioactive fallout occupies a unique position in veterinary research. The effects of nuclear fission and fusion tests on meat, milk, butter, and leather supplies for human use are not fully known. Immediate and residual effects of the most harmful radioactive elements on cattle are under study. Influences of environmental or natural radiation are also insufficiently understood at the present stage of scientific knowledge.

The pathology and distribution of malignant and nonmalignant tumors, which cause considerable monetary losses in livestock annually, and may even pose a problem in human health, are other subjects of research.

By way of background, it may be pointed out that in the fifth committee print in the subcommittee's series entitled "Cancer—A Worldwide Menace," the following paragraphs pointed up the need for study of comparative malignant neoplasms.

*1. What is cancer?*

Cancer is a popular term for malignant neoplasms, a great group of diseases of unknown (and probably multiple) cause, occurring in all human and animal populations and arising in all organs and tissues. The malignant cells lack the usual controls over their growth and function. As a result, they invade adjacent tissue and spread to distant parts of the body, with serious adverse effects to the individual.

* * * * * * *

*31. What areas of cancer research lend themselves particularly to an international approach?*

* * * * * * *

5. *Tumors of domestic animals.*—This is both an economic problem for many countries and an opportunity for international research into the causes of cancer.

Some tumor-producing diseases, such as malignant lymphoma in cattle and leukosis in poultry, also occur in man. Cattle lymphoma has shown a marked increase in the last 6 years. The reasons for this sharp increase (if the increase is not due merely to better methods of detection and reporting) also need study.

*New chemicals.*—ADP Division veterinarians are studying the toxicological and pathological effects of insecticides, pesticides, herbicides, and fungicides in livestock. They are using radioactive isotopes to trace these residues in the various parts and products of the animal. The results of this work will guide entomologists, parasitologists, and manufacturers in their recommendations of chemicals for specific purposes.

*Parasitology research.*—Research underway in the field of parasitology is designed to find new information about many of the internal and external parasites of animals that reduce food and clothing production in the United States and throughout the world. Through fundamental and applied research, scientists are studying the effect of parasiticides in the treatment and control or eradication of animal parasites. These research projects may directly benefit human health, because a large number of animal parasites also infect man. Anaplasmosis, caused by a protozoan organism and transmitted by ticks and flies, is one of these diseases and when it appears in cattle is a serious economic drain on the cattle industry in many Southern and Northwestern States. Basic research on this disease is continuing; new experimental field trials apply current research findings to anaplasmosis control.

Antiparasitic investigations are directed toward the three major parasite groups: worm parasites, protozoan parasites, and arthropods. The work in all groups is concerned primarily with the discovery and development of new antiparasitic agents; the standardization of certain newer remedies; the comparative evaluation of alternative treatments on basis of safety, value, simplicity, and cost; and the development of practical chemical control programs for all important parasitic infections of livestock and poultry.

The life histories of parasites in the three major groups are studied to develop programs of control or eradication. Simple changes in management practices have led to control of roundworms and of lungworms in swine, and to prevention of blackhead in turkeys.

*Unique publication.*—An important part of parasitological research is the publication and maintenance at the Beltsville Laboratory of "The Index-Catalogue of Medical and Veterinary Zoology." The only publication of its kind, it frequently is used by ADP Division investigators and other American and foreign research scientists throughout the world. This catalog is a compilation of the world's literature on parasites and parasitic diseases of animals and on the parasitic nematodes of plants. It now includes more than 1½ million entries gleaned from over 22,000 publications. The index lists information on the parasite, its host, and the scientist reporting on it.

The ADP Division's parasite collection is a national depository for documented specimens. Both the index-catalog file and the parasite collection are valuable working tools for the identification of parasites. Information and specimens from ADP sources are sent upon request to parasitologists throughout the world.

*Infectious disease research.*—In the field of infectious and contagious diseases of animals, ADP and BAI accomplishments are recorded throughout scientific literature. Contagious pleuropneumonia of cattle, foot-and-mouth disease, glanders and fowl plague were eradicated from the United States many years ago through application of research findings. Research knowledge has been the basis for the initiation of control or eradication programs on other widespread and costly diseases—such as tuberculosis, brucellosis, dourine, pullorum disease, and vesicular exanthema.

Sufficient research facts have been gathered to support further experimental field trials against hog cholera, which may lead to an eradication program in the not too distant future.

*Cooking of garbage fed to hogs.*—Vesicular exanthema, or VE, of swine was recognized in California in 1932 and remained in that State for 20 years. Then, in 1952, the disease spread rapidly throughout the United States. Veterinarians of the ADP Division discovered that hogs contracted the disease by eating contaminated feed. Knowledge of this natural method of spread—plus the observation that the disease occurred most frequently in garbage-fed hogs—led to the recommendation that the disease be controlled by cooking garbage. Individual States passed laws requiring the cooking of garbage before it was fed to swine. Vesicular exanthema has been eradicated from the United States; the entire world is now free from it.

*Look-alike disease lesions.*—A large group of ADP Division scientists embracing several disciplines of research conducts basic or fundamental investigations on vesicular diseases. Vesicular, or blister-causing, diseases produce grave economic problems—indeed, crises—when they appear in a country. Foot-and-mouth disease is the most economically important vesicular disease; it is one of the world's most dreaded and most easily communicated diseases. Vesicular stomatitis and vesicular exanthema are less serious economic problems.

Foot-and-mouth disease and vesicular stomatitis produce lesions and symptoms which are similar, if not indistinguishable, from vesicular exanthema. A tremendous amount of work is necessary to differen-

tiate between these vesicular diseases of livestock; laboratory diagnostic services must be constantly available.

Newer methods of tissue culture provide economical and rapid means for studying foot-and-mouth virus and produce large quantities for tests and analyses. Recently the infectious part of the virus has been separated from the part that reacts in specific laboratory tests to identify it. This basic technique and information may be used in developing improved diagnostic tests and vaccines. Tests with meat from carcasses of infected animals showed that the virus of foot-and-mouth disease survived in certain tissues for as long as 50 days. This study prompted reevaluation in 1959 of regulations on the importation of cured beef from countries where the disease is present.

*Rapid, accurate diagnosis.*—Success in the early control and eradication of infectious diseases is largely dependent on prompt and accurate diagnosis. At the Plum Island Animal Disease Laboratory, exotic diseases have been studied with particular emphasis on diagnostic procedures. Trained personnel and biological tools are available to make immediate diagnosis of animal diseases that do not occur in the United States. Diagnostic tests have been developed for fowl plague, contagious bovine pleuropneumonia, foot-and-mouth disease, and rinderpest. Biologic materials for the diagnosis of other exotic diseases are also available at Plum Island.

ADP Division scientists assigned to the European Mission for Foot-and-Mouth Disease Research and their European colleagues have contributed valuable scientific data. Their findings include development of diagnostic techniques, data on the biochemical and biophysical characteristics of the virus, methods of transmission, adaptation of the virus to the developing chicken embryo and the chicken, and duration of immunity.

*African swine fever.*—ADP Division research workers in Africa indicate that new techniques may soon be available for prompt and accurate diagnosis of African swine fever. This disease produces symptoms indistinguishable from hog cholera. Should it gain entrance to the United States, it would be difficult to control without the diagnostic tools to differentiate it from hog cholera.

African swine fever is an odd disease because the causative virus remains for life in the blood stream of infected swine that survive the initial attack. The virus is shed in the excreta and the animals are constant sources of infection; in other words, surviving animals become carriers, or reservoirs, of the infection. African swine fever had been limited to Africa until recently, when it appeared in Portugal and later in Spain. British and American workers in Africa assisted in confirming the presence of African swine fever in Portugal and Spain.

ADP Division workers in Africa have materially added to data on the diagnosis, immunization, and control of rinderpest.

*New approach.*—Only since 1950 have veterinarians seriously considered that bovine genital vibriosis and leptospirosis contribute to abortions and reproductive disorders of cattle, swine, sheep, and goats. Both diseases are prevalent throughout the world and certain types, or strains, affect man.

Vibrio fetus infection in cattle causes an estimated annual loss of $135 million, and accounts for an estimated 40 percent of bovine

infertility in the United States. Research at Beltsville, Md., has shown:

1. Cows bred to infected bulls may be infected at each calf crop.
2. After two calf crops produced by artificial insemination with noninfectious semen, cows were free of vibriosis and safe for natural breeding.
3. Bulls remain infected much longer than cows.

The ADP scientist in this field of research is a member of the FAO panel to disseminate information and devise means for control or eradication of bovine genital vibriosis.

Economically, leptospirosis is ranked the third most important disease of cattle and swine in the United States. Research has developed quantitative methods of culturing the causative agent for further analyses, and standardized the microscopic agglutination test for leptospirosis diagnosis. These two steps constitute the first forward movement against leptospirosis which can be applied on a nationwide basis.

*Research brings practical control.*—Research by department scientists has provided the basis for sound and practical programs of eradication of tuberculosis and brucellosis. Many years of diligent basic research have contributed to a drastic reduction in the incidence of tuberculosis and brucellosis in the animal populations of the United States and have also contributed to the reduction of these diseases occurring in man. Tools for the diagnosis and methods for the treatment of brucellosis developed by the veterinary profession have been adapted for use in human medicine.

*Vaccine has worldwide use.*—Division workers found and developed strain 19 brucellosis vaccine. It is now used in 30 countries throughout the world for immunizing animals against the disease. Other fundamental studies on the methods of transmission of the disease, localization of the organism in the animal, development and standardization of diagnostic techniques, and classification of strains have saved the animal industry many millions of dollars annually. The people of the world have benefited directly by improved health and economic status.

*TB theory proved.*—Based principally on Koch's findings and his work on a tuberculin, in the 1890's, BAI scientists began research which proved their theory that tuberculosis in animals is infectious for humans. Methods for growing the tuberculosis organism to produce superpotent diagnostic tuberculin were worked out by USDA research workers. These have been adopted throughout the world by organizations concerned with the health of animals and man.

*Hog cholera research.*—In the early 1900's, veterinary researchers of the Division developed the virus-serum method of immunizing swine against hog cholera, an achievement that made it possible to continue to grow hogs in the United States. Vaccination with live virus and serum was found actually to perpetuate the disease, so a killed vaccine against hog cholera was produced by the Department as early as 1935. This, together with commercially produced modified live-virus vaccines, has greatly reduced the incidence of disease. Large-scale experiments with the use of these products in the field are underway, with the view of establishing procedures for a pro-

gram of eradication of hog cholera in the United States. A variant strain of hog cholera virus was found by Department veterinarians in 1949.

*Shipping fever.*—Closely akin to human influenza virus, shipping fever virus was recently isolated from sick cattle by a Division veterinarian. This development brings closer the production and use of a vaccine against this disease of cattle which causes annual losses of $25 million.

*Anaplasmosis.*—In anaplasmosis research the development of diagnostic techniques to detect apparently healthy carriers has been a major accomplishment of the Animal Disease and Parasite Research Division. Discovery of insect vectors, methods of anaplasmosis treatment, and epizootiological findings have been helpful in combating this costly disease of cattle.

*Other diseases studied.*—Epizootiological and diagnostic studies have been conducted on swine erysipelas, fowl cholera, ornithosis of turkeys, air sac infection of poultry, bluetongue of sheep, atropic rhinitis of swine, and Newcastle disease of poultry. Killed vaccines have been developed for fowl cholera and Newcastle disease. Effective treatment and improved diagnostic techniques for ornithosis in turkeys have been developed in cooperative research. Gnats have been shown to be vectors and transmitters of bluetongue. The viruses of hog cholera, bluetongue, mink and fox distemper, and shipping fever have been adapted to cultivation on tissue cultures. Distemper vaccines and botulism antitoxins have been prepared for use on mink.

*Research develops tools.*—Basic research on animal diseases has furnished knowledge on which a number of sound programs of control or eradication have been established. In addition, it has produced procedures for reducing the economic losses from diseases for which sound control measures cannot yet be recommended. Although they perhaps seem obscure to the casual observer, the techniques or tools developed through this research will more rapidly further the solution of present and future animal disease problems.

*World scientific leaders.*—The subcommittee has noted that USDA scientists have always been among the foremost world leaders in the field of research on animal parasites. The development of new, safe treatments has favorably influenced the economic status, health, and general welfare of the peoples of the world.

Many foreign scientists have come to the United States to study methods of research, to discuss findings, to exchange ideas, and to seek solutions to the perplexing problems in the field of parasitism. These visits and reciprocal exchanges by scientists of the United States have proved to be of mutual and lasting benefit.

*Significant accomplishments.*—Specific accomplishments in the field of antiparasitic investigations have brought worldwide recognition to the ADP Division and, earlier, to BAI. Among these achievements are the following:

1. The development in 1915 of a critical test for evaluating worm remedies. This accomplishment provided the first accurate method of ascertaining the efficiency of antiparasitic drugs. As a consequence, scientists throughout the world have used the basic principles of the test to develop and evaluate more efficient and reliable treatments for the control of parasitic diseases in both man and animals.

2. The discovery of treatments for hookworms in dogs and their subsequent use against related hookworm species in man. In 1921, scientists of the USDA discovered the markedly efficient action of carbon tetrachloride against hookworms in dogs. Later, it was tested against related species in man. The chemical has been used in all parts of the world where hookworm disease occurs. Further research with this chemical led to its widescale use against a variety of helminthic parasites of livestock. Carbon tetrachloride remains today the treatment of choice against the common liver fluke of sheep and is an alternative treatment for certain other worm parasites.

Government researchers found in 1925 that tetrachlorethylene had all the advantages of carbon tetrachloride, but carried less risk to the patient. This drug has remained for over a quarter of a century the standard treatment for human hookworm disease in many parts of the world. Later studies in the USDA and elsewhere showed that this chemical also had important antiparasitic applications in ruminants and other animals.

3. The development of phenothiazine for the control of parasites in farm animals and poultry. Following the discovery of its antihelminthic action in 1938 by scientists in the USDA, phenothiazine became the principal drug used against gastrointestinal roundworm parasites throughout the world. It combines an unusual margin of safety and wider range of action in more classes of livestock than any other drug. Savings in livestock production in this country, as well as in all parts of the world, are incalculable. For example, phenothiazine has been credited with saving sheep producers in one State nearly $5 million annually.

Its worldwide acceptance is reflected in the more than 100 scientific papers published annually on various aspects of its antiparasitic effects. While scientific research for more effective new chemicals continues, phenothiazine has remained a highly important factor in livestock production. For several years, phenothiazine was used against pinworm infections in man.

4. The development of the sodium fluoride treatment for removal of large roundworms from swine. In 1944, workers in the USDA solved one of the most serious problems of swine producers with this treatment for roundworms. Sodium fluoride possesses the qualities of an ideal antihelminthic; when used as recommended, it is inexpensive, safe and easy to administer, and highly effective. Because the chemical is rapidly eliminated from edible tissues of treated animals, it is not a hazard to the consumer. The successful use of sodium fluoride in feed has controlled this most injurious worm parasite of swine, ended the need for individual treatment, and set the standard for the medication of swine to control other worm parasites.

5. The development in 1917 of oil of chenopodium for the removal of large roundworms from swine. This drug became the treatment of choice in all important swine-raising areas of the world for almost 30 years. It was supplanted by sodium fluoride. Oil of chenopodium is also effective against certain worm parasites in horses, dogs, and other animals.

6. The evaluation of carbon disulfide in 1917 as an effective treatment against stomach bots of horses. This is the most widely recommended chemical for the removal of these parasites from horses. Later

investigations by USDA researchers established its usefulness against large roundworms of horses and swine.

7. The development in 1919 of the copper sulfate treatment for removal of large stomach worms from sheep, goats, and cattle. This treatment promptly attained worldwide usage; it has been given to untold millions of animals. After 40 years, copper sulfate remains one of the commonly employed remedies against stomach worms, among the most injurious of all parasites attacking farm animals.

8. The development of N-butyl chloride in 1932 for removing the common intestinal roundworm parasites in dogs. This chemical exhibited a wider range of action against these parasites than either carbon tetrachloride or tetrachlorethylene. It remained the drug of choice for the removal of large roundworms, hookworms, and whipworms for several years.

9. The discovery in 1934 of stibophen for controlling heartworms of dogs. This drug became the standard treatment for heartworm infections until the World War II development of arsenamide.

10. The discovery and development of barium antimonyl tartrate as an effective treatment for controlling gapeworms of poultry. Gapeworms, which are prevalent in all parts of the United States and many foreign countries, frequently cause severe losses among infected chickens and pheasants. The highly efficient treatment is the only one known for this condition.

11. The development of sulfaguanidine for the treatment and control of coccidiosis of domestic animals and poultry. In 1941, the drug was recommended in coccidiosis of sheep, a disease causing bloody diarrhea and death in feedlot and farm lambs. When the drug was subsequently tested against coccidiosis of calves and chickens, it showed unprecedented benefits. Discovery of the marked efficiency of this sulfa compound was a highly significant breakthrough and led to major advances in the chemotherapy of coccidial infections.

12. The development and standardization of the hexachloroethane drench for the destruction of liver flukes in cattle. This treatment, perfected in 1943, solved one of the principal parasite problems of stockmen in the gulf coast area of the United States. It is the treatment of choice for liver flukes in all areas of the world where this cattle parasite is found. The chemical is an alternative treatment for liver flukes in sheep and is also effective against certain roundworm parasites in sheep, goats, and cattle.

13. The development of the winter-treatment program with phenothiazine for the control of nodular worm disease of sheep. This project was a major contribution to the war effort in 1945 when the country faced a shortage of surgical suture material. Sutures could be made from normal sheep casings, but those showing nodules produced by the larval stages of the parasite were useless. Winter treatment proved a remarkably satisfactory solution to the immediate problem; more importantly, it led to the worldwide acceptance by stockmen of preventive medication against parasites.

14. The 1950 development of the portable pen program to reduce mortality of dairy calves. This system brought major savings in calf crops in areas where death losses from coccidiosis and other filthborne diseases were threatening the economic existence of dairy herds.

15. The development of spray-dipping to eradicate external parasites of livestock. This provided a rapid, efficient, and economical method of treating large numbers of animals with mobile equipment. It was introduced in 1955.

16. The 1956 demonstration of dusting as a safe, efficient, and simple method of eradicating external parasites of sheep. Dusting permits the treatment of animals during periods of inclement weather when dipping and spraying are contra-indicated.

17. The demonstration that systemic drugs, particularly organophosphates, are effective against nose bots of sheep. Until systemic drugs were used in 1957, treatment of infested animals was extremely laborious and not particularly effective.

18. The experimental establishment of mange mites of sheep and cattle in rabbits. This 1957 achievement permits economical research on potential antiparasitic agents and on the biology of the mites.

19. The development of an in vitro technique to assay miscellaneous chemicals as potential systemic treatments against cattle grubs. Use of test serum from medicated bovine and sheep nose bot larvae instead of parasites that spend long periods in the tissues of the natural host has speeded research. Until this development in 1957, each study required 8 to 9 months to complete.

*Insecticide research.*—All commercial and hundreds of other chemical compounds of significance to animal welfare have been studied by the ADP Division. A safe dosage for livestock, toxicity, and residues in meat and milk which might be hazardous to man have been determined for each chemical tested. Many compounds have been found to be too poisonous for animals or man to be permitted in commercial use.

A discovery by a Division veterinarian that insecticides which are insoluble in water can be as effective as water-soluble insecticides has been of widespread importance. The method applies insecticides to the skin in a suspension of fine particles in water. Division veterinarians have proved that residues in meat and milk followed application of either suspensions or solutions and occurred in equal quantity. The demonstration is the basis upon which systemic insecticides are now used for treatment of cattle grubs. Each year, use of systemic insecticides affords significant savings to cattle owners and the leather industry.

Safety measures established for humans who handle insecticides are also based on this discovery.

By use of radioactive toxaphene, ADP Division scientists demonstrated that large-particle emulsions deposited up to 30 times more substance on hair and wool than uniformly small-particle emulsions. This knowledge has been applied by industry in developing safer and more effective insecticides for use on cattle and sheep.

*Surgical procedure.*—The study of poisonous residues of insecticides in meat and milk was formerly a very slow and costly procedure because each animal treated by one sample of insecticide had to be disposed of by burning or burial. A Division veterinarian devised a surgical procedure for the removal of samples of fat from the abdomen of test cattle, sheep, or goats. The procedure permits periodic sampling of the fat before and after treatment, thereby giving accurate determinations of the amount of residues present and the time at

which they disappear. Test animals could later be used for other purposes or sold. Since 1948, this surgical procedure in research on residues of insecticides has saved more than $600,000.

Cooperative research with entomologists has shown that injections of insecticides such as dieldrin, aldrin, and lindane are effective against cattle grubs, lice, flies, and screwworms. Residues of these products were abundant and toxic when they were used in dips or sprays.

Teamwork by a Division veterinarian and entomologist resulted in a method of estimating the natural populations of screwworm flies. When flies were labeled with radioactive phosphorous 32, both the flies and their eggs could easily be identified with Geiger counters. This contribution was one of several which helped in the final elimination of the screwworm from the Southeastern States in 1959.

*Hyperkeratosis eliminated.*—The noninfectious disease of cattle known as hyperkeratosis caused an estimated annual loss of from $2 to $4 million a year in cattle production in the 1940's and the 1950's. The ADP Division initiated concerted cooperative research. State and Federal veterinarians found that the disease was caused by a chemical—highly chlorinated naphthalene—which was added to the greases, oils, and wood preservatives used on farms and in feed-pelleting machines. As a result of this research, hyperkeratosis was virtually eliminated from the United States by 1954.

Another cause of noninfectious diseases is poisoning by plants and weeds. Investigations in the Western United States have identified the poisonous plants and weeds which cause "trembles" and "loco" poisoning in cattle, sheep, and horses. "Big head" of sheep also proved to be caused by poisonous plants. Recommendations based on this research have saved livestock producers millions of dollars.

*Benefits of cooperative research.*—Cooperative research with State institutions affords urgently needed information on the regional or national animal disease and parasite problems which produce grave economic impact on the animal industry of the United States.

Results of internationally conducted research are measured not only in terms of gain to the animal industries of the United States and to the foreign country; such cooperative activities also increase the prestige of American veterinary research and foster better foreign relations.

Research now underway in the laboratories of foreign countries will be expanded when it is feasible and of mutual advantage. Countries stand to benefit mutually when the United States sends its scientists and furnishes material and equipment to an established foreign laboratory already investigating dangerous animal diseases and parasites which are prevalent in that country.

*Foreign scientists welcome.*—Many foreign scientists have been welcomed into ADP Division laboratories to do research. Since World War II, the number of foreign visitors has increased because the ADP Division, through its use of more and better equipment and other factors, has developed new techniques and procedures at a faster pace than most foreign countries. Many visitors have sought specific up-to-date information concerning U.S. research. These mutually beneficial contacts have been more valuable than transmission of information through publications and correspondence.

Many underdeveloped countries have grossly inadequate library facilities. The Department of Agriculture on one occasion furnished scientific and veterinary books for the establishment of three libraries.

*Major problems.*—Despite the tremendous advances within the last 15 years, many major problems in the field of veterinary research remain unsolved. More information is needed in the fields of virology, bacteriology, mycology, parasitology, poisonous plants, and toxicology of pesticides, fungicides, herbicides, and their residues. All unanswered questions are obstacles to the achievements desired by researchers and the public at large.

*Approaches to disease problems.*—The ADP Division has emerged from frontier-type research to a program of carefully planned, basic research. A review shows that available research knowledge governs the methods used to regulate specific diseases. The question for the future: Will the United States continue to live with its disease problems or will it eradicate animal diseases?

Rabies, hog cholera, Newcastle disease, and infectious bronchitis of poultry are examples of diseases that are controlled through the use of modified live-virus vaccines. They are diseases that the United States is, at present, "living with."

Contagious bovine pleuropneumonia, foot-and-mouth disease, vesicular exanthema of swine, and fowl plague in the infectious diseases group and hyperkeratosis of cattle in the noninfectious diseases group have been eradicated. They indicate the possibilities for wiping out other animal diseases through the use of research findings.

Tuberculosis, brucellosis, and salmonellosis (pullorum disease) of chickens are primary examples of advancement toward eventual eradication of animal diseases. In respect to these three diseases, the major problem is the development of more definitive diagnostic techniques for the recognition of the remaining small percentage of infected animals. Then, infected animals can be destroyed and total eradication completed. It is absolutely necessary to search for and identify nonpathogenic antigenic agents which are confusing the diagnosis of these diseases.

*Still enigmas.*—Scrapie in sheep, African swine fever, equine infectious anemia, and atrophic rhinitis are examples of diseases which are still largely enigmas to researchers.

What is the cause of scrapie?

Why do the viral causative agents of African swine fever and equine infectious anemia constantly remain in the bloodstream of affected, yet apparently healthy, animals and transmit the disease?

What is the cause of atrophic rhinitis in swine which has caused many hog growers to go out of business?

What are the natural reservoirs of the viruses of equine encephalomyelitis, hog cholera, and ornithosis?

What roles do the genetic differences in animals play in their susceptibility or resistance to disease? What is the mechanism of infection of disease agents?

*New findings create problems.*—Often, new research knowledge raises new problems about diseases under study. The ADP Division has found a variant of the old virulent hog-cholera virus, new types of foot-and-mouth disease, and Newcastle disease viruses, antigenic differences in strains of the same type of foot-and-mouth disease and

Newcastle disease viruses. These recognized factors greatly and adversely influence present ability to effectively cope with these disease problems.

Effective research on many existing problems can be most advantageously pursued by teamwork which will encompass the efforts of the various disciplines of biological investigations, such as bacteriology, virology, chemistry, biochemistry, physics, cytology, immunology, epizootiology, radiology, and pharmacology. The development of disease-free experimental animals is necessary for research in these areas.

### B. EXPERIMENT STATIONS AND VETERINARY SCIENCE DEPARTMENTS OF LAND-GRANT COLLEGES AND STATE UNIVERSITIES

There are 35 land-grant colleges in the United States and Puerto Rico which do not have colleges of veterinary medicine, but do conduct activities in the field of veterinary medicine. See map, "Veterinary Education in the United States," (fig. 8).

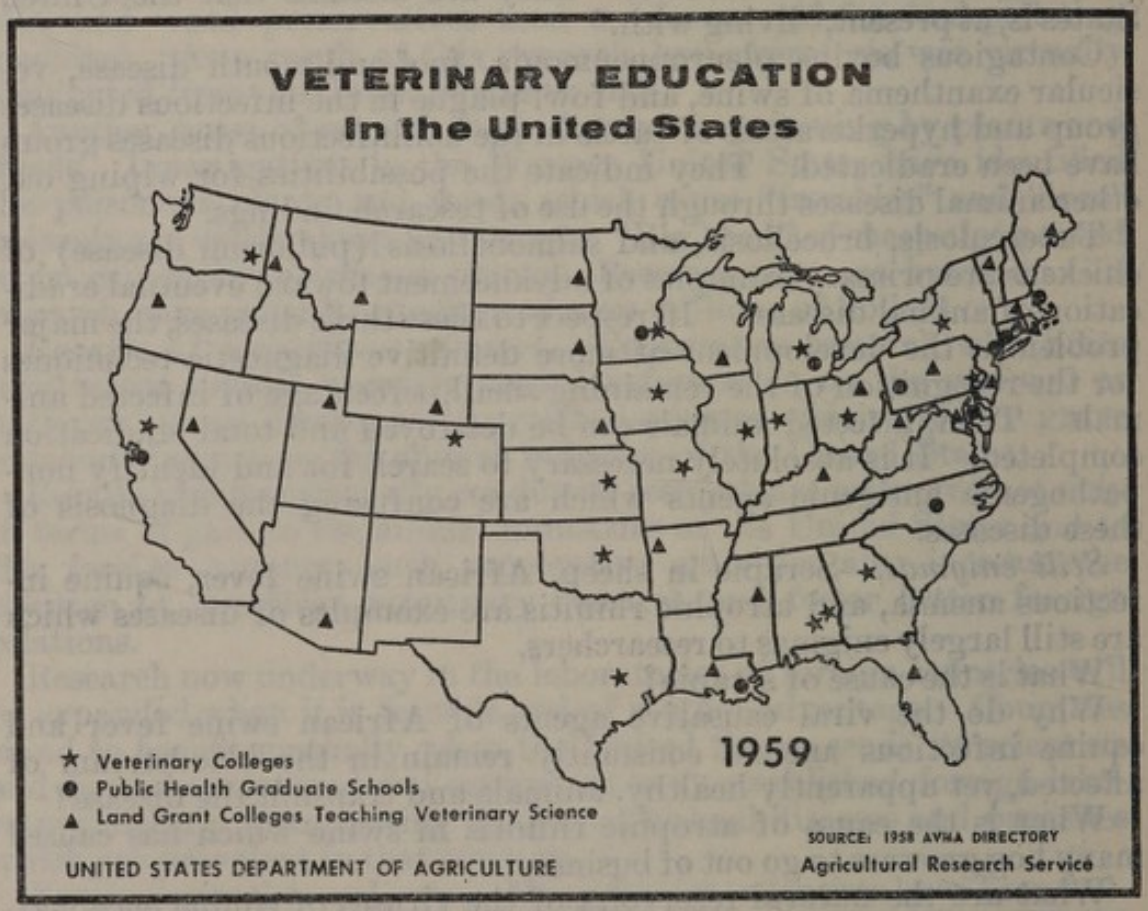


FIGURE 8

Of this total, 26 are separately designated as departments of veterinary science, veterinary medicine, or animal pathology. These departments are a part of, and administered by, the college of agriculture or the agricultural experiment station of the respective institutions. The remaining nine have varying degrees of activity in the area of animal health associated with departments of animal, dairy, and poultry husbandry.

Most of the departments started with one man performing a number of activities associated with animal health. Some of these departments have been in existence since about 1880, while others have developed as recently as 1952. In the areas of our country where the livestock populations were concentrated, several large departments were in operation by the early thirties. Since World War II, five of these have taken on the additional responsibility of establishing and maintaining a college of veterinary medicine. Therefore, their work is included in the report of the colleges of veterinary medicine. (See p. 81.)

*Increase in veterinary research.*—The principal financial support of these veterinary departments in land-grant colleges comes from the agricultural experiment stations, which in turn receive their major support from the individual States in which they are located. The Federal Government also contributes funds. Specific disease problems and an awareness of the economic importance of diseases and parasites of animals have accounted for a substantial increase in research funds at some institutions during the past 5 years. For example, one department received $18,000 a year for veterinary research from 1937 to 1947; $28,000 a year from 1947 to 1952; and $225,000 a year from 1953 to 1959. Another department received $30,000 a year from the early thirties until 1940; $40,000 a year from the midforties to the midfifties; and $170,000 a year from 1955 to 1959. Substantial grants have been made to some departments by industry and Federal agencies for veterinary research.

*Educational contributions.*—The principal educational function of these veterinary departments is the teaching of agricultural students who are to become livestock producers, agricultural teachers, and county agents. Sound management practices as they apply to animal disease and parasite control are stressed. A number of these departments now offer graduate courses and advanced degrees, while others are preparing to offer such academic work. These departments are making a major contribution to the training of competent research workers. In the past 10 years, these departments have awarded approximately 100 M.S. and 40 Ph. D. degrees. During the past 5 years, 144 foreign students have received training in the veterinary departments. Since the colleges and universities do not offer work for professional veterinary medicine degrees, few have advanced courses in clinical veterinary medicine but have specialized in the study of specific disease problems. However, these institutions offer preveterinary courses to prepare students for admission to the professional schools.

*Extension work.*—Another area of work is extension education in veterinary medicine and animal health. Twelve of the land-grant institutions have full-time extension veterinarians. In practically all departments, members of the research and teaching staff at times perform extension duties.

Eighteen of these institutions maintain veterinary diagnostic laboratories and six others operate veterinary diagnostic laboratories jointly with their State departments of agriculture.

In the area of research, which represents a major emphasis of these departments, the prime objective is to develop means of protecting the health of livestock. Livestock and poultry industries have been

made possible and profitable as a result of animal disease and parasite research conducted by scientists at these institutions. Methods of treatment, control, prevention, or eradication developed and applied 25 years ago compounded the benefits many times.

*Achievements.*—Some of the findings of use to the livestock industry were accomplished with small outlay of funds. Others have required more complex and extensive research to obtain the answers. In innumerable instances, stations have taken advantage of research performed by others to arrive at the solution of a disease problem. Estimated savings to the livestock industry, resulting from veterinary research within land-grant colleges each year, amount to hundreds of millions of dollars.

Some of the more outstanding accomplishments by scientists associated with these institutions are as follows:

1. Discovery of the cause of pullorum disease in birds, which led to the eventual development of a control program which has practically eliminated this disease.
2. Detailed studies on tuberculosis of animals, which led to knowledge applicable to the disease in humans and paved the way for the bovine tuberculosis eradication programs. (See p. 109.)
3. Development of hog cholera immunization procedures.
4. Major contributions to the overall knowledge of brucellosis, such as the relationship of this disease in cattle to humans, and assistance in the development of an eradication program for bovine brucellosis. (See p. 107.)
5. Proof that so-called forage poisoning was caused by a bacterial toxin rather than a mold, which opened the way for differential diagnosis and treatment of several diseases.
6. Development of a fowl pox vaccine.
7. Demonstration that goiter and hairlessness in newborn animals is associated with iodine deficiency.
8. Discovery that a virus caused equine abortion with subsequent development of methods for prevention.
9. Discovery of the cause of hemolytic icterus in newborn foals and the development of methods for its prevention.
10. Differentiation of the causes of several respiratory diseases of birds, which led to the development of effective immunization agents.
11. Knowledge of the life cycles of many of the internal parasites of animals, which led to the development of effective control measures.
12. Discovery of the cause of hyperkeratosis in cattle, which led to a method of prevention and has eliminated the disease.
13. Discovery of the causes of enteric diseases of swine, which led to the development of effective control measures.
14. Low-level feeding of phenothiazine, which proved effective for the control of certain internal parasites of sheep, cattle, and horses. (See p. 37.)
15. A method of treating acute anaplasmosis with antibiotics.
16. Discovery of the cause of dysentery and arthritis of lambs, which led to the development of methods of prevention.
17. A method for raising disease-free swine herds.

18. Discovery of the cause of infectious red water in cattle and the development of an effective vaccine.

19. Discovery of the cause of sleeping sickness in horses and mules and the development of a vaccine for its control.

20. Discovery of the cause of pregnancy disease in ewes, which led to methods of control and prevention.

21. Extensive studies on a group of diseases referred to as the mucosal complex, which led to methods of differential diagnosis and preventive measures.

22. Development of methods to treat coccidiosis.

Many scientists in veterinary activities in these institutions have contributed materially to profitable livestock production and, through this channel, directly and indirectly to human health and welfare.

*Unsolved problems.*—Many problems are still unsolved, and new disease complexes are constantly coming into the picture. It is reported to the subcommittee that the land-grant institutions' veterinary departments face the following major obstacles: Shortage of well-trained personnel, inadequate facilities for holding experimental animals, lack of adequate laboratory buildings, and lack of modern research equipment. Inadequate funds are reported as the primary limiting factor to more and better research. The most expensive single item of operating support, other than adequate salaries, is the cost of disease-free animals for use in research.

Animal disease research is the most expensive experimental work carried on by an agricultural experiment station. In the entire realm of biological sciences, only research in the area of human medicine is more costly than that of veterinary medicine. On the basis of estimates received by the subcommittee, these departments of land-grant colleges may need approximately $17 million in the next 5 years to build and equip physical plants. Annual operating budgets of this group of institutions may need to be increased by $2.5 million, according to experts.

Specific and detailed evaluation of such needs is, of course, not within this subcommittee's purview.

### C. ENTOMOLOGY RESEARCH DIVISION, AGRICULTURAL RESEARCH SERVICE

Insects, ticks, and mites have plagued animals and man since the dawn of history. Their attacks reduce weight gains and milk yields, and some species, such as screwworms and fleeceworms, actually kill livestock. In addition, many of these arthropods transmit diseases of man and animals. If the intermediate arthropod hosts could be destroyed, these diseases probably could not persist. · Thus, control of insects, ticks, and mites of veterinary importance contributes to human health and welfare.

*Origins.*—The U.S. Department of Agriculture initiated investigations on insects affecting animals in 1881. By 1900 research was being conducted on the biology and control of cattle grubs, screwworms, lice, and ticks. In 1926, the Division of Insects Affecting Man and Animals of the Bureau of Entomology was organized. Work in this field is now carried on in the Insects Affecting Man and Animals

Research Branch of the Entomology Research Division, ARS. Since its establishment, this unit has conducted research on the biology of all of the important pests and known disease carriers of livestock. It has developed insecticides and other control measures which have been adopted by livestock growers in the United States and in many other countries.

*Classification of insects.*—Taxonomy, or identification and classification, of arthropods of medical and veterinary importance has been an essential activity of the Federal Government since 1854. Entomological work was initiated as a branch of the Patent Office. In 1897, in recognition of the vital need for proper identification of injurious and beneficial insects, the classification of insects was transferred to the U.S. Department of Agriculture. This activity is now carried on in the Insect Identification and Parasite Introduction Research Branch of the Entomology Research Division, ARS.

*Research approaches.*—The objective of research on insects of veterinary importance has been to develop efficient and practical means of control. This, in turn, contributes to man's health and welfare by preventing the spread of human and animal diseases. Research has involved two approaches. The first has been environmental study of the life history, habits, and development of pests as a basis for control through cultural and management practices. Livestock management, use of natural enemies, and use of atomic energy are being studied. The second approach has been development of efficient, low-cost insecticides or repellents which are safe to apply on animals and which will destroy insects or prevent their attack.

Research stations on biology and control are located at Kerrville, Tex.; Orlando, Fla.; and Corvallis, Oreg. Work on special problems is conducted at Stoneville, Miss.; Lincoln, Nebr.; Beltsville, Md.; and Reno, Nev.

Taxonomic research attempts to develop means by which different kinds of insects and mites may be readily recognized and to develop schemes of classification that associate related kinds. This permits certain deductions about the biological habits of little-known insects.

Current work emphasizes morphology, or insect structure, and the associations and habits of insect hosts.

The Federal Taxonomic Unit in Washington, D.C., makes identifications of insects and related arthropods of veterinary and medical importance for many agencies. In 1958, over 14,000 identifications were made for individuals and institutions located in foreign countries. Between 60 and 75 countries are aided in this way annually.

As a result of identification activities, the Taxonomic Unit of the Insect Identification and Parasite Introduction Research Branch has become one of the world's leading sources for information in the field of insect taxonomy.

*Achievements.*—U.S. Department of Agriculture entomologists have made many significant contributions to the health and welfare of man and his animals. Among these are:

1. *Screwworm control through the use of chemicals and by atomic radiation.*—The screwworm, a serious myiasis-producing insect of animals and man, has been a major problem in the South and Southwest for many years. This problem also exists in Mexico, Central America, and South America.

In the late 1920's, research produced a pine oil-benzol preparation which was the first effective remedy for screwworm control. Continued research produced even more effective remedies which save thousands of animals and millions of dollars for U.S. livestock growers each year. These remedies have also been of incalculable value to livestock growers of other countries in which the screwworm occurs.

In 1938, the concept of releasing sexually sterile male flies into the native population to reduce the incidence of screwworms was proposed by a Department entomologist, Dr. E. F. Knipling. This theory was based on the fact that the screwworm is comparatively scarce in nature and could be reared on an artificial medium in numbers exceeding the natural population in certain areas. Later, it was demonstrated that males of the screwworm could be sterilized by exposure to X-rays or cobalt 60. These flies would then mate with normal females, but no progeny would develop. A series of laboratory and field experiments began in 1950 on the use of gamma radiation for control of the screwworm. The idea was demonstrated as sound; field trials that reared and released sterilized screwworm flies over a given area successfully eradicated this insect from the 170 square-mile island of Curacao. In no other known way can eradication be so surely achieved as by exploiting the mating habits of these insects. See chart "Atomic Research Breakthrough" (fig. 9).

This and other fieldwork led the way to a successful cooperative program between the U.S. Department of Agriculture and the Southeastern States for the eradication of the screwworm from that area. Eradication of the screwworm in the Southeast is estimated to save $20 million annually.

Since it causes myiasis in man as well as animals, the screwworm is also of public health importance.

The research and field trials on screwworm eradication have been of interest to many foreign scientists. Several have visited this country to view the work and to obtain details of the new techniques employed. The first field experiment on Curacao could not have been accomplished without the full and substantial cooperation of the government of the Netherlands Antilles. The efforts were mutually beneficial and this, as well as visits by foreign groups, has contributed to better international relations.

Further research is necessary to develop the possibilities of this new approach to insect control. The sterile-male method may be adapted to eradicate mosquitoes and other insects which are carriers of human and animal diseases. The technique may also be applicable to certain serious pests of fruits and field crops.

2. *Systemic chemicals.*—The development of chemicals that could be applied in or on animals to act systemically and destroy internal and external livestock arthropods has been a goal of veterinary entomologists and parasitologists for over 40 years. A major breakthrough occurred during 1950–57. Department entomologists conclusively demonstrated that certain insecticides given orally, injected, or even applied externally to cattle, would destroy cattle grubs in tissues of the host. From this work, two superior systemic organophosphorus insecticides were developed and are now recommended for controlling the cattle grub.

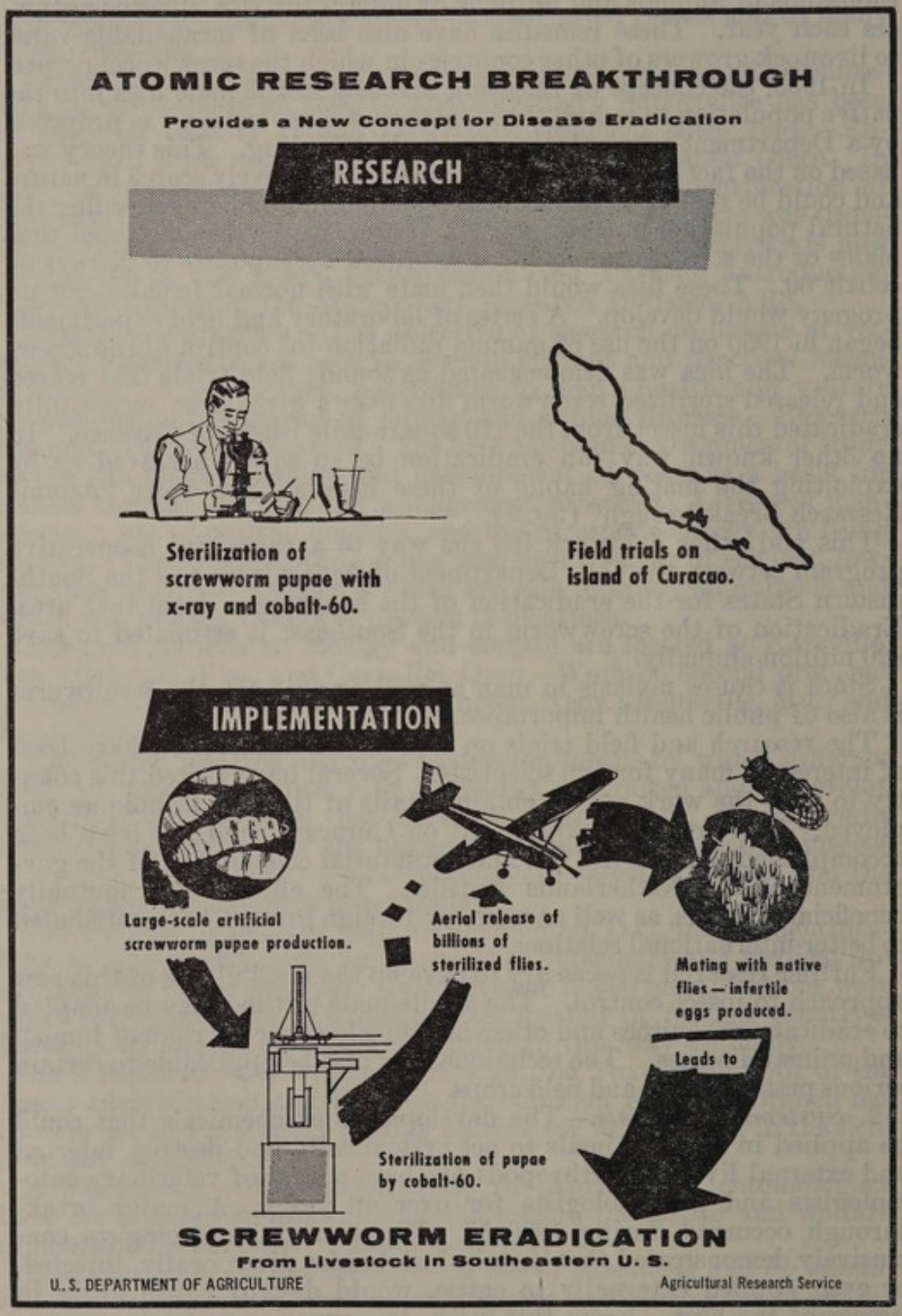
ATOMIC RESEARCH BREAKTHROUGH
Provides a New Concept for Disease Eradication
RESEARCH
Sterilization of screwworm pupae with x-ray and cobalt-60.
Field trials on island of Curacao.
IMPLEMENTATION
Large-scale artificial screwworm pupae production.
Aerial release of billions of sterilized flies.
Mating with native flies — infertile eggs produced.
Leads to
Sterilization of pupae by cobalt-60.
SCREWWORM ERADICATION
From Livestock in Southeastern U. S.
U. S. DEPARTMENT OF AGRICULTURE
Agricultural Research Service

FIGURE 9

The financial benefit of sytemic organophosphorus insecticides is already substantial and will eventually amount to millions of dollars annually to the livestock industry as well as the general public. This contribution may lay the groundwork for possible future eradication of the cattle grub from the United States. Systemic methods of livestock insect control will no doubt be applicable to important pests in foreign countries.

3. *Other livestock insecticides.*—Arthropods—house flies, lice, ticks, cattle grubs, biting flies, fleas, and screwworms—exact a heavy toll in production and dollars annually from the livestock industry. The advent of DDT, lindane, toxophene, methoxychlor, TDE, chlordane, and many other insecticides since 1942 has offered promise of control of several livestock insects. However, the fact that these compounds became available for use as sprays and dusts did not of itself solve the problems. A vast amount of research was necessary to determine their entomological effectiveness against different pests. Before these materials could be recommended, it was necessary to determine the best formulations, dosages that the hosts would tolerate, and the amount of secretion and storage of the various insecticides in tissues and milk.

The economic return to the grower and to the general public in reducing losses from pests amounts to many millions of dollars annually. As an example, it is estimated that the use of recommended insecticides for control of the horn fly, alone, is benefiting growers by about $30 million annually through increased meat and milk production.

4. *Contributions of veterinary entomology to medical entomology.*—With the beginning of World War II, the U.S. Department of Agriculture and the military services recognized the necessity for intensive research to develop ways of effectively combating numerous arthropod vectors of diseases of man and animals. A special project was staffed largely with veterinary entomologists trained and experienced in research on insects affecting animals. This special project provided the military services with specific control measures against dangerous disease-transmitting arthropods. The measures were used by the United States and allied military personnel as well as foreign civilian populations.

Perhaps the entomologists' greatest contribution was the development of an effective body-louse powder. It was used with such great success that only a few cases of human typhus occurred during World War II. During World War I, the number of human cases totaled hundreds of thousands.

This group of veterinary entomologists also conceived, planned, and demonstrated that new chlorinated insecticides, such as DDT, could control malaria by controlling the mosquito vector. This was accomplished by use of residual sprays in habitations of man and animals. This research led to the adoption of the residual-spray method of malaria control and eradication throughout the world. A worldwide program of malaria eradication, sponsored by the World Health Organization, utilizes the residual spray procedure. (See committee print entitled, "The United States and the World Health Organization.")

Repellents were also developed which protected personnel from biting pests and minimized the transmission of certain arthropod-

borne diseases. This development saved thousands of Allied troops from highly fatal scrub typhus, a disease transmitted by chigger mites. The material and procedures have since been adopted for civilian use in many parts of the world.

5. *Identification of arthropods.*—Many of the arthropod enemies of animals are so similar that incorrect identification can jeopardize biological and control work on the pest or disease vectors. Without taxonomic research to establish identification characteristics, scientists conducting studies on an arthropod-borne disease are helpless.

As an example, when bluetongue of sheep was identified in the United States in 1953, a survey to determine vector species was initiated in areas where the disease was prevalent. Taxonomic knowledge indicated that a bloodsucking midge found in the survey was the probable vector. Subsequent research has tended to confirm this conclusion.

*Resistance to insecticides.*—A major problem in insect control is the onset of resistance to insecticides. Expanded research is urgently needed to determine the basic nature of resistance and to find ways of overcoming it.

Another major problem is the storage of small amounts of insecticides in tissues of animals. This storage follows the external application of insecticides or the consumption of insecticide-treated feed. The development of chemicals that do not produce residues is of utmost importance and is the chief objective of current research.

The projection of current knowledge for the economic benefit, health, and welfare of people in foreign lands requires greatly expanded coordination and liaison between U.S. scientists and those of other countries. There are many destructive and debilitating diseases carried by insects over the world that might well be studied from the viewpoint of applicability of the sterile-male technique and other methods for their control or eradication. An example is the devastating sleeping sickness, called nagana or trypanosomiasis, which the tsetse fly spreads to man and animals in Africa. This insect group and the diseases they transmit are major deterrents to the full expansion of the health and welfare of the people of Africa. Research is needed to assess the possibilities of application of the new insect control method against the tsetse fly.

The use of systemic chemicals in livestock may lead the way to research on projecting these findings to man. For example, the military services need a simpler and more effective method of personal protection of troops against disease-carrying mosquitoes and biting flies than the currently used repellents. An orally administered chemical that would prevent bites of insects or offset the reaction to such bites would be a major contribution to public health.

*International exchange.*—The development of systemic chemicals for use against livestock insects is recognized as an outstanding research accomplishment. This work has raised the stature of U.S. entomologists throughout the world. Numerous foreign scientists have visited the U.S. Department of Agriculture's laboratories to learn about these systemic insecticides. The exchange of scientific information has been a major contribution to better relations between world scientists. In order to move forward in this important field, much more basic information on modes of action of systemic chemicals against insects is needed.

### D. NATIONAL INSTITUTES OF HEALTH, U.S. PUBLIC HEALTH SERVICE

In view of its intrinsic significance, the National Institutes of Health has received more consideration in the course of the international health study by this subcommittee than any other unit of the U.S. Government.

NIH has cooperated with us in the development of all of our publications bearing upon its broad-gaged work.

For the fiscal year 1961, NIH received from the Congress obligational authority to expend $590 million.

The following pages of this section bear upon only two phases of NIH's vast program:

(*a*) Its substantive intramural and extramural research involving veterinary science;

(*b*) A still more specialized look at costs involved in NIH's own use of laboratory animals.

It may be noted at the outset that, at present, 30 veterinarians are assigned to the various activities of the National Institutes of Health.

#### *1. NIH intramural and extramural research involving veterinary science*

Veterinarians have played an important role in NIH's research since its inception.

In medical parasitology, veterinarians have made numerous contributions over the years, beginning with the treatment and control of hookworm in the United States and abroad. Later studies included those with roundworm in man and animals, schistosomiasis and leishmaniasis. In the past decade comparative parasitology studies have taken NIH investigators to all parts of the world where they have investigated public health problems under the auspices of the World Health Organization and other international agencies. A problem now under study in the Far East is the relation of monkey malaria to that of man.

After World War II, a tremendous increase in activity resulted in the expansion of the National Institute of Health into the National Institutes of Health, and subsequently the addition of the Clinical Center. Much experimental effort was expended in work on animals. In 1948, two veterinary pathologists became staff members of the Experimental Biology and Medicine Institute (now Arthritis and Metabolic Diseases Institute). Their interests were primarily in the diseases and anatomical variations of animals used in the laboratory and in the supervision of large breeding colonies of animals used for research purposes.

In 1949, a veterinary pathologist joined the staff of the National Cancer Institute to make comparative studies on malignancies in mammals and birds. Another aspect of these cancer studies concerned the pathology of transplanted bone tumors and the effect of radioisotopes on those tumors.

*Laboratory Aids Branch.*—In 1948, the Laboratory Aids Branch, under the Office of the Director of the National Institutes of Health, was formed with a veterinarian in charge. The function of this branch, now in the Division of Research Services, is to operate centrally (1) the preparation of media and glassware; (2) a large closed breeding colony of research animals; (3) an animal hospital for ex-

perimental surgery and the conditioning of larger animals, and a large animal farm; (4) a comparative pathology section; and (5) a section for germ-free animal production.

The media section provides a wide variety of complicated nutrient growth media for use in growing bacteria and cells from animal tissues. The major accomplishments of this group lie in the adaptation of mass methods of producing these highly complex laboratory media.

The animal production section now produces over 1 million laboratory rodents per year of known genetic constitution, a large number of which are highly inbred and free from all the major diseases affecting such animals. These animals are to the biologist as pure chemicals are to the chemist, a necessity for the conduct of modern laboratory research.

Veterinarians in the Animal Hospital Section (1) operate central surgical suites for experimental procedures; (2) maintain anesthetic devices as required; (3) supervise surgical aftercare; and (4) perform X-ray services. They also supervise the conditioning of and provide medical care for experimental animals such as dogs, cats, monkeys, horses, and a variety of exotic animals used in research.

Among the recent research accomplishments of this group are a method for lengthening long bones which may later prove useful in human orthopedic surgery; techniques for the use of radiographic contrast media in animal surgery, which has direct application in the interpretation of experimental results; and a surgical procedure for the removal of the pineal gland in the brain, making possible more definite studies of this ill-defined endocrine organ in the body.

Through the diagnostic laboratory, veterinary pathologists maintain a constant vigil for the possibility of disease outbreaks in these large colonies. Their research is based primarily on diseases of laboratory animals; and their efforts, along with those of others, have led to many contributions to the scientific literature on the nature and prevention of these diseases.

In each of these areas, active research programs provide further insight into the basic nature of the disease and into the biological nature of the animals.

*Work in other NIH units.*—Veterinarians are staff members of various institutes and are engaged in basic research on cardiovascular disease, cancer, Q fever, poliomyelitis, and respiratory viruses. The nature of these diseases and their interactions between man and animal have been more clearly established by these investigators. Research on these projects is being carried out at the various institutes at NIH headquarters in Bethesda, Md., as well as the Rocky Mountain Laboratory, Hamilton, Mont.

*Extramural programs.*—In addition to the talents, energy, and funds expended in behalf of intramural research activities by the scientific staff at the National Institutes of Health, substantial funds are appropriated each year by the Congress, and administered by NIH staff, to support a wide variety of health-related research by the scientific community outside of the Public Health Service. A substantial proportion of the active research in progress in veterinary institutions is supported through the broad extramural programs of the institutes of the National Institutes of Health. These

activities include those that relate particularly to veterinary problems and that are of significance immediately or ultimately to the health of the Nation, as well as those that deal with basic aspects of comparative anatomic and physiologic sciences and with the cardiovascular, neoplastic, infectious, and degenerative diseases.

Veterinarians who, through training and experience, have particular insight into these activities occupy positions of responsibility in the administration of research and training grant programs of the National Institutes of Health. In recognition of the unique potential for even more extensive and significant research activities within the broad ramifications of veterinary medicine, several of the institutes are currently making special efforts to stimulate such activities in veterinary institutions throughout the country.

It is clear that an increasing number of veterinary laboratories across the country are looking to the National Institutes of Health for possible research assistance.

Information supplied by the Bio-Sciences Information Exchange indicates that, as of late 1960, there were 211 current grants from NIH, totaling $3,055,422, which might be construed as veterinary in character.

*Grant to University of Pennsylvania.*—Writing to the subcommittee on one such grant, Dr. James Watt, Director of the National Heart Institute, stated:

> Effective on January 1 of this year, a grant (H–4885) of $1,100,000 was awarded for the establishment of a comparative cardiovascular studies unit at the School of Veterinary Medicine, University of Pennsylvania. The grant was accompanied by a commitment, contingent on appropriations, which would provide funds for 9 additional years.
>
> The unit is headed by Dr. D. K. Detweiler, chief of the Laboratory of Physiology at the School of Veterinary Medicine. His plans for the unit, which will serve as an international model, are to conduct a research program comparing the cardiovascular systems of various animals, to carry out a training program in the basic medical sciences related to veterinary cardiology, and to review and catalog existing literature in the field.
>
> A very important aspect of this unit is that it will be integrated with the University of Pennsylvania Medical School and with the Penrose Research Laboratory of the Zoological Society of Pennsylvania.
>
> In announcing the grant, Dr. I. S. Ravdin, vice president for medical affairs at the University of Pennsylvania, said, "The award of the grant to the School of Veterinary Medicine and Dr. Detweiler is an appropriate one for this university. It follows closely our philosophy of medical education, and that of one of our most illustrious former faculty members, Sir William Osler, who said 'There is but one medicine.' We are enthusiastic about the opportunities which will be presented in the work of the unit. Not only will it make possible advancement in knowledge of heart and blood vessel diseases through comparative research, but it will also bring closer together those involved in the research and study of the related diseases of animals and humans.

*Problem of definition.*—In connection with NIH grants of this nature, we may note the following: Exact definition of what may constitute a "veterinary grant" may depend on who is doing the defining. Can it, for example, be construed that any NIH grant to a veterinary institution is veterinary per se? If a grant is made to a nonveterinary institution, must an animal disease, as such, be specified? Other problems similarly present themselves.

The subcommittee would not attempt to offer its own conclusive definition.

What is most important, as NIH officials are known to feel, is that the full promise of veterinary medicine for advancement of the frontiers of biology and medicine be developed.

Dr. James A. Shannon, Director of the National Institutes of Health, has advised this subcommittee of his own strong conviction toward the attainment of this goal.

It appears that his associates in the Institutes and the numerous study sections in the Division of Research Grants (which, on individual occasions, handle veterinary research-type applications) are also increasingly cognizant of the opportunity.

Actual availability of funds in the face of competitive possibilities for use is, of course, a crucial determinant as to future allocations of this nature.

*2. Costs of laboratory animals*

It is emphasized in many connections throughout this report that an incalculable proportion of Federal biomedical research hinges upon the soundness of extrapolating the results of animal experiments in terms of man, himself.

In view of the importance of laboratory animals, the subcommittee felt it advisable to take a brief, specialized look at the matter of their costs. In taking this approach, the subcommittee would nonetheless wish to emphasize clearly that a healthy laboratory animal, no matter what its cost, can hardly be overestimated as a crucial and relatively "inexpensive" element in research. By contrast, a diseased animal, or an animal which, for any of a vast number of reasons, is "off standard" might have been inexpensive to purchase or breed but might inadvertently distort or ruin the results of an experiment costing thousands of dollars.

There follow extracts from a letter from NIH, as prepared at the subcommittee's request, referring to NIH procurement of laboratory animals.

The letter from NIH's Division of Research Services bears, it will be noted, largely on NIH intramural research which represents only a small proportion of total NIH effort (most of which is directed to the extramural program).

The use of animals in NIH research must necessarily be considered under two headings. One is related to intramural research on the NIH reservation in Bethesda, where practically all animals used are provided by the Laboratory Aids Branch of this Division. The other, and much larger category of NIH research is the extramural research program conducted by grantees. For the most part, NIH grantees purchase experimental animals from commercial vendors.

The number and cost of major animal species used in intramural research is shown in table I, II,[1] and III. Cost figures include all operational expenses except the cost of utilities. In determining costs, no allowance was made for amortization of buildings.

Virtually all experimental animals larger than rabbits are purchased from commercial sources. Following quarantine, vaccination, and needed medical

[1] As of the date this publication was sent to press in mid-1961, the subcommittee was advised that animal costs have risen considerably above the levels for the base period indicated.

procedures, they are supplied to the investigators at a cost considerably below the cost that would be incurred if the animals were bred and reared by NIH. For example, the average cost of dogs supplied to NIH investigators on a fee-for-service basis is $16.25 each, while the average cost of rearing such animals at NIH is estimated to be about $150 each.

Most dogs and cats are procured under contract from licensed dealers. A few are donated by public pounds or private individuals. Most of the primates are purchased by agreement with the National Foundation; a few are bought on contract from licensed importers. Farm animals are purchased directly from livestock owners or dealers.

In contrast, more than 90 percent of the smaller laboratory animals used for intramural research are produced in NIH breeding colonies. Several factors make it essential for NIH to maintain a program of animal production. These include the opportunity for participation by investigating scientists in the development of animal strains particularly suited to their needs; continuity over many years in the breeding and maintenance of special animal colonies, many of which cannot be obtained from commercial sources; and the need for larger numbers of rats and mice as two- and three-day-old litters.

The number and cost of animals used in NIH extramural research is not available. Such data have been obtained, however, for a major extramural program—that of the Cancer Chemotherapy National Service Center (CCNSC) of the National Cancer Institute. The CCNSC is responsible for assuring a constant supply of mice for the use of NIH grantees participating in the chemotherapy tests. The mice used are produced by commercial breeders who are approved under criteria established by CCNSC.

CCNSC estimates that 2,850,000 mice at an average price of 52 cents each and 51,400 rats at an average price of 87 cents each are purchased in a 12-month period. The animals are purchased in the United States.

TABLE I.—*Intramural research program—Number of cost of rabbits and smaller animals issued to NIH laboratories in Bethesda, May 1, 1959, through Apr. 30, 1960*

| Species | Number issued | Average unit cost | Total cost |
|---|---|---|---|
| Mice (23 strains) | 700,293 | $0.33 | $231,097 |
| Rats (16 strains) | 127,848 | .91 | 116,342 |
| Guinea pigs (5 strains) | 27,470 | 3.70 | 101,639 |
| Rabbits (4 strains) | 11,567 | 6.46 | 74,723 |
| Hamsters (3 strains) and unusual species (9 species) | 30,655 | .67 | 20,539 |
| Total | 897,833 | | 544,340 |

The unit cost may vary over a wide range within species. The development and maintenance of a small colony of a genetically pure strain are often essential but relatively expensive because of the close professional supervision required and the small number of animals actually "issued" for experimental use.

TABLE II. *Intramural research program—Number and cost of larger experimental animals issued to NIH laboratories in Bethesda, May 1, 1959, through Apr. 30, 1960*

| Species | Number issued | Average unit cost | Total cost |
|---|---|---|---|
| Dogs | 3,658 | $16.25 | $59,442 |
| Cats | 2,485 | 5.50 | 13,668 |
| Monkeys | 4,120 | 45.09 | 185,770 |
| Total | 10,263 | | 258,880 |

Dogs and cats are procured under contract from licensed dealers, humane societies, and municipal pounds.

Monkeys and other subhuman primates are, for the most part, purchased through the National Foundation (for infantile paralysis), and come from

commercial sources in India. A few are purchased from licensed dealers in the United States and may come from the Philippines, South America, or Africa.

The National Foundation has recently announced an increase in price to $70 per monkey because of increased operating costs and the fact that diseases, contracted prior to shipment from India, result in heavy losses.

TABLE III.—*Intramural research program—Number and estimated cost of farm animals held for NIH investigators, as of May 26, 1960*

| Species | Number on hand | Average unit cost | Total cost |
|---|---|---|---|
| Horses | 15 | $300 | $4,500 |
| Sheep | 32 | 40 | 1,280 |
| Goats | 24 | 50 | 1,200 |
| Cows | 5 | 300 | 1,500 |
| Total | 76 | | 8,480 |

These animals were acquired through donation and by purchase from commercial breeders. They are not expendable in the usual sense of the word; they are used for serum production and research in neurology, metabolic diseases, and cancer. The cows, for example, were donated by a farmer because they had developed cancer of the eye, a condition of interest to National Cancer Institute investigators.

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE, PUBLIC HEALTH SERVICE, NATIONAL INSTITUTES OF HEALTH, BETHESDA, MD.

*Wednesday, April 27, 1960*

The Public Health Service today announced two grants totaling $1,917,275 to the Medical Research Foundation of Oregon, Inc., for the construction and operation of a Regional Subhuman Primate Research Center.

The proposed site for the center is a 163-acre tract of land located approximately 10 miles west of downtown Portland, Oreg. The new facility, which provides for a research program and a colony of 400 monkeys for this research, is expected to be in operation by early 1961.

Purpose of the new research center is to provide a specialized environment for scientific exploration of all possible areas of study relating to the biological characteristics of rhesus monkeys over their entire life span. Care for the animals in the new center will be of the highest order, as is mandatory in all federally supported medical research programs.

"Nonhuman primates have already played an important role in the research effort of this country," said Surgeon General Leroy E. Burney. "The giant strides of the past few years in the conquest of yellow fever, malaria, tuberculosis, poliomyelitis, and mental disorders, to mention only a few examples, would have been impossible without the use of monkeys.

"Research in this center will yield needed insight into mechanisms which can form the basis for progress in research on human diseases," he added. "It will also make possible long-term studies, possibly extending beyond the lifetime of an individual investigator." One grant totals $1,792,000 for the construction of facilities; the other $125,275 for initial operation of the center.

The grants in support of this project were made by the National Heart Institute from funds especially appropriated by the Congress to the National Institutes of Health for the establishment of primate research centers. The National Advisory Committee on Primates and the National Advisory Heart Council recommended the establishment of this center following a review of applications from various institutions throughout the country.

In announcing the awards, the Surgeon General underscored the following three points:

1. The work of the center, although emphasizing the field of cardiovascular research, will include opportunities for fundamental research as well as for studies more directly related to a variety of human diseases.

2. The grants have been made to the Medical Research Foundation of Oregon, Inc., which will have administrative responsibility for the execution of the grant. The University of Oregon Medical School will provide the academic environment within which the center will operate.

3. This regional center will also be a resource for other geographic areas. Approximately 45 percent of the facilities and efforts in the center will be devoted to the activities of visiting scientists.

Donald E. Pickering, M.D., Doernbecher Memorial Professor of Pediatrics and Research Associate in Biochemistry, and Edward S. West, Ph. D., Professor and Chairman, Department of Biochemistry at the University of Oregon Medical School, are the principal investigators on the grants.

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### E. COMMUNICABLE DISEASE CENTER, PUBLIC HEALTH SERVICE

The Public Health Service's Communicable Disease Center plans, executes, and evaluates a comprehensive, nationwide program for the prevention and control of communicable diseases. The baseline for these activities is a research program carried out at headquarters in Atlanta and Chamblee, Ga., and at facilities in Savannah, Ga., and 11 field stations in 10 States and Puerto Rico.

*1. Zoonoses research*

CDC's veterinary program consists of specialized studies in the zoonoses, including such areas as methodology research, pathogenesis, immunology, etiological factors influencing transmission, host-parasite relationships, and prophylactic and therapeutic field trials. (See table 5: Epidemiological Aspects of Some of the Zoonoses.) These research activities cover a broad portion of the human-animal disease spectrum. Among representative disease studies are the following:

TABLE 5.—*Epidemiological aspects of some of the zoonoses*

1. VIRUS DISEASES

| Disease | Causative organism | Principal animals affected | Geographical distribution | Probable vector or means of spread |
|---|---|---|---|---|
| Arthropod-borne infections: | | | | |
| Group A: | | | | |
| Eastern encephalitis | Virus | Birds, fowl, horses, and mules | North and South America | Various mosquitoes. |
| Western encephalitis | do | do | do | Do. |
| Venezuelan encephalitis | do | do | South America and Panama | Do. |
| Group B: | | | | |
| Japanese B encephalitis | do | Birds, horses, cattle and swine | Eastern Asia and East Indies | Various culex mosquitoes. |
| St. Louis encephalitis | do | Birds and fowl | North America | Various mosquitoes. |
| West Nile fever | do | Birds | North Africa and Asia | Do. |
| Murray Valley encephalitis. | do | do | Australia | Do. |
| Tick-borne spring-summer group including louping-ill, Russian spring-summer encephalitis, Omsk hemorrhagic fever, Kyasanur forest disease. | do | Birds, mammals, cattle, sheep and goats. | Europe and Asia | Wood tick, *Ixodes persulcatus*. Pasture tick, *Ixodes ricinus*. |
| Colorado tick fever | do | Squirrels and rodents | Western North America | Western tick, *Dermacentor andersonii*. |
| South African diseases: | | | | |
| Rift Valley fever | do | Sheep, goats, cattle and related wild animals. | South and Central Africa | Various mosquitoes. |
| Wesselsbron fever | do | Sheep | South Africa | Do. |
| Middleburg disease | do | do | do | Do |
| B Virus | do | Monkeys | Worldwide | Bites of monkeys; occupational exposure. |
| Cat scratch fever | do | Cats | do | Wounds. |
| Contagious ecthyma | do | Sheep and goats | Europe and North America | Occupational exposure. |
| Cowpox | do | Cattle and horses | Worldwide especially where smallpox exists. | Contact exposure. |
| Eneephalomyocarditis | do | Rodents, squirrels and primates | Worldwide | Contact-mosquitoes may be involved. |
| Pseudo cowpox | do | Cattle | do | Occupational exposure. |
| Psittacosis-ornithosis | do | Birds. Related virus found in cattle and cats. | do | Contact and occupational exposure. |
| Foot-and-mouth disease | do | Cattle, swine and related species | Europe, Asia, Africa, and South America. | Contact exposure; man is quite resistant. |
| Influenza and parainfluenza including type A (Shope and Prague) and Sendai (type D). | do | Swine and rodents | Asia and Europe | Contact exposure. |
| Lymphocytic choriomeningitis | do | Rodents, swine and dogs | Worldwide | Virus contaminates food and environment. |
| Newcastle disease | do | Fowl | do | Occupational exposure. |

| | | | | |
|---|---|---|---|---|
| Rabies | do | Dogs and biting animals | Worldwide except Australia, New Zealand, Great Britain, Scandinavia, and parts of western Europe. A number of islands are also free. | Bites of diseased animals. |
| Vesicular stomatitis | do | Swine, cattle and horses | North and South America, Europe | Contact exposure and possibly insect bites. |
| Yellow fever | do | Monkeys and marsupials | South Central America, Africa | Aedes and Haemagogus mosquitoes. |

[1] Not proven.

## 2. RICKETTSIAL DISEASES

| | | | | |
|---|---|---|---|---|
| Boutonneuse fever | *Rickettsia conorii* | Dogs and rodents | Europe and Africa | Bite of infected ticks. |
| Murine typhus | *R. typhi* | Rats | North America | Bite of infected rodent fleas. |
| Q Fever | *Coxiella burnetii* | Sheep, cattle, goats, fowl, wild birds and mammals. | Worldwide | Mainly airborne although milk may be a vehicle and occasionally ticks. |
| Rickettsialpox | *R. akari* | Mice | Eastern United States and U.S.S.R. | Bite of infected rodent mites. |
| Scrub typhus | *R. tsutsugamushi* | Rodents | Asia, Australia, and East Indies | Bite of infected larval mites. |
| Spotted fever | *R. rickettsii* | Rabbits, field mice and dogs | North and South America | Bite of infected ticks or their crushing on the skin. |

## 3. BACTERIAL DISEASES

| | | | | |
|---|---|---|---|---|
| Anthrax | *Bacillus anthracis* | Cattle, sheep and goats | Worldwide | Occupational exposure; ingestion of contaminated meat; occasionally airborne or biting insects. |
| Brucellosis | *Brucella abortus*, *Br. suis*, *Br. melitensis* | Cattle, sheep, goats and swine | do | Occupational exposure. Ingestion of contaminated milk products and other foods; occasionally airborne. |
| Bacterial food poisoning | Various bacteria and their toxins including *Salmonella Staphylococcus* and *Clostridia.* | Cattle, swine, and fowl | do | Ingestion. |
| Colibacillosis | *Escherichia* spp.. Arizona group | do | do | Do. |
| Erysipeloid | *Erysipelothrix rhusiopathiae* | Swine fowl, and fish | do | Occupational contact. |
| Glanders | *Actinobacillus mallei* | Equines | Asia, Africa, and South America | Do. |
| Leptospirosis | *Leptospira* spp | Rodents, dogs, swine, cattle | Worldwide | Occupational contact, immersion exposures and ingestion. |
| Listeriosis | *Listeria monocytogenes* | Rodents, sheep, cattle, swine | do | Unknown. |
| Melioidosis | *Pseudomonas pseudomallei* | Rodents, sheep | Asia and North America | Exposure and ingestion. |
| Pasteurellosis | *Pasteurella multocida* | Mammals and birds | Worldwide | Do. |
| Plague | *Pasteurella pestis* | Rodents | do | Infected fleas and airborne. |
| Pseudotuberculosis | *Pasteurella pseudotuberculosis* | Guinea pigs and other rodents | do | Occupational exposure. |
| Rat bite fever | *Spirillum minus*, *Streptobacillus moniliformis* | Rodents and wild animals | do | Rodent bites and exposure. |
| Relapsing fever, endemic | *Borrelia* spp | do | do | Infected ticks. |

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TABLE 5.—*Epidemiological aspects of some of the zoonoses*—Continued

3. BACTERIAL DISEASES—Continued

| Disease | Causative organism | Principal animals affected | Geographical distribution | Probable vector or means of spread |
|---|---|---|---|---|
| Salmonellosis | *Salmonella* spp | Cattle, swine and fowl | Worldwide | Ingestion, airborne and contract. |
| Staphylococcus | *Staphylococcus* spp | Cattle, swine | do | Ingestion and contact. |
| Streptococcus | *Streptococcus* spp | Cattle and fowl | do | Do. |
| Tuberculosis | *Mycobacterium tuberculosis:* | | | |
| | var. *bovis* | Cattle | do | Ingestion, inhalation and occupational exposure. |
| | var. *hominis* | Monkeys | | |
| | var. *avium* | Fowl | | |
| Tularemia | *Pasteurella tularensis* | Rabbits, sheep and wild rodents | North America, Europe, and Asia. | Occupational exposure, handling, ingestion and bite of infected insects. |
| Vibriosis | *Vibrio foetus* | Cattle, sheep | Europe, North and South America. | Unknown. |
| **4. FUNGUS DISEASES** | | | | |
| Ringworm | *Microsporum* spp | Dogs and cats | Worldwide | Exposure especially those fondling animals. |
| | *Trichophyton* spp | Cattle, horses and rodents | do | Occupational exposure. |
| **5. PROTOZOAL DISEASES** | | | | |
| Balantidiasis | *Balantidium coli* | Swine | Worldwide | Ingestion. |
| Leishmaniasis | *Leishmania donovani* | Dogs, cats and rodents | South America | Bite of infected sand flies (*Phlebotomus*). |
| Visceral | | | Africa, Europe | |
| Cutaneous | | | Asia | |
| Oriental sore | *L. tropica* | Dogs, cats and gerbils | Asia, Africa and Europe | Bite of infected sand flies (*Phlebotomus*). |
| Espundia | *L. braziliensis* | Dogs, cats and spiny rat | Central and South America | |
| Toxoplasmosis | *Toxoplasma gondii* | Birds and animals | Worldwide | Probably contact and ingestion although exact route is not known. |
| Trypanosomiasis: African sleeping sickness. | *Trypanosoma gambiense, T. rhodesiense, T. brucei.* | Wild and domestic ruminants and swine. | Africa | Bite of infected tsetse fly (*Glossina* spp.). |
| American Chagas' disease | *T. cruzi* | Dogs, cats, swine, foxes, bats and rodents, monkeys. | North, Central and South America. | Fecal material of triatomid bug. |

## 6. HELMINTH DISEASES

| | | | | |
|---|---|---|---|---|
| Trematodes or flukes: | | | | |
| Clonorchiasis | *Clonorchis sinensis* | Dogs, cats, swine and wild animals | Asia | Ingestion of raw or partially cooked fresh water fish. |
| Fascioliasis | *Fasciola hepatica*<br>*F. gigantica* | Cattle and sheep | Worldwide | Ingestion of contaminated greens. |
| Fasciolopsiasis | *Fasciolopsis buski* | Swine and dogs | Asia | Ingestion of raw aquatic plants. |
| Paragonimiasis | *Paragonimus westermanni* | Dogs, cats, and wild animals | Asia and Africa | Ingestion of diseased crayfish. |
| Schistosomiasis | *Schistosoma japonicum* | Cattle, swine, dog and rodents | Asia | Immersion and cercariae penetration of the body. |
| Swimmer's itch | *Schistosoma spp* | Birds and rodents | Worldwide | Do. |
| Cestodes or tapeworms: | | | | |
| Fish tapeworm | *Diphyllobothrium latum* | Dogs and fish eating animals | do | Ingestion of diseased fish. |
| Dog tapeworm | *Dipylidium caninum* | Dogs and cats | do | Swallowing dog or cat flea. |
| Hydatidosis | *Echinococcus granulosus* | Dogs, sheep, cattle, swine and rodents. | do | Swallowing dog tapeworm eggs. |
| Rat tapeworm | *Hymenolepis nana* | Rodents | do | Swallowing rat tapeworm eggs. |
| Beef tapeworm | *Taenia saginata* | Cattle | do | Ingestion of measly beef. |
| Pork tapeworm and cysticercosis. | *Taenia solium*<br>*Cysticercus cellulosae* | Swine | do | Ingestion of measly pork and autoinfection. |

## 7. NEMATODE DISEASES

| | | | | |
|---|---|---|---|---|
| Ancylostomiasis and cutaneous larva migrans ("creeping eruption"). | *Ancylostoma braziliense* | Dogs and cats | Worldwide | Contact with infective larvae which penetrate the skin. |
| Strongyloidiasis | Strongyloides stercoralis | Dogs | do | Do. |
| Toxocariasis (visceral larva migrans). | *Toxocara canis* | do | do | Swallowing dog and cat roundworm eggs. |
| | *Toxocara cati* | Cats | do | |
| Trichinosis | *Trichinella spiralis* | Swine, rodents, wild carnivores | do | Ingestion of pork and other flesh containing viable cysts. |

NOTE.—Many proved zoonoses particularly helminth infections of relatively rare occurrence have been omitted, as well as those diseases caused by fish and reptile toxins. Also omitted are those diseases whose causative organism, while found in both man and animals, appears to be derived from a common source, e.g., soil, or where the importance of the vertebrate animal component in the disease cycle appears to be negligible. Examples of these diseases include diphtheria, gas gangrene, tetanus, botulism, shigellosis, amoebiasis, actinomycosis, aspergillosis, coccidioidomycosis, histoplasmosis, moniliasis, nocardiosis, sarcosporidiosis and others.

Prepared by Veterinary Public Health Section, Communicable Disease Center, Public Health Service, HEW, Atlanta, Ga., April 1960.

*Old disease, new types and sources of infection.*—Today leptospirosis is known to be one of the most widespread bacterial diseases of man and animals. Prior to 1950, the only types of leptospiral infections that had been recognized in man in the United States were "Canicola Fever," acquired primarily from infected dogs, and the classic Weil's Disease, which is usually transmitted from infected rodents. At this time, investigations at Walter Reed Army Institute of Research discovered that the outbreaks of "Fort Bragg Fever," which occurred in the early 1940's, were caused by another type of Leptospira known as *L. autumnalis*. Through epidemiological investigations of febrile diseases of unknown causes, investigators at CDC found still other types of leptospires caused some of the outbreaks of human illness. Furthermore, they showed that the disease was not restricted to rodents and dogs but could also infect farm livestock such as cattle, swine, and horses. In addition, numerous wild mammals, such as raccoons, skunks, and opossums, were found to harbor leptospiral serotypes that had not been found in the United States. Field studies are continuing in CDC to determine what other types of leptospirosis may be present in this country, their host range, and their geographic distribution.

The primary source of the disease in human outbreaks has been the urine from animals in the acute stage of infection or, more frequently, from a "carrier" animal showing no evidence of clinical symptoms. Humans contact these animals either directly or indirectly when working or swimming in water contaminated with the urine.

While these epidemiological aspects of research on leptospirosis have increased the knowledge about the scope of this disease in man and animals, the veterinary public health laboratory has continued to improve the techniques for its diagnosis. Formerly, methods for the isolation of leptospiral organisms were difficult and time consuming. Very few diagnostic laboratories were equipped or had personnel trained to carry out these tests. One problem was the difficulty in obtaining urine samples from dogs that were free from contamination and satisfactory for direct culture. CDC veterinary officers found that urine, satisfactory for direct culture, could be obtained quite easily by puncture of the bladder through the abdominal wall with a sterile needle and syringe. This bladder tap method to obtain urine for direct culture isolation of leptospires is much simpler than the time consuming animal inoculation procedure formerly used with voided urine.

Another CDC-developed technique which has broken the bottleneck of leptospiral diagnosis in man and animals is the rapid slide agglutination test. This screening test employs a battery of pooled antigens to detect evidence of leptospiral infection with at least 12 different leptospiral organisms. It is faster, simpler, and as sensitive as other more involved techniques.

*Foodborne infections.*—Infections of the intestinal tract continue to be widespread disease problems, not only in the underdeveloped areas of the world but also in the United States. The major part of this disease problem in the United States is foodborne infection, particularly in foodstuffs of animal origin. Poultry and pork products, for

instance, lead the list of animal-origin foods responsible for the spread of foodborne infections.

The Communicable Disease Center carries on an active research program in the investigation of foodborne outbreaks caused by bacteria such as the salmonellae, shigellae, and staphylococci. Specific epidemiological studies are carried out to determine the factors that contribute to their perpetuation and spread.

Quite recently, CDC investigators uncovered a number of epidemics due to what is known as the Arizona group of bacteria. These Arizona organisms had been known to occur in a variety of lower animals, particularly snakes and related reptiles, but cases in humans had been quite rare. CDC is now studying this group of bacteria to determine factors involved in their appearance as important disease-producing bacteria of the human intestinal tract.

An early contribution of the Center's veterinary public health program was the revelation that dogs will serve as carriers of *Salmonella* organisms. These organisms are frequently the cause of infections in man, and, particularly, in children.

One of the important contributions of CDC's veterinary laboratory has been the development of new and improved techniques for the isolation of these diarrhea- and dysentery-producing organisms directly from animals and humans and also from meat and sausage samples. These techniques, particularly in the testing of infected meat and sausage, have given the veterinary epidemiologist and food hygienist effective tools for investigating foodborne outbreaks of animal origin.

Field studies are currently being carried out by CDC veterinary officers to determine whether there is a relationship between the increased incidence of staphylococcal infections in humans and in animals. This increase is no doubt influenced by the fact that in both human and animal hosts the staphylococci causing these conditions have become resistant to antibiotics. In animal hosts this is especially prevalent where there are severe infections of the udders of dairy cattle. CDC veterinarians investigating bovine infections in several parts of the country have uncovered certain staphylococcal strains from these cows which have been responsible for outbreaks of disease in man.

*Disease of farm and factory.*—Anthrax, a disease that affects both animals and man, has assumed a new significance in the field of public health since the bacteria which produces this serious and sometimes fatal human illness could effectively serve as one of the most important potential agents of biological warfare.

Human anthrax cases stem primarily from infected animals and their byproducts, such as hides, hair, and wool. Thus, the human cases in the United States fall into two categories: (1) Agricultural—those that result from contact with infected livestock and contaminated farm environment; and (2) industrial—workers in industries which process hides, wool, and goat hair for specialized textile uses.

During the past several years, CDC investigators have made a concentrated effort to obtain more precise knowledge about human and animal anthrax infection. In the goat-hair factories of the Eastern United States, investigations have included collection of samples in the factories to determine the areas most heavily contaminated; to study the behavior of the organisms; to carry out field trials of human

anthrax vaccine; and to study human exposure by inhalation or contact. Practically all of the human industrial anthrax cases have been the cutaneous type where the lesions are restricted to the skin. However, an outbreak of the inhalation type of anthrax occurred recently, by coincidence, in a goat-hair factory in New England where CDC anthrax vaccine studies were in progress. This epidemic was the first outbreak of inhalation anthrax—four of them fatal. In addition, four workers contracted cutaneous anthrax. None of the nine persons infected had received the vaccine.

Studies on anthrax in animals are being made where evidence of epidemic situations are reported by the CDC surveillance program. Special studies of anthrax-contaminated soils have been carried out in various parts of the country. In certain areas of Louisiana which had experienced outbreaks of animal anthrax 3 years in succession, the anthrax bacteria were isolated from grazing areas as well as from sites where cattle had died.

*Virus disease carried by mosquitoes.*—In the United States, a group of three related virus diseases known as arthropod-borne viral encephalitides are increasing in importance when the other mosquito-borne diseases, such as malaria, have been reduced almost to the point of eradication. The encephalitides are designated eastern encephalomyelitis (EE), western encephalomyelitis (WE), and St. Louis encephalitis (SLE). Principal victims of these diseases are humans and horses. Death rates are highest in EE, but there are more cases in WE. Besides the deaths caused by these diseases, the severity of the illness and the damage to the nerves and brain of many survivors make these diseases of serious concern.

CDC veterinarians have made a major effort to work out the cycle of transmission of these diseases. Each has its own complex host-parasite relationship and life cycle, but, in general, birds (wild and domestic) seem to serve as the principal reservoirs of the infection, which is then carried by various species of mosquitoes who feed on these birds. Apparently, horses and man are "accidental" or "dead end" hosts, with neither playing an important role in the perpetuation or continuous transmission of the disease in nature. (See figure 10, "Virus encephalitides.")

One of the factors uncovered in CDC's investigations was that domestic chickens are particularly susceptible to WE and SLE infection, and have become useful as "sentinel" animals. Blood tests in the chickens can determine an impending outbreak of encephalitis in the human population of the area.

Numerous outbreaks of EE have occurred in humans, horses, and farm-raised pheasants in the Eastern States, particularly Massachusetts, Rhode Island, Connecticut, and New Jersey. The greatest number of cases of EE occur among children and aged people, and death rates are highest in these groups.

Areas in the West, especially in California, have experienced endemic WE over a number of years. One particular mosquito that is widely prevalent there has been incriminated as the principal vector of this disease to its equine and human hosts.

Besides experiments which have revealed important phases in the life cycle of the encephalitides, CDC veterinary officers have been successful in improving the diagnostic methods for the rapid identifica-

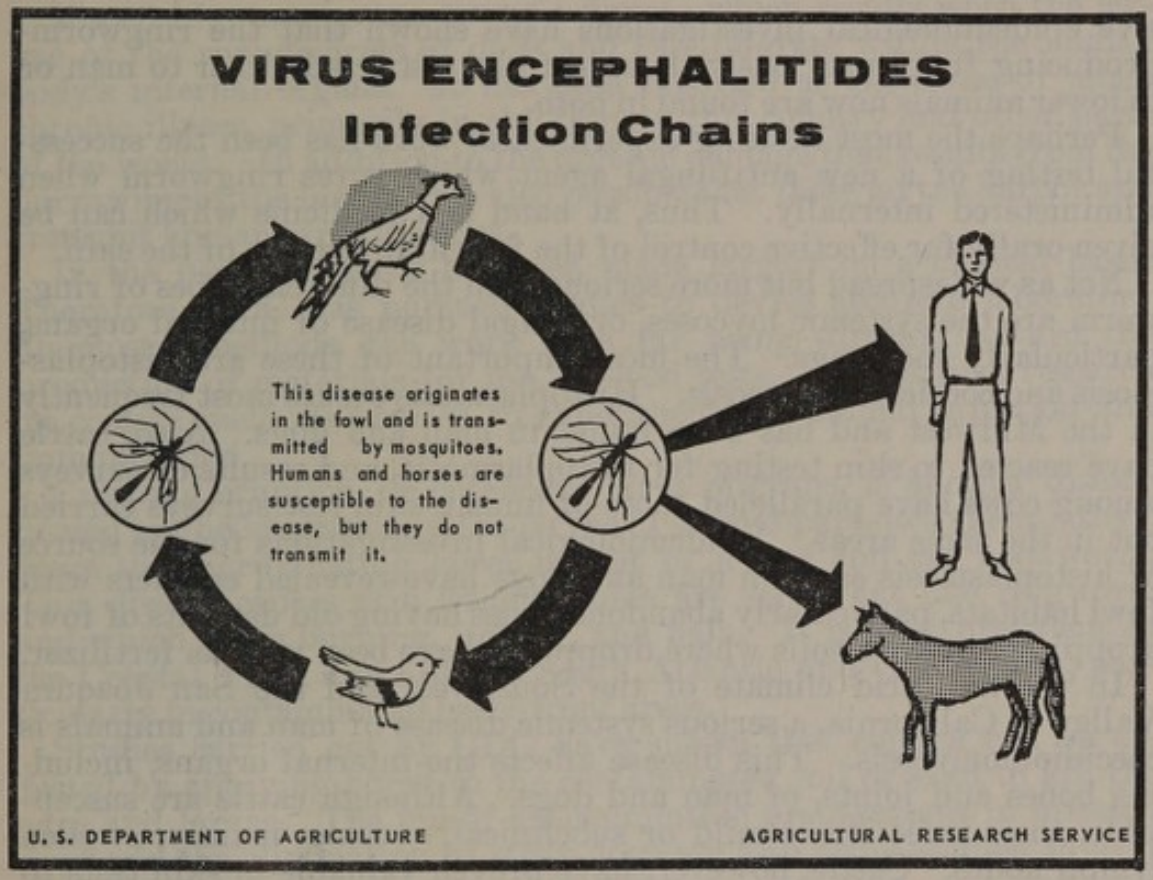


FIGURE 10

tion of these viruses. Recently, they have succeeded in growing them in tissue cultures which holds promise for further improvement in diagnosis.

*Flu in animals and man.*—Interest in the various strains of influenza virus was revived in recent years as a result of the reported episodes of Asian influenza strains. Historically, there was some evidence of epidemiological relationships between influenza of horses, swine, and man, particularly in the severe pandemic of 1918–20. Pilot studies are being carried out at CDC to determine what part swine played, if any, in the Asian influenza episode in the United States.

*The fungal (mycotic) diseases.*—Among the animal diseases transmitted to man which are caused by disease-producing fungi, the most widespread are the dermatophytes, or ringworm. CDC has been particularly active in this area. Its veterinary mycologists have uncovered an ever-growing list of animal ringworm organisms which have caused outbreaks of human ringworm in the United States. Of the fungal diseases of the skin of animals that have caused epidemic and sporadic disease in man, those in dogs, horses, and cattle have been the most frequent. In a survey recently carried out, 25 per cent of over 1,600 specimens of animal hair and skin scrapings were positive on laboratory diagnosis. Collaborative surveys are showing that organisms isolated from these specimens are widespread in this country and that infected animals are providing an extensive potential source for human exposure to infection.

Research activities concerning the fungal disease of the skin have included the methods for improved diagnosis, particularly for developing simplified tests for the fungi causing the disease. Exten-

sive epidemiological investigations have shown that the ringworm-producing fungi previously thought to be restricted either to man or to lower animals now are found in both.

Perhaps the most exciting experimental work has been the successful testing of a new antifungal agent which cures ringworm when administered internally. Thus, at hand is a medicine which can be given orally for effective control of the fungal infections of the skin.

Not as widespread but more serious than the different types of ringworm are the systemic mycoses, or fungal disease of internal organs, particularly the lungs. The most important of these are histoplasmosis and coccidioidomycosis. Histoplasmosis occurs most frequently in the Midwest and has been found in man and dogs. Also, cattle have reacted to skin testing for histoplasmosis, and results of surveys among cows have paralleled those of human skin test surveys carried out in the same areas. Epidemiological investigations for the source of histoplasmosis cases in man and dogs have revealed contacts with fowl habitats, particularly abandoned ones having old deposits of fowl droppings, or with soils where droppings have been used as fertilizer.

In the hot, arid climate of the Southwest and the San Joaquin Valley of California, a serious systemic disease of man and animals is coccidioidomycosis. This disease affects the internal organs, including bones and joints, of man and dogs. Although cattle are susceptible, their infection is mild or subclinical, causing, mainly, swollen lymph nodes. Cattle, however, have proven valuable in skin tests to determine the geographic distribution of the causative organism of coccidioidomycosis.

Coccidioidomycosis in dogs has been related to contact with certain soils, and evidence is accumulating that the diggings extruded by rodents from their burrows is favorable for the growth of the causative organism and are, therefore, an important source of canine infection and possibly also of bovine infection. Since the clinical course of the disease is similar in man and dogs, dogs have been used in treatment studies by CDC veterinary officers using several antifungal drugs working in the areas of the Southwest where coccidioidomycosis is prevalent.

In other research, biochemical tests have been used to study approximately 100 strains of the causative organism of nocardiosis, an important fungal disease of man and animals which has been the cause of infection of the udders of cows. Most of the specimens were obtained from the sputum of patients in tuberculosis sanitariums. So far, the results indicate that this fungus can be isolated from human sputum even though the person does not appear to be ill with nocardiosis.

*Parasitic diseases.*—Echinococcosis (hydatidosis) is a disease resulting from the cysts (hydatids) formed in various organs of the body by the developing larvae of a dog tapeworm. Severity of the disease varies from vague, uncomfortable symptoms to death. Many animals become infected but only dogs or other members of the canine family, such as foxes and wolves, are known to transmit the disease to other animals and humans.

Investigators at CDC have carried out studies on the diagnosis of this disease and, as a result, have introduced the indirect hemagglutination test. This test and the bentonite-flocculation test were proven more accurate than the older complement-fixation test in diagnosing this disease.

Visceral larva migrans causes a disease which results when the larvae of the roundworms of dogs and cats migrate within the human body's internal organs. It has been reported as the cause of much chronic illness, primarily in children, in this country and other parts of the world. In addition to the organic damage that results from the burrowing of the larvae, it is also possible that these larvae harbor and transmit human virus diseases.

In the past, diagnosis has been made largely on a clinical basis. Therefore, CDC has pursued studies to devise accurate laboratory diagnostic methods, the work thus far being directed toward the production of materials for use in blood tests. In addition, research on control methods has led to experiments on animal infection and immunization.

Creeping eruption, or cutaneous larva migrans, is another disease caused by the migration of the larvae of animal parasites (helminths). Here the incriminating larva is that of a dog and cat hookworm. This disease causes skin lesions which are somewhat like ringworm and which cause burning, itching, and pain. It is most prevalent in the Coastal Plain areas of the South Atlantic and Gulf States, particularly in contaminated beachfront areas.

Studies carried out by CDC have shown that control can be effected by applying borax to the contaminated soil or sand to kill the eggs and larvae. The use of antihelminthic preparations in infested dogs and the elimination of stray dogs are also being studied in field trials.

Toxoplasmosis is a relatively new disease caused by a protozoan parasite. It has been recognized in humans for less than three decades. There are many unsolved problems regarding its transmission, symptoms, diagnosis, prevention, and treatment. Besides man, toxoplasmosis is also recognized in the dog, cat, rat, pig, cow, and wild animals, but the relationship between the disease in man and lower animals is still not understood.

CDC researchers developed a silver stain so that this parasite could be seen and studied. This had led to the discovery of previously undescribed structures within the parasite, thus providing a basis for comparing it with other related protozoa. Work has also been carried out on techniques for detecting the infection such as the use of methylene blue in a blood test. There is still, however, much to be done in determining the nature of toxoplasmosis in man and animals.

*Rabies research problems.*—The national rabies control program is described in the section on the veterinary public health program in the Communicable Disease Center. (See p. 147.) It seems worthwhile here to outline a few selected rabies research projects undertaken by the veterinary public health officers of CDC. One of the most recent contributions has been the successful adaptation of the fluorescent antibody test for the diagnosis of rabies. A highly specific procedure, this is one which depends essentially upon the fact that the rabies virus in the tissue of the infected animal reacts with antirabies serum which has been labeled with a fluorescent dye. The actual virus particles can be seen in a green fluorescent cast under a microscope which uses an ultraviolet light source. Laboratory and field tests have shown that this test is highly accurate and can be used as an important tool

in the diagnosis of rabies, particularly in tissue specimens which older tests do not show to be infected. Another advantage is that the diagnosis can be had within 1 working day as compared to the 8 to 21 days required for animal inoculation tests.

Another major breakthrough at CDC has been the growth of the rabies virus in the tissue from hamster kidneys. This, then, has important potential as a research tool for growing and studying the virus, for other possible tests, and for use as a vaccine.

In studies on rabies in wild animals, 75 percent of captured rabid foxes and skunks contained the rabies virus in their salivary glands. These animals have been shown to be the most dangerous transmitters of the disease in field and forest. Virus surveys of over 1,500 small wild rodents have shown that these animals do not serve as reservoirs of rabies in nature.

Bat rabies investigations at CDC's Las Cruces, N. Mex., station have shown that outbreaks of rabies are the cause of large bat die-offs in some of the great caves of the Southwest. Preliminary evidence based on blood tests and isolation of the virus solely from salivary glands suggests the possibility of true rabies carriers among U.S. insectivorous bats, that is, bats which carry the disease but do not appear rabid. Other experiments have been started to determine if there are any differences among the strains of bat rabies viruses in their ability to infect other animals.

Field studies with human rabies vaccines prepared in duck and chicken eggs are now being carried out in veterinarians and veterinary students. Early results of these studies suggest that this vaccine will serve a useful purpose as a preventive immunization measure in groups such as veterinarians who are constantly exposed to the disease.

*Conclusion.*—These then are but a few of the many pertinent contributions by the Communicable Disese Center in the field of zoonoses research.

*2. Veterinary Public Health Laboratory*

Limited investigations in the field of veterinary public health have contributed materially to our knowledge of the epidemiology, laboratory aspects of diagnosis, and control of those diseases transmissible from animal to man. Continued concerted effort is essential to solve the vital problem of diseased animals as a direct source of human infection through consumption of infected meat and meat products; through contact in certain occupations; or, indirectly, through contamination of foods, water, and soil. In addition, it is necessary to be prepared to attack the inevitable new problems brought about by changing epidemiological patterns and the changing patterns of micro-organisms.

With these factors in mind, a Veterinary Public Health Laboratory was established in the Communicable Disease Center in April 1959. This was accomplished by the addition of personnel and broadening of activities of the Leptospirosis Research Laboratory, established in August 1954, to include investigations on foodborne diseases and other zoonoses caused by bacterial pathogens. At present the activities of the Veterinary Public Health Laboratory are confined to bacterial disease studies and are divided into two subunits:

(1) Foodborne Disease Subunit: Enteric infections (salmonellosis, *Escherichia coli* infections, and shigellosis); staphylococcal infections and intoxications; streptococcal infections, botulism, or any possible foodborne infections due to other micro-organisms including parasites.

(2) Leptospirosis Subunit: Identification of leptospiral serotypes, consultation and training.

The overall aims of these subunits include epidemic aid, experimental epidemiological investigations, laboratory services and research.

*Epidemiological investigations.*—Activities in this area require constant epidemiological appraisal of diseases with established patterns as well as those in which further elucidation of the epidemiology is needed. For example, Salmonella organisms are known to be highly prevalent in our food-producing animals, with frequent transmission to man through food products derived from these infected animals. Recent studies have revealed that man is, in fact, infecting many of these animals by feeding contaminated foods inadequately processed.

Our knowledge of the interrelationships of some other bacterial diseases that affect both man and animals is more limited. For example, staphylococcal infections in fowl and in cattle occur frequently, but little is known of the virulence of these strains for man. Recent reports of food poisoning outbreaks in the United States attributed to staphylococci in cheese indicate their origin to have been infected cattle. At least two incidents have been reported in which bovine mastisis has been attributed to a staphylococcal strain frequently found in human epidemic infections. In both instances infections occurred in humans working with the cows.

Recent evidence indicates an increase in the occurrence of leptospirosis in humans and in domestic animals. Although the basic epidemiological pattern of transmission has not changed, certain conditions may be changing that favor this increase in the spread of leptospirosis. The wide distribution of leptospires in wild animals presents many problems in our efforts to control the disease in both humans and domestic animals. Epidemiological studies are being undertaken in areas associated with human and animal cases to determine the role of wild animals in the possible transmission of leptospirosis.

The epidemiology of listeriosis is not so clear. It is widespread in domestic animals, but in only a few of the increasing number of human cases being recognized has epidemiologic evidence pointed to diseased animals as the possible source of infection. There is speculation that infection may be acquired by direct contact with animals, or it may be foodborne or airborne. Recently it has been confirmed that the organism can live in silage and soils with an acid pH. Similarly, little is known of the source and mode of transmission of the human infections with *Vibrio fetus*, another prevalent disease of domestic animals. The fact that few human infections have been reported does not lessen the importance. The rare occurrence of a disease is just as important to the epidemiologist as an outbreak in his attempt to obtain a more complete understanding of the relationship of the organism to host and environment. Information is obtained on conditions of exposure, possible sources of infection, and clinical course of the diseases investigated.

*Laboratory services and research.*—This phase of activity is concerned with the performance and interpretation of laboratory diagnostic examinations; the development and evaluation of new, rapid epidemiologic tools, and the development and evaluation of biological products for control purposes.

Definite studies such as serotyping of leptospires are provided and as the need arises serotyping or phage typing of other bacterial cultures may be added. As the Veterinary Public Health Laboratory is one of two laboratories in the Western Hemisphere adequately equipped to identify the 60 recognized leptospiral types serologically, this service is continued to assist State health departments, veterinary research laboratories, and other investigative groups in an effort to determine the prevalence of different serotypes.

Salmonella and Shigella typing service of strains from both human and animal sources is adequately provided. Serological screening procedures are employed for these cultures.

A similar service is not available in the United States for serotyping *Escherichia coli* strains from animal sources. Little is known of the relationships of strains associated with infections in animals and those found in human infant diarrhea. A definite need exists for a service to compare isolates from human and animal sources. Such a service is included in long-range planning for this laboratory. Similarly, no control reference laboratory service is available for phage typing of staphylococcal cultures isolated from animals. Future plans include these essential tools for epidemiologic studies.

In cooperation with local health departments, survey studies are conducted on fresh and processed foods which are frequently found in outbreaks of illness to determine bacterial flora under normal conditions.

Bacteriological services are provided to the States in epidemic situations; and field investigations, including examination of specimens from human patients and study of human or animal contacts and food samples, are made.

Training is given to professional staff from the field in diagnostic bacteriological procedures, collection of specimens, and interpretation of findings as needed. Special arrangements are made to train other professional personnel in health departments, universities, or other Federal agencies in the epidemiology and laboratory diagnoses of bacterial diseases of animals transmissible to man. The training is combined with the study of various infections in laboratory animals, particularly those animals that become carriers.

*Respiratory diseases.*—Establishment of another unit in the Veterinary Public Health Laboratory to study certain respiratory diseases is anticipated. The immediate objectives of the Respiratory Disease Unit will be to study Q fever and to (1) determine the prevalence and distribution of Q fever infections in humans in previously unstudied areas; (2) conduct epidemiological investigations to learn the source of infection and factors influencing its spread; and (3) develop and evaluate methods for control through animal experimentation. Later activities of this unit would be expanded to include studies on some of the "orphan" viruses found in animals. Little is known regarding their relationship to similar viruses in humans. Further studies are needed to determine the possible role of animals in human influenza.

Similarly, the widely disseminated psittacosis-lymphogranuloma group of organisms should be investigated further to evaluate their public health significance.

Long-range plans include proposals for further expansion of the Veterinary Public Health Laboratory to develop a Comparative Medical Research Center. This broad plan would encompass not only epidemiological investigations and research on the bacterial, viral, and rickettsial zoonoses, but such problems as animal tumors and parasitic diseases.

Certain evidence now indicates that transmissible agents are associated with some animal lymphomas. Preliminary investigations are underway in New Jersey in an attempt to relate the distribution of animal lymphoma to human lymphoma cases and to seek evidence of an interrelationship between the animal and human diseases. Only by concerted epidemiological studies in different areas and by animal experimentation can the significance of the problem be clarified.

Investigations are needed on such parasitic diseases as hydatidosis, toxoplasmosis, and cutaneous and visceral larva migrans. For example, studies on the biology of the tapeworm that causes hydatidosis should provide information that will shed more light upon the epidemiology of this disease and possibly lead to better control procedures. The widespread distribution of toxoplasmosis in animals and its not infrequent occurrence as a cause of severe disease in man presents an important problem. While circumstantial evidence indicates that animals may serve as a reservoir for human infection, the means of transmission is not known.

It is estimated that cost of the proposed activities of a Comparative Medical Research Center would be approximately $500,000 per year.

### F. RADIOLOGICAL HEALTH

Two interrelated areas of radiological health to which the veterinary profession can make significant contributions are (1) research to provide the needed quantitative information on the long-term effects of radiation, and (2) fieldwork and research to define the mode of entrance of radionuclides in the animal-to-man food chain and to interpret the public health significance of radioactivity in the biosphere.

*Veterinary research on long-term effects of radiation.*—Considerable information is available on the acute effects of high levels of radiation exposure on animals as well as man. Veterinary research groups at various places, including Oak Ridge, Tenn., the University of California, and Hanford, Wash., have made significant contributions to this area of work. (See the Veterinary Corps of the Army and the Air Force, p. 128 ff.) However, a serious gap exists in available knowledge of the long-term effects of radiation. From a public health viewpoint, the effects of population exposure to relatively low levels of radiation must be more accurately defined than they are today. To resolve this problem will require many years of human epidemiological studies and accurately controlled, supportive, long-term animal studies.

New projects are being developed by the Radiological Health Division, U.S. Public Health Service, to investigate the effects of low-

level, long-term radiation on various segments of the animal population throughout the country. PHS veterinary officers are being trained in the specialized techniques required for these studies and will be assigned to PHS radiological health research stations in Las Vegas, Nev., and Montgomery, Ala. PHS veterinary officers also will be assigned, as collaborating radiobiologists, to research projects sponsored by AEC and other agencies and institutions.

It is in the latter area that the veterinary profession can make the most important contributions, as such studies require the ultimate in animal care coupled with carefully conceived radiobiological research. In many instances the experiments must be designed to permit experimental animals to live their "normal" life span. In some instances, even subsequent generations will need to be studied. Large numbers of animals under experimental observation for long periods of time will be required for studies of this nature. Veterinary science can make a significant and necessary contribution through the long-term studies at the University of California Veterinary School investigating the effects of external radiation on dogs. These studies are soon to expand into studies on the effects of ingested strontium 90.

*Contamination of foods with radionuclides.*—Radioactivity as an environmental contaminant in foodstuffs has been the object of increasing public and scientific concern. This problem area is closely related to various aspects of veterinary food hygiene and will require increasing veterinary study. Contemporary veterinarians should be knowledgeable in the metabolic as well as the physical properties of the important radionuclides as related to animal foodstuffs and should be sufficiently familiar with the subject to evaluate the public health significance of contamination levels in the biosphere.

The PHS Radiological Division and the Veterinary Services of the Army and Air Force are engaged in a training program to acquaint veterinarians and other specialists on the public health team of the methods used for determining levels of contaminating radioactivity in foodstuffs and the common environment of man and his animals.

Many facets of this problem are not clearly understood. A veterinary group at the University of Tennessee-AEC project at Oak Ridge has been working for several years to better define the metabolic behavior of fission-product radionuclides. More recently a radiation biology laboratory has been established at Cornell University Veterinary School for the purpose of research in this same area.

*Resolution at International Congress.*—The 1959 International Veterinary Congress manifested great interest in these problems and adopted the following resolution:

**In view of the increasing impact of nuclear energy and radiobiology upon veterinary medicine and public health, the 16th International Veterinary Congress recommends that national and international veterinary authorities and institutions should undertake appropriate action with respect to the following fields:**

**1. The utilization of radioisotopes as research, diagnostic, and therapeutic agents.**

**2. The use of ionizing radiation in food preservation and its public implications.**

**3. The measurement and evaluation of environmental contamination with radioactivity from fallout or nuclear accidents with respect to its effects on animals and, via the animal food chain, its effects on man.**

**4. The undergraduate and postgraduate training of veterinarians to implement these recommendations.**

Use of the radioisotope as a research tool is another area of modern science that transcends the veterinary public health interest per se in that it is related to the many phases of the veterinary sciences. It is likely in the years to come that the major contribution of the radioisotope to biological sciences and medicine will be its use as a research tool. Radioisotopes provide a method of investigation of clinical and metabolic problems with a sensitivity and precision heretofore unavailable. It appears then that knowledge and understanding of radioactivity should not be confined necessarily to those aspects related to environmental contamination of the biosphere and the public health aspects of radiation, but should be constructively applied to provide a better understanding and application of the sciences basic to veterinary medicine.

### G. AIR POLLUTION RESEARCH IN THE PUBLIC HEALTH SERVICE

The veterinarian has become an established member of the research and field teams investigating air pollution. The potential threat of environmental pollutants is becoming so prevalent that it requires serious consideration.

The term "air pollution" is quite descriptive. It generally is used in reference to manmade contamination with industrial wastes, substances resulting from combustion of fuel and radioactive fallout. The number, type, concentrations, and combinations of air pollutants present at any given place and time appear to be limitless. A combination of gases, particulates, and fog commonly has been referred to as "smog." However, it is now apparent that fog is not a necessary component of the dense atmospheric hazes known as smogs.

Certain health hazards of toxic airborne pollutants have been recognized for many years. For example, the toxicity of fluoride emissions for animals has been well defined. During the past decade, health authorities and the general public have developed an increasing concern over the potential hazard of continued exposure to less well-known air pollutants.

While there has been, historically, some concern about air pollution, the awareness of its threat as a health hazard seems roughly parallel to the increasing industrialization and urbanization which has occurred during the 20th century. Currently, the most severe air pollution generally is found in and near large urban centers where the basic components of "smogs" are emitted in large quantities.

*Evidence of serious problem.*—Already we have some direct evidence, as well as some suggestive leads, concerning the broad potentials of this menace. First, there have been major air pollution disasters causing death. Second, there have been lesser disasters, or incidents, which caused widespread morbidity. Third, there have been instances of public alarm due to the irritating effects of air pollutants on the eyes and upper respiratory tract. Fourth, many components of polluted air, when present in high concentrations, have been demonstrated to have biological effects.

In 1955, U.S. Public Law 159 gave official recognition to the need for investigation and control of air pollution. The Public Health Service has the major responsibility for conducting the research and training program outlined by this law. Assistance to State or other local governmental authority has been provided upon request.

*Consequences of Donora and other smogs.*—The most enlightening observations of the effects of air pollution on health have been made during or after the occurrence of acute episodes. The best known of these occurred in London in 1952; Poza Rica, Mexico, in 1950; the Meuse River Valley in 1930, and Donora, Pa., in 1958. At these locations persistent, dense air pollution was associated with human morbidity and mortality rates which were markedly increased above the expected.

Following the air pollution episode at Donora, a PHS survey disclosed that appreciable numbers of animals were reported to have become ill and that some died during the week of intense pollution. While dogs were allegedly affected in greater numbers than other species, owners of cats, rabbits, calves, and poultry reported the occurrence of illness and death among these species.

The illnesses of animals attributed to the Donora smog were most frequently characterized by respiratory distress. The signs of illness included cough, retching and emesis, sneezing, dyspnea. Cases of calf pneumonia were attributed to the smog by farmers. The reports of illness at Donora were clouded by the inability to identify specific pollutants; veterinarians were unwilling to indict the smog as a cause for animal morbidity or mortality.

During the London fog in 1952, a number of prized cattle which had been grouped for exhibition showed acute respiratory distress during the period of severe air pollution. Five of them died, 11 were subjected to emergency slaughter, and over 40 others developed signs which were attributed to the smog. Sulfur dioxide was identified as the chemical most likely responsible for the increased morbidity and mortality.

A related sulfur compound, hydrogen sulfide, was held responsible for the unusual number of animal deaths which occurred during the air pollution disasters at Poza Rica and in the Meuse River Valley.

Interest in the effects of air pollution on animals has generally developed as a corollary to the concern about its influence on human health. Studies in which animals have been exposed experimentally to air pollutants have been prompted by the need for specific information concerning the toxicity of various known pollutants.

The air pollution medical program of the Public Health Service now has a cadre of seven veterinary research officers carrying out studies on the effect of air pollution in animals. Headquarters of this program is in Washington, D.C., and field studies are being pursued in Los Angeles County, Detroit, and Columbus, Ohio. The projects are designed to investigate specific effects of selected toxic airborne elements on various tissue and organ systems and also to study long-term health effects of naturally occurring ambient air pollution on controlled animal colonies.

## H. NATIONAL ACADEMY OF SCIENCES-NATIONAL RESEARCH COUNCIL

### *1. Institute of Laboratory Animal Resources*

The need for a central clearing agency in the rapidly growing laboratory animal field developed after World War II. A conference, called by the National Academy of Sciences-National Research Council in 1952, met this need by establishing the Institute of Laboratory Animal Resources.

*Purposes of Institute.*—The objectives of the Institute are to survey, list, and publish sources of animals used in biomedical work; to improve research animals by establishing standards for their production, transportation, maintenance, and use; to collect, evaluate, and disseminate information; to promote international exchange of laboratory animal data and animal stocks; to assist in training programs for animal care personnel and scientists; and to improve the care of laboratory animals.

The Institute's current programs include publications, information service, standards, training, and international cooperation.

A quarterly newsletter on animal diseases is sent to veterinarians, animal technicians, breeders, and research workers. The Institute distributes reprints on animal diseases and other publications written by its members.

*Publication of standards.*—It serves as a central clearing agency for information on breeding, care, supply, use, and diseases of laboratory animals. Staff and committee members occasionally conduct field consultations.

The Institute has developed and published standards for the production of laboratory mice and rats, with information about disease prevention and diagnosis. It has published standards for the care of experimental animals used in secondary schools and universities for teaching and research. Members are preparing standards for the transportation of research dogs, with information about disease prevention and eradication. Development of standards for the diagnostic examination of so-called germ-free and pathogen-free laboratory animals is planned.

The Institute staff assists local groups in planning training programs for veterinarians, animal technicians, and research scientists.

*International activities.*—As the organization responsible for the United States participation in international laboratory animal affairs, the Institute cooperates in the programs of the International Commitee on Laboratory Animals. In addition to its work with ICLA, the Institute assists foreign scientists in arranging visits to research laboratories in the United States.

In the 7 years of its existence, the Institute has contributed to the wide gains made in quality of research animals, training of personnel, systemization of supply, and international understanding of problems in experimental animal production. The Institute has fostered interest in the raising and use of pathogen-free laboratory animals. Elimination of disease from experimental animals provides medical and biological investigators with far more precise research tools.

Although the program is relatively recent, more than 100 supervisory technicians and commercial breeders have been trained in basic biological principles and in animal maintenance techniques.

The development of production standards for mice and rats has improved sanitation, introduced better equipment, and increased the use of diagnostic laboratories. These results have produced research animals better able to withstand the stresses of experimental procedures.

*Better experimental animals.*—The Institute's emphasis on competent and trained personnel has led to a minor influx of veterinarians into the commercial breeding of laboratory animals and also the supervision of animal colonies for research and testing institutions. These

62587—61——7

veterinarians are contributing to the availability of better experimental animals. In turn, better experimental animals lead to greater gains in human and veterinary medicine.

The work of the Institute, in providing assistance to foreign scientists visiting America and in cooperating with international organizations, has created better international understanding of laboratory animal problems.

The main obstacle to the continuing supply of vigorous, healthy research animals is the lack of knowledge about their diseases. Research is needed on the cause, diagnosis, prevention, and therapy of such diseases as rabbit coccidiosis, salmonellosis of mice and rats, chronic respiratory disease in rats, and mouse pox.

*Diagnostic laboratories needed.*—Better diagnostic tests and trained personnel to administer them need to be developed. A particularly urgent need is reported for more diagnostic laboratories designed for experimental animals.

In addition to the unsolved problems presented by disease, obstacles to progress include lack of postgraduate educational opportunities for veterinarians in laboratory animal medicine and lack of research on such basic problems as housing and breeding of laboratory animals.

The opportunity for the veterinarian who works with laboratory animals to be of service in human and animal health cannot be exaggerated. The improvement of health in test animals guarantees a more uniform and stable research tool for all investigators. The results of research will provide a brighter future for human health and valuable information on animal health.

*2. Agricultural Board*

Before concluding with the NAS–NRC, it would be well to note certain observations made by its Agricultural Board. The latter is a part of the Division of Biology and Agriculture of the Academy. It studies and reports on scientific problems of agriculture in relation to the national economy. Financial support for the meetings and publications of the Board is derived primarily from the Agricultural Research Institute, which is an organization composed of representatives of industry, trade organizations, academic institutions, and governmental agencies concerned with agriculture. Members of the Agricultural Board and of its committees serve without compensation beyond their actual expenses. Funds for the work of the Agricultural Board are received and administered by the Academy.

There will follow extracts from its publication, "Animal Health Research Needs." These paragraphs bear upon the value of coordination of research—a phase of special significance to this subcommittee. The quotations refer as well to the issue of levels of appropriations for research. This latter phase is mentioned elsewhere in the subcommittee's publication, based upon various contributors' comments, but is not and could not be the subject of subcommittee recommendations, as indicated in the introduction (p. XIV).

NATIONWIDE APPROACH WOULD AID RESEARCH PROGRAM

**An evaluation of research needs for animal health clearly shows the value of a coordinated program to make the most effective use of the efforts available. Public and private research—Federal, State, and industrial—should coordinate their efforts as closely as possible in order to make faster progress. Closer**

coordination in planning research programs and in exchanging results could help to expand the total value of the time, money, manpower, and facilities in use throughout the Nation.

The very nature of today's livestock industry, with multiple transportation and vast intersectional livestock movements, emphasizes the need for a national approach to animal disease problems. Any disease or pest that appears in any part of the country should immediately be considered a national problem. Disease can break out in a single spot and by normal livestock movement spread through every section of the country within a matter of weeks. Inherent in the same mobile nature of the industry is the need in a coordinated research program for a close study of the epizootiology as well as the rapid and accurate diagnosis of communicable diseases of livestock and poultry.

### FALSE ECONOMY HINDERS RESEARCH PROGRAMS

In planning a coordinated research program in animal health, certain pitfalls should be recognized and avoided. For example, at certain strategic spots the progress of veterinary medical research studies strikes a barrier—a barrier created by the high cost of conducting complex, long-term projects with a sufficient number of large animals. When these barriers are met, research stops and efforts concentrate on less costly jobs.

Lack of funds and facilities to conduct proper research with large animals has forced scientists to carry out projects with an inadequate number of animals. Therefore, no matter how accurate the methods and procedures may be, the results are virtually meaningless because of the small number of animals involved. The same studies are repeated again and again by various research institutions in an attempt to reach valid conclusions, or the inconclusive results are released to livestock producers who must then bear the cost of trial-and-error proof.

As a result, support is given to a needless repetition of inadequate research projects which do not solve disease and pest problems. Heavy economic losses continue from diseases and pests that could be eradicated or controlled with better knowledge developed through adequate research. * * *

The continuing heavy losses from mastitis and shipping fever complex are direct results of this false economy. Research institutions have probably conducted more studies on these two diseases than any others in the field of veterinary medicine. No one laboratory has been able to spend the time and money necessary to conduct the full-scale research project it will take to find an effective means of controlling the diseases.

Repetition of inadequate research is wasteful. Neglecting research just because it may be long-term and expensive is false economy. By pooling the country's best brainpower to develop research programs aimed at valid and useful conclusions, the barrier of false economy can be overcome, no matter how complex and time-consuming the procedures. By increasing and coordinating funds, these high-cost projects can be successfully completed.

### BASIC RESEARCH IS A VITAL PART OF THE PROGRAM

A nationwide program should include adequate provision for the basic research needed to solve the pest and disease problems. Combined talents of the various scientific disciplines concerned—veterinary medicine, pathology, chemistry, biology, and other related sciences—should be made. The best of modern techniques should be included in the methods and procedures.

With such a national research program, it is possible to explore the nature of the diseases that present an active or potential threat to the livestock industry and to human health. Basic information on cause of disease, how it spreads, and its physical and economic effects could be discovered. Armed with this knowledge, recommendations for prevention and control would be the result. From there the Nation would be in a position to eradicate the more serious animal and poultry diseases. But to reach this position, sound basic research is the vital first step.

### EQUIPMENT AND FACILITIES SHOULD BE EXPANDED

Equipment and facilities available to carry out such an expanded research program in animal health are inadequate and outmoded. Many scientists across the country are working today in laboratories that were barely adequate to serve

their purpose 30 years ago. Even with more and better-trained personnel working together in a coordinated nationwide research program, efforts would still be handicapped unless, as the third positive step toward speeding the program of research, equipment and facilities can be improved and increased.

### APPRAISAL OF FACILITIES SHOWS INADEQUACY

Surveys of existing facilities for research in animal health in the United States have been made by the U.S. Department of Agriculture and by independent scientists outside the Federal Government. The results of these surveys have not been published, but an analysis of two of them shows that in order to modernize and expand the facilities to the point at which research can begin to solve the most pressing problems, $100 million will be needed in the next 5 years. This $100 million objective can be met by the combined efforts of Federal, State, and industrial research institutions.

Federal facilities for animal health research are largely centered in the Agricultural Research Service of the U.S. Department of Agriculture. Much of the work is being conducted with laboratories and equipment that seriously need expansion and modernization. The National Animal Disease Laboratory under construction at Ames, Iowa, will help to modernize some Federal equipment, but it is a replacement for outmoded and abandoned facilities and does not represent an increase. Even when the new laboratory is completed, adequate facilities to conduct the extensive research projects with a sufficient number of large animals that are urgently needed will still be lacking.

National facilities at the Plum Island Animal Disease Laboratory represent the first attempt in the Nation's history to provide research protection against foreign diseases. In today's world of fast travel, the country should be prepared to face at any time such diseases as foot-and mouth disease, rinderpest, Teschen disease, and East Coast fever. The livestock industry should be prepared to face the fact that if one of these dangerous foreign diseases should invade the country and spread widely, a great deal of research information would be needed rapidly. If this should occur at any time in the immediate future, the one laboratory at Plum Island would barely be sufficient. There would be an urgent need for more research facilities that could be converted for use in the study of a highly contagious disease.

The 18 colleges of veterinary medicine and the State agricultural experiment stations are responsible for most of the animal health research in the States. Some additional work is being done by a few State departments of agriculture. Research programs of the colleges of veterinary medicine are hard pressed to keep ahead of the teaching needs in all fields of animal health. Also, the State agricultural experiment stations are overburdened with requirements from intensified livestock and poultry industries for more precise information to protect their herds and flocks.

In most cases, the State institutions have well qualified, though small, staffs for research in this field. Usually they lack sufficient laboratory facilities, including safe provisions for isolation of adequate numbers of laboratory and farm animals for precision research. Modern equipment incorporating the means for the most efficient research methods is also often lacking.

Industry and other private organizations augment these Federal and State laboratories. They provide a large portion of the facilities engaged in developing parasiticides, antibiotics, and other chemicals used in the treatment of animal diseases and pets. However, the total is so far short of what is needed that it would take at least the $100 million in new research facilities and equipment during the next 5 years to meet the minimum requirements of animal health protection.

## I. FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR

The health of wild animals is important in the national effort to conserve natural resources. Conservation of native fauna is related not only to the recreational factors associated with preservation of game animals, but to the guarding and conserving of the natural beauty and wildlife community of the United States.

Disease is one of the most important factors influencing changes in population levels among sylvatic fauna. Research in this area is

necessary to apply improved game management practices for the conservation of wildlife. Research in wildlife diseases is one of the responsibilities of the Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, U.S. Department of the Interior. Wildlife disease investigations are carried out at the Patuxent (Md.) Wildlife Research Center, Laurel, and the Denver (Colo.) Wildlife Research Laboratory.

The Patuxent Wildlife Research Center conducts research on blood parasites of squirrels, waterfowl, and quail; hookworm parasites of fur seals; gizzard worm parasites of Canada geese; trichomoniasis in doves; avian botulism; virus diseases of rabbits, raccoons, squirrels, and foxes; internal parasites of raccoons and foxes; fungus diseases of waterfowl; avian parasites; and diseases of icterine birds.

The U.S. Fish and Wildlife Service's Denver Laboratory investigates botulism, parasites, and other maladies of birds, and fowl cholera in waterfowl.

*Zoonoses research.*—Many of the 100 zoonoses—diseases transmissible between man and animals—are found in wildlife. Thus, the health of wild animals is directly related to the health of man. Often these wild animals serve as reservoirs or vectors for the diseases of humans and domestic animals.

Principal zoonoses are investigated in wildlife disease research projects of two agencies of the U.S. Public Health Service—the Communicable Disease Center and the Rocky Mountain Laboratory of the National Institutes of Health. Studies are carried out on an epidemiological, ecological, immunological, and pathological basis.

The Communicable Disease Center in Atlanta, Ga., and other locations has studied enzootic rabies of sylvatic hosts—primarily skunks, foxes, and bats—bubonic plague of sylvatic fauna and wild rodents, encephalitis, leptospirosis, and mycotic infections—coccidioidomycosis, histoplasmosis, and ringworm.

The U.S. Public Health Service Rocky Mountain Laboratory at Hamilton, Mont., has investigated Rocky Mountain spotted fever, relapsing fever, tularemia, Colorado tick fever, Q fever, bubonic plague, leptospirosis, yellow fever, psittacosis, toxoplasmosis, brucellosis, botulism, salmonellosis, St. Louis and western equine encephalitis, fungus diseases, salmon poisoning, rabies of insectivorous bats, tick paralysis, scrub typhus, epidemic typhus, Siberian and North Queensland tick typhus, histoplasmosis, ratbite fever, rickettsialpox, and boutenneuse fever.

## Section 4—Veterinary Medical Education

### A. INTRODUCTION

Veterinary medicine started as an art of healing animals. Today, as indicated in preceding sections, the profession has reached into many additional fields. In order to prepare veterinary students for the fields of their choice, education must be specialized, yet encompassing. The borders of the biological, physical, and nuclear sciences are the only limits today for graduate veterinarians.

*Veterinary education strengthened and expanded.*—Before 1863, only a small percentage of the practicing veterinarians in the United

States were college graduates. Today all States require graduation from a recognized school or college of veterinary medicine in order to practice veterinary medicine within the State.

An increased recognition of veterinary medicine as a career and as a science has been coupled with realization of the importance of competent animal disease control to the Nation's agricultural economy and to public health. These advances were reflected in the establishment of seven new veterinary colleges at State-supported institutions in the 10 years following World War II.

Today, there are 18 schools and colleges of veterinary medicine in the United States and 2 in Canada. The number of graduates has increased from the low of 127 in 1927 to over 900 in 1960. The standards for veterinary medical education and the essentials for acceptable veterinary medical schools are established by the Council on Education of the American Veterinary Medical Association. They are periodically reviewed, revised, and strengthened as advances are made in veterinary science and educational methods.

A system of accreditation of all schools and colleges of veterinary medicine in the United States and Canada has been conducted by the AVMA for around 50 years. A method of evaluation of foreign veterinary colleges was initiated nearly 20 years ago to provide professional recognition for qualified refugee and immigrant veterinarians.

In 1937 the Association of Deans of American Colleges of Veterinary Medicine was formed. Its purpose is to advance the formal training of the veterinarian. (See p. 164.)

*Academic training necessary.*—In order to enter a college of veterinary medicine, the student must complete a minimum of 2 years preveterinary work at a recognized college or university. Most students complete their preveterinary training in land-grant colleges and State universities.

Acceptance into veterinary colleges depends upon the evaluation of the applicant's preveterinary record. If accepted, the student must spend 4 years of concentrated training in formal classes and clinical work. Internships are spent by most graduates during summers or following graduation under the careful guidance of successful veterinarians.

Many veterinarians decide to specialize and return to colleges and universities for graduate studies. They spend an additional 3 to 5 years to obtain a master's degree or doctor of philosophy degree in some specialized field of the medical sciences. The veterinarian of today is a professional man with 6 to 11 years of schooling serving as a broad base for his professional experience.

*License to practice.*—Veterinarians must satisfy State requirements by passing the licensure examinations of the State in which they intend to practice. These examinations are given by State veterinary medical examining boards.

In 1950, a National Board of Veterinary Medical Examiners was formed to prepare a standard examination for licensing. This examination is accepted by approximately 25 States. The final decision as to passing grades on this examination is retained by the respective State boards.

Representatives of all States banded together in 1958 to form the Association of American Boards of Veterinary Medical Examiners.

This association is striving for elevation of veterinary medical education and uniformity of educational standards, examination, and legislation regarding veterinary medical licensure.

*Facilities needed for technological advances.*—Although tremendous improvements have been made in the facilities for the schools of veterinary medicine during the past decade, many schools are still reported to be suffering from lack of adequate physical facilities. It is indicated that new facilities are required to keep pace with the technological advances in the basic sciences and the rapidly changing field of clinical medicine, including the use of deep X-ray therapy with radioactive materials and improved surgical procedures.

*Inadequate salaries fail to retain staff.*—Nearly all colleges of veterinary medicine are confronted with the problem of recruiting and retaining younger staff members. Graduate training attracts some young veterinarians, but many leave upon receiving advanced degrees. It is increasingly difficult to retain staff members at the lower faculty grades and salaries. The competition for veterinarians with graduate training is extremely keen; the high salaries offered by commercial companies that develop and produce drugs and biologics have taken many young men out of college teaching. If the colleges cannot retain these individuals, they cannot properly develop senior staff members of the future.

This problem is more acute in colleges of veterinary medicine than in other professional schools. The use of part-time instructors is not practiced in colleges of veterinary medicine; staff members do not have outside practices or consultant incomes. Practically all faculty members receive their entire remuneration by direct salaries from the institution. If the veterinary colleges of the United States are to meet the educational needs of the future, experts advise the subcommittee that the staffs must receive salaries commensurate with their training and technical ability.

### B. COLLEGES OF VETERINARY MEDICINE

The United States has 18 schools and colleges of veterinary medicine. (See table 6, p. 82.) The colleges' primary objective is to educate competent veterinarians to serve American livestock and pet owners and the public. Graduates are prepared to enter private practice with large or small animals; governmental service in animal disease control, public health, military corps, or research; teaching; research; and industrial and commercial work.

The veterinary colleges have their roots in the schools of agriculture. Most were outgrowths of departments of veterinary science. The colleges located in land-grant or State-operated institutions are financed through State appropriations. The University of Pennsylvania and Tuskegee Institute are private colleges. Veterinary education at Pennsylvania was proposed by a medical faculty member and has been closely associated with the school of medicine for 76 years.

Most schools admit qualified students from their own or adjoining States. Regional plans in the South and West have been organized to provide veterinary education without expensive duplication of professional schools. Under the cooperative plans, States secure places for a specified number of their own students in another State's veterinary

college by paying a proportionate share of the educational cost. Compacts for 14 States are administered by the Southern Regional Education Board and compacts for 11 continental States, Alaska, and Hawaii are administered by the Western Interstate Commission for Higher Education. Several colleges also maintain private contracts with individual States for the training of veterinary students.

*Early schools.*—The first veterinary institution in the United States was the Veterinary College of Philadelphia, which operated from 1852 until 1870. The AVMA does not list any bona fide graduates of this college. More successful schools were established in the latter part of the 19th century. Iowa State University's College of Veterinary Medicine, founded in 1879, is the oldest school still in operation.

*Accreditation.*—Both the Council on Education of the AVMA and the U.S. Department of Agriculture accredit veterinary schools. However, no school is accredited until it has graduated its first class. Minimum requirements are established for faculty, laboratories and classrooms, curriculum, and clinical training. AVMA's council, which inspects colleges every 3 years and recommends ways to strengthen veterinary education, has been responsible for initiating many educational advances. The deans of the veterinary colleges, through their own association, have standardized entrance requirements and have adopted many identical practical methods for teaching laboratory and clinical classes.

Many of the colleges are of comparable size. At present, no school admits more than 75 students in a freshman class. Classes range from 30 to 70 students; larger classes are divided into several sections for lectures and into small groups for laboratories.

The veterinary colleges had a total enrollment of 3,778 students in 1959–60. Each year, colleges award D.V.M. or V.M.D. degrees to about 900 students who have completed the 4-year professional course (table 6).

TABLE 6.—*Veterinary colleges in the United States*

| College and year opened | Degrees awarded (to July 1959) | | | Foreign students (1955–59) | Foreign visitors (1955–59) | Faculty on foreign service (1955–59) |
|---|---|---|---|---|---|---|
| | D.V.M. or V.M.D. | M.S. | Ph. D. | | | |
| Auburn University (1907) | 1,610 | 7 | ------- | 27 | 25 | 2 |
| University of California (1948) | 389 | 5 | 24 | 25 | 250 | 6 |
| Colorado State University (1907) | 1,443 | 35 | 1 | 10 | (1) | 0 |
| Cornell University (1896) | 1,984 | 65 | 38 | 39 | 278 | 10 |
| University of Georgia (1946) | 560 | 0 | 0 | 4 | 100 | 0 |
| University of Illinois (1944) | 226 | 37 | 15 | 0 | 0 | 1 |
| Iowa State University (1879) | 2,124 | 74 | 18 | 22 | 117 | 2 |
| Kansas State University (1905) | 1,873 | 100 | 10 | 33 | 60 | 4 |
| Michigan State University (1909) | 1,576 | 347 | 141 | 75 | 200 | 4 |
| University of Minnesota (1947) | 387 | 7 | 40 | 21 | 180 | 4 |
| University of Missouri (1946) | 286 | 5 | 0 | 20 | 250 | 0 |
| Ohio State University (1885) | 2,552 | 116 | 22 | 50 | 200 | 3 |
| Oklahoma State University (1947) | 293 | 12 | 4 | 7 | 50 | 1 |
| University of Pennsylvania (1884) | 2,000 | 20 | 8 | 5 | 35 | 3 |
| Purdue University (1959) | 0 | 23 | 14 | 0 | 160 | 2 |
| Texas Agricultural and Mechanical College (1916) | 1,414 | 38 | 2 | 17 | 275 | 3 |
| Tuskegee Institute (1945) | 127 | 0 | 0 | 16 | 75 | 1 |
| Washington State University (1899) | 1,176 | 9 | 0 | 4 | 0 | 2 |
| Total | 20,020 | 900 | 337 | 375 | 2,255 | 48 |

[1] Figures not available.

*Well-trained faculties.*—American veterinary colleges have well-trained faculties. The 18 colleges have a total of 1,364 faculty and staff members. Of these, 711 are veterinarians, 146 are professionally trained in other fields, and 304 are technicians.

Laboratory, basic science, and clinical courses require individual instruction for students. Because of these demands, the veterinary colleges maintain a ratio of about one faculty or staff member for each three students.

An increasing number of veterinary professors hold master's or doctor of philosophy degrees. Many faculty members have taken postgraduate courses in radiation, biophysics, and other specialized fields. Professors are important contributors to professional journals. Faculty members serve as consultants on diseases, treatments, and abnormal conditions to practicing veterinarians.

All colleges encourage faculty research. Many teachers are allowed part time to study new aspects of their special fields.

*Preprofessional education.*—Veterinary education requires a minimum of 6 years. Two years of preprofessional college training is a prerequisite for entrance to all American veterinary schools. The preveterinary curriculum includes biological sciences, physical sciences, social sciences, and humanities.

The 1,010 students who entered veterinary colleges in 1958 were selected from 1,924 applicants. More than half of the freshmen had completed 3 or more years of preprofessional training (table 7). There were 234 with bachelor's degrees, 15 with master's degrees, and 1 with a doctor of philosophy degree.

TABLE 7.—*Preprofessional training of first-year veterinary students, 1958–59*

| Students | Years of college completed | | | |
|---|---|---|---|---|
| | 2 | 3 | 4 | 5 or more |
| Number | 1,010 | 256 | 201 | 89 |
| Percentage | 100 | 25.8 | 21.2 | 9.0 |

Source: Journal of the American Veterinary Medical Association, Dec. 15, 1958.

*Veterinary curriculum.*—Although schools vary in individual courses, all professional curriculums include 2 years of basic sciences and 2 years of clinical veterinary medicine and surgery.

While the student of human medicine learns only about man, the veterinary student has to know about all animals. He learns the special characteristics of the horse, ox, hog, dog, cat, sheep, and fowl, and the important differences. Beginning with the normal animal, the future veterinarian learns about physiological functions, organs, bones, muscles, nerves. Then he proceeds to abnormal conditions and the body changes caused by various diseases. His education includes using a microscope, identifying harmful and helpful bacteria, and studying the effect of drugs on animals. Required basic sciences are anatomy, physiology, parasitology, pathology, pharmacology and toxicology, bacteriology, mycology, virology, biochemistry, histology, and radiology.

The third- and fourth-year veterinary student assists faculty members and then handles sick animals under faculty supervision. He

diagnoses diseases and abnormal conditions, treats animals, performs surgery, and conducts post mortem examinations. All veterinary colleges make extensive use of large and small animal clinics. These clinics serve livestock owners and pet owners in the areas near the colleges; in addition, many practicing veterinarians refer unusual cases to the clinics for observation and study. Ambulatory clinics enable seniors, under the supervision of a graduate veterinarian, to make farm calls.

Advanced courses include poultry diseases, radiology, veterinary jurisprudence, and public health, which includes food hygiene, meat inspection, epidemiology, and control of diseases transmissible from animal to man.

Most veterinary colleges require students to gain practical experience by working with a practicing veterinarian during at least one summer session. Several colleges have organized internship or preceptorship programs, which students must complete before they receive degrees.

*Graduate training.*—The military demands in World War II spotlighted the need for veterinarians with specialized training. The number of veterinarians in graduate study has increased threefold since 1948. The number of graduate courses has more than doubled. In the 1959–60 academic year, 288—or 7 percent of all veterinary students—were engaged in graduate studies. Graduate work in the fields of anatomy, microbiology, public health, physiology, pharmacology, and veterinary pathology leads to masters' and doctor of philosophy degrees. Schools of public health accept veterinary graduates in degree courses.

*Extension services.*—Some extension veterinarians are members of the veterinary college faculty; others are staff members of the State extension service who work closely with the college. In States which do not have extension veterinarians, faculty members serve as consultants and conduct fieldwork upon request.

Most colleges offer conferences and technical demonstrations at the postgraduate level. These are staffed by faculty members, extension veterinarians, research workers, and regional or national specialists. Short courses for veterinarians and farmers also are held.

*Diagnostic laboratories.*—All of the veterinary colleges operate some form of diagnostic services. Some are available without fee to veterinarians and livestock owners; others are operated on a fee basis. In some instances, the colleges maintain the State's principal diagnostic laboratory in cooperation with the State veterinarian's office.

Diagnostic services include clinical necropsy—gross and microscopic, microbiologic, and hematologic-serologic examinations. The University of Illinois veterinary diagnostic laboratory, which is one of the Nation's largest, received more than 126,000 specimens in a single year. The University of Missouri performed 115,302 hematologic examinations in 1 year.

While these laboratories are maintained primarily to provide technical services in the diagnosis of animal diseases, much of the specimen material received is valuable in the classroom for veterinary students' use.

Several diseases have been reported for the first time in the United States after tests in college diagnostic laboratories were completed.

*Faculties conduct research.*—Research has always been an integral part of the academic program of veterinary colleges. Faculty members have gained national stature for their outstanding research and scientific findings. All colleges have encouraged faculty research projects, whether or not the teachers were employed by the research department.

The largest single source of funds for veterinary research is State appropriations. A few veterinary colleges have research budgets of $400,000 annually, although most colleges spend from $50,000 to $200,000.

Federal grants have been offered to veterinary colleges for research in designated areas for many years. These account for a substantial amount of experimental work, and employ outstanding graduate and undergraduate students as well as faculty members of veterinary research departments. The largest grant ever given to a veterinary college—$1.1 million—was presented to the University of Pennsylvania in 1960 for work in comparative diseases of the heart in animals and man. The grant from the National Heart Institute of the U.S. Public Health Service will be used for veterinary research over a 10-year period.

Since the conflict in Korea, grants and contributions from nongovernmental sources have increased as foundations, drug and biological companies, and livestock groups have recognized the need to support veterinary college research.

Veterinary research projects and studies made significant advances in the 1950's. Budgets increased 4½ times from 1949 to 1959, the number of research projects doubled, and 3 times as many veterinarians engaged in research.

*Broad aspects of research.*—College research workers have studied almost every infectious, parasitic, metabolic, nutritional, and genetic disease of livestock and poultry. Almost every college has done some work in tuberculosis, brucellosis, and mastitis. College experiments have covered more than 60 separate diseases and abnormal conditions of economic importance to livestock owners. These include hog cholera, leptospirosis, erysipelas, parasites, liver abscesses, plant poisoning, respiratory disease of chickens, rabies, anaplasmosis, nutritional anemia in baby pigs, brisket disease, shipping fever, infectious bovine rhinotracheitis, enterotoxemia, and many others. Studies have sought the causes of disease and other fundamental information, as well as development of treatments, preventive methods, diagnostic tests, and surgical techniques.

*Benefits.*—No one can measure the benefits of research in terms of dollar savings to the livestock industry of the United States. Auburn University recognizes that the livestock industry in the State of Alabama was made possible by early research conducted by faculty members in cattle tick fever and other diseases. Veterinary research at Texas A. & M. College has brought an estimated saving of $883.5 million in livestock production at a cost of $3 million over a 72-year period. This includes a $500 million saving from cattle tick fever and tick control.

As one animal disease is eradicated or brought under control, other, more complex diseases appear. As indicated earlier within this volume, modern conditions—including the advent of mass production of

livestock and poultry, concentration of animals and poultry in small areas, transportation over long distances, feed additives of hormones, chemicals, drugs, and antibiotics for increased growth and production—have created many new disease problems. One of the most neglected and yet potentially productive fields of research is that dealing with normal physiology of food animals. Other diseases and abnormal conditions require additional study. New techniques and methods are needed to prevent and treat diseases. There is no shortage of pressing areas for animal disease research in the foreseeable future.

*Veterinary college needs.*—It is reported to the subcommittee that colleges need additional, competent faculty members, better laboratories, equipment, clinics, and classrooms, and additional funds for necessary fundamental and applied research. More graduate students, it is reported, must be attracted to expand advanced training programs, which will offer specialized training in biological and physical sciences for teachers, research workers, and public health officials of the future.

Needed facilities and increased financial support would allow veterinary colleges to improve the veterinary training they provide and to study many of the control and public health aspects of animal diseases. Better scientifically trained personnel to teach and to conduct basic veterinary research can enable the veterinary colleges to do their full share in meeting the needs of a changing agriculture.

### C. VETERINARY MEDICAL LICENSURE

After a veterinarian has completed his preprofessional and professional education and has received a degree in veterinary medicine, he must also qualify for a license to practice. Professional licensure for all branches of medicine is a legal responsibility and function of all State governments.

In the case of veterinary medicine, licensure examinations are given by the respective State veterinary medical examining boards. These boards are usually appointive, the members being selected by the Governor of the State for specified terms. The boards are independent agencies but may be a part of the State department of education and registration or of a State division of professional licensure.

The State veterinary examining boards operate under respective veterinary practice acts. These acts specify the time and place of examinations; the credentials which candidates must present (diploma from an accredited veterinary medical school, proof of good moral character, age); the subject matter that the examinations shall cover; citizenship requirements, if any; the fees charged for examination and annual renewal or registration of license; and reciprocity with other State boards.

State board examinations comprise written, oral, and practical tests. In some States, the written discussions of test questions have been replaced by objective-type tests.

*National Board of Veterinary Medical Examiners.*—In 1950, a National Board of Veterinary Medical Examiners was established following several years of study by a committee of the American Veterinary Medical Association. The National Board has about 30 mem-

bers who are selected by associations and agencies representing all fields of veterinary medical activity. In collaboration with Professional Examination Service of the American Public Health Association, the National Board of Veterinary Medical Examiners prepares objective-type tests. These are currently used by about 25 State veterinary examining boards. The objective tests include over 400 multiple-choice questions which cover the various subject fields, such as anatomy, histology, bacteriology, physiology, pathology, surgery, medicine, radiology, and preventive medicine.

These objective tests are offered to State veterinary examining boards on a fee basis. The scoring of the candidates' answers is done by electrical-machine methods so that the grades or scores are exact measurements of the correctness of answers in any given test. The respective State boards set their own "passing points" for the objective tests. In this way, the examining boards retain full control of the licensing process in their respective States.

The Association of American Boards of Veterinary Medical Examiners was formally organized in 1958. Its membership comprises representatives of all the State boards of veterinary medical examiners. Its objectives are to bring together all State boards of examiners in veterinary medicine to foster exchange of ideas; to promote better communication between State boards; to elevate standards of veterinary education; to extend mutual help to affiliated boards and their members; and to maintain uniform minimum standards of education, examination, and legislation regarding veterinary medical licensure.

## Section 5. Veterinary Food Hygiene

### A. INTRODUCTION

Food hygiene is designed to prevent illness or disease that might be caused by food products. Foods of animal origin must first of all come from healthy animals. These animals must then be slaughtered and their carcasses or their products processed under sanitary conditions that will prevent contamination or deterioration. The food hygiene programs covering the foods of animal origin are generally provided by Federal, State, and local agencies found in Departments of Agriculture or Health. (See Veterinary Public Health at Local, State, and Federal Levels, p. 140; Food Hygiene in the Public Health Service, p. 142.) Food hygiene is the responsibility of the military veterinarian on military installations in the United States and in foreign countries. (See p. 123.)

*Consumer confidence.*—The American consumer has come to rely upon food hygiene agencies to assure the safety, wholesomeness, and accurate labeling of meats and animal food products.

In the United States, the inspection of foods of animal origin has traditionally been a veterinary medical activity. The oldest food inspection program is the Federal meat inspection service. Federal veterinarians have conducted compulsory inspection of all meat products entering interstate or foreign commerce since 1906. Federal poultry inspection was begun in 1927 on a voluntary basis. It became mandatory for all poultry products moving in interstate or foreign commerce on January 1, 1959.

In addition to the Federal programs, some States and local jurisdictions have meat and poultry inspection programs which provide a valuable health protection service. Most of these are supervised by veterinarians. Many practicing veterinarians participate in these inspection programs on a part-time basis.

*Inspection of milk.*—The inspection of milk and dairy products is conducted by local or State authorities. A standard milk ordinance and code, developed as a model by the U.S. Public Health Service, is used officially by many State and local jurisdictions as a standard for inspection of milk and dairy products. (See Food Hygiene in the Public Health Service, p. 143.) However, there is no compulsory national milk inspection program similar to the Federal meat and poultry programs.

Because the health of the animals producing the product directly influences quality, veterinarians have always been engaged actively in milk and dairy inspection. Sanitary engineers and other technicians assist in carrying out the inspection programs.

*Raising standards of inspection.*—It is estimated that 20 percent of the "red meat" animals and 10 percent of the processed poultry are slaughtered under State or municipal inspection—or receive no inspection at all. The standards of inspection conducted by non-Federal agencies vary widely. Experts reporting to the subcommittee state that the raising of standards of non-Federal inspection or the inclusion of all slaughtering and processing under Federal programs would further extend the benefits of adequate food inspection to the general public.

The U.S. Public Health Service recently developed a standard poultry inspection ordinance, which is beginning to be adopted by State and local health departments. In 1955, the AVMA Committee on Milk and Food Hygiene developed a standard meat inspection law and code of regulations for States and municipalities, which included plans for a model packinghouse.

*Needs for inspection.*—Food inspection cannot be partially adequate; there is no middle ground between an effective program and one that fails to protect the public.

Only an animal-by-animal or bird-by-bird inspection conducted by competent personnel prior to slaughter and during every step of processing can eliminate all diseased animals or unwholesome parts from food-supply channels.

A major problem has been the shortage of veterinarians available for food inspection activities. Adequately staffed inspection programs require the services of many veterinarians. Although trained technicians can assist with inspections, veterinarians must make the final determination to approve or reject products. In some instances, inspection programs have been curtailed because of the shortage of veterinarians. Adequate funds with a satisfactory salary scale could result, temporarily at least, in adequate staffing, but possibly at the cost of creating shortages of veterinarians in other activities. Experts reporting to the subcommittee state that, in actuality, what is very pressing is direct attention to (*a*) the problem of training more veterinarians than are presently supplied; and (*b*) the problem of compensation as related to other sciences.

*Records available.*—Information on conditions of poultry and meat animals before and after slaughter has been compiled by the inspection

services over the years. More complete use of this information could be made for disease control purposes. Losses caused by disease and abnormal conditions could be evaluated and considered when research, control, and eradication priorities are established. State and Federal disease control agencies can use information regarding the origin of diseased animals in tracing the presence of disease back to farms and ranches. Then disease prevention methods can be applied.

Information on diseases and abnormal conditions of animals can also be used in research on human diseases. For example, the cumulative data on tumors found during meat inspection have never been fully analyzed. These data are an excellent source of material for comparative research of tumors in humans and animals.

A major need of the USDA inspection services is reported to be pathological and bacteriological laboratories where complete examinations may be made of all types of specimens from suspect carcasses and poultry found in packinghouses. Present facilities do not permit the use of infectious agents in diagnosing conditions found on the killing floor of the slaughterhouse. If the Meat Inspection Division had adequate and separate bacteriological and pathological laboratories, isolated from animal handlers and normal research animals, it could install necessary safety facilities and maintain safety standards.

### B. MEAT INSPECTION DIVISION, AGRICULTURAL RESEARCH SERVICE

The meat inspection program of the United States was begun in 1890 and has reached a position of world leadership in food hygiene. That year the first Federal meat inspection law was passed to satisfy demands of several European countries for U.S. Government controls on American meat shipments. Only meat intended for export was subject to U.S. Department of Agriculture inspection.

In 1906 the first comprehensive meat inspection law was passed. Under this law, all U.S. meatpackers preparing products for interstate or foreign commerce became subject to inspection. This basic law and its amendments continue to guide meat inspection activities in the United States.

Since the Federal laws cover only plants that prepare products for interstate or foreign commerce, the balance of the meat production plants in the United States operate under State and local laws. The extent and effectiveness of such State and local inspection vary considerably.

*Stringent inspection.*—Meat inspection veterinarians and their assistants search out and eliminate from food channels diseased and otherwise unfit carcasses; see that meat and meat products are kept clean during all stages of preparation into articles of food; guard against adulteration, harmful preservatives, and other deleterious substances; cause sound and wholesome meat to be branded as inspected and passed; and prevent the use of false or deceptive labels and statements on meat foods.

All establishments that prepare meat and meat food products for interstate or foreign commerce must operate under Federal meat inspection. On June 30, 1959, inspections in 1,334 establishments located in 546 cities and towns covered about 80 percent of the commercially produced meat in the United States.

*Live animals to labels.*—During the year, the Meat Inspection Division of the Department of Agriculture, engaged principally in:

1. Examining food animals—including cattle, calves, sheep, swine, goats, and horses—prior to slaughter to eliminate those animals affected with diseases or other unwholesome conditions.
2. Providing a thorough post mortem examination of each carcass at time of slaughter to detect and eliminate diseased and otherwise unfit meat.
3. The destruction for food purposes of all diseased, unsound, or otherwise unwholesome meat and meat food products.
4. Supervising of the preparation of meat and meat food products to assure their cleanliness and wholesomeness.
5. Guarding against the use of harmful preservatives and other deleterious ingredients.
6. Supervising the application of marks to meat and meat food products to show that they are "U.S. Inspected and Passed."
7. Supervising the application of informative labeling and preventing the use of false and deceptive labeling on meat and meat food products.
8. Certifying meat and meat food products for export.
9. Inspecting meat and meat food products offered for importation into the United States.
10. Examining meat and meat food products for compliance with specification requirements of governmental purchasing agents.
11. Investigations to insure the accuracy and effectiveness of the inspection procedures.
12. Supervising the manufacture and labeling of process or renovated butter.
13. Guarding against residues in meat resulting from ingestion, treatment with, or exposure to pesticides, growth-promoting substances, drugs, or biological products.
14. Developing and determining acceptable methods for humane slaughter of meat animals.

Each year approximately 100 million animals are slaughtered under Federal meat inspection.

As of June 30, 1959, a total of 3,443 employees carried out the complex functions of the Meat Inspection Division. Of this number, there were 737 veterinarians, 2,547 meat inspectors, 23 chemists, and 136 clerical, administrative, and other supporting personnel. Veterinarians direct all slaughtering and administer the overall meat inspection program.

*Financing.*—The program is financed by appropriations. However, the Division is reimbursed for all overtime work performed at establishments or for importers or exporters. The Division is also reimbursed for identification service, special certification, and the work done for other Government agencies.

Meat inspection protects the human population from unwholesome, adulterated, or mislabeled meat, and aids in protecting the livestock industry from devastating foreign livestock diseases. Detection and reporting of livestock diseases that are diagnosed by veterinarians on ante mortem and post mortem inspection provide additional protection against possible spread of new diseases into the United States.

During October 1958, responsibility was given to the Meat Inspection Division for administering the humane slaughter law, which requires that animals be rendered insensible before slaughter begins. Veterinarians of the Meat Inspection Division, working with industry and the humane societies, developed methods to meet the full requirements of the law. They consulted veterinary scientists in universities and other countries.

*Meats condemned, retained.*—Animals, carcasses, parts, and processed meat items found to be unfit for use or otherwise not in compliance are marked with a "U.S. Retained" tag. Depending upon the condition, the product is either destroyed for use as human food under the direct supervision of the inspector or the offending condition is removed or corrected. Veterinarians make or supervise all dispositions.

During 1958, over 235,000 carcasses were condemned in their entirety because of various diseases and conditions found on post mortem inspection. In addition, over 8½ million carcasses were temporarily retained until diseased or affected portions were removed.

A wide variety of chemicals are used to protect animals and crops against insects. Many of these chemicals leave a residue which is cumulatively deposited in the animal. When the residue exceeds acceptable levels of toxicity, the affected product is disposed of in accordance with good food hygiene principles. Such information is promptly reported to officials who can act to prevent further contamination.

*Imported meats certified.*—In order for a foreign country to import meat into the United States, it must have a national inspection system and a reliable certification program. Salaried veterinarians of the country of origin must certify that the product has been prepared according to U.S. requirements. The following countries have an inspection system and a certification program which meet U.S. requirements:

Argentina
Australia
Belgium
Brazil
Canada
Costa Rica
Cuba
Czechoslovakia
Denmark
Dominican Republic
England and Wales
Finland
France
Germany (Federal Republic)
Honduras
Iceland
Ireland (Eire)
Italy
Luxembourg
Madagascar
Mexico
Netherlands
New Zealand
Nicaragua
Northern Ireland
Norway
Panama
Paraguay
Poland
Scotland
Spain
Sweden
Switzerland
Uruguay
Venezuela
Yugoslavia

All products imported into the United States are required to bear labels which have to be approved by the Meat Inspection Division. All imported meats must be inspected and passed at ports of entry.

During fiscal year 1959, the largest importation of meat on record was made into the United States. This amounted to 945,227,733 pounds accepted for entry. Because the requirements of the United States were not met, 10,025,944 pounds of foreign meat and meat food products were refused entry and/or condemned.

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*U.S. standards explained.*—When a product is either refused entry or condemned, the exporting country usually, and understandably, wants an explanation. Foreign veterinarians responsible for certifying such products to the United States have demonstrated concern and an objective attitude toward wanting to meet U.S. requirements. During 1959, five countries—Mexico, Australia, Germany, New Zealand, and Argentina—sent high-level delegations to the United States to learn the reasons for the rejections and to study U.S. meat inspection standards. In each case, these representatives returned to their countries and improved local conditions. The exchanges, marked by a spirit of trying to understand the U.S. criteria, helped to improve the relationships with these nations.

Some foreign countries restrict meat from the United States because of the presence of certain diseases in this country. The Meat Inspection Division has a certifying service which permits the careful selection of meat from areas which do not have the particular disease in question. For example, some countries in which hog cholera does not occur will accept U.S. pork for import if the Meat Inspection Division certifies that the product originated in a State where the live virus of hog cholera is not used as an immunizing agent.

*Model for packing plants.*—In 1 year, veterinarians of the Meat Inspection Division reviewed drawings and specifications for 1,058 projects for new or remodeled facilities for slaughtering and meat processing establishments. The standards developed by the Meat Inspection Division are included in a booklet entitled "Information for Applicants for Federal Meat Inspection," which has received worldwide attention. Some foreign meat processors and veterinarians use this publication to guide them in constructing establishments in their own countries. This information is also widely used in the United States as a model for plants operated under Federal and non-Federal inspection.

Meat inspection veterinarians have contributed significantly to the development of mechanical systems for the rapid handling and slaughtering of food animals in the American meatpacking industry. Accurate inspection methods have speeded production; methods of processing and product control have improved meat quality. Shifting pressures in world economics are causing foreign countries to search for time- and labor-saving systems. Many foreign meat hygienists are adopting the advanced handling, processing, and inspection techniques used in the United States.

*Data from autopsies available.*—The Meat Inspection Division records all post mortem pathological findings on cumulative rapid data mechanical processing equipment. Information on approximately 100 million autopsies is made available annually to domestic and foreign veterinary medical and scientific groups.

The Meat Inspection Division has provided information to and assisted in collecting specimens for research projects both in animal and in human health. Quantitatively it is estimated that it could be the world's leading supplier of information on gross pathology. However, full use is not being made of this research material. Data are quickly available as to incidence and geographical location for conditions found on post mortem inspections. Scientists could use these data in epidemiological intelligence studies of diseases common to

animals and man or diseases limited to animals and to plan emergency or long-range activities.

*Location for laboratories.*—One of the Meat Inspection Division's major needs is a location for its pathological and bacteriological laboratories which will permit the use and study of potentially dangerous tissues under controlled safety conditions.

At the present time, the Meat Inspection Division's pathological and bacteriological laboratories are located in the animal husbandry building at the Agricultural Research Center, Beltsville, Md. Many healthy experimental animals are also housed in this building. To protect these animals against all possibility of an infectious disease spreading from pathological specimens, the Meat Inspection Division has taken numerous precautions and imposed restrictions on laboratory activities.

No potentially dangerous tissues are admitted into the laboratories. All specimens must be fixed in 10-percent formalin solution, so they arrive at the laboratory free of infectious agents.

These self-imposed restrictions have limited the work of the Meat Inspection Division on diseases such as brucellosis, leptospirosis, tuberculosis, swine erysipelas, and the mucosal disease complex.

*Potential testing aids.*—Use of bacteriological techniques and animal inoculation to study diseases would provide new knowledge and ultimately serve the public. Extensive laboratory work with tissues from brucellosis reactors is needed to determine whether the present procedures are acceptable from a meat-hygiene standpoint. Tuberculosis studies would prove whether the basis for disposition of animals showing lesions adequately protects the consumer and meat handler.

Because lesions of many infectious diseases resemble each other, these diseases cannot be differentiated on post mortem inspection by visual means. Use of animal inoculation tests would enable field inspectors to make more rapid specific diagnoses for use by the Animal Disease Eradication Division.

Working with pathogens requires isolation from animal handlers and normal animals. Also required are safety facilities and maintenance of safety standards by competent trained personnel. As indicated earlier, if the Meat Inspection Division had adequate and separate bacteriological and pathological laboratories, isolated from animal handlers and normal research animals, it could install necessary safety facilities and maintain safety standards.

The extended use of toxic chemical materials as spraying or dipping compounds to treat animal and plant parasites presents a growing problem. Residues of toxic quantities of insecticides may be absorbed by exposed livestock. While destruction of parasites is necessary from an economic point of view, the health of the human consumer of the meat or meat product must not be endangered. New approaches of parasitic control, including nontoxic sprays or restricted exposure before slaughter, coupled with rapid methods of detection, must be found.

*Division reports abnormal conditions in animals.*—Recent Meat Inspection Division reports have pointed up conditions that cause great economic loss to the American livestock producer and packer and that have public health significance. The reports show that 1 in every 20 hogs is affected with cervical abscesses; 1 in 36 hogs is affected with a

mild form of tuberculosis; 1 in 65 cattle is affected with actinobacillosis or actinomycosis; and 1 in 1,414 cattle is affected with coccidioidmycosis, a condition which also affects humans.

The prevalence of tumors, or malignant neoplasms, in domestic animals is extensive. Last year, 8,243 cattle carcasses and 1,875 swine carcasses were condemned under Federal meat inspection for neoplasms; thousands of other carcasses were "passed" after affected areas were removed. Studies as to kind, anatomical location, age of animal, and geographical location of tumors of livestock could be helpful in research on human tumors.

As human and animal populations increase, livestock will face new disease hazards because of more intensive production methods and crowding. Diseases common to man and animals will require new research. The resources of the Meat Inspection Division, with its trained veterinary pathologists and its rich source of information, can be valuable to such investigations.

### C. POULTRY DIVISION, AGRICULTURAL MARKETING SERVICE

Federal poultry inspection was undertaken in 1927 after a soup manufacturer requested service that would enable his products to meet Canadian import laws. The Bureau of Agricultural Economics, USDA, then offered poultry inspection on a voluntary basis to any processor willing to pay for its cost. Only a few thousand pounds of New York dressed poultry were presented for inspection the first year.

Demands for the service increased in 1928 when New York City began to require inspection of all eviscerated and canned poultry products. By July 1929, 14 plants were operating under voluntary inspection.

As processing practices changed, more poultry was slaughtered and eviscerated within the same plant. Fresh or frozen birds were moved to retail markets in ready-to-cook form or as poultry food products. Recognizing advances in the industry, Congress passed the Poultry Products Inspection Act in 1957. This law required inspection of all poultry products moving in interstate or foreign commerce after January 1, 1959.

*Inspection assures wholesomeness.*—Poultry inspection assures consumers that poultry and poultry food products moving in interstate and foreign commerce are wholesome and that product labels are neither false nor misleading. The regulations define wholesome as "sound, healthful, clean, and otherwise fit for human food."

The Agricultural Marketing Service, through the Inspection Branch of the Poultry Division, employed 515 veterinary poultry inspectors and 1,042 nonveterinary inspectors on August 31, 1959. These men conduct inspection service in 641 plants. Approximately 500 plants conduct slaughtering and eviscerating operations.

*Mandatory inspection.*—In its first 6 months of mandatory inspection, January 1 to June 30, 1959, the Inspection Branch inspected a total of 757,194,000 head of all classes of poultry, representing 2,686,454,000 pounds of live weight. Of these, 1,979,073,000 pounds of ready-to-cook poultry were certified as wholesome and moved into the channels of commerce. A total of 11,425,000 head was condemned as unwholesome. This condemnation represents a total of 34,962,000 pounds dressed weight, including heads, feet, and all viscera.

About half of the poultry slaughtered in the United States in November 1958 was processed under voluntary Federal inspection. In 1959, the year that inspection of interstate and foreign poultry products became mandatory, approximately 90 percent of all commercially slaughtered poultry was federally inspected.

*Sanitation regulated.*—Inspection helps to eliminate diseased and otherwise unsound poultry from the market. Regulations that require adequate sanitation in all phases of processing and packaging go a long way toward preventing development of many micro-organisms which are common to both poultry and man. If these regulations were not enforced, such micro-organisms could produce disease conditions in man with serious public health consequences such as salmonellosis and other food borne infections. Therefore, the poultry inspection program helps to assure the public wholesome and safe poultry food supplies. It enables consumers to buy higher quality poultry and poultry food products.

Inspection has stimulated demand for poultry products in both domestic and foreign markets. Since passage of the 1957 law, a substantial volume of ready-to-cook poultry has moved into foreign commerce.

The poultry industry has accepted mandatory inspection as an incentive for improving poultry husbandry and processing procedures.

Adequate inspection, which is primarily carried out to protect human health and welfare, has benefited the Nation's economy and promoted consumer confidence.

*Industry benefits.*—Although mandatory poultry inspection is new, it already influences poultry disease control activities. Inspection Branch reports give disease control authorities information about the incidence and geographic extent of various poultry diseases. Use of this information will benefit the poultry industry, poultry disease control programs, and other fields of regulatory veterinary medicine in planning for the future.

## Section 6. Animal Disease Prevention, Control, and Eradication

### A. INTRODUCTION

The foundation for control and eradication of animal diseases in the United States is the relationship of the practicing veterinarian with the individual animal owner. This relationship is traditionally American and follows the pattern of medical practice. Most of the other nations have a government-supplied veterinary medical service that practically excludes the private practitioner. In the United States, almost from the beginning of the livestock industry, private practitioners have provided service to animal owners on a professional basis.

There are some functions of animal disease prevention, control, and eradication which the individual practicing veterinarian, working with the individual animal owner, cannot perform. The individual veterinarian and the livestock producers are helpless in preventing the introduction of diseases in the United States from foreign lands. In many of the infectious and contagious diseases, the careful preventive measures followed by an individual farmer—with his veterinarian's help—can be nullified by the carelessness of a neighbor or a

distant farmer or by still unknown modes of transmission. Infectious disease agents can be spread to clean herds through wild animals, and surface, water, and air travel of domestic animals before the individual farmer, rancher, or pet owner can take steps to detect, identify and prevent them.

*State-Federal role.*—Federal and State Governments help prevent and control infectious and contagious animal diseases through organized programs. The Bureau of Animal Industry of the U.S. Department of Agriculture was established in 1884 to cooperate with the States in the extirpation and suppression of animal diseases. The first disease attacked through the joint efforts of the BAI and State agencies was contagious pleuropneumonia. It was eradicated from this country under an intensive program conducted from 1887 to 1892; it has been successfully kept out of this country since 1892.

Foot-and-mouth disease has been eradicated from the United States nine times, and it has been prevented from gaining entrance for the past 30 years. Many other successful animal disease eradication programs undertaken by the States in cooperation with the Federal Government have also been successful.

*Basic philosophy.*—The basic philosophy of the Federal Government has always been to prevent the introduction of diseases that do not occur in the United States. This is carried out through a national program of inspection of animals and animal products imported into the United States from foreign countries. Through this program, rinderpest, African swine fever, Rift Valley fever, and other devastating foreign animal diseases have been kept out.

However, if a foreign disease does gain entrance into the United States, controls are imposed as soon as it is detected. Usually an eradication program, which involves the slaughtering of infected and exposed animals, is carried out as expeditiously as possible. This method of attack has proven successful with foot-and-mouth disease and again proved its value in the recent successful eradication of vesicular exanthema.

*Other controls.*—Immunizing agents are also used as tools in the control and eradication of animal diseases. Practicing veterinarians use these tools—vaccines, serums, and quarantines—as well as other effective control measures to aid the livestock and pet owner in prevention and control.

*Cooperative policy set.*—The U.S. Department of Agriculture, in cooperation with State directors, commissioners, and secretaries of agriculture, has developed a policy to guide the cooperative State-Federal animal disease control and eradication programs.

The Federal Government protects the United States from the invasion by foreign diseases and pests, organizes programs to eradicate foreign diseases that gain entrance, and cooperates with the States in organized efforts to reduce or eliminate further losses caused by a given animal disease or pest. It also cooperates with the States in preventing the interstate spread of diseases.

The States protect their livestock producers, work closely with livestock producers and practicing veterinarians in controlling diseases that do occur, and cooperate with the Federal Government in emergency outbreaks of disease and disease control and eradication programs.

This cooperation between Federal and State Governments aids the livestock producer in his battle against the ravages of animal diseases and pests. It also protects the health of the livestock owner and his employees and the public through the prevention, control, or eradication of animal diseases that are transmissible to man.

*Areas of potential extension.*—Many areas of the United States do not have adequate veterinary medical services. Experts say that if these areas would consider the potentiality of a communitywide effort, such as has marked the recruitment of doctors in areas without a physician, such services could be provided if farmers, ranchers, and livestock owners would organize into groups to support a veterinary practitioner for a limited period of time which would enable him to become established. It would be one way for the livestock owners to improve the health of their animals and protect themselves from animal diseases that are transmissible to man.

*Support for programs.*—Today, effective control and eradication of many contagious and infectious diseases of livestock are possible through the development of research knowledge. This knowledge can be applied effectively if animal owners will support organized control and eradication programs, and if governmental officials make a stronger effort to explain the objectives. Too often, owners fail to understand the objectives of eradication programs, or the efforts to explain have not been completely effective, or they may be unwilling to make the temporary sacrifices necessary to get rid of disease. Education efforts to explain the need for these sacrifices perhaps were not adequately programed, and the needs for this type of information program were not fully contemplated.

Experts advise that State and Federal programs designed to eradicate animal diseases have almost inevitably been initially opposed by organized groups of animal owners, a characteristic behavior too well observed in other branches of science. These programs have been carried out through the support and participation of practicing veterinarians and the majority of livestock owners. In many cases, as programs gained momentum, the opposing minorities have recognized the benefits and have actively supported effective disease control and eradication. For example, tuberculosis and brucellosis eradication programs met strong opposition at times. Because the programs proved effective, both now have the support of nearly all animal owners.

When all animal owners are willing to support these programs, both privately and through their governments, the full potential of disease prevention, control, and eradication will be realized.

*Responsibility for disease control.*—Federal regulatory agencies become involved when a disease spreads across State lines. However, experts say, the responsibilities for initiating the regulatory programs are not clear cut.

They add that if the responsibility to initiate, develop, and cooperate in regulatory programs for animal diseases were clearly assigned to Federal and State agencies, many more animal diseases could be effectively and expeditiously controlled. Livestock producers would serve on advisory committees to aid in initiating and developing control programs.

### B. ROLE OF THE PRIVATE PRACTICING VETERINARIAN

Veterinarians perform a diverse and complex role in the field of animal health and in the diagnosis, treatment, and prevention of animal diseases. The practicing veterinarian's primary interest and efforts are directed to the recognition and treatment of the many ailments and diseases of domestic animals.

The category of practicing veterinarian includes all those in general and in specialized practice. About half of all the veterinarians in the United States and Canada are in general—large and small animal—practice; about 15 percent conduct specialized—bovine, equine, or small animal—practice. The responsibility for final diagnosis of an animal disease has always rested upon the private practitioner. As the man on the spot, he has the equipment and knowledge to fight animal diseases or to prevent them. Because the veterinarian has the confidence of the livestock and pet owners, his position in America is secure.

Until the colonization of America, native livestock were free of many of the diseases which trouble the Nation today. European stocks brought diseases with them; owners treated their sick animals with home remedies, herbs, or preventive amulets brought from Europe. As some farmers gained a reputation for success in treating sick animals, they were frequently called upon to treat the sick stock of their neighbors.

*Growth of population creates new problems.*—The sparsity of the animal population, isolation of communities, and distance between farms prevented the rapid spread of animal diseases among livestock. While the death of a cow or a horse was a tragedy to the owner, the loss had small effect on the community. As the country and the livestock population grew, however, livestock disease problems also increased.

Shortly after the Revolutionary War, graduates from veterinary schools in France, Germany, and England emigrated to the United States and established thriving practices. At the same time, native Americans were acquiring a vast knowledge of animal diseases by observation and self-education. These self-trained "veterinarians" cared for the country's horses and livestock.

*First American veterinary school.*—In 1852, a group of veterinarians established the first American veterinary school, called the Veterinary College of Philadelphia. While this school failed in a few years, it was the forerunner of other schools established to train men for a professional veterinary service.

The oldest operating U.S. veterinary school was established as a part of Iowa State College in 1879.

Veterinarians who had obtained formal training in America began serving the horse owner of urban areas and livestock owners in rural areas. With a competent service, the demand for more veterinarians led to the establishment of additional schools.

*Guardian of animal health.*—The practicing veterinarian's responsibility is greatest when an animal has an infectious or contagious disease. The practitioner first diagnoses the disease, then treats af-

fected animals. If necessary, he carries out immunization or other control measures which governmental agencies impose to prevent a serious disease outbreak in a herd or in a community. (See fig. 11, "Practicing Veterinarian—Protecting Man and His Animals.")

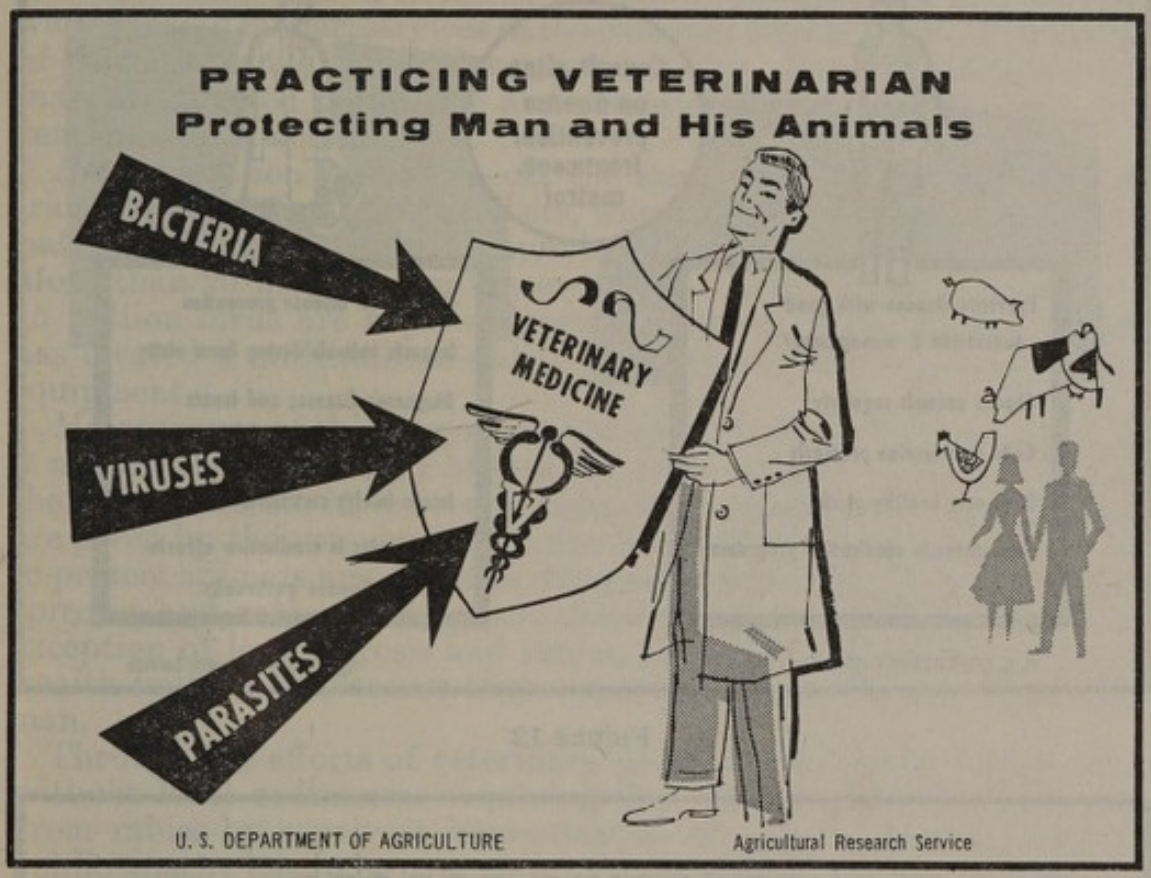



FIGURE 11

The well-trained practicing veterinarian of today is a many-sided fighter for the common good. He is the primary guardian of animal health, a defender of human health through his work to control and eradicate animal diseases communicable to man, and a vigilant sanitarian. The veterinarian's work on diseases related to animal breeding and reproduction has great economic significance to the Nation as a whole as well as to the individual livestock owner. The economic contributions of the practicing veterinarian to individual farmers, to the community and State, to industry and agriculture are incalculable. (See fig. 12, "Farmer-Veterinarian Cooperation.")

Many people assist the practicing veterinarian in his efforts to improve animal health. Although he usually works by himself, he has the active support of local, State, and Federal veterinarians, county agents, and the farm press and radio. He uses the facilities of diagnostic laboratories, the consulting services and training courses of veterinary colleges, the biologics developed by drug and supply concerns. The practicing veterinarian frequently draws upon the work of governmental and private research workers. (See fig. 13, "Supporting Forces Behind the Practicing Veterinarian.")

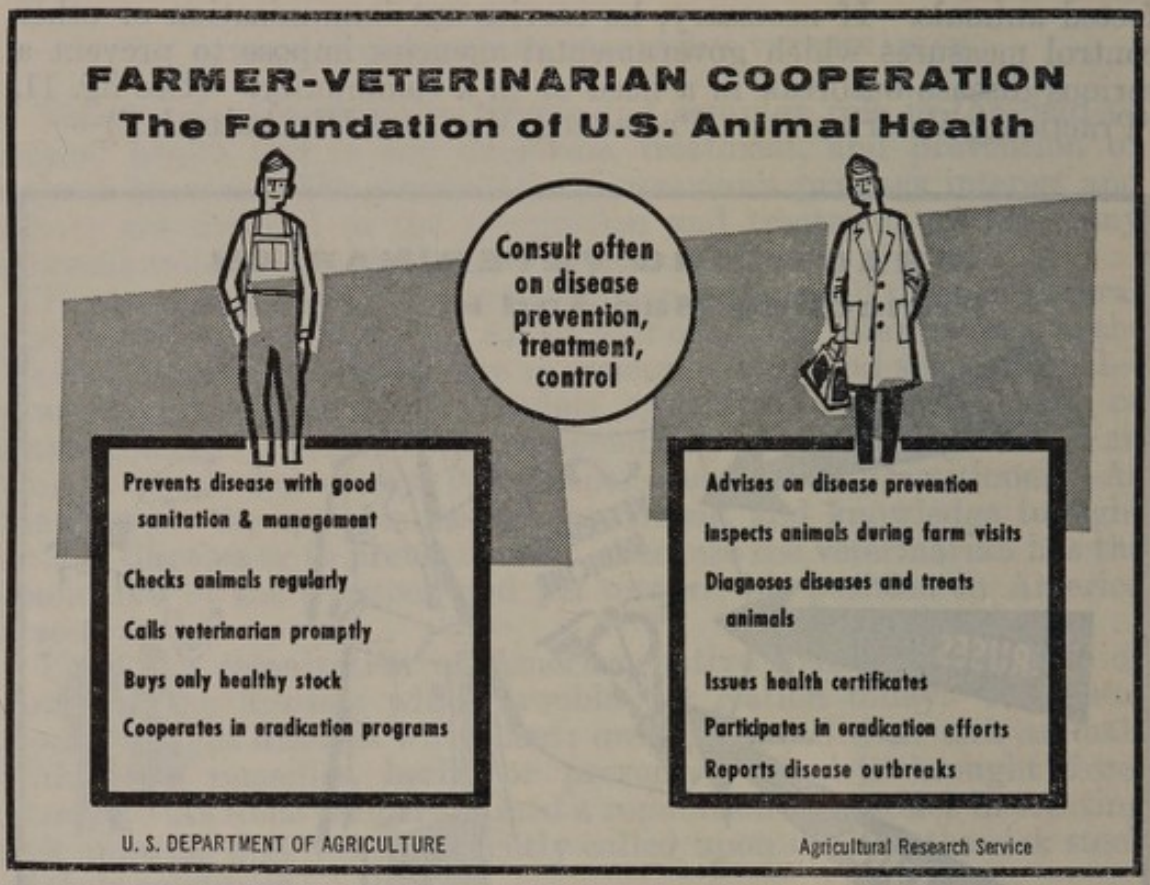



FIGURE 12

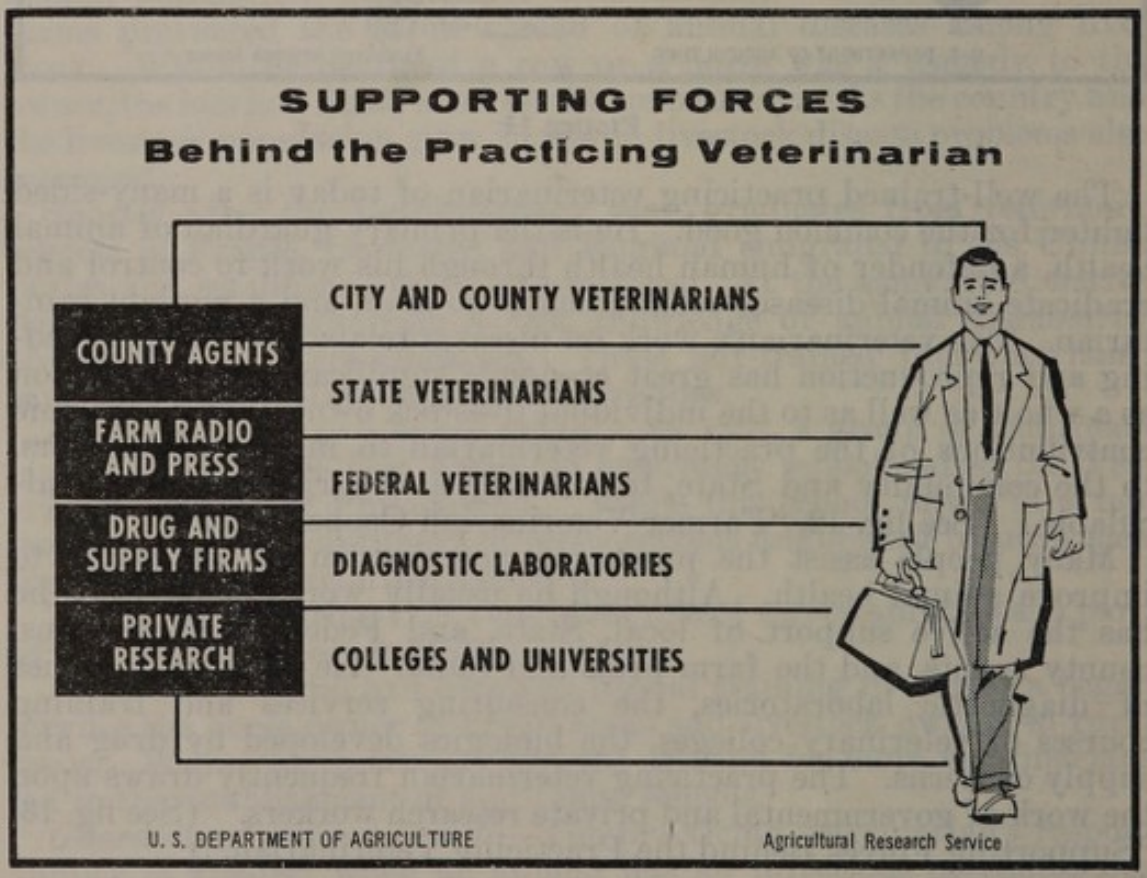



FIGURE 13

*Practice shifts from horses.*—Not too long ago, practicing veterinarians were referred to as "horse doctors," because they directed their main efforts to the care of the domestic animal that was then the most important and valuable. As practice with horses declined following World War I, livestock owners demanded, and veterinarians were quick to render, services in the care and treatment of other species of animals—cattle, swine, sheep, and poultry. Rural practicing veterinarians directed more time and attention to disease treatment, prevention, and control.

*Pet population increases.*—At the same time, cities and towns attracted small animal practitioners, whose special services were eagerly patronized by the growing number of dog, cat, and pet owners. More than 25 million families own dogs. Over 25 million cats and 15 million birds are kept in American homes. This interest in pets has created a multimillion-dollar industry in breeding, feeding, and equipment.

Maintenance of this large pet population would not be possible were it not for the availability of immunization agents. Vaccines against the major diseases have been developed by pharmaceutical firms, and are given by the veterinarian at the individual pet owner's discretion to protect animals against such diseases as hepatitis, distemper, leptospirosis, and rabies in dogs and feline distemper in cats. With the exception of leptospirosis and rabies, these diseases are not of public health importance because they are not known to be transmissible to man.

Through the efforts of veterinary practitioners, many communities without local ordinances requiring dog immunization are protected from rabies by a private immunization of dogs. In some instances, public apathy has to be overcome by a municipal, county, or State authority. Other immunization programs have resulted from public anxiety accompanying an outbreak of rabies in dogs.

*Animal hospitals.*—Practicing veterinarians have constructed hospital facilities in recent years in the interests of better and more efficient care and treatment of animal patients as part of their services to the public. A recent survey showed that there were over 4,000 animal hospitals in the United States and Canada. Of these, over 3,000 were for small animals, about 800 had combined facilities for large and small animals, and the others were exclusively for large animals.

*Prevention of disease.*—The primary objective of medicine, whether directed to animals or man, is prevention of disease. With the present trend toward concentration of animals, the hazards of contagious and infectious diseases of animals are multiplied. Operators of such establishments as the 100,000-bird broiler flock and the 1,000-animal cow pool are learning the benefits of planned disease prevention. Practicing veterinarians guide preventive disease programs, in addition to treating sick animals and poultry.

*Research.*—Although practicing veterinarians do not have fully equipped scientific laboratories in which to work, many conduct research on animal diseases of special concern in their localities. They work with pharmaceutical and feed companies to conduct field trials of new biologics, drugs, and medicated feeds. They also develop new

surgical and medical techniques and equipment, such as the Stader splint, used extensively by the military services during World War II in treating men with broken limbs.

*Challenge of animal diseases.*—Losses caused by animal diseases and their possible effect on the Nation's ability to feed future populations present a challenge to the practicing veterinarian.

America's increasing urbanization leaves fewer acres for agriculture. In turn, intensified agriculture concentrates animals in smaller areas and increases disease hazards. As this movement progresses, the veterinarian will devote more time to preventive medicine. He will oversee herd health and sanitation. He will remove sick animals for treatment or disposal. Thus, the veterinarian will become an integral part of management on the large farm. He may also serve as a consultant to the management team of several smaller farm units on a percentage or retainer fee basis.

In the small animal field, metropolitan centers will probably be served in the future by large hospitals for inpatient pets. These veterinary facilities will be supplemented by clinics for diagnostic service and outpatient treatment.

Such changes in rural and urban practice may enable veterinarians now in private practice and those who will graduate in the future to give more complete service at lower cost.

### C. STATE ANIMAL DISEASE CONTROL AGENCIES

Each of the 50 States has established an agency responsible for the protection of the health of all domestic animals within the State. In nearly all States, these animal disease agencies have been given broad powers and have emerged into strong, well-knit, purposeful organizations.

These State agencies were established as a result of realization by the livestock and poultry industries and those interested in public health that animal disease prevention, control, and eradication were essential to the welfare and health of man.

In nearly all States, a State veterinarian directs the activities of the animal disease agency. Other veterinarians and personnel trained in livestock disease control methods serve on the agency's staff.

*Animal disease responsibilities.*—While State agencies are concerned with all domestic animal health, their main responsibilities are in the control of tuberculosis, brucellosis, scabies, hog cholera, Johne's disease, scrapie, anaplasmosis, swine erysipelas, pullorum disease, Newcastle disease, rabies, vesicular exanthema, screwworm, and other animal diseases which pose a threat to the livestock and poultry industries or to public health. Many of the State agencies' programs for the control or eradication of these diseases utilize the practicing veterinarian and operate in cooperation with the Agricultural Research Service of the USDA.

Some of the methods used in disease eradication programs involve the control of interstate and intrastate livestock movement, State quarantine of infected animals or poultry, maintenance of diagnostic and biological laboratories, licensing and supervision of markets and rendering plants, and the supervision of livestock exhibitions.

*Emergency disease plans.*—The prompt detection and combating of foreign diseases—in cooperation with the ARS, USDA—is another

means of protecting animal health. Most States have formed emergency disease organizations, composed of members of cooperating agencies and headed by the State veterinarian and the Federal veterinarian in charge. The main objective of these organizations is to maintain a state of readiness. If an animal disease of foreign origin should appear within the State, the emergency disease organization would initiate control measures. The organization also encourages practicing veterinarians to report promptly to State officials any suspected foreign animal disease. The emergency programs emphasize the importance of a close working relationship among the practicing veterinarians, the State veterinarian, and the Federal veterinarian.

*State meat inspection.*—The animal disease agencies of many States are responsible for the inspection of meat and meat food products at packinghouses which do not have Federal meat inspection. This inspection is made to insure safe and wholesome products which are fit for human consumption. Some State agencies also inspect for label control and ingredient control of meat food products.

In 1935–36, State animal disease regulatory officials formed the National Assembly of Chief Livestock Sanitary Officials. It provides a forum for free and useful exchange of information between members. (See p. 164.)

State animal disease agencies provide one of the most essential links in the Nation's fight against animal disease. In cooperation with the practicing veterinarian and Federal agencies, State agencies have made and will continue to make notable advances in protecting human and animal health and welfare.

### D. ANIMAL DISEASE ERADICATION DIVISION, AGRICULTURAL RESEARCH SERVICE

The Animal Disease Eradication Division of the Agricultural Research Service, USDA, has the primary responsibility at the Federal level for formulating and administering cooperative State-Federal programs for the control and eradication of animal diseases. The Division employs 625 veterinarians and has a total staff of 2,167 in these programs.

The chief objective of the ADE's programs is the complete eradication of animal diseases posing a threat to the livestock industry and the welfare of the Nation. With this objective, the Division has joined other endeavors of veterinary medicine and the livestock industry in attaining an enviable animal health status for the United States. These cooperative efforts and their successful accomplishments have served as a stimulus for the attainment of similar goals by many countries all over the world.

*Former Bureau of Animal Industry.*—The ADE Division had its beginning in the former Bureau of Animal Industry of the USDA. The BAI was established by an act of Congress in 1884, "to prevent the exportation of diseased cattle and to provide means for the suppression and extirpation of pleuropneumonia and other contagious diseases among domestic livestock" Following the original charge given to it, the BAI expanded into an organization with broad responsibilities in animal disease diagnosis, control, and eradication as well as animal disease research.

With the realinement of functions in the USDA in 1954, the activities of the former BAI became the responsibility of several new divisions in the present Agricultural Research Service. The responsibility for controlling and eradicating animal diseases and otherwise protecting livestock by the enforcement of laws governing interstate movement of animals was assigned to the Animal Disease Eradication Division.

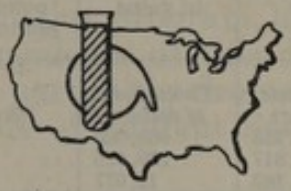
The broad programs of the ADE Division and its predecessor, the BAI, have been highlighted by many significant contributions to animal and human health and to the welfare of man. (See fig. 14, "Highlights in the Fight—United States Versus Animal Diseases.") The programs of the Division have contributed significantly to the welfare of the Nation through the eradication of animal diseases which threatened the livestock industry. Among these contributions are the eradication of foot-and-mouth disease from the United States, a cooperative international program that eradicated foot-and-mouth disease from Mexico, the eradication of contagious bovine pleuropneumonia, the eradication of glanders, the discovery of vector-transmitted diseases and the subsequent use of this knowledge to eradicate cattle tick fever, and in 1959 eradication of vesicular exanthema of swine.

*Human welfare related to animal health.*—It is the thesis of this publication that the establishment and maintenance of a healthy animal population has a direct bearing on the health and welfare of man. Eradication programs for diseases of animals, such as brucellosis and tuberculosis, to which man is also susceptible, have decreased the incidence of these diseases in the human population. For example, efforts to eradicate brucellosis of cattle have reduced the incidence rate of this disease in man. In fiscal year 1947, 4.5 percent of all cattle tested by the brucellosis blood serum test revealed evidence of infection; in fiscal year 1960, only 1.1 percent of the cattle tested were similarly classified by the same test. The incidence of human brucellosis has shown a decrease from 6,321 reported cases in 1947 to 741 in 1960.

Coincident with the reduction of tuberculosis in cattle has been a decrease in the occurrence of bovine tuberculosis in humans. Before the national eradication program was launched, gland tuberculosis was rather common in children who consumed raw milk from infected cows. Today bovine tuberculosis is almost unknown in man. The cooking of raw garbage fed to swine, a practice used to eradicate vesicular exanthema from the swine population of the United States, also resulted in the reduced incidence of trichinosis in swine and subsequently in humans.

Animal diseases are capable of depriving man of animal proteins that are essential to his nutrition and well-being. Thus, these diseases may adversely affect human health.

Although the United States enjoys one of the highest standards of animal health in the world, USDA has estimated that the Nation lost $2.7 billion annually in livestock production during the period of 1942–51 due to livestock diseases (table 8). This average annual production loss of $2.7 billion illustrates the influence of livestock diseases on the Nation's economy and thus its citizens' welfare. Although great strides have been made in reducing losses through the control or eradication of the more economically important diseases, increased efforts are needed in the fight against animal diseases.

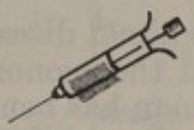


## HIGHLIGHTS IN THE FIGHT
## United States vs. Animal Diseases

1884 Bureau of Animal Industry established

1892 Pleuropneumonia eradicated from cattle

1893 Cattle tick fever research first revealed diseases are carried by insects



1907 Hog cholera immunization developed

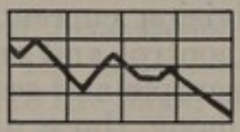
1917 Bovine tuberculosis eradication program launched

1929 Foot-and-mouth disease eradicated from U. S.

1934 Bovine brucellosis eradication program launched

1935 Poultry pullorum control program launched

1940 Bovine tuberculosis reduced to 0.5%



1954 Foot-and-mouth disease eradicated from Mexico

1958 Southeastern screwworm control program launched

1959 Vesicular exanthema of hogs eradicated

U. S. DEPARTMENT OF AGRICULTURE Agricultural Research Service

FIGURE 14

TABLE 8.—*Estimated annual livestock and poultry losses in the United States, 1942 to 1951*

| Nature of loss | Production value | Losses in value | Percent loss from potential production |
|---|---|---|---|
| | *Thousands of dollars* | *Thousands of dollars* | *Percent* |
| Cattle diseases: Losses in production of meat, hides, and milk | 7,659,913 | 669,065 | 8.0 |
| Swine diseases | 3,473,817 | 539,615 | 13.4 |
| Sheep diseases: Losses in production of meat and wool | 404,162 | 12,077 | 2.9 |
| Poultry diseases: Losses in production of meat and eggs (including nonhatchability of eggs) | 3,149,002 | 248,672 | 7.3 |
| Goat, horse, and mule diseases | [1] 851,602 | 560 | .1 |
| Mink and rabbit diseases | 45,208 | 10,266 | 18.5 |
| Internal parasites of livestock and poultry | 14,742,727 | 432,136 | 2.8 |
| Insect pests of livestock and poultry | 4,771,680 | 507,712 | 9.6 |
| Marketing losses in poultry products | 2,756,667 | 268,339 | 9.7 |
| Livestock industry as a whole | [2] 15,717,000 | 2,688,442 | |

[1] Average January inventory value; not included in annual income totals.
[2] Average annual farm marketings of livestock and products plus value of home consumption, 1942–51.

Because animal diseases are so closely related to human health and welfare and the economic welfare of the livestock industry and the consumer, man has benefited directly from the programs of the ADE Division.

*Current animal health efforts.*—The ADE Division meets its responsibility of safeguarding the Nation's livestock health by conducting activities for the control and eradication of infectious, contagious, and communicable diseases.

These activities range from full-scale control and eradication programs and disease incidence surveys to laboratory and field diagnostic services and epidemiological projects. All of these activities are cooperative efforts with the various States. The extent of participation is governed by the States' needs and requests. There are approximately 180 animal diagnostic laboratories located in the various States. The ADE Division maintains close liaison with these laboratories and cooperates with them in programs for improved diagnostic services.

The Division currently conducts cooperative programs with the States to control and eradicate brucellosis, tuberculosis, and scabies of cattle, scrapie and scabies of sheep, and screwworms from all livestock. Among those diseases in which the Division maintains an active interest and conducts more limited activities are anaplasmosis, leptospirosis, vesicular stomatitis, anthrax, salmonellosis, enzootic abortion in ewes, bluetongue, Johne's disease, and contagious ecthyma. Cattle tick fever, dourine, glanders, foot-and-mouth disease and vesicular exanthema have been eradicated from the United States; however, active programs are conducted to prevent their reintroduction.

A national animal disease report is issued monthly by the Division. This report, containing statistics of animal diseases within the United States, is used by the Food and Agriculture Organization of the United Nations in preparing a world's livestock disease report. In this way, the Division participates in communication of disease data and contributes to world knowledge of the incidence and distribution of animal diseases.

*A major zoonosis.*—Brucellosis is one of the major disease problems confronting the cattle industry of the United States and many other countries of the world. It is also one of the world's major diseases transmissible from animals to man. (See fig. 15 "Transmission of Brucellosis From Animals to Man.") A State-Federal brucellosis eradication program, launched in 1934, has been successful in reducing the incidence of this disease in cattle. This reduction has played a large part in the decrease of brucellosis in humans. (See fig. 16 "Brucellosis—Undulant Fever.")

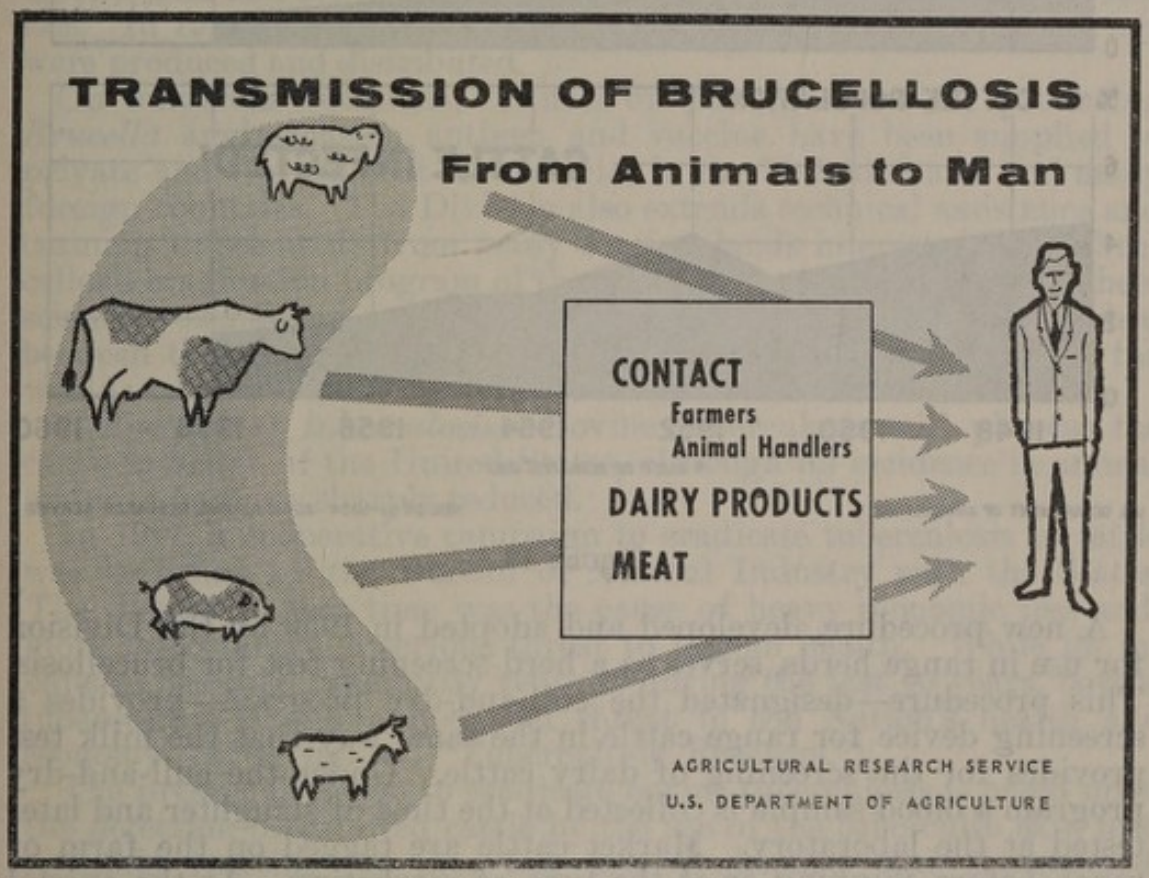



FIGURE 15

The present program for the eradication of brucellosis in cattle consists of wide-scale calf vaccination (strain 19) and blood testing to detect infected animals. Cattle which react to the blood-serum test are slaughtered and in most States indemnity is paid the owner to partially compensate for the loss. A milk test, utilizing a herd composite milk sample, has been used quite successfully in locating herds suspected of being infected with brucellosis. The blood-serum test is then used to further confirm or disprove the herd as being infected as well as to identify individual infected animals. Where it has been used to vaccinate calves, strain 19 vaccine has provided a serviceable resistance to brucellosis infection. It has proved to be a valuable adjunct to the testing program. Over 6,000 practicing veterinarians have performed many of the operations concerned with the brucellosis eradication program, including the collection of blood samples and vaccination under the State-Federal program.

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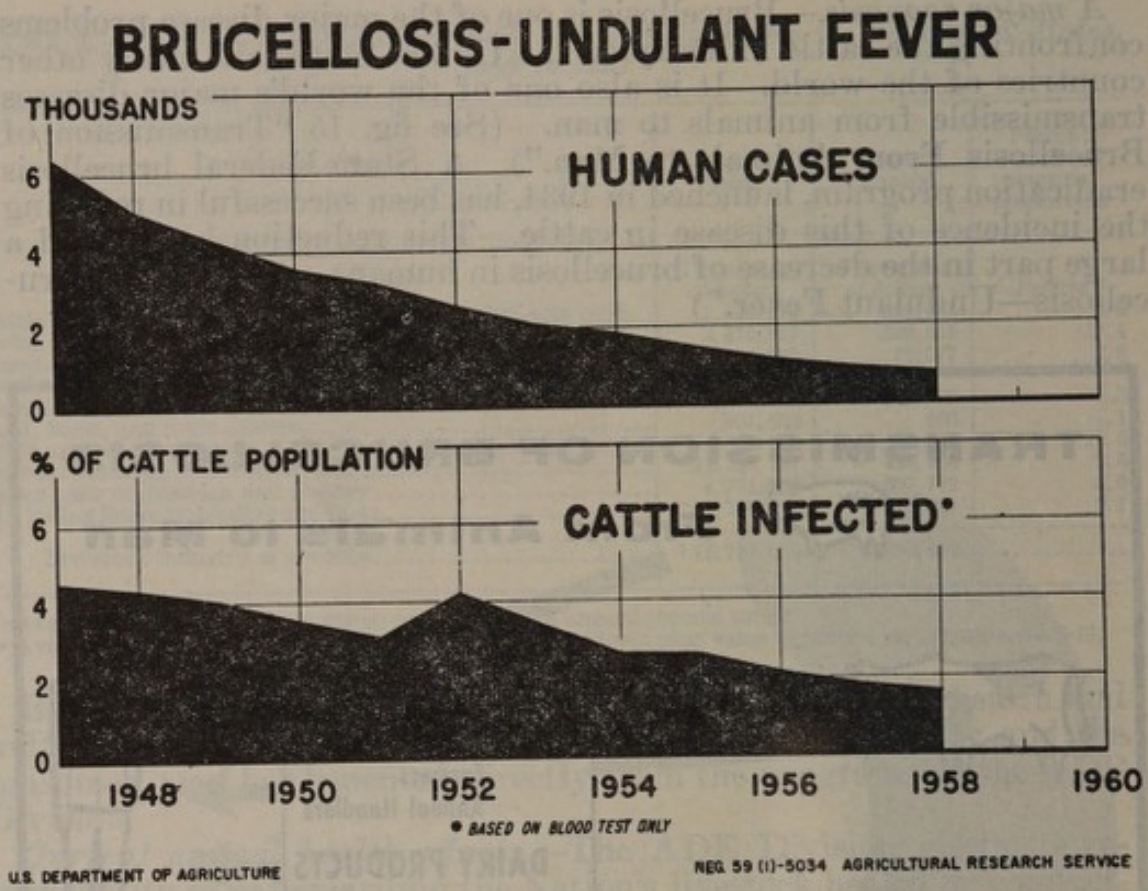


FIGURE 16

A new procedure, developed and adopted in 1959 by the Division for use in range herds, serves as a herd-screening test for brucellosis. This procedure—designated the cull-and-dry program—provides a screening device for range cattle in the same way that the milk test provides for the screening of dairy cattle. Under the cull-and-dry program a blood sample is collected at the time of slaughter and later tested at the laboratory. Market cattle are tagged on the farm or ranch before shipping or at the time of marketing. As the animal is slaughtered, identification of the animal and its origin is made through reference to its tag number. The result of the blood test is employed to indicate the brucellosis status of the herd from which the animal originated.

The cull-and-dry program has proved very effective in locating infected herds and is expected to be a valuable asset to the Division's brucellosis eradication program. In addition, it has great potential as an epidemiological tool for surveying the incidence of many other animal diseases.

Approximately 11.5 percent of the cattle tested by the brucellosis blood serum test at the beginning of the program showed evidence of infection. Only 1.5 percent of all cattle tested by the same test in 1959 were similarly classified. The estimated annual loss from brucellosis of cattle in 1947 was $90 million; it had been reduced to an estimated $27 million by 1957. This drastic reduction in incidence, along with the fact that many areas have been completely freed of the disease, indicates that complete eradication of brucellosis from the United States is both possible and practical.

Cooperative laboratories are maintained by the Division in most States. These laboratories, which number approximately 170, are usually staffed by both Division and State laboratory personnel, who employ the latest serological and bacteriological techniques in diagnosing brucellosis. As the need increases, many of these laboratories are being equipped to render testing services on a limited scale for other diseases such as leptospirosis, anaplasmosis, and salmonellosis.

All diagnostic materials used to conduct routine serological tests in the brucellosis eradication program are produced by the Division's laboratories and are distributed to State-Federal cooperative laboratories. In 1959, 968,940 cubic centimeters of these diagnostic materials were produced and distributed.

On numerous occasions, cultures of the organisms for producing *Brucella* agglutination antigen and vaccine have been supplied to private and Government laboratories in the United States and many foreign countries. The Division also extends technical assistance and training to scientists from many foreign lands interested in the brucellosis eradication program of the United States. As a result of these scientific exchanges, a close working relationship has been established between the Division and veterinary scientists in many parts of the world.

*Reduction of tuberculosis.*—Bovine tuberculosis still plagues the cattle industry of the United States, although its incidence in animal and man has been sharply reduced.

In 1917, a cooperative campaign to eradicate tuberculosis in cattle was launched by the Bureau of Animal Industry with the States. The disease at that time was the cause of heavy economic loss and, more importantly, a serious threat to human health. While its incidence has been drastically reduced during the last 40 years, bovine tuberculosis is still a potential threat to the Nation's health and economy. (See fig. 17, "Tuberculosis Reactors.")

The present program to eradicate bovine tuberculosis is based upon the detection of infected cattle by the use of the tuberculin skin test. Animals reacting to this test are condemned and slaughtered. Owners are then partially compensated for their loss by indemnity payments from State and Federal sources.

Another method of detecting tuberculosis-infected herds consists of utilizing information gathered from the post mortem examination of animals at slaughtering establishments which often reveals evidence of tuberculosis infection. Through the system of tracing back, the farm or ranch of origin can in many cases be determined. All cattle on the farm or ranch of origin are then tested for tuberculosis. This technique has proven valuable as an adjunct to the testing program.

All tuberculin used to test animals for tuberculosis is produced commercially. Samples of each lot of tuberculin used in State-Federal cooperative programs are tested in Division laboratories for compliance with program specifications and requirements.

Practicing veterinarians have worked with Federal and State veterinarians in reducing bovine tuberculosis. In this way, they have contributed to the health of man by reducing bovine tuberculosis in humans. They have also cooperatively contributed to man's welfare by reducing a serious economic loss to the Nation and by increasing the supply of wholesome meat for nutrition.

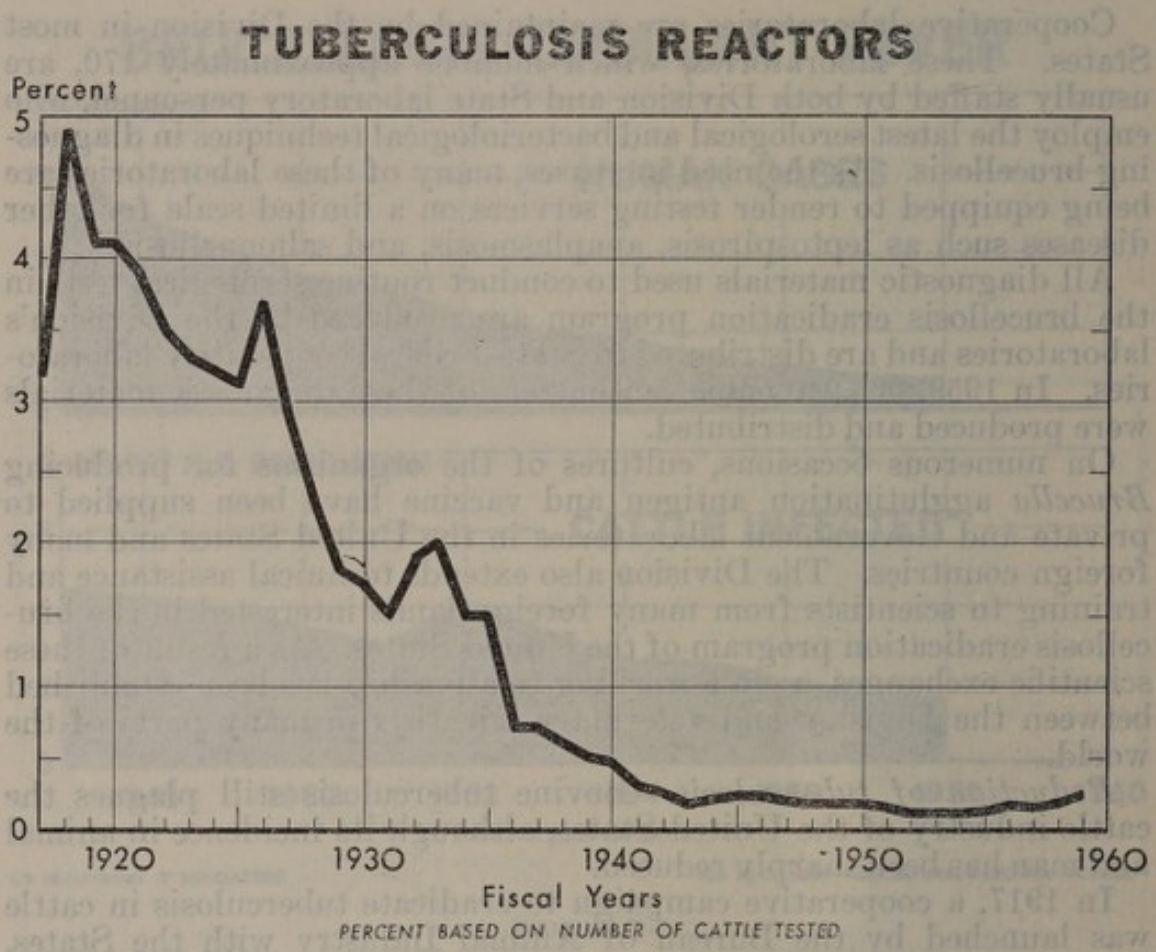


FIGURE 17

At the beginning of the tuberculosis eradication program for cattle, 1 animal in every 20 was found to be infected. Today, tuberculosis is found in slightly more than 1 in every 500 head of cattle tested. Records of Meat Inspection Division show that in the early years of the tuberculosis eradication program, approximately 50,000 whole beef carcasses were condemned annually on routine slaughter as unfit for human consumption because of tuberculosis. At present, less than 100 beef carcasses are condemned annually on routine slaughter for the same reason.

The decline of tuberculosis in cattle has been paralleled by a similar decline of bovine tuberculosis in humans. This decline in humans has occurred largely as a result of the reduction of the disease in cattle and the pasteurization of milk.

Epidemiological studies are continuously being made on infected herds to aid in developing more effective procedures for combating the disease. These studies concentrate on evaluating new diagnostic techniques, improving those which are currently being used, and determining the sources of infection.

*Nuclear energy and animal diseases.*—A new concept for fighting animal disease is being employed to eradicate the screwworm from livestock in the southeastern United States and forms the basis of a cooperative State-Federal program in that region. (See Entomology Research Division, p. 46, and fig. 9, p. 48.)

The program was put into full-scale operation in July 1958. Over 3 billion sterile flies were systematically released during the following 17 months. Production of sterilized flies was discontinued in Novem-

ber 1959 because of the program's success. Only one screwworm infestation was found in the Florida, Georgia, and Alabama sterile-fly-release area between February 1959 and January 1960. Another case occurred in 1960.

In addition to the release of sterile flies, the program includes the inspection and treatment of animals entering the eradication area from regions which are infested with screwworms. Inspection and treatment are being continued to prevent introduction of screwworms.

The screwworm eradication program has made satisfactory progress in eliminating the cause of great losses in livestock production in southeastern United States. Since it was accidentally introduced into the Southeast in 1933, the screwworm has caused an estimated $20 million annual loss in livestock production in this region. Indications are that this loss will be largely eliminated as a result of the first full-scale utilization of this new concept for fighting disease.

Man, like all warm-blooded animals, is susceptible to infestation by the screwworm. It is not, however, a major public health problem in this country.

*Scrapie—a disease of sheep.*—The first case of scrapie, a disease of sheep causing nervous symptoms and subsequent death, was diagnosed in the United States in 1947. In 1952, a second outbreak was diagnosed.

The introduction of this new disease prompted a request by the sheep industry for a cooperative eradication program. A program was launched in 1952 by the Bureau of Animal Industry and cooperating States.

Due to its early detection and the present program of slaughtering infected and exposed animals, the disease has been kept under control. As of January 1, 1960, 83 flocks of sheep had been found to be infected with scrapie. Constant vigilance is necessary to prevent its further spread and free the Nation's sheep industry from the threat of this disease.

*Livestock industry plagued by mite disease.*—Cattle and sheep are affected by two separate, but closely related, varieties of mites which cause a disease called scabies. This disease at one time covered most of the United States and cost millions of dollars in losses of wool and livestock production.

A half century ago, sheep scabies was considered the worst disease problem facing American sheepmen. The disease affected 90 percent of the flocks in some States; many livestock producers would not raise sheep because of scabies. The disease was so prevalent that in 1896 England prohibited the importation of live sheep from the United States.

While cattle scabies was never as widespread as sheep scabies, it was fairly common among range cattle of the West and was also found in other regions of the United States.

At the turn of the century, the present cooperative State-Federal program was launched to rid cattle and sheep of scabies. It involved inspection of animals, treatment of infected and exposed animals with acaricides, and the quarantining of infected or exposed herds or flocks.

The vigorous program succeeded in eradicating cattle scabies from the Western States. Since this remarkable achievement, there have

been occasional recurrences of this disease. Today, scabies of cattle has been virtually eradicated.

Although most range States have been freed of sheep scabies, the disease remains a serious problem in the Midwestern States. The present program to eradicate sheep scabies is being intensified.

A chemical laboratory is maintained by the Division to examine acaricides for use in its programs. Only acaricides which conform to specifications and meet program requirements are approved.

*Alertness for foreign animal diseases.*—As a cooperative effort with other divisions of the Agricultural Research Service and the States, the Animal Disease Eradication Division has the responsibility of developing and enforcing measures to prevent the introduction of foreign animal diseases into the United States. If such diseases should be introduced, the Division is prepared to mobilize emergency programs for their eradication. Knowledge of foreign animal diseases is obtained by the Division through a free exchange of technical information with scientists of America and other countries.

*Animal health and interstate movement.*—Other ADE activities entail the prevention of the spread of infectious, contagious, or communicable diseases by interstate livestock shipments. Much of this work is accomplished by the inspection of animals in public stockyards. The Division enforces the 28-hour law to prevent overconfinement of animals in transit by common carrier, and to assure proper feed, water, and rest of these animals while in transit.

*Successful programs.*—The Animal Disease Eradication Division and its predecessor, the Bureau of Animal Industry, have been successful in disease control and eradication programs. Some of the diseases which once threatened the livestock industry have not been seen in the United States for many years, and a constant vigilance prevents reintroduction of those diseases that have been eradicated from the United States. It is true that some diseases have been reintroduced into this country despite constant vigilance, but these have again been successfully eradicated.

This control and eradication of animal diseases has not only been beneficial from the standpoint of animal health, but also from the standpoint of contributions to human health and welfare. Few countries enjoy the high standard of nutrition and health found in the United States. Animal health has played a major role in this high standard of human nutrition and well-being by furnishing a bountiful supply of wholesome animal proteins. Human health in the United States has also received direct benefit from the control and eradication of those diseases transmissible from animals to man.

*Potential economic chaos.*—An outstanding example of a disease capable of causing economic chaos is foot-and-mouth disease. It can paralyze a livestock industry if allowed to run rampant. This disease is prevalent in many parts of the world today, draining nations of a prosperous livestock economy and a supply of animal proteins for the nourishment of their people.

The United States has experienced nine outbreaks of foot-and-mouth disease, the first in 1870 and the latest in 1929. In all but two instances, the disease was eradicated and quarantines were removed within a few months following its detection. In 1914 and again in

1924, 20 months of ceaseless efforts were required to eradicate the disease.

*A helping hand.*—Not all the animal disease eradication programs of the U.S. Department of Agriculture have been conducted in the United States. A successful cooperative international program was conducted with Mexico to eradicate foot-and-mouth disease from that country. (See fig. 18, "International Cooperation—Mexico-United States Aftosa Eradication.")

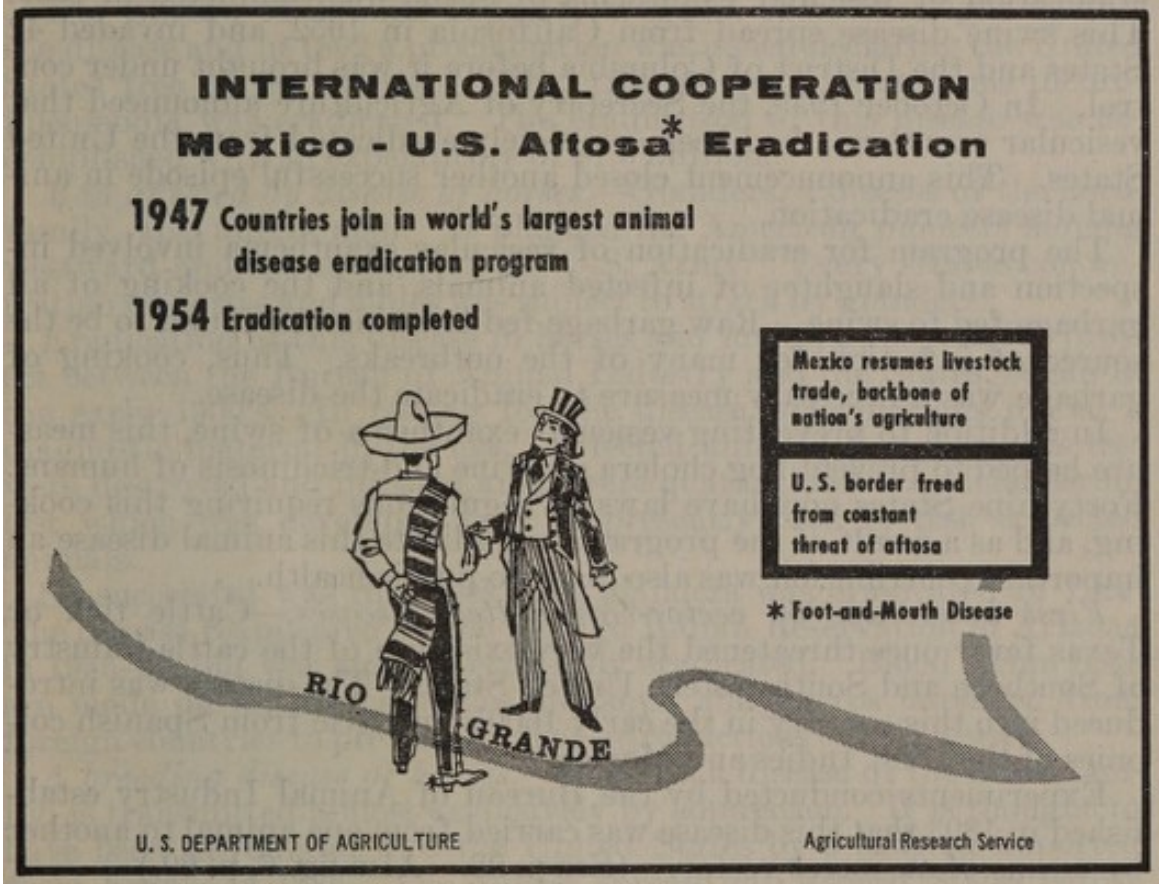


FIGURE 18

On December 26, 1946, the existence of foot-and-mouth disease in Mexico was confirmed by Mexican and U.S. Bureau of Animal Industry veterinarians. The Mexico-United States border was closed to the importation of livestock from Mexico on the same date. Through an exchange of diplomatic notes between the two Governments, the Mexican-United States Commission for the Eradication of Foot-and-Mouth Disease was created. Through the joint efforts of the Bureau of Animal Industry and Mexican veterinarians, this Commission successfully waged a campaign to eradicate foot-and-mouth disease from Mexico. The pattern of disease eradication used so successfully in the United States was used in Mexico. The program to rid Mexico of the disease employed methods of detection and slaughter of infected and exposed animals and the quarantining of infected areas. Joint work by veterinarians of the two countries produced a foot-and-mouth disease vaccine, which was widely applied in the program.

In 1952, foot-and-mouth disease was no longer considered present in Mexico and the Mexican-United States border was opened to importa-

tion of livestock from Mexico. It was closed again in 1953 due to a recurrence of the disease. In 1954, it was reopened, and since that date cattle have been imported from Mexico.

The helping hand extended by the U.S. Department of Agriculture to Mexico has greatly benefited relations between the two countries. The United States also benefited by the removal of an immediate and serious threat to the livestock industry of this country.

*Animal health measure is human health measure.*—The successful eradication of vesicular exanthema of swine was completed in 1959. This swine disease spread from California in 1952, and invaded 42 States and the District of Columbia before it was brought under control. In October 1959, the Secretary of Agriculture announced that vesicular exanthema had been completely eradicated from the United States. This announcement closed another successful episode in animal disease eradication.

The program for eradication of vesicular exanthema involved inspection and slaughter of infected animals, and the cooking of all garbage fed to swine. Raw garbage fed to swine was found to be the source of infection for many of the outbreaks. Thus, cooking of garbage was a necessary measure to eradicate the disease.

In addition to preventing vesicular exanthema of swine, this measure helped to prevent hog cholera of swine and trichinosis of humans. Forty-nine States now have laws or regulations requiring this cooking, and as a result of the program to eradicate this animal disease an important contribution was also made to public health.

*First knowledge of vector-transmitted diseases.*—Cattle tick or Texas fever once threatened the very existence of the cattle industry of Southern and Southwestern United States. The disease was introduced into this country in the early 1600's by cattle from Spanish colonies of the West Indies and Mexico.

Experiments conducted by the Bureau of Animal Industry established in 1893 that this disease was carried from one animal to another by means of an insect vector. (See p. 28. Also fig. 6, p. 29.)

Utilizing this newly confirmed theory of disease transmission and an acaricide that had been developed for use against the tick, a concerted effort was begun in 1906 to eradicate the cattle fever tick. A quarantine area of the Southern States had previously been established.

The program was essentially one of inspection, dipping of cattle with an approved acaricide, and maintenance of quarantines. Although many cattle owners at first opposed it, the eradication program gained momentum and proved effective. In 1945, all previously quarantined areas were freed, with the exception of a narrow strip along the Texas-Mexico border. In 1945 and again in 1957, cattle fever ticks were found in Florida. In both instances, a successful eradication program was applied in cooperation with the State of Florida. Occasionally, cattle ticks are found on animals illegally entering the United States from Mexico. Because these animals pose a continuing source of reinfestation, quarantines are maintained against cattle fever ticks in several counties along the Mexican-United States border.

Conservative estimates in the early 1900's placed the losses directly and indirectly chargeable to cattle tick fever at $40 million annually. This loss has been entirely eliminated; however, small expenditures are necessary to guard against reintroduction of fever ticks. The

fight to wipe out the cattle fever tick from the United States is probably the most extensive and sustained attack ever conducted against a parasitic enemy. (See "Colleges of Veterinary Medicine," p. 85.)

*Eradication of pleuropneumonia.*—The act that established the former Bureau of Animal Industry outlined its first duty as the eradication of contagious pleuropneumonia of cattle in cooperation with the States. Since its first appearance in the United States in 1843, this disease had run rampant through many of the Eastern States.

The Bureau of Animal Industry waged a successful fight against the disease and in 1892 a proclamation was issued declaring the United States free of the disease. Thus, after 40 years, contagious pleuropneumonia was eradicated. The eradication of this disease was accomplished with an expenditure of $1.5 million.

*Man affected by disease of horses.*—Glanders, a disease of the horse family, also affects man. It plagued the American pioneers moving westward and the cavalry of the U.S. Army. Every sizable concentration of horses and mules was subject to attack by glanders.

Eradication of this disease in horses and mules, a cooperative project between the Bureau of Animal Industry and the States, began in the early 1900's. In testing for the disease, veterinarians placed a diagnostic material in the eye. Infected animals found by this test were destroyed and infected areas were quarantined. A blood serum test which was developed later is presently used to test suspected animals.

So successful was the work that glanders was eradicated in 1929. The disease reappeared on the Papago Indian Reservation in Arizona in 1955–56, but was again successfully eradicated. Blood serum tests are made on all horses, mules, donkeys, and burros imported from foreign countries to prevent further introductions of this disease.

*A breeding disease of horses.*—Dourine, a disease of the horse family, is transmitted almost exclusively by copulation. It is thought to have been introduced into the United States by a stallion imported from France in 1886. The disease spread into several States before eradication was undertaken as a State-Federal cooperative project in 1893.

At first, animals were individually examined for the disease; later a blood serum test was developed. The blood serum test was widely applied and aided greatly in successfully eradicating the disease.

After several years of apparent freedom from the disease, dourine reappeared in the Southwest in 1940. With renewed eradication efforts, the disease became quiescent until 1953 when it appeared on the Papago Indian Reservation in Arizona. It was again eradicated.

Although dourine has been eradicated from this country, continued vigilance is necessary to prevent its reintroduction. The presence of this disease among Mexican horses and burros serves as a continued threat. Tests for dourine are made of all horses, mules, donkeys, and burros imported into the United States.

*Poultry diseases eradicated.*—The eradication of animal diseases has not been limited to large animals. Two poultry diseases—fowl plague and Asiatic Newcastle disease—have been successfully eradicated.

Fowl plague, a deadly infectious disease of poultry, was identified in the United States in 1924. It swept rapidly from the east coast as far west as Missouri. At a cost of $50,000, the Bureau of Animal Industry used quarantine, slaughter, and disinfection measures to eradicate the disease. It has not appeared in this country since May 1925.

In 1950, Asiatic Newcastle disease in poultry was introduced into California by an air shipment of pheasant, quail, ducks, and partridge from Hong Kong. The eradication program, which was conducted in cooperation with the State of California, cost the Federal Government $15,000.

Although one form of Newcastle disease is widespread in this country, the Asiatic strain is not thought to be present. The Asiatic strain is considered more severe than the strains commonly found in the United States.

*Pullorum disease reduced.*—A cooperative State-Federal program to control pullorum disease of chickens and turkeys is administered by the Animal Husbandry Research Division of the ARS as a part of the national poultry and turkey improvement plans. All flocks under the plans are blood tested and reactors removed from flocks. When the program started for chickens in 1935, 3.7 percent of the chickens tested reacted positively to the test. In 1959, only 0.024 percent of chickens tested reacted positively. When the program was started for turkeys in 1943, 2 percent of the turkeys tested reacted positively to the test. Only 0.01 percent of the turkeys tested in 1959 were found infected.

*A pattern and new horizons.*—A pattern to eradicate animal diseases has been used many times by the Animal Disease Eradication Division and its predecessor, the Bureau of Animal Industry. This pattern, one of detection and slaughter of infected animals and quarantine of exposed animals, has aided the United States in reaching an enviable animal health status.

An even higher status could be attained by the control and eradication of other animal diseases—such as hog cholera, anaplasmosis, mastitis, cattle grubs, domestic Newcastle disease, and paratyphoid of poultry. While the eradication or better control of these diseases appears both possible and practical, they are still allowed to subtract from man's health and welfare.

*Disease knows no compromise.*—There is no compromise and no neutral ground in the battle with disease. When diseases are running unchecked and causing wholesale destruction, attention is more easily focused upon them. Support for control and eradication is more easily obtained. When the effect of these diseases on man's health and welfare is lessened, attention is often diverted to more seemingly immediate problems. The lessons learned from the original devastating effect are often forgotten. Complacency or apathy often serve as barriers to the full utilization of animal disease control and eradication agencies.

*World meeting ground.*—The Animal Disease Eradication Division has been active in training programs for veterinary medical scientists. Technical assistance—in establishing animal disease eradication programs and producing diagnostic materials essential to these programs—has been furnished on numerous occasions to other countries of the world. Technical diagnostic training has also been provided

for foreign scientists. These cooperative efforts with foreign scientists have made tangible contributions to better relations between the United States and these countries.

The Division has reaped many benefits from the technical assistance of foreign scientists. On many occasions, scientists of the Division have visited foreign countries to learn new techniques in disease control. (See p. 113.)

Medical and veterinary medical knowledge form a common meeting ground in the world's struggle to better mankind. An increased exchange of scientific knowledge and other forms of mutual assistance would be a positive step toward reducing world tensions.

### E. ANIMAL INSPECTION AND QUARANTINE DIVISION, AGRICULTURAL RESEARCH SERVICE

The Animal Inspection and Quarantine Division of Agricultural Research Service, USDA, emerged from two separate animal disease prevention programs that protect the Nation's livestock and poultry. One program involves inspection and quarantine of imported animals and their byproducts; the other involves control of veterinary biologics.

Animal disease prevention through inspection of import animals and products is described below. The regulation of veterinary biologics to assure their effectiveness in preventing and controlling diseases is discussed in the section on veterinary medical drugs and biologicals (see p. 171).

*First controls for exports.*—English embargoes on American cattle in 1879 and other foreign restrictions led to U.S. inspection and certification of live domestic animals intended for export. Similar inspection and certification now also cover animal and poultry byproducts processed in the United States for export. Until the USDA offered these services, many foreign markets were closed to American hides for tanning, inedible tallow for soaps and lubricants, and meat meal for animal feeds.

Exported animals were shipped overseas without adequate space, ventilation, food, or water until late in the 19th century. An 1891 reform law authorized the Department of Agriculture to develop standards for the proper care of animals transported by ship. The Animal Inspection and Quarantine Division enforces standards for humane shipment.

*Imports restrictions.*—The first step in protecting the American livestock industry against destructive foreign diseases was taken in 1865. Legislation authorized the U.S. Secretary of the Treasury to ban imports of cattle from countries with serious animal disease outbreaks. After foot-and-mouth disease was reported in Spain in 1875, the United States used this law to stop imports of Spanish cattle and hides. Later, U.S. animal quarantine stations at ports of entry and 90-day quarantines were established.

Animal quarantine work was transferred to the U.S. Department of Agriculture in 1884. The veterinary staff of the new Bureau of Animal Industry began to develop an effective animal inspection and quarantine system. Animal quarantine regulations in 1959 covered cattle, horses, sheep, swine, poultry, and ruminants for exhibition

in zoos. Use or disposal of animal products and related materials—meats, bones, blood, glands, manure, hides, and skins—also are carefully controlled.

*Biological products licensed.*—Licensing and inspection of veterinary biologics produced in the United States help to assure the American stockman and poultryman safe, pure, and effective products for the prevention, control, or diagnosis of livestock and poultry diseases. Maintenance of adequate reserves of hog cholera serum assures the swine industry of an immediate and available supply whenever it is needed.

To make sure that only healthy livestock are imported into the United States, Animal Inspection and Quarantine Division requires:

1. A USDA import permit indicating that disease incidence and control procedures in the exporting country are satisfactory and describing specific conditions under which the importation may be made.
2. A certificate of health from an official veterinarian in the country of origin indicating freedom from communicable diseases and exposure to such diseases.
3. Inspection upon arrival at port of entry by a USDA veterinarian, who uses tests, quarantines, or treatments to make sure that the animal, livestock or bird, will not bring a foreign disease into the United States.

*Million animals inspected.*—Veterinarians inspected 1,149,815 animals and 12,582 birds presented for import during the 1959 fiscal year. Of these, 21,888 animals and 1,963 birds were refused entry into the United States. The inspection program was conducted by 35 veterinarians, 62 byproducts inspectors, 15 clerks, and 4 laborers. Other U.S. Government border clearance agencies cooperated with and reinforced the animal inspection program.

Imported animal byproducts may enter with a certificate from the government of the country of origin. This certificate must show that the products came from healthy animals. Uncertified products are held under U.S. Government seal until the potential danger to human and animal health has been removed by treatment and reprocessing or until the product is safely destroyed.

In the 1959 fiscal year, USDA veterinarians inspected and certified 22,248 animals for export to 55 foreign countries.

*Garbage disposal checked.*—All garbage removed from international ships and aircraft in U.S. ports is safely disposed of under the supervision of USDA inspectors, as a protection against importation of plant and animal disease organisms.

*Foreign diseases kept out.*—The Animal Inspection and Quarantine Division prevents the entry of foreign animal diseases into the United States through its inspection of imported animals, poultry, and byproducts. Without these safeguards, many of the foreign diseases could so impair food, feed, and fiber productivity that the Nation would be confronted with a short-supply problem. Among these diseases are rinderpest, African swine fever, fowl plague, foot-and-mouth disease. Other diseases which have been eradicated through national programs—contagious bovine pleuropneumonia and cattle tick fever, dourine and glanders in horses—have been kept out of the United States through inspection and quarantine procedures.

The animal inspection and quarantine system of the United States is recognized for its efficiency. Foreign veterinarians have studied its operation during visits to the United States, and some foreign governments have used it as a model.

U.S. Government inspection and certification of animals, poultry, and byproducts for export have promoted trade and improved foreign relations. The certification service of the Federal Government allows the small U.S. businessman to compete with internationally known U.S. concerns in foreign livestock and animal byproduct markets.

*Quarantine station said to be needed.*—The U.S. Government maintains a quarantine station for imported animals and poultry at Clifton, N.J. Experts say that establishment of a similar quarantine station at a Pacific Ocean port would provide increased protection from the diseases of animals and poultry imported from Asia and the Pacific islands.

Adequate Government controls over privately owned quarantine facilities at ports of entry are needed. At all ports except Clifton, livestock and poultry importers provide their own facilities; frequently, these are unsatisfactory. Under present regulations, the USDA control is limited to closing the port until facilities meet minimum standards.

Present animal quarantine laws were designed to protect the Nation's herds and flocks when slow transportation localized animal diseases. These laws must be consolidated and revised to meet the challenge of jet-age transportation and the possibility of diseases entering undetected while in the incubating stage.

## Section 7. Military Veterinary Medicine

### A. INTRODUCTION

Military veterinary medicine can claim its share of "firsts." It has paralleled its civilian counterpart in contributing to human health and welfare. The "firsts" have improved the health of American and allied armed forces, added to the world's knowledge about animal diseases, and benefited all mankind. A few of the outstanding achievements:

1. The development of a vaccine for rinderpest—the most devastating cattle disease in the world, and the perfection of an effective vaccine that could be mass produced.
2. The demonstration that a neurotropic virus disease, sleeping sickness of horses, could be transmitted by insects. This discovery also explained how the disease is transmitted to man.
3. The demonstration of the value and safety of tetanus toxoid in preventing lockjaw in animals before it was used for humans.
4. The development of the first large-scale disease-free colony of laboratory animals. Several other research projects had and have been concurrently working on this problem but on a smaller scale.

*Food inspection.*—The first veterinarians in the Armed Forces were primarily concerned with the health of horses, which were then essential to military campaigns. At the same time, the military veterinarians were responsible for food inspection; today, this inspection is a major part of the veterinarians' work in the United States and over-

seas. Assisting the Veterinary Corps of the Army and the Air Force are the meat inspection service and poultry inspection service of the U.S. Department of Agriculture. (See Meat Inspection Division of Agricultural Research Service, p. 89; Poultry Division of Agricultural Marketing Service, p. 94.)

Within recent years, veterinarians have been included in the modern team concept of military preventive medicine. This concept utilizes all facets of the medical sciences with the single objective of protection and preservation of human health.

Veterinarians are integral members of military medical research teams. They make notable contributions in the care of laboratory animals, interpretation of results of experiments; and the extrapolation of these results to humans. (See National Institutes of Health, p. 51; American Board of Laboratory Animal Medicine, p. 161; Animal Care Panel, p. 166.)

*Animal disease control.*—Control of animal diseases that are transmissible to man is vital to the health of troops overseas. The military veterinarian is responsible for animal disease control on the military base or post in the United States and in the community in which the oversea base is located. Animal disease prevention through the use of immunization, treatment, and quarantine is an important part of the military veterinarian's activity.

Following World War II, military veterinarians assisted the occupied countries in raising healthy herds and flocks which could provide a safe food supply for American troops at oversea bases. American military veterinarians have continued to work with the civilian authorities of these countries in developing large supplies of wholesome milk from disease-free herds. This has contributed greatly to the economic recovery of these countries.

*Increased utilization of military veterinarians.*—The subcommittee has been advised that veterinarians presently in the U.S. Armed Forces stationed in underdeveloped countries could be effectively used to assist in the improvement of their animal industry. (See International Cooperation Administration, p. 182.)

They could work with foreign government officials to provide valuable counseling on animal health as well as nutrition and breeding. A few military veterinarians have been utilized in this capacity in Panama and some South American, European, and Middle Eastern countries.

### B. THE VETERINARY CORPS OF THE ARMY AND THE AIR FORCE

Military veterinary medicine is based upon the full utilization of veterinary medical arts and sciences as applied to the prevention of disease, protection of life, and the promotion of the well-being and efficiency of man.

Growth of military veterinary medicine in the United States has paralleled that of its civilian counterpart, particularly in its contributions to human health and welfare.

*Origins.*—Employment of veterinarians for the care and treatment of Army animals was first authorized by Congress in 1848. They were employed in a civilian, or contract, status to serve with the Cavalry, Artillery, and Quartermaster Department.

Events associated with the Spanish-American War led to the later establishment of the Army Veterinary Corps. History records with accuracy that contaminated food caused more American casualties than Spanish bullets. The demand for hurried deliveries and lack of thorough inspection contributed to the issue of improperly stored and processed foods. Spoilage was hastened by midsummer heat, and thousands of soldiers were incapacitated from eating these foods.

The Spanish-American War experiences brought prompt action to improve the quality of rations and to protect military troops from future outbreaks of food poisoning. In 1901, the Secretary of War was authorized by Congress to employ contract veterinarians. The Subsistence Department of the Army announced on July 7, 1901, that meats it purchased would be subject to veterinary inspection. The following day the first graduate veterinarian was employed.

*Corps established.*—The Army Veterinary Corps was established by the National Defense Act of June 3, 1916. Congress, in enacting the law, was aware that the inspection of Army food products was a proper function of the corps. Because this major function was related to the health of troops, it was one of several important reasons that the Veterinary Corps was placed in the Medical Department under the direction of the Surgeon General.

Each officer, then as now, was required to hold a doctor of veterinary medicine degree from one of the schools approved by the Surgeon General.

During the period 1922–39, approximately 50 percent of the Veterinary Corps officers were engaged in food inspection.

Beginning with the formation of the Civilian Conservation Corps in 1933, the requirements for Army veterinary inspection of foods of animal origin became increasingly demanding. Previously, quality inspections of most food products had been made at posts, camps, and stations. As a result of food procurement for the Civilian Conservation Corps, Army veterinarians discovered that quality inspections made in processing plants benefited both the contractor and the Government. To conduct such inspections, approximately 100 additional Veterinary Reserve officers were called to active duty.

*World War II.*—During World War II, the Army Veterinary Corps expanded to a strength of 2,200 officers and 5,000 enlisted men. Most corps personnel performed food inspection, environmental health, and research functions. Although approximately 50,000 animals were utilized during World War II, relatively few veterinary personnel were assigned to animal service duties.

World War II saw the beginning of centralized procurement of subsistence, and the Army Veterinary Corps was an important factor in its success. The variety and perishability of the soldier's ration had greatly increased since World War I. Procurement of healthful and nutritious food for the large number of personnel in Military Establishments throughout the world required extreme diligence to prevent foodborne diseases. The problem was intensified when subsistence procurement centers were established in foreign countries. The excellent results in minimizing noneffectiveness of personnel because of foodborne diseases and intoxications are now a matter of record.

During and immediately following World War II, veterinary officers were assigned to civil affairs and military government groups. The purpose of these assignments was to aid the economic recovery of livestock industries in liberated and occupied countries.

*Air Force Veterinary Corps.*—The Air Force in 1949, when organizing its new Medical Service, established a Veterinary Corps along with the medical and other related corps. The number of veterinary officers has increased with an expanding Air Force to meet new requirements in public health, food inspection, and research.

Of necessity during World War II, the preservation of health and of combat potential became major objectives of all medical services. Manpower and economic resources dictated that a minimum of men and material be utilized in the most effective manner. This led to the present concept of military preventive medicine in which all facets of the medical sciences are welded into a basic team with a single objective—protection and preservation of human health. As one of their responsibilities, the military veterinary services function as an integral part of this team.

Through the years, increased attention has been given to the importance of controlling and maintaining the health of the military and adjacent community. Because of his professional training, the veterinary officer has become a valuable member of the medical staff in protecting and preserving the health of a command.

*All-service function inaugurated.*—As the functions of the military veterinary services evolved, the Department of Defense directed that the veterinary services of the Army and Air Force be utilized by all military departments. Food products purchased for the Navy under the single manager for subsistence system are inspected by Army or Air Force Veterinary Corps personnel. Veterinary officers are assigned to certain Navy and Marine Corps installations on a full-time basis to perform food inspection and research functions. Part-time service is also provided to a large number of oversea naval and Marine Corps installations as well as those located in the United States.

The Department of Defense now has a corps of carefully picked veterinary officers who are well qualified and well trained. They have evolved from an unorganized group to an organized corps that has earned a place as an essential member of the military medical team. This corps provides a basis for coping with mobilization or other expansion requirements.

Military veterinary programs are directed to benefit both allied and domestic civilian health programs, as well as those involving the military community. The Department of Defense has recognized the role, contributions, and capabilities of the military veterinarian and has documented his importance in the protection of man's health.

The Surgeons General are charged with the responsibility for the health of troops. In the broad sense, this implies not only health but also maximum physical effectiveness. Prerequisites to such effectiveness are the application of the best methods in preventive medicine and research and the provision of a safe and ample food supply.

*Research objectives.*—Each Surgeon General makes use of allied professional services to free the physician for direct patient care. Because his training in medical sciences parallels that of the physician, the doctor of veterinary medicine is qualified to assume certain pre-

ventive medicine and research functions, in addition to those which are strictly veterinary in nature. The number of military physicians required for the Armed Forces has been proportionately minimized by the full utilization of veterinary officers.

The objective of veterinary medicine in military research is to provide assistance for all projects involving foods or animals. As previously indicated, veterinarians use data from animal research to assist in extrapolating probable effects on humans. Veterinarians also participate as research team members. Progress in medical research has resulted in a continuing and increasing need for veterinary support.

Continued research is essential, not only to provide the military services with maximum support, but also to keep the military veterinary services abreast of fields such as astronautical medicine, defense against radiation, biological agents, new space weapons, and other new fields.

The armed services attempt to attract veterinary scientists into military research and provide them with subsequent specialized training. Because civilian demands for these scientists exceed the supply, recruiting and training have become important phases of military veterinary services.

The military service is primarily a training organization. Under certain conditions, it must become self-sustained and be directed entirely from within to obtain maximum utilization and military effectiveness in time of need.

The military doctor of veterinary medicine applies, monitors, and further develops his professional skills for the maximum benefit of the worldwide health mission and economic interests of the Department of Defense.

Although the functions of the military veterinarian have changed and expanded through the years, the control and administration of the military veterinary services have been retained within the medical service. The current programs fall into the following general areas:

*1. Worldwide food inspection service*

The Department of Defense has assigned worldwide food inspection responsibilities to the military veterinary services. It has directed that optimum joint use be made of veterinary facilities and services, including health and quality inspection of food products and health inspections of establishments. In oversea areas, no other recognized agency is available to inspect foods for U.S. military installations. The Armed Forces procure foods from sources approved by the military veterinary services. The importance and impact of health or wholesomeness inspections of food are apparent. Inspection of food for quality, i.e., the examination of foods with respect to type, class, grade, and other specifications, is essential in protecting the financial interests of the Government.

In the United States, the military veterinary services use Federal food inspection agencies to the maximum extent for procurement inspection. However, some military veterinarians perform inspections in the United States because this training is considered essential. It prepares military veterinary services for mobilization, supports current oversea responsibilities, and insures continued proficiency in the areas of food production and processing.

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Through experience with and intimate knowledge of food production and processing, the military veterinary services perform important functions in quality food inspection activites. Examples are:

*Purchasing and contracting of foods.*—Technical guidance is provided to purchasing and contracting personnel in writing contracts, inspection clauses, specification interpretation, availability of foods, detail product requirements, packaging, and transportation. This same guidance is given club officers, exchange officers, and other food-procuring personnel.

*Warehousing—Cold and dry storage.*—Technical guidance is provided to commissary and supply officers on such procedures as proper rotation of stocks in warehouses, storage life of various foods, air circulation, dunnage, refrigeration problems, insect and rodent control, and other factors affecting food supplies and cold and dry storage equipment.

*Public relations with food industry.*—A good relationship with the food industry is created through joint discussion of problems by veterinary officers and vendors. Assistance is provided for problems which arise regarding food inspection, food equipment approval, and contract interpretation on detail quality requirements. Much benefit and prestige accrue to the military services and the U.S. Government in allied countries when discussions are carried on by a qualified veterinary officer with technical knowledge of food-processing industries. Both the Government's and the vendor's interests are protected.

*Liaison with other agencies.*—Military veterinary services work closely with governmental agencies in the United States and foreign countries to resolve mutual problems and avoid unnecessary duplication of effort. Veterinary officers representing supply and contracting officers continually contact agencies such as U.S. Public Health Service, local health departments, Food and Drug Administration, other units in the Department of Defense, and U.S. Department of Agriculture. In oversea areas, similar liaison activities are conducted with various agencies of allied countries. The United States and the other governments are protected by these activities, which insure compliance with foreign laws and quarantine requirements in the procurement and movement of military food supplies and in the disposal of garbage and other salvage or waste materials.

*Food item improvement programs.*—The military veterinary services, equipped with their knowledge of the armed services' needs and of food processing techniques, are in a key position to recommend improvements of subsistence items and specifications. As a result of routine inspections, deficiencies in products, packaging, and shipping methods are detected. Correction of these deficiencies through proper channels results in financial savings to the Armed Forces and assures wholesomeness for food and food acceptability by personnel.

*Training for food service, supply, and other Armed Forces personnel.*—The military veterinary services assist in training food service and supply personnel in certain aspects of the handling, examination, storage, and proper utilization of subsistence.

*2. Preventive medicine.*

The veterinary officer functions as an essential component of preventive medicine units and programs. He assists medical officers by performing functions within the following areas:

*Health aspects of food handling.*—The health inspection of all foods until consumed is a responsibility of the Surgeons General. This inspection is conducted for the most part at the military installation. It includes such activities as health inspection of emergency rations, subsistence in storage, in-flight rations, the handling of food at ration breakdown points, in-transit supplies, and the handling, preparation, and serving of food in mess halls. This supervision not only applies to the facilities operated with appropriated funds, but also covers exchanges and clubs.

*Community areas.*—Dining halls, recreation centers, sports areas, housing, and other establishments on and off military installations and normally frequented by military personnel are given continuing health inspections to insure that proper standards are maintained.

*Utilities and waste disposal.*—Although water supply, sewerage systems, and garbage and waste disposal are engineering responsibilities, they are kept under constant medical surveillance. This eliminates the possibility of contamination or the chance that substandard practices might develop into a health hazard. The practice of using unsafe fertilizing methods (night soil) in oversea countries is one of the many disease hazards which has been controlled.

*Animal disease control.*—The military veterinary services diagnose animal diseases, conduct epidemiological surveys, and establish control measures for animal diseases affecting man. Among these diseases are bovine tuberculosis, brucellosis, rabies, Q fever, psittacosis, parasitism, encephalomyelitis, and fungus infections. In its military veterinary services, the Department of Defense has the capability of coping with and controlling these diseases when they occur in allied countries.

*Nutrition.*—Wherever U.S. troops are located in the world, they are provided an adequate, palatable diet. The military veterinary services help insure the safety and wholesomeness of all food in this diet. Through military veterinarians' efforts, local producers have applied American standards of food hygiene to the growing and processing of essential fresh foods. Thus, locally procured dairy, meat, and vegetable products that normally would not be safe to use overseas can be served daily to American troops. Fresh milk can be provided on a worldwide basis. The military veterinarian often assists in menu planning, advising on the condition and acceptability of menu ingredients.

*Preventive medicine units.*—In oversea areas, preventive medicine units trace and eliminate the causes of diseases of man. Their work enables American troops to maintain a low noneffectiveness rate. The veterinary officer, who is a vital and necessary member of such teams, correlates the incidence of animal diseases with human diseases. He relieves the medical officer of many environmental health problems. Specifically qualified veterinarians work in clinical and food-testing laboratories.

*Mobilization reserve subsistence.*—Surveillance inspection of large stocks of reserve subsistence supplies is conducted on a continuing

systematic basis. Correct rotational issue keeps spoilage at a minimum. When inspection determines that products are losing quality and approaching a health hazard, these products are recommended for withdrawal and use to prevent their loss.

*Insect and rodent control.*—Insect and rodent control measures are employed under constant medical supervision. The actual work of draining, applying insecticides and larvicides, screening, and protecting foods from infestation are engineering functions. The collection and identification of specimens, determination of the effectiveness of control measures, epidemiological surveys, and identification of the type of disease threat are purely medical functions. Another phase of the insect and rodent control program requiring constant medical supervision is the employment of toxic agents. Because the agents used are equally toxic to man and because they are usually employed in and around food establishments, strict supervision and control are imperative. The veterinary officer assists medical officers and, in some instances, relieves them of these duties.

*Liaison and public relations.*—The military veterinarian frequently functions as the senior medical officer's representative with local civilian agencies. He also maintains close liaison with his counterparts in the other services. A professional relationship has been established between the military veterinary services and the various agencies concerned with food procurement and handling and disposal of food waste. Military veterinarians have been able to prove the unsoundness of claims against the Government which allege that animal disease outbreaks or other animal losses were a result of military operations. They frequently provide other technical knowledge to legal officers. When such foods as chickens, turkeys, and pork are sent to U.S. troops overseas, the military veterinarian must assure certain allied countries these items will not become the sources of local animal disease outbreaks. Their professional services would be available if outbreaks from other causes should occur.

*Training of nonmedical personnel.*—The military veterinary services are called upon to furnish instructors for many medical courses as well as for the training of line officers in the fields of health, hygiene, and other basic science subjects.

*Administration.*—The military veterinarian administers portions of the preventive medicine program for the responsible medical officer.

*3. Military medical research and development*

Military research is directed toward future military requirements. In order for this to be a complete program, every new advance must be completely exploited. The military veterinarian, as a team member with other scientists, assists in research for the solution of biomedical problems. Animals are used in this type of work because the majority of projects in the initial stages are too unpredictable to risk human lives. An animal's reaction to situations that would be experienced by man can be studied and interpreted. Military veterinarians are involved in such vitally important studies as—

*High altitude problems.*—The problems man will face at high altitudes are being solved by using animals in vehicles projected into space.

*Acceleration and deceleration.*—Problems of acceleration and deceleration have been brought closer to solution by extrapolating physio-

logical results obtained by the use of animals. Data collected from animal experiments made it possible to use human volunteers in this project. Lt. Col. John P. Stapp, in his famous sled ride, was correctly protected through the application of information gained from prior animal runs.

*Space flight and space travel.*—Lower animals have been projected to phenomenal heights and have lived to return and furnish invaluable scientific data. Existence in sealed cabins where it is impossible to pull air in from the atmosphere has been proven feasible. Animal life has been maintained in such cabins under actual conditions of space travel. The "Journal of Space Flight" states: "There is only one way to solve this problem, by direct experimentation, first on animals, then on human beings here on earth, then under weightless conditions."

The interest of the Armed Forces in the use of animals for flights in outer space has developed at an even faster rate than had been foreseen but a few years ago.

In addition, the National Aeronautics and Space Administration—responsible for civilian activities—has developed a comprehensive program in the life sciences.

NASA has estimated that this overall program will require $8.6 million for the 1962 fiscal year. No detailed breakdown as to the role of animals in the multifaceted program is at present available. There may, however, be noted the following excerpts on a few of the problems in the life sciences. The excerpts appear in a NASA statement in the hearings conducted by the Subcommittee on Independent Offices, Committee on Appropriations, House of Representatives, 87th Congress, 1st session (pp. 1193–1194).

FLIGHT MEDICINE AND BIOLOGY

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The hazards of space flight are such that tests to insure survival and meaningful performance must be determined with animals prior to subjecting man to this experience involving application of combined stresses which can be expected to alter the distribution of blood flow to vital organs including the brain, heart, lungs, and kidneys as well as the neurological consequences of long-term altered sensory input as it affects internal regulating systems and the mind. Inflight tests of life support systems as regards their long-duration adequacy, efficiency, and reliability in maintaining a habitable artificial environment will precede trials with men.

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*Space medical and behavioral sciences*

Activity in this field is directed toward obtaining basic metabolic, physiologic, and psychologic contributions for implementation of manned space flight. Included are observations and studies of the fundamental aspects of the reactions of animals and men related to space flight and exploration as they affect survival and performance; and studies of human ecology as it relates to advances in space science and technology.

As manned space flights become voyages of days, weeks, or months duration, there is need for a more fundamental approach to problems involving the basic medical and behavioral disciplines of radiology, metabolism, cardiovascular physiology, respiratory physiology, neurophysiology, psychology, and sociology.

Physical measurements of the radiations in space have defined the requirements for more precise evaluation of the effects of long-term, relatively low dosages of ionizing radiation and the finding of means for protection therefrom in addition to conventional shielding techniques. Altered metabolic reactions achieved through temporary lowering of body temperatures or pharmacologic means hold promise of affording varying degrees of protection from radiation

or effects which may result from exposure to other sources of energy in the electromagnetic spectrum as occur in space flight.

Metabolic requirements of animals and men in terms of energy exchange, heat transfer, and nutrition under the limitations imposed by confinement in an artificial-space capsule environment pose problems of a fundamental nature which require further study.

Acceleration forces and weightlessness produce a redistribution of blood flow to the heart, lungs, brain, and kidneys. The chronic effects of these physical stresses on vital organs and adaptation thereto, as well as the long-term cardiovascular effects of restricted mobility, are subjects for detailed scientific consideration as they relate to space exploration.

Long-term living in an artificial atmosphere which can be expected to deviate from optimal conditions on occasion necessitates further study of the process of diffusion of gases including toxic substances from the lungs to blood and from blood to body tissues as well as further consideration of the chemical alterations incident to pulmonary ventilation.

More detailed knowledge of nervous system sensors; visual and auditory perception; the physiologic substrate of orientation, thought, and emotion, the neural control of respiration, cardiovascular function, temperature, and metabolism; and, the neurophysiological aspects of environmental adaptation and fatigue as well as psychological reactions involved in motivation, vigilance, and social adjustment, reflect a series of important areas of concern in regard to man's performance under conditions imposed in flight.

Several committees of the Congress have stressed the importance of coordination between the life sciences programs of NASA, of the Department of Defense and of other agencies. NASA, the chairman of this subcommittee has stressed, should draw to the fullest possible extent upon the competence in veterinary science within other agencies. The latter, in turn, can and should draw upon the pioneering know-how and insight developed by NASA in space telemetering and other skills, as related to all forms of life.

*Nuclear energy.*—Problems involving nuclear energy are increasing and will become of greater importance as more atomic-powered projects are begun. Effects on livestock at the Nevada tests were investigated by military veterinarians. Previous studies conducted in anticipation of related problems provided the basis for accurate deductions. Veterinary officers assisted in demonstrating at the site that fallout was not a factor in livestock losses or a threat to human health in this instance.

Detailed research studies of the effects of radiation were conducted at the Oak Ridge Institute of Nuclear Studies by the military veterinary services. The findings have been of great value in developing protective measures and criteria for man; they will be of even greater value in formulating emergency plans and solving future problems in the nuclear field. Veterinary officers are engaged in radiation experiments to determine the effects of ionizing radiation upon animals, and by extrapolation, upon man. Exposed animals and plants are also being studied as possible sources of food in the event of nuclear warfare. Acceptable tolerances for food are being investigated and standards and instruments for field assay are being developed.

*Cardiac research.*—Heart functions present one of the oldest problems in medicine and one of the most critical for flying personnel. Due to his training in physiology and pathology of experimental animals, the military veterinarian has much to offer in assisting the physician in cardiac research. For example, he can interpret electrocardiograph potentials, which vary from one animal to another, for the research team.

*Flight and ground feeding research.*—Military veterinarians with their operational knowledge of military transport, feeding requirements, physiological limitations of personnel, and scientific knowledge of foods are assisting in research on flight and ground feeding. Food technologists and research scientists at the Aero-Medical Laboratory, the Food and Container Institute for the Armed Forces, and other laboratories have developed new knowledge of foods. Veterinary officers, working with these research scientists and with operational personnel, have applied the new knowledge to produce the world's safest and most modern in-flight and ground feeding rations. Combat rations, dehydrated foods, precooked frozen meals, precooked hot meals, survival food packets, special box and sandwich lunches, and food in liquid and tablet form for high altitude jet pilots are typical examples. An urgent unsolved problem in this field of research is that of feeding crews airborne at high altitudes over long periods of time.

*Preservation of foods by radiation.*—Radiation of foods may offer a revolutionary and improved method for feeding military personnel on the ground or in flight. It may extend the safe shelf life of highly perishable fresh foods long enough to feed crews on the longest flights. Also, it may save weight by eliminating heavy packaging and refrigeration.

The Quartermaster General is charged with this radiation research project, and the Surgeon General is responsible for approval of the health aspects. Veterinary officers are assigned full time to this program. A study of the effects of one irradiated food requires tests with 100 rats and 48 dogs. The rat tests must continue through four generations. Thousands of pathological samples from these animals must be examined by qualified military veterinary pathologists.

*Disease research in oversea areas.*—The scope of the work of personnel of the military veterinary services is international. As members of medical service teams, military veterinarians conduct research in exotic diseases in such areas as Africa, Turkey, Korea, and Japan. Specimens collected in this research are sent to the Armed Forces Institute of Pathology and Walter Reed Army Institute of Research in Washington, D.C., for examination. The purpose of such research is to develop means of controlling exotic diseases for protection of military personnel overseas, to assist allied governments, and to prevent the spread of such diseases to the United States.

*Armed Forces Institute of Pathology.*—Organized under the Department of Defense, the Armed Forces Institute of Pathology provides service to all branches of the Armed Forces and to certain civilian agencies. Military veterinary officers on residency and fellowship programs are engaged in research in pathology and virology. This research institute collects specimens of diseased animal tissues from all parts of the world in a constant search for information concerning comparable human diseases. Pioneering work in exotic diseases at the Institute provides material for teaching veterinarians to recognize foreign diseases, and for use by civilian and governmental agencies.

*Biological research in passive defense.*—Effects of passive defense on man are being studied by veterinary officers assigned to work directly for the Animal Assessment Branch, Fort Detrick, Md. This

branch uses various animals to test all aspects of biomedical programs contemplated for man, with particular emphasis on the use of such animals to guide clinical care of subsequently exposed volunteers.

*Mobilization preparedness.*—The military veterinary services continuously review military plans and proposed tactical concepts. They develop military veterinary organizations to support the Armed Forces in the event of changing missions or a national emergency. Plans include biological, chemical, and radiological activities. The military veterinary services are presently training and assisting in passive defense measures as pertain to biological effects, radiological effects, and mass casualties. In the event of an all-out emergency, the service is capable of rapid expansion into an operating force to detect biological agents, radioactivity, and chemical agents in subsistence supplies. This detection will be important not only in maintaining the health of troops, but also in maintaining the health of the civilian population.

*Research on animal diseases transmissible to man.*—Among the more important centers of medical research in the continental United States is the Walter Reed Army Institute of Research in Washington, D.C. Here continuous research is conducted on certain aspects of animal diseases which are transmissible to man. Vaccines for human beings are developed to prevent outbreaks of the various diseases of military significance. A germ-free and pathogen-free colony of laboratory animals is maintained for all types of experimentation with animals. As part of the medical research conducted at the Institute, laboratory techniques and test results from foreign areas are studied and compared with local techniques.

*Research assignments.*—Veterinary officers are assigned to research activities at the following locations:

Aero-Medical Laboratory, Wright Air Development Center, Ohio; School of Aviation Medicine, Randolph Air Force Base, Balcones Research Center, Tex.; Atomic Energy Commission Headquarters, Washington, D.C., and Las Vegas (Nev.) Field Office; Oak Ridge (Tenn.) Institute of Nuclear Studies; Hanford (Wash.) Atomic Products Operation; U.S. Naval Radiological Defense Laboratory, California; Arctic Aero-Medical Laboratory, Alaska.

U.S. Army Medical Unit, Fort Detrick, Md.; Armed Forces Institute of Pathology, Washington, D.C.; U.S. Army Medical Research Laboratory, Fort Knox, Ky.; U.S. Naval Air Development Center, Pa.; Walter Reed Army Institute of Research, Washington, D.C.; epidemiological units and medical laboratories throughout the world; Food and Container Institute for the Armed Forces, Chicago, Ill.

Surgical Research Unit, Brooke Army Medical Center, Tex.; Surgical Research Unit, Letterman Army Hospital, Calif.; Aero-Medical Field Laboratory, New Mexico; U.S. Army Medical Research and Nutrition Laboratory, Colorado; Air Force Special Weapons Center, N. Mex.; U.S. Army Chemical Center, Md.; National Aeronautics and Space Administration, Washington, D.C.

*4. Worldwide health service to control diseases of animals transmissible to man*

The military veterinarian has placed increased emphasis on veterinary public health to strengthen the Medical Service's preventive medicine program. Military personnel and their dependents both in

the United States and overseas are frequently exposed to the animal diseases which are transmissible to man. Through animal disease control and quarantine programs, the military veterinarian protects not only the health of these personnel, but also the health of civilian communities in the United States and allied countries. He works closely with his professional counterparts of other governmental agencies and the practitioner. In no way are the objectives and purpose of these activities directed toward encroachment or duplication of the work of civilian veterinarians.

*5. Worldwide medical laboratory support*

The veterinary specialist in medical laboratories conducts professional functions in virological, bacteriological, serological, pathological, and radiobiological examinations. Other functions include the chemical and bacteriological analysis of foods. These services are required in all parts of the world where military personnel are stationed.

*6. Veterinary service for Government-owned animals used in research laboratories and for other military purposes*

Today, with the exception of several thousand Army and Air Force sentry dogs, the Government-owned animal is the laboratory animal. During 1957, the Army utilized over 2 million laboratory animals in research and diagnostic procedures. The military veterinarian's work with the laboratory animal includes procurement, inspection, management, and preparation for use in experiments. Knowledge of the diseases, anatomy, and physiology of all species of animals equips the military veterinarian for many activities involving laboratory animal research. Laboratory animal medicine has become a specialty within the veterinary profession, and a specialty board has been established for certification. Military veterinarians are members of this board and undergo advanced training in the specialty. (See American Board of Laboratory Animal Medicine, p. 161.)

The use of sentry dogs in the military services in recent years has become worldwide. The veterinarian is a principal cog in the operation of these programs.

*7. Training and monitoring a nucleus of military veterinarians for specialized assignments, oversea requirements, and mobilization*

Training and advanced professional education are an integral and continuing part of every veterinary officer's career. This training provides the military services with veterinary specialists not available from other sources; prepares the military veterinary services to perform certain functions, such as food inspection, in oversea areas where U.S. agencies are not available; and establishes a core of military veterinarians from which an expansion could be efficiently accomplished in the event of mobilization. Veterinary officers perform an important function on the Surgeon General's staff by continuously monitoring and directing individual careers.

Selected veterinary officers are assigned as instructors to provide formal training in professional and technical service schools. Other officers direct on-the-job training.

Service professional and technical courses for veterinary officers include Army Medical Service meat and dairy hygiene courses, courses

at the Gunter branch of the School of Aviation Medicine, classes in laboratory examination for radioactive contamination of foods, preventive medicine courses, and laboratory animal medicine and disease pathology courses.

Civilian graduate training for officers is offered in public health, bacteriology and virology, pathology and radiobiology, food technology, physiology and surgery, and nuclear energy.

On-the-job training is offered in the fields of surgery, physiology and pathology, food technology, specialized animal service (stressing comparative medicine), and the medical aspects of chemical, biological, and radiological warfare defense.

Command and staff schools, the Army Medical Service School, and the War College are open to qualified veterinary officers.

Field studies, residency and fellowship programs, and refresher courses in various veterinary activities keep the military veterinarian equipped to fulfill a role in the broad worldwide military health mission. Many of his professional counterparts in allied countries are trained by the American military veterinarian, and are provided opportunities to attend courses of instruction in the United States.

*8. Staff, advisory, and administrative work*

Veterinarians at all levels of command perform staff, advisory, and administrative functions. They are normally assigned to the staff of the senior medical officer and in this capacity advise and assist him in all matters pertaining to the military veterinary services within the Medical Service.

The military veterinarian is called upon professionally in the fields of advancing technical specialties as well as staff functions. He has an important and challenging role on the team of scientific specialists who are so necessary in conducting the day-by-day and future missions of the military medical services.

The consistent progress that has characterized the military veterinary services since their inception emphasizes that current activities are not antiquated functions of a former era. The activities and accomplishments in the fields of public health, space medicine research, and chemical, biological, and radiobiological research attest to this fact.

Military veterinarians have made important contributions as members of research groups investigating medical problems of flight, radiobiology, the toxicity of chemical agents, and problems associated with food. Because animals of various species are utilized in these experiments, the veterinary officer contributes his professional competence in animal anatomy, physiology, and comparative pathological medicine. His military background furnishes an appreciation of the military significance and application of the problem under investigation.

Veterinary officers have been engaged in biological research in passive defense since its beginning. The value of this research is based on the effective screening and examination of experimental animals. Results of preventive and therapeutic measures on animals are extrapolated to human dosage and treatments.

Military veterinarians have been included in most, if not all, scientific groups for the nuclear weapons test series conducted in Nevada

and the Pacific. The military veterinary services initiated the first veterinary radiological health course to orient their officers in the fundamentals of nuclear physics and the effect of radiation on food products and food-producing animals.

*Training in radiological health.*—Qualified veterinary officers have participated as instructors and staff members of the Oak Ridge Institute of Nuclear Studies for courses in veterinary radiological health. Requests have been received from many allied countries for attendance of selected individuals at these courses. The veterinary colleges of the United States, the Public Health Service, the Federal Civil Defense Agency, and the Department of Agriculture have all sent representatives to attend the course. Under the specific direction of the military veterinary services, a unique symposium for the deans of veterinary colleges was conducted on the effect of nuclear energy upon animal life and animal products.

The United States now has a nucleus of military veterinary officer specialists well qualified in the critical field of nuclear energy, plus a large number of indoctrinated veterinary officers capable of competent field support.

Experts have commented to the subcommittee on what is regarded as a critical need for military veterinary specialists in human factors research and development programs. They state that experience has shown that the supply of competent personnel to perform these duties is severely limited for a variety of reasons—security, lack of understanding of military problems, motivation, and others. A major factor is that no exact civilian counterpart exists; and, in addition, civilian employment offers far greater emolument. These key specialists were not available until the Veterinary Service anticipated the problem, procured, trained, and assigned the people, and then followed through with continuity of technical supervision.

Textbooks and publications written for use in military veterinary service training programs are recognized as authoritative throughout the world.

*Research contributions.*—Outstanding research and disease control contributions by the military veterinary services include the following:

1. Developed a chloroform-treated tissue vaccine for the prevention of the devastating foreign cattle disease, rinderpest (1926), and perfected a more effective avianized vaccine (1944). Produced and maintained emergency supplies of these vaccines during World War II.

2. Demonstrated for the first time that insect transmission of a neurotropic virus disease (equine encephalomyelitis) occurs, and indicated a means for control (1935). This was a major scientific advance in explaining how the disease is transmitted to humans.

3. Participated in developing methods for the mass production of equine encephalomyelitis vaccine (1938); demonstrated its effectiveness in controlling this disease; and aided in the development of a vaccine for human use (1940).

4. Cooperated in developing and produced a vaccine to protect troops against Japanese B encephalitis (1944).

5. Collaborated in developing and produced human typhus vaccine during World War II.

6. Demonstrated the value and safety of tetanus toxoid for lockjaw in animals prior to its use for humans.

7. Established (1944) and continuously operated the Registry of Veterinary Pathology at the Armed Forces Institute of Pathology. This registry, which includes specimens collected from all over the world, is internationally recognized as the only activity of its kind. Medical scientists throughout the United States and many allied countries use this facility in connection with research on human and animal diseases. Animal specimens are submitted by pathologists from all military stations. A residency program provides graduate-level training to prepare Army and Air Force veterinarians as pathologists for assignment to research teams and histopathology diagnostic laboratories.

8. Established a leptospira research and diagnostic center that provides a diagnostic service to three military departments and the Veterans' Administration. This center functions as a Pan American reference laboratory for the World Health Organization.

9. Established (1946) a fresh milk supply for troops stationed in Europe through the development of tuberculosis-free areas in Denmark, Holland, Germany, France, and Austria. Maintained complete supervision from source to point of consumption over the "longest fresh milk route in the world." This program, a valuable aid in the European recovery program, eliminated the necessity for shipping frozen milk from the United States. Improvement of dairy herds throughout Europe is rivaled by improvement in the sanitary standards of dairy plants. New cleaning methods and stainless steel equipment have been introduced into northern European dairies under the detailed supervision of the military veterinary services.

A Department of Defense report on this activity as a part of the armed services people-to-people program stated:

> A program conducted overseas by the Veterinary Corps of the Army * * * justifies particular attention. While it is directed toward improvement in the quality of dairy supplies purchased by the Army, it has contributed directly to technical progress and good will among Europeans. This program is focused on eradication of tuberculosis among dairy herds in various countries in Europe. The officers of the Veterinary Corps have provided intensive technical guidance to Europeans in developing tuberculosis-free herds. This activity has been well received and is, in effect, a small-scale point 4 program conducted quietly and unostentatiously by the Veterinary Corps. Undoubtedly, there are other such programs. It seems that the persons responsible for these programs and their resultant people-to-people contacts should be properly recognized so that others may "go and do likewise."

10. Developed and supervised a program for concentrating milk in Holland for reconstitution and issue to U.S. forces in north Africa.

11. Developed the first large-scale, pathogen-free colony of laboratory animals at the Walter Reed Army Institute of Research where it continues to be maintained.

12. Established the first residency training program in laboratory animal care.

*Impact on international relations.*—Since the end of World War II, substantial numbers of Armed Forces personnel have been stationed throughout Europe and the Far East. Both areas, ravaged by years of war, were ill equipped to provide the military forces of the United States with the quality and quantity of food desired. The supervision of food processing and inspection of establishments and locally pro-

duced provisions therefore became a large part of the military veterinarian's job overseas.

There are unique problems in the various oversea areas in procurement of locally produced products. Sanitary standards, possibly the chief problem in the oversea areas, had to be raised to a level similar to those in the United States before local products could be used by the military forces. In many European countries, this raising of sanitary levels resulted in the establishment of areas which are free from bovine tuberculosis and improved the quality of many food products. It also emphasized the shortcomings of many sources and processors of food, leading to improvements throughout the various food industries and farming areas.

Increased supplies of locally produced provisions, improved health of both the military and civilian population, and enlarged job opportunities for the indigenous population are accomplishments which mean more economical utilization of the American taxpayer's dollar, and tend to improve good will abroad. By providing these various services in allied countries, the military veterinarian carries out his two fundamental responsibilities—protecting the health of military and other U.S. personnel wherever they are stationed, and protecting the financial interests of the Government. Although the mission is accomplished through technical and supervisory assistance to the civilian population in many cases, the end result can be both economical and efficient. The value of this good will is perhaps not realized. Although it constitutes only a small part of American military expenditures abroad, both in terms of dollars and personnel, the work of the military veterinarian and the Medical Service can reap a rich harvest in increased health of all peoples, improved international understanding, and industrial and agricultural efficiency.

Higher standards of living, improved sanitation, and better health for peoples abroad—some of the elements upon which our foreign policy is based for keeping free countries free—are the byproducts of this effort.

*Rabies checked in Korea.*—In Korea, the senior military veterinarian functions as a staff member of the program for the prevention and control of disease, and maintains close liaison with the representatives of the local government who are responsible for preventive medicine. In the mid-1950's, the growing number of dogs in Korea increased the danger of an epizootic of rabies. To remove the danger to U.S. troops and Korean civilians, military veterinarians aided local government officials in an expanded program of immunization. The incidence of rabies was reduced considerably by this all-out military and civilian effort.

The veterinary members of the Military Government of Japan did an outstanding job of promoting rabies eradication in that country. Beginning about 1950, an intensive rabies control program was inaugurated. By 1956 this program had been extended to all parts of Japan. Since 1956 there has not been a reported proven case of rabies in the Japanese islands. The success of this program has demonstrated to the Far Eastern countries that rabies can be eradicated.

*Assistance to other nations.*—The Arabian Government requested and received assistance on animal disease problems from the military veterinarian assigned to Dhahran Air Force Base. Military veteri-

narians were assigned to Iran to assist the local government in meat inspection programs.

Military veterinarians stationed in the Azores have made valuable contributions to the health and economy of the local population. They have been instrumental in raising the standards and production of the poultry and dairy industries. Recently, they cooperated with Portuguese veterinarians in a program to eradicate tuberculosis in dairy cattle. The Department of the Air Force arranged for an additional veterinarian to assist in this program.

Military veterinarians have been active in assisting the Icelandic and Danish Governments in animal disease control programs.

Yugoslavia has received help from the U.S. Army in developing food hygiene standards.

Military veterinarians have been assigned to military missions in Bolivia, Peru, Panama, and Greece.

The work of U.S. Army veterinarians in Eritrea presents an excellent example of veterinary activity in promoting health and welfare of man and in contributing to better relationships between the United States and an allied country. In the beginning, there were no medically acceptable food sources in the country. Through the efforts of veterinary personnel, tuberculosis-free dairy herds were developed and a sanitary milk supply established. Construction of an approved slaughterhouse was arranged for, utilizing acceptable meat inspection procedures. The quality and sanitary standards of meat, poultry, and seafood products were raised.

Military veterinarians, in formal and informal courses of instruction, have trained veterinary officers and technicians of allied countries from every major continent. Interchange of information and techniques, increased prestige and understanding have been valuable byproducts of these programs.

Port veterinarians concerned with the processing of animals and inspection of provisions work closely with the animal quarantine service and the plant quarantine service maintained by the government of the country in which the port is located. In Guam, the assigned Air Force veterinarian has the additional duty of official representative of the U.S. Department of Agriculture on animal shipments and quarantine.

*Problem areas.*—Major problem areas include the need for a public information program to tell the story of military veterinary medicine. There is a continuing need to inform the public that the Department of Defense utilizes the doctor of veterinary medicine solely for his contributions to human health and welfare, for military medical research, and for the economic interests of the Government.

Because clinical treatment of animals is the function of the civilian practitioner, it is the best known phase of veterinary medicine. Unfortunately, the major contributions of military veterinarians in food inspection, public health, research, and other areas are less well known. Misunderstandings have involved the relation of the military veterinarian to other veterinary groups, although there is reported to be no duplication of effort.

*Future role in veterinary services.*—Opportunities for the military veterinary services to advance the health and welfare of humans and

animals occur in many fields. As reported by experts to the subcommittee, these include:

1. Training: Through additional specialized training, more military veterinarians would have the opportunity to increase contributions to the health of personnel and to research endeavors.

The basic training in the medical sciences which the doctor of veterinary medicine receives has been shown to furnish an excellent foundation for advanced training. Radiobiology, physiology, pathology, and public health are examples of specialized training which veterinary officers have received. These specialists have contributed to the overall health and research mission directly and, in many instances, have released the physician and other professionals to work in other areas.

2. Disaster assistance: The following extract from "National Emergency Medical Care," which was prepared under the direction of the American Medical Association for the Office of Civil and Defense Mobilization, April 15, 1959, points out increased areas of opportunity for the military veterinarian:

> A veterinary education for national defense program, covering the necessary aspects of disaster veterinary medicine and such instruction as will enable graduates to apply lifesaving and first-aid procedures to human casualties, as well as to assist the medical profession in approved activities [should] be instituted and supported by Federal funds. This program should include all approved colleges of veterinary medicine, be designed to include all essential instruction, and made as uniform as practicable.

It is anticipated that future military conflicts might involve numbers of casualties far in excess of the capacity of medical services available to civilian and military populations. In military situations and in oversea areas, the shortage of trained personnel would be magnified. Every medically trained individual will be needed; the doctor of veterinary medicine has been recognized as a valuable adjunct to military and civil defense programs.

3. Civil affairs: The military veterinarian has a distinctive opportunity to contribute to the health of man and his economic improvement in civil affairs. In an article titled "Veterinary Aspects of Civil Affairs—Military Government," Brig. Gen. Crawford F. Sams, Medical Corps, U.S. Army, as the Chief of Public Health and Welfare Section, Supreme Commander Allied Powers, and Chief of Public Health and Welfare Section, United Nations Command, discussed the health problems encountered and eliminated in Japan and Korea. He points out

> Health and welfare fields, which to me include a most important element, veterinary affairs, are the programs which directly affect all of the people of a nation if they are properly carried out.

4. Increased utilization of military veterinarians: The Department of Defense in recent studies has shown there are increasing opportunities for maximum utilization of the military veterinarian by all the military departments. The particular areas of biomedical research and new food inspection techniques have been singled out as examples of opportunities. The increased emphasis on the contractor's own role in quality control and inspection of his own products prior to offering on Government contracts calls for the development of new verification inspection procedures.

## Section 8. Veterinary Public Health

### A. INTRODUCTION

As early as 1880, a Boston veterinary surgeon urged that a veterinary sanitary section be established in the National Board of Health and that a National Veterinary Institute be organized. These recommendations did not materialize for almost 70 years. During World War I, some veterinarians served as civilian sanitarians in environmental sanitation activities. One who remained in the service after the war became a specialist in control and diseases of rodents.

*National milk sanitation campaign.*—In the 1920's the Public Health Service embarked on a national milk sanitation campaign. Veterinarians were brought into the Public Health Service as milk specialists and performed much of the pioneer work in developing the Public Health Service's milk ordinance. In the decade before World War II, they surveyed the milksheds for practically the entire country and helped raise the standards of milk sanitation. The importance of this work became meaningful with the beginning of World War II and additional veterinarians were recruited as milk and food specialists in 1941. These veterinarians served as civilians until 1942 when they were commissioned as sanitarians. The contributions of veterinary medical officers were recognized formally in 1947 when the veterinary category was created as a distinct professional grouping in the Commissioned Corps of Service.

*First veterinarians in NIH.*—In the 1930's two veterinary parasitologists joined the National Institute of Health. One of these veterinarians had previously made noteworthy contributions in the treatment of human hookworm disease. He continued with the Public Health Service and eventually became Chief of the Tropical Medicine Laboratory. In 1958, he retired as a veterinary director and is now serving as consultant to the National Research Council on tropical medicine and veterinary education.

*Increase for 1940's and 1950's.*—At the end of World War II, a veterinary public health program was drafted to meet the national needs. A Veterinary Public Health Section was established in the States Relations Division. In 1947 this activity was transferred to the Communicable Disease Center. In 1947, the veterinary medical category was established in the regular corps of the Public Health Service. A short time after the establishment of a veterinary program at the Communicable Disease Center, additional veterinarians were appointed to the National Institutes of Health in the field of comparative pathology and infectious diseases. The program at the CDC was largely concerned with animal diseases transmissible to man. Veterinarians were needed also in other health programs such as milk and food sanitation, industrial health, and tuberculosis research, and additional veterinary officers were brought into the Service.

In the 1950's, with the advent of new programs such as radiological health, air pollution, experimental surgery, civil defense, comparative cardiology, and cancer epidemiology, and because of further needs by the CDC, additional veterinarians were appointed. (See "National Institutes of Health," p. 51; "Air Pollution Research in the Public Health Service," p. 73; and "Veterinary Medicine's Contributions

to Radiological Health," p. 71.) Their initial training was usually in epidemiology, although some were trained in experimental surgery and pathology. By the end of 1960, approximately 75 veterinary officers were on duty and a comparable number trained in the Service had accepted outside appointments.

*State and local activity.*—Concurrent with the development of veterinary public health at the national level, there was an expansion of veterinary medical problems in public health at the State and local levels. In 1945, only two State health departments had veterinarians on their staff. In 1959, there were more than 30 veterinary medical programs. At the local level there has been a similar growth from approximately 400 veterinarians in health work in 1945 to 1,200 in 1959 in various capacities. The need for competent public health veterinarians at the National, State, and local levels is expected to continue.

The program of the Communicable Disease Center, as indicated previously, has been concerned largely with the epidemiology of animal diseases that are transmissible to man. These include rabies, encephalitis, psittacosis-ornithosis, Q fever, brucellosis, salmonellosis, leptospirosis, histoplasmosis, coccidioidomycosis, and animal ringworm, all of which require the attention of both veterinary and medical epidemiologists. (See "Zoonoses Research in the Communicable Disease Center," p. 57.) While specialists in laboratory procedures have tried to develop better diagnostic techniques, others concerned with control operations have given their attention to the elimination of these diseases. Rabies is an excellent example to cite. In 1945 almost 10,000 cases were reported in animals, and thousands of persons were treated for this deadly disease. As a result of research, demonstrations, and training by the CDC, the incidence of this disease has dropped more than 50 percent in the past 15 years. Unfortunately, investigation of rabies has revealed that it has a much broader reservoir in nature than was formerly thought. The recognition of bat rabies in 1953 revised the thinking of public health authorities that this disease could be eradicated. Previously it had been thought eradication was possible by dog vaccination and control and reduction of certain wildlife reservoirs.

The dog and cat population of the United States is now estimated to exceed 50 million. Of this group between 6 and 7 million are vaccinated annually. Some of the new vaccines provide lifetime immunity. The rise of immunity levels in the pets of the United States obviously contributes to the reduction of incidence of rabies. Today, increasing attention is focused on the wildlife reservoir where in some areas trapping and animal reduction programs have been successful.

Veterinary medicine is also a part of international public health activities. The services of veterinarians are found in such international activities as World Health Organization and Pan American Sanitary Bureau. (See "The World Health Organization's Veterinary Public Health Program," p. 196; "Veterinary Medicine in the Pan American Sanitary Bureau," p. 202.)

More than 100 animal diseases have been found to be transmissible to man (table 5). These animal diseases must be brought under control and eradicated where possible in order to raise the standards of health and welfare of the people.

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B. VETERINARY PUBLIC HEALTH AT THE LOCAL, STATE, AND FEDERAL LEVELS

Although the historic contributions of veterinary medicine to the health and well-being of man have been widely known for many years, the formal integration of veterinary medical services into the total public health program has been accomplished in comparatively recent times. Health officers began to discover that the background, training, and specialized competencies of veterinarians could be utilized to improve and enlarge the services of a progressive health department. At the local level, in county and municipal health departments, where the activities of veterinarians had formerly been restricted to part-time duty as meat inspectors at the post mortem table, the need was soon felt for more complete utilization of the veterinarian's highly specialized know-how in communicable disease control, in the broader aspects of food hygiene, in his capacity as a training officer and investigator in the everyday problems of public health services that continually emerge in city and county health departments. (See fig. 19, "Health Activities Performed by Veterinarians.")

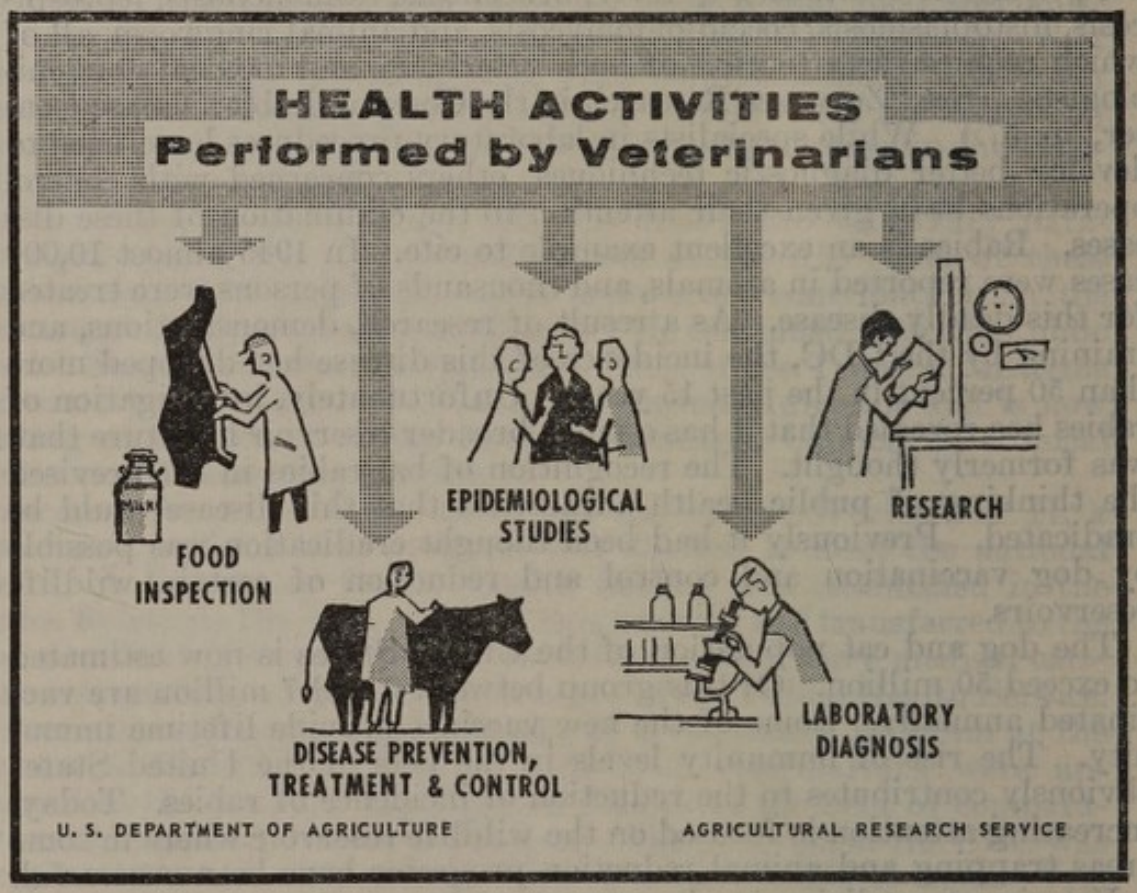


FIGURE 19

This same need was soon felt in public health departments at the State level of government. The veterinarian, trained in graduate schools of public health alongside his medical colleagues, soon became a senior member of the staff of a State health department. He bridged a long standing gap in the public health program. As a result of the increasing demand for qualified public health veterinarians, the number of State health departments with complete veterinary public health programs has grown from 2 to 33 in the last 15 years.

*American Public Health Association report.*—The functions of the public health veterinarian in administering his program at the local, State, or Federal level are outlined in the report of the Committee on Professional Education of the American Public Health Association as follows:

The public health veterinarian is responsible for that field of activity which protects and advances the health of man by utilizing the knowledge and resources concerned with the interrelationships of animals and human health. His sphere of activity includes the planning, conducting, supervising, and coordinating of community efforts for the improvement of health and well-being of man. The public health veterinarian's efforts are directed toward improvement of public health by application of his professional knowledge in coordination with other public health competencies.

The public health veterinarian is responsible for a broad variety of functions which depend on the problems of the area and the scope of the agency with which he is associated. The functions listed below are illustrative of his activities and responsibilities at the local, State, or Federal level. Any one position may not include all these functions nor will all functions necessarily be listed. The functions include:

1. Promotion of veterinary public health activities in urban and rural environs to prevent and control those animal diseases that are transmissible to man by direct contact, indirectly through food products, or by insect vectors.

2. Consultative and field assistance in health administration to obtain the maximum professional contribution of veterinarians in the areas of public health relating to veterinary medicine. For example: As a staff function the veterinarian advises the health officer and other divisions of the health department in the areas where his broad professional training in biology, medicine, and public health can be applied to the planning and development of programs.

3. The epidemiological estimation of public health dangers and problems arising from the diseases of animals.

4. Development and maintenance of animal disease reporting and statistical services for the evaluation of the danger presented by the zoonoses and the procedures employed for their control and prevention.

5. Participation in the planning, promotion, coordination, and supervision of programs related to the inspection and hygiene of milk, meat, and other food and the application of biological principles to the production, processing, and distribution of food products.

6. Planning and participation in laboratory and research activities in the field of comparative medicine, including diagnosis, epidemiology, epizootiology, microbiology, production of biological products, and all aspects of comparative pathology.

7. Active participation in the definition of radiation hazards and in the planning and promotion of programs for the prevention or alleviation of radiation hazards as they may affect the interrelationships of human and animal health.

8. Enlisting the cooperative participation of private veterinary medical practitioners in urban and rural community public health problems. Liaison with the veterinary medical practitioner. Promotion of various programs such as accident prevention, selected animal disease prevention and control programs, milk and meat hygiene, and general health in the community.

9. Active participation in cooperation with health education personnel in the planning, promotion, and development of health education programs relating to veterinary public health activities and the public health needs in the community and participation in the development and enforcement of health laws and regulations.

10. Consultation and liaison with voluntary and official organizations at local, State, and Federal levels, as well as enlisting the cooperation of the departments of agriculture and conservation in the prevention and control of animal diseases affecting the public health. For example:

(a) Provision of consultative services to the Public Health Service, State and local health officers, and other departments of government, medical and veterinary medical practitioners, animal and food industries, universities, and the general public.

(b) Cooperation with farm and rural organizations for the control of health hazards peculiar to agriculture in the improvement of rural health.

(c) Consultation and liaison with agriculture and conservation departments in the prevention and control of animal diseases affecting the public health.

In any program to influence and benefit the public health, both from an investigational viewpoint and by development of feasible solutions, the 10 areas of activity listed require the biological approach, the concept of group or community health, and the use of the principles of comparative medicine, pathology, bacteriology, and physiology. The veterinarian has been taught to approach problems in terms of the herd or the flock, and thus has been trained in the public health and preventive medical concept of considering the group or the community as a unit.

### C. FOOD HYGIENE IN THE PUBLIC HEALTH SERVICE

Federal milk and food sanitation activities are conducted by the U.S. Public Health Service. The Service provides research data, program guides, training aids, and technical assistance to the States and local governments.

The broad medical training and capabilities of veterinarians equip them for work in various aspects of food hygiene programs. Veterinarians participate in food hygiene research, field demonstrations, epidemiological investigations, and training courses. They advise and assist in the development and maintenance of recommended ordinances, codes, and related program guides on milk sanitation, poultry inspection and sanitation, and food service establishment sanitation. These activities are conducted by the Communicable Disease Center, Atlanta, Ga., and by veterinarians assigned to the Milk and Food Program, Division of Engineering Services, Washington, D.C. The veterinarians also provide liaison with and advisory services to other Federal agencies and industry on the public health aspects of food hygiene.

*Diseases spread in food.*—Many animal diseases are of significance in food hygiene programs because they are transmissible to man through milk, meat, or other animal food products.

Animal diseases are of public health significance in food hygiene programs because some are transmissible to man through milk, meat, poultry, and other animal food products. Brucellosis, bovine tuberculosis, tapeworms, and salmonellosis are among the more important animal diseases transmitted in food to man. Food products may serve as a vehicle of human infections, namely, typhoid fever, diphtheria, scarlet fever, and streptococcal sore throat.

*Milk's relation to disease.*—In 1909, the Hygienic Laboratory (the predecessor of the present National Institutes of Health), published a comprehensive review of milk and its relation to public health. A number of diseases were shown to be spread through contaminated milk. These included typhoid fever, scarlet fever, diphtheria, and tuberculosis.

In 1908–9, more than 81,000 persons in the United States died of tuberculosis. About 20 percent of these deaths were caused by the bovine type of tubercular organism, which is present in raw milk of infected cows. Surveys indicated that bovine-type tuberculosis was higher among people who drank raw milk than among those who drank pasteurized milk.

Chicago passed laws that required the pasteurization of milk in 1908. Other cities adopted similar laws. In the post-World War I period many dairies began to pasteurize milk.

*Milk sanitation.*—The first milk sanitation work in the United States was performed by veterinarians in connection with tuberculosis testing and other disease control in dairy cattle. In 1917, the Department of Agriculture's Bureau of Animal Industry began its intensive program for the eradication of bovine tuberculosis.

In the 1920's, the Public Health Service initiated a comprehensive program to guide State and local health departments in the establishment and maintenance of effective milk sanitation programs. The first PHS-recommended milk ordinance was published in 1924.

With the development of veterinary public health programs in local health departments following World War I, milk hygiene became one of the important activities supervised by veterinarians. As the number of veterinarians in the United States decreased, engineers and sanitarians replaced veterinarians in official milk sanitation programs.

*Abundance of protein foods.*—Veterinary research, clinical practice, and public health and regulatory activities in the United States have made possible an abundance of safe, wholesome protein foods. In 1957, the average per capita consumption of food in the United States was almost 1,500 pounds per year. Of this, an average of 650 pounds per capita was food of animal origin.

*Food poisoning research.*—A veterinarian's study of food poisoning, or botulism, aided in the development of the modern food-canning industry. Dr. K. F. Meyer, a University of California veterinarian, headed a canning industry-Public Health Service team which did epochal research on botulism in the 1920's. This work paved the way for the development of canning methods, including pressure cooking, to prevent production of the deadly toxin killer in commercial- and home-canned foods.

Since 1925, the United States has been almost free of cases of human botulism caused by commercially canned foods.

*Q-fever.*—Cows, sheep, and goats are primary sources of Q-fever in man; they shed the causative organism in milk as well as in other secretions and excretions. However, contaminated dust is the most common single source of human infection. Studies in the areas in which Q-fever is endemic have shown that the incidence of infection is much higher in persons who drink raw milk than in those who drink pasteurized milk.

A recent research project determined temperatures and the length of time necessary to assure destruction of the Q-fever organism in pasteurized milk. This project to protect the public's health was a cooperative undertaking of the University of California, the Milk Industry Foundation, the Dairy Industries Supply Association, and the Public Health Service.

*Foreign assistance.*—A major objective of veterinary public health in recent years has been to provide veterinary advice and assistance to other countries of the world where malnutrition and foodborne diseases are common in man, where livestock and milk production efforts are hobbled by animal diseases which can be prevented, and

where communicable animal diseases are still major health hazards to man.

*Public concern.*—As the United States approaches more complete prevention or eradication of animal diseases and associated food hazards, the more difficult and costly further progress becomes. Unfortunately, it is at this point that public concern frequently diminishes. Many people are unaware of the deadly hazards which made the original development and make the current maintenance of food hygiene programs so essential. Others, knowing that communicable animal diseases have been largely controlled, pay scant heed to the hazards associated with rapidly changing techniques in food production, processing, and service. Wholesome food supplies become taken for granted, and it becomes correspondingly difficult to obtain the necessary financial support for maintaining existing programs and safeguards and for evaluating and meeting new problems.

From a worldwide viewpoint, the United States is in an enviable position. Great progress has been made in the field of food protection and safety. Currently, however, there are not enough veterinarians engaged in this field.

*Opportunities.*—In spite of tremendous progress in controlling animal diseases, U.S. livestock and poultry production losses continue at a high level. Foodborne disease outbreaks are still common. Newly developed biological and chemical techniques, food additives, and treatments in livestock production and food processing require evaluation and control. Irradiation of foods, space-flight feeding, and radiological, biological, and chemical hazards to the food supply in peace or war have significant health implications. All of these areas of food hygiene will present continuing, serious, and complex problems. Opportunities and needs are increasing for veterinary surveillance, research, control programs, consultation, and training on various phases of these problems in government, industry, educational institutions, and private agencies.

### D. VETERINARY PUBLIC HEALTH PROGRAMS IN THE COMMUNICABLE DISEASE CENTER

As indicated earlier, the Communicable Disease Center is the division of the U.S. Public Health Service engaged in programs for the control of communicable diseases. It is the only division in the Service with its headquarters outside the Washington, D.C., area. The division is based in Atlanta, Ga., and was established in 1946 as an outgrowth of the Service's activities in malaria control in war areas. In the 15 years of its existence, CDC has made outstanding contributions to the control of communicable diseases on a national and global scale.

The Veterinary Public Health Section of the Public Health Service was moved from the States Relations Division to the Communicable Disease Center in 1947, since the bulk of the newly formed veterinary program was concerned with the control of the zoonoses, those diseases transmissible between animals and man.

*Three-point program.*—The veterinary public health activities in the control of human-animal diseases are carried out in a program which encompasses a three-point approach—research, training, and

consultation. Research in a particular problem area may range from the discovery of new infectious agents to the development of methods for improved diagnostic techniques. Training activities include the holding of regularly scheduled courses in laboratory and field phases of disease control, the preparation and publication of control manuals and pamphlets, the production of audiovisual aids such as motion pictures, and the holding of regional training conferences on selected diseases. The area of consultation reflects the basic operational concept of the CDC: extending technical services to the States. In this activity the specialized professional resources of the center are made available to State and local health departments and institutions which have problems in communicable disease control. This technical assistance may be epidemic aid—to investigate and control severe outbreaks of infectious diseases—or the development of long-range control programs.

*Illustration of activity—Leptospirosis epidemic.*—An example of how the veterinary officer is utilized in these operations can be cited here. An outbreak of a febrile disease in a large group of persons in the southern part of Alabama was reported in midsummer. Most of the patients were in lower age groups, and outstanding among the symptoms was stiffness of the neck, fever, nausea, vomiting, and malaise. The picture presented was one which suggested several diseases, particularly "aseptic meningitis." Careful analysis of the epidemiological data collected by the CDC investigating team and the results of laboratory tests on serum samples revealed that this was an outbreak of acute leptospirosis. Followup investigations by CDC veterinary officers showed that the source of the infection was leptospirosis-infected cattle and swine watered in a creek which had been dammed up to be used by the local population for swimming. As a result of this epidemic aid activity, veterinary measures were undertaken for controlling the disease in the livestock of the area.

*Diseases of greatest concern.*—Not all of the 100 diseases of animals that are transmissible to man are of great importance in the United States. In fact, variations in the prevalence of the zoonoses are found within U.S. borders. For this reason emphasis on investigational and control activities will differ in various parts of the country. For instance, CDC field operations in the control of coccidioidomycosis, a serious systemic fungal disease of man and animals, are concentrated in the lower Sonoran life zone of the Southwest, with headquarters in Phoenix, Ariz. By the same token, CDC veterinary public health operations in the detection and control of eastern equine encephalitis are concentrated in the marshland areas of the east coast and the Gulf States.

Among the bacterial diseases which have received the greatest part of the attention of the CDC veterinary program are leptospirosis, anthrax, tuberculosis, brucellosis, and salmonellosis. The mycotic diseases of greatest concern have been ringworm, histoplasmosis, and coccidioidomycosis. In the parasitic field, work has been carried out in trichinosis, hydatidosis, beef tapeworm, and cutaneous and visceral larva migrans. Among the viral infections the focus has been on rabies, encephalitis, Newcastle disease, and psittacosis; and among the rickettsial diseases Q fever has received the most attention. (See fig. 20, "Some transmissible diseases common to man and animals.")

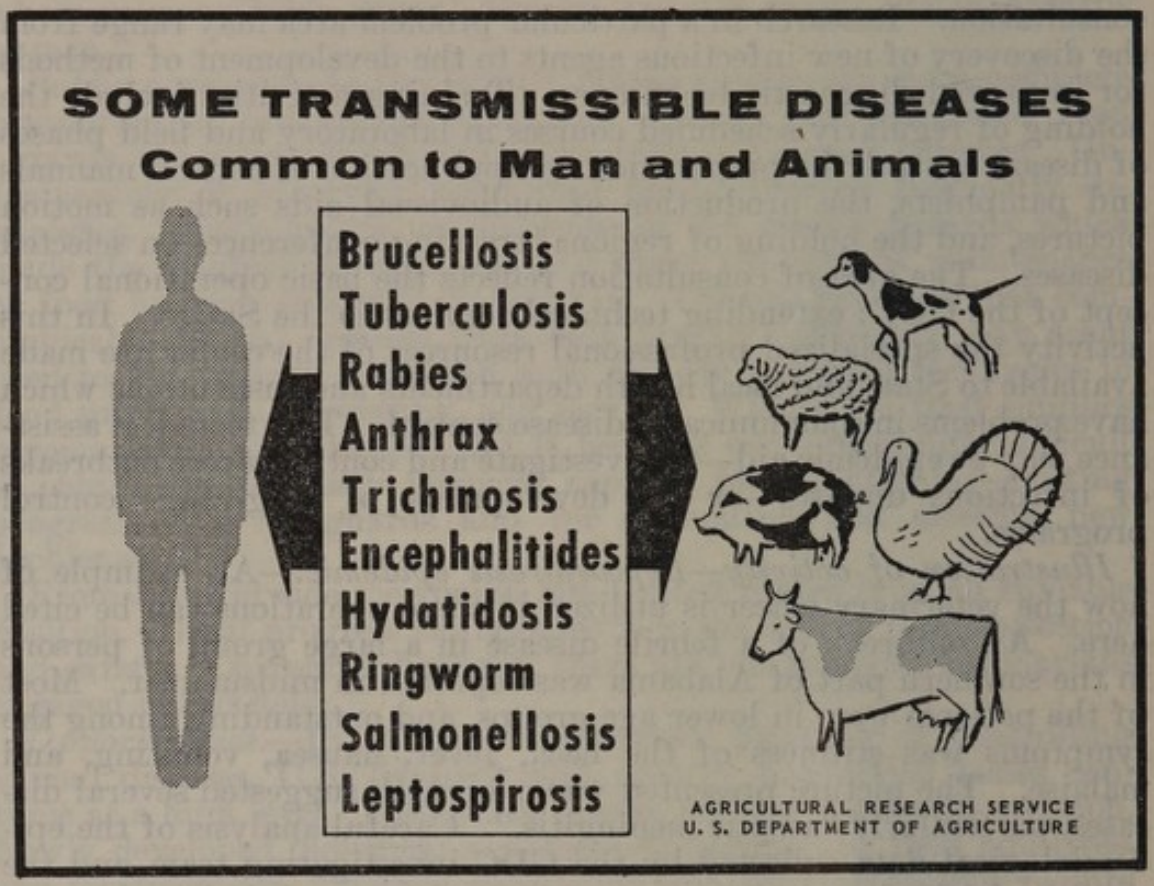


FIGURE 20

*Emerging problems.*—As the result of improved methods which have been developed for investigating diseases, a group of newly emerging zoonoses are coming to the fore, the most dramatic being the virus diseases. New viruses are being isolated and identified in man and lower animals. With modern epidemiological techniques, CDC veterinary and medical officers are discovering that many of these virus isolates are the agents of a nebulous group of enteric, respiratory, and neural diseases. Examples of these are ECHO, REO, adeno, and hemagglutinating viruses, many of which are now known as the cause of diseases which were not understood previously. CDC veterinarians, uncovering the fact that many of these newly discovered viruses are found in animal reservoirs, particularly cattle and swine, are linking these investigations with studies designed to increase the knowledge and understanding of the epidemiological patterns of these viruses in their human and animal hosts, including an understanding of their transmission and antigenic relationships.

*Teamwork approach.*—The veterinary public health services at CDC are utilized in concert with specialists in related medical professions for a teamwork approach to the problems encountered in the control of infectious diseases. In solving these problems, an orderly progression of activities is undertaken. The first consideration is the problem of accurate diagnosis and the establishment of sensitive surveillance mechanisms for the prompt recognition and reporting of the disease. Included in this consideration are the development and utilization of improved diagnostic techniques and criteria. Second is the epidemiology of the disease in man and animals. This requires a study of the characteristics of the disease as it affects both the human

and animal victims under study. Analysis of these epidemiological data is carried out and comparisons are made in a search for relationships of the disease between its human and animal hosts. The next step is the undertaking of experimental control measures, first in the laboratory under artificially controlled conditions and then in limited field trials under natural conditions. The last step in this progressive pattern is the use of these laboratory- and field-proven control practices on a larger scale in a CDC-sponsored demonstration control project.

*National rabies control program.*—Rabies is one of the most important zoonotic diseases in North America, and activities directed toward its control constitute a major part of the veterinary public health program. This disease has ravaged the United States since it was first reported in the colony of Virginia in 1753. The disease spread westward with the movement of settlers, and by 1899 it had reached California.

The rabies problem in the United States today is measured not so much by the number of human deaths as by the number of persons who require treatment—more than 30,000 persons each year are bitten by suspected rabid animals and are required to take the lengthy, painful, and expensive series of Pasteur treatments. Complicating the problem, these vaccine treatments are not always given without danger of severe reactions affecting the nervous system.

Once clinical symptoms of rabies begin, death always ensues. During the period 1945–59, over half of the human rabies deaths in the United States occurred in children under 15 years of age. (See fig. 21, "Age-Group Distribution of Human Rabies Deaths.")

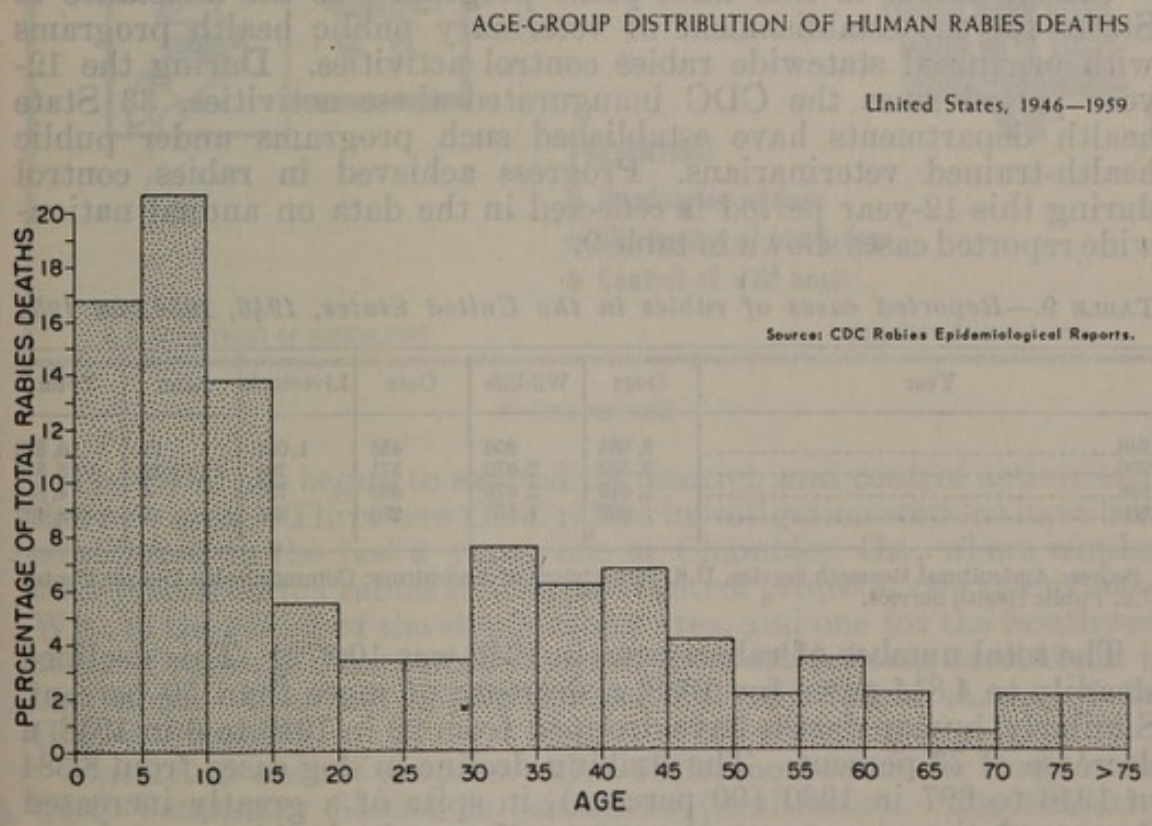


FIGURE 21

Sporadic and ineffective efforts at control of rabies have been made in this country over the years. Restricting the movements of dogs by itself had little effect on the constantly mounting incidence of rabies.

The first attempts to use canine vaccination in rabies control met with spotty success until a standard vaccine potency test was devised in 1940 by the U.S. Public Health Service. The next significant advance in rabies control came when a research worker of the Rockefeller Foundation showed that a single inoculation of Semple-type vaccine protects dogs against rabies for 1 year. This established the efficacy for a policy of annual canine rabies immunization.

In 1946, CDC's Veterinary Section established a nationwide program of rabies investigations and control. The early phases of the program were concerned primarily with the immunization studies at the Virus Laboratory in Montgomery, Ala., which CDC had taken over from the Rockefeller Foundation. In these years, a new live virus vaccine prepared in chicken eggs was developed, tested, and demonstrated to produce immunity in dogs for at least 39 months.

Thus, over the years the competence of the Center's Veterinary Section in devising techniques and programs for the prevention of rabies in man and animals increased. Research was directed toward methods of diagnosis, immunity, the progress of the disease in its victims, and epidemiology; training was directed toward laboratory diagnosis, vaccine production and testing, and field control methods; and technical assistance to States directed toward total programs ranging from intensified mass canine immunization procedures to the clinical management of human and animal exposures.

Closely allied to this three-point program was the assistance to States for the establishment of veterinary public health programs with organized statewide rabies control activities. During the 12-year period since the CDC inaugurated these activities, 33 State health departments have established such programs under public health-trained veterinarians. Progress achieved in rabies control during this 12-year period is reflected in the data on annual nationwide reported cases shown in table 9.

TABLE 9.—*Reported cases of rabies in the United States, 1946, 1956, and 1958*

| Year | Dogs | Wildlife | Cats | Livestock | Man | Total |
|---|---|---|---|---|---|---|
| 1946 | 8,384 | 956 | 455 | 1,055 | 22 | 10,872 |
| 1956 | 2,592 | 2,079 | 371 | 794 | 10 | 5,846 |
| 1958 | 1,643 | 2,075 | 353 | 737 | 6 | 4,814 |
| 1960 | 697 | 1,805 | 288 | 635 | 2 | 3,427 |

Source: Agricultural Research Service, U.S. Department of Agriculture; Communicable Disease Center, U.S. Public Health Service.

The total number of rabies cases in 1946 was 10,872. This declined steadily to 4,814 cases for 1958, a decrease of more than 50 percent. Similarly, human deaths have dropped from 22 in 1946 to 6 in 1958, a decrease of 73 percent. The striking decline in dog cases from 8,384 in 1946 to 697 in 1960 (90 percent), in spite of a greatly increased dog population, respresents the success of organized rabies control programs throughout the country.

Success with the control of dog rabies has focused attention on the twofold increase in the number of reported wildlife rabies cases. The principal vectors of sylvatic rabies in the United States at present are the fox, skunk, and pushing for prominence in this field, the bat. (See fig. 22, "Rabies.") During the past several years, 20 percent of the human deaths in the United States were due to bites of rabid wild animals, principally foxes and skunks. Since rabies in insectivorous bats was first reported in the United States in 1953, over 300 isolations have been made from bats of 20 different species; over 100 of these were associated with the biting of people. Five human rabies cases have been attributed to exposure to rabid bats, three of these occurring in the past 12 months.

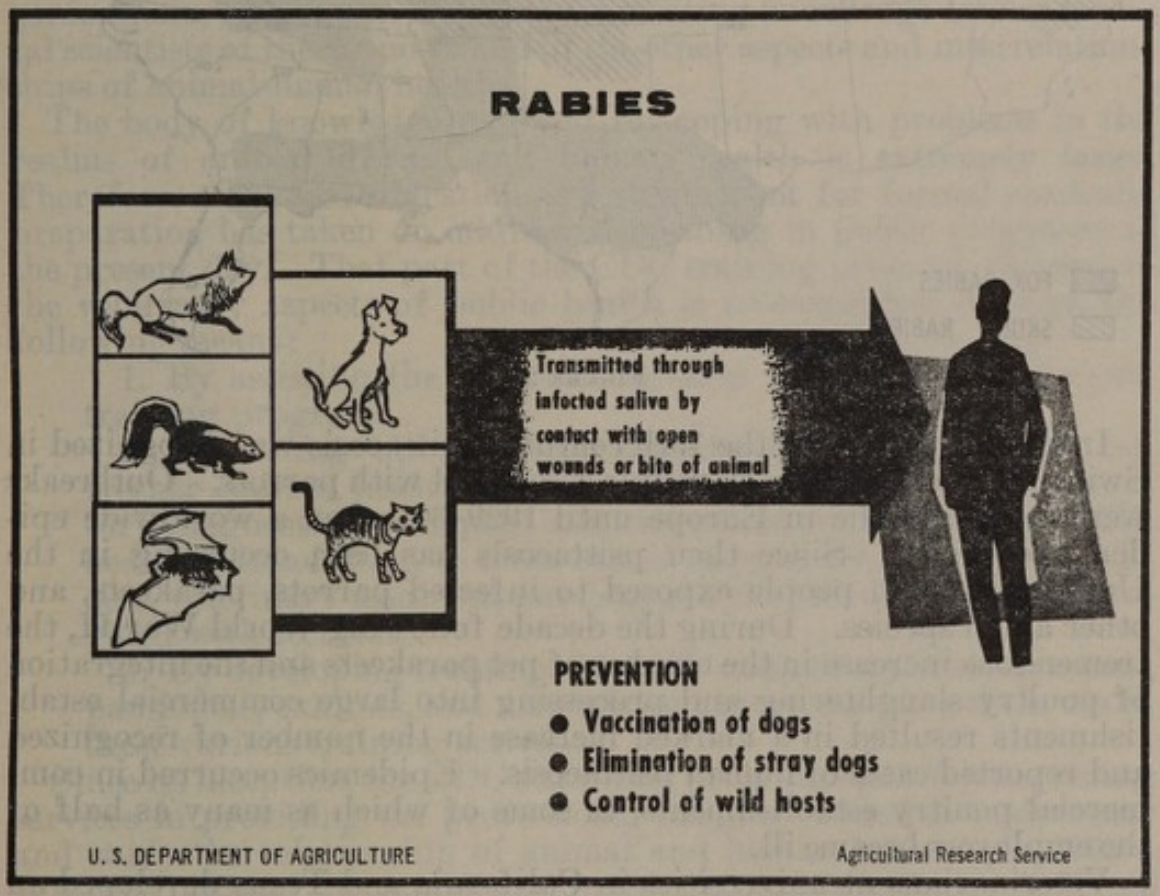


FIGURE 22

The CDC has begun to expand its research and control activities in this new area. Three new CDC rabies investigation stations have been established in the last 2 years, one at Chamblee, Ga., where emphasis is placed on fox rabies studies and control projects; one at Poynette, Wis., in the center of the skunk rabies area, and one for the Southwest at Las Cruces, N. Mex., where most of the work is being carried out in bat rabies. (See fig. 23, "Principal Sylvatic Rabies Areas of the United States.")

*Psittacosis control program*—One of the zoonoses under study in the CDC Veterinary Section is psittacosis (ornithosis). The causative agent of psittacosis is a virus which may produce severe illness and death in humans, birds, and poultry. It may reside in avian species without causing illness in these carrier hosts, but humans may be infected through exposure to these carriers.

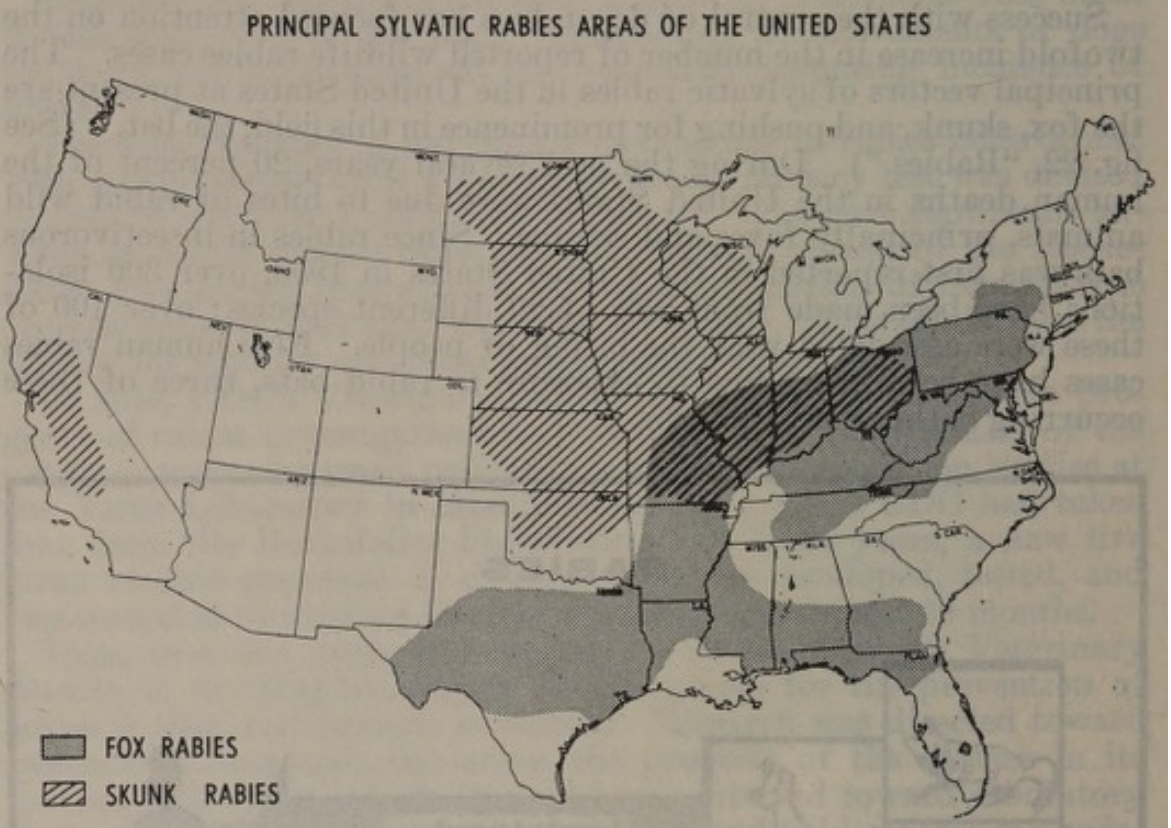


FIGURE 23

In the latter part of the 19th century, psittacosis was recognized in Switzerland as a disease in people associated with parrots. Outbreaks were only sporadic in Europe until 1929–30, when a worldwide epidemic occurred. Since then psittacosis has been occurring in the United States in people exposed to infected parrots, parakeets, and other avian species. During the decade following World War II, the tremendous increase in the number of pet parakeets and the integration of poultry slaughtering and processing into large commercial establishments resulted in a marked increase in the number of recognized and reported cases of human psittacosis. Epidemics occurred in commercial poultry establishments, in some of which as many as half of the employees became ill.

Veterinarians at universities in California and Texas developed an effective treatment using antibiotics for infected parakeets. Veterinarians of the Public Health Service and several State health departments demonstrated that treatment of infected parakeets is feasible in commercial aviaries and sales agencies. Treatment to rid other avian species of infection is not so successful as it is with parakeets; however, current treatment will reduce the severity of clinical illness in turkeys. Control studies are being continued on the effectiveness of practically administered antibiotic and/or immunizing agents in poultry flocks. One of the newest projects underway at CDC is one carried out in cooperation with the Public Health Service's Foreign Quarantine Division to determine the effectiveness of prophylactic antibiotic therapy in imported shipments of parrots and related psittacine birds.

Included in the work on psittacosis at CDC is the maintenance of a nationwide surveillance program. Under this program, the public health veterinarians in the various States promptly report outbreaks

of human disease to CDC so that epidemic aid and consultation can be offered. In order to strengthen this surveillance program, the Veterinary Research Unit of CDC's virus laboratory provides diagnostic services on specimens referred to it by the States.

Recently it has been shown that psittacosis-like viruses are found in mammals. They have produced pneumonia, abortion, and encephalitis in cattle, sheep, goats, and cats. Another disease similar to human trachoma has been found in sheep. This disease is also caused by a member of the psittacosis family of virus.

*Training programs.*—The Communicable Disease Center serves professional health workers of the Nation through cooperative training programs conducted for schools of the health professions, State and local health departments, voluntary agencies, and professional organizations. Attention is given to increasing knowledge among medical scientists of the zoonoses and of the other aspects and interrelationships of animal-human health.

The body of knowledge required for coping with problems in the realms of animal disease and human health is extremely large. Therefore, continued education as a supplement for formal academic preparation has taken on additional meaning in public programs of the present day. That part of the CDC training program devoted to the veterinary aspects of public health is accomplished through the following means:

1. By assisting the States to develop and improve their own training programs.
2. By setting up regularly scheduled training courses, refresher courses, institutes, and seminars in epidemiology, laboratory diagnostic techniques, and other areas of veterinary public health. In addition to these varied approaches, schools of medicine, veterinary medicine, nursing, and the allied sciences are provided with lecturers.
3. By developing training aids such as motion pictures, posters, pamphlets, exhibits, and manuals and by stimulating their use in these various training activities.

Since its inception, the CDC's training program has offered training services in providing the professional insights needed to understand and study the relationship of animal and human health. In 1955 a full-time position was established in the training branch to coordinate instruction in this field. Today physicians, nurses, veterinarians, and others who register for CDC-sponsored courses or for CDC-State cooperative endeavors, receive the benefit of the latest information on a variety of diseases. The faculty is drawn from the center's staff and special consultants, thereby achieving representation in virtually all public health disciplines.

More specialized are the symposiums on single disease problems, such as rabies and leptospirosis, and also the short courses given by CDC personnel at schools of veterinary medicine. In 1957, the center cooperated with the New York Academy of Sciences in holding its second Conference on Animal Disease and Human Health. In 1958, in cooperation with the University of Michigan, the first Institute on Veterinary Public Health Practice was held in Ann Arbor, Mich., for a group of over 100 physicians, veterinarians, nurses and others. Its purpose was to explore ways of increasing the professional use-

fulness of veterinarians in the Nation's health program. In 1959, at a WHO-USPHS-sponsored conference in Kansas City, veterinary educators of the Americas met together for the first time to discuss how the undergraduate veterinary curriculum might be strengthened in the area of comparative medicine and veterinary public health.

The major problem in this fast-growing field of comparative medicine is the method whereby newer knowledge can best be assimilated and integrated into programs. For example, the fluorescent antibody technique is a useful tool for the diagnosis of rabies and other zoonoses; therefore, this information must be furnished to laboratory personnel and program directors in infectious disease control activities throughout the world.

Also, veterinary medical problems must be freely discussed and understood not by veterinarians alone but by nurses and physicians as well. This requires effective programs of continued education and the full utilization of all forms of communications media including TV, radio, and the press. The health professions are demanding increased knowledge of animal diseases in all their aspects.

## PART III—NATIONAL VETERINARY MEDICAL ORGANIZATIONS OF THE UNITED STATES

It is an axiom in this subcommittee's approach that it relies heavily upon the judgment of the professional organizations of medical science for the development of our factual information and our findings. That is why, in the very process of compiling this and other publications, we have turned to the men and women who know the technical subject matter best—the leaders in the profession.

### Section 1. Introduction

Veterinarians have united into professional organizations to better serve the public, who directly or indirectly use veterinary medical services, and to foster scientific progress. The objective of these professional associations is to advance the science and art of veterinary medicine, including its relationship to public health and agriculture.

The parent organization is the American Veterinary Medical Association. It was formed in 1863 as the U.S. Veterinary Medical Association. In 1898, in deference to its Canadian members, the name was changed to the American Veterinary Medical Association. All the States, and many smaller geographical areas such as counties or districts within the States, have also formed veterinary medical associations. Many specialty organizations have been founded to advance a particular area of veterinary medicine.

Through scientific meetings and conferences, these associations stimulate research in veterinary science; collaborate with other professional and scientific associations in medicine, agriculture, and closely related fields; and participate in far-ranging programs of public and professional education and information.

One of the oldest specialty organizations is the United States Livestock Sanitary Association. Its membership includes veterinarians, livestock and poultry producers, representatives of stockyard companies, marketing agencies, and transportation companies, producers and distributors of milk, meat, and dairy products, teachers, and others closely allied with the control and eradication of animal diseases.

The chief veterinarians for each of the States also have an organization, the National Assembly of Chief Livestock Sanitary Officials. They deal with programs and methods of handling outbreaks of infectious and contagious diseases of animals and poultry. A greater uniformity of State regulations is one of the primary objectives of the national assembly and its four regional groups.

*AVMA specialty associations and boards.*—Within recent years many specialty groups have been organized, usually as subgroups of the American Veterinary Medical Association. Among these are the Zoo Veterinarians Association, the Equine Practitioners Association, and the American Association of Veterinary Bacteriologists. Spe-

cialty boards—such as the American Board of Veterinary Public Health, American Board of Laboratory Animal Medicine, and American College of Veterinary Pathologists—are designed to improve the education and training available for members and to establish higher standards for the specialty field.

One of the most recent groups to organize is the Conference of Veterinary Laboratory Diagnosticians. State diagnostic laboratories are specifically designed to assist the practicing veterinarian and the livestock producer in making an accurate diagnosis of animal disease. There is a need for a standardization of the procedures between laboratories. With this goal in mind, the veterinary laboratory diagnosticians conference is working to develop more proficient and uniform techniques and procedures.

Other associations, such as the Conference of Public Health Veterinarians and the Association of State Public Health Veterinarians have been formed in recent years to create a greater awareness of the role and purpose of the veterinarian in public health. Improvement of veterinary education is the goal of the Association of Deans of American Colleges of Veterinary Medicine.

*Laboratory animal health.*—In recognition of the problem of producing and maintaining healthy laboratory animals, a national organization called the Animal Care Panel was formed. Its efforts have been directed toward prevention and control of laboratory animal diseases. Through its program of improving quality of experimental animals, the panel is providing scientists with a more accurate research tool. (See Institute of Laboratory Animal Resources, p. 74.)

*Elevation of educational standards.*—The American Veterinary Medical Association is largely responsible for setting and maintaining high standards of veterinary medical education. For over 50 years, an association committee or council has worked to elevate the standards of the schools and colleges of veterinary medicine in the United States and Canada. (See Colleges of Veterinary Medicine, p. 81.) Essentials for an acceptable veterinary school are periodically reviewed, revised, and strengthened as advances are made in veterinary sciences and educational methods. For over 20 years, the association has evaluated foreign veterinary colleges to provide professional recognition for qualified refugee and immigrant veterinarians.

*Licensure.*—The AVMA and its State associations have pioneered in the supervision and regulation of veterinary practice. They fostered the enactment of State veterinary practice laws in the United States and the formation of State boards of examiners. (See Veterinary Medical Licensure, p. 86.) These public-interest measures assure livestock and pet owners of qualified veterinary medical practitioners.

*Official recognition.*—The AVMA had a key role in supporting the establishment of the Veterinary Corps of the U.S. Army in 1916. As early as 1879, the U.S. Veterinary Medical Association sought legislation that would require the Army Cavalry to hire only graduate veterinarians. This was enacted by Congress. For 15 years, the AVMA supported the proposal to create the Bureau of Animal Industry in the Department of Agriculture. This agency became one of the important animal disease control and veterinary service organizations.

*Veterinarians must keep abreast.*—The professional associations achieve their maximum potential only when they receive support by all of the veterinarians within their jurisdiction. The AVMA offers its professional services to all veterinarians in the United States and Canada. Today, more than 80 percent of all the veterinarians in the United States are members of the AVMA, one of its constituent State associations, or one of the specialty groups.

Many veterinarians, like specialists in other sciences, still find it difficult to keep abreast of new developments in veterinary medical science. Experts advise that professional associations, colleges of veterinary medicine, and Government agencies could do much to aid the veterinarian in keeping abreast of these new developments by sponsoring more seminars, symposiums, and short courses.

*Need for public information on veterinary medicine.*—As the volume reflects, today's veterinarian is found in animal and human disease research, in inspection of animal-origin foods and other food hygiene activities, in animal disease control activities of agriculture and public health agencies, in the development, production, and testing of human and animal drugs and biologicals, in the Armed Forces conducting public health as well as military research activities, in schools and colleges, and in private practice.

The public is not fully aware of the availability and benefits of veterinary medical services. Educational programs to inform the public have been only partially successful. Experts feel that official agencies and professional associations should expand programs to inform the animal-owning public of these veterinary services, and should strive to make better understood the direct relationship animal diseases have to man's health.

Information programs need to stress (1) the benefits of sanitation and good husbandry to animal health; (2) the role of the veterinarian in eliminating needless losses from animal and poultry diseases; (3) new treatments and preventive measures, including immunizations; (4) the reasons for quarantining animals affected by communicable diseases; (5) the veterinarian's work in safeguarding food products of animal origin; and (6) the need for veterinary assistance in artificial breeding programs.

Only when the public recognizes and utilizes all the services that veterinarians can provide will the full potential of the veterinary medical profession of the United States be realized.

## Section 2. The American Veterinary Medical Association

Basically, the work of the American Veterinary Medical Association is directed to the fundamentals of education, licensure, practice, and the manifold problems which confront veterinary medicine in the United States and Canada. The AVMA serves a profession whose services are essential to the health, welfare, and economy of the people of America and the world.

Standards for veterinary medical education and the essentials for acceptable veterinary medical schools are established by the association. These are periodically reviewed, revised, and strengthened as advances are made in veterinary science and educational methods.

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A system of accreditation of all schools and colleges of veterinary medicine in the United States and Canada has been used by the association for more than 50 years. A method of evaluating foreign veterinary colleges was initiated nearly 20 years ago to provide professional recognition for qualified refugee and immigrant veterinarians.

*Professional activities.*—The association sponsors scientific meetings and conferences; stimulates research in the various fields of veterinary science and practice through a program of research fellowship grants; collaborates with other professional and scientific associations in medicine, agriculture, and related fields to study mutual problems. It conducts far-ranging programs of public and professional education and information.

All association programs are conducted in the interests of the public, which uses veterinary medical services directly or is affected by these services indirectly, and the profession, so that it may make continuous scientific advances.

*Recognition sought.*—The U.S. Veterinary Medical Association was formed in New York City on June 9, 1863. Its primary objectives were to raise veterinary science and practice from obscurity; to gain recognition for educated veterinary practitioners; to correct veterinary abuses; to stimulate interest in education; and to improve veterinary practice. The objectives were realized after years of debate, struggle, and discouraging setbacks.

The Canadian members of the profession brought about the need for the change of name to American Veterinary Medical Association in 1898. The principal objective of the AVMA today is to advance the science and art of veterinary medicine, including its relationship to public health and agriculture.

The association's acceptance of professional responsibility to the public it sought to serve brought prestige to the profession itself. In the field of veterinary medical education, the infant association set up a committee on intelligence and education, forerunner of the present AVMA Council on Education.

Similarly, the need for supervision and regulation of veterinary practice was recognized. The association held special meetings to discuss regulation of veterinary practice through a system of examination and licensure. These meetings eventually led to the formulation and enactment of veterinary practice laws in the various States, the formation of State boards of examiners, and the formation of an association of State veterinary examining boards. Every State has developed measures to test the competency of practitioners. These measures safeguard the public as well as providing for high standards of professional competence.

*AVMA programs.*—The work of the association is accomplished by a number of councils, committees, and subcommittees which meet periodically. They outline programs and consider problems in their respective fields, conduct studies, and report their findings for the information and guidance of the AVMA. The AVMA then establishes policies and programs in the public interest and for the advancement of the profession and veterinary science generally.

The actual implementation of these programs and the other business of the AVMA are conducted by a full-time headquarters staff of

about 30 persons. A more detailed organizational description concludes this section.

*Significant contributions.*—The American Veterinary Medical Association has made significant contributions to the Nation as well as the profession. Some of its early accomplishments:

1. Cavalry veterinarians required to be veterinary graduates: In 1879, the U.S. Veterinary Medical Association vigorously supported the proposal before Congress for a law requiring that veterinarians in the cavalry arm of the Army be graduate veterinarians. At that time, the veterinary service of the Army was considerably below professional standards because many noncommissioned personnel with no professional training were used in some veterinary capacities. The ensuing corrective act by Congress was important in building up the veterinary service in the U.S. Armed Forces and had a beneficial impact on the prestige of veterinarians generally.

2. Founding of the Bureau of Animal Industry, USDA: Dr. E. F. Thayer, president of the association from 1869 to 1871, played an important part in supporting the creation of the Bureau of Animal Industry in 1884. Dr. Thayer's successful work in stamping out bovine contagious pleuropneumonia in New England had given him a national reputation as a livestock disease control authority.

3. Commissioned status for Army veterinarians: The part played by the association in the interest of animal conservation and welfare in the Army has become one of its earliest achievements. Through the association, Dr. W. Horace Hoskins worked from 1898 to 1916 for the granting of commissioned rank to Army veterinarians. Success crowned these efforts on June 3, 1916, when the National Defense Act created the Army Veterinary Corps and provided for veterinary officers ranking from second lieutenant to major.

The significance and practical advantages of this accomplishment were demonstrated in World War I. This brought the status of the veterinary services in the American Expeditionary Forces on a par with Allied armies already in the field for 3 years and who had developed veterinary services to a high level under leadership of commissioned personnel.

The importance of well-qualified veterinary military services to food, clothing, and transportation needs of the allied nations' forces has been recognized. (See p. 120, Veterinary Corps of the Army and Air Force.)

*Total veterinarians in the United States and AVMA membership.*—In 1863, most of the educated and graduate veterinarians in the United States were located along the eastern seaboard. As the profession grew, services were extended into the West. AVMA membership increased as the number of graduate veterinarians in the United States increased. (See fig. 24, "AVMA Membership and Total Veterinarians.")

*Number of veterinarians declines.*—The marked decline in the number of veterinarians in the United States from 1920 to 1940 reflects a "depression" in veterinary medicine as a career. It coincides with the rapid development of automotive equipment both for transportation and for farm use. Automobiles, trucks, tractors and other mechanical means of transportation were rapidly replacing horses in the cities and on the farms.

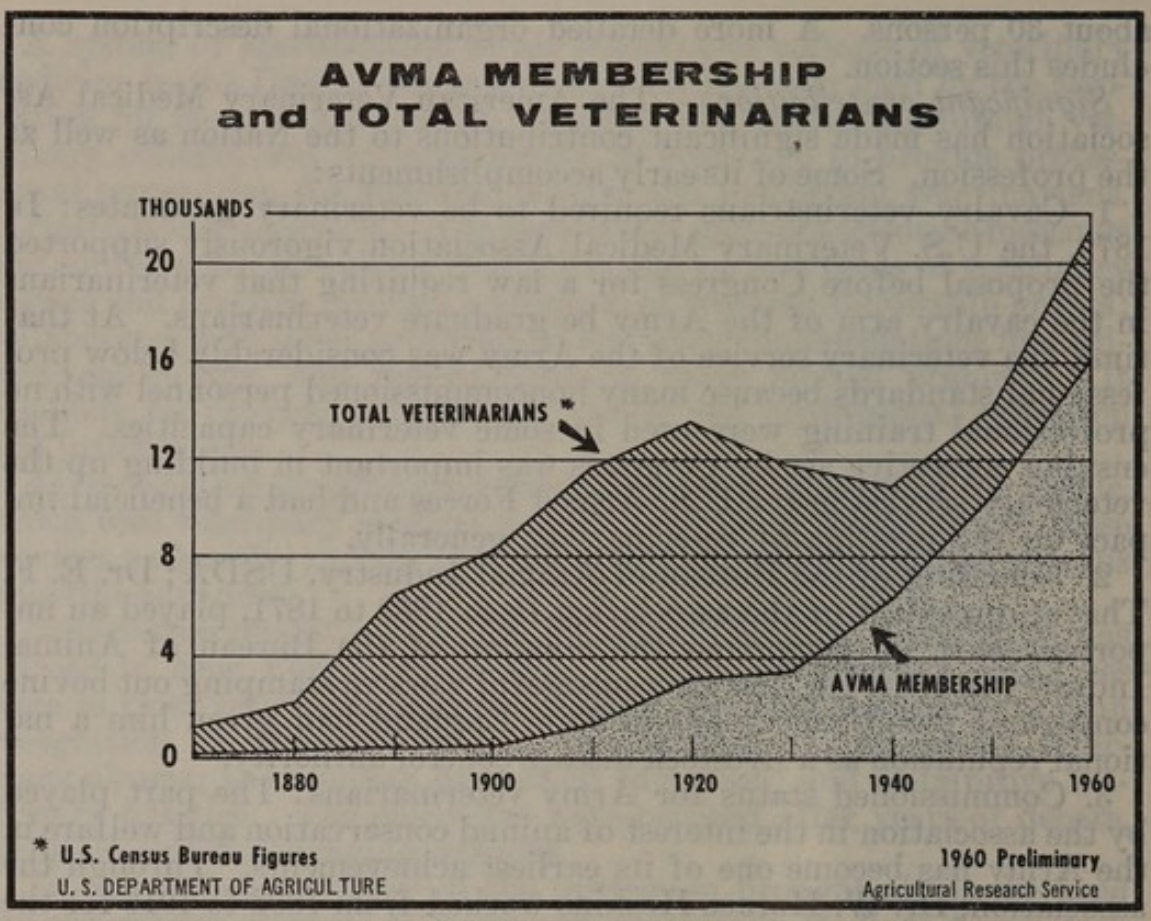


FIGURE 24

A number of private veterinary colleges, which had contributed significantly to the output of graduate veterinarians, were closed. From a high in 1920 of 26 veterinary schools, both publicly supported and privately operated, the number declined to 12 publicly supported schools in 1933. Veterinary medicine was no longer attractive as a career to many prospective students, whose concept of the practitioner was that of "horse doctor."

Actually, the depression in veterinary medicine in that score of years served a useful purpose in focusing on the profession's fundamental service potential: The control and treatment of diseases of food-producing animals, particularly beef and dairy cattle, sheep, swine, and poultry. (Demand for specialized attention to ailments of pet animals had not yet arisen.) During World War II, the essentiality of competent veterinary services was placed in sharp focus. Special measures were developed to insure the most effective possible control of diseases of food-producing animals. Livestock losses from disease became of vital concern to the Nation, and the veterinary profession at all levels of private and governmental service cooperated in control programs.

*Postwar growth of profession.*—This "renaissance" in veterinary medicine as a profession and as a science was coupled with increasing recognition of the importance of competent animal disease control to the Nation's agricultural economy and to public health. These advances were reflected in the establishment of seven new veterinary colleges at State-supported institutions in the 10 years following World War II.

Today, there are 18 schools and colleges of veterinary medicine in the United States and 2 in Canada. The annual number of graduates has increased from the low of 127 in 1927 to more than 900 in 1960. Nearly all of these new graduates seek membership in the AVMA.

*Fields of professional activity for veterinarians.*—Seven broad fields of work are open to graduate veterinarians. These are:

1. Private practice, which includes large animal, small animal, and mixed practice.
2. Government service: Federal (domestic or international), State, and local (county or municipal) work in animal disease control, research, and public health areas.
3. Military service in the Army or Air Force Veterinary Corps.
4. Teaching.
5. Research.
6. Teaching and research (combined).
7. Commercial employment, which includes research on and production of biological and pharmaceutical products.

The borders of the biological, physical, and nuclear sciences are the only limits today for graduate veterinarians. More veterinarians will be needed in the next decade to serve the increasing human, livestock, and animal pet populations.

A breakdown of the professional activities of the approximately 19,500 veterinarians in the United States in 1958 reveals that 65.5 percent were in private practice—50 percent in general practice and 15.5 percent in specialized practice; that 17.7 percent were in Government service—including 4 percent in military service; that 4.5 percent were in teaching and/or research; that 1.5 percent were in commercial work; that 5 percent were retired or inactive; and 5.8 percent were in miscellaneous categories.

*Current activities.*—The current work of the American Veterinary Medical Association is carried out by officers, councils, and special committees. Representatives are named to work with allied organizations, governmental agencies, and conference groups. The association publishes two professional and scientific periodicals—the Journal of the AVMA, a semimonthly; and American Journal of Veterinary Research, a bimonthly publication. Other publications are designed for public education purposes. AVMA has prepared radio and television scripts and visual aids for use by constituent associations and members.

*Organization of the AVMA.*—The association is organized as follows:

Elective officers: The five elected officers are president, president-elect, vice president, executive secretary, and treasurer.

Executive board: The 15-member executive board is the administrative body of AVMA. Eleven members are elected from respective geographic districts in the United States and one member is elected from Canada. The president, president-elect, and immediate past president serve as ex officio members.

Board of Governors: The AVMA president, president-elect, and chairman of the executive board serve as the board of governors. They act for the board between its regular biannual meetings.

House of delegates: Delegates from the 60-odd constituent associations of the AVMA form the house of delegates. One delegate is

elected from each State and provincial veterinary medical association, plus one from other groups entitled to representation, such as the Army Veterinary Corps, Air Force Veterinary Corps, and National Association of Federal Veterinarians.

The house of delegates is the legislative body of the association and the voice of the active members. Its decisions, plus those of the executive board, determine the policy of the association.

Councils: Six councils are established to conduct AVMA activities. They are the judicial council, council on education, council on research, council on veterinary service, council on biological and therapeutic agents, and council on public health and regulatory veterinary medicine.

These councils are subject to the direction of the executive board. Each council appoints committees to study specific phases of a given problem; membership on these special committees is not restricted to council members. The councils report annually to the executive board and these reports are referred to the house for action.

Two boards of trustees: One board of trustees serves for the AVMA research fund trust and one for the AVMA group insurance trust.

Section officers: The annual meetings of the association are divided into six scientific sections. Each of the following sections has its own officers: general practice, research, small animal practice, poultry, surgery and obstetrics, and public health and regulatory veterinary medicine.

Headquarters executive and editorial staff: Full-time personnel in the Chicago headquarters include an executive secretary, a business manager, a general consultant, a director of professional relations and membership services, a director of public information, an editor in chief, and six editorial assistants.

The headquarters has seven departments: accounting, central files, circulation, membership records, subscriptions, reception, and library. Each department is headed by trained personnel.

Washington office: The association maintains a full-time representative in Washington to provide liaison with the various departmental agencies of the Federal Government, the Congress, and the executive branch. This office provides means for a two-way flow of information on impending and enacted legislation and departmental rulings on matters of concern to veterinary medicine and the profession. It also provides a contact and source of information for the Congress and other branches of the Government on veterinary medical and professional matters.

Women's auxiliary: Since 1917, a women's auxiliary has carried on increasingly effective and comprehensive programs which have aided AVMA's research, fundraising, public relations, and professional relations activities. The auxiliary now has a membership of 7,000.

## Section 3. Specialty Boards

### A. American Board of Veterinary Public Health

The American Board of Veterinary Public Health, a specialty board of the American Veterinary Medical Association, was established and incorporated in 1950 as a nonprofit organization. Found-

ers were a group of public health veterinarians and educators from schools of veterinary medicine in the United States. This specialty board was organized to recognize outstanding veterinary contributions to the medical sciences and to encourage higher standards of performance in the practice of veterinary public health.

Specialization in the field of public health materially increases the influence and usefulness of members of the veterinary profession, because it enables them to serve more competently with others in the allied arts and sciences of public health and preventive medicine. The American Board of Veterinary Public Health endeavors to interest and encourage young veterinarians to acquire further public health training and experience so that they may contribute more effectively to veterinary medicine and to the public health. Certification requirements include prescribed periods of formal training and experience and the successful completion of an examination in veterinary public health.

The objectives of the American Board of Veterinary Public Health are:

1. To further the educational and scientific progress in this specialty of veterinary medicine and to encourage education, training, and research in veterinary public health.
2. To establish and maintain the highest possible standards of training and experience for qualification as specialists in veterinary public health.
3. To provide recognition for such qualified specialists by suitable certification and other means.

### B. AMERICAN BOARD OF LABORATORY ANIMAL MEDICINE

The American Board of Laboratory Animal Medicine, a specialty organization of the American Veterinary Medical Association, was founded in 1955. Current membership is about 70.

Objectives of the board are to encourage research in laboratory animal medicine and to stimulate interest in this area among veterinarians. Membership requirements include: 5 years of experience in laboratory animal medicine, or a doctor of philosophy degree plus 3 years of experience; membership in the AVMA; and completion of an examination in laboratory animal medicine.

The board meets twice each year, in conjunction with annual meetings of the Animal Care Panel and the AVMA. At both sessions, scientific papers are presented and qualifying examinations are held.

*Field recognized professionally.*—In its first 4 years, the board's activities promoted wide interest in laboratory animal medicine and raised it to the level of a recognized veterinary specialty.

Present educational opportunities in the field are limited, however. Few colleges or research institutions offer postgraduate courses for veterinarians who wish to specialize in experimental animal medicine.

Research on laboratory animal diseases is a major need; at present, too little is known about the illnesses of these animals.

Laboratory animal veterinarians can serve mankind by discovering basic information and developing techniques that will improve the health of animals and enable scientific laboratories to conduct more effective research.

### C. THE AMERICAN COLLEGE OF VETERINARY PATHOLOGISTS

The American College of Veterinary Pathologists serves as a certifying body whose objective is to establish and maintain a high level of competency for veterinary pathology. It was established in 1949 by a group of recognized veterinary pathologists of the United States and Canada, and incorporated in the District of Columbia with the objective of furthering scientific progress in veterinary pathology and, especially, of establishing standards of training and experience which merit recognition of qualified specialists in the field.

The organization encourages veterinarians to enter veterinary pathology, to acquire training of acceptable standards, and thus to equip themselves to render maximum service to the public and to their profession. Those who meet the standards of training and competence established by the college are awarded a suitable certificate. A list of certificate holders is maintained for guidance of institutions and the interested public.

The objectives of the American College of Veterinary Pathologists are as follows:

1. To further scientific progress in the specialty of veterinary pathology.
2. To establish standards of training and experience for qualifications of specialists in veterinary pathology.
3. To further the recognition of such qualified specialists by suitable certification and other means.

The certificate evidencing qualification and membership in the college is granted only after the applicant has completed a minimum of 5 years of postgraduate study, training, and experience. At least 2 of those years must have been spent under the formal supervision of a preceptor approved by the council of this college and at least 1 additional year must have been devoted to teaching, research, or practice of veterinary pathology. The applicant must then have demonstrated upon thorough formal examination his ability to perform the duties and assume the responsibilities of a veterinary pathologist. Thus, the certificate is earned in the same way as a college degree and the standards that must be met are no less strict, the study and training no less arduous.

Educational and research institutions have come to recognize certification by the American College of Veterinary Pathologists as evidence of qualification when selecting a scientific staff.

## Section 4. U.S. Livestock Sanitary Association

The U.S. Livestock Sanitary Association emerged from the joint efforts of several States to deal with cattle tick or Texas fever. Outbreaks of cattle tick fever in Illinois, Missouri, and Kansas led to the first meeting at Fort Worth, Tex., September 28–29, 1897. The main purpose of this initial meeting was to urge the Federal Government to take more effective action in protecting the cattle tick fever quarantine line. At this initial meeting, other diseases were discussed, including tuberculosis—which was being vigorously combated at that time in Illinois.

From this beginning, the U.S. Livestock Sanitary Association developed into a nationwide organization of State and Federal live-

stock disease officials, ranchmen, and farmers interested in controlling livestock diseases.

*Disease prevention and control.*—The purposes of the association in clude: the study of livestock sanitary science, meat and milk hygiene, dissemination of information; the unification of the laws, regulations, policies, and methods pertaining to meat and milk hygiene; and the prevention, control, and eradication of transmissible livestock diseases.

The association coordinates the efforts of livestock regulatory organizations. It also serves as a livestock sanitary science clearinghouse between its own members and the following groups: Livestock owners, livestock sanitarians, meat and milk hygienists, veterinary practitioners, stockyards and auction markets, railroad and truck transportation companies, producers and distributors of milk and meat, and other interested agencies.

*Committees organized.*—To carry out its purposes, the association works through committees. They are appointed annually to study the problems of diseases and to make recommendations on methods of controlling or eradicating infectious diseases of livestock and poultry. Following is a list of the USLSA committees:

Advisory Committee to Agricultural Research Service of the U.S. Department of Agriculture; committees on biologics and pharmaceuticals, anaplasmosis, brucellosis, infectious diseases of cattle, eradication of hog cholera, laws and regulations, legislation, leptospirosis, parasitic diseases, transmissible diseases of poultry, public health, public relations, rabies, regulatory education, stockyards, markets, and transportation, infectious diseases of sheep and goats, transmissible diseases of swine, tuberculosis, vesicular diseases, disease control in livestock integration, and nominations.

The members of these committees include the following: educators; research workers; livestock producers; State, Federal, and practicing veterinarians; and others with recognized ability in livestock and poultry fields. Each committee studies the disease or subject with which it is concerned; it then holds open meetings the day before the annual meeting of the USLSA. Any person may attend and present his views.

*Recommendations for dealing with diseases.*—Committees report to the USLSA executive committee, which is composed of the State livestock sanitary official of each of the 50 States and representatives of the Departments of Agriculture of the United States and of the Dominion of Canada. When adopted by the executive committee, the recommendations constitute USLSA policy for dealing with the respective diseases or subjects.

In many instances, the committee reports have been adopted by the U.S.Department of Agriculture as the official program for the control and eradication of infectious diseases of livestock and poultry.

The association has played a significant part in the eradication of cattle tick fever, glanders, dourine, vesicular exanthema, and foot-and-mouth disease from the United States. The advice and counsel of its committees have materially aided the tuberculosis, brucellosis, and pullorum disease programs of the USDA.

*Obstacles.*—It is reported to the subcommittee that many barriers still exist to prevent the U.S. Livestock Sanitary Association from

utilizing its full potential of protecting the livestock and poultry industry of the United States. Among them are: Lack of adequate control of the health of animals moving from farm to market; lack of uniform requirement for proper cleaning and disinfection of vehicles handling all livestock; insufficient stress placed upon farm sanitation by schools and extension services; insufficient facilities and personnel to provide adequate control over the health of livestock and poultry entering the United States.

Nonetheless, the U.S. Livestock Sanitary Association strives to expand its contributions to man's health and welfare by its efforts to protect the health of animals.

### Section 5. National Assembly of Chief Livestock Sanitary Officials

The National Assembly of Chief Livestock Sanitary Officials was founded in 1935 by State regulatory officials. Membership is held by the State veterinarian or the chief livestock sanitary official in each State.

The assembly provides a forum for the discussion of the problems of chief regulatory officials. The assembly studies the best methods of handling animal and poultry disease outbreaks and exchanges practical ideas for control and eradication programs.

The assembly meets twice annually. Meetings introduce the newly appointed chief livestock sanitary official to his counterparts in other States. Sectional meetings for the assembly's four geographic groups—northeastern, southwestern, north central, and western—also are held each year. These groups deal with interstate health requirements; details of control and eradication of brucellosis, tuberculosis, hog cholera, and other infectious and contagious diseases; and other problems.

Working through the assembly, the chief livestock officials have developed greater uniformity in the regulations, programs, and procedures of the 50 States.

### Section 6. Association of Deans of American Colleges of Veterinary Medicine

The Association of Deans of American Colleges of Veterinary Medicine is concerned with the standards, quality, and problems of veterinary education in the United States and Canada.

The association, which was formed in 1937, evolved from informal meetings of the veterinary deans who attended other professional conferences. The deans of the two Canadian veterinary schools became association members in 1939. In 1959, the association extended associate membership to the deans of veterinary schools in Latin American countries.

The association holds its annual meeting concurrently with the American Veterinary Medical Association. Frequently, the deans hold a second session during the annual meeting of the American Association of Land-Grant Colleges and State Universities.

*Educational problems.*—Problems which confront the deans include entrance requirements, curriculum changes, teaching and re-

search facilities, accreditation, student dress, fiscal matters, libraries, and interprofessional relations.

The association works closely with the AVMA Council on Education. Through cooperative efforts of these two groups, the preprofessional requirements for veterinary students were increased in 1949 to a minimum of 2 years of college. The deans also cooperate with officers of the AVMA, the Agricultural Research Service of the USDA, the U.S. Public Health Service, State divisions of health, and State livestock regulatory and licensing officials.

Heads of foreign schools of veterinary medicine meet with the association on occasion. Individually, American veterinary deans serve on national and international committees on education and animal and human health. Many have gone to foreign countries as veterinary or animal industry advisors or consultants.

Currently, the association has great opportunities in training students to meet the complex challenges of atomic-age veterinary medicine.

### Section 7. Association of State Public Health Veterinarians

The Association of State Public Health Veterinarians was organized June 16, 1953, in Atlanta, Ga. Membership consists of executive veterinarians employed by the State and territorial departments of health to administer veterinary public health programs. At present, there are representatives from 33 States. The association was established to exchange information and to further the knowledge of veterinary public health among the chief veterinary public health officials in the State health departments. The association also strives for closer liaison between the medical, dental, nursing, and veterinary professions.

Activities are conducted in industrial hygiene, rural and urban health activities, tuberculosis programs, and studies involving the relationship of cancer in humans and animals. All animal disease control activities are conducted in departments of health in cooperation with State and Federal animal disease control agencies.

Some examples of specific projects conducted by members of the association are studies of lymphoma in dogs, leptospirosis in cattle and humans, Q fever in cattle, rabies in man and animals, virus encephalitides in wild and domestic birds and in horses, and salmonellosis in all animals. All investigative projects study the relationship of these diseases to human health. The protection of human health—the ultimate goal of these programs—is achieved by reducing or eliminating the disease in the animal reservoir, or by the development and use of transmission barriers.

### Section 8. Conference of Public Health Veterinarians

The Conference of Public Health Veterinarians, organized in 1946, is the national organization of persons who are professionally engaged, or actively interested, in the application of veterinary medicine to the prevention of disease, protection of life, and the promotion of the well-being and efficiency of man. The conference provides leadership in promoting the quality and effectiveness of veterinary public health activities wherever conducted.

Major objectives are listed below:

1. To create a greater awareness of the role and purpose of the veterinarian in public health through the following:
   a. Fostering and supporting dissemination to the general public of educational data pertaining to all phases of veterinary public health;
   b. Fostering and facilitating the exchange of scientific information between public health veterinarians and all other categories of public health workers; and
   c. Disseminating to all categories of public health workers the principles and practices of veterinary public health.
2. To create in the individual veterinarian a greater awareness of public health and his responsibilities in this field by the following:
   a. Fostering and supporting education, training, and research in veterinary public health programs and practices at all veterinary colleges and research facilities;
   b. Promoting and facilitating the exchange of scientific information on all phases of public health between veterinarians and their organizations and associations; and
   c. Promoting cooperation, liaison, and mutual support between the American Veterinary Medical Association and American Public Health Association in all public health matters having veterinary medical implications.

As a related organization, the conference holds annual scientific and business sessions in conjunction with the annual meeting of the American Public Health Association. A second business session is held each year during the annual meeting of the American Veterinary Medical Association.

In all of its endeavors, the conference works closely with other organizations of veterinarians, such as the American Veterinary Medical Association, the American Board of Veterinary Public Health, the Association of Military Surgeons of the United States, State and local veterinary medical societies, and the U.S. Livestock Sanitary Association. Close liaison is maintained with other scientific bodies in connection with activities of mutual interest.

Active membership in the conference is made up of graduate veterinarians engaged in public health activities of local, State, or Federal Governments; the Armed Forces; agriculture, food and drug agencies; research, teaching, or voluntary organizations. Associate membership is granted to graduate veterinarians whose activities do not qualify them for active membership at the time of application, or to individuals, possessing special qualifications and skills, who are contributing in some measure to progress in the area of veterinary public health.

### Section 9. Animal Care Panel

The Animal Care Panel was organized in 1947 by veterinarians and others who shared an interest in the problems of care of and for experimental animals. It serves as a forum for the exchange of data and ideas between scientists, technicians, and others associated with research animal work. The panel has expanded to include several hundred animal caretakers, commercial producers of laboratory animals, manufacturers of research animal equipment, and scientific in-

vestigators. Approximately 100 research and testing organizations are institutional members.

The panel conducts its program through meetings, committee work, and publications. Reports of scientific progress in animal care are presented at annual meetings. These papers cover genetics and breeding, equipment, disease, germ-free and pathogen-free animals, nutrition, and housing. Training sessions are held for animal caretakers and films on experimental animals are shown.

Typical of ACP committees are the Committee on Animal Transport and the Reference File Committee. The transportation committee makes recommendations for the carriage of experimental animals, evaluates the design of shipping containers, and assists institutions with animal transport problems. The Reference File Committee is developing a bibliography on laboratory animals and animal care.

The panel publishes "Proceedings", a quarterly journal containing scientific papers, technical notes, and reports on panel affairs. The ACP also runs a placement service and coordinates local chapter activities.

*Need for scientific care.*—Perhaps the panel's most important contribution has been the focusing of attention on the need for scientific care of experimental animals. Panel committees, frequently working with the Institute of Laboratory Animal Resources, have been instrumental in improving the animals' health, housing, and nutrition.

The number of animals used in research is increasing each year. It is estimated that 25 million mice, 9 million rats, 900,000 guinea pigs, 500,000 rabbits, 250,000 monkeys, 250,000 dogs, and 100,000 cats are used annually in the United States for research, teaching, and testing purposes. In addition, many burros, canaries, hamsters, pigeons, and chickens are used. The value of these laboratory animals approximate $250 million.

The disease problems of test animals require continued and forceful research. The difficulties of providing animal stocks free of pathogenic organisms must be solved. Another major problem is to stimulate the interest of research workers in the diseases and nutrition of their laboratory animals.

*Veterinarians' role.*—Veterinary services are necessary in the production and care of healthy, well-nourished laboratory animals. Veterinarians serve as administrators of research animal colonies and consultants on animal disease problems for Government laboratories, universities, private research facilities, and commercial production establishments. It is reported that there is an increasing need for veterinary centers that would specialize in the diagnosis of diseases of experimental animals.

An educational campaign for research workers on diseases and nutritional problems of laboratory animals would pay dividends in future human and animal medical research.

## Section 10. Zoo Veterinarians Association

Zoological parks and other animal exhibitions are making ever-increasing use of the veterinarian's resources and abilities. Even before World War II, administrators recognized the veterinarian as a necessary member of the zoo staff. The zoo veterinarian's primary job is the

clinical treatment of exotic animals. He also is responsible for prevention and control of zoonoses—diseases common to man and animals—as well as animal breeding, dietary regulation, and the welfare of exhibit animals, which are a prime source for public enjoyment and education.

The Zoo Veterinarians Association was organized to disseminate and exchange information regarding the care and treatment of exotic animals. In 1959, the association had 94 members. It meets yearly during the American Veterinary Medical Association's annual convention. It circulates reprints and case reports to all its members. These reprints and reports deal with pathological examinations of diseased specimens, clinical and surgical treatments, and the diagnoses of animal diseases.

*Animals kept healthy.*—The zoo veterinarian has an important role in preventive medicine. Effective preventive medicine procedures not only insure exhibition of healthy animals, but also protect the public from exposure to diseases through contact with the animals on exhibit. The development of techniques for vaccination of exotic animals against zoonoses, such as rabies, feline panleukopenia, canine distemper, canine hepatitis, makes possible the exhibit of these animals without endangering human health. The routine testing and examination of animals for internal and external parasites, tuberculosis, psittacosis, and other infectious diseases have done much to eliminate the possible spread of disease to other zoo animals, to humans, and to local livestock populations.

Important advances in dietary regimens and general animal husbandry practices have enabled zoos to continuously exhibit animals that were, in former years, kept on exhibit for only a few weeks or months. In addition, new techniques developed by veterinarians have resulted in breeding and reproduction of animals that previously did not reproduce in captivity. Numerous techniques for the restraint and treatment of captive animals have been devised by zoo veterinarians. These are constantly being improved to facilitate safe, expeditious handling of zoo animals.

The zoo veterinarians have disseminated their specialized knowledge of exotic animals to private individuals and smaller animal exhibitors. Use of this information has aided these exhibitors in maintaining collections of the more unusual animals by reducing the danger of transmission of disease to people and domestic animals.

*Data on zoo animal diseases.*—Zoo veterinarians have built up a valuable fund of information on the care, diseases, and treatment of a wide variety of zoo animals. The detailed reports of diseases of these animals are of interest to medical research workers using laboratory animals.

# PART IV—VETERINARY MEDICAL DRUGS AND BIOLOGICALS

## SECTION 1. INTRODUCTION

From the outset of its study in late 1958, the subcommittee recognized the importance of a full description of the significant work of the American pharmaceutical industry.

In part II of Senate Report 142, the staff analysis of U.S. biomedical research, there will be summarized a wide variety of data contributed by the drug industry as regards its international role.

Within the present publication, we refer only to that branch of the industry active in veterinary drugs and biologicals.

Veterinary drugs and biologicals constitute the most potent single weapon available to the veterinary profession in its battle against animal diseases. Through research, new drugs and biologicals are constantly being added to the veterinarian's armamentarium. Outstanding examples of these are new antibiotics and the modified-live-virus vaccines used to control rabies, canine distemper, hog cholera, and poultry respiratory diseases.

*Industry and government work closely.*—The need for group action was recognized by the U.S. veterinary biological industry, which formed the Veterinary Biological Licensees Association in 1947. The VBLA has worked to improve the quality and to develop standards for individual veterinary biological products. These standards, in most cases, have been adopted by the Animal Inspection and Quarantine Division of the Agricultural Research Service as U.S. Department of Agriculture requirements for biological products. In this manner, private industry and government have worked closely to assure quality products reaching the consumer.

*Biologics must meet requirements.*—The Animal Inspection and Quarantine Division has the responsibility for licensing veterinary biologicals and establishments which produce them. The Division briefly describes a biological as a preparation for actively or passively immunizing animals. The Division requires that biological products meet certain standards for quality, that the label is accurate in describing care, use, and limitations, and that the product is safe to use and will not spread animal diseases. It also regulates the importation and shipment of pathogenic organisms and vectors affecting animals into the United States from other countries. (These organisms are usually sent to research scientists in this country for their studies. See p. 172.)

Veterinary biological licensing and inspection has restored faith in the once discredited hog cholera serum industry by insuring the reliability, purity, potency, and safety of biological products. Another Federal agency, the Food and Drug Administration, has the responsibility for approving each new veterinary drug.

Evaluation of new biologicals and adequate inspection of products now in production require thorough laboratory testing to prove that the product is not worthless, contaminated, dangerous, or harmful. The National Animal Diseases Laboratory, which recently opened at Ames, Iowa, will provide new facilities for testing veterinary biologicals.

*Assistance to foreign countries.*—As earlier indicated, one of the ways in which American veterinary medicine aids underdeveloped countries is by assisting in the development of livestock industries. Information on the production of biologicals and their use has contributed much to this phase of assistance. The International Cooperation Administration sends veterinarians to many of these underdeveloped countries to assist in planning and equipping biological laboratories. (See International Cooperation Administration, p. 182.) Others have been sent to assist in developing programs for the prevention of animal diseases through use of biologicals.

Private veterinary drug and biological companies have sent many of their veterinarians to foreign countries to lend assistance to the production of biologicals.

Veterinary drugs and biologicals are produced and shipped to foreign countries from the United States. Many U.S. firms also maintain subsidiary plants in foreign countries to produce these products. In both American and foreign plants, veterinarians are employed to assure the development of quality drugs and biologicals. These products are helping to reduce animal losses and raise living standards in foreign countries.

Veterinarians of foreign countries have come to this country to receive training in the production and use of veterinary drugs and biologicals. This training is given at colleges of veterinary medicine, drug and biological companies, and Government agencies concerned with animal disease control work. Much of this type of training is under the direction of the Foreign Research and Technical Programs Division, ARS. (See Foreign Research and Technical Programs Division, p. 188.)

*Safeguarding human health.*—As indicated in section 3, hereinafter, the Food and Drug Administration of the U.S. Department of Health, Education, and Welfare contains a veterinary medical branch. This branch is responsible for the safety and efficacy of drugs used in animals; false or misleading labels are prohibited.

In fulfilling its responsibility to safeguard human health, the Veterinary Medical Branch of FDA must also consider the possibility of drug residues in food animals and their products. It also regulates animal feeds containing additives used to increase animal weight gains.

*Greater exchange of information possible.*—Veterinary drugs and biologicals developed in the United States are often quickly adopted for use in foreign countries. Foreign-developed biologicals find good use in this country. An example of this is an anthrax vaccine developed in South Africa and now used widely in the United States.

While there has been some exchange of veterinary biologicals between countries, this exchange could be increased. Cross-testing and cross-checking of biologicals between countries should provide information that would be helpful in the prevention and control of animal

diseases. Often, the absence of exposure to a certain disease builds up an ultrasusceptible animal population; these animals react differently than animals which have been raised in epidemic or endemic areas.

The trend toward the almost complete use of modified-live virus vaccines for immunizing animals against diseases has created new problems. One of these is the need for procedures and standards to test these new type vaccines for safety, potency, and stability. Biological producers and Government agencies need to devote more attention to this problem if proper evaluation is to be made of existing and new biological products. Funds, facilities, and specially trained personnel will be required to solve this problem.

Drugs and biologicals furnish the greatest single potential in fighting animal diseases. Constant efforts must be made to develop new products and improve old ones.

## Section 2. Animal Inspection and Quarantine Division, Veterinary Biologics Control, Agricultural Research Service

Biological products used in veterinary medicine are regulated by the Animal Inspection and Quarantine Division of Agricultural Research Service, USDA. This Division also conducts activities involving inspection and quarantine of imported animals and their by-products. This program is discussed in the section on inspection of import and export animals and products. (See p. 117.)

The animal quarantine law of 1903 placed Federal controls on organisms and vectors that cause animal and poultry diseases. These controls were later extended to cover all foreign veterinary biologics after foot-and-mouth disease was brought into the United States in contaminated smallpox vaccine.

*Anti-hog-cholera serum.*—USDA scientists developed an effective anti-hog-cholera serum in 1907. However, limited Government production could not satisfy the demand that resulted from widespread hog cholera outbreaks. Worthless or harmful commercial serum flooded the markets and tended to discredit the worth of all disease-control products. To restore farmers' confidence in American biologics, the Virus-Serum Toxin Act of 1913 set up quality standards. Serum shortages during later hog cholera outbreaks caused disastrous swine losses. The lack of sufficient reserves prompted Federal regulation of the supply of anti-hog-cholera serum and hog-cholera virus.

Veterinary biologics and the establishments in which they are produced are licensed and inspected by USDA. These Federal controls guarantee the livestock and poultry industries that the product meets standards for quality; that the label is accurate in describing care, use, and limitations; and that the product will not spread animal diseases.

*Types of biologics licensed, 125.*—On June 30, 1959, 125 types of veterinary biologics were produced at 65 licensed establishments operated under USDA inspection. A total of 618,668,968 milliliters of anti-hog-cholera serum, 123,810,265 milliliters of hog-cholera virus, and 3,925,104,430 doses of other biological products were inspected in 1959. About 3.5 million milliliters of hog cholera products and 92 million doses of other products were destroyed because they were worthless, contaminated, dangerous, harmful, or over age. The in-

62587—61——13

spection program was conducted by 33 veterinarians, 22 virus-serum inspectors, and 10 clerks.

Importation and shipment of organisms and vectors that cause animal and poultry diseases have been regulated for over half a century. Control of these agents is of inestimable value in preventing the spread of disease. Animal Inspection and Quarantine Division veterinarians review all applications for bringing animal disease organisms and vectors into the United States or for moving them interstate. Before permission is granted, the research agency must show that its use of the organism will not endanger American livestock and poultry. The research scientist is responsible for using and disposing of the organisms safely. Some extremely dangerous disease-producing agents, such as the viruses of rinderpest and foot-and-mouth disease, are restricted from the United States and its possession. This control of foreign disease organisms and vectors allows vital research to continue, but prevents the introduction of disease.

*Hog cholera product supply insured.*—USDA supervision of anti-hog-cholera products insures the swine producer of an adequate supply at reasonable cost. The serum industry is required to maintain reserve serum stocks.

USDA veterinary licensing and inspection have restored faith in the serum industry by insuring the reliability, purity, potency, and safety of biological products. There have been no nationwide hog cholera outbreaks since Federal controls were imposed on supplies of serums and viruses.

*Problems and future.*—Laboratory facilities have long been needed to develop standards for the evaluation of new biologics and to determine the quality and reliability of products already on the market. These facilities will be provided in the National Animal Disease Laboratory at Ames, Iowa. However, it is reported that technical staff and equipment for veterinary biologic licensing and testing must be provided.

Strengthening the existing programs of international organizations, so that exchange information on current veterinary biologic tests and standards is improved, would benefit participating countries and encourage them to improve the quality and safety of their products.

An extensive educational program is needed to continually alert scientists of the danger inherent in indiscriminant importation of animal disease organisms.

## Section 3. Veterinary Medical Branch, Food and Drug Administration

In 1906, Congress passed the original pure food and drug law. Its enforcement was originally a function of the Bureau of Chemistry of the U.S. Department of Agriculture. Congress passed a completely revised, more comprehensive Food, Drug, and Cosmetic Act in 1938. Two years later, the Food and Drug Administration was transferred to the Federal Security Agency. In 1953, FSA became the Department of Health, Education, and Welfare.

*Objectives.*—The Veterinary Medical Branch is one of five branches in FDA's Bureau of Medicine. It is directly responsible for the safety

and efficacy of drugs, devices, and medicated feeds which are intended for use in livestock and poultry. Sales of veterinary drugs covered by the Federal Food, Drug, and Cosmetic Act totaled $160 million in 1958.

The basic objective of the FDA veterinarian is the protection of human health. To accomplish this, he must develop and use scientific methods of detecting and testing worthless or harmful veterinary medical drugs. The Veterinary Medical Branch must be thoroughly convinced of the safety of new veterinary medical preparations that enter interstate commerce. Manufacturers are required to submit data to prove that the recommended use of the drug in food-producing animals is safe for the ultimate human consumer. Then, veterinarians decide by tests and other criteria, such as prerequisite conditions for manufacture, whether the product will result in residues, or metabolites of questionable safety in the edible tissues of a treated animal, or its milk or eggs.

*Pure, wholesome products.*—Compliance with the Food, Drug, and Cosmetic Act insures that foods, drugs, devices, and cosmetics are pure and wholesome, safe to use, made under sanitary conditions, and truthfully labeled. With the exception of the section on habit-forming drugs, all the provisions dealing with adulterated or misbranded drugs, devices, and foods apply to veterinary products. Certifiable antibiotics, which include penicillin, streptomycin, dihydrostreptomycin, bacitracin, chloramphenicol, chlortetracycline, tetracycline, and their derivatives, used in therapeutic drug products and animal feeds are regulated by FDA.

The Food Additives Amendment of 1958 extended the scope of FDA veterinary activities to food additives. A food additive is any substance which becomes a component of food or affects food characteristics. Thus, any drug used in a food-producing animal is a potential food additive. FDA places proof of the safety of additives on the manufacturer. All manufacturers must submit data concerning residues in the tissues of food-producing animals.

*New veterinary drugs.*—Before marketing a new medicament for animals or poultry, a manufacturer submits an official new drug application. Veterinary Medical Branch personnel review each application or supplement. If the product satisfies FDA requirements, the manufacturer may market it. During the 1959 fiscal year, 91 new drug applications for veterinary drugs and 444 supplemental applications were submitted.

Since 1949, more than 1,500 original applications for new drugs have been reviewed by the Veterinary Medical Branch. The rapid growth of the veterinary pharmaceutical industry is indicated by the fact that 3,449 supplemental applications and 1,446 permits to market animal feeds containing certifiable antibiotics were reviewed by FDA from 1955 through 1958.

*Violations.*—FDA has approximately 360 field inspectors who periodically inspect 84,000 establishments involved in the manufacture, sale, and distribution of regulated items. Additional thousands of retail establishments handle products subject to FDA supervision. Inspectors' reports of violations involving veterinary drugs, devices, or medicated feeds, and the veterinarians' recommendations for regulatory actions are referred to the FDA Bureau of Enforcement. Violations frequently involve misbranding or misleading labeling, based on

exorbitant claims, omission of required warning statements, inadequate directions for administration, or failure to provide informative dosage recommendations. If the label does not declare the ingredients correctly, FDA makes a charge of adulteration.

Since FDA began enforcing the laws against adulterated and misbranded veterinary drugs in 1928, most worthless drug products have disappeared from interstate channels. Formerly, new preparations were represented as preventatives or treatments for such serious animal diseases as hog cholera and brucellosis. Today, with rare exceptions, manufacturers have accepted responsibility for marketing ethical products that have been scientifically tested; they no longer rely on information obtained from "satisfied users" and uncontrolled field tests.

Devices or apparatus that claim to be of therapeutic value to animals or poultry still are marketed occasionally. One example of this was a new device, from which "long violet rays" emanated, and which was described by the manufacturer as an effective method for treating a variety of diseases from mastitis in cows to blackhead in turkeys. Scientific tests found that the device was potentially dangerous to both the operator and the animal being treated. FDA action removed it from the market.

*Relationship with industry.*—FDA's efforts are directed toward establishing a relationship with the industry which must conform to the Food, Drug, and Cosmetic Act that will benefit the industry and the users of its products. An example of such cooperation is the symposium on medicated feeds, sponsored by the Veterinary Medical Branch in January 1956. Scientific material from the symposium has been collected in a book, which is considered a classic reference on medicated feeds, and is widely used by the industry. The book is entitled "Symposium on Medicated Feeds."

The FDA is constantly alert to reports of unusual responses to drugs and medicated feeds or outbreaks of unknown etiology. In 1957, broiler producers were losing large numbers of birds. FDA investigations showed the disease was caused by a toxic material in fatty byproducts used in several brands of commercial feeds. The material was identified as a residue from the production of fatty acid that had been incorporated in poultry feed to induce more rapid growth. Methods of assay for this material were developed, and the material was removed by feed processors.

*Foreign visitors.*—In the past few years, the Veterinary Medical Branch has received official delegations from Japan, Russia, and some South American countries. The free exchange of ideas and information during these visits has contributed to an environment favorable to the growth of understanding.

*Problems.*—It is reported that the Veterinary Medical Branch facilities at Beltsville, Md., are inadequate to accommodate the research which should be conducted to protect human food supplies. The effects of radioactive fallout and contaminated feeds on edible tissues and products of food-producing livestock is a significant new field of study that must be explored.

The subcommittee has been advised that FDA veterinarians have carried heavy workloads and frequently have been hampered by lack of funds, which also has limited their participation in scientific meetings to which they have been invited.

## Section 4. Veterinary Biological Licensees Association

The producers of veterinary biological products in the United States have been instrumental in many advances made in veterinary medicine. The products of this industry reflect the utilization of research findings in the control, prevention, and treatment of animal diseases. The development of new products and the upgrading of old products have kept pace with livestock and pet owners' needs arising from outbreaks of new diseases and changes in animal production and management.

The industry is made up of many companies engaged in production of veterinary biologics and in research to develop new products or to improve those already on the market. Each biological product must meet certain requirements and be licensed by the U.S. Department of Agriculture before it can be made available to the livestock industry.

*Origin.*—Although companies independently produce and distribute licensed products to aid in animal disease control, they cooperate through the Veterinary Biological Licensees Association. This group was organized in 1947. It immediately undertook a study of the value of mixed bacterins in animal disease control. When the study was completed, the majority of association members decided to continue production of mixed bacterins.

*Quality of biologics.*—After a few years of comparative inactivity, the VBLA was reorganized and strengthened in 1952. The objectives were redefined as follows:

1. To improve the quality of biological products used in the diagnosis, prevention, and/or treatment of animal diseases.
2. To work with Federal regulatory agencies to create better understanding of mutual problems.
3. To promote the interests of the livestock industry.

Membership was expanded to 29 companies. Each company is represented by specialists in research and development, production, or testing and standards.

*Standards established.*—The association has established standards for individual veterinary biological products, which assure a quality product. The VBLA has also been concerned with improvement and standardization of testing methods for all animal biologics produced in the United States. This work has been done in cooperation with the Animal Inspection and Quarantine Division of USDA. When new standards are recommended by VBLA, each veterinary biological producer adopts them for 1 year. If satisfactory, these standards are officially adopted at the end of the trial period. The standards of quality will continue to be upgraded as a result of industry's group action.

*Advances in disease control.*—Individual veterinary biological companies have been responsible for many significant advances in animal disease control. Among the products that member companies of VBLA have introduced for the control of animal diseases are the following:

1. *Rabies vaccine.*—A modified-live-virus rabies vaccine of chicken embryo origin was licensed for use in dogs in 1949. This vaccine was produced by the technique of modifying the virulence of the rabies virus by passage in chicken embryos. The vaccine has demonstrated its

effectiveness in the prevention of rabies in dogs and is being used in increasing amounts. Routine vaccination of dogs with this modified-live-virus vaccine aids in maintaining an immune dog population. In turn, immune dogs reduce the possibility of rabies transmission from wild animal hosts to man.

2. *Equine encephalomyelitis vaccine.*—The introduction and use of a vaccine for equine encephalomyelitis has been highly effective in the prevention of sleeping sickness of horses. This vaccine is prepared by culturing Eastern, Western, and combined types of encephalomyelitis virus in chicken embryos and then inactivating the virus with formalin, a technique used in the production of other vaccines of this type for other diseases.

3. *Bluetongue vaccine.*—The use of a modified live-virus vaccine has made possible the prevention of bluetongue in sheep in areas where the disease occurs seasonally. This disease was diagnosed in the United States in 1952.

American scientists utilized research that had been conducted in South Africa to identify the bluetongue virus and develop a vaccine. Three biological firms in the United States produced vaccines, which were licensed and placed on the market in 1954.

4. *Hog-cholera vaccines.*—Modified-live-virus vaccines to protect hogs against cholera were introduced in 1951. These new vaccines were perfected through intensive research conducted by individual biological companies and have demonstrated their effectiveness.

5. *Infectious bovine rhinotracheitis vaccine.*—A modified-live-virus vaccine is used to prevent serious economic losses from infectious bovine rhinotracheitis. This disease, which was first recognized in 1954, causes severe losses in weight in cattle. When scientists found that the virus could be modified in virulence by serial passage in tissue culture, a vaccine was developed. It was marketed in 1957.

6. *Anthrax vaccine.*—Anthrax vaccines for animals have been available since Pasteur developed the first one in 1879. An improved vaccine, without the disadvantages of Pasteur's vaccine, was developed by Dr. Max Sterne in South Africa in the 1930's and 1940's. Dr. Sterne first produced a mutant strain of the anthrax organism, which lost its ability to form a capsule. This type of vaccine is incapable of causing disease in animals, but is highly effective in protecting animals against anthrax. Research workers and biological producers in the United States recognized the success of this vaccine in South Africa and secured the organism. They then introduced this type of vaccine in the United States in 1953. It has been found to be highly effective in safely and rapidly immunizing farm animals against anthrax.

7. *Enterotoxemia vaccine.*—Vaccines and antitoxins that prevent toxemias have greatly reduced the hazards in sheep production. Overeating disease, also called pulpy kidney disease or enterotoxemia, has caused high losses in sheep and other livestock being fattened for market. Australian and New Zealand research workers found the disease is caused by a toxin liberated in the intestines of sheep under certain feeding conditions. Then they developed an effective vaccine. An improved vaccine was made available commercially in the United States in 1948. Since that time other toxins have been found to be important causes of this disease, and other vaccines have been de-

veloped. Antitoxins also are available for immediate, short-term protection of animals.

*Future trends.*—Many diseases of animals still resist control. Continued research is necessary to develop effective immunizing agents against anaplasmosis, vibriosis, atrophic rhinitis of swine, shipping fever of cattle and sheep, and many others. VBLA members help farmers and veterinarians prevent and control animal diseases by the development and production of safe and effective immunizing products.

# PART V—ORGANIZATIONS ACTIVE IN VETERINARY MEDICINE IN THE INTERNATIONAL SPHERE

Consistent with the international focus of Senate Resolution 347, 85th Congress, authorizing an international health study, this part is exclusively devoted to the interrelationship of American and foreign veterinary medicine.

If only for the reason of supply of food, much less fiber, man's fate is linked inexorably with the supply and well-being of animals throughout the world.

No study of the health of the world could fail to come to grips with the fact that essential to the health of increasing population is man's improved ability to feed himself.

The oft-repeated statement that "half of the people of the world go to bed hungry every night" is but one of the many reminders that the availability or unavailability of food is one of the most crucial effects of and contributors to the condition of man. It is not only, however, the amount of food, but the quality of food which counts. In all these connections, veterinary medicine plays a crucial role.

Not only, however, do animals provide meat, milk, and other dairy products, but livestock provide much of the draft power on farms in the emerging areas of the world. They transform rough feed into manure which is still essential in many countries for soil fertility. They provide fibers without which man could not adequately clothe himself.

The health of animals, their ability to perform satisfactorily in all the varying environments throughout the world in terms of terrain, climate, soil conditions, available feed, etc., is therefore, a crucial determinant of man's ability to sustain himself.

All types of animals are involved. No American need be reminded of the value of dairy or beef cattle to mankind. But a close study of the problems of peoples throughout the world reveals the crucial importance of the livestock which are characteristic of their societies—the yak, the water buffalo, and other animals which are exotic in our terms but familiar as life to them.

## Section 1. Introduction

The participation of veterinarians in international organizations and cooperating U.S. agencies helps to promote cooperation and better relations between the United States and foreign countries. This international cooperation sets the stage for improved animal and human health in countries throughout the world. The goals of these programs are:

1. Cooperating with the peoples of other countries to develop their local animal resources more completely.
2. Exchanging information about new developments in animal disease and parasite control with other countries.

3. Training veterinarians and developing educational programs through exchanges, missions, seminars, and formal studies.

4. Enabling other countries to improve their veterinary and public health programs through the activities of veterinary advisers on oversea assignments.

*International exchange of animal disease knowledge.*—Through a free exchange of information between veterinarians in all parts of the world, new research information and improved techniques are adapted and applied to livestock production.

The oldest international professional association is the World Veterinary Association. This association has been promoting animal health since its organization in 1863. It has held 16 international meetings, which have made significant contributions to veterinary science.

A younger organization, the International Office of Epizootics (OIE), was formed in 1925. It coordinates the efforts of member nations in the worldwide fight against animal diseases. In collecting and disseminating information concerning the incidence of animal diseases, OIE stimulates world cooperation. It also encourages and coordinates international collaboration in research on infectious animal diseases.

Advancing the science of veterinary medicine in the Americas is the objective of the Pan American Congress of Veterinary Medicine. This association has held three meetings to exchange information on veterinary education and animal diseases.

*Veterinary public health in international organizations.*—The World Health Organization and the Pan American Health Organization both recognize the importance of veterinary medicine. WHO integrated veterinary medicine into its program at its inception. At first, PAHO, as it is now known, was mainly concerned through its operating arm, PASB, with diseases of man; later, it broadened its scope to include animal diseases important to human health and economy.

Today, these international organizations conduct active programs to prevent rabies, brucellosis, tuberculosis, leptospirosis, hydatidosis, viral encephalitides, salmonellosis, and other zoonoses.

PASB has established an international zoonoses center at Azul, Argentina, to study animal diseases that are transmissible to man and to provide training and consultation on these diseases. A zoonoses expert committee, formed in 1950 by WHO in collaboration with the Food and Agriculture Organization of the United Nations, has promoted a campaign to eradicate bovine tuberculosis in Western Europe.

*Cooperating U.S. agencies.*—The U.S. Departments of Agriculture, State, and Health, Education, and Welfare have actively promoted international cooperation in the prevention of animal diseases. This cooperation has served the interests of the United States by—

1. Obtaining information on animal diseases and new developments for their control in other countries so that such information can be evaluated and applied in this country when appropriate.

2. Reducing the level of animal disease in other countries, thereby reducing the danger of introducing foreign diseases into the United States.

3. Creating a better understanding of the reasons for quarantine regulations that govern the movement of livestock and livestock products into the United States.

4. Improving the standards of veterinary medicine, thus increasing the reliability of certifications of imported livestock and livestock products.

5. Developing friendly relations with other countries.

The Foreign Agricultural Service of the USDA was assigned a leadership role in representing the United States in its participation with the Food and Agriculture Organization of the United Nations. The United States is also a member nation of PASB; it often sends observers to OIE meetings.

Beginning with the point 4 technical programs, American veterinarians have been officially assigned to aid underdeveloped countries. American veterinarians, assigned to programs of the International Cooperation Administration, have helped to lift the standards of living in many foreign countries. These veterinarians have aided in formulating and conducting animal disease control programs in emerging nations. Other veterinarians have conducted research and teaching activities. ICA has brought many veterinarians to this country for training in meat inspection, animal disease research, and regulatory work.

The Foreign Research and Technical Programs Division, ARS, has the responsibility in the USDA to train foreign veterinarians in animal disease research and control. This training is given in colleges of veterinary medicine, veterinary science departments of land-grant colleges, State departments of agriculture, and Federal animal disease research and regulatory agencies. Through this training, veterinarians have become better equipped to contribute to animal disease prevention and control in their homelands.

*Surpluses utilized for research.*—Veterinary medicine has the opportunity of contributing to the improvement of the health of animals and, in turn, the health of man through a USDA program of research abroad. Under Public Law 480 (the Agricultural Trade Development and Assistance Act of 1954), American surplus agricultural commodities are exchanged for foreign currencies. These funds remain in the country in which the commodities are sold and are used to support agricultural and animal disease research. This research may be of a basic nature or designed more specifically for application in control or eradication programs of animal diseases existing in the United States or in the foreign countries involved. Through this program, veterinary research has a challenge to aid in the improvement of man's health and welfare in all parts of the world and to strengthen the relationships of the United States with many foreign countries.

*Potential development.*—Cooperative international veterinary activities can bring about improvements in animal health throughout the world. (See Animal Disease and Parasite Research Division, p. 28; Animal Disease Eradiction Division, p. 103.) The accomplishments of the past 15 years amply demonstrate what can be achieved. In many instances, modest efforts to improve sanitation and reduce the incidence of animal diseases in foreign countries have directly contributed to better health for both man and animals.

Increased travel by veterinarians from the United States to and from other countries would be one way to possibly increase the exchange of information about animal diseases. For example, a Scandinavian veterinarian, during a visit to the United States in 1947, described the success of the milk ring test that was in use in his country. American veterinarians evaluated and adopted the test, which has proved to be one of the best tools available for brucellosis eradication in dairy herds.

Many nations of the world have virtually no programs to control devastating animal diseases transmissible to man. Many disease control techniques have been perfected in the United States and other highly developed nations and this scientific knowledge is now available.

*Restrictions on international cooperation.*—When asked what is the major obstacle to future progress in this area, the subcommittee was advised that it is the limitation of available funds. Often, money is not available to carry out planned programs, scientific meetings and seminars, and exchanges of veterinarians. Funds and personnel for participating in international organizations or for advancing the animal health programs of underdeveloped countries must apparently come mainly from the countries with highly developed animal industries, including the United States. It has been demonstrated that animal diseases, like those affecting humans, know no political frontier and constitute an ever-present danger to all countries in the world when epidemics occur. To strengthen our international veterinary activity would be, in the judgment of experts reporting to the subcommittee, to serve our own interest as well as that of others.

## Section 2. International Cooperation Administration

The work of the International Cooperation Administration, the oversea technical assistance arm of the U.S. Government, is described at length in part II, an appendix volume to the subcommittee's hearings held in July 1959.

Herein, reference is solely made to that phase of the program of the International Cooperation Administration as to what technical assistance is provided in the control of livestock diseases to foreign governments upon request. From 1952 to 1959, ICA and its predecessor U.S. agencies assisted local authorities in 19 countries with animal disease programs and the training of veterinarians. (See fig. 25, "ICA Veterinary Medical Aid, 1952–59.")

*Disease prevention demonstrations.*—American veterinarians assigned to each country have assisted the ministry of agriculture in developing programs for the prevention and control of livestock diseases and parasites. These veterinarians have demonstrated practical parasite treatments and sanitary practices to groups of native livestock owners. After the disease prevention demonstrations, farmers have become interested in active participation in agricultural programs and organized cooperatives. Community dipping vats designed to control the parasites that are most detrimental have been built for use on a time schedule. Diagnostic clinics have been established in some countries. Local veterinarians and lay vaccinators have been trained, and mobile vaccinator teams have been organized.

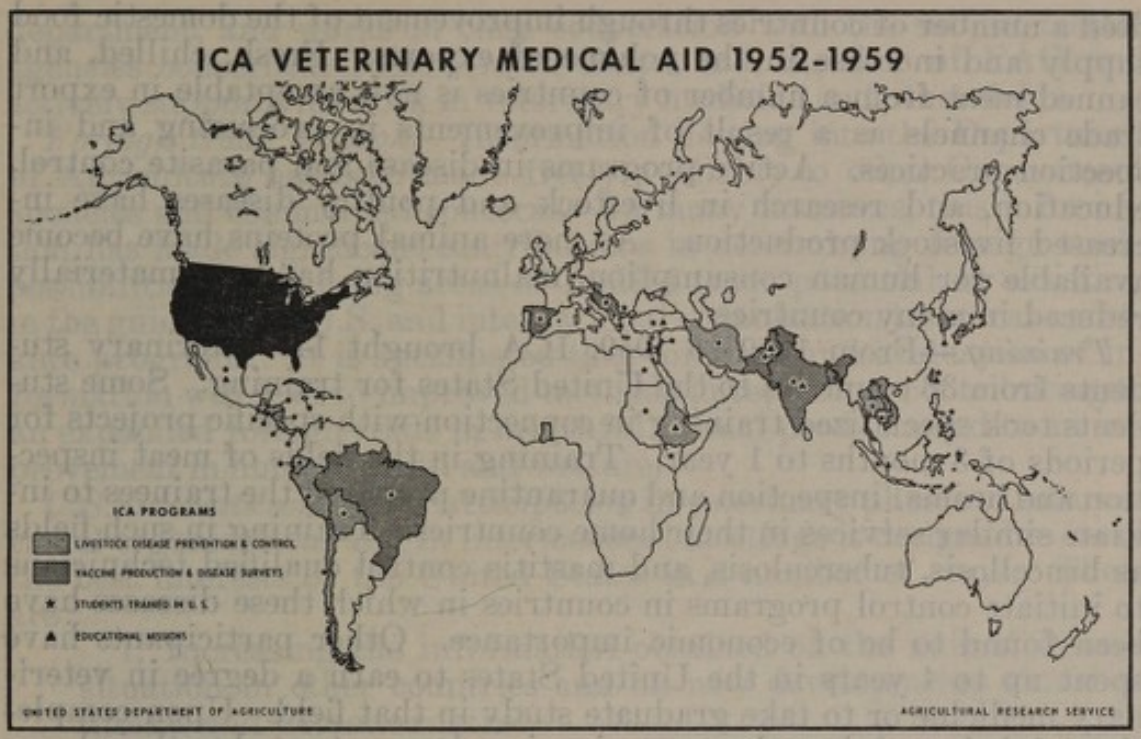


FIGURE 25

*Vaccination programs.*—Extensive vaccination programs for the control of rinderpest and other devastating diseases are being carried out. A regional rinderpest eradication program for southeast Asia is now in operation. Eradication of rinderpest has been accomplished in Thailand and substantial progress is being made in the other countries. In Formosa and Korea, lapinized, modified-live-virus vaccines are being produced for the prevention, control, and eventual eradication of hog cholera.

In a number of countries, both financial and technical assistance has been provided in developing laboratories for the production, biological assay, and standardization of vaccines and serums. Modern equipment has been installed and local technicians have been trained for maintenance and operation.

*Cooperation with FAO.*—The ICA and the Food and Agriculture Organization of the United Nations have coordinated those programs in countries in which both provided veterinary assistance. The two agencies have cooperated in carrying out surveys to determine the prevalence of disease, in equipping laboratories for vaccine production, and in conducting immunization programs. They have also provided assistance in veterinary education through classroom training, demonstrations, and establishment and operation of the diagnostic clinics under supervision of qualified veterinarians. Mobile vaccination teams use ICA or FAO transportation facilities in carrying out disease control programs. Survey teams also use these vehicles in carrying out a testing program to determine the incidence of brucellosis, bovine tuberculosis, and other diseases. Research technicians have been assigned to specific disease problems and pilot projects have been developed to determine the practicability of suggested solutions to certain problems.

*Improved food quality.*—Technical assistance in drafting and promulgating sanitary codes and food inspection regulations has bene-

fited a number of countries through improvement of the domestic food supply and increase in the volume of exports. Fresh, chilled, and canned meat from a number of countries is now acceptable in export trade channels as a result of improvements in processing and inspection practices. Active programs in disease and parasite control, education, and research in livestock and poultry diseases have increased livestock production. As more animal proteins have become available for human consumption, malnutrition has been materially reduced in many countries.

*Training.*—From 1952 to 1959, ICA brought 149 veterinary students from 36 countries to the United States for training. Some students took specialized training in connection with specific projects for periods of 3 months to 1 year. Training in the fields of meat inspection and animal inspection and quarantine prepared the trainees to initiate similar services in their home countries. Training in such fields as brucellosis, tuberculosis, and mastitis control qualified technicians to initiate control programs in countries in which these diseases have been found to be of economic importance. Other participants have spent up to 4 years in the United States to earn a degree in veterinary medicine or to take graduate study in that field. Upon completion of their training, these veterinarians have returned to their home countries to assume responsible positions. American training equipped them to develop and direct programs for livestock disease prevention and control in their own countries. Some entered the field of veterinary education. Others are now directing vaccination teams, diagnostic clinics, vaccine production, and similar action phases of recently organized programs for livestock disease control.

ICA-sponsored training of veterinary technicians has been carried out by veterinary colleges and institutes, research and regulatory services of the U.S. Department of Agriculture, Federal and State extension services, and private and commercial firms. The American Veterinary Medical Association has cooperated by extending membership to trainees and providing technical training not otherwise available through its members in specific fields.

## Section 3. Foreign Agricultural Service

The Foreign Agricultural Service, through its agricultural attaché reporting system and individual reports of its technical specialists, has for many years provided information on the status of foreign animal diseases, the activities of foreign veterinary health services, the development of foreign veterinary educational and research programs, and the regulations and legislation affecting U.S. foreign trade in animal products. Recently, a foreign veterinary analysis project has become an added function in the Foreign Agricultural Analysis Division.

FAS also has a coordinating function aimed at facilitating effective U.S. participation in the veterinary work of international organizations and meetings. The establishment of the Food and Agriculture Organization of the United Nations provided a mechanism for international cooperation on veterinary as well as on other agricultural and food problems. In 1946 the Department of Agriculture was assigned the leadership role by President Truman for planning and participating in FAO activities. FAS coordinates this work in the

department, and works in close cooperation with the subject-matter agencies concerned. The United States is a member of FAO and actively supports its work in veterinary medicine and other fields.

*Foreign trade outlook.*—Information flowing into the Department of Agriculture has been made freely available to other Government agencies and commercial concerns. In many instances, this information has made significant contributions in determining foreign trade possibilities, identifying areas of limited trade potential, or assisting in the guidance of U.S. and international organization technical assistance programs. It is anticipated that collation and evaluation of information will lead to improved methods in reporting, contributing to an expanded foreign trade in healthful animal products and to an improvement in human health and welfare.

*U.S. interests served.*—Participation in veterinary phases of international organizations and in international meetings is designed to serve the best interests of the United States in a number of ways. These are:

1. Increasing the information obtained on the animal disease situation in other countries and on new developments aimed at disease and parasite control.
2. Widening the opportunity to convey information to other countries that will be useful in improving their veterinary programs, thereby reducing the danger of bringing animal diseases and parasites into the United States.
3. Developing friendly relations with other countries, including better understanding of the reasons for quarantine regulations that govern the movement of livestock and livestock products.

*FAS surveys.*—The FAS veterinary programs are primarily directed to surveys of individual countries to accumulate, analyze, and evaluate material on animal health; the development of veterinary activities related to animal and human health; and the significance of current disease problems to livestock production and trade. These veterinary and public health information surveys are intended for use of other Government agencies, commercial concerns, and international agencies in formulating trade programs, or technical assistance policies.

Compilations of animal disease and veterinary data from various countries are used in arranging itineraries and studies of foreign fellowship students. This procedure establishes a course of studies applicable to the special problems that will confront the participants on return to their own countries.

Many of the first notifications of foreign animal disease outbreaks affecting U.S. foreign trade programs or influencing veterinary technical assistance projects have been received through the Foreign Agricultural Service reporting system. In several instances, the initial step of prompt reporting has contributed to the prevention of wider spread of such disease. The development of programs to control or eradicate animal diseases in specific areas has ultimately contributed to restoration of normal trade between affected and nonaffected territories.

Reporting of foreign embargoes on U.S. livestock or livestock products has resulted in development of research projects on infectious diseases. Research findings have enabled U.S. producers to comply with sanitary regulations for export products.

*International contacts.*—Through U.S. participation in intergovernmental organizations, technical congresses, and meetings of nongovernmental groups, much has been accomplished in the realms of securing additional information of value to the United States and assisting other countries in improving their animal health programs. This participation has helped to reduce the danger of introducing diseases and pests that would damage the livestock industry of the United States and create hazards to the public's health.

*Fear of economic sanctions.*—The most important barrier to the development of a sound FAS program of factual disease reporting is the universal distrust which tends to be associated with identifying the extent of infectious animal or public health conditions. A part of such distrust stems from fear of economic sanctions. The practical worldwide approach to improvement in animal health and human welfare is largely dependent on intelligent evaluation of those factors which impair, restrict, or prevent the equitable distribution of animal food products.

Efficient animal disease reporting has become a responsibility that can no longer be ignored by any country with the technical competency to establish such a system. The development of adequate disease reporting services in all countries and the effective international exchange of information on outbreaks is a major international problem.

Another major problem is to strengthen the internationally coordinated system for providing reliable interpretation of factual data. This data can be used to alleviate animal disease and public health problems in individual countries or geographical areas.

Major international problem areas also include:

1. Cooperation among countries to eliminate the danger of epizootic diseases, such as rinderpest and foot-and-mouth disease. (See fig. 26, "Foot-and-Mouth Disease or Rinderpest" below.)
2. Developing of adequate training facilities leading to adequate staffing of veterinary services in underdeveloped areas of the world.
3. Developing adequate quarantine facilities and legislation covering livestock and livestock products. This includes a better understanding of the reasons for quarantine measures, and adequate provision for freer but safe movement of breeding stock for use in livestock improvement programs.

*International data exchange.*—A number of media, not currently exploited, exist to improve the international exchange of animal disease and public health information. FAS could use these media without significantly increasing its technical resources and funds needed.

For example, FAS could further develop its service of collecting, evaluating, and forwarding animal disease and public health reports of concern to veterinarians to an internationally supported reporting

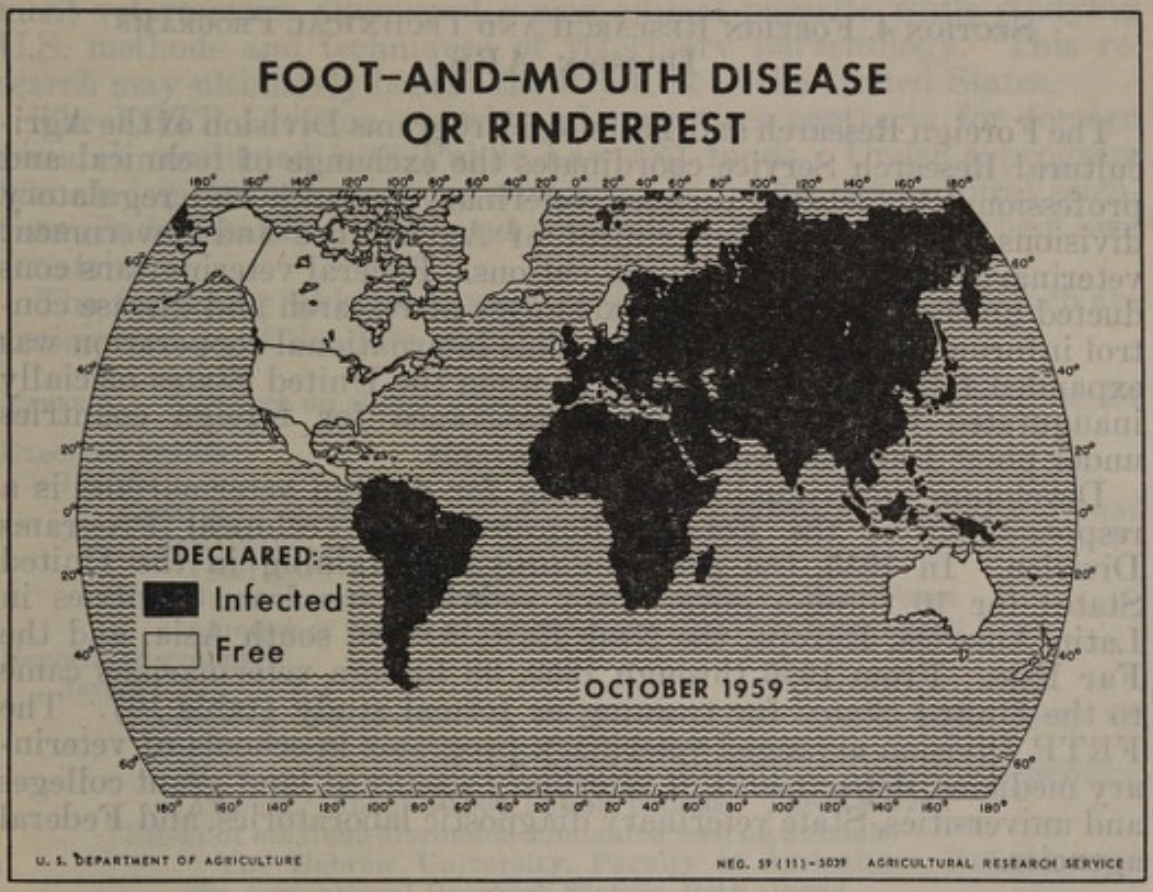


FIGURE 26

service. These reports are available from Government agencies such as the Agricultural Research Service and the Public Health Service, State veterinary authorities, and private veterinary practitioners. A complete, coordinated contribution to the international reports would increase the prestige of the U.S. veterinary profession and stimulate other countries lagging in this effort. Such information would be ultimately beneficial in the planning and directing of future international animal disease and public health control measures.

Existing systems for reporting foreign animal diseases could be expanded. More comprehensive and practical animal disease reports could be developed by appropriate agencies by use of the existing attaché service and other U.S. personnel overseas. In many areas, the cost of elaborating existing reporting systems might be supported by available Public Law 480 funds.

FAS and the ICA could benefit mutually by improved exchange of information and services, in addition to those now provided and made available by both organizations for use in the guidance of veterinary missions abroad. In many areas, an intimate forehand knowledge of local conditions would lead to accelerated practical approaches to veterinary problems and eliminate needless and costly expenditures or misinterpretation of information. An evaluation incorporating improved data on animal disease and related public health problems would point out the practical approach toward solutions of existing worldwide veterinary problems.

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## Section 4. Foreign Research and Technical Programs Division, ARS

The Foreign Research and Technical Programs Division of the Agricultural Research Service coordinates the exchange of technical and professional knowledge between veterinary research and regulatory divisions in the U.S. Department of Agriculture and government veterinarians of friendly foreign nations. Federal veterinarians conducted unofficial international exchanges of research and disease control information for many years. This international cooperation was expanded following World War II when the United States officially inaugurated technical veterinary assistance for foreign countries under point 4 and subsequent aid programs.

Developing individualized training for foreign veterinarians is a responsibility of the Foreign Research and Technical Programs Division. In 1955, the program provided training in the United States for 16 foreign government veterinarians from countries in Latin America, Europe, the Near East, Africa, south Asia, and the Far East. From 1956 through 1959, 98 foreign veterinarians came to the United States for training or formal study (table 10). The FRTP Division arranged veterinary programs in schools of veterinary medicine, departments of veterinary science at land-grant colleges and universities, State veterinary diagnostic laboratories, and Federal agencies.

Table 10.—*Foreign veterinarians in U.S. training programs arranged by Foreign Research and Technical Programs Division, Agricultural Research Service, 1956 to 1959, by countries*

| Country | 1956 | 1957 | 1958 | 1959 | Country | 1956 | 1957 | 1958 | 1959 |
|---|---|---|---|---|---|---|---|---|---|
| Bolivia | ------ | ------ | 1 | ------ | Jordan | ------ | ------ | 1 | ------ |
| Brazil | 1 | ------ | 1 | ------ | Kenya | ------ | ------ | ------ | 1 |
| Cambodia | ------ | ------ | ------ | 1 | Korea | ------ | 1 | 1 | 2 |
| Chile | 1 | ------ | ------ | 2 | Lebanon | ------ | ------ | 1 | ------ |
| China | ------ | ------ | ------ | 1 | Mexico | 2 | 2 | ------ | ------ |
| Costa Rica | ------ | 1 | ------ | ------ | Nicaragua | ------ | ------ | ------ | 1 |
| El Salvador | ------ | 1 | ------ | ------ | Pakistan | ------ | ------ | ------ | 2 |
| Egypt | 5 | ------ | ------ | ------ | Panama | 1 | 1 | ------ | ------ |
| Greece | ------ | ------ | ------ | 1 | Peru | 2 | ------ | 1 | 1 |
| Guatemala | ------ | 2 | ------ | 1 | Philippines | 4 | ------ | 1 | ------ |
| Honduras | ------ | 1 | ------ | 1 | Spain | 3 | 2 | ------ | 2 |
| India | 1 | 1 | ------ | ------ | Sudan | ------ | ------ | ------ | 3 |
| Indonesia | 3 | ------ | ------ | ------ | Thailand | 1 | 1 | 2 | 1 |
| Iran | 3 | ------ | 1 | 3 | Turkey | 3 | ------ | ------ | 4 |
| Israel | 3 | 1 | ------ | ------ | Yugoslavia | ------ | ------ | 6 | ------ |
| Jamaica | ------ | ------ | ------ | 1 | | | | | |
| Japan | ------ | ------ | 1 | 6 | Total | 33 | 14 | 17 | 34 |

The training of foreign veterinarians has contributed to the ability of friendly foreign governments to reduce the incidence of animal diseases so that more food can be produced and human health can be improved. International cooperation also benefits the United States. Along with newly acquired methods and techniques, the foreign veterinarians take home a better understanding of the United States and its people. Contacts are established for future exchange of technical information.

During their training in the United States, these foreign veterinarians may make scientific discoveries or develop techniques that contribute toward the general welfare. For example, a Spanish Govern-

ment veterinarian discovered a new animal parasite while studying U.S. methods and techniques of veterinary parasitology. This research may ultimately benefit the livestock of the United States.

The FRTP Division awards and supervises contracts for foreign research conducted with Public Law 480 funds. Under a program launched in 1959, foreign veterinarians and other agricultural scientists conduct carefully planned research in laboratories in their own countries.

The following table lists grants to date, including several which are anticipated as of the date of publication of this print.

TABLE 11.—*Research on animal diseases supported overseas under Public Law 480*

Executed grants:
- Poland:
  - Control of the liver fluke in domestic ruminants by chemotherapy and destruction of the snail intermediate hosts.
    Veterinary Institute, Pulawy.
    Grant executed: May 25, 1960. Duration: Four years.
    Amount of grant: 2,128,400 zlotys ($38,698 equivalent).

Negotiated grants:
- Israel:
  - Studies on the prevention, control of chronic respiratory disease (in chickens) and the chemistry of its causative agent.
    Hebrew University of Jerusalem, Faculty of Agriculture, Rehovot.
    Amount: About 50,800 Israeli pounds. Three years.
  - Effect of ethylene dibromide fumigated feed on animals.
    The Hebrew University, Faculty of Agriculture, Rehovot; and the Agricultural Research Station, Beth Dagan.
    Amount: About 149,600 Israeli pounds ($82,280). Three years.
- Poland:
  - The changeability of biological properties of viruses (using Newcastle disease virus in chicks).
    Veterinary Institute, Pulawy.
    Amount: 861,164 zlotys ($15,657 equivalent). Four years.
- Turkey:
  - The transmission, distribution, and bioeconomics of the giant liver fluke disease of domestic ruminants in Turkey.
    Veterinary Faculty, Ankara University, Ankara.
    Amount: Estimate 105,500 lira. Two years.
  - Etiologic investigation of bovine urinary bladder tumors due to enzootic bovine hematuria in Turkey and its relation to bovine papilloma agent.
    Veterinary Faculty, Ankara University, Ankara.
    Amount: Estimate, 265,500 lira. Five years.
  - Foot-and-mouth disease in Turkey, its virus types, its virus production in tissue cultures and comparative studies with cattle, sheep, goat and guinea pig kidney tissue cultures, vaccine production with these viruses and experimental application for the control of this disease.
    Veterinary Faculty, Ankara University, Ankara.
    Amount: Estimate, 246,000 lira. Five years.

Anticipated grant negotiations in very near future:
- Israel:
  - A study of the antigenicity of avianized modified foot-and-mouth disease virus (to protect cattle).
    Veterinary Institute, Ministry of Agriculture, Beth Dagan.
    Amount: About 270,600 Israeli pounds. Two years.
- United Kingdom:
  - Investigation of scrapie, a transmissible disease of sheep of obscure etiology, to determine the nature of the transmissible agent of scrapie to establish the epidemiology, pathology, and method of control or eradication.
    Agricultural Research Council, Compton, Berkshire, England.
    Amount: About $200,000. Five years.

## Section 5. Food and Agriculture Organizations

Assistance is being given in several directions by intergovernmental organizations to increase the production of food for human consumption. The Food and Agriculture Organization of the United Nations, a member of the United Nations group of specialized agencies, was set up in October 1944 and is one of these organizations. Beginning with 42 member countries, the number has now increased to 76. The aims of FAO are (1) to help nations to raise the standard of living; (2) to improve nutrition of the people of all countries; (3) to increase the efficiency of farming, forestry, and fisheries; (4) to better the conditions of rural people; (5) through all means to widen the opportunity of all people for productive work.

The activities of an international organization such as FAO differ in several important respects from those of national agencies dealing with animal health problems. FAO, as an agency that exists to assist its member governments, has no sovereignty over its member countries. FAO does not own laboratories in which to carry out research or in which to produce vaccines. It does not exercise control over national disease programs or the international movement of livestock or livestock products.

*Summary of activities.*—FAO activities may be characterized as follows:

1. Holding technical meetings on a regional or an international basis.
2. Sending missions to study the needs of countries and propose programs for development. Such survey missions are usually of relatively short duration.
3. Sending individual experts or groups of experts to countries for extensive periods to advise and assist in the planning and carrying forward of technical projects.
4. Providing limited amounts of technical supplies, equipment, and literature to facilitate the work of experts serving in countries.
5. Establishing training centers, either for the benefit of single countries or groups of countries having common problems.
6. Providing fellowships for advanced training outside the fellows' home countries.
7. Preparing and publishing documents containing summaries of new technical findings, incidence of disease, or other information that is of value to member countries.
8. Maintaining contacts with key officials of governments through correspondence and brief staff visits to encourage developments within countries and to facilitate intercountry cooperation.
9. Organizing permanent bodies as arms of FAO to facilitate cooperation among governments. The Commission for the Control of Foot-and-Mouth Disease in Europe is an example.
10. Assisting governments, at their request, in the preparation of conventions or agreements governing common action.

ARTICLE BY SIR THOMAS DALLING

Sir Thomas Dalling, consultant to FAO, is author of the following observations on the work of the Organization.

The importance of livestock in all countries is appreciated by the Organization and animal production receives much attention. Improvement in livestock production is urgently required to increase the availability of the much needed proteins of animal origin and of animal byproducts. In addition, animals are still required in some regions for use for agricultural and transport purposes and their value in soil fertilization will probably continue. Improvement of animal health and control of animal diseases are recognized as vital factors in increasing animal production and efforts are being directed toward these ends. Although more livestock is necessary, it follows that the better the health of animals, the greater will be the production from smaller numbers of animals; a smaller total area of land will be required to produce food for these smaller numbers and so, eventually, more land could be available to raise crops to feed the human population. Improvement of animal health and control and eradication of animal diseases constitutes a worldwide challenge which requires the active collaboration of all countries.

Most attention is, of course, being given to countries classified as under or less developed, because the potentialities in some of them to increase animal production is great. Concurrently with work on improvement in animal health and disease control, production of more and better feeding stuffs for animal consumption, improvement of pastures, improvement in some aspects of animal husbandry and improvement in breeds to meet their required purposes all receive attention. It is with animal health and diseases that most veterinary technical assistance is concerned.

*Types of technical assistance.*—Veterinary technical assistance is given in several ways. At the headquarters of the Organization in Rome there is a team of veterinarians drawn from different countries, part of whose duty is to provide information and advice on veterinary subjects to any member country, on request. The requested information may already be available in FAO or it may be necessary to consult literature, reports, etc., or even to get in touch with veterinary and other authorities in different parts of the world. It is not uncommon to put veterinarians in personal touch with such authorities in other countries. There is an extensive library in FAO headquarters, in which textbooks, journals, and reports are available to the staff and they are freely made use of in supplying information, opinions, and advice to member countries. The headquarters veterinarians are largely responsible for the veterinary fieldwork carried out by FAO; they are in regular communication with the veterinarians assigned to member countries and supervise and advise them on their work. They visit member countries periodically to discuss programs with the responsible authorities, to give any necessary advice on veterinary topics and to take part in meetings on veterinary and other subjects of a local, regional, or worldwide character. Worldwide types of meetings are also held, from time to time, at headquarters, for which the necessary arrangements are in the hands of the veterinary staff. They also participate in meetings convened, separately or jointly with FAO, by other international organizations which have veterinary interests. Veterinarians from headquarters are sometimes called upon to be members of teams which visit countries or regions to carry out surveys on any particular subject concerning agricultural and allied projects. From the Animal Health Branch of the Organization, information, collected from many sources, is supplied for publication and the branch itself publishes articles of general interest. An example of such a publication is the "Annual Yearbook on Animal Health" which contains full particulars, in tabular form, of the incidence of animal diseases in countries throughout the world with particulars of the methods adopted for their control and a series of articles on topical subjects, some prepared in Rome and some by well-known veterinarians in various parts of the world.

Technical assistance to individual member countries is given in several ways. Following discussions in the country and in Rome, requests are made by the countries for technical assistance in specific subjects. The requests are placed in order of priority and are carried out according to the availability of the funds and the possibility of making detailed arrangements. Normally, one or more veterinarians, appointed by FAO, are assigned to the requesting country to

proceed with the work. These veterinarians, drawn from many parts of the world, are usually experienced in the type of work required and have often had service in countries with climatic and other conditions similar to those of the country in question. Young veterinarians, specially qualified and experienced in some special veterinary subject, may also be appointed, especially for work which does not demand experience of a special climatic condition.

A veterinarian assigned to a country works as an adviser, assisting and collaborating in planning and operating schemes for animal health improvement and disease control and in giving instruction to national veterinarians and others on techniques for the diagnosis, prevention, and control of diseases.

For the satisfactory control of some animal diseases in a country and for preventing the introduction of disease, legislative action is necessary and regulations have to be formulated. FAO veterinarians give advice on this subject and often assist in drawing up the regulations.

Some of the veterinarians spend much of their time in the laboratories in the country to which they are assigned, teaching and supervising the preparation of biological products for use in animal disease control schemes. Others are concerned with the veterinary schools in the country and advise on and assist in the introduction of changes which are considered beneficial. Activities in slaughterhouses come under the purview of some of the assigned veterinarians. They advise on the construction and establishment of new slaughterhouses and alterations in existing premises to meet more modern requirements, plan operations and supervision of staff, advise on and give instruction in meat inspection, refrigeration techniques and safe disposal of waste and condemned material as well as on the care and inspection of animals destined for slaughter during their transport to and after collection at the slaughterhouse.

Veterinarians work sometimes in more than one country in a region, devising schemes which may benefit the whole region by preventing spread of infections from country to country. One of the conditions imposed by FAO on member countries receiving such technical assistance is that one or more national veterinarians are attached to the FAO veterinarian so that the work may be continued satisfactorily and without a break after his departure.

For the diagnosis of and control of many of the infectious diseases, biological products are required. For various reasons including economy, the required materials are being produced in the different countries where these products have been prepared in the past. More modern techniques are now in use and result in more efficient products. Special equipment is required and FAO has supplied a considerable amount to a number of member countries. In the control of other diseases, drugs not available in a country or region are sometimes necessary, for example, for the control of parasitic diseases such as liver fluke disease and diseases caused by worms in the stomach and intestine of sheep and cattle. FAO has supplied considerable quantities of the necessary drugs in order that extensive control schemes could be successfully inaugurated. Similarly, the control of diseases caused by external parasites, for example, sheep scab, has been encouraged by the provision of a quantity of the necessary medicaments for use in the form of dips and sprays.

*Fellowships.*—FAO provides assistance for training in modern scientific methods. This is done as much as possible by FAO veterinarians during their assignments to a country. In addition, however, fellowships are awarded by FAO to selected national veterinary personnel, enabling them to proceed to another country to receive special tuition and experience in a specific subject, a group of subjects, or in the more general aspects of animal health and disease control. Such trained national personnel, on return to their country at the completion of their training, are expected to be employed in the type of work in which they gained experience abroad, to meet the requirements in their country.

While fellowships are allotted mostly for individual travel and training, FAO also convenes and operates training centers for veterinarians from countries often in a region. The courses vary from more general instruction for 2 to 3 weeks on such subjects as the preparation and testing of virus-vaccines, to more detailed work for several months on subjects such as milk and meat hygiene and infertility in animals. For the courses of longer duration, the host country sometimes provides part of the necessary financial outlay.

*Expert panels.*—In order to obtain up-to-date information on specific subjects and to bring together recognized world authorities on them, FAO has set up panels whose members, conversant with essential parts of the subject, meet from time to time and, together with FAO, prepare reports for general dis-

tribution. Examples are those dealing with infertility in animals and with tick-borne diseases. FAO also links up with other international organizations in the formation and work of such panels, for example, brucellosis, created jointly by FAO and the World Health Organization (WHO), the subject being of much importance in both human and veterinary medicine.

For discussions of problems of animal health and control of animal diseases which affect the economy of a number of countries in a region and to draw the attention of governments to the steps which can be taken to improve the position, meetings, attended by representatives of the countries, are convened in the region. Sometimes such meetings are arranged jointly by FAO and another international organization—the International Office of Epizootics (OIE), which has been in existence since 1927 and whose headquarters are in Paris. The reports from such meetings, agreed by all present, are circulated to governments of all FAO member countries and are made available for distribution.

FAO collaborates with other international organizations interested in veterinary problems in different parts of the world. The International Office of Epizootics, mentioned above, is an independent organization whose work is confined entirely to veterinary matters and whose finances are provided by its 63 member countries. In addition to convening regional meetings on veterinary problems, often jointly with FAO, an annual meeting is held in Paris when delegates from member countries and observers from many parts of the world attend. In addition to receiving reports of the animal disease from member countries, papers are given and discussions take place on some of the most recent research work on animal disease problems. Representatives of FAO participate fully at these annual meetings.

The OIE also collects and disseminates information on outbreaks of diseases; information is sent to interested countries whenever received, and to all other countries at short regular intervals. OIE also publishes an interesting journal bimonthly. Research work is encouraged and is sometimes financed by OIE. A close association exists between FAO and OIE.

The World Health Organization, whose headquarters are in Geneva, is interested also in veterinary work, particularly in animal diseases which may have a bearing on human health. Meetings are held from time to time when full consideration is given to the most recent available information on diseases affecting both animals and man. These are attended by experts, both medical and veterinary, in the specific subjects and the meetings form a common ground for exchange of information, following which reliable and up-to-date reports are published. Most of these meetings are arranged jointly by WHO and FAO. Milk and meat hygienes are also dealt with by WHO in collaboration with FAO. This collaboration is extremely valuable to both medical and veterinary services.

The Organization for European Economic Cooperation (OEEC) with its headquarters in Paris has also shown considerable interest in veterinary matters. At one time it had a working party on animal health, whose chairman was a member of the FAO staff. In addition to issuing valuable publications and producing films on some of the diseases of economic importance in Europe, it arranged meetings of veterinary representatives from European countries when the problems of animal health were discussed. FAO participated fully in these meetings. Although the working party on animal health has been disbanded, the OEEC is still much interested in veterinary activities and, undoubtedly, would again give serious consideration to calling together representatives of European countries to discuss any vital problems of animal disease which might arise.

Then, there is the International Veterinary Congresses with headquarters in Utrecht, Holland. It has worldwide country membership and a meeting is held once every 4 years when delegations from many countries meet and many important papers are presented and discussions on them take place. This body is supported financially by small contributions from veterinarians in the member countries. FAO is represented on the governing body and a member of the FAO veterinary staff is a member of some of the committees.

FAO also collaborates wherever and whenever possible with organizations in the United States which are carrying out much good work on veterinary matters in many of the less-developed countries throughout the world; and with the Organismo Internacional Regional de Sanidad Agropecuaria (OIRSA) which works in Central America, to whose headquarters a veterinarian, appointed by FAO, is attached.

Although FAO is not empowered, generally, to engage in research, the need for such work is fully appreciated and encouragement is given whenever possible.

There are a few special fellowships, recently provided, for award, under certain conditions, for research purposes: some have already been awarded to veterinarians who are working abroad.

*Examples of fieldwork.*—To complete this article a few examples of the fieldwork of FAO veterinarians may be of interest.

Rinderpest or cattle plague is one of the diseases of cattle and buffalo most dreaded in parts of Africa and the Far East. In some countries, it is always present although in a "silent" or somewhat quiescent state; on occasion, however, the infecting virus attains a high degree of virulence and the disease sweeps over districts and countries, sometimes invading several countries and causing a high death rate. In some parts of the world the disease is the cause of severe economic loss not only in animal production but also in general agriculture because at critical times there may remain no or only a few cattle or buffaloes for use in agricultural activities. From the results of research work, vaccines, the systematic use of which will prevent spread of the infection, are available. FAO veterinarians have worked in some of the infected countries, teaching the national personnel how to prepare the vaccines and advising on extensive schemes for the control of the disease; training centers have been held where the preparation of the vaccines and their testing for efficiency have been demonstrated to groups of future workers; equipment for the preparation of the vaccines has been supplied; fellowships have been awarded to enable national personnel to receive instruction in the working and maintenance of the equipment. All this assistance has led to the application of control measures which are resulting in lowering the incidence of rinderpest and have already been responsible for the clearing of some large areas. With a continuation of concentrated effort by the countries concerned and full collaboration between infected countries in a region, the progress should continue until rinderpest is no longer a menace to livestock production and to the economy of countries.

FAO takes much interest in veterinary education, realizing fully that sound veterinary education is an essential requirement for an efficient veterinary service. FAO veterinarians have visited many countries for information on veterinary schools and educational systems, regional meetings have been held when the only subject of discussion has been veterinary education to meet the requirements of the region, an FAO veterinarian spent some considerable time in Calcutta, India, and, following his advice, many alterations were made in the veterinary college there and in teaching veterinary students, FAO has now arranged a worldwide meeting on veterinary education to be held in London in April 1960, when it is hoped to discuss the subject in general terms and to make recommendations.

Foot-and-mouth disease continues to influence animal production in some parts of the world and to impede export and import of livestock and products of animal origin. Countries, free from the disease, impose severe restrictions which prevent or minimize the risks of introducing the infection. FAO is much concerned with the general position; FAO veterinarians advise countries on methods of control and eradication and on legislative measures to protect countries against invasion; worldwide meetings have been held for discussions on the conditions which might be imposed for safeguarding countries against the introduction of the disease; the European Commission for the Control of Foot-and-Mouth Disease was set up, at the request of governments, as a unit of FAO with its own budget and is engaged in assisting European member countries in the application of measures to eradicate the disease from the country and from the whole of Europe; FAO keeps in close touch with research workers on all aspects of the disease and makes recent information available.

Hemorrhagic septicemia in cattle and buffaloes causes much economic loss, especially in eastern parts of the world. Having learned of some important work on the causal organism which might lead to the development of better vaccines for the control of the disease, FAO appointed a veterinarian, familiar with this work, to make further observations on the subject and to prepare and test out the value of the vaccines under consideration. All the fieldwork was carried out in the Far East and vaccines are still being tested on an extensive scale; the available information indicates that this newer type of vaccine is an improvement on those formerly used.

Contagious bovine pleuropneumonia is an important disease of cattle in parts of Africa, India, Australia, and some few areas in Europe. Research is being

pursued in different countries on improvements in the vaccines now in use for its control. FAO convened a meeting of the veterinarians interested in this subject and formed a panel composed of research workers who will meet from time to time when they will compare and discuss the results of their work and provide up-to-date information for distribution.

Brucellosis in goats and sheep continues to cause much economic loss and much human disease in some parts of the world. FAO, with the collaboration of WHO, provided some assistance for the study of suitable vaccines for the protection of goats and sheep and consequent reduction in the risk of human infections. This assistance was continued for several years and has been of much value in the development of at least two types of vaccines, both of which have given promising results in small observations and will now be tested in the field on a large scale.

The serious effects of parasitic infestations of animals on animal production are well recognized, not only because of the death rate but also because of the losses from interrupted and slow development. Different types of parasites assume higher importance in different areas. Important diseases are caused by the protozoan group of parasites which are "tickborne." Realizing their importance, FAO convened a meeting attended by observers from many countries and an up-to-date report was produced for distribution. Because of the complexity and extent of the subject and the amount of research and investigation work in progress, FAO has set up a panel of workers on the subject; one meeting has been held and a report from it is available. Other types of parasites have not been forgotten and FAO veterinarians have investigated and given advice on the control of parasites causing such diseases as liver-fluke disease, parasitic gastroenteritis and others in several widely separated parts of the world. In some South American countries, theoretical and practical instruction has been given on several occasions to groups of veterinarians and others.

The introduction of artificial insemination as a method of breeding has attracted the attention of those interested in livestock improvement in practically all countries and there has been much demand for technical assistance from FAO for instruction of the method. FAO veterinarians have spent long periods in some countries demonstrating techniques and advising on and assisting in the introduction of schemes; veterinary personnel have been sent abroad to study methods in other countries. Sexual hygiene and infertility control have always been taught and dealt with side by side with artificial insemination and three training centers have been held in Sweden, each of some 10 months' duration, when very thorough training in all these subjects has been given to groups of selected veterinarians, mostly from Near East and Far East countries. FAO also organized a meeting at which recommendations were made on the conditions for the export and import of semen.

These are examples of some of the work carried out by FAO on more specific subjects of animal health and disease control. In addition, much work of a more general nature is undertaken under the technical assistance programs when surveys of disease are made and advice given on the more general aspects of disease control and the improvements of animal husbandry and nutrition, including necessary changes, all with the object of improving and increasing livestock production.

*Personnel activities.*—It should be noted that a considerable number of FAO and other foreign fellowship students take advanced study in the United States. From this training, they gain information and experience which they can use in their own countries. At the same time, relationships between the United States and the countries from which the trainees come have an opportunity to be improved upon.

Some American veterinarians hold FAO appointments on the headquarters staff or on field assignments under the expanded technical assistance program. Veterinarians from the United States also serve as members of expert committees set up by FAO to study specialized problems and propose future courses of action for more effective control of certain diseases.

## Section 6. World Health Organization

As the world's foremost health arm, the World Health Organization has received the attention of this subcommittee from the commencement of our review.

Our fourth committee print, "The United States and the World Health Organization," was devoted exclusively to this distinguished organization.

When the World Health Organization was formed, veterinary medicine was integrated into its program. In 1949, a veterinary consultant to the World Health Organization headquarters office in Geneva was appointed. Since this time, the WHO veterinary medical program has developed rapidly and has had worldwide influence.

*Expert committee established.*—Among its more important activities has been the establishment of expert committees to study various animal disease problems. The committee on rabies was the first to be organized. The influence of this committee has been far-reaching. It has stimulated and actively cooperated in control programs in Asia, Africa, Europe, and the Americas. The recommendations of the committee for the treatment of human rabies, the vaccination of animals, the evaluation of vaccine, and methods of animal control have been accepted by most nations of the world.

*Rabies eradication and control.*—As a result of control programs stimulated and guided by WHO, the incidence of human and animal rabies has declined throughout the world, and the disease has been eradicated in a number of areas. In Japan, a country where rabies had existed for centuries, no new cases have been identified and for all practical purposes the disease since 1956 is considered eradicated. Hong Kong, Singapore, and Malaya are other areas in the Far East in which rabies is considered to have been eradicated. In the Middle East and parts of Africa, the disease has been brought under control, although it has not been eradicated. Most of Western Europe and some parts of Eastern Europe are now free of the disease.

The WHO program is designed to control rabies in dogs and greatly reduce the disease in wild animals. Bat rabies, which is common in the Americas and has been identified in Europe and Asia, is difficult to handle. Countries free of rabies are especially concerned with the possibility of its introduction by bats. Some of these disease-free areas have requested consultation from WHO and its American consultants on this problem.

In 1952 and 1955 WHO provided rabies research consultation and training to countries in Africa and Asia. One of the most important projects under study has been the evaluation of human immuno-therapeutic regimes. Consultations have also been held on the production of vaccine, the diagnosis of disease, and the training of professional and nonprofessional personnel. The Pan American Health Organization has had a similar program in the Americas.

*Bovine tuberculosis.*—The Zoonoses Expert Committee was organized by WHO with the collaboration of FAO. It met for the first time late in 1950 to advise WHO on tuberculosis and other animal health problems of public health concern. The recommendations of this Committee have received worldwide attention. One of its most important contributions has been its encouragement in the campaign to eradicate bovine tuberculosis in Western Europe. This program

has also received direct assistance from American military veterinarians and International Cooperation Administration advisers. The Scandinavian countries, which inaugurated animal tuberculosis eradication programs immediately after World War II, are almost free of the disease today. The Netherlands, which inaugurated a program in 1950, has brought the problem under control. Great Britain has made excellent progress and expects to be free by the end of 1962. Switzerland and Portugal also have had success in eliminating the disease. Parts of Germany and France have made considerable headway. The most serious tuberculosis outbreaks in Europe are in the Mediterranean countries. Animal tuberculosis is a major problem in parts of Asia and Africa.

*Other diseases.*—The Zoonoses Committee also deals with such complex diseases as hydatidosis, one of the major zoonoses problems of the world. It is found on every continent. The highest incidence occurs in southern Europe, the Middle East, northern Africa, southern South America, Australia, and New Zealand. Animal tapeworms are of considerable importance in Africa, Asia, and parts of the Americas. Salmonella infections of animals and men are major problems on every continent. Other diseases of varying importance are Q fever, psittocosis, leishmaniasis, schistosomiasis, trypanosomiasis, and anthrax. (See fig. 27, "Some Major Animal Diseases of the World.") WHO reports have listed more than 100 diseases of animals that have public health significance in some areas of the world. In some parts of the world, no human health programs can succeed until certain animal diseases are brought under control. Trypanosomiasis in Africa is an example. Brucellosis and hydatidosis in some areas of the world are further examples.

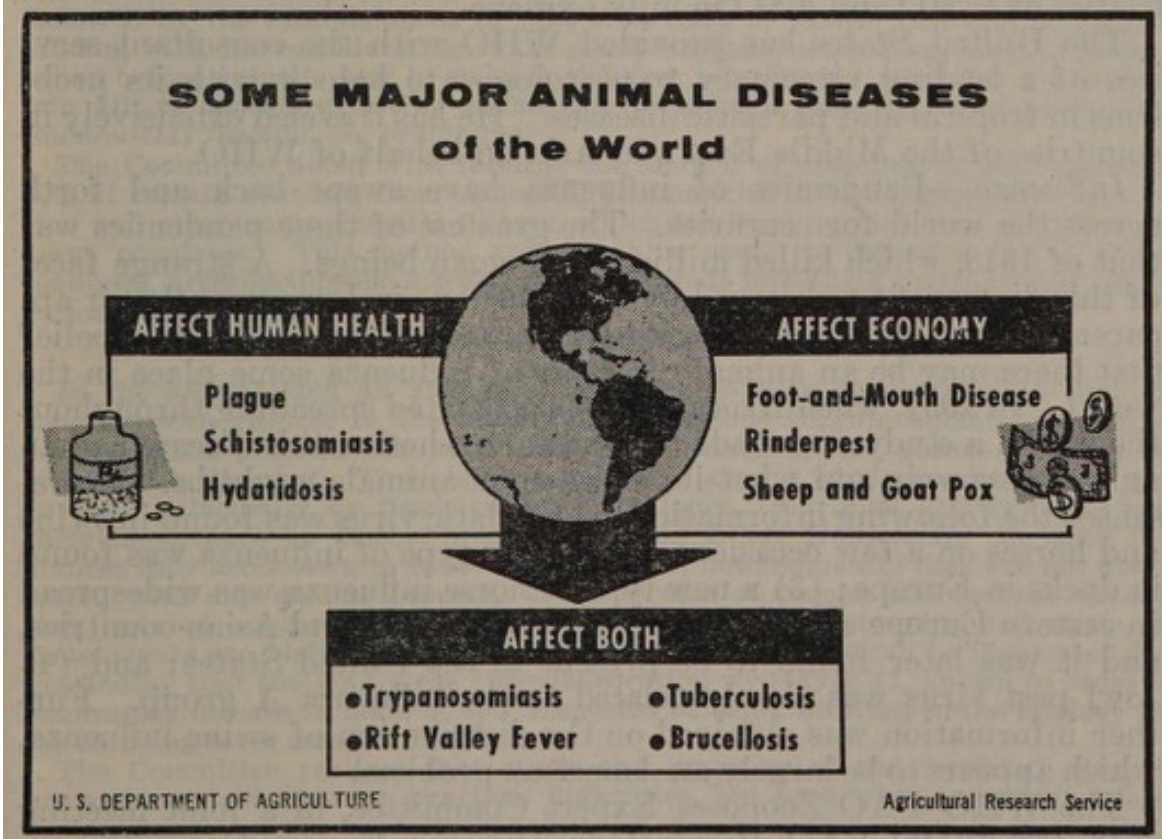


FIGURE 27

*Brucellosis.*—The first WHO–FAO Brucellosis Expert Committee was called in 1951 at the time of the Inter-American Brucellosis Congress. At this meeting some authorities indicated that there were as many as 100,000 human cases of brucellosis annually in the Western Hemisphere and that a much larger number of human cases occurred in the Old World. The committee pointed out the value of brucellosis eradication procedures developed in the United States and also the success that had been achieved in eradicating this disease in Scandinavia. Considerable progress in the control of this disease has been made in many areas of the world. Brucellosis of goats and sheep is a major problem. WHO has set up studies in north Africa, Spain, Israel, and Argentina to test various immunizing agents. Some promising agents are now being used in field demonstrations. The Brucellosis Expert Committee has been instrumental in standardizing vaccines and sera throughout the world. It has also provided other valuable assistance to many countries.

*Plague.*—The Plague Expert Committee of WHO is probably one of the most important because of the existence of plague throughout the world. An American veterinarian's work in developing diagnostic procedures, therapeutic evaluations, immunizing agents, and knowledge of the sylvatic reservoir of plague has been one of the most important veterinary contributions to world health.

*Milk and meat hygiene.*—The WHO in cooperation with FAO has also organized a committee on meat hygiene. Meetings of a WHO–FAO Milk Hygiene Expert Committee were held in 1955 and 1959 with UNICEF participation. The 1961 meeting will consider the needs of poultry hygiene throughout the world. Veterinarians have been prominent in the work of these committees as well as in field activities of WHO and FAO in milk hygiene.

The United States has provided WHO with the consultant services of a leading veterinary parasitologist to help it with its problems in tropical and parasitic diseases. He has traveled extensively in countries of the Middle East and Asia on behalf of WHO.

*Influenza.*—Pandemics of influenza have swept back and forth across the world for centuries. The greatest of these pandemics was that of 1918, which killed millions of human beings. A strange facet of this disease, first observed by veterinarians in Iowa, was that it apparently was able to establish itself in swine. This has led to a belief that there may be an animal reservoir of influenza some place in the world. In 1957, when Asiatic influenza started spreading throughout the world, a study was made to determine whether this disease had an animal reservoir and what its effect upon animals might be. It presented the following information: (1) Asiatic virus was found in swine and horses on a few occasions; (2) a new type of influenza was found in ducks in Europe; (3) a new type of horse influenza was widespread in eastern Europe and present in other European and Asian countries, and it was later found to be present in the United States; and (4) fowl pest virus was closely related to the influenza A group. Further information was obtained on the distribution of swine influenza, which appears to be largely an American problem.

The WHO–FAO Zoonoses Expert Committee, in a joint meeting with the WHO–FAO Respiratory Diseases Expert Committee in 1958, decided to continue epidemiological studies of influenza in animals and man. No one can state precisely what the relationships are,

but it is apparent there is a tie between influenza in man and animals.

EXCERPTS FROM REPORT BY EXPERT COMMITTEE

A few pertinent extracts from WHO Technical Report 169, 1959, follow:

* * * * * * *

14. ECOLOGY OF WILD ANIMAL RESERVOIRS

Several of the important zoonoses have wild animal reservoirs. With few exceptions, information on the ecology of wild hosts available from most areas of the world is inadequate. This has often led to hesitation or failure in the application of control measures. It is, therefore, necessary that enzootic foci of zoonoses should be carefully investigated where this has not been done so far. Besides a study of environmental factors, the investigation of such foci should include taxonomic survey of all vertebrates and their parasites and detailed studies on animal populations, life histories, migration, food and habits of the reservoir hosts. Where a vector is involved, it should be studied similarly. The tissues and excretions of the hosts and vectors should be surveyed for the causal organism, antibodies and morbid changes.

This work warrants the cooperation of epidemiologists, ecologists, microbiologists and parasitologists with advice from botanists, geologists, and climatologists. In practice, a very elaborate organization is not generally necessary; a few enthusiastic and interested field workers backed by an efficient laboratory and museum service can accomplish much.

Information on the biology and ecology of reservoir hosts and vectors should be compiled, preferably on a regional basis, and made available to workers in the area. Production of field guidebooks, containing instructions on the collection, preservation and preliminary identification of animals should be encouraged, particularly in areas for which such guides do not exist.

Sometimes animals new to an area are introduced for the biological control of vermin without due regard to the effect they may have on human health. For example, the introduction of the Javan mongoose (*Herpestes javanicus*) into the Caribbean Islands and of ferrets into Cuba for the control of rats was followed by the establishment of new reservoirs of rabies. Careful ecological studies, with due consideration of the possible effects on zoonoses, must be undertaken before animals new to an area are thus introduced. Also, the use of vermin killers containing living pathogenic organisms (e.g., rat baits containing *Salmonella*) should be prohibited.

The Committee noted with interest the method of detection of wild enzootic foci of certain zoonoses from ecological peculiarities of topography, soil, vegetation and other environmental factors, which has been applied over the years in many countries.[1] This method appears to be useful in detecting foci of leishmaniasis, arthropod-borne diseases and trematode infections, and may find application in other areas.

15. ANIMAL "ORPHAN" VIRUSES

In the animal field an analogous situation is being encountered to that in humans with respect to the ECHO (entero-cytopathogenic human "orphan") viruses. The problem has aptly been summarized by the phrase "viruses in search of a disease." Thus, large numbers of strains of viruses have been uncovered, principally by tissue-culture techniques, from man and animals, but their importance as disease-producing agents is far from clear. In some instances they are known to cause frank disease, but frequently they are not associated with any disease process. Some strains of human and animal viruses thus isolated appear to be related, and the systematic grouping and study of these agents are highly desirable. The value of doing this can be illustrated by the finding that the HA1 virus (haemadsorption virus type 1), known to cause a respiratory disease in man, is now suspected of being involved in the etiology of the shipping-fever complex in cattle.

The Committee realizes that study and grouping of the "orphan" viruses present very considerable practical difficulties, but such work is essential lest

[1] This has been exemplified in recent years by the mass application of "landscape epidemiology" by Pavlovsky and his coworkers in the USSR.

the great confusion already existing becomes completely chaotic. The Committee recommends that WHO and FAO take whatever steps possible to coordinate this work between groups already engaged on the problem.

### 16. EMERGING ZOONOSES

New disease entities or previously unsuspected human-animal disease relationships are being reported with increasing frequency. It is clear that host-parasite-environment interactions are constantly changing, and this, together with the availability of more refined tools for biological study, no doubt partially explains these observations. It can be anticipated further that, with such factors operating as (*a*) the increasing control or eradication of major known diseases, (*b*) the great changes in human and animal ecological patterns which are being brought about by development of virgin territories, and (*c*) the increase in human and animal populations, diseases will come to the fore which have been submerged, latent or restricted to well-defined areas and animal or human groups. Recent observations, such as (*a*) the apparent spread or mere uncovering of arthropod-borne viral infections in new areas, (*b*) the detection in animal sera of substances reacting serologically but of which the specificity is doubtful with respect to the poliomyelitis, coxsackie, measles and mumps viruses, and (*c*) the problem of animal influenza and animal "orphan" viruses (see pp. 47 and 54), illustrate some aspects of this situation. It is important, therefore, to clarify wherever possible the natural history of specific disease agents and to be alert to the possible emergence of new zoonoses.

The Committee notes with satisfaction that WHO, with FAO collaboration, is considering specific studies in this direction and that a special meeting on the subject will be convened. For example, one of the failures in studies on communicable diseases up to now has been our inability to follow the progression of disease in geographical areas at different points of time. This failure cannot be attributed to human oversight, but rather to the limited opportunities and tools available for instituting appropriate studies. While conditions are better in this connection, it will be some years before there will be sufficient facilities to cope with the many problems associated with studies of progress in communicable diseases. Nevertheless, in the meantime, certain steps are possible that would no doubt be of invaluable assistance later when more detailed studies become feasible. Thus, serum specimens from different age groups in human beings and animals in various parts of the world could be taken within a given span of time, and the specimens cataloged and stored in a freeze-dried state for examination. Thereby, where a particular study is undertaken, perhaps many years later, serum specimens from the human and animal population of a geographical area of interest would be available for examination by qualified laboratories.

Such work can be undertaken and coordinated uniquely by such organizations as WHO and FAO, and should be of immense benefit in improving our knowledge of communicable diseases both in the near and more distant future. The Committee, therefore, strongly recommends that WHO and FAO give the maximum possible support to such activities.

*Salmonellosis.*—Another important subject discussed by the WHO Expert Committee on Zoonoses in 1958 was that of the worldwide spread by animal feed of new types of Salmonella infection. Much animal feed—including fish meals from the Tropics, meat meals in the temperature zones, and vegetable products in many areas of the world—has been found to be infected. The problem has become so serious that many European countries no longer allow importation of feed without heat treatment that will insure the sterility of the animal meal products. Scandinavian and German authorities, who have studied this problem, point out that many new types of Salmonella never seen in Europe until recently have probably been introduced by various types of animal feed substitutes. This problem is not confined to Western Europe but also exists in other parts of the world. It is becoming increasingly apparent that diseases such as this cannot be controlled by national agencies acting separately and that close inter-

national cooperation is required to prevent the further spread of Salmonella infections to man and animals.

*Professional education.*—Veterinary medical education throughout the world has received attention from the WHO and FAO. Veterinary public health symposiums have been held for national leaders, educators, and research workers. These conferences have been attended by veterinarians as well as physicians, public health administrators, and other public health officials. Americans have contributed substantially to these meetings and have served as consultants to nations that are organizing veterinary medical training.

*Scientific Group on Cardiovascular Research.*—In the period of May 30 to June 3, 1960, a WHO scientific group interested in research progress in cardiovascular diseases met in Geneva. Although the report of that group has not been published, it is understood that the group, like previous similar groups, indicated keen interest in what it apparently regarded as relatively unexplored variants and spontaneous diseases of the cardiovascular system of animals. Opinion was expressed in the scientific group that investigation of such phenomena would contribute significantly to knowledge of the cardiovascular system in health and disease in man. It is believed, for example, by WHO experts that increased knowledge of physiological adaptations and spontaneous diseases of the cardiovascular system of animals could provide additional models for experimentation and could better acquaint medical researchers with the prevalence of preexisting disease in experimental animals.

Following the compilation of prevalence rates of cardiac and vascular diseases in animals, it might be possible to include animals when epidemiological studies of human population samples are made. This would add an additional dimension to the investigation of the natural history of these pathological processes.

Experts are known to feel that an urgent problem from an international point of view is the paucity of adequately trained personnel with an interest in the comparative study of cardiovascular problems. Indeed, the subcommittee may generalize to state that in other major disease problem areas, likewise, there is a paucity of experts in comparative medicine.

*Animal tumors.*—During the past 2 years the Veterinary Public Health Section of the World Health Organization has organized some exploratory meetings on comparative cancer investigations. The first of these meetings dealt with the broad outlines of comparative medicine including heart disease, arteritis, and cancer. The second meeting was held early in 1961 to coordinate studies in Western Europe and the United States. It is the belief of the experts who participated in these meetings that the epidemiological investigation of animal tumors may shed light on environmental causes of human malignancies. Studies in this area are also providing an excellent opportunity to determine if there are transmission factors. At a later date, it is planned to expand these studies to cover the world so geographical distribution and incidence of animal tumors may be studied.

*Delay in implementing expanded WHO research.*—The chairman of the subcommittee has maintained close contact with WHO on that agency's program of expanded medical research, since the initial

U.S. grant in 1958 to facilitate the program. In the ensuing years, expert groups, as noted above, have been assembled by WHO to lay the foundation for expanded research operations.

However, it is the chairman's understanding that the unavailability of funds has seriously delayed the actual implementation of large-scale veterinary research operations.

Considering that these veterinary operations actually involve only comparatively small sums (in relation to the totals spent on comparable problems in the United States alone), the delay is to be regretted. It is the chairman's view that the planned WHO veterinary research program, whose value has long since been attested by renowned experts, will have a tremendous "multiplier" effect in accomplishment throughout the world. Early implementation appears therefore essential, in his judgment.

## Section 7. Pan American Health Organization

The Pan American Sanitary Bureau (PASB), known until 1923 as the International Sanitary Bureau, had its origin in a resolution of the Second International Conference of American States (Mexico, January 1902) recommending that "a general convention of representatives of the health organizations of the different American Republics" be convened. This convention met in Washington, D.C., from December 2 to 4, 1902, and established the Bureau on a permanent basis. The Pan American Sanitary Code (Havana, 1924), a treaty ratified by the governments of the 21 American Republics, assigned to the Bureau broader functions and duties as the central coordinating agency for international health activities in the American Republics. The XII Pan American Sanitary Conference (Caracas, 1947) adopted a reorganization plan whereby the Bureau became the operating arm of the Pan American Sanitary Organization (PASO), the Constitution of which was officially approved by the directing council at its meeting in Buenos Aires later that year.

At the XV Pan American Sanitary Conference (San Juan, P.R., September 21 to October 3, 1958) the designation of the Pan American Sanitary Organization was changed to the Pan American Health Organization (PAHO). The name of the Bureau remains unchanged.

Pursuant to the agreement concluded between PAHO and the World Health Organization (WHO) in 1949, PASB serves as the WHO regional office for the Americas. PAHO is also recognized by the Council of the Organization of American States as an inter-American specialized organization with fullest autonomy in the accomplishment of its purposes.

A separate committee print (No. 9) was devoted to the work of PAHO.

*Evolving program.*—At first PASB was mainly concerned with quarantinable diseases such as yellow fever, smallpox, typhus, and those diseases spread from man to man. Later, attention was focused on other fields including animal diseases that are transmissible to man—plague, murine typhus, encephalitis, brucellosis, tuberculosis, and cysticercosis.

The U.S. Department of Agriculture and the U.S. Public Health Service as well as many universities and State agencies have for years assisted what has come to be known as PAHO by providing veterinary consultation and advisers. Among the animal-human disease epidemics investigated by U.S. veterinarians are the 1943 anthrax epidemic in Haiti, and the 1945 eastern equine encephalitis epidemic in Panama. Both affected many animals and many people. On a number of occasions veterinary specialists have provided technical assistance in the establishment of laboratories and animal colonies, and in control programs for rabies and other diseases.

With the establishment of a veterinary medical program in 1949, the Pan American Sanitary Bureau was able to provide more services. Today the Pan American Health Organization has career veterinary consultants in nearly all its zone offices.

It also has established an International Zoonoses Center at Azul, Argentina, to study animal diseases that are transmissible to man and to provide training and consultation for all the countries of the hemisphere. In Rio de Janeiro, Brazil, the organization established a center for the study of foot-and-mouth disease and is progressing in the development of vaccines aimed at immunizing cattle.

In Mexico the organization has carried on a long-term investigation of bat rabies. These studies have been of special interest to the United States since the identification of bat rabies in the States in 1953.

The Directors of the Pan American Sanitary Bureau—PAHO's operating arm—have recognized an important place in international health for veterinary skills. They have given complete support to the development of their veterinary medical programs. They hope eventually to be able to help the various nations to eradicate tapeworms and such diseases as hydatidosis, brucellosis, and tuberculosis, and to control others such as rabies, leptospirosis, and salmonellosis.

## EXCERPTS FROM SUBCOMMITTEE PUBLICATION

Committee Print No. 9, "Health in the Americas and the Pan American Health Organization," noted as follows:

From available information, in 1957 there were 22,343 veterinarians in the Americas of which 18,329 (82 percent) were in Northern America. In Northern America with the present shortage there is only 1 veterinarian per 10,000 population. To bring the number of veterinarians in Middle and South America to the level of 1.0 per 10,000 in 1980 would require 34,900 veterinarians and thus a great expansion of present training facilities. However, in Northern America, to take care of an increase in activities in the public health field, it is estimated that 1.75 veterinarians per 10,000 population would be desirable.

*Number of veterinarians and veterinary schools in 1957 and estimated veterinarians needed in 3 regions of the Americas, 1980*

| Region | Veterinarians | | Veterinary schools, 1957 | 1980 estimated need [1] |
|---|---|---|---|---|
| | 1957 | Per 10,000 | | |
| Northern America | 18,329 | 0.97 | 19 | 47,250 |
| Middle America | 1,525 | .25 | 5 | 11,500 |
| South America | 2,489 | .19 | 21 | 23,400 |

[1] 1.75 per 10,000 population for Northern America and 1.0 per 10,000 for Middle and South America.

**At present there are 19 veterinary schools in Northern America, 5 in Middle and 21 in South America. The total graduates per year are approximately 1,250. Greater utilization of these schools as well as expansion will be necessary to provide veterinarians to meet the challenging problems of zoonoses control, supervision of food supplies, and medical research.**

## Section 8. The World Veterinary Association

The World Veterinary Association, originally organized as the International Veterinary Congress, was first convened in 1863 in Hamburg, Germany.

Prof. John Gangee, an English veterinarian and one of the best informed authorities on livestock diseases of his day, invited teachers from veterinary colleges and practicing veterinarians from all parts of Europe to the Congress to meet the problem of increasing prevalence of contagious diseases among cattle, sheep, and other farm animals in European countries.

The almost complete absence of reliable statistics regarding the incidence and mortality caused by such plagues and the consequent need for devising measures to prevent the export of diseased animals from one country to another also stimulated the need for such an organization. The International Veterinary Congress was the first international effort in veterinary medicine. Discussions on the prevention and control of contagious livestock diseases led to the adoption of resolutions, which were transmitted as recommendations to the respective European governments.

*Organized veterinary knowledge.*—The principal subjects of discussion at the first Congress were contagious bovine pleuropneumonia and sheep pox. Subsequently, the 100 participants called the attention of the respective governments to the need for research institutes to investigate animal diseases. The Congress also recommended that statistics on contagious animal diseases be compiled.

At congresses held in Vienna, Austria, and Zurich, Switzerland, in 1865 and 1867, rinderpest and pleuropneumonia were the chief subjects of discussion. Professional education and the organization of a veterinary service in each participating country were also discussed at the Zurich Congress.

During the next four congresses, the scope of the program and deliberations was broadened. Contagious diseases of livestock, however, continued to receive the greatest attention.

The 8th Congress in Budapest, Hungary, in 1905, took an important step toward advancing the organization of these international veterinary meetings. Membership had increased to 1,400, and 900 attended this Congress. The large attendance and diversified interests of members made it necessary to hold sessions for special-interest groups in addition to the general sessions. Recommendations were adopted to provide an adequate connecting link between successive congresses, regulations and methods for conducting and financing the increasing costs of staging the sessions.

*Permanent committee formed.*—A permanent committee was formed to plan succeeding congresses. The 40 current members on this committee represent each national veterinary association or national group that holds membership in the World Veterinary Association. In addi-

tion to the permanent committee, the association has four elected officers: a president, two vice presidents, and a secretary-treasurer.

International Veterinary Congresses did not meet during the Franco-Prussian War, World War I, and World War II. The continuation of these congresses was assured, however, by the existence of the permanent committee and by the realization that the congresses were important instruments in the world's increasing efforts to combat animal diseases.

*Name changed.*—The 16th congress was held in Madrid, Spain, in 1959. It changed the name of the International Veterinary Congresses to World Veterinary Congresses and the parent organization became the World Veterinary Association. Its executive body is now known as the Permanent Committee of the World Veterinary Association.

A proposal for the World Veterinary Association to affiliate with international associations of veterinary specialists was approved by the Madrid Congress. This proposal provided authority to affiliate with associations in the following fields: Anatomy, physiology, biochemistry, pharmacology (including animal behavior), zootechnics (including nutrition, animal breeding, and production), pathology (including chemical pathology), infectious diseases (including microbiology and immunology), parasitology (including helminthology, protozoology), hygiene of animal products, clinical medicine, tropical veterinary medicine, surgery (including anesthesia and radiology), veterinary medicine in government including veterinary public health, small animal diseases, avian diseases, veterinary education, and professional interests.

The Madrid Congress established an advisory committee for the scientific program of the congresses. The committee consists of the members of the bureau of the permanent committee and one representative from each affiliated specialist association.

*Objectives.*—The objectives of the World Veterinary Association, which were restated at the Madrid Congress, are as follows:

1. To unify the veterinary profession throughout the world by providing a central link for national veterinary associations.
2. To organize and hold world veterinary congresses.
3. To promote all branches of veterinary science by appropriate means, including:
   (*a*) The exchange of information on matters of veterinary interests.
   (*b*) The collection and distribution of information on films.
   (*c*) The establishment of a uniform nomenclature.
   (*d*) The exchange of veterinarians and students.
4. To help improve veterinary education.
5. To promote the standing of the veterinary profession.
6. To establish relations with organizations whose interests are related to the purposes of the association.

A veterinary film catalog was completed in 1959. It was prepared by the association's film subcommittee, the Veterinary Film Committee of the International Scientific Film Association, and several national veterinary associations.

A current project of the association is the compilation of a comprehensive list of the diseases of animals. When the "List of Animal

Diseases" is completed, 2,000 copies will be published for worldwide distribution.

*World Animal Health Year.*—The World Animal Year will be observed in 1963, coinciding with the 100th anniversary of the World Veterinary Congress. Designation of the international year was made at the 1959 meeting. Other resolutions adopted at Madrid for future study and action covered the following subjects: radiobiology and the impact of nuclear energy on veterinary medicine and public health; the importance of further research in the application of blood grouping and similar procedures in animals in relation to animal husbandry and disease control; the increase in animal diseases due to industrial and environmental contamination by toxic substances; the need for international standards for veterinary antitoxins, antiserums, and vaccines; the need for regular contacts and exchange of information between research workers on foot-and-mouth disease; and the need for intensifying activities for the control and eradication of the zoonoses.

## Section 9. Pan American Congress of Veterinary Medicine

The first Pan American Congress of Veterinary Medicine was held at Lima, Peru, October 20–26, 1951. It was one of the several scientific gatherings which marked the 400th anniversary of the founding of the University of San Marcos. The congress was organized by the faculty of the school of veterinary medicine at San Marcos in collaboration with the Pan American Sanitary Bureau and the Food and Agriculture Organization.

Original plans specified that congresses would be held at 4-year intervals, with 2-year intervals between the sessions of the World Veterinary Association and those of the congress. Since the first meeting there have been congress sessions held in Sao Paulo, Brazil, in 1954, and Kansas City, Mo., in 1959. (The latter was held jointly with the 96th annual meeting of the American Veterinary Medical Association.)

The objective of the Pan American Congress of Veterinary Medicine is "to advance the art and science of veterinary medicine throughout the Americas." This is accomplished through a directing council, an organizing committee for each congress, and the plenary and scientific sessions.

The directing council forms a permanent link between successive congresses. The council is composed of one member and one alternate member from each American country; the host country for the next congress has two members and two alternates. Council members and alternates are designated by the principal veterinary medical association of a country. Officers are elected by the council from within its membership.

During its relatively short existence, the Pan American Veterinary Congress has demonstrated its importance and value. Many mutual problems concerned with veterinary education or infectious and contagious diseases of animals have been studied and discussed by members. Animal diseases which are particularly important to the economic and personal welfare of man have received primary consideration. Other topics presented in scientific papers have included veterinary medical practice, research, livestock sanitary regulations,

animal husbandry, zootechnics, and zoonoses. In addition each congress has increased understanding and improved relationships among the Latin American countries, Canada, and the United States. This exchange of scientific information in the field of veterinary medicine has particular significance in improving foreign relations.

Each Pan American Veterinary Congress has had the support of the host country, which issues official invitations to the governments of participating countries. The State Department of the United States extended invitations for the third Congress.

One ever-present problem, which has been reported to the subcommittee in this discipline as in others, is the lack of travel funds for the veterinary scientists who are requested to participate in scientific programs. In many instances, these scientists are engaged in research or teaching in colleges and universities or are employed by a government. They often are unable to participate in international meetings for financial reasons. This situation applies to scientists in the United States as well as those in other countries. The organization feels that some means of partial financial assistance should be developed to provide for travel by the scientific investigators who, in a broad sense, are representatives of their countries.

## Section 10. International Office of Epizootics

The International Office of Epizootics (OIE)[1] coordinates the cooperative efforts of the veterinary services of its member nations in the worldwide fight against animal diseases.

Although the United States is not a member nation of OIE, it is an active member of the Food and Agriculture Organization. OIE cooperates closely with FAO, which it serves as a consultant. Both the United States and the OIE benefit indirectly through this relationship.

The need for cooperation between the veterinary services of the world was clearly shown in 1920, when rinderpest was accidentally introduced into Belgium by Zebu cattle on their way to Brazil. This disease outbreak led to a demand for greater international cooperation in the study and control of animal diseases.

The agreement creating the OIE was signed at Paris, January 25, 1925, by representatives of 28 countries. Negotiations leading to the signing of this international agreement were held by a group of veterinarians, including Prof. Emmanuel LeClainche, Director of Veterinary Services for France. He became first Director of OIE.

*Purposes.*—The principal purposes of the OIE are:

1. To encourage and coordinate all research and experiments related to infectious diseases of cattle, for which international collaboration is necessary.
2. To collect and disseminate to the governments and to their health services any facts and documents of general interest concerning the progress of epizootic diseases and the methods used to combat them.
3. To study international agreements on the sanitary policing of animals and to provide governments the means for making these agreements.

[1] The French name is l'Office International des Épizooties.

*Permanent committee.*—The Office is placed under the authority and supervision of an international committee of permanent delegates appointed by the governments of the member countries. These delegates are veterinarians who generally occupy such offices as those of director of veterinary services or director of a research institute.

Since the first general annual session was held in 1927, the permanent committee of the OIE has been enlarged frequently. At the same time, OIE membership has increased. In 1959 there were 65 member countries. The newest members of the OIE were Canada, Iran, and the Republic of Sudan.

The Central Bureau of OIE in Paris collects and disseminates information from member countries and several nonmember countries on the appearance and development of outbreaks of epizootics. World statistics on all epizootic diseases are reported in a special bulletin. Beginning in 1960, this statistical bulletin is published annually. A worldwide annual on animal health is being prepared jointly by OIE and the Animal Health Branch of the FAO.

The official bulletin of OIE is published every 2 months. It contains original papers on animal diseases, a section on epidemiology, and notices of international veterinary meetings and conferences. Abstracts of scientific papers and reports on international animal diseases are also presented.

The OIE holds an annual meeting in Paris each May.

Reporters are chosen from the specialists in research, epizootiology, or animal disease control in each country. They prepare reports which are submitted to the annual sessions. Thus, the OIE work is carried on without interruption, in spite of the geographical separation of the reporters. Because the same studies frequently are pursued on different continents, comparison of the reports is especially valuable.

*1959 resolutions.*—During the 27th session held in 1959, the OIE committee adopted resolutions on the following subjects: respiratory diseases of poultry, role of veterinary services in the field of radioactivity, veterinary inspection of airplanes, care of live animals in transport, influence of feeding on susceptibility to disease, dissemination of information on animal diseases, development of regional activities of the OIE and relations with other international organizations, risk of spreading rinderpest and other virus diseases of cattle through meats, and formation of new groups of specialists. All resolutions are brought to the attention of the governments of the member countries of OIE, FAO, Inter-African Bureau of Epizootic Diseases, and the World Veterinary Association.

Items on the agenda for the 28th general session of the OIE committee in 1960 included epizootiology and prophylaxis of foot-and-mouth disease, the rapid detection of new outbreaks of contagious diseases, enterotoxemia and related diseases, prevention of swine and poultry diseases that are due to intensive feeding, diseases of fish, and animal health throughout the world.

Since 1946, the permanent committee on foot-and-mouth disease of the OIE has studied the problems of outbreaks and of immunization.

*Regional conferences.*—The OIE, with officials of the Department of Agriculture of the U.S.S.R. and of the Republic of Kazakhstan, organized a regional conference on parasitic diseases of animals in Asia. Scientific and practical reports of this conference were presented in French and English in a special OIE bulletin. Periodically, OIE and FAO organize regional conferences on epizootics. The conference held in Manila, Philippine Republic, in December 1959 studied regional problems: rinderpest, foot-and-mouth disease, hemorrhagic septicemia, diseases of birds, and diseases of young animals. The United States participated in this conference.

The International Office of Epizootics effectively aids in the prevention of contagious diseases of animals. Since 1927, OIE has been working to limit misery and famine due to outbreaks of animal disease. It fulfills the obligation of the veterinary profession of the world by safeguarding animal health. In member countries, OIE also contributes to man's health and welfare by protecting him from animal diseases which are transmissible to man or which cause economic losses.

## Section 11. United Nations Educational, Scientific and Cultural Organization

The work of the United Nations Educational, Scientific and Cultural Organization with respect to laboratory animals is worthy of note.

In 1955, the International Union of Biological Sciences (IUBS) and the Cell Biology Group of UNESCO independently recognized the existence of this problem on a world scale. Both made an attempt to enlist the help of scientists who had made a special study of this subject. As a direct consequence, there came into being, in December 1956, an International Committee on Laboratory Animals (ICLA) which today has the support of IUBS, CIOMS (Council for International Organizations of Medical Sciences), IUPS (International Union of Physiological Sciences), and UNESCO. The first three international organizations support the work of ICLA by direct monetary grants, while UNESCO provides substantial help by way of contracts for specific projects, provision for traveling and the holding of meetings and much assistance from the secretariat.

A recent report, "Appraisal of UNESCO's Programs," sums up the significance of ICLA's work as follows:

> By drawing up a detailed inventory of pure strains of laboratory animals existing in more than 12 countries of America, Europe, and Asia, and of each country's capacity for breeding specialized strains of animals; facilitating international exchanges of pure strains of animals for use in biological research; and giving advice (to Belgium and Poland in particular) on the establishment of national committees and centers for the selection and breeding of laboratory animals, the committee has shown what can be done, with very modest funds, by concentrating on one specific aspect of a subject, in a sphere in which certain States and many scientific institutions are expending considerable sums in other directions.

A detailed list of documents which have been issued by UNESCO in connection with its work on laboratory animals may be found in appendix part II to the hearings in the International Health Study conducted by this subcommittee, page 616.

## Section 12. National Veterinary Establishments in Foreign Countries

As confirmed in many of the preceding pages, veterinary medical science in the United States has made important contributions to the international scientific community.

It is clear that the converse is true as well. As in every other field of science, foreign nationals have written important chapters in the history of the development of veterinary medicine.

American historians of this particular discipline have reported in detail on the extensive foreign contributions.

### ARTICLE ON HISTORIC CONTRIBUTIONS

A past president of the American Veterinary Medical Association, Dr. A. H. Quin, has written:

> A hundred dramatic sagas could be written about specific contributions of veterinarians to the welfare of the husbandry industries, contributions that actually have contributed countless millions of dollars to our national economy. Let us turn, however, to some of the less publicized contributions of veterinarians to the welfare of mankind.

### RAMON

All down through history dreaded lockjaw—spore-borne tetanus—was a fatal hazard to both civilian and military populations. In the wars of history, including our War Between the States, this killer took as high as 68 of each 1,000 wounded soldiers. In World War II, deaths of our troops from lockjaw could be counted on the fingers of one hand.

A twin killer, the toxin-forming diphtheria bacillus, filled the graveyards of the world with children all through previous centuries.

We can thank a veterinarian, Gaston Ramon of the Pasteur Institute, Paris, France, for tetanus and diphtheria toxoids, effective agents that create solid immunity against these two plagues of man.

Ramon,[1] still living and still working, is a name unknown to the millions of mothers who take babies and children for the preventive "shots" against lockjaw and diphtheria but they can be forever grateful to him.

[1] Deceased in March 1961.

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### FRANZ BENESCH

Not many decades ago, spinal anesthesia was used sparingly, if at all, in human surgery and obstetrics. Today it is used universally and carries an almost negligible number of postoperative complications.

We can state rightfully that Dr. Franz Benesch of the Vienna, Austria, Veterinary Clinic lent major impetus to the employment of spinal anesthesia. Thirty years ago he reported the use of caudal anesthesia in cattle and horses—the technic of injecting the anesthetic posterior to the cauda equina. This technic was safer than the classic puncture of the meninges and its use has vastly broadened the indications for this mode of anesthesia.

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### TABOURIN—PRAVAZ

It is generally conceded that Wood, an Edinburgh physician, made the first therapeutic, hypodermic injection in 1850.

Back of this, there is some credit where credit is due for Tabourin, a veterinarian at the veterinary college in Lyon, France, paved the way for parenteral therapy (the administration of drugs by injection).

Between 1845 and 1848, Tabourin experimented, first with nux vomica or dog button, then with other Galenicals, by inserting them through small incisions in the neck skin of horses and studying the systemic reactions.

Tabourin had a friend in Lyon, one Pravaz, a prominent physician, who soon became intimately associated with Tabourin in studying this new mode of drug administration. To expedite their studies, they fashioned a crude piston instrument with an attached sharpened tube, the forerunner of the present day hypodermic syringe. In Europe, even now, the synonym for hypodermic syringe is Pravaz syringe. Unfortunately the name of Tabourin was forgotten long ago.

* * * * * * *

SCHOFIELD

A great President and some half million other middle-aged males are stricken with coronary thrombosis annually. Deaths from this too common syndrome have been reduced a third by the use of dicumarol.

Few of these victims know that their lives may be saved because of the practical research of a brilliant Canadian veterinarian.

In 1923, Dr. Frank Schofield of the Ontario Veterinary College established that hemorrhagic deaths of cattle grazing sweet clover or fed sweet clover hay were due to presence of a blood anticoagulant factor present in this forage. It was on this basis that Link and others in Wisconsin developed the life saving drug dicumarol—a tamed type of the sweet clover poison that kills animals.

## MODERN CONTRIBUTIONS FROM ABROAD

In still more recent times, the veterinary establishments of foreign lands have contributed significantly to the progress of veterinary regulation and veterinary practice over and above work in research, as such.

Accordingly, the subcommittee has endeavored to explore, at least to the extent that limited time and resources would permit, the status of relationships between American veterinary science and veterinary establishments within foreign countries.

## MULTILATERAL AND BILATERAL RELATIONSHIPS

Earlier sections of the report have described such relationships as they occur through multilateral organizations, both official and private. Such multilateral groups are illustrated by the Food and Agriculture Organization, on the one hand, and the World Veterinary Association, on the other.

A great many United States-foreign contacts occur, however, on a purely bilateral (or, less frequently, trilateral) basis; e.g., between the United States and the United Kingdom, or between them and a third country; e.g., perhaps, within the British Commonwealth.

It would not be feasible in the present print to attempt a detailed discussion as regards these numerous relationships. However, it would be well, we believe, to note the foundation on which such relationships exist, namely, the nature of foreign veterinary medical establishments themselves.

## ARTICLE ON FOREIGN VETERINARIAN ORGANIZATIONS

A pertinent article provides interesting background information on state veterinary organizations in a number of European countries.

The article by M. C. Lambrechts from the September 1959 issue of the Journal of the South African Veterinary Medical Association follows.

It underlines both similarities and differences as compared with our American veterinary establishment.

## A Few Remarks on State Veterinary Organizations in a Number of European Countries by M. C. Lambrechts

During a recent official tour in Europe in connection with the control and eradication of Bovine Tuberculosis, veterinary organizations in a number of countries were also discussed.

It is intended to deal briefly with veterinary services in Italy, England, the Republic of Ireland, Norway, Sweden, Denmark, the Netherlands, Germany, Austria, Switzerland, and Spain.

To discuss in any detail the veterinary organizations of the countries mentioned will take up more time than could be allowed for a talk of this nature. Further information can be supplied on request.

### *General*

Veterinary services have become an essential part of modern society. The need for this service is recognized by all governments. The manner in which the service is to be made available to the nation differs from country to country and is dictated to a large extent by the needs of the particular country.

The rapid increase in human populations underlined the need for greater production of foodstuffs of animal origin. Often this need could not be supplied at home and resulted in the mass movement of animals and animal products between various countries. This in turn increased the danger of the spread of animal diseases to regions where they do not occur. Steps had therefore to be taken not only to control and eradicate animal diseases in the country but to prevent the introduction of diseases from outside. The development of better and more valuable animals also created a need for more veterinary services. Farmers often organized themselves into Associations or co-operatives and employed their own veterinarians.

Veterinarians are increasingly employed not only as inspectors of foods of animal origin but sometimes also of other foods intended for human consumption. The progressive development of the whole plan has extended the scope of the veterinarian to various branches of commerce and industry. All these developments are again based on veterinary education and research.

### *The Development of State Veterinary Services*

State veterinary services were often established as a result of the necessity to control certain epidemic diseases, the organizations created to control these diseases being retained as the nucleus of a general service. In other instances the increasing need to control diseases of animals in the country, for reasons of economy and food supply, as well as the protection of the country's livestock against the introduction of diseases, necessitated the creation of a state veterinary service.

In countries where no serious epidemic diseases occurred the development of the state services were slow and farmers often established their own veterinary services to supply the needs of a highly developed animal industry. These services were sometimes integrated into the state service at a later stage or remained as such and complementary to the state service.

The establishment of private veterinary services were usually the result of a definite need and the reluctance of the State to supply these services. They seldom cover the entire country and ultimately result in expensive overlapping and duplication. They have the advantage of being adapted to particular regions but must lack uniformity of purpose.

In addition to the services mentioned there had been the progressive development of private veterinary practice. There are, however, few European countries where private practitioners are not in some way or other attached to the state machine. This is generally done in a part-time capacity or the execution of certain duties on a fee basis.

Veterinary education is of fundamental importance to ensure a steady supply of a sufficient number of veterinarians with the required training. It is still a state function in countries like Norway, Sweden, Denmark, etc. Elsewhere the training of veterinarians is the function of one or more universities and veterinary schools. The state remains interested in such training at all times.

The extent of veterinary training is impressive in a number of countries where the stock populations are relatively smaller than that in the Union. There are, for instance, no less than 10 veterinary faculties in Italy and the total number of veterinarians in the countries visited range from more than 500 to nearly 8,000.

Veterinary control of animal diseases cannot be efficiently executed without veterinary research and it is a general feature of all state veterinary services for the director to have at his disposal one or more state veterinary research institutes. These institutes are responsible for general research, the production of vaccines and other biological products and diagnosis. Where these products are produced at state institutes uniformity in quality can generally be assured. In many countries the production of vaccines, etc., is also undertaken by private firms and in practically all those countries standards are prescribed by law and a state institute is responsible to control all products before they are allowed to be sold—examples are the State Institute at Alfort in France, and the Paul-Ehrlich Institute in Frankfurt, Germany.

In more recent times the tendency has been to decentralize services and veterinary investigation centres or diagnostic laboratories have been established in many countries to serve particular regions or areas where the services are required. These laboratories also undertake a certain amount of research of a regional nature and cooperate with the central laboratories in research projects covering the entire country or large parts of it.

They further play a major role in disease campaigns, e.g., tuberculosis and brucellosis. There are for instance, 18 such centres in Great Britain, 10 in Norway, 10 in Sweden, 23 in Germany, 3 in Austria, 1 in nearly every Canton in Switzerland and 12 in Spain. In the Netherlands there is a laboratory attached to each of the 11 provincial veterinary services. In Italy there are 10 experimental prophylactic laboratories with a further 39 subcentres.

Most veterinary faculties and schools are also concerned with veterinary research and are often state-aided for the purposes, e.g., in Germany.

There is also a tendency to establish specialized institutes to deal with particular problems, e.g., Foot and Mouth disease, Salmonellosis, Brucellosis, Food Canning (animal products), etc.

Progressively more attention has been paid to zoonoses and even sections for the particular control of these diseases have been established.

Finally, it was found that the control of animal diseases could only be effectively controlled through international cooperation. As a result there were established the well-known organizations through which this cooperation was made possible.

*The place of veterinary services in the state machine*

Veterinary services, like all other services, had to develop in competition with the other services. This had a material influence on what is regarded to fall within the veterinary field in the various countries. The veterinarian plays an important part not only in animal health but also in the production of animal products of high quality and free from disease. Animal breeding and feeding is intimately tied up with his functions. His duties are therefore closely connected with animal husbandry in general and also with public health. The latter relationship becomes more important in view of the large number of zoonoses.

It is therefore not surprising that there appears to have been some difficulty in placing veterinary services in the state machine. They were made a part of either Agriculture or Health. Veterinary services in England, the Republic of Ireland, Norway, Denmark, Austria, and Spain form part of the Departments of Agriculture. In Sweden a Veterinary Board was established in 1947 which is responsible to the Crown through Agriculture. In the Netherlands the Director of Veterinary Services is also Chief Inspector of Public Health and is responsible to both the Departments of Agriculture and Health. In Italy the general direction of veterinary services falls under a Commissioner of Hygiene and Public Health and is an equal partner to Medical and Pharmaceutical Services. There exists, however, the necessary legislation to ensure cooperation between veterinary and agricultural services.

The Federal Veterinary Service in Germany falls under the Department of Agriculture. The veterinary services of the states are, however, all part of the Departments of Health except those in the states of Schleswig-Holstein, Niedersachsen und Nordrheinland-Pfalz.

These developments are interesting and present evidence of the fact that governments are realizing that the entire field of animal health and animal products, even in relation to public health, fall within the scope of the veterinarian. The background and training of the veterinarian form the best foundation for specialization to render the specialized services of the production, inspection, and further preparation of foodstuffs of animal origin.

In Italy and the Netherlands the control of products of animal origin is entirely under veterinary control. Even abattoir construction and municipal meat and milk inspection are ultimately controlled. The same position applies in a number of the Federal States of Western Germany. Meat and milk inspection is under veterinary control in all the rest of the countries mentioned except England. Italy even provides for specialized training in the canning of animal products.

Whilst it is correct and in the interests of the particular services that the veterinarian should function in his own field, it remains most important that liaison should not only be maintained but ensured with the Departments of Agriculture and Health.

A feature of disease control in countries like Italy and Austria is that the civil control officers, Prefect and Mayor (Italy) and "State Chief," "District Chief" and Mayor (Austria), are primarily responsible for veterinary measures against disease with the assistance of the veterinarians concerned.

In Denmark, the private practitioner and police chief take the first steps to control outbreaks of disease.

*The scope and organization of veterinary services*

The State Veterinary Services are generally charged with the following duties:

1. Control and eradication of diseases of animals declared under law.
2. Research, vaccine, and other biological production and diagnosis.
3. Advice in connection with stock disease legislation.
4. Control and registration of veterinary remedies.
5. International cooperation in the control of animal diseases.
6. Stock disease reports.
7. Control of artificial insemination as a means of disease control. The quality of the seed is also a veterinary responsibility.
8. Inspection of meat for export and import purposes. In some countries also inspection for internal consumption forms part of the duties of the state service. Milk inspection is also sometimes included.
9. Control of the import and export of animals and border control.
10. Control of zoonoses.
11. Implementation of the laws for prevention of cruelty to animals.
12. Representation on control bodies of farmers' organizations and co-operatives, etc.
13. Execution of such other duties as may become necessary from time to time.

In some countries the veterinary service is also responsible for the hygiene and control of stock markets, agricultural shows and other gatherings of animals; public drinking places, stables, manure disposal, collecting and handling of offal, abattoir construction; the movement of animals and the means of transport; bees and honey products; the control of the veterinary profession. Also municipal meat and milk inspection and private abattoirs are controlled in certain instances.

Finally, the state veterinary service is insurance against the decimation of the country's livestock and animal industry by the invasion of disease.

The organization of the veterinary services naturally varies but it is interesting to note that a certain pattern of control arrangement is adhered to practically throughout. The Director, or Chief, is assisted by a deputy or deputies followed by a number of senior officers each of whom is responsible for a particular part of control (one or more diseases, imports and exports, etc.). Thereafter follows provincial, regional and/or divisional control with the State Veterinarian right at the front of action, sometimes assisted by lay units.

The inclusion of jurists in the veterinary organization, e.g. Norway, Sweden, Germany, is interesting and must serve a very useful purpose.

A further feature in many countries is the use made of private practitioners. In Italy they are employed as part-time border control officers, officers in control of ports and airports, in certain instances, and part-time meat inspectors. In Switzerland very much the same pattern applies. In England large numbers of practitioners are on the special and general panel and perform state duties at prescribed fees. Practitioners perform part-time state duties in all the other countries concerned and in Sweden this organization is so arranged that very few practitioners are engaged in practice only. Sometimes practitioners are employed full-time on a temporary basis, e.g., in England, Spain, Germany.

These officers are mainly engaged on tuberculin testing and the control of brucellosis.

Research institutes generally enjoy a fair amount of autonomy but always fall under the direction of the Chief of the Service.

State veterinary research is often supplemented by special research organizations like the Agricultural Research Council in England, specialist institutes, regional laboratories, universities and private firms.

Admission of veterinarians to the state service in, for example, Germany and Austria is subject to some 8 years' experience as a practitioner followed by about a year's intensive study in veterinary law, meat and milk inspection, and finally a State Examination. State veterinarians are allowed to practice privately on their own account in Norway and Sweden.

Technical assistants for employment in laboratories are specially trained and receive diplomas on completion of their studies, for example, Germany. The same applies to lay meat inspectors. The latter class of officials are not extensively used on the continent where meat inspection is essentially carried out by veterinarians.

The large numbers of veterinarians in state employment in the various countries, either full- or part-time, are proof of the requirements of the modern State Veterinary Service.

*Conclusion and discussion*

Observations in Europe indicate that the responsibility of the state in regard to veterinary control does not decrease with modern development. The opposite is rather the case. Improved animals and farming methods, increased demands for foodstuffs of animal origin and the development in food preparation dictate not only bigger but more specialized state veterinary services. The animal industry has also become relatively more precious and must be protected. The large numbers of veterinarians required to combat and eradicate diseases like bovine tuberculosis are beyond the scope of any state service. This difficulty had been overcome by making extensive use of the services of practicing veterinarians who have often been integrated in the state machine. In this way it is generally possible to establish a sufficient veterinary force to meet all eventualities.

Veterinary research is undertaken on an extensive scale. Apart from topical research, modern developments have also dictated fundamental research. It is further a recognized fact that central research institutes can, in most instances, no longer cope with all the needs of research and diagnosis. Especially the latter service had to be decentralized in the interests of disease control generally, regional research in cooperation with the central institutes and the needs of particular regions and types of farming. Particular circumstances cannot always be reproduced at the central research institute. These laboratories also lend themselves as administrative centres of a regional nature.

Specialist institutes have been established, sometimes at very considerable cost, as a further safeguard of the countries' animal industries.

Veterinary education can be the function of the state or universities, if the latter are financially able to undertake this service. The state should, however, remain interested in the training of veterinarians through its State Service and by way of financial support where necessary. The curriculum should be realistic and in step with modern demands. Provision for postgraduate and specialized training have become essential facets of this service and must provide the trained manpower required for the varied aspects of modern veterinary administration and control.

Efficient veterinary administration can be achieved in more than one way. The Swedish system of a Veterinary Board whose Director in Chief is also chairman of the controlling body of the State Research Institute and ex officio member of the controlling body of the Royal Veterinary College, appears to have several organizational advantages. The four members of the Veterinary Board are also Heads of Departments and administer specific aspects of control. The controlling bodies of both the Royal Veterinary College and the Research Institute are appointed for definite terms of office.

The patterns of administrative organization found elsewhere are obviously based on experience and the needs of the country. The general arrangement of a Director, assisted by Deputies or other senior officials as Heads of Departments or Sections, responsible for particular aspects of control, must have the merit of establishing specialized control. Specialization of this nature has the further advantage of placing at the disposal of the director a well balanced advisory body of responsible officials.

A scientific advisory committee of the nature of that existing in Sweden appears to be a further modern innovation which is essential to enable the director to perform his duties efficiently. Representation on this committee can also serve to establish essential liaison with other services.

The director (chief) of veterinary services should be represented either directly, or through his staff, on all bodies, organizations, etc., which are concerned with animals and their products.

Regional veterinary administration is usually arranged in provincial, regional, divisional and district veterinarians' districts. The extent of these services depends on the particular needs.

The function of the veterinarian in connection with the production, handling, inspection, etc., of foodstuffs of animal origin, has been widely recognized. This public health service is variously rendered, either directly by the State Veterinary Administration and in conjunction with local authorities, farmers' associations and cooperatives or indirectly by the departments of health with State veterinary control of imports and exports. Fractional veterinary control is detrimental because it prevents proper planning on a national scale and sometimes results in expensive overlapping of control, which hampers efficiency.

The ideal and most efficient control and administration could be achieved by placing the entire aspect of hygiene and public health, of a veterinary nature, in the hands of the state veterinary administration. The control of animal transport, markets, shows, expositions, slaughterings, care of meat and other animal products, disposal of manure, etc., form essential aspects of the control of animal diseases and zoonoses. The further treatment and manufacture of animal products also rightly belong in the veterinary field.

A unified service will enable of a balanced approach not only of the specialized training required to perform all these functions, but also a planned service with enormous advantages to the state economy.

A service of the nature should obviously be an autonomous unit. Its functions should be clearly defined by law and provision made for the necessary liaison and cooperation with allied departments.

*Acknowledgments*

The author wishes to thank sincerely all the colleagues who so kindly supplied information on this subject.

*References*

1. Veterinary work in the Netherlands, 1953.
2. Organisation du Service Vétérinaire en Italie par M. le Professeur I. Altara.
3. Veterinary Services in Sweden.
4. The Danish Veterinary Service as it is today by F. Woldike Nielsen.

## Section 13. The International Challenge

### Appraisal by Dr. Martin Kaplan

Few individuals are more competent to offer an expert appraisal as to current international priorities in animal disease control than Dr. Martin Kaplan, Chief, Veterinary Public Health Section, Division of Communicable Diseases, World Health Organization.

The following is an excerpt of an article which he contributed to the Annals of the New York Academy of Sciences a few months before our subcommittee commenced its project. The passage of time has not substantially altered the significance of his competent analysis, which follows:

### Global Priorities in Animal-Disease Control[1]

By Martin M. Kaplan, World Health Organization, Geneva, Switzerland

#### The Major Diseases

Now a glance at the animal-disease problems having the greatest visible impact on public health and the economics of food production. Here we shall

[1] New York Academy of Sciences, Ann. 70(3)743–746. June 3, 1958.

use capsule summaries of the major diseases as they affect the less-developed countries and as they may affect the more technically advanced ones.

*Foot-and-mouth disease.*—The difficulties in the control of this malady may be summarized thus: extreme communicability, with such bizarre features as human and avian migrants as vectors; at least seven distinct major types of virus with intratype variation; and costly and cumbersome methods of control, such as slaughter and ring vaccination with inactivated vaccines of short and often doubtful efficacy. A light on the horizon appears to be the successful development of living attenuated strains for vaccination purposes, the only practical answer for most countries apart from North America, northern Europe, and Oceania.

*Rinderpest.*—In distinction to foot-and-mouth disease, rinderpest is a rather easy disease to control. Effective and inexpensive living attenuated vaccines have been developed and are available, and even rudimentary sanitary measures can limit its spread. The problem is how to use these tools under the difficult conditions prevailing in Africa and Asia, but even on these continents the progress has been considerable, for which we thank FAO for its energetic efforts. In general, the same thing may be said about contagious pleuropneumonia, hemorrhagic septicemia, and anthrax, diseases of great destructiveness in these areas.

*Parasitic diseases.*—The many ailments in this category unquestionably take the greatest economic toll. Helminths, flukes, and blood parasites lead the roster. Textbook recommendations for the control of these diseases often fail in the face of the realities of field conditions in underdeveloped countries. The magnitude of the problems posed by these diseases, involving as they do the social organization and economic structure of these countries, is such as to make impossible any early solution.

*Brucellosis and leptospirosis.*—These two diseases illustrate the close working relationship between WHO and FAO as they deal with zoonoses problems of economic and public health importance.

The major problem at this time with respect to brucellosis lies in the development and application of a vaccine effective in sheep and goats. During the past five years WHO and FAO have coordinated and supported research in this field, and results are encouraging. In October 1957 the joint FAO-WHO Expert Committee on Brucellosis will have met in Lima, Peru, to evaluate the experimental work carried out on brucellosis in the fifteen FAO-WHO brucellosis centers located in different parts of the world, and the report of this committee should be useful as a guide to our member countries.

In leptospirosis, WHO and FAO have concentrated their efforts on typing procedures with reference to *Leptospira*, and in developing standard diagnostic tests that can be used without too much difficulty in hospitals and laboratories in the routine diagnosis of this disease in man and animals. This work is being carried out through six WHO-FAO Reference Leptospirosis Laboratories, one each in Australia, Holland, Italy, Japan, the United Kingdom, and the United States.

*Rabies.*—Most of you are aware of the considerable attention WHO has given to rabies, with respect to the improvement of vaccines, investigations of hyperimune serum in prophylaxis, and in wildlife studies. Perhaps one of the greatest obstacles in the way of advances in laboratory research connected with rabies has been the inability to cultivate the virus on tissue culture to any satisfactory degree.

*Hydatidosis.*—This disease deserves brief mention because of the extent of human illness it produces as well as the very great economic losses it causes in livestock products in South America, in the Mediterranean area, and in Oceania. Effective control of this disease cannot be achieved under conditions found in most affected areas until a better drug than arecoline is found for the treatment of dogs infested with the *Echinococcus* tapeworm, and until more practical ovacides than creolin are developed. We are encouraging research on this problem, but we are not optimistic about finding an early answer because relatively few laboratories are working in this field.

### DISEASES OF LESS IMPORTANCE

Now let us take a quick jump from these obvious diseases to more shadowy areas where future developments in human-animal disease relationships are likely to be most interesting and fruitful. Here we find that actual and potential

zoonoses occupy only a part of these relationships, while essentially noncommunicable entities begin to call for increased attention. In keeping to my assignment, however, I shall deal only with the communicable diseases having an animal component, known or suspected, in their epidemiology. To remain within the limits of the space at my disposal I shall use the device of question and no answer.

Do the findings of *apparently* specific antibodies to the polio, Coxsackie, and adenoviruses in domestic animals, and to canine distemper in humans, have any significance in the epidemiological cycles of these diseases?

Do animal reservoirs play any part in the epidemiology of human influenza? Of toxoplasmosis?

What is the evolutionary history of the arthropod-borne (arbor) viruses (or of any virus)?

To what extent are the "orphan" viruses being isolated from man and animal species specific? The psittacosis-like organisms? What is their significance as disease-producing entities?

Is rabies in nonvampire bats a new phenomenon, or have these animals long been involved in the natural history of this disease? Are they of any importance in its epidemiology? Apart from vampire bats, are there other asymptomatic carriers of the rabies virus in wildlife?

The common denominator of these questions is that we are dealing with viruses and their natural history: a rich field for speculation with commensurate rewards in pragmatic achievement and intellectual satisfaction to those providing the keys to their solution.

WHO is approaching these problems by taking advantage of its unusual opportunity to coordinate laboratory research efforts and field investigations. This is illustrated by animal serologic studies on human influenza antibodies, now under way in twenty-five countries, to determine whether animals are involved in the epidemiology of human influenza, and by a worldwide survey for Q fever prevalence recently completed. In addition, networks of laboratories are collaborating with WHO with respect to poliomyelitis, treponematoses, tuberculosis, malaria, and schistosomiasis, apart from influenza, rabies, brucellosis, leptospirosis, and hydatidosis, all mentioned previously.

### A PROJECT OF INTEREST

One further project, as yet unimplemented, may be worth mentioning. It is clear to everyone that host-parasite relationships are continuously changing, and it is probable that new disease entities or unsuspected human-animal disease relationships will evolve. Until the present time, one of the failures in studies on communicable diseases has been our inability to follow the progression of disease in geographical areas at different points of time. This failure cannot be attributed to human oversight, but rather to the limited opportunities and tools available for instituting appropriate studies. While conditions are better in this connection, it will be many years before there will be sufficient facilities to cope with the many problems associated with progression parameters in the epidemiology of communicable diseases. Nevertheless, in the meantime certain steps are possible that would no doubt be of invaluable assistance later when more detailed studies will be feasible. This thought underlines the reasoning behind projected work in epidemiological studies based on serology. Briefly, it is planned to arrange for serum specimens to be taken from different age groups in human beings and animals in various parts of the world within a given span of time, to catalogue these specimens, and to store them in a refrigerated or freeze-dried state for examination, perhaps many years later. Thus, where a particular study will be undertaken on one or more diseases, serum specimens from the human and animal population of a geographical area of interest would be available for examination by qualified laboratories.

Such work can be done uniquely by an organization such as WHO, with the collaboration of FAO, and should be of immense benefit in improving our knowledge in control efforts of communicable diseases both in the near and more distant future. WHO's role would be principally that of a coordinator, for it should be stressed that the real contribution and effort would come from the collaborating laboratories and scientists throughout the world who have so generously contributed their services and facilities in the past, and who, we do not doubt, will continue to do so.

REPORT BY ORGANIZATION FOR EUROPEAN ECONOMIC COOPERATION

The subcommittee has noted with interest a series of reports by the Organization for European Economic Cooperation [1] which are pertinent to the strengthening of veterinary services in Western Europe. For example, in 1952 there was published a report entitled, "Control of Livestock Diseases in European Countries." This was followed by a series of separate publications on particular diseases.

In March 1959, OEEC's European Productivity Agency, through its Division for Technical Action and Productivity in Agriculture and Food published a helpful report entitled, "Livestock Diseases and the Organization of Veterinary Services in Europe."

The following are a few excerpts from that report, bearing particularly on research:

RESEARCH

The development and effectiveness of scientific research in veterinary medicine are dependent on personal and economic factors. In any field, research should be sheltered from material anxieties. It is lamentable that the scientist should find himself obliged to interrupt his research in order to engage in some remunerative activity.

Large, well-equipped premises are doubtless necessary, but it is also necessary to assure to the research worker a salary and status compatible with his intellectual worth. Scientific work cannot flourish except in a calm atmosphere. Too often are the costs of research regarded as a heavy burden by the very people who would be the first to benefit from its results. Given sound mutual understanding, there could be full cooperation between research and public authorities, and also with agricultural associations.

Research concerned with diseases of livestock finds the infectious diseases an easier domain to explore than the parasitic diseases and the disorders of nutrition. Many of these call for close correlation between clinical medicine, statistics and laboratory investigation.

The research worker must be able at all times to go into the field, and be supplied with necessary material and statistics by the operational services concerned. The essential close coordination between the various services dealing with the control of animal diseases could perhaps be best assured by a high level advisory council of some kind at which the responsible authorities could discuss and review results. Similarly, research teams should be fully complemented since the veterinarian, even though he be a specialist, cannot attain the achievements of the professional research scientist working within the scientific discipline which is the product of his basic training.

The notion of international research should not be abandoned a priori. But it should be borne in mind that if research is conducted by independent teams, all dealing with the same subject, the comparisons of methods and of results are likely to be much more fruitful. Further, it would certainly be most regrettable if among large multinational groups personal initiative was negatived or ignored and was unable to develop through lack of independence. In research, more than in any other field, success is determined by the ability of the individual.

[1] Now reorganized as the Organization for Economic Cooperation and Development.

# PART VI. OBSERVATIONS ON VETERINARY MEDICAL RESEARCH

Preceding parts have been drawn by and large from individual contributions to the subcommittee from various experts.

The present part represents observations by the chairman of the subcommittee, based upon 2 years of staff study and innumerable communications from the scientific world.

Three sections comprise this part:

1. Organization, financing, and goals of veterinary effort;
2. Management of information on veterinary science; and
3. Veterinary medical education and international research and assistance.

## Section 1. Organization, Financing and Goals of Veterinary Effort

The initial section will be devoted to certain broad considerations relating to the organization, financing and goals of veterinary effort.

### A. MULTIPLE FEDERAL SOURCES OF SUPPORT

It is a longstanding policy of the U.S. Congress to have, within the framework of specialized statutes, multiple sources of support for Federal biomedical research. This is a sound policy, according to virtually all reports received by the subcommittee from scientists throughout the Nation.

No one Federal department has or should attempt to have a monopoly on scientific competence. Each department naturally specializes according to its mandate under law and Executive order and develops a particular pool of know-how, expertness, and interest. But it is neither feasible nor desirable, in the judgment of scientific authorities, to try to draw an artificial boundary line between, let us say, veterinary medicine and human medicine, and to attempt to say that "the Department of Agriculture should stay exclusively on the one side and the Department of Health, Education, and Welfare exclusively on the other."

In the first place, more than these two departments are involved; in the second place, as dozens of illustrations throughout this report have shown, what appears pertinent to "veterinary medicine" alone today may tomorow be an invaluable clue in the solution of disease afflicting man, and vice versa.

In the third place, as in the case of the zoonoses, themselves, an "animal-man" dichotomy would be false; the subject is, by definition, one.

### B. CONGRESS' INTEREST IN AGENCIES' JURISDICTIONS

It is clear, however, that the Congress definitely wishes and insists that each Federal department and agency conform to and carry out its particular responsibilities under law and, in so doing, avoid, to the extent that it is feasible, needless duplication.

The taxpayer is entitled to every possible protection against unjustified and unknowing overlapping of effort and expenditure.

The key words obviously are "needless," "unjustified," "unknowing"; their converses—"necessary," "justified," and "knowing"—represent an entirely different matter.

Multiple approaches by one or two or more Federal agencies to try to solve a given disease problem are not only necessary; they are often indispensable. Countless times, scientists, whether federally or nonfederally sponsored, will intentionally repeat other scientists' experiments; or they will parallel other's experiments, altering them slightly or appreciably, depending upon an individual's hypothesis and objective.

The ultimate scientific goal is the same—the advancement of human knowledge, the unlocking of the mysteries of the unknown, the quest of truth.

An agency's or an individual's path of research is rarely easy; it may appear, at least in retrospect, to have been "simple," but it is invariably lined with detours, blind alleys and pitfalls.

For Federal and federally supported administrators and scientists, each day offers new problems of how to attain the targets of science within the framework of existing law, regulation, appropriations and jurisdiction.

### C. AREAS OF COMMON INTEREST AMONG AGENCIES

Related activities by both governmental and intergovernmental organizations tend, like most human institutions, to "sprawl." It is clear, therefore, that caution against possible needless, unjustified and unknowing duplication must be exercised in the administration of related programs by such entities as:

1. Agricultural Research Service (USDA) and National Institutes of Health (HEW).
2. Veterinary Biologics Control (USDA) and Food and Drug Administration (HEW).
3. Foreign Agricultural Service (USDA) and International Cooperation Administration (State Department).
4. Food and Agriculture Organization and World Health Organization.
5. Publicly supported and privately supported endeavors.

Evidence received by the subcommittee indicates that, fortunately, with but a few exceptions, such caution is indeed being observed. Where need is great, as it is in research, few are the scientists who will knowingly and unjustifiably duplicate effort.

But the rate of growth of scientific knowledge is accelerating so rapidly and the nature of the Nation's needs evolving so dynamically that areas of jurisdiction, which may once have been relatively clear cut between agencies, may become more and more difficult to demarcate.

Human personality, too, is such that a flexible mandate may, with the best of motives, be interpreted in ways beyond the scope intended by the giver of the mandate, resulting in needless overlap.

That is why this subcommittee has sought to survey the vast range of present Federal biomedical research to determine who is now actually doing what. It is for this reason that the subcommittee held a hearing on coordination of interagency research. It is why this volume draws together, for the first time, all or virtually all the pieces of the total picture of Federal veterinary outlay as it exists today, rather than merely as it was defined by statute, present and past.

Similarly, it is why we note the significant comments by the Agricultural Board of the National Academy of Sciences-National Research Council (see p. 76) not only on what it regards as the need for more men, money, and facilities, but on the need for more coordination of public and private research activity.

### D. THE CRUCIAL NEED—CREATIVITY

As in other sciences, future results of veterinary medical research will indeed depend basically upon the three factors—men, money, and facilities. Money may help toward providing men and facilities, but no one would dispute the fact that, in the final analysis, it is the creativity of the scientists which is the ultimate determinant of the actual success of research. The scientist must have an atmosphere of freedom in which to work; a climate in which creativity is encouraged. He must have conditions of employment which assure him what he personally needs and when he needs it—recognition by his peers and by the public, adequate materials, equipment, laboratories, etc.

He must also have time—time to think, to read, to confer, to work.

No timetable for research results can be set in advance. The mysteries of a disease—cancer or influenza—may be unraveled in a month, a year, or "never." All that is known is that if research is well supported, it will tend to yield benefits which will more than repay the investment.

That fact is borne out throughout this publication.

### E. POLICY QUESTIONS CONFRONTING CONGRESS

A number of important policy questions confront the Congress:

(*a*) Within the framework of present statutes, what should be policy as regards future funding of veterinary medical science and veterinary medical research, as between:

(1) the Federal Government and State governments;

(2) the Federal Government and private industry.

(*b*) What should be policy as regards possible encouragement by Federal and other sources for manpower entering into veterinary science—into private practice, public service, veterinary education and research—as contrasted with entry into other fields of science?

Shortages are reported in most veterinary fields, but they exist elsewhere in science as well. Which disciplines have the highest priority needs? This is an exceedingly complex question which can hardly be solved except by broad interagency and public-private review by the most knowledgeable experts.

Science in the United States is changing. Agriculture is changing. Food consumption patterns are evolving. The nature and size of the animal population is in flux. Yesterday's statistics and formulas for manpower and funds may be and probably are obsolete.

Expert projections as to the future must be made, and this must be done within a broad frame of reference.

This subcommittee would not presume to offer any suggestions on problems such as the above which can be addressed only by the most competent experts.

*Man-oriented and animal-oriented research*

Finally, we would not attempt to recommend any changes in the present proportions of Federal effort as between what might be termed, for purposes of simplification, "man-oriented" or "animal-oriented" research. Since public information has tended to be concentrated on the former, however, we might, at this point, quote less often heard observations by a veterinarian. The following is an extract from an article by a distinguished expert, H. J. Stafseth, D.V.M., Ph. D., Department of Microbiology and Public Health, Michigan State University.

Speaking in January 1957 before the 57th Annual Conference of Veterinarians, University of Pennsylvania, Philadelphia, he noted, first, the difficulty of using arbitrary labels:

> During the preparation of this paper I found it difficult, at times, to decide when medicine is strictly human or strictly veterinary medicine. In dealing with medical practices there is, of course, no difficulty. Obviously, when medicine is applied to human beings it is human medicine and when applied to animals it is veterinary medicine. However, when one considers medical research, preventive medicine and public health, the line of demarcation is not always so clear. Is medical research to be labelled human medicine or veterinary medicine according to the degrees held by the investigators? If so, what is it when the researcher has neither the M.D. nor the D.V.M. degree, as in the case of Pasteur, whose work with fowl cholera, anthrax, and rabies, etc., revolutionized medicine? Fowl cholera is a disease of poultry, and rabies and anthrax are diseases of animals communicable to man. What about the work of Ramon? This French veterinarian developed the flocculation test for the standardization of diphtheria toxin, and was also one of the pioneers in the development of toxoids. Is his work to be classed as veterinary medicine because he was a veterinarian or as human medicine because diphtheria is a disease of human beings?
>
> There are other examples of this kind that illustrate what I mean. Texas fever is a disease of cattle, occasionally affecting deer but not man. This disease was studied by three employees of the Bureau of Animal Industry, U.S. Department of Agriculture: Theobald Smith, a physician, and F. L. Kilborne and Cooper Curtice, both veterinarians. These men discovered the cause of Texas fever and proved the claim of cattle men, long ridiculed by medical experts, that the tick *Margaropus annulatus* is one of the vectors of *Babesia bigemina*, the cause of this disease. The Chief of the BAI, and the director of this work, was D. E. Salmon, D.V.M. In most of the literature, both scientific and popular, Smith is generally credited with those discoveries. Kilborne is unquestionably given too little credit for his part in this work, and Curtice is relatively seldom mentioned.
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> * * * * * * *
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> Not only was this work of prime importance in that it made profitable cattle raising possible in the South and, thereby, increased the amount and improved the quality of the meat supply of the world, but it also helped solve problems related to the epidemiology of yellow fever and malaria. So, again I ask, is this monumental work to be classified as human medicine because a physician was involved as one of the bosses of a team, or is it to be classed as veterinary medicine because the disease concerned affects only animals, and one of the bosses and two members of the team were veterinarians?

Another thing that makes it difficult to decide when we are dealing with human or veterinary medicine is the fact that the principles of physiology, pharmacology, microbiology, immunology, and pathology are essentially the same whether we deal with man, beasts, or birds. Therefore, research in one field often contributes to others. Perhaps the wise thing to do is to agree with Sir William Osler, who took the attitude that there is only one medicine.

Dr. Stafseth went on to observe:

*What About the Comparative Productiveness of Human and Veterinary Medicine?*

Considering the manpower, the physical facilities and amounts of money available for research in the two branches of medicine, I think we have to admit that veterinary research workers have been quite productive. While veterinary research institutions spend hundreds of dollars, medical institutions spend thousands, and while veterinary research workers spend thousands, medical men spend millions. All this, despite the fact that many problems related to animal diseases are just as difficult as those encountered in human medical research.

Research on diseases of large animals is especially expensive; in fact, so expensive that it is practically impossible to do respectable work with the funds, physical facilities, and the limited, trained manpower presently available. Why is this so? There has always been a shortage of well-trained personnel, because relatively few young men and women have entered veterinary medicine. At present, we have larger numbers of students, but lately veterinary practice has been so lucrative that it is difficult to interest capable people in the less remunerative fields of teaching and research. Also, veterinary services have far too long been considered purely from an economic point of view. Little or no attention has been paid to the general medical values and the public health aspects of veterinary services and animal disease research. Sentiment and sympathy are important factors to those who seek money for research on human diseases. Generally speaking this is not so with respect to animal disease research. Strong support for animal disease research has, so far, usually come from lovers of pet animals and those who have suffered great economic losses because of diseases of animals. Unfortunately, few such people sit in our legislative halls.

Another important reason for inadequate support of animal disease research is that most of the work is done in agricultural experiment stations, where the allocation of funds for animal disease research are compared with those granted for research on hay, potatoes, or some other relatively inexpensive project. Experiment station directors are usually agriculturalists, almost never medical men of any sort. Therefore, they do not seem to appreciate our problems fully. One ray of hope is the fact that the U.S. Department of Agriculture has succeeded in setting up an elaborate experiment station for research on exotic diseases of food-producing animals. Another will be established soon for the study of serious domestic diseases. However, the most difficult thing is not to get money for buildings, but to get continued, adequate financial support for research. Another ray of hope is the increased interest shown by commercial manufacturers of biological and pharmaceutical products as well as by other commercial companies. These concerns employ a considerable number of able veterinarians and are supporting research in their own institutions and by grants to agricultural experiment stations. Unfortunately, also in such cases the grants are not always adequate for high quality work.

### F. CONSERVING THE TAXPAYERS' RESOURCES

It is central to the interest of this subcommittee to find ways and means of conserving the resources of the taxpayers of the United States. There are several ways of doing so. A principal way is by maximizing the yield from any given level to research expenditures.

One way of doing this is to make sure that if "A" is doing research related to what "B" is also doing, there be optimum exchange of information between them. This is one of the reasons why detailed comment is made in the following section on communication between researchers.

Another channel of communication is between research administrators. There is little doubt that communication can and should be improved in this respect as well. Thereby, research administrators can better plan, program, and fund their projects. They can allocate their limited resources in ways which will reap the most good for a given amount of money. They can plan joint projects in circumstances where collaborative interagency or intragency projects may be desirable and feasible. They can decide that one agency should attack one phase of a problem while another can concentrate on another, rather than have them divide their efforts without specialization of labor.

It is not without reason that the Agricultural Board commented on the need for greater coordination in veterinary research. The proliferation of units, research investigators, and research projects makes such coordination essential in this, as in other fields. At the same time, rigid coordination, excessive requirements for conferring or reporting may prove as harmful to scientists' productivity as a complete lack of coordination. What is needed is flexibility of communication in which "A" voluntarily seeks to work together as a team with "B" rather than because of arbitrary edicts.

But, if there is to be communication between research administrators it must occur both within and outside the boundaries of veterinary science.

The subcommittee has nowhere found dispute of the fact that the lines of communication between veterinary medical science and other branches of medical science must be widened. This is a process which must be started at the undergraduate level between the faculties and student bodies of colleges of medicine and colleges of veterinary medicine as well as throughout the entire subsequent fabric of research and regulation.

In particular, communication and cooperation must be widened between Federal regulatory units on the one hand and research units on the other. It is pointed out earlier that Federal-State inspection of meat provides the largest single body of evidence to be found anywhere in the world on gross pathology. If this vast body of evidence is to be utilized to the fullest, it will take a mandate from the Congress to do so. But it will also take an interest on the part of scientists and administrators and adequate technical personnel to pursue the opportunity.

The point which we make is that it is not enough to have a mandate for communication together with resources for and lines of communication; it is important that there be something to communicate, a will to communicate, and adequate technical personnel to do the job.

In the 1961 fiscal year, the Congress provided for the National Cancer Institute alone $110 million. If the battle against cancer is worth this sum, as the chairman of the subcommittee believes it to be (and far more), then, it is certainly worth expending a relatively small proportion of it or an additional sum in order to learn from animal tumors whatever can be learned.

Thereby, we may speed the day when the $110 million or more annual appropriations can be saved (or diverted to other purposes),

because the problem of cancer may have then been solved, in whole or in part.

The conclusion is that a total, broad-gaged research effort which may accelerate the conquest of a disease may in the long run be "cheap," while a limited, segmented research effort which goes on year after year with smaller sums and inadequate teamwork may be actually fiscally "expensive" (not to mention the toll in lives lost in the interim).

What appears necessary is a comprehensive program which makes the fullest possible use of every resource, every skill, every discipline.

Multidisciplinary research is called for by the very nature of today's scientific development. Pursuit of knowledge of viruses "alone" demands the skills of the geneticist, the biologist, the taxonomist, the ecologist, the physiologist, embryologist, microbiologist, biochemist, biophysicist, not to mention other specialties which may or may not be found in any given USDA, NIH, or other laboratory. Science is a unity, because nature is a unity. And in prying the secrets from nature, long-range research may actually prove "cheaper" than short-range research, and interagency research more productive than a "go-it-alone" effort.

## Section 2. Management of Information on Veterinary Science

For the past 3 years, the Senate Committee on Government Operations has concentrated intensively on two particular problems within the general domain of science:

1. The organization of scientific activity in the U.S. Government.
2. Within that context, the organization of scientific documentation services.

This section concerns the latter phase: how information in one area of science—veterinary science and, in particular, veterinary medical research—is managed.

### A. BACKGROUND

It would not be the purpose of these observations to attempt a definitive analysis of this subtopic, for that would take a volume in itself.

Rather, there are submitted here certain personal observations on a few phases of this subject.

*Committee's report on documentation*

These observations, it should be noted, do not stand alone. The reader's attention is invited to Senate Report 113, 86th Congress, 2d session, entitled, "Documentation, Indexing, and Retrieval of Scientific Information." It was published by the Senate Committee on Government Operations in June 1960 and represents our definitive statement in this general field of information in published form. The report was compiled by the staff of the full committee under the direction of the staff director-chief clerk, Mr. Walter Reynolds.

Within that publication are contained numerous references to the work of the Department of Agriculture Library as one of the three great Federal library systems, the other two being the National Library of Medicine and the Library of Congress.

No point would be served by repeating the considerable body of information set forth at length within that publication, as it bears upon the USDA Library as a whole. That section (pp. 144 to 147) serves as excellent background, however, to the more specialized focus herein on the availability of information on veterinary medical research in particular.

This section poses the following question:

> Are present information resources adequate for progress in veterinary medical science?

The question is asked because, as shown earlier within this volume, the Federal Government alone is spending—

(*a*) Over $65 million for veterinary medicine including

(*b*) Over $13 million in veterinary medical research;

(*c*) Small but rising amounts in foreign currencies abroad for veterinary activities.

Moreover, as indicated earlier, there is a vast indirect impact by veterinary medical research on the much larger overall body of federally supported biomedical research. The latter expenditure aggregates three-quarters of a billion dollars currently.

The question, then, may be rephrased:

> Does the information system on $13 million of veterinary medical research make an optimum contribution to progress from the three-quarters of a billion dollars of all biomedical research?

Even a cursory examination would lead to the answer, "Unfortunately, no."

The negative answer is not given because of any deficiency in the individuals' attempting to meet the veterinary information problem. Precisely to the contrary, the answer is given despite the high caliber of documentation experts within the USDA Library and other facilities.

But resources are not available to come to grips with the information problem in the most modern and efficient manner.

Why? In large part because, in the judgment of the chairman of the subcommittee, neither the legislative nor the executive branches have given the necessary recognition to the crucial role of information services in maximizing the return on the invested research dollar, so to speak.

Such recognition as has been given has come primarily from the Congress, to date, notably through the National Defense Education Act and the establishment of the expert Science Information Service within the National Science Foundation.

What, then, comprises the information problem?

### B. THE PROBLEM

The information problem may be considered in two major categories:

1. Information on research prior to publication.
2. Information on research which has been published.

The problem is:

> How to assure optimum management and dissemination of information in both categories?

Of the two phases, the latter is infinitely more significant. The reason is obvious. Science advances on the basis of the proven results of scientific experimentation, as reported in the journals of science.

This section accordingly concentrates on the problem of scientific documentation—the storage, indexing, and retrieval of information from scientific papers, monographs, articles, and books.

*1. Utilizing prepublication data*

But before turning to that phase, let us note briefly the matter of information on prepublication research.

On August 11, 1960, the subcommittee held a hearing on Coordination of Interagency Activities in Biomedical Research. Representatives of nine Federal agencies, including the Department of Agriculture, testified. One of the main subjects of discussion was the exchange of information among research administrators and researchers on scientific research still in process or completed, but not written up.

The subcommittee felt that this topic was worth serious consideration because:

1. Research administrators should be able to make their decision for funding new research, based on at least general knowledge as to related research which is in progress elsewhere.

2. Many individual researchers may be interested in surveying the field of current research in order to be better able to decide whether to undertake a support of a given new project and to apply for support of it.

Is someone already doing virtually the same work? Or is someone doing related work which could provide useful leads? These are important questions to a researcher before he gets underway.

3. Both researcher administrators and individual researchers can find value in learning whether a project was already undertaken elsewhere, only to yield negative results.

It is important, therefore, that there be a reliable information system which would chronicle the existence of research from its very inception. The reason is that much research will never be published at all or even orally discussed.

It may be terminated prematurely. It may be completed but end in negative results; or, for a variety of other reasons, it may never reach publication form. Some system should exist, therefore, whereby the fact that research once took place on a given subject can be traced back.

*USDA systems*

The Department of Agriculture, through its central project file and its State experimentation file, provides useful information on current research. The Department does not, however, contribute to what has heretofore been known as the Bio-Sciences Information Exchange, and what is now termed as the Science Information Exchange (in that it will henceforth include data for the physical sciences, as well).

The matter of USDA–Science Information Exchange relationships was therefore discussed at the August 11, 1960, hearing. The Department of Agriculture representatives present at the hearing and USDA officials, in helpful correspondence subsequent to the hearing, confirmed the Department's appreciation of the significance of the problem of USDA–SIE cooperation.

"How then to assure getting optimum value out of information on current or completed, unpublished research?" remains an important problem.

It is a problem for the Department and for all other agencies which might have projects related to those of USDA.

*Report on prepublication information*

On May 18, 1961, the Committee on Government Operations filed Senate Report 263, 87th Congress. The report was entitled "Coordination of Information on Current Scientific Research and Development Supported by the U.S. Government."

The report analyzed (pp. 115–127) the Department of Agriculture's central project office file and State experimental station file, among other systems.

*Magnitude of overall USDA research*

The report also set forth certain useful information as to the magnitude of all USDA and other sponsored research (of which study of a veterinary nature is but a small part). The report noted on pages 115–116 the following facts (which may provide perspective as to the general matrix within which veterinary research is carried out):

Agricultural research in the United States involved appropriations in fiscal year 1960 exceeding $234 million. By far the majority of this program is supported by public funds, either State or Federal. Approximately three-fifths of all agricultural research is conducted by State agricultural experiment stations, although in part on a cooperative basis with Federal grant funds. The USDA is directly responsible for the sponsorship or conduct of the remaining sector of agricultural research, amounting to $88,542,000, primarily through intramural activity. A breakdown of appropriations for agricultural research is given in table 14.

TABLE 14.—*Estimated appropriations for research—U.S. Department of Agriculture and State experiment stations, fiscal years 1959–60*

[Thousands of dollars]

| Category and agency | 1959 | 1960 |
|---|---|---|
| U.S. Department of Agriculture: | | |
| Production research | 58,485 | 57,128 |
| Utilization research | 19,017 | 19,026 |
| Marketing research | 10,199 | 10,203 |
| Home economics research | 2,184 | 2,185 |
| | [1] 89,885 | 88,542 |
| State agricultural experiment stations: Federal grant [2] | 31,804 | 31,804 |
| Total, Federal supported | 121,689 | 120,346 |
| Estimated non-Federal | 108,000 | 114,000 |
| Total, all agricultural research | 229,689 | 234,346 |

[1] Includes $5,746,510 administrative costs to meet pay act and penalty mail costs.
[2] Includes $250,000 for penalty mail costs.

Source: U.S. Congress, House of Representatives, Committee on Science and Astronautics, hearings "Basic Research in Agriculture," Washington, Government Printing Office, 1959.

At present, approximately 13,000 scientists in the United States are engaged in agricultural research and development supported by Federal and State funds. Four thousand eight hundred are employed directly by USDA laboratories at some 300 locations throughout the United States. These range from the 11,000-acre installations at Beltsville, Md., to small two- to five-man groups working on special local problems in remote geographical areas; often these smaller groups are accommodated in State experiment stations.

Some research is also conducted by industrial firms which manufacture, process, or distribute farm machinery, products, or supplies. Although it has not been inventoried, it has been estimated by the Department that this research may equal or exceed expenditures by the Federal and State Governments. Research is also conducted by farm cooperatives, but again of an unknown degree. From a survey conducted in 1953 of research sponsored by all types of cooperatives, it was estimated that the agricultural organizations spent $2,951,000.

Within the past 2 years, the USDA program has become international in scope. Particularly through food surpluses disposed of abroad under Public Law 480, the foreign currencies thus made available are being used by the Department to support agricultural research in foreign laboratories that either will be of mutual benefit to the United States and the country from which the funds derive, or offers the promise of primary benefits for U.S. agriculture.

Within this vast area, veterinary activity is, as noted, but a relatively small phase. Yet, it is clear that it is a difficult problem for an individual administrator or investigator to try to keep up with all current work which might be pertinent to any given area of veterinary science.

*2. Postpublication data*

While it is helpful to know that someone somewhere is experimenting or did experiment on a given hypothesis in veterinary science or in any other field of science, it is infinitely more important to know what results he reported as regards his experimentation.

This brings up the more fundamental question of postpublication data, traditionally identified as the "documentation problem."

This is a problem besetting all of agricultural science, all of physical, social, mathematical, and engineering science. The situation as regards veterinary science is a particularly significant one.

Documentation is multiplying faster than it can be absorbed, indexed, cross-referenced, stored, and disseminated to all the potential users.

No one, therefore, knows what invaluable data may be lying somewhere, relatively unused, in terms of solving today's problems of virology or of any other important biomedical area.

*Publications*

It is estimated that, at the present time, approximately 20,000 journal articles and monographs are published each year in the veterinary field. The veterinary articles appear in publications from at least 40 countries in as many different languages. Although many have assumed that the major contributions appear in English language publications, studies should be made to determine the scientific value of articles in other languages. In addition, an equal or greater number of articles appear in publications of allied fields such as human medicine, entomology, mycology, zoology, etc., and are of basic importance to research scientists in veterinary medicine.

*Bibliographies, indexes, abstracts*

Journals published in at least 20 countries throughout the world contain sections listing new publications in the field of veterinary medicine. There are probably 100 journals containing such information. In addition, many of the major scientific abstract journals in biology and chemistry contain listings of articles in veterinary medicine and other sciences important to workers in veterinary research. The most comprehensive current reporting of articles is found in the U.S. Department of Agriculture Library "Bibliography of Agri-

culture." This monthly index provides listings of more than 10,000 articles in veterinary medicine each year. More detailed listings, but not as current, are found in the "Index Veterinarius" published in England. The British also issue a comprehensive abstract journal in the field, "Veterinary Bulletin," containing about 4,000 abstracts annually. The East German publication "Veterinärmedizin" contains about 16,000 abstracts each year. Appendix A lists the primary indexing and abstracting journals for veterinarians. Appendix B lists the number of journals per country abstracted by "The Veterinary Bulletin."

*Detailed indexing in veterinary medicine*

The Animal Disease and Parasite Research Division of Agricultural Research Service, U.S. Department of Agriculture, Beltsville, has for 65 years prepared a card listing, "Index-Catalogue of Medical and Veterinary Zoology." The card catalogs are arranged in five sections:

Author index.
Parasite (subject) list.
Host index.
Checklist of names.
Anthelmintic catalog.

Miss Mildred A. Doss, who is in charge of the project, is one of the experts in the field of scientific indexing. She points out that of all the publications which she indexes for the catalog:

> * * * less than 2 percent, are standard journals on parasitology, helminthology, protozoology, or veterinary medicine, whereas more than 98 percent represent publications in peripheral fields.
>
> Among the peripheral fields are anthropology, bacteriology, botany, chemistry, engineering, evolution, fisheries, forestry, heredity, hunting, malacology, mining, nursing, nutrition, oceanography, radiology, refrigeration, sanitation, sewage, speleology, viniculture, and virology * * *.
>
> Parasitological information is also found in many types of publications such as reports and publications of livestock sanitary boards, quarantine services, departments of fish and game, reindeer industry, marine laboratories, pearl oyster fisheries, zoological parks, conservation agencies, tea research institutes, scientific academies and institutes, chambers of commerce, and expeditions; diplomatic and consular reports; reports on the Arctic and the Antarctic; compendia; symposia; monographs; and Festschrifts. All these publications have contributed items of scientific importance in this field of biology.

It is most unfortunate that only the author index to the card catalog is now being printed. The four other sections of the index are extremely valuable to scientists doing research work in the biological field. The only way to use them at the present time is to visit the office in Beltsville.

Many scientists throughout the United States and the world would like to use the host index, parasite index, geographic index, and the checklist of names. The publication of the totality of these indexes would constitute a major contribution to international scientific bibliography.

Research workers in animal diseases, as is stated above, must have immediately available publications in a wide range of fields, such as:

Bacteriology
Biology
Chemistry
Cytology

Helminthology
Immunology
Microbiology
Mycology
Pathology
Physiology
Physiopathology
Protozoology
Rickettsiology
Serology
Toxicology
Virology

*International activities*

Appendix C is a selected list of the major veterinary medical libraries throughout the world. It is known that special emphasis has been given to these libraries in both Soviet Russia and Communist China. A recent report from Russia shows that at least 43 places there receive the current issues of the "American Journal of Veterinary Research." The libraries at Vitebsk Veterinary Zootechnical Institut and All-Union Science-Research Institut of Experimental Veterinary Medicine have effective management and good support.

*Needs*

It is estimated that the British list about 12,000 articles per year in "Index Veterinarius" and abstract about 4,000 articles in "Veterinary Bulletin." The USDA Library "Bibliography of Agriculture" lists annually about 10,000 articles. In 1959 "Veterinärmedizin" printed about 16,300 abstracts.

Although the above publications cover a broad area of veterinary medicine, the individual scientist needs special bibliographies and assistance in finding publications for specific needs. Automation can give him real assistance.

For this country, there appears need for a broad continuing program to (*1*) coordinate USDA and land-grant university library activities, and (*2*) insure that there is collected and made available needed data from within the totality of worldwide publications.

Special attention should also be given to publishing in some form the special lists prepared for the "Index-Catalogue of Medical and Veterinary Zoology" at Beltsville. The Wildlife Disease Association is anxious to make the indexes available and has offered to publish them in microcard form, if they can be furnished to them for reproduction.

The USDA Library serves, as noted earlier, with the Library of Congress and the National Library of Medicine as one of the three national libraries. The libraries cooperate in their activities and try to prevent unnecessary duplication of materials. Several years ago the National Library of Medicine requested the USDA Library to take over primary responsibility in collecting veterinary publications. Lack of staff and funds have prevented the USDA Library from doing a thorough job of collecting and disseminating information in this branch of science. The library probably has many of the major publications but does not collect as exhaustively as is necessary to make this a comprehensive national collection.

## Appendix A

### Veterinary Medicine

#### indexing and abstracting journals

(*Selected List*)

Advances in Veterinary Science.
Animal Breeding Abstracts.
Annual Review of Biochemistry.
Annual Review of Microbiology.
Bibliography of Agriculture.
Biological Abstracts.
Bulletin Signalétique d'Entomologie Médicale et Vétérinaire.
Chemical Abstracts.
Dairy Science Abstracts.
Excerpta Medica.
Helminthological Abstracts.
Index-Catalogue of Medical and Veterinary Zoology.
Index Veterinarius.
Index Medicus.
International Abstracts of Biological Sciences.
Journal of Microbiology, Epidemiology and Immunobiology (translation of Russian journal).
Nutrition Abstracts and Reviews.
Recueil de Médicine Vétérinaire.
Referativnyi Zhurnal. U.S.S.R. Biologiia.
Review of Applied Entomology. Series B: Medical and Veterinary.
Review of Applied Mycology.
Review of Medical and Veterinary Mycology.
Schweizer-Archiv für Tierheilkunde.
Tijdschrift Voor Diergeneeskunde.
Veterinary Bulletin.
Die Veterinärmedizin.
Zentralblatt für Bakteriologie, Parasitenkunde, Infektions-krankheiten und Hygiene.
Zoological Record.

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## Appendix B

### The Veterinary Bulletin

Published by Commonwealth Bureau of Animal Health, Weybridge, Surrey, England

Abstracts 499 journals; also annual reports of governments and research institutions.

Four hundred and ninety-nine journals from following countries, with number of journals indicated in each:

| | | | |
|---|---|---|---|
| Algeria | 5 | Japan | 15 |
| Argentina | 7 | Kenya | 3 |
| Austria | 3 | Malaya | 2 |
| Australia | 20 | Mexico | 1 |
| Belgian Congo | 2 | Mozambique | 1 |
| Belgium | 5 | Morocco | 2 |
| Brazil | 15 | Netherlands | 9 |
| Bulgaria | 4 | New Zealand | 10 |
| Canada | 11 | New Guinea | 1 |
| Ceylon | 2 | Pakistan | 3 |
| Chile | 1 | Peru | 2 |
| China | 2 | Philippines | 3 |
| Colombia | 1 | Poland | 7 |
| Czechoslovakia | 6 | Portugal | 4 |
| Denmark | 8 | Portuguese West Africa | 1 |
| Egypt | 1 | Puerto Rico | 1 |
| Fiji Colony | 1 | Rumania | 7 |
| Finland | 3 | Scotland | 2 |
| Formosa | 1 | South Africa | 8 |
| France | 22 | Spain | 10 |
| Germany | 35 | Sweden | 2 |
| Great Britain | 80 | Switzerland | 7 |
| Greece | 1 | Tasmania | 1 |
| Hungary | 4 | Trinidad | 1 |
| India | 11 | Tunisia | 2 |
| Indonesia | 2 | Turkey | 3 |
| Iran | 2 | U.S.S.R | 11 |
| Ireland | 3 | U.S.A | 94 |
| Israel | 1 | Uruguay | 3 |
| Italy | 20 | Venezuela | 4 |

## APPENDIX C

### VETERINARY MEDICINE LIBRARIES

**Austria**
Vienna III
Linke Bahnstr. 11
*Tierärztliche Hochschule, Bibliothek*
36,200 volumes (1 branch—2,600 volumes)

**Belgium**
Cureghem
45 rue des Vétérinaires
*Ecole de Médicine Vétérinaire de l'Etat, Bibliothèque*
35,000 volumes

**Bulgaria**
Sofia
55 Boul. Lenin
*Viss Veterinarno-Medicinski Institut*
39,200 volumes

**Denmark**
København, V
Bülowsvey 13
*Den Kgl. Veterinaer- og Landhohøjskoles Bibliotek* (Royal Veterinary and Agricultural College Library)
220,000 volumes

**France**
Alfort
7 rue Jean Jaurès
*Ecole Nationale Vétérinaire, Bibliothèque*
65,000 volumes

62587—61——17

Germany (West)
Hannover
Hans-Böckler-Allee 16
*Tierärztliche Hochschule Hannover, Bibliothek*
30,150 volumes

Hungary
Budapest VII
Rottenbiller u.23
*Allatorvostudományi Föiskola, Könyvtár* (Veterinary College, Library)
65,000 volumes

Netherlands
Utrecht
Bildstraat 172
*Veeartsenijkundige Faculteit der Rijksuniversiteit, Bibliotheek* (Veterinary Science Faculty of the University, Library)
30,000 volumes

*Sweden*
Stockholm 51
*Kungl. Veterinärhögskolans Bibliotek* (Royal Veterinary College Library)
75,000 volumes

*Union of Soviet Socialist Republics*
(Armenia)
Erevan
*Armyanskii Nauchno-Issledovatel'skii Institut Zhivotnovodstva i Veterinarii, Biblioteka* (Armenian Animal Husbandry and Veterinary Research Institute, Library)
50,000 volumes

(White Russia)
Vitebsk
ul Lenina 14
*Vitebskii Veterinarnyi Institut, Biblioteka* (Vitebsk Veterinary Institute, Library)
105,000 volumes

(Georgia)
Tbilisi
Universitetskaya 13
*Gruzinskii Zootekhnicheskii Veterinarnyi Institut, Biblioteka* (Georgian Animal Husbandry and Veterinary Institute Library)
100,000 volumes

(Kazakhstan)
Alma-Ata
Arychnaya 46
*Alma-Atinskii Zooveterinarnyi Institut, Biblioteka* (Alma-Ata Veterinary Institute Library)
96,400 volumes
Semipalatinsk
ul. Uritskogo 19
*Semipalatinskii Zootekhnicheskii Veterinarnyi Institut, Biblioteka* Semipalatinsk Animal Husbandry and Veterinary Institute, Library)
52,000 volumes

(Lithuania)
Kaunas
ul Gil'szhes 18
*Litovskaya Veterinarnaya Akademiya, Biblioteka* (Lithuanian Veterinary Academy, Library)
72,000 volumes

(Russian Soviet Federated Socialist Republic)
Kazan
ul. Gogolya 4
*Kazanskii Veterinarnyi Institut, Biblioteka* (Kazan Veterinary Institute, Library)
69,810 volumes

Kuzminki
Moscovskaya obl., Ukhtomskii Raion, Poselok Kuz'minki
*Moskovskaya Veterinarnaya Akademiya, Biblioteka* (Veterinary Academy, Library)
256,000 volumes
Leningrad
Chernigorskaya 5
*Leningradskii Veterinarnyi Institut, Biblioteka* (Leningrad Veterinary Institute, Library)
171,000 volumes
Novocherkassk
Podtelkovskii prospekt 35
*Novocherkasskii Zooveterinarnyi Institut im.I-i Konnoi Armii, Biblioteka* (Novocherkassk Veterinary Institute, Library)
123,000 volumes
Saratov
B. Sadovaya 220
*Saratovskii Zootekhnicheskii Veterinarnyi Institut Biblioteka* (Saratov Animal Husbandry and Veterinary Institute, Library)
105,000 volumes
(Ukraine)
Kharkov
Sumskaya 37
*Kharkovskii Veterinarnyi Institute, Biblioteka* (Kharkov Veterinary Institute Library)
80,140 volumes
Lvov
ul. Mayakovskogo 67
*Zooveterinarnyi Institut, Biblioteka* (Veterinary Institute, Library)
118,000 volumes

*United Kingdom*
London
183 Euston Road, London, N.W. 1
*Wellcome Historical Medical Library*
250,000 volumes
Weybridge
New Haw, Weybridge, Surrey
*Central Veterinary Laboratory (Ministry of Agriculture, Fisheries & Food), Library*
15,000 volumes

*U.S.A.*
(Illinois)
Urbana
250 Veterinary Medicine Building
*University of Illinois Veterinary Medicine Library*
8,500 volumes
(Missouri)
Columbia
210 Connaway Hall, University of Missouri
*Veterinary Library*
6,000 volumes
(New York)
Ithaca
*Flower Veterinary Library*—New York State Veterinary College at Cornell University
32,000 volumes
(Pennsylvania)
Philadelphia
39th and Pine Street, Philadelphia 4
*University of Pennsylvania School of Veterinary Medicine C. J. Marshall Memorial Library*
12,000 volumes

*Argentina*
Buenos Aires
Avda. San Martin 4453
*Facultad de Agronomia y Veterinaria (Universidad de Buenos Aires), Biblioteca*
78,000 volumes

*India*

Mukteswar, U. P.
*Indian Veterinary Research Institute Library*
16,000 volumes

*Japan*

Sagamihara, Kanagawa
Azabu Veterinary College Library
20,000 volumes

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## Section 3. Veterinary Medical Education and International Rerearch and Assistance

It is fitting that this report conclude with observation on and from the institutions which constitute the foundation of the Nation's veterinary science—the veterinary medical colleges.

Earlier in this volume (p. 81) the role, achievements, opportunities, and problems of the veterinary colleges were touched upon.

It is clear from evidence which has come to the subcommittee's attention that the future needs of veterinary colleges should be sympathetically considered by policy echelons of Federal and State Governments and by the scientific community, if sound long-range decisions are to be made.

This type of long-range review, has, fortunately, occurred in recent years with respect to other elements of our country's higher education establishment. However, veterinary medical education does not appear to have had its proper share of consideration to date.

As the final phase of this print, it was felt that there might profitably be reprinted at least a sampling of verbatim observations from the deans of the colleges themselves. These authorities are, of course, among the most highly qualified in the Nation to appraise the past, present and future of veterinary medical science.

Over a period of several months, many helpful messages were received from the educators at the subcommittee's invitation. The messages came both directly to the chairman, and, at our suggestion, to Dr. James H. Steele, Chief, Veterinary Public Health, Communicable Disease Center, who, as earlier indicated, assisted in this, as in many other phases, of the subcommittee's efforts.

The views of the deans were not restricted to any single area. Their comments were concerned primarily, however, with further opportunities for international research and international technical assistance.

There follow excerpts from but a few of the comments received.

### University of Minnesota

On the research phase, W. T. S. Thorp, D.V.M., dean, College of Veterinary Medicine, University of Minnesota, St. Paul, Minn., wrote:

> * * * at the present time we have, at the College of Veterinary Medicine, a combined total of $440,000 in research grants from the Public Health Service, National Science Foundation, and the Atomic Energy Commission. Our main problem is that we are limited in facilities and the necessary additional faculty.
>
> * * * many of our research projects are cooperative with the College of Medical Sciences in the University of Minnesota. We are fortunate here in Minnesota because of this relationship. * * *
>
> It should be emphasized that the University of Minnesota, College of Veterinary Medicine, has the largest enrollment of Ph. D. candidates majoring in the

various basic sciences and veterinary medicine of any of the other colleges in the United States. This is due primarily to the support which we have available from research grants, the U.S. Public Health Service, and projects supported on cooperative agreements from the U.S. Department of Agriculture.

In addition to the research program which supports graduate veterinarians as research fellows while they carry on their research and obtain their Ph. D. degree, we have approximately $100,000 in training grant funds from the U.S. Public Health Service, National Institutes of Health.

* * * * * * *

On the phase of international education and other technical assistance, Dean Thorp noted:

* * * we participate in the University of Minnesota ICA contract for the National University of Seoul in Korea, and since that program started we have had a total of 12 Koreans from the faculty of their College of Veterinary Medicine who have received or are receiving training at the university in our College of Veterinary Medicine. Four of these have returned to Korea; the remaining eight are still here for additional training.

* * * * * * *

We have had six Rockefeller Foundation fellows for a year's training in the College of Veterinary Medicine in various divisions since the college was established. These have been from five different South American countries. Five graduate students from India or its Provinces are presently taking training in the College of Veterinary Medicine.

* * * * * * *

One problem faced by many universities was described by Dean Thorp in this way:

Some consideration might be given to the formation of a central screening agency for foreign students as an aid in evaluating their potential as graduate students after they arrive in this country. One of our big problems is to evaluate the credentials from the various foreign colleges of veterinary medicine, and we have had rather embarrassing experiences when their graduate students did not have the necessary background to embark upon graduate training at the level expected at the University of Minnesota. On the other hand we have had some very capable individuals.

* * * * * * *

In an address in San Francisco on November 2, 1960, before the annual meeting of the American Public Health Association, Conference of Public Health Veterinarians, Dean Thorp commented on the importance of comparative medical research. He then observed:

* * * After some years experience, one is convinced that there is a large gray area between research dealing strictly with human medicine and research going on with various animal diseases. As a member of the Health Research Facilities Council, I have had the opportunity to see first hand the interrelationship of medical research concerning animals and man. This is observed each time one visits health-related research facilities, be it in a medical school, a hospital, a department of veterinary medicine in an experiment station, or the components of a college of veterinary medicine.

Another factor in this whole medical and biological science area is the need for well-trained scientists and research workers to carry out the various projects in our research institutions, private or public. It has been said that even though we need to establish new medical schools to provide the physicians necessary for a growing population in this country, that less than half of the actual basic medical research will be carried out by individuals with the M.D. degree. Therefore, much emphasis should be placed on the interrelationship of those other branches of the medical profession interested and skilled in medical research. The doctor of veterinary medicine and the doctor of philosophy or sciences can contribute much to relieve their shortage.

PURDUE UNIVERSITY

Erskine V. Morse, D.V.M., Ph. D., dean, School of Veterinary Science, Purdue University, Lafayette, Ind., wrote:

There are no boundaries in veterinary research except those imposed by our own mental limitations and appreciation for the opportunities and knowledge which lie in the scientific unknown.

* * * * * * *

Dean Morse pointed to the contributions to basic research by veterinarians in:

* * * the disciplines of physiology, nutrition, pathology, microbiology, and anatomy. The development of the "germ free" animals at the Lobund Institute of Notre Dame University provides new avenues and vistas for fundamental research in all phases of veterinary medicine.

He added:

More investigative effort is needed; scientific teamwork is required; but in this push for quantity, the standards for excellence must be retained. One of our best means for maintaining quality is to attract our most capable and astute graduates into fields of basic research. The greatest contributions are often made by the bright, young graduate working with the mature, established researcher.

* * * * * * *

The role of the veterinarian in public health was stressed:

* * * Most veterinary colleges in North America are stressing in their formal curriculums the public health and preventive medicine approach. Human disease problems are often used as models in the teaching of epidemiology and epizootiology to veterinary students. In these presentations and in the process of learning, the young veterinarian gains his background in both human and animal health problems.

The Indiana General Assembly recently passed a bill which requires that a licensed veterinarian be a member of all municipal and county boards of health on which there are five or more members. This recognition of the importance of the veterinarian in public health is of singular importance. In order to provide an up-to-date background, the Indiana Veterinary Medical Association, the Indiana State Board of Health and the Purdue University School of Veterinary Science and Medicine are organizing a postgraduate conference in public health. Problems other than those of a strictly veterinary nature will be discussed; i.e., air pollution, radiation hazards, rural accident prevention, water and sewage, polio, influenza, tuberculosis, food poisoning, cancer, mental health, and gerontology. The topics and information stressed should provide veterinarians with a working knowledge of the present problems facing our health departments.

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IOWA STATE UNIVERSITY

I. A. Merchant, D.V.M., dean, College of Veterinary Medicine, Iowa State University of Science and Technology, Ames, Iowa, noted these opportunities on the international scene:

* * * * * * *

1. Increased opportunities may be offered to young men to study veterinary medicine because the world at large is extremely short of capable young men educated in this profession. Opportunities may be offered by many countries, and certainly by the colleges of veterinary medicine in the United States, to provide graduate education for young men from countries not providing such education. Letters are received daily from young men in various parts of the world to come to our school to study, but lack of financial assistance prevents them. We do not have scholarship funds which can be diverted to this purpose.

2. Veterinarians from the United States may be sent to various parts of the world to aid in the development of veterinary medicine and animal disease control projects. There is a real need for establishing better curriculums and teaching methods in most of the veterinary schools of the world, including our own. In many sections of the world, animal disease control is completely unknown or is inadequately supervised. It is a well-established fact that the economy of a country depends upon its agricultural development, which includes the production of livestock, which in turn is absolutely dependent upon disease control.

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UNIVERSITY OF GEORGIA

Thomas J. Jones, D.V.M., dean, School of Veterinary Medicine, University of Georgia, Athens, Ga., wrote:

* * * * * * *

The past offers mute testimony to the achievements of veterinary medicine in international health; the present affords ever-expanding challenges and responsibilities; and the future allows unlimited opportunity for improving the lot of man on this planet.

* * * * * * *

It is a ceaseless battle, this conflict with human suffering, and though the fronts are ever changing, the enemy remains common. Veterinary medicine continues to stand at the right flank in the struggle against man's misery of ill health. The present status of international health has been so closely allied with veterinary medicine that future progress in this area would be inconceivable without its continued contributions. This is especially true when one considers the needs of the underdeveloped areas of the world, upon whose success so much of ours depends.

* * * * * * *

As in the past, today's basic knowledge of human disease is gained through experimental studies in animal populations. Atherosclerosis, arthritis, cardiology, cancer, and a host of others are among the present research efforts which utilize veterinary medicine to secure the fundamentals necessary to a complete understanding of disease processes in man. New therapeutic agents are tested first in animals before subsequent use in humans. Monkey has preceded man into outer space. Veterinarians around the world are constantly striving to protect the animal food supply so essential to human nutrition and to prevent the spread to man of such animal diseases as rabies, brucellosis, tuberculosis, leptospirosis, and hydatidosis.

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UNIVERSITY OF ILLINOIS

C. A. Brandly, D.V.M., dean, College of Veterinary Medicine, University of Illinois, Urbana, Ill., wrote:

* * * * * * *

Veterinary medicine has indirectly contributed to man's health, happiness, and well-being. It is in those countries and areas where the veterinary medical profession is strongest that livestock production is safest, most profitable, most productive and, therefore, most beneficial to man. Few that have had these benefits are willing to deny themselves the advantages of a liberal and healthful supply of meat, milk, eggs, as well as wool, hair, leather, and glandular products derived from animals. Except in those areas where the economy does not permit it, animal pets are a great source of enjoyment and recreation. Healthy animals still remain essential in parts of the world for transportation as well as motive power. The recent spread of African horse sickness from Africa to the Near East has brought disaster to many who depended on a single horse for food, cultivation, and for transport.

Today, pets are being prescribed for invalids and shut-ins who are greatly benefited by them. These unfortunates can bestow their affection and likewise receive gratitude and affection.

* * * * * * *

I might mention the appreciation of the role of veterinary medicine internationally as shown by the substantial interest in the Illinois Center for Research on the Zoonoses. This center was established in September 1960. Various pledges of assistance and cooperation have been proffered at the State, National, and international level. The National Institutes of Health has given support for the center's research projects and several of its members have accepted appointments as consultants. Likewise, the Public Health Service through its Communicable Disease Center has offered counsel and assistance toward progressive development of the center's program as a potential contributor to health in the future.

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TUSKEGEE INSTITUTE

T. S. Williams, D.V.M., dean, School of Veterinary Medicine, Tuskegee Institute, Tuskegee, Ala., wrote:

* * * * * * *

The history of the veterinary medical profession is significant in recording the contributions made to international society through scientific discoveries and the prevention of diseases in man and animal. The opportunities for even greater contributions to mankind through the expansion of veterinary public health services are limited only by the inability of veterinarians and related health scientists to properly visualize the totality of these services.

The role of veterinary medicine in methods of control and eradication of the world zoonoses has resulted in singular contributions to international health. Reductions in incidence and losses, mortal and economic, have provided major advances toward higher standards of health throughout the world. Veterinary regulatory activities have significantly raised the level of the world's food supply of animal origin to unprecedented heights reflected in the increased economic value of livestock and poultry everywhere in the universe.

In the area of international public health planning and education, the role of the veterinary public health specialist assumes major importance. In this area it would be difficult to envision the magnitude of the contribution to be made by veterinary medicine as an integral part of the international health team.

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UNIVERSITY OF CALIFORNIA

D. E. Jasper, dean, School of Veterinary Medicine, University of California, Davis, Calif., stated:

* * * * * * *

Veterinary medicine is among the generally least understood and appreciated of all our learned professions. Yet it is a bulwark in the production of our food supply, our standard of nutrition and living, and in the protection of the peoples of the world from the many serious diseases which may spread to man from animals.

As our friends in some of the underdeveloped areas of the world strive for improved health, productivity, and welfare, the control of diseases of animals must be an important part of the program. Veterinary medicine has shown the effectiveness of programs of disease eradication. Concerted action throughout the world can eradicate many plagues from the face of the earth.

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MICHIGAN STATE UNIVERSITY

W. W. Armistead, D.V.M., dean, College of Veterinary Medicine, Michigan State University, East Lansing, Mich., had made the following comments in an address before the annual meeting of the Illinois State Veterinary Medical Association, Chicago, February 20, 1961:

* * * * * * *

The burgeoning world population already has produced terrifying food shortages in most of Asia and Africa. The tragedy of world hunger and its threat to the future of the United States cannot easily be grasped by the average, overfed American citizen. And protein foods, particularly animal products, which are so important to disease resistance, are the scarcest foods of all wherever people are starving. There is some cause to wonder if the United States might not make a greater contribution to the underdeveloped countries of the world if instead of sending so many economists, engineers, military advisers, educators, and even physicians, we would first send more veterinarians to speed up the development of animal agriculture. The vast plains of central Africa could produce tremendous quantities of meat if animal-disease problems peculiar to that region could be mastered. And there is no doubt that a little meat in the diet of millions who now get none at all would eliminate more human disease than could a hundred heroic medical missionaries like Albert Schweitzer and the late Tom Dooley.

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UNIVERSITY OF WISCONSIN

Carl Olson, D.V.M., chairman, Department of Veterinary Science, College of Agriculture, University of Wisconsin, Madison, wrote of the international challenge:

* * * * * * *

There is the prospect of introducing diseases, which we do not now have, into our animal population. To prevent such introduction we must have restrictions on importation of livestock and the animate or inanimate carriers of disease pathogens. We must also have familiarity with exotic diseases so that they may be recognized early in event they occur in the United States. We must also realize that an exotic disease may manifest itself differently in a highly susceptible population.

Reservoirs of certain pathogens for both man and domestic animals are known to exist in wild animals. We should give more attention to the natural occurrence and methods of spread of disease in wildlife on an international basis.

There are a number of disease entities which result from combinations and interplay of viruses, bacteria, and parasites in man and animals. With the increasing speed of transportation and changing methods of management, we may expect development of new entities from combinations of disease agents and factors that have not previously been brought together.

There is the need for research on the interplay of disease agents and environment. Some diseases are peculiar to, or have unusually high incidence in, certain geographic areas which must reflect environmental influences. These may be soil-plant conditions, altitude, climate, etc. Infectious agents as well as metabolic and genetic factors can be involved here. For example, tumors of the urinary bladder in cattle reach an incidence of 50 to 80 percent in certain restricted areas of the world. There is some reason to believe the virus of papillomatosis is involved, but this cannot be a sole cause since there is so little disease in areas where papillomatosis is common. In such situations, nature has established conditions and fashioned experiments for us to study. From these we gain basic knowledge that is important for progress in the understanding and control of disease in man and animals.

International repositories or centers for collections of certain disease-producing viruses and bacteria such as influenza, foot-and-mouth disease and Salmonella have been important. Similar centers for other diseases would be desirable.

One can reflect that many of the discoveries advancing bacterial, viral, and parasitic disease, as well as the development of immunization and methods for control, were initially done with disease problems of animals.

Within recent years we have had veterinarians with us in research and study from several foreign countries such as Canada, England, Poland, Turkey, Brazil, Germany, Guatemala, Colombia, India, Rhodesia, Japan, and Yugoslavia. The men from these countries have contributed as well as gained from this experience.

These, briefly, are some of the thoughts I have on the role of veterinary medicine in international health.

UNIVERSITY OF WASHINGTON

E. C. Stone, D.V.M., dean, College of Veterinary Medicine, University of Washington, Pullman, Wash., wrote:

* * * * * * *

During World War II in my travels in Italy and north Africa I was impressed with the need for better sanitation and the reduction of animal diseases transmissible to man. Again in the summer of 1959 when I had an opportunity as consultant for the World Health Organization in Brazil, I noted these same needs and was pleased to note that this very important work was receiving considerable attention.

The relationship of animal health to human health demands a team approach to the solution of health problems. The public health aspects of veterinary medicine are being emphasized in our teaching programs to a greater extent today than in past years. It is my opinion that this trend will continue.

The improvement of human health through reduction of animal diseases has been demonstrated many times in our country and in my opinion will continue to be a major objective in any public health program. In underdeveloped countries the need for improvement of health is very great. The related economic gains associated with reduction of animal diseases is another factor that should stimulate the expansion of public health programs.

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UNIVERSITY OF PENNSYLVANIA

M. W. Allam, D.V.M., dean, School of Veterinary Medicine, University of Pennsylvania, wrote:

Research in cattle diseases, as presently being conducted jointly by the School of Veterinary Medicine of the University of Pennsylvania and the Mexican Government, is producing results which are helpful to all countries as the information is disseminated through scientific media.

A comparative cardiovascular studies unit which will serve as a research center for the study of the comparative aspects of the cardiovascular systems of animals has been established at the University of Pennsylvania. This program is supported by the National Health Institute. The unit will also carry out international training programs for research in comparative cardiology of the World Health Organization.

* * * * * * *

Except for very specific infectious or nutritional problems, no line can be drawn that separates health problems on a national or international basis. Aside from administrative problems, national boundaries are insignificant.

For the future we must expand in all areas in international health activities—exchange of scientists—provide for more graduate training of foreign students, especially from Asia and South America—expand in cooperative research between countries for the benefit of all mankind.

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CONCLUSION

It will be recalled that, on the occasion of the 75th anniversary of the School of Veterinary Medicine, University of Pennsylvania, in February 1959, Leroy Burney, M.D., then Surgeon General of the U.S. Public Health Service, stated:

* * * * * * *

We meet on ground that has fascinated biologists for years, namely the relation of health and disease in man and animals to environment. Man has made many of his disease problems. He has also improved his health by altering the environment to his advantage, and by changing his habits. Public health and veterinary medicine, with their modern armamentaria for the protection of human and animal life, can work together for further advances in human ecology.

# INDEXES

## 1. Contributors


| | Page |
|---|---|
| American Board of Laboratory Animal Medicine | 161 |
| American Board of Veterinary Public Health | 160 |
| American College of Veterinary Pathologists | 162 |
| American Veterinary Medical Association | 155 |
| Animal Care Panel | 166 |
| Animal Disease and Parasite Research Division, Agricultural Research Service, USDA | 28 |
| Animal Disease Eradication Division, Agricultural Research Service, USDA | 103 |
| Animal Inspection and Quarantine Division, Agricultural Research Service, USDA | 117, 171 |
| Army and Air Force Veterinary Corps, Department of Defense | 120 |
| Association of Deans of American Colleges of Veterinary Medicine | 164 |
| Communicable Disease Center, U.S. Public Health Service, HEW | 57, 144 |
| Conference of Public Health Veterinarians | 165 |
| Division of Engineering Services, U.S. Public Health Service, HEW | 142 |
| Division of Radiological Health, U.S. Public Health Service, HEW | 71 |
| Entomology Research Division, Agricultural Research Service, USDA | 45 |
| Foreign Agricultural Service, USDA | 184 |
| Foreign Research and Technical Programs Division, USDA | 188 |
| Institute of Laboratory Animal Resources, National Research Council–National Academy of Sciences | 74 |
| International Cooperation Administration | 182 |
| International Office of Epizootics | 207 |
| Meat Inspection Division, Agricultural Research Service, USDA | 89 |
| National Assembly of Chief Livestock Sanitary Officials | 164 |
| National Board of Veterinary Medical Examiners | 80, 86 |
| National Institutes of Health, U.S. Public Health Service, HEW | 51 |
| Pan American Sanitary Bureau | 180 |
| Pan American Veterinary Congress | 206 |
| Patuxent and Denver Wildlife Research Centers, Fish and Wildilfe Service, Department of Interior | 27, 78 |
| Poultry Division, Agricultural Marketing Service, USDA | 94 |
| United States Livestock Sanitary Association | 162 |
| Veterinary Biological Licensees Association | 175 |
| Veterinary Division of the American Association of Land-Grant Colleges and State Universities | 42 |
| Veterinary Medical Branch, Food and Drug Administration, HEW | 172 |
| World Health Organization | 196 |
| World Veterinary Association | 204 |
| Zoo Veterinarians Association | 167 |


Note.—Organizations listed within this index supplied information and viewpoints which are generally reflected within this publication. But, as noted in the introduction, they are responsible neither for the final phraseology nor interpretations presented herein.

## 2. Abbreviations

ACP—Animal Care Panel
ADE—Animal Disease Eradication Division
ADP—Animal Disease and Parasite Research Division
AIQ—Animal Iuspection and Quarantine Division
AMS—Agricultural Marketing Service
ARS—Agricultural Research Service
AVMA—American Veterinary Medical Association
BAI—Bureau of Animal Industry
CDC—Communicable Disease Center
FAO—Food and Agriculture Organization of the United Nations

FAS—Foreign Agricultural Service
FDA—Food and Drug Administration
FRTP—Foreign Research and Technical Programs Division
FWS—Fish and Wildlife Service
HEW—Department of Health, Education, and Welfare
ICA—International Cooperation Association
ICLA—International Committee on Laboratory Animals
NIH—National Institutes of Health
OIE—International Office of Epizootics
PAHO—Pan American Health Organization
PASB—Pan American Sanitary Bureau
PHS—Public Health Service
UNESCO—United Nations Educational, Scientific and Cultural Organization
USLSA—United States Livestock Sanitary Association
USDA—United States Department of Agriculture
VBLA—Veterinary Biological Licensees Association
WHO—World Health Organization
WVA—World Veterinary Association

### 3. Selected Subjects and Individuals


| | Page |
|---|---|
| Abscesses | 93 |
| Abstracting | 234 |
| Acceleration, deceleration | 126 |
| Actinobacillosis | 94 |
| Actinomyosis | 94 |
| African swine fever | 34 |
| Agricultural Marketing Service | 94 |
| Agricultural Research Service | 28, 45, 89, 103, 171 |
| Air Force Veterinary Corps | 120 |
| Air sac infection of poultry | 36 |
| Allam, M. W | 244 |
| American Board of Laboratory Animal Medicine | 154, 161 |
| American Board of Veterinary Public Health | 154, 160 |
| American College of Veterinary Pathologists | 154, 162 |
| American Public Health Association | 141 |
| American Veterinary Medical Association | 155 |
| Anaplasmosis | 36 |
| Animal Care Panel | 166 |
| Animal Disease and Parasite Research Division | 28 |
| Animal Disease Eradication Division | 103 |
| Animal Inspection and Quarantine Division | 117, 169, 171 |
| Anthrax | 63, 176 |
| Armed Forces Institute of Pathology | 129 |
| Armistead, W. W | 242 |
| Army Veterinary Corps | 120 |
| Arthritis of lambs | 44 |
| Arthropods | 45, 49 |
| Association of Deans of American Colleges of Veterinary Medicine | 164 |
| Association of State Public Health Veterinarians | 165 |
| Astronautical medicine | 126 |
| Atomic radiation | 46 |
| Atomic research breakthrough | 48 |
| Atrophic rhinitis of swine | 41 |
| Bang's disease. (*See* Brucellosis.) | |
| Basic research discovery | 29 |
| Biological research | 42, 129 |
| Blackhead of turkeys | 33 |
| Blackleg | 29 |
| Bloat | 31 |
| Bluetongue | 36, 176 |
| Body louse | 49 |
| Botulism | 16, 143 |
| Boutenneuse fever | 79 |
| Brandly, C. A | 241 |
| Brucellosis | 12, 104, 107, 198 |
| Bubonic plague | 13, 79 |
| Bureau of Animal Industry | 28 |
| Burney, Leroy | 244 |
| Cancer | 14, 51, 165, 226 |

Page
Cardiovascular disease ... 52, 201
Cattle grubs ... 39, 47
Cattle tick fever ... 6, 28, 114
Chronic respiratory diseases of rats ... 76
Civil Defense ... 130, 137
Coccidioidomycosis ... 66, 139
Coccidiosis ... 38
Colleges of Veterinary Medicine ... 81
Colorado tick fever ... 79
Communicable Disease Center ... 57, 138
Conference of Public Health Veterinarians ... 165
Conference of Veterinary Laboratory Diagnosticians ... 154
Contagious bovine pleuropneumonia ... 6, 115
Contagious ecthyma ... 106
Coordination ... 77, 221
Curtice, Cooper ... 28
Dalling, Sir Thomas ... 191
Denver Wildlife Research Laboratory ... 27
Distemper ... 9, 101
Dourine ... 115
Drugs, antiparasitic ... 36
Dysentery of lambs ... 44
Encephalitides. (*See* Encephalitis and Encephalomyelitis.)
Encephalitis:
  Japanese B ... 133
  St. Louis ... 64
Encephalomyelitis:
  Eastern equine ... 64
  Western equine ... 64
Enteric diseases of swine ... 44
Enteric infections ... 69
Enterotoxemia ... 176, 208
Entomology Research Division ... 27, 45
Enzootic abortion in ewes ... 106
Equine abortion ... 44
Equine infectious anemia ... 41
Equine Practitioners Association ... 153
Erysipelas ... 36
Erysipeloid ... 59
*Escherichia coli* infections ... 70
Experiment stations ... 42
Farmer-veterinarian cooperation ... 95, 100
Feline panleukopenia ... 168
Fleeceworms ... 45
Fluoride toxicity ... 73
Food and Agriculture Organization ... 183, 190
Food hygiene ... 87, 142
Food research ... 72, 174
Foot-and-mouth disease ... 7, 33, 113, 217
Forage poisoning ... 44
Foreign Agricultural Service ... 181, 184
Foreign nations' veterinary programs ... 210
Foreign Research and Technical Program Division ... 181, 188
Foreign veterinarians in U.S. training programs ... 36, 40, 188
Fort Detrick ... 129
Fowl cholera ... 79
Fowl plague ... 116
Fowl pox ... 44
Fungus diseases. (*See* Mycotic diseases.)
Gapeworms ... 38
Garbage ... 33, 118
Glanders ... 115
Goiter ... 44
Hall, Maurice C ... 12
Health activities ... 73, 151, 170
Heart research ... 53, 128, 211
Heartworms ... 38
Hemolytic icterus ... 44

Page
Hepatitis ..... 79, 168
High altitude problems ..... 126
Highlights in fight against animal diseases ..... 105
Histoplasmosis ..... 66
Hog cholera ..... 33, 35, 172
Hookworm ..... 37, 67
Horn fly ..... 49
Hoskins, W. Horace ..... 157
Humane shipment ..... 112, 117
Humane slaughter ..... 90, 91
Human health products from animals ..... 18
Hydatidosis ..... 66, 197
Hyperkeratosis ..... 40, 44
Index-Catalogue of Medical and Veterinary Zoology ..... 232
Infectious bovine rhinotracheitis ..... 176
Infectious bronchitis of poultry ..... 41
Infectious diseases ..... 33
Infectious red water ..... 45
Influenza ..... 13, 65, 70, 198
Information ..... 155, 185
Insecticides ..... 39, 49
Institute of Laboratory Animal Resources ..... 74, 167
International cooperation ..... 50, 120, 179, 211
International Cooperation Association ..... 182
International Office of Epizootics ..... 180, 207
International Zoonoses Center, Azul, Argentina ..... 180, 203
Interrelationship—veterinary and human medicine ..... 5, 106, 221
Japanese B. encephalitis ..... 133
Jasper, D. E ..... 242
Johne's disease ..... 102
Jones, Thomas J ..... 241
Journals ..... 159, 231, 234
Kaplan, Martin ..... 216
Kilborne, F. L ..... 28
Knipling, Dr. E. F ..... 47
Laboratory animals ..... 54, 74, 131, 166
Larva migrans ..... 67, 71, 145
Leptospirosis ..... 35, 62, 69, 145
Leukosis ..... 14
Libraries ..... 41, 233, 235
Lice ..... 45
Licensure ..... 80, 86
Listeriosis ..... 69
Liver flukes ..... 38, 189
Livestock losses ..... 104, 106
Lockjaw ..... 119, 134, 210
Lungworms ..... 33
Lymphoma ..... 71, 165
Malaria ..... 13, 49
Mange mites ..... 39
Mastitis ..... 116
Meat inspection ..... 16, 87
Meat Inspection Division ..... 89
Medicated feeds ..... 174
Merchant, I. A ..... 240
Meyer, K. F ..... 16
Military medicine ..... 119
Milk inspection ..... 88, 120, 134, 138, 143
Milk ring test ..... 107, 182
Morse, E. V ..... 240
Mouse pox ..... 76
Mucosal diseases ..... 45, 93
Mycotic diseases ..... 65
Nagana ..... 50
National Academy of Sciences ..... 27
National Aeronautics and Space Administration ..... 127

Page
National Animal Disease Laboratory, Ames, Iowa ..... 27, 78, 172
National Assembly of Chief Livestock Sanitary Officials ..... 164
National Institutes of Health ..... 51
National parasite collection ..... 33
National Research Council ..... 74
Newcastle disease ..... 116
Nocardiosis ..... 66
Nodular worm disease ..... 38
Noninfectious diseases ..... 31
Nose bots ..... 39
Nuclear energy. (*See* Radiation.)
Olson, Carl ..... 243
Organization for European Economic Cooperation ..... 219
Ornithosis (*see also* Psittacosis) ..... 139, 149
Pan American Congress of Veterinary Medicine ..... 206
Pan American Health Organization ..... 180, 202
Parasites ..... 32, 39, 217
Paratyphoid in poultry ..... 116
Patuxent Wildlife Research Center ..... 27, 79
Phenothiazine ..... 37
Piroplasmosis. (*See* Cattle tick fever.)
Plant poisoning ..... 31, 40
Plum Island Animal Disease Laboratory ..... 27, 78
Pneumonia ..... 151
Poliomyelitis ..... 52
Poultry inspection ..... 87, 94
Poultry Division, Inspection Branch ..... 94
Practicing veterinarian ..... 1, 5, 80, 98
Pregnancy disease ..... 45
Preprofessional training ..... 80, 83
Psittacosis (*see also* Ornithosis) ..... 139, 149
Public Health Service ..... 51, 71, 73, 138
Pullorum disease ..... 44, 116
Q fever ..... 52, 70, 139, 143
Rabies ..... 12, 67, 135, 139, 147
Radiation ..... 71, 128
Radioactive fallout ..... 31, 128, 174
Rat-bite fever ..... 79
Registry of Veterinary Pathology ..... 134
Relapsing fever ..... 79
Residues ..... 39, 90, 173
Respiratory diseases of poultry ..... 189, 208
Respiratory viruses ..... 52
Rickettsialpox ..... 79
Rift Valley fever ..... 96
Rinderpest ..... 119, 133, 207, 217
Ringworm ..... 65
Rocky Mountain spotted fever ..... 13, 27, 79
Roundworms ..... 37, 38
Salmon, D. E ..... 28
Salmonellosis ..... 79, 197, 200
Salmon poisoning ..... 79
Scabies ..... 111
Schistosomiasis ..... 51
Scrapie ..... 41, 111
Screwworm ..... 7, 46
Scrub typhus ..... 50
Shaw, Byron T ..... 15
Shipping fever ..... 36
Shope, Richard E ..... 13
Sleeping sickness. (*See* Encephalitis and Encephalomyelitis.)
Smith, Theobald ..... 28
Smog ..... 73
Staphylococcal infection ..... 69
Streptococcal infection ..... 142
Stomach bots ..... 37

Page
Stomach worms ..... 38
Stone, E. C ..... 244
Strain 19 vaccine ..... 35, 107
Surgery ..... 39, 52
Systemic chemicals ..... 39, 47
Tapeworms ..... 142, 197, 217
Tetanus ..... 134, 210
Texas tick fever. (*See* Cattle tick fever.)
Thayer, E. F ..... 157
Thorp, W. T. S ..... 238
Tick fever ..... 6, 28, 79, 114
Tick paralysis ..... 79
Ticks ..... 45
Toxoplasmosis ..... 67
Transmissible diseases ..... 57, 131
Trichinosis ..... 114
Trichomoniasis ..... 79
Tsetse fly ..... 50
Tuberculosis ..... 13, 35, 104, 109, 196
Tularemia ..... 79
Tumors ..... 31, 32, 89, 201
Twenty-eight-hour law ..... 112
Typhus fever ..... 133, 202
Undulant fever. (*See* Brucellosis.)
United Nations Educational, Scientific and Cultural Organization ..... 209
USDA veterinary research ..... 222
U.S. Department of Agriculture ..... 19, 230
U.S. Department of Defense ..... 23
U.S. Department of Health, Education, and Welfare ..... 23
U.S. Department of Interior ..... 78
U.S. Department of State ..... 180
U.S. Livestock Sanitary Association ..... 162
U.S. Veterinary Medical Association ..... 153
Vaccines. (*See* specific diseases.)
Vesicular exanthema ..... 33, 114
Vesicular stomatitis ..... 33
Veterinary Biological Licensees Association ..... 175
Veterinary colleges ..... 81, 203
Veterinary education ..... 79, 201, 238
Veterinary science departments ..... 42, 81
Vibriosis ..... 34
Virus encephalitides ..... 12
Walter Reed Army Institute of Research ..... 130
Williams, T. S ..... 242
World Animal Health Year ..... 4, 206
World Health Organization ..... 180, 196
World Veterinary Association ..... 4, 180, 204
Wolrd Veterinary Congress ..... 205
Yellow fever ..... 6, 79, 202
Zoonoses ..... 12, 57, 130, 139
Zoo Veterinarians Association ..... 153, 167

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