

II INTER-AMERICAN MEETING ON

**FOOT-AND-MOUTH
DISEASE AND
ZONOOSES CONTROL**



PAN AMERICAN HEALTH ORGANIZATION
Pan American Sanitary Bureau, Regional Office of the
WORLD HEALTH ORGANIZATION

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II INTER-AMERICAN MEETING ON FOOT-AND-MOUTH DISEASE AND ZOONOSSES CONTROL

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ADDRESS BY THE DIRECTOR OF THE PAN AMERICAN SANITARY BUREAU

DR. ABRAHAM HORWITZ

On the occasion of your meeting at the Headquarters of the Pan American Health Organization in April 1968, I said that I hoped it "would be the first of a series of regular meetings at which we would have, together with the pleasure of your company, an opportunity to discuss the advances made and their consequences, the obstacles encountered and solutions to them, in all aspects of our work in which the prolongation of human life essentially depends on agricultural and livestock production and productivity, on research, and on the university training of professional and technical personnel. In this way your wealth of experience would serve to guide us in improving the discharge of our responsibilities."

Accordingly we are going to give an account of what we have done in the control of foot-and-mouth disease and certain zoonoses, in our capacity as advisers to the Governments in the rational application of existing knowledge, in the elucidation of problems of immediate import for the above-mentioned general purpose, in the improvement of human resources, and in the modernization of the complex technology needed for dealing with a process of such importance for health, welfare, and economic growth.

The Governments of the Americas have clearly decided progressively to reduce the incidence of foot-and-mouth disease because it means the loss of proteins essential to children under 5 years of age whose mortality annually accounts for 45 per cent of all deaths. Evidence has been repeatedly produced to show that well-nourished children resist environmental assaults, especially infectious diseases and those of a psychological nature, whereas the malnourished child—a by-product of underdevelopment—rapidly falls victim to them. Among the survivors there is a growing proportion whose impaired intellectual development is reflected in the inability to learn and to grow. Malnutrition in the final months of pregnancy and in the first six months of life gives rise to as much as a 30 per cent reduction in the number of brain cells; these are the findings of research studies being carried out with the collaboration of our Organization.

According to conservative estimates, the protein loss due to foot-and-mouth disease and some of the more prevalent zoonoses affecting cattle is about 25 per cent, a figure that needs to be expressed in terms of the loss of human lives and the reduced intellectual capacity we have mentioned. In addition, we must take into account the economic consequences for the countries, the lag in agricultural policy, and constraints on production and productivity. All these factors mili-

tate against the progress of the Hemisphere, which should be measured scientifically and realistically. The order of magnitude of the figures usually cited in this context justifies the increasingly urgent drive to reduce the incidence of and possibly to eradicate those diseases. These facts point up the need for a system of coordination and reference, a true focal point to which the Governments and their experts can turn for the solution of the biological, epidemiological, and administrative problems that confront us today and may confront us in the years ahead.

Thus we understood, and, I go as far as to say, anticipated many years ago the responsibilities of the Pan American Zoonoses Center and the Pan American Foot-and-Mouth Disease Center, both of which are administered by our Organization.

We shall hear what these two institutions have done in the past year and their plans for the immediate future. We have received the considered opinions of the Scientific Advisory Committee which is composed of distinguished authorities of the Americas. In its report the Committee stated that "it is essential that progress of control activities in foot-and-mouth disease be measured in terms of reasonable and practicable epidemiological parameters as outlined in the guide for the evaluation of campaigns prepared by the Center, rather than in terms of doses of vaccine produced, number of vaccinations performed, or number of personnel employed in the field." In other words, statistics on the dynamics of the disease must be collected and analyzed periodically, and not only those relating to current control methods. With a virus that exhibits so high a degree of variation in nature, we cannot rely exclusively on inoculation with an immunizing agent, no matter how well tested it might be. If we are to adapt methods of prevention to the characteristics shown in each environment by infectious diseases affecting a large number of living organisms, we must closely follow their evolution. Closely related to these ideas are the principles and methods of planning, organizing, and administering animal health programs. They are part of a process that is supported by investments the size of which must be assessed in terms of the costs incurred and the benefits achieved: the last-mentioned, both in the long-term and in the short-term, are focused on the well-being of mankind.

We shall learn of the significant progress made in immunizing sheep and hogs, and of the possibilities of the industrial production of vaccines and their introduction into general use. If this happens, it will be possible to make a global attack on foot-and-mouth disease in its main reservoirs and, once these have been reduced to small foci, to eliminate the disease through the slaughter of the infected animals that remain.

The Center has made valuable scientific contributions to the identification of viruses, both the classical types and new subtypes; to the preparation and assay of inactivated vaccines derived from modified live virus, and—what is of enormous practical significance—to the identification of carriers by means of a technique which it is in a position to make available to the countries. It has continued and, one might say, has institutionalized its program of education and advanced training for professional personnel specializing in various aspects of the prevention or control of the spread of foot-and-mouth disease.

¹ Document RICAZ-2/3 (mimeographed).

We shall also report on the achievements of the Pan American Zoonoses Center in the field of rabies, brucellosis, tuberculosis, and hydatidosis—with respect to epidemiology, diagnostic procedures, control methods, and new lines of research—as well as on the advisory services to the Governments. Some of these problems will be discussed in depth in your working sessions.

We also wish to report on the research carried out by the Institute of Nutrition of Central America and Panama (INCAP) on the feeding of animals in the tropics with agricultural by-products. It involves the synthesis of animal proteins from mixtures of vegetable proteins. The results obtained so far show the enormous possibilities that must be explored because of their present and future implications for animal nutrition. The basis of our policy is health as a component of development; it involves, on the one hand, a spiritual commitment, inspired by the need to enhance the quality of life and the dignity of man, and a practical one, to stimulate the inventiveness, the imagination, the sense of enterprise so as to make better use of the resources available and to join our efforts to achieve the common good. That is why, at your first meeting, we said that agriculture and health are the sciences and arts of the well-being of man and must work in close collaboration.

I am sure that you will be interested to learn that the Pan American Health Organization and the Food and Agriculture Organization of the United Nations have jointly convened a meeting of experts to be held next week at our Headquarters in Washington, D.C., at which the bases of a food and nutrition policy for Latin America will be examined. The reason for that meeting is the disparity between the production and quality of foods on the one hand and population growth and economic needs on the other. In the health field considerable progress has been made in the diagnosis and treatment of nutritional diseases, even though this progress has been confined to the prevention of malnutrition in young persons and in infants, especially those under 5 years of age who, as I said earlier, are the most severely affected. This situation is a result of our lack of knowledge of the actual availability of proteins and nutrients for meeting the biological needs of the communities. There is a marked lack of coordination between the various State agencies and those of the private sector in ensuring a fair distribution of foods, regardless of their origin. Clearly, we must also take into consideration foodstuffs provided by international agencies, both public and private. In short, we intend to provide the Governments with background information, methods, and systems for establishing a food and nutrition policy and for implementing it in consonance with the needs of the population—to ensure normal growth and development of children and productivity of adults—and with those of the economy.

This is the background against which we should view the problem of foot-and-mouth disease and that of the most prevalent zoonoses in the Americas, which must be stamped as the cause of major losses of essential foods. Insofar as science and technology offer effective methods for their control, their continued existence cannot be justified solely on the grounds that funds are not available. Today there are tangible possibilities of obtaining external capital, in particular from the Inter-American Development Bank. No less important in terms of disease, death, and feelings of hostility is the enormous destruction of foodstuffs by rodents and the like, and the losses due to improper storage. The restricted purchasing power of large segments of the population affects

nutrition even more, as does ignorance of the basic principles of domestic economy and inadequate dietary practices, which frequently reflect age-long traditions and cultural patterns.

What is evident in the health services is, we believe, applicable to other public institutions, namely, that the human and material resources available can improve the present level of living. There are abundant opportunities for reducing waste, for the joint planning and coordination of activities designed to achieve common goals—all of which must be focused on human beings as the depositories of national development. It was Aristotle who said that the nature of man is revealed not in how he was born but for what he was born.

The problems that threaten our countries in the face of the continuing growth of their population are so important that they can be neither considered nor solved in isolation or without regard to the future. The truth is that we are far from knowing all the factors involved in the relations of man with his fellow creatures, with other living species, and with the environment which surrounds, influences, and molds them all. The greater the advances of science—those in the past twenty years have been dramatic and those that are imminent are startling—the more urgent it is to master the basic concepts of ecology as a science and an art and, by so doing, to improve coexistence in society. As has been so admirably said by Dubos: "To serve human welfare, action must be guided by a better knowledge of fundamental human needs. A truly human concept of technology might well constitute the force that will make science once more part of the universal human discourse, because technology at its highest level should integrate the external world and man's nature."²

Mr. President, I should like to ask you to be good enough to accept and to convey to His Excellency the President of Brazil the thanks of the Pan American Health Organization for his sustained support of the Pan American Foot-and-Mouth Disease Center—which has been the reason for its continuing advance—and for the excellent facilities made available to us for this Second Inter-American Meeting of Ministers of Agriculture.

² Dubos, René. *So Human an Animal*. New York, Charles Scribner's Sons, 1968, p. 220.

ADDRESS BY THE MINISTER OF AGRICULTURE OF BRAZIL

DR. IVO ARZUA PEREIRA

It is a great honor and satisfaction for the Government of Brazil to receive in the City of Rio de Janeiro the distinguished participants in the II Inter-American Meeting on Foot-and-Mouth Disease and Zoonoses Control.

United by their sincerity of purpose and a high sense of solidarity, the countries and international organizations are meeting for a second time in the Americas to discuss serious animal health problems of common interest that affect the economy and the public health of the Hemisphere.

To speak of the importance and the significance of this meeting being held under the auspices of the Pan American Health Organization, so well represented here by the eminent and dynamic Dr. Abraham Horwitz, would be to waste your valuable time, which could be better devoted to the work you are now beginning.

However, the meeting of this select group, which includes representatives of the International Bank for Reconstruction and Development (IBRD), the Inter-American Development Bank (IDB), the Food and Agriculture Organization (FAO), the International Office of Epizootics (OIE), the International Regional Organization for Health in Agriculture and Livestock (OIRSA), as well as other international agencies, will afford an opportunity to examine in a friendly and relaxed setting some of the many livestock problems besetting the countries of the Americas.

The vast livestock holdings of Latin America were estimated in 1967 to be about 250,000,000 cattle, 130,000,000 sheep, 65,000,000 hogs, 45,000,000 goats, 40,000,000 horses, and 800,000,000 poultry. The rate of development, however, has not kept pace, save in exceptional cases, with that recorded in other sectors of the economy of our countries or with the population growth.

If this disparity is not corrected in due course, it could give rise to serious food shortages, a phenomenon which is already appearing in certain regions where the supply of foods to the human population, especially protein foods, is considered the most important biological problem to be solved.

This assertion is corroborated by the fact that although in the Americas the average per-capita consumption of meat is about 17 grams a day, there are South American countries in which the consumption does not exceed 8.5 grams a day. Despite the moderate 1.7 per cent increase in meat production in the Americas in the 1950's, there has been a decrease in consumption primarily due to exports.

The damage caused by animal diseases throughout the world has not been accurately assessed, but Professor William R. Pritchard, Dean of the School

of Veterinary Medicine of the University of California, has estimated that the losses in fresh meat, milk, and eggs amount to about 27,000,000 metric tons a year in the Americas, where so much high quality protein is ruthlessly destroyed by diseases such as foot-and-mouth disease and other vesicular diseases, brucellosis, rabies, tuberculosis, parasitic diseases, nutritional diseases, and the like.

It is therefore not hard to see how the control of animal diseases could help increase food supplies, in particular supplies of proteins of animal origin indispensable to the human diet, and how important this control is for the economic development of our countries.

Starting from the basic premise that this development is the logical outcome of the balanced and harmonious progress of the various sectors of the economy of any country and that livestock production, which plays a highly significant socioeconomic role in that process, must therefore be included among priority activities, it necessarily follows that all problems relating to the control or eradication of animal diseases are an integral part of a comprehensive development program.

It is true that no little effort has been devoted to coping with these problems. The meeting that is now beginning bears witness to the efforts of our countries to overcome them. Yet these efforts appear insufficient when compared with the magnitude of those problems. The fact is that in many countries of the Americas their solution is hampered by a wide and varied range of obstacles, including—in addition to economic, financial, institutional, and technical problems—a shortage of skilled manpower.

We refer in particular to the shortage of veterinarians. Surveys made in 19 Latin American countries in 1967 showed that there was a total of 10,366 veterinarians and that the annual increase was on the order of 570, or approximately 5.5 per cent of that total. That number appears to be inadequate, especially if we take into account losses due to retirement, disability, death, or transfer to better paid activities.

Nevertheless, despite the shortage of skilled manpower, serious campaigns are being carried out in our countries against foot-and-mouth disease and other vesicular diseases, against brucellosis, rabies, parasitic diseases, and swine fever, and promising results are being obtained. This shows what we are capable of and how much respect and admiration we owe to veterinarians whose efforts and patriotism in conducting those campaigns have never lacked technical support from agencies such as the Pan American Foot-and-Mouth Disease Center and the Pan American Zoonoses Center.

Other international agencies have been established to supply increased technical assistance to livestock producers, particularly in border areas, and to promote a more efficient exchange of knowledge between veterinarians of the various countries. They include, *inter alia*, the Technical Regional Animal Health Commission, which was set up as a result of the agreement between our country, Argentina, Uruguay, Paraguay, Chile, and Bolivia; International Regional Organization for Health in Agriculture and Livestock (OIRSA), which comprises the countries of Central America and Mexico; and the Bolivarian Animal Health Organization. To these must be added agreements such as that which is being negotiated among Brazil, Venezuela, and Guyana; and bilateral agreements like those already concluded by us with Uruguay and that between

Argentina and Paraguay, a country with which we are also negotiating a similar agreement for the same purpose.

Other international agencies with a larger sphere of action are working along the same lines—for example, FAO, OIE, IDB, and IBRD, as was mentioned earlier—which means in the final analysis that steps have been taken to set up an efficient system of technical cooperation and international economics, capable of sustaining more effective control of animal diseases in different countries and furthermore of averting the introduction of exotic diseases into the Americas.

I do not wish to extend this examination of the problems which are the subject of this meeting, except to tell you of our conviction that we can solve them by our concerted efforts. Nevertheless, it appears appropriate to make some comment on the position of the veterinary services of our countries, with a view, on the one hand, to safeguarding the livestock of the Americas against exotic diseases and, on the other, to adjusting it to the similar needs of foreign importers and, in particular, to the economic integration of the Americas.

The concept of economic integration is embodied in the Treaty of Montevideo, which launched the Latin American Free Trade Association. Fresh life was breathed into it at the meeting of the American Chiefs of State held in Punta del Este, Uruguay, in April 1967, for the purpose of setting up a Latin American Common Market, the main purpose of which is to unify the efforts of the participating countries in order to gradually and progressively complement their several economics on the basis of reciprocal benefits.

The adoption of this policy has increased the responsibility of veterinary services for eliminating animal health problems that may act as constraints on international trade in animals on the hoof and animal products, a responsibility that is further enhanced as a result of the population growth in the Americas and the consequent increasing demand for foodstuffs of animal origin.

Viewed in this light, its implications transcend the limits of national political interests in that they involve the very preservation of world peace, which is continually threatened by poverty, hunger, and disease.

We trust that we shall be understood both by Brazilians and by the distinguished representatives of so many sister nations who are aware of our position and can bring it to the knowledge of their Governments which, like our own, are surely anxious to place livestock problems in the forefront of their concerns.

You all know better than I do, particularly the veterinarians, as a result of the experience you have gained in long years of work and study, that the visible aspects of a given activity are not always the most significant. As in buildings, the foundations are not always conspicuous in the finished work.

Factors of preservation and safety as well as those that create a balance with the rural environment and harmony with the environment in general sometimes call for the deployment of considerable human resources as well as physical, intellectual, and financial efforts.

This holds true for activities for the protection of animal health, in tasks of undoubted merit, which are not always appreciated in circles unrelated to livestock problems.

In the silence of libraries and laboratories, in university lecture halls, molding mentalities and forming specialists so necessary for the development of production—at your desks and in the fields, you are constantly catechizing in

favor and in defense of scientific and technical principles, in an effort to bring the subjects of your concerns to the attention of your Governments and furthermore, as you are doing now, to make them the subject of discussion at the international level.

It seems appropriate that out of this magnificent opportunity should come a recommendation that as complete an assessment as possible should be made of the health situation in the various countries, of its impact on the development of the livestock economy in the Americas, and of its true and far-reaching implications for international trade in animals and animal products, and that measures should be adopted that are conducive to the moderation, if not the elimination, of the obstacles frequently encountered in that trade.

You well know the impact of the effective control of animal diseases on the social and economic conditions of the countries. Allow me on this occasion to state that, as regards meat alone, the losses due to those diseases annually amount to 7,650 million tons.

If we were able to remove those hindrances to livestock production, we could achieve two significant results: (a) an increase in the consumption of meat in the Americas from 17 to 22 grams per day per person; or (b) the annual supply of the same amount of meat each day to an additional 108,000,000 persons, that is, 3 per cent of the world population.

I should like these final words of thanks, in my name and in that of my Government, to all those who are participating in the meeting beginning today, to be a signal tribute to those veterinarians who, in this and other countries, are carrying out such excellent work. We sincerely hope that they may continue their fruitful endeavors in their countries.

We believe that the distinguished Ministers present here today will endeavor to ensure the continuity of these efforts in their own countries so that when we meet again we shall be able to report significant progress in so important a field of human endeavor.

In inaugurating this meeting I should like to express, on behalf of the Government of Brazil, our best wishes for a happy and profitable stay in our country.

FINAL REPORT OF THE MEETING

FINAL REPORT

The II Inter-American Meeting, at the Ministerial Level, on Foot-and-Mouth Disease and Zoonoses Control was held in the Gloria Hotel in Rio de Janeiro, Brazil, from 14-17 May 1969. The meeting was convened by the Director of the Pan American Sanitary Bureau, in implementation of Resolution XIX¹ approved by the Directing Council of the Pan American Health Organization at its XVII Meeting and of Resolution VII² of the I Inter-American Meeting on Foot-and-Mouth Disease and Zoonoses Control.

OFFICERS

The heads of delegation met on 14 May to elect the officers of the meeting. The following were elected:

President:	Dr. Ivo Arzua Pereira Minister of Agriculture (Brazil)
Vice-Presidents:	Dr. Angel Duarte Minister of Agriculture and Livestock Production (Ecuador)
	Dr. Francisco Montenegro Girón Minister of Agriculture (Guatemala)

Dr. Abraham Horwitz, Director of the Pan American Sanitary Bureau, served as Secretary ex officio.

PARTICIPANTS

Representatives of the following Governments attended the meeting: Argentina, Barbados, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, France, Guatemala, Guyana, Haiti, Honduras, Kingdom of the Netherlands, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, United Kingdom, United States of America, Uruguay, and Venezuela. Canada sent an official observer. Observers from the following international organizations were also present: Inter-American Development Bank, Inter-American Institute of Agricultural Sciences, International Office of Epizootics, United Nations Development Program, and Food and Agriculture Organization.

PLENARY SESSIONS

Dr. Ivo Arzua Pereira, Minister of Agriculture (Brazil), presided over the inaugural session, which was held on 14 May. After expressing his thanks for his election and welcoming the participants, the President emphasized the im-

¹ *Official Document PAHO 82*, 74-76.

² *Scientific Publication PAHO 172*, 12-13 (in Spanish).

portance of the meeting and expressed his wishes for its successful outcome. Problems concerning the control and eradication of animal diseases, he said, should be taken into account in a broad program of development aimed at the balanced and harmonious progress of the different sectors of a country's economy; in this regard, the responsibility of the official veterinary services was a heavy one. He mentioned the need for close international coordination if the countries were to reach the established goals in the control of animal diseases, which so adversely affected economic and social development.

Next Dr. Abraham Horwitz, Director of the Pan American Sanitary Bureau, referred to the decision of the Governments to progressively reduce the incidence of foot-and-mouth disease and consequently its negative effects on the economy of the countries, agricultural development, and human well-being. He mentioned the loss of animal proteins caused by the disease as well as that caused by other zoonoses, and said that reports would be given on the activities of the technical entities of the PAHO, whose purpose was to assist the countries in solving those exceedingly serious problems. In conclusion, he expressed his thanks to the Government of Brazil for its support of the Pan American Foot-and-Mouth Disease Center and for the excellent facilities it had made available for holding the present meeting.

At the first plenary session, Dr. Otoniel Velasco, Coordinator of Short-Term Plans for the National Planning Institute of Peru, spoke on the subject "Planning in Animal Health." He drew attention to the need to incorporate animal health programs into national agricultural plans and, at the same time, to give veterinarians a larger part in high-level administrative functions, in particular in planning.

The Observer from the Inter-American Development Bank, Mr. José Irineu Cabral, dealt with the topic "International Credit and Its Importance in the Campaign against Animal Diseases." He referred to IDB loans for agriculture and livestock production, the provision of credits since 1968 for foot-and-mouth disease control programs, and the decision to extend financial assistance to campaigns against other diseases that were a regional problem.

The topic "Administrative Factors Affecting the Organization and Conduct of Health Campaigns" was presented by Dr. Yccid Aliaga, Adviser on Administrative Methods, PASB. He illustrated modern concepts of administration in the context of the foot-and-mouth disease campaigns of certain South American countries.

The second plenary session was devoted to country reports on the status of vesicular diseases and control or preventive programs. Following the order in which the speakers had enrolled, reports were submitted by Chile (Mr. Emiliano Ortega), Colombia (Dr. Jorge Ortiz-Méndez), Argentina (Dr. Jorge Borsella), Uruguay (Dr. Joaquín de Freitas), Costa Rica (Dr. José Luis Solano), Guyana (Hon. Robert J. Jordan), Venezuela (Dr. Humberto Olmos), and the United States of America (Dr. Robert J. Anderson).

After the presentations, there was an exchange of views on the incidence of vesicular stomatitis, human cases of the disease, the production of foot-and-mouth disease vaccine, the collection of epidemiological data, and experience with modified live virus vaccines. The Representatives of the United States of America, Argentina, Colombia, Costa Rica, Chile, Ecuador, and Venezuela took part in the discussion.

The third plenary session was held on 15 May, as was the meeting of Panel A (Foot-and-Mouth Disease Control Activities), at which presentations were made by the Representatives of Paraguay, Argentina, Brazil, and Venezuela. Dr. Parisio Pineda Ayala, President of the Council of the National Foot-and-Mouth Disease Control Service (SENALFA) of Paraguay, spoke on "Planning of a Foot-and-Mouth Disease Control Program." He emphasized the importance of the preliminary phases in ensuring the successful outcome of a health program; the major role of the political decision—the indicator of the priority, value, and interest the Government assigned to the problem; and finally, the need for the planning process to be subdivided into two clear-cut phases: diagnosis of the situation, and plan formulation proper.

Next Drs. Jorge Borsella (Argentina), José Freire de Faria (Brazil), and Miguel Villegas Delgado (Venezuela) presented the results, benefits, and prospects of the foot-and-mouth disease control campaigns in their countries.

After these reports, Dr. Roberto Goic of the Pan American Foot-and-Mouth Disease Center took up the subject "Data on Foot-and-Mouth Disease in South America." He indicated the desirability of establishing a foot-and-mouth disease surveillance system in the infected countries, based on case-reporting, and stated that the organization and operation of such a system would have the support of the Pan American Foot-and-Mouth Disease Center.

The Representative of Argentina then submitted a draft resolution on the establishment of a foot-and-mouth disease epidemiological surveillance system, such as described by the Pan American Foot-and-Mouth Disease Center.

In the second half of the plenary session the presentation of country reports was continued. The speakers included the Representatives of Ecuador (Dr. Luis Flor Cedeño), Honduras (Dr. Carlos H. Aguilar), El Salvador (Mr. Francisco Lino Osegueda), Nicaragua (Dr. Alfonso Lovo-Cordero), and Bolivia (Dr. Mario Zambrana Barbary).

Dr. Francisco Montenegro Girón, Minister of Agriculture of the Republic of Guatemala, presided over the fourth plenary session, held on 15 May. Country reports were delivered in the following order: Guatemala (Dr. Edgar E. Leiva Santos), Brazil (Dr. José Freire de Faria), Barbados (Hon. Kenmore N. R. Husband), Peru (Dr. Emilio Matto Cárdenas), Panama (Dr. Rolando Humberto Martinelli), Trinidad and Tobago (Mr. W. Andrew Rose), Kingdom of the Netherlands (Dr. Robby G. Lieuw-A-Joe), Paraguay (Dr. Parisio Pineda Ayala), and Haiti (Dr. Jean Théard).

As there were no comments or observations on any of the country reports, a revised version of the draft resolution on an epidemiological surveillance system for foot-and-mouth disease, submitted by the Representative of Argentina at the third plenary session, was discussed and unanimously approved.

At the fifth plenary session, held on 16 May, Group B discussed "Foot-and-Mouth Disease Preventive Activities." Dr. Frank Mulhern, Deputy Administrator, United States Agricultural Research Service, spoke on "Repercussions of the Occurrence of Foot-and-Mouth Disease in a Disease-Free Area." He described, by way of illustration, what happened in Mexico in the period 1947-1953 and what would happen in his own country if an outbreak of the disease were to occur. He emphasized in particular the damage that would be caused to the livestock industry as a result of the compulsory closing of cattle markets.

He was followed by Dr. Kenneth F. Wells, Veterinary Director General, Department of Agriculture of Canada, who spoke on the subject "Foot-and-Mouth Disease: Eradication and Preventive Measures in Canada." He outlined the history of the disease in his country and gave a detailed description of the procedures used to eradicate the 1952 outbreak, the last to occur in Canada. Finally, Dr. Ramón A. Vega, Director of Animal Health of Panama, spoke on "The Foot-and-Mouth Disease Prevention Program in the Darién Area." He described the area and the problem involved, the national and international efforts being made to solve it, and finally, the program being carried out in Darién by the Government of Panama in cooperation with the International Regional Organization for Health in Agriculture and Livestock (OIRSA).

The session continued with the presentation of Dr. Otto Bier, Professor of the Paulista School of Medicine, São Paulo, Brazil, on "The Research Program of the Pan American Foot-and-Mouth Disease Center and the Pan American Zoonoses Center." He outlined the projects being carried out by both institutions, including training and technical advisory services to the countries. He drew special attention to virus subtyping and vaccine research activities of the Pan American Foot-and-Mouth Disease Center. He concluded by indicating the desirability of the Center being transferred to a more suitable location in Brazil, especially with a view to facilitating communications with other scientific institutions.

The Representatives of Argentina, Bolivia, Brazil, Colombia, and Panama took part in the discussion that followed, asking for further explanations or proposing resolutions on rabies and foot-and-mouth disease research.

In the latter part of the fifth plenary session Dr. Carlos A. Palacios, Director of the Pan American Foot-and-Mouth Disease Center, submitted the program and budget estimates of the Center for 1970 and the preliminary draft estimates for 1971. After the document had been considered, the Representative of Argentina submitted a draft resolution on it.

On the same day Dr. Angel Duarte, Minister of Agriculture and Livestock Production (Ecuador), presided over the sixth plenary session. In accordance with the program, Dr. Robert Sharman, United States Agricultural Research Service, dealt with the subject "Myiases as Zoonoses of Importance in the Americas," illustrating his statement with a film on the screwworm. He gave a descriptive list of the flies and larvae constituting an economic problem for stockraising as well as of those causing myiasis in man. He also outlined the methods and measures used for the control and eradication of these insects and appraised future prospects.

The President submitted to that plenary session the draft resolution on the program and budget estimates of the Pan American Foot-and-Mouth Disease Center which had been submitted by the Representative of Argentina, as well as the amendment to it submitted by the Representative of the United States of America. On being submitted to the vote, the amendment was rejected. A vote was then taken on the original proposal, which was approved by 20 votes in favor and none against.

Dr. Aurelio Málaga Alba of the National University of San Marcos, Peru, then read a paper on "The Status of Rabies in the Americas." He described the public health problem caused by stray dogs and the importance of bat

rabies in the livestock industry. The Delegations of Argentina, Bolivia, and Panama submitted draft resolutions on the Scientific Advisory Committee of the Centers, on paralytic rabies, and on the control of exotic diseases, all of which were approved.

At the seventh plenary session, held on 17 May, the following papers were presented: "Zoonoses, Public Health, and Livestock Development in Latin America," by Dr. Boris Szyfres, Director of the Pan American Zoonoses Center; "The Problem of Hydatidosis in the Americas," by Dr. Alfonso Trejos, Director of the Laboratory Division of the Center; and "Some Observations on Animal Feeding in the Tropics," by Dr. Ricardo Bressani, Chief, Division of Agricultural Sciences and Food Chemistry, Institute of Nutrition of Central America and Panama.

Dr. Ramón A. Vega, Representative of Panama, referring to the prevention of foot-and-mouth disease in the Darién area, to which he had called attention at the fifth plenary session, stated that, in addition to the measures to be taken by the program, its success would only be possible with the collaboration of the Government of Colombia and the permanent advisory services of the Pan American Foot-and-Mouth Disease Center.

At the same session the draft resolutions on these items were reviewed and approved and are included in this report. The Delegation of Venezuela requested the representatives to consider the possibility of inviting an observer of the Inter-American Livestock Producers Association (CIAGA) to future meetings of this type, in compliance with the wishes expressed by its President. He asked that this request be included in the report of the meeting.

Also at the seventh session a draft resolution presented by the Delegation of Venezuela was approved, expressing appreciation for and accepting the generous offer of the Government of Argentina to hold the next meeting in Buenos Aires. Appreciation was also expressed to the Director and staff of the Pan American Sanitary Bureau for the effective collaboration rendered in the organization and conduct of the meeting. The Delegation of Ecuador presented a resolution thanking the Government of Brazil for its excellent collaboration in connection with the II Meeting, which undoubtedly had assured its success. Dr. Carlos Ruiz Martínez, of the International Office of Epizootics (OIE), read a message to the participants on behalf of that organization. He congratulated the World Health Organization on its Twentieth Anniversary held last year, and referred to the great interest the International Office has in the control of foot-and-mouth disease in the Americas. He also congratulated the Pan American Health Organization on the excellent work carried out by the Pan American Foot-and-Mouth and Zoonoses Centers to protect the livestock wealth of all the countries.

Dr. Paricio Pineda Ayala of Paraguay, speaking on behalf of the delegations, thanked the Minister of Agriculture of Brazil for the welcome extended and the many courtesies received from both the authorities and people of Brazil. He then referred to the importance of these meetings, which constitute positive progress in international collaboration in the fight against foot-and-mouth disease and the zoonoses, which have such devastating effects on the livestock economy of the Americas. Proper planning and organization of the animal health campaigns under way in the countries, as well as the decided participation of international credit in the campaigns against livestock diseases will

assure the success of the venture. He expressed his appreciation, as well as that of the delegations, for the effective collaboration the countries have been receiving from the Pan American Foot-and-Mouth and Zoonoses Centers, as well as from the Pan American Health Organization and, in particular, from the Director of the PASB, Dr. Abraham Horwitz.

This last plenary session was closed with a statement by the Minister of Agriculture of Brazil, Dr. Ivo Arzua Pereira, who congratulated the delegates on their fine presentation which had permitted the study of the many problems affecting the livestock industry of the Americas in a cordial and informal atmosphere. His concluding remarks were: "The resolutions we have approved today represent a challenge for our Governments. I am certain that, in the same manner as those of us present here, they will make every effort to ensure the continuity of these tasks in the countries so that when we again meet we shall be able to prove that we have achieved significant progress in this very important human endeavor."

RESOLUTIONS APPROVED

The following resolutions were approved in plenary sessions:

Resolution I

Epidemiological Surveillance of Foot-and-Mouth Disease

THE II INTER-AMERICAN MEETING,

Considering that foot-and-mouth disease spreads rapidly, giving rise to epidemic outbreaks that easily cross international frontiers; and

Bearing in mind the importance of knowing the types and subtypes of foot-and-mouth disease virus in the conduct of programs for the control and prevention of disease,

RESOLVES:

1. To support the proposal of the Pan American Foot-and-Mouth Disease Center to institute an inter-American foot-and-mouth disease epidemiological surveillance program.
2. To recommend to the affected countries in the Americas that they submit to the Center at regular intervals epidemiological reports on outbreaks of foot-and-mouth disease, identifying the types and subtypes of causative virus, in accordance with the guidelines to be issued by the Center.
3. To request the Pan American Foot-and-Mouth Disease Center to analyze, summarize, and distribute this information, with the least possible delay, to the official animal health services of the countries of the Americas.
4. To recommend to the Center that it follow the same practice in the case of vesicular stomatitis.

(Approved at the fourth plenary session, 15 May 1969)

Resolution II

Draft Program and Budget Estimates of the Pan American Foot-and-Mouth Disease Center for 1970 and Preliminary Draft for 1971

THE II INTER-AMERICAN MEETING,

Recognizing the importance of foot-and-mouth disease for nutrition, the development of the livestock industry, and the economic progress of the Americas;

Mindful of the activities of the Pan American Foot-and-Mouth Disease Center in the promotion, conduct, and coordination of programs for the prevention and control of this disease;

Noting Resolution I³ of the I Inter-American Meeting on Foot-and-Mouth Disease and Zoonoses Control (Washington, D.C., 8-11 April 1968) concerning the draft program and budget estimates for 1969 and the preliminary draft program and budget estimates for 1970; and

Having considered in detail the draft program and budget estimates for 1970 and taken note of the preliminary draft program and budget estimates for 1971,

RESOLVES:

1. To pledge its full support to the Pan American Foot-and-Mouth Disease Center and the work it is carrying out.

2. To emphasize the need for the Center to continue its activities in the promotion, conduct, and coordination of programs for the prevention and control of foot-and-mouth disease, as well as its research program and its program for the training of personnel from the countries of the Americas, as mentioned in the draft program and budget for 1970 and the preliminary draft for 1971.

3. To note that the draft program and budget estimates of the Center provide for balanced activities necessary to furnish the Governments with scientific assistance and technical advisory services in the planning, execution, and coordination of national and regional programs for the prevention and control of foot-and-mouth disease.

4. To recommend to the XIX Meeting of the Directing Council of the Pan American Health Organization that it give favorable consideration to the approval of the draft program and budget estimates of the Center for 1970 as set forth in Document RICAZ-2/4.

5. To note that the preliminary draft of the program and budget estimates for 1971 contains activities that are soundly conceived and very necessary, and that the draft will be subject to further discussions in 1970 by the III Inter-American Meeting, at the Ministerial Level, on Foot-and-Mouth Disease and Zoonoses Control and by the Executive Committee and the Directing Council of the Pan American Health Organization.

(Approved at the sixth plenary session, 16 May 1969)

Resolution III

Paralytic Rabies

THE II INTER-AMERICAN MEETING,

Recognizing the seriousness of the problem of paralytic rabies for the development of the livestock industry throughout the Hemisphere,

³ *Scientific Publication PAHO 172, 7-8 (in Spanish).*

RESOLVES:

1. To recommend that, with the assistance of the Pan American Zoonoses Center, programs for the control of paralytic bovine rabies be organized in the various ecological zones of each country, based on the immunization of cattle with approved vaccines and effective systems for the control of vampire bat population.

2. To set up an adequate system for the quality control of domestically produced rabies vaccine in which the Pan American Zoonoses Center will serve as the reference laboratory.

3. To promote the training of laboratory and field personnel for the development of control programs, with the assistance of the Pan American Health Organization.

4. To carry out, in collaboration with the Pan American Zoonoses Center, ecological studies of vampire bats in the most affected areas and also epizootiologic surveys.

(Approved at the sixth plenary session, 16 May 1969)

Resolution IV

Control of Exotic Diseases

THE II INTER-AMERICAN MEETING,

Considering that the introduction of exotic animal diseases into the countries of the Americas poses a serious threat;

Bearing in mind that the rapidity of modern means of transportation and the development of communication facilities heighten this danger;

Recognizing that trade in agricultural and livestock products is of vital importance to the economic development of the countries and that it would be gravely affected by an outbreak of an exotic disease in any one of these countries, which would make it necessary to impose restrictions on trade in animals and animal products; and

Considering that most of the countries are not in a position to apply proper quarantine measures to imported animals or surveillance measures to imported animal products,

RESOLVES:

1. To affirm that it is necessary for the countries to make every possible effort to organize their quarantine and surveillance services in ports, airports, border stations, and post offices in order to prevent the introduction of exotic animal diseases into the Americas.

2. To stress the need to equip these services with appropriate means for rapidly diagnosing these diseases.

3. To affirm that it is advisable for the countries of the Americas to conclude a high-level agreement on the protection of the Hemisphere from the possible introduction of exotic animal diseases.

4. To state that it is of special importance that the Pan American Health Organization give all possible assistance in training veterinarians specializing

in quarantine, supervision, and surveillance measures designed to prevent the introduction of these exotic diseases.

(Approved at the sixth plenary session, 16 May 1969)

Resolution V

Vote of Thanks to the Scientific Advisory Committee

THE II INTER-AMERICAN MEETING,

Having considered the report of the Scientific Advisory Committee on the work of the Pan American Zoonoses Center and the Pan American Foot-and-Mouth Disease Center in 1968; and

Bearing in mind the distinguished scientific qualifications of the members of the Committee,

RESOLVES:

1. To point out that the report contains an examination of the work of the Centers in accordance with the recommendations of the first meeting of the Committee, and that it indicates new approaches to research on problems affecting or hampering the prevention or control of foot-and-mouth disease and the zoonoses.

2. To express its appreciation of the work of the Scientific Advisory Committee of the Pan American Zoonoses Center and the Pan American Foot-and-Mouth Disease Center and to support its recommendations.

3. To emphasize the importance of continuing the periodic evaluation, orientation, and review of the work of both Centers by recognized scientific researchers.

(Approved at the sixth plenary session, 16 May 1969)

Resolution VI

Hydatidosis

THE II INTER-AMERICAN MEETING,

Bearing in mind that hydatidosis poses a serious public health problem and, moreover, causes enormous economic losses to the countries of South America;

Considering that these factors should be taken into account by other countries that intend to develop a livestock industry in the future;

Recognizing that the campaigns and control programs carried out in the past have not been successful because of lack of continuity and failure to take into account simultaneously all the factors involved in the maintenance of the enzootic; and

Noting that because of lack of basic information it has not been possible to make an evaluation of the activities carried out and to modify them accordingly,

RESOLVES:

1. To recommend to the affected countries that they take the necessary measures for coordinating public health and animal health activities directly or indirectly related to the control of hydatidosis.

2. To recommend that the necessary steps be taken to ascertain the status of the problem in man and in animals in each country.

3. To concentrate epidemiological, ecological, and laboratory studies in high incidence areas in which only minimum resources are available for the control of the disease.

4. To draw up a pilot plan for operations in selected areas, which will include new control techniques, especially health education and the elimination of the parasite from intermediate and final hosts.

(Approved at the seventh plenary session, 17 May 1969)

Resolution VII

Epidemiological Surveillance of Rabies

THE II INTER-AMERICAN MEETING,

Considering that rabies is an important livestock disease in rural areas and that it has an important impact on public health in urban areas;

Bearing in mind that a continuous and rapid exchange of information on the occurrence of rabies cases is essential to the effective planning of activities for the control and prevention of this disease; and

Aware of the urgent need for better international arrangements for rabies surveillance in the Americas,

RESOLVES:

1. To support the proposal of the Pan American Zoonoses Center for the development of an inter-American rabies surveillance program.

2. To recommend to all the countries of the Americas that they send to the Center a monthly report containing basic epidemiological data on rabies cases.

3. To request the Pan American Zoonoses Center to analyze and summarize this information and to distribute it within the shortest possible time to the agricultural and public health authorities of the countries of the Americas.

(Approved at the seventh plenary session, 17 May 1969)

Resolution VIII

Zoonoses Control as an Integral Part of Agricultural Development

THE II INTER-AMERICAN MEETING,

Bearing in mind that zoonoses are a main cause of the reduced livestock production in Latin America and that they also adversely affect human health;

Considering that methods for the control of brucellosis and bovine tuberculosis have proven to be valuable and effective and that with new types of vaccines it is possible to effectively protect cattle against bat-borne rabies; and

Considering that in zoonoses control the cost-benefit ratio is highly favorable, as has been shown in the Americas and in other parts of the world,

RESOLVES:

1. To recommend that the Governments make provision in their agricultural development plans for the control of these serious zoonoses.

2. To request the Governments to give preferential treatment to veterinary education so as to produce professional personnel capable of satisfying the most important needs of the countries.

3. To request the Governments to study the possibility of providing the Pan American Zoonoses Center with the necessary funds to expand and extend its activities for the benefit of the economy and the health of the peoples of the Americas.

4. To request the Pan American Health Organization to submit to the III Inter-American Meeting, at the Ministerial Level, on Foot-and-Mouth Disease and Zoonoses Control a study on the assistance which the Pan American Zoonoses Center could render to the agricultural and stockraising agencies of the Americas in their efforts to control zoonoses, and on how those agencies could collaborate in the work program of the Center.

(Approved at the seventh plenary session, 17 May 1969)

Resolution IX

Animal Nutrition

THE II INTER-AMERICAN MEETING,

Considering the gravity of nutrition problems in the Region, which adversely affect large segments of the population, especially children, and seriously limit the human potential of the countries in the Hemisphere;

Bearing in mind that the scarcity and high cost of protective foods, mainly products of animal origin, constitute one of the basic factors responsible for this problem;

Noting that Latin America has the potential for more efficient production of foodstuffs, if the advances in science and technology are applied;

Mindful that operational research is required if this knowledge is to be applied in the ecological and socioeconomic conditions prevailing in the countries of Latin America;

Considering that not only agricultural agencies of the various countries but also nutrition and health organizations should take part in this research, since in the areas of human and animal nutrition they may be able to complement the work of agricultural research programs, so as to make better use of existing resources; and

Aware that the Institute of Nutrition of Central America and Panama (INCAP) has great experience in this area, and has shown by its important projects, the results of some of which are already being applied, what can be done to better utilize natural resources in such a way as to increase and improve the production of foods,

RESOLVES:

1. To commend the Institute of Nutrition of Central America and Panama (INCAP) for the initiative it has shown in conducting research programs aimed at increasing the quantity and improving the quality of foods, and to request it to continue its work in this area, which is of fundamental interest to all the countries of Latin America because of its importance not only for the nutrition of their inhabitants but also for their economic development.

2. To request the Director of the Pan American Sanitary Bureau to study how the resources of INCAP in this field may be made better known and more widely used by all the agricultural agencies of the Americas and elsewhere, and if necessary endeavor to increase the resources of INCAP for that purpose.

(Approved at the seventh plenary session, 17 May 1969)

Resolution X

Diagnosis and Reference Laboratory

THE II INTER-AMERICAN MEETING,

Bearing in mind the importance of types and subtypes of foot-and-mouth disease virus in epizootiology and for programs for the prevention and control of the disease in the Americas;

Aware of the efficient work being carried out in this area by the diagnosis and reference laboratory of the Pan American Foot-and-Mouth Disease Center; and

Considering that the countries need to be kept informed at all times of the virus types and subtypes that are discovered and of the development of epizootic outbreaks caused by them,

RESOLVES:

1. To recognize the Pan American Foot-and-Mouth Disease Center as the reference laboratory for the countries of the Hemisphere in the diagnosis of foot-and-mouth disease, without prejudice to the maintenance of technical and scientific relations with the World Reference Laboratory on Foot-and-Mouth Disease in Pirbright, England.

2. To recommend that the countries of the Americas in which foot-and-mouth disease is present send to the Center specimens from foci or outbreaks of the disease which it is suspected have been produced by any new virus type or subtype.

(Approved at the seventh plenary session, 17 May 1969)

Resolution XI

Training of Personnel

THE II INTER-AMERICAN MEETING,

Bearing in mind the need to increase the number of trained veterinarians required for the planning, execution, and evaluation of animal health programs in the Americas; and

Recognizing that these activities should be based upon the most up-to-date technical and scientific knowledge,

RESOLVES:

1. To recommend that the countries continue to promote the education and training of veterinarians in epidemiology and statistics as well as in

administrative methods for the programming, supervision, and evaluation of activities for the prevention and control of animal diseases.

2. To recommend that the Pan American Health Organization explore the possibility of expanding its assistance to the countries in the aspects mentioned in the preceding paragraph.

(Approved at the seventh plenary session, 17 May 1969)

Resolution XII

International Credit and its Importance in the Control of Animal Diseases

THE II INTER-AMERICAN MEETING,

Bearing in mind the importance of the control and prevention of animal diseases for the economy of the Latin American countries;

Aware of the major role of international credit in the conduct of campaigns for the control and prevention of animal diseases; and

Considering that the Inter-American Development Bank has established a credit policy for foot-and-mouth disease control campaigns,

RESOLVES:

1. To express its thanks to the Inter-American Development Bank for the financial support it is giving to the countries for the conduct of campaigns against foot-and-mouth disease.

2. To recommend that the countries which are planning national campaigns against foot-and-mouth disease consider the possibility of using the credit facilities being granted by the Inter-American Development Bank to supplement the financing of their campaigns.

3. To recommend to the Inter-American Development Bank that it examine the possibility of making credits available for programs for the control of other animal diseases which are serious problems in the economic and social development of the countries of the Hemisphere.

4. To recommend to international or national credit agencies that they make it a condition for the grant of loans for financing livestock development programs that part of the funds made available be used for technical assistance and for the prevention or control of zoonoses and animal diseases.

(Approved at the seventh plenary session, 17 May 1969)

Resolution XIII

Evaluation of Foot-and-Mouth Disease Control Programs

THE II INTER-AMERICAN MEETING,

Considering that many programs for the prevention, control, or eradication of foot-and-mouth disease are being conducted, initiated, or prepared; and

Bearing in mind that this effort for the control of foot-and-mouth disease is being undertaken in a broad spirit of international solidarity in the Americas,

RESOLVES:

To request the Pan American Foot-and-Mouth Disease Center to prepare a reference guide for evaluating the conduct and results of foot-and-mouth disease prevention and control campaigns so that the Governments may appraise the results of these efforts and have available uniform indicators for measuring the progress made by the countries as a whole.

(Approved at the seventh plenary session, 17 May 1969)

Resolution XIV

Vote of Thanks to the Government of Brazil

THE II INTER-AMERICAN MEETING,

Bearing in mind the wholehearted collaboration of the Government of Brazil in the holding of the present meeting, the support and participation of that Government in its organization, and the successful outcome of its deliberations,

RESOLVES:

To express its thanks to the Government of Brazil for its cooperation in the conduct of this II Inter-American Meeting on Foot-and-Mouth Disease and Zoonoses Control.

(Approved at the seventh plenary session, 17 May 1969)

Resolution XV

Place of the Next Meeting

THE II INTER-AMERICAN MEETING,

Considering the importance of animal health in the production of foodstuffs for mankind and for the economic development of the countries of the Americas; and

Bearing in mind that Resolution XIX⁴ of the XVII Meeting of the Directing Council of the Pan American Health Organization (Port-of-Spain, Trinidad and Tobago, 2-12 October 1967) authorized the Director of the Pan American Sanitary Bureau to convene annually a meeting of representatives of the ministries of agriculture to review the program of the Pan American Foot-and-Mouth Disease Center and to discuss matters of mutual interest,

RESOLVES:

1. To express its satisfaction with the interest shown by the Governments of the Americas in the present meeting, and with the valuable information supplied and the presentations made by the technical groups.

2. To emphasize the importance of providing the Governments with an opportunity, at regular intervals, to exchange ideas and experiences in the field

⁴ Official Document PAHO 82, 74-76.

of animal health with a view to improving the health and the development of their countries.

3. To thank the Government of Argentina for its kind invitation to hold the next meeting in its country, and to recommend to the Director of the Pan American Sanitary Bureau that he convene the next Inter-American Meeting on Foot-and-Mouth Disease and Zoonoses Control in the city of Buenos Aires, Argentina, in 1970.

4. To thank the Director of the Bureau and his staff for their assistance in the organization and conduct of this meeting.

(Approved at the seventh plenary session, 17 May 1969)

SPECIAL RECOMMENDATION

THE II INTER-AMERICAN MEETING,

Whereas, because of the enormous importance of the livestock industry both for promoting the countries' economic development and for increasing the supply of animal protein to the population, it is necessary to study all diseases affecting livestock, not only those which are dangerous because they can be transmitted to man but also those that reduce, or help to reduce, the production of the herds;

Whereas each country must be left free to decide on its priority needs, so that in accordance with the specific need to control zoonoses, epizootics, or pests, the country may adopt periodic or permanent measures to promote the improvement of livestock production, in both quality and quantity;

Whereas it is recognized that our countries cannot undertake such programs individually and by themselves, in part because they lack technical personnel and also because they lack funds, which is why the assistance and support of other countries is necessary; and

Whereas at the I Inter-American Meeting on Foot-and-Mouth Disease and Zoonoses Control (Washington, D.C., 1968) the technical adviser to the Guatemalan Delegation, Dr. Jorge H. Corletto, proposed that the myiasis control program be re-established in Guatemala, especially the control of *Cochliomyia hominivorax* and *Dermatobia hominis*, and pointed out that for this purpose it would be necessary to provide it with material produced in laboratories in Honduras or Mexico as well as equipment and technical assistance; and that Guatemala would provide a laboratory, professional personnel, and subprofessional technicians, and would finance a short visit by a professional health worker to observe the work of laboratories and control areas in the above-mentioned countries,

THEREFORE:

Requests that there be recorded in the Final Report of the present meeting that Guatemala again recommends:

a. That, in addition to Guatemala, other countries and areas especially in Central America be surveyed to determine the losses which each country sustains as a result of such diseases.

b. That model control programs be drawn up so as to establish minimum requirements in personnel, equipment and material, and costs per unit of

measure (after it has been established), which documents could be prepared by the Pan American Sanitary Bureau on the basis of the information supplied to its technical personnel by the countries that already have such programs.

c. That the minimum of aid (technical advisory services, equipment and material, etc.) which can be supplied to countries that need it be established, in accordance with a planned program.

(Approved at the seventh plenary session, 17 May 1969)

PART I
PLANNING AND ADMINISTRATION OF PROGRAMS

PLANNING IN ANIMAL HEALTH

DR. OTONIEL VELASCO *

During the last five or six years, planning has been adopted as a governmental system in Latin America and has proved relatively successful in some countries, although it has had no major impact on decision-making in others. But in almost every case it is recognized as an invaluable instrument of orderly administration and one that can be used to derive the maximum benefit from productive resources in short supply.

As a result of planning techniques, economic and development plans have emerged which, while not fully implemented in most cases, have helped to enhance and clarify the analysis of our economies. This analysis, depending on its acceptance, has served to identify the main symptoms of the economic and social malady called underdevelopment.

The methods used in analyzing and formulating these plans have been developed and continuously improved by social scientists working in the Economic Commission for Latin America (ECLA) and in the Latin American Institute for Economic and Social Planning and supplemented by the experience of many countries of the Region. By applying these methods it is possible to identify and follow the behavior of the major meaningful economic variables. At the same time, and with varying degrees of mutual consistency, methodologies are being used in Latin America for the plan-

ning of certain specific economic sectors, such as health and education. The health planning method lays stress on the analysis of the situation at the local level and the behavior of a given establishment (i.e., the hospital) as the basic unit providing services. In other words, it adopts the micro-economic rather than the macro-economic approach customarily used in general planning.

Analysis of the farm sector has focused attention on the unsatisfactory system of land tenure predominating in the Region and the need to initiate, *inter alia*, over-all land reform in order to modernize the rural environment. For this purpose, in addition to a more or less radical transformation of the land tenure system, the plans have advocated the rechannelling of credit so as to extend its coverage for the benefit of the majority of agricultural workers and not just a small minority, as well as the re-directing of crop and livestock promotion activities, sacrificing depth in favor of broader coverage, and finally, the concentration of action in certain priority or strategic programs or crops.

An animal husbandry program has emerged in almost all the countries, but in very few cases has attention been given to what has to be done in the matter of animal health under the program. Even less has been done to formulate an animal health program as a component of the agricultural plan.

* Coordinator of Short-Term Plans, National Planning Institute, Lima, Peru.

The main reason for this omission is, in my opinion, the fact that the veterinarian plays only a limited role in the top-level administration, especially in planning activities. This limited role has had a restrictive effect on the systematic analysis of the problems of animal health, of its links with other aspects of animal husbandry, and of its relationship with economic and social development as a whole.

In view of the importance of animal husbandry in Latin America, the serious damage caused by animal diseases, the acute shortage in the Latin American's diet of proteins of high biological value, and the pressing need to settle the vast Amazon region, where we are encountering unusual animal health problems requiring intensive research, we consider it urgently necessary to encourage an approach that is better suited to the problem of animal health.

First, we must have more reliable data on the characteristics of the problems that concern us: the cattle population of the Continent, by species, herd size, situation, etc. For this purpose census legislation should make it mandatory to collect data on cattle herds and to take systematic samples.

Once the main characteristics of the cattle population have been determined, it is necessary to ascertain which diseases affect them most, by establishing mortality and/or morbidity rates, so as to be able to set a sufficiently clear order of priority for diseases.

It is also essential to establish the quantity and quality of the human resources available for controlling and/or eradicating diseases in domestic animals. The number, geographic situation, specialties, etc., of the veterinarians and auxiliary personnel are important in this connection. Replies must also be sought to questions such as the following. Does a larger number of veteri-

narians result in better animal health? What is the optimum number of veterinarians for a given cattle population? Is it true that at present veterinarians devote more attention to the diseases of dogs and cats than to those of cattle? What is the reason for this trend? Are the curricula in Latin America's veterinary schools relevant to the problems of the Region or are they mere adaptations of European and United States experiences?

It is very important to answer these questions, because they can suggest lines of policy which will enable maximum yields to be obtained from the human resources employed in these essential services, and may even induce us to change some of our very deep-rooted ideas about the training of veterinarians and auxiliary personnel.

The capital and financial resources which each country allocates to animal health should also be determined. Capital resources mean laboratories, research centers, educational buildings, etc., with their appropriate equipment. Financial resources mean those used to finance these establishments, including staff costs. In other words, expenditures defrayed by the country should be quantified, broken down into the contribution of the public sector and that of the private sector.

Obviously most of the national expenditure on animal health is borne by the State, but private expenditures must not be disregarded, especially what is spent on veterinary vaccines and drugs. As for these private sources, a detailed study should be made of the structure of their costs and sales prices, and we may possibly find, as in the case of drugs for medical use, that the standard of packaging, enclosed literature, and sales promotion is much more advanced than ours and that more realistic regulations should be introduced to make these products

available at lower cost to the cattleman while allowing the producers a fair profit.

A study of this kind will reveal what are called "strategic inputs," i.e., those components of a product or service the absence or scarcity of which impedes the production of the product or service. Drugs and vaccines for veterinary use are included in this category.

Another aspect to be considered is the study and evaluation of the legislation on animal health and the organizational structures for combatting epizootics. The legislation now in force seems out of date and inconsistent.

After the aspects mentioned above have been ascertained, we can diagnose the situation on which "forecasting" will be based, i.e., projecting passively into the future the trends observed in the past and proposing solutions for changing the anticipated course of events.

The proposing of solutions, properly itemized and quantified in respect of costs and targets, is called "programming." The targets set must be expressed in terms of time and space.

Next comes the stage of implementing the program, which is generally the responsibility of an administrative unit different from the one that carried out the previous stage. It is advisable, however, that the executive personnel participate in the phases preceding implementation so that they are familiar with the program and consider it their own.

Equal in importance to programming is the evaluation of results, i.e., checking the targets set against those actually met, and the rational explanation of the discrepancies between them. The evaluators should preferably not be connected with the planning and implementation units.

These ideas, which provide an outline of the planning method used in various

economic activities, imply that suitable personnel for putting plans into effect are available. In that regard, it is necessary that the following measures be adopted simultaneously:

a. A study should be made of the advisability of including, in the final year of professional training, a course on economic development to enable the future veterinarian to analyze the economic, social, and political context in which he will have to develop and which will also show him the part which he, as a member of his country's intellectual elite, must play in effecting social change. In other words, the veterinarian, like any other university graduate, should be not merely someone who applies modern technology to animal health but also someone who transmits the ideas which bring about the structural changes needed to overcome underdevelopment.

b. Veterinarians should be encouraged to participate more actively in the national courses on economic development organized by various countries for their civil servants, and in courses at the international level, such as those given by the Latin American Institute for Economic and Social Planning in Santiago, Chile.

The effective settlement of the Amazon region constitutes a real challenge for the present generation of Latin Americans. Veterinary medicine must be in the forefront in this enterprise, solving the complex problems of animal health in a humid tropical climate. The possibility of establishing animal husbandry as a fundamental economic activity in this conquest will put our talent and zeal to the test. Hence, research into the tropical diseases of cattle is a priority area in the field of animal health.

Lastly, I think it necessary to point out that animal health is an excellent field for the practical application of the philosophy and principles of Latin American integration. The efforts being made to combat foot-and-mouth disease should constitute the basis for more ambitious projects which

will lead, in the near future, to the organization of the campaign against other animal diseases, to the coordination of education, and to more frequent exchanges of experiences in the field of animal health. We will

thus be pointing the way to our children, and the goods and services which they produce may move freely over the entire length and breadth of their great country—Latin America.

INTERNATIONAL CREDIT AND ITS IMPORTANCE IN THE CAMPAIGN AGAINST ANIMAL DISEASES

MR. JOSÉ IRINEU CABRAL *

Just one year ago, when the I Inter-American Meeting on Foot-and-Mouth Disease and Zoonoses Control was held in Washington, D.C., the Inter-American Development Bank joined with the Ministers of Agriculture, the national directors of livestock and animal health agencies, and other experts in a common search for the best solutions and most direct action in the campaign against livestock diseases.

I now have the honor of expressing to the Pan American Sanitary Bureau, to the Ministers and other high authorities, in the name of Mr. Felipe Herrera, President of the IDB, the Bank's gratitude for this new opportunity to learn of the progress made and the concern of the Member Countries about these important matters, and above all to better understand how the Bank can more effectively support the efforts to achieve a more prosperous livestock industry that will lead to improvement of our national diets and strengthen the economy of our countries. Meetings such as this bring us into closer touch with the day-to-day situation and afford us insight into the urgent problems confronting each sector.

Also, on behalf of the Bank, I should like to convey our appreciation for the hospitality and facilities offered to us by the Brazilian people and Government, whose

concern for the progress of the livestock industry is a matter of record.

The Inter-American Development Bank and Agriculture

The need for more rapid development of the agricultural sector has long been recognized as essential to the progress of Latin America. Following its establishment, one of the first tasks undertaken by the IDB was to promote agriculture, extend financing in this field, and study its complex factors with a view to developing an agricultural policy consistent with today's pressing requirements.

It was undoubtedly with deserved satisfaction that President Herrera was able to state at the recent Meeting of the Board of Governors held in April in Guatemala City, that "the Bank is maintaining its leading role as the major external financing agency for Latin American agriculture."

Agriculture does in fact account for 22.6 per cent of all financing granted by the Bank, followed by industry with 19.4 per cent. Up to 30 April 1969, 110 agricultural loans totalling US\$720 million had been granted, with a total program cost exceeding \$2 billion. These credits have benefited more than five million persons, have brought under production or improved over two million hectares of land, and are helping small and medium-scale farmers to a better

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life through 600,000 individual credits extended under the Bank's over-all agricultural loans.

The IDB has consistently endeavored to further its contribution to agricultural development and, in addition to the now standard credit and land-settlement projects, has promoted other more complex and complete operations such as industrialization, marketing, and the modernization of agriculture as a genuine and positive means of expanding productivity through technological improvement. To these will be added our forestry and fishing development projects.

Livestock Development Activities

The countries' considerable interest and activity in livestock development has received Bank support; this is expected to expand considerably in the future. The IDB's contribution to date can be considered very substantial, since it has granted 11 direct loans for livestock financing totaling \$64 million. Under 12 agricultural development loans, special livestock allocations were made for an aggregate of \$27 million.

Finally, in other loans for agricultural development in general, the livestock component is estimated at an additional \$20 million. Consequently, the Bank's total contribution to livestock development financing amounts to \$111 million, not including the loans for control of foot-and-mouth disease to which I shall refer later. The aim of these operations is to promote existing livestock development activities, but we are also undertaking other equally important actions to ensure such development. For instance, the Bank conducts studies designed to provide greater incentives to stock-raisers without neglecting to consider the types of livestock best suited to the various regions of Latin America; it

also explores facilities and opportunities in the domestic and foreign market. The Bank's policy in this area is guided by national experience, close coordination with other international agencies, and multinational and integration efforts.

Animal Health Programs

For the first time, in collaboration with the Pan American Sanitary Bureau, loans were granted last year for programs to prevent and control foot-and-mouth disease in Chile and Paraguay for a total of \$5 million. This year a \$10.5 million loan was granted to the Republic of Argentina for the same purpose, bringing the total to \$15.5 million for campaigns against foot-and-mouth disease. Similar projects are in preparation in Brazil, Bolivia, Ecuador, and Peru.

Colombia is interested in a project that will enable it to expand to the national level its current campaign against foot-and-mouth disease. We have also learned of an interesting campaign in Uruguay, to which the Bank has offered financial support for supplementation or expansion purposes and for other aspects of animal health. Venezuela is considering the preparation of a health project which would include the present drive to eliminate foot-and-mouth disease, duly coordinated with related efforts in neighboring countries.

It seems superfluous to mention here the exceptional role of the livestock industry in the agricultural process, since all of those present are making an invaluable contribution to its development. In any case, I would like to say that the IDB has already outlined a policy for promotion and financial support and expects in the future, through its loans for foot-and-mouth disease campaigns in our countries, not only to reduce losses from this disease but to

make its elimination possible. We are aware, however, that there are other diseases which, like foot-and-mouth disease, cause very heavy losses, and the necessary financial support will be extended to programs set up by the Member Countries to control brucellosis, bovine paralytic rabies, and other diseases.

*Inter-American Development Bank
Strategy in the Campaign against
Foot-and-Mouth Disease*

This entire action is a continuation of the policy outlined by the Bank after careful study and consideration based on the interests and needs of the countries and of Latin America as a whole. If integration seems necessary in various aspects, it is absolutely essential in others, such as disease control, which must be undertaken jointly so that it may not result in wasted effort.

In no area do we appear to be more interdependent than in diseases and their control. We have therefore sought a multinational approach to the control of foot-and-mouth disease and the inclusion within our program of all facets of animal health.

The campaigns to which the Bank is contributing funds share certain characteristics that should be mentioned at this point since they are essential to success. These requirements are:

1. Adequate capacity of the executing agency in terms of both administrative and technical personnel.

2. Intensive participation in the campaigns by stock-raisers and the rural population, including within national foot-and-mouth disease programs plans for health extension and education to assure their cooperation.

3. Cooperation of local authorities.

4. Control of the type and quality of vaccines, through regional laboratories.

5. Border control and enforcement of sanitary measures for livestock exportation and importation.

6. Legal and financial bases for rapid and effective action.

7. Stated goal of 100 per cent inoculation of livestock herds.

8. Inclusion in the contracts of loans granted to the countries for their campaigns of the provisions necessary to ensure continuation of the drive until control and eventual elimination of the disease have been achieved.

9. Regional approach and coordination with similar programs in the Hemisphere.

10. Periodic evaluation of results.

International Financing for Disease Control

International collaboration appears to be a factor of great effectiveness and assistance in animal health programs. Up to a certain point, it can serve as a catalyst in promoting interest, coordinating action, and establishing goals and general common provisions. It can also support and strengthen national institutions responsible for animal health by providing the systematic and multinational approach to the campaigns and thus ensuring their continuity through timely provision of funds. Still other advantages are the exchange of information, experience, and modern technology utilizing the best sources available.

We also believe that international collaboration facilitates and amplifies the work that can be performed by such agencies as the Pan American Foot-and-Mouth Disease Center, which is extremely valuable since its experts are able to ascertain the degree of progress made and the proper time for action. Furthermore, by setting up certain common objectives, it will be possible to identify generally applicable standards and methods of work and evaluation providing a guarantee for the countries

with regard to the execution, caliber, and continuity of the campaigns.

The foregoing considerations form, in essence, the basis for our multinational approach to the protection of animal health and reaffirm our collective action.

The IDB has shared the countries' concern in these matters and has sought to organize a common effort. On this occasion, the achievement and progress attained in such a brief period by the countries are a source of profound satisfaction to the Bank

and it awaits with interest the projects now in preparation, which will be assigned the highest priority for consideration and study.

In again expressing our pleasure and appreciation at this meeting, allow me to reiterate the Bank's confidence in the effort and resolution of its Member Countries and of PAHO, whose collaboration will make it possible for us to attain our stated goal of accelerating the development of this Hemisphere.

ADMINISTRATIVE FACTORS AFFECTING THE ORGANIZATION AND CONDUCT OF HEALTH CAMPAIGNS

DR. YECID ALIAGA *

For the purpose of this paper we shall first state in general terms that we conceive a campaign to be the organizing and carrying into effect of technical and administrative measures designed to accomplish a specific objective, limited in time and space. This presupposes a program that has been clearly defined and can be implemented in a specified time period with previously established goals and methodology that would ensure the achievement of its aims.

Thus in the health sector the various measures taken to combat certain communicable diseases such as yellow fever, smallpox, and others are known as campaigns. Such activities are not peculiar to this sector, as similar programs are conducted in most other sectors in which the Government is active (education, crop farming, and stock-raising).

This paper does not seek to go deeply into the theoretical aspects of administration and to examine its role as a social science made up of principles, techniques, and practices whose application to social groups forms the basis for formulating rational systems of cooperative effort to achieve common purposes that could not be achieved individually. Rather it represents a series of general observations based on practical experience in the handling of ad-

ministrative problems arising in the conduct of campaigns against certain communicable diseases, more particularly, in the conduct of malaria eradication campaigns.

Relative Progress Made by Technology and by Public Administration

The first factor to consider is the imbalance in practically all our countries between the progress made by technology and that achieved in the field of public administration.

In 1960, Dr. Abraham Horwitz, Director of the Pan American Sanitary Bureau, in a speech before the Seminar on the Organization and Administration of Public Health Services at the Advanced School of Public Administration of Central America, drew attention to this imbalance and stated: "It has become essential to deal with the problem of improving administrative structures, methods, and procedures so as to benefit the greatest number of persons in the health services and to restore a proper balance between the biological sciences and the social sciences of administration."

Subsequently little real progress has been achieved in practice in the field of public administration, which continues to remain largely unaffected by the dynamic advances in science and technology in other sectors of public and private activity.

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It is no exaggeration to say that in the majority of our countries, to a greater or lesser degree, public administration suffers from a marked failure to adopt and apply modern administrative principles and methods that could effectively and capably resolve the complex problems faced by Governments in their efforts to produce the goods and services needed to meet the growing demands of society.

This imbalance has unfavorable repercussions on the efficiency of governmental programs and is largely responsible for the public outcry for administrative reform. It is clear that this growing concern has found expression in calls for reform but it is no less certain that these have been less than wholehearted. They have not been acted on and, if they have, have not amounted to more than structural changes such as streamlining of ministries and relocation of departments, divisions, and units, the methods and practices of the past remaining unaltered.

In this connection the following quotation from a paper presented in 1964 by Dr. Helio Beltrán, the present Brazilian Minister of Planning, to the Special Commission on Studies of Administrative Reform is pertinent: "The administrative structure is not the cause but is in fact the result; the result of a misconception of the role of the State and of how this should be discharged; the outcome of the inbred vice of overcentralization of executive authority; the consequence of a maze of excessively detailed legislation made up of regulations that effectively preserve outdated administrative procedures; the end product of a consistently authoritarian and centralizing regulatory system subordinating the solution of everyday administrative problems to the formal decision of higher authority."

Special or Exceptional Forms of Approach

This situation leads to the consideration of a second aspect. In face of the inertia of the bureaucratic structure, how will it be possible to conduct campaigns that by their very nature call for flexible procedures and uncomplicated administrative practices to enable them to accomplish their objectives?

It cannot be denied that the process of administrative reform over a wide front is a slow one and that it also calls for a change in attitude on the part of the bureaucracy, and this rules out any possibility of early success. Does this then mean that the obstacles to the effective conduct of campaigns are insuperable until this new approach has been adopted?

The facts show that it is possible to conduct campaigns by adopting certain procedures that can be defined as special or exceptional, and by employing machinery based on the decentralization of action and the effective delegation of authority, especially in the fundamental areas of personnel administration and budgetary implementation.

It should be remembered that the principles of administration are general in character and apply to the entire governmental structure, and that it is not possible to formulate specific principles applying solely to given enterprises or activities that are intrinsically different. On the other hand administrative practices and procedures, within the framework of the general principles of administration, can be adapted, to a greater or lesser degree, to facilitate the accomplishment of specific tasks and give flexibility to particular operations. It is by this means, rather than by any methodological approach, that it has been possible, even within a formal and rigid structure, to conduct and carry out campaigns with an acceptable measure of practical effectiveness.

When we refer to special or exceptional methods, it is of these very practices and procedures that we are thinking rather than of general administrative principles that form part of the legal structure governing all the activities of the State. It is more especially the mechanisms of the administrative auxiliary and support services that can be largely rationalized and made more effective.

Given the manifold and progressively more complex activities of the State, it is impossible to provide separate forms of personnel, financial, and control administration corresponding to each of these activities. It is both possible and necessary to formulate specific legal principles governing the employment of technical methods in the conduct of a malaria eradication campaign as opposed, for instance, to a smallpox campaign, but it is not feasible to provide for a separate administration for each, since the governing principles apply generally to the majority of the sectors in which the State is active.

Autonomy as a Solution to the Problem

This is a further general aspect of the problem that should be considered. Because of the slowness, traditionalism, rigidity, and centralization of public administration, the principle of autonomy as a short-term remedy has been welcomed. It is therefore recommended that the administration of a campaign or of any other State activity should be in the hands of an autonomous and separate service, so as to ensure its efficient operation and the accomplishment of its objectives.

Aside from the fact that it is inappropriate to apply the term "autonomy" to the public services of the State—the agencies in question being more properly defined as semiautonomous bodies, separately administered, and with varying degrees of inde-

pendence—would it be possible to adopt such a system generally and accept it as the one best suited to the production of those goods and services for which the State is responsible? Would the proliferation of agencies of this kind, in the context of all the various activities and obligations of a Government, be the mark of good public administration?

If we look at the problem solely in terms of organized activities or campaigns, we can readily come to the conclusion that autonomy provides the answer. On the other hand, in the context of an integrated series of programs and services discharging the social responsibilities of the State and meeting community needs with the resources available, we realize the magnitude of the problem and the inadequacy of the principle of autonomy.

Within the constitutional framework the executive branch of a Government is responsible for the administration of public activities through its political-administrative structure, a mandate that it cannot readily discharge by the mere distribution and surveillance of public funds, all the more so when the scope of the State's activities is progressively expanding.

The multiplicity of more or less independent agencies gives rise to problems of integration, overlap, and dispersal of human, material, and financial resources, which are prejudicial to sound administration.

More particularly in the developing countries, the State must assume a decisive role in the direction of economic and social development, as part of a process of planning that calls for integrated public agencies and uniform administrative systems, dynamic in character and capable of giving form and effect to proposals for better utilization of resources that are almost invariably unequal to the needs.

It is therefore apparent that in practice it becomes increasingly difficult to justify the formation of independent and disconnected agencies within the framework of effectively organized State policies, strategies, and administration.

It is therefore more feasible and practical to adopt a principle of centralized decision-making and executive decentralization and to think in terms of machinery designed to secure effective distribution of constitutional authority, replacing the principle of autonomy by a workable system of executive decentralization and a rational delegation of authority. This will retain central control over the decision-making activities of a Government, essential to the discharge of its responsibilities for policy-making, planning, coordination, integration, and control.

This is tantamount to saying that, within the governmental administrative structure, the delegation of authority should be used as a means for securing administrative decentralization and ensuring greater flexibility, rapidity, and objectivity in carrying out measures and decisions, relating these closely to the known facts, to the services to be provided, or to the volume of goods to be produced.

This approach, more than any based on the practical efficiency of the administrative structure, has made it possible to conduct a large number of campaigns, even within the framework of an underdeveloped public administration.

Principles Governing Campaign Administration

In the light of the principles we have been examining, we shall proceed to indicate certain requirements that are essential to an effective general administrative structure and to the efficient discharge of administra-

tive services as tools for implementing programs of this kind.

It should be remembered at this stage that administration is not an end in itself but a means, undoubtedly a very important one, for the implementation of any measure—in the present instance, a campaign.

1. A campaign should be the responsibility of the interested governmental sector. It should therefore be consistent with sectoral policies and plans as well as with the general plan for economic and social development.

2. Both a general plan and an operational plan must be formulated and integrated in the sense that they should include not only the principal actions and the objectives envisaged in technical terms but also the administrative services that are the instruments of such action and furnish the necessary support. If the structure and organization of the support services are not included in those plans, serious problems will later emerge when technical activities are being carried out.

3. Pertinent legal instruments must be adopted, embodying a rational delegation of authority allowing the discharge of administrative responsibilities, including that of decision-making, in the appropriate areas of jurisdiction and at the appropriate levels of authority.

4. There must be a clear definition of the lines of authority and of the channels of coordination and of communication of the higher administrative authorities at sectoral and national levels, in order to remove any obstacles that might interfere with the normal conduct of the campaign.

5. Procedural mechanisms should provide for the adequate and timely supply of financial resources. The budget should be administered with a certain degree of flexibility, especially with respect to the alloca-

tion of funds and their transfer between various budget heads.

6. Internal structure and organization must be compatible with the nature, scope, duration, and magnitude of the program to be carried out.

7. It is necessary to define internal lines of authority and channels of communication, distribution of activities, levels of responsibility, and the desired degree of decentralization or delegation in the light of the structural organization adopted.

8. A flexible system should be introduced for the expeditious handling of administrative services (personnel, supplies, communications, transportation, accounts), such services being regulated through the issue of simple procedural manuals or sets of instructions.

Internal administrative procedures should be established to cover temporary field personnel (recruitment, selection, appointment, contracts, rotation, training, and termination of services), who generally, at the wage-earning levels, are not subject to the statutory provisions governing regular public servants.

To the extent consistent with the provisions of the Civil Service Act, the public service statute, or the various labor laws, simple and practicable procedures should be drawn up for handling all levels of personnel.

It should be understood here that it is not intended to introduce legal provisions that differ from or replace those laid down by the central Government and that therefore apply to all officials in the public service. What are needed are supplementary procedures of a clear and straightforward character, within the framework of these legal provisions, for the management and movement of campaign personnel, adapting their duties and obligations to operational requirements.

9. Facilities should be established for the programming, direction, and implementation of staff training activities, especially those relating to field personnel.

10. The method and means should be established for integrating the campaign either progressively, partially, or in its entirety with the regular services of the corresponding sector, to ensure continuity and the adoption of permanent surveillance and maintenance measures.

Structure and Internal Organization of Campaigns

Following the general line of argument developed in the preceding section, we shall consider those bodies that are regarded as essential to the infrastructure of a campaign and to its operation, relationships, and *modus operandi*, factors that together constitute its organization.

It should be borne in mind that the present section relates to those structural and organizational components that are generic to most campaigns. However, because of the diversity of the activities, the wide range of local conditions, the variations in scope and coverage and in resources available, and a whole series of other factors, such campaigns do not lend themselves to any pattern of organization that can be applied consistently to each and every one of them.

The aim is rather to prepare a guide which can serve as a working document and whose value will lie in its presentation of data essential to the planning and organization of a campaign; due weight should be given to the variables that must necessarily arise in implementing legal requirements, the principles and procedures of administrative efficiency that apply to the effective implementation of a program, and the achievement of the target set.

In most instances campaigns have to solve urgent problems—a function that is quite distinct from the day-to-day work of ministries. It is clear that, unless they possess an effective structure and a proper organizational basis and operate more rapidly than do the routine programs, it will be very difficult for them to reach their targets within the time limits set.

Their structure and organization should enable them to obtain the maximum yield and most rational deployment of effort so that they can use to the fullest possible extent the available resources, whether human, financial, or material. Their administration must, in short, be dynamic.

1. Internal Structure

a. The campaign should be administered by a specific unit, body, or bureau of the responsible ministry, division, or department in the governmental structure.

b. It should possess a central unit, which may be a department, division, superintendency, or other equivalent body. It should correspond to the general staff in the military hierarchy.

c. This central unit should preferably have two closely linked sections directly responsible to a single chief, one charged with the direction of substantive or technical functions and the other with auxiliary functions, i.e., administrative and general services. As a variant to this structure a single section should be organized under the name of field operations. In this instance the administrative services will be responsible to the section chief, possibly without the title of section, but performing identical functions.

d. These sections may be subdivided under a single chief into subsections, according to the needs imposed by an effective division of labor, in the light of the scale

of the responsibilities they are expected to discharge and consistent with the volume of campaign work to be done.

e. If the campaign is on a national scale and covers an extensive geographic region, an intermediate level can be established on the basis of a rational decentralization or delegation of functions; such an intermediate level will generally consist of a variable number of units described as regions, or zones, or sectors. In small local campaigns such an intermediate level is not justified and serves no useful purpose.

f. Lastly the operational units, primarily executive in character, vary in number and are generally known as districts, brigades, nuclei, or simply as operational units.

2. Internal Organization

Before any administrative structure is brought into service, it must be provided with an effective organizational basis. The following general principles have an important bearing on this:

a. Adoption of a system in which the decision-making and directing functions are centralized and the operational and executive structure is decentralized. The policy-making, decision-making, and directing functions are the responsibility of the central unit and will be discharged in terms of the basic processes of planning, programming, organization, direction, command, coordination, supervision, and inspection. The central unit will have to lay down the principles to be followed, determine the methods to be employed, and devise the administrative procedures to be adopted.

b. Under such a system the central unit, by delegation of authority, will authorize the intermediate level to perform the functions of direction, command, coordination, supervision, and control of the operational units for which it is responsible, within the

framework of the policies, plans, and principles established by the central units.

c. It will be the duty of the operational units to carry out essential operations and produce goods and services within the framework of the regulations and directives issued by the central unit and, wherever this exists, by the supervisory intermediate level.

d. The central unit will have its own chief, responsible for the direction, administration, and conduct of the campaign. This gives expression to the principle of unity of command and establishes a decision-making authority, limited by the framework of his sphere of responsibility.

It will be evident that such diverse and wide-ranging functions cannot be performed by a single person, a fact that is all the more true in the case of major and complex programs (excessive centralization fatally hampers the conduct of operations and precludes dynamic action). It is in overcoming this difficulty that recourse is had to the most effective means of decentralization: the delegation of authority. By this means, without loss of authority or the grant of autonomy, the exercise of decision-making powers and the discharge of technical and administrative functions is transferred to those in charge who can thus act with a certain measure of independence within limits.

e. In the internal organization it will be desirable to form a group or committee of senior campaign officials to advise the chief of the central unit on major problems and their solutions.

f. It is essential to have clear-cut definitions of duties, obligations, responsibilities, and of lines of authority and communication, both for officials of the central unit and for directing staff at the intermediate level and in the operational units. Authority should be expressly delegated and the extent of such a delegation and the limits set

on it should be specifically defined in both technical and administrative fields.

g. The central unit should have all the personnel required for the discharge of administrative functions. In a decentralized system such staff will perform a dual role and will discharge certain limited executive functions for the central unit itself as well as regulatory informational and general supervisory functions for the intermediate level and for the operational units.

h. These functions will include planning, budget, accounts, statistics, personnel, supplies, transportation, communications, and archives, the organization of such functions depending on the scale and nature of the campaign. The model system is therefore not practicable. What is essential in each instance is to determine the most feasible and economical means for the discharge of these functions, through either specific or combined units, distributing them according to the type, volume, and scope of the tasks to be undertaken. For instance those in charge of planning, statistics, and the budget will be directly responsible to the campaign chief and those performing such auxiliary administrative functions as supply, transportation, accounts, and communications to the head of the administrative section, who in turn will be directly responsible to the campaign chief, director, or superintendent.

i. The same criteria should apply to the organization at the intermediate level, which must be provided with the personnel needed both for performance of its technical functions and to discharge auxiliary administrative services that will facilitate the work of the operational units. These administrative services should be provided with a head who is directly responsible to the intermediate level chief and will relieve the latter of the work that would otherwise be involved in undertaking routine administrative tasks.

j. It is evident that the operational units must be properly organized and distributed in order to discharge the major tasks in the operational plan. At the same time, the importance of auxiliary administrative functions should not be overlooked (i.e., payment of salaries and per diem, supplies of equipment and materials, minor expenditures, etc.), as the timely performance of these has a decisive bearing on the maintenance of adequate work standards. Auxiliary administrative services will have to be organized at all levels and not only in the central unit. They will need to be decentralized in parallel with the decentralized technical functions as part of the same approach of centralized decision-making and decentralized executive action.

k. We shall now examine three fundamental prerequisites of this system: (1) adequate provision of funds, (2) rapid assignment of personnel, and (3) timely supplies of equipment and materials.

- As to financial administration, the central unit, which is responsible for budget implementation and expenditure control, must formulate and adopt a program of regular appropriations to the intermediate level and to the operational units. It must also regulate procedures for the documentation of expenditure and the rendering of accounts. One of the methods that has shown the best results in practice is the revolving fund.

Under the same procedure, the intermediate level must handle the provision of funds for the operational units: the actual remittance of such funds to these units can, of course, be undertaken by the central unit itself, the intermediate level being informed of the action taken. The operational units, in addition to their regular appropriations, should be provided with a small "petty cash" account for dealing with emergencies and urgent needs that cannot always be readily foreseen. Handling of this account and its replenishment should be clearly and specifically regulated.

- In the personnel field, staff records must be maintained at all levels covering: periods of employment, leave, vacations, transfers, short-

comings, recruitment and discharge, staff and payroll lists, allowances and per diem, private and commercial transport facilities available to staff, distribution of responsibility for the allocation of jobs and assignments to workers, changes and discharges, and disciplinary action taken.

- The central unit should draw up and implement a plan for the provision of materials and equipment, subject to periodic review in the light of requirements. It should assume responsibility for imports of equipment and materials that cannot be obtained by local purchase, and for centralized bulk purchases for distribution. It should regulate the control of stores, their maintenance, minimum stocks, and replenishment plans. It should have a central storehouse for the receipt, temporary storage, and distribution of imported and purchased equipment and materials, whenever delivery cannot be arranged directly between supplier and consumer.

The intermediate level should also possess storage facilities for equipment and materials received and purchased and should perform a similar function to that of the central storehouse in the provision and replenishment of the operational units.

The operational units should be provided with mobile supply posts to meet immediate requirements. Orders for replenishment of stores should be placed systematically, before supplies actually run out, so as to allow sufficient time for supply agencies to complete the formalities of purchase, dispatch, and transportation. Minimum stocks of each item to be held at the supply posts should be determined so as to ensure availability of necessary quantities throughout the operational period.

- A similar approach should be adopted to the organization of other administrative services and to the multiplicity of tasks associated with the conduct of technical operations. In transportation, for instance, if the plan provides for the organization of a fleet of vehicles it will be necessary to provide, according to the number of these, workshops for preventive maintenance, spare parts and repairs at the intermediate level, and mobile facilities for mechanical inspection, adjustments, and minor repairs in the operational units. In many cases where commercial facilities already exist, it will be more economical and practicable to make use of private services on a contract basis.

3. Procedures

This paper has repeatedly referred to administrative procedures, on the understanding that they constitute the nervous system of an operation and provide the machinery for meaningful and coordinated action and cooperative effort.

To know how to do things is as important as knowing what has to be done and for what purpose. In the conduct of programs, and in particular in handling the succession of administrative measures and counter-measures, the failure to understand procedural mechanisms leads to errors and delays that hinder the flow of business, proliferate paperwork, and are a cause of false moves.

Just as manuals of procedure are prepared for technical functions, we believe it essential to prepare, introduce, and regularly update simple and clearly worded manuals of administrative procedures for the use of administrative and auxiliary personnel at all levels.

It is evident that certain procedural mechanisms are generally laid down in legislation and in regulations, but is no less certain that these do not, or for that matter should not, contain a detailed account of

the sequence of routine functions that are often circumstantial in character and varied in nature. The object of the manual of procedures is, therefore, within the framework of the legal mechanisms, to define these details in a manner much more readily understandable by the officials responsible for work of this kind and one that can much more readily be amended.

Such manuals are also an effective means of rationalizing and simplifying many administrative functions and also of minimizing or dispensing with controls of a purely formal nature whose cost clearly exceeds the risk against which they ensure.

We know that the most laborious part of administration is to be found in the maze of time-consuming, confused, and outdated procedures. A manual containing clearly worded instructions on the conduct of auxiliary administrative services will do a great deal to reduce these defects.

The manual or set of instructions governing each administrative service should be in loose-leaf form so as to provide for the replacement or modification of instructions, thereby ensuring up-to-date guidance on all operational procedures.

PART II

**FOOT-AND-MOUTH DISEASE:
CONTROL AND PREVENTION**

PLANNING OF A FOOT-AND-MOUTH DISEASE CONTROL PROGRAM

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In preparing this paper we have taken as a basis the activities related to the foot-and-mouth disease control program in Paraguay, which was begun not long ago, even though the first steps in that direction were taken at a much earlier date. It is the experience gained in those preliminary steps, up to their culmination in the adoption of a national plan and the decision to implement it, that we shall attempt to describe here, in order to illustrate the stages leading to the successful implementation of a health program of this kind.

Assuming that in a country no systematic governmental efforts have been made to control foot-and-mouth disease, except the routine activities of the animal health services and sporadic vaccinations administered by the more progressive livestock owners, the planning of a foot-and-mouth disease control program to be carried out within a short period of time is divided into two well-defined phases: (1) preparatory phase, and (2) planning phase proper.

I. PREPARATORY PHASE

In this phase the various types of situations in the country which may have a decisive bearing on the following steps, what we might call preconditions, must be studied

in order to identify the obstacles that may arise and must be overcome lest they abort the plan. Furthermore, in this phase data for judging the feasibility of the program and establishing its main lines must be collected.

This essential information should include the following:

Position of Livestock Production in the Economy of the Country

The control of a livestock epizootic is of crucial importance when the livestock sector occupies a key position in the economy of a country either because of its contribution to the national income or because it is of importance in the export trade—as is the case of Paraguay, where livestock, primarily beef, which pre-empt a significant area of productive land, accounts for 11 per cent of the gross national product and represents 35 per cent of the country's total exports. In other situations, the fact that a country does not produce enough meat to supply its domestic needs and has to import it is also important. In these conditions the livestock resources available must be safeguarded and efforts made to achieve better yields, for which purpose health control is indispensable.

It is also advisable to evaluate the potential of the natural resources devoted to livestock production, because a situation in

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which those resources could be still more productive is very different from one in which they are being exploited to the maximum of their capacity.

Another very important consideration is the nutritional status of the country's population, for where there is a considerable deficit of proteins of animal origin in the national diet, meat production should be a high priority.

Degree of Development of Livestock Production

It is very important to evaluate the level achieved by livestock production in the light of representative indicators, since the implementation of a health control program, such as one against foot-and-mouth disease, will call for a series of elements to be available on the farms themselves and also will require a willingness on the part of livestock owners to cooperate in the program. The importance of this prior analysis must be emphasized, since often the people involved in any plan are disregarded, possibly because planners are somewhat perfectionist, allowing themselves to be completely taken up by what can be expressed quantitatively or graphically and neglecting social and human aspects which, even though not reducible to numerical terms, can be evaluated qualitatively on the basis of interviews, meetings, or simply through the knowledge and experience of persons closely connected with those sectors. Proper allowance should therefore be made for this aspect, at the same time as efforts are made to measure the level of development of livestock production, by means of indicators such as availability of facilities, efficiency of the business organization, business awareness, progressive outlook or persistence of antiquated beliefs, existence or absence of health practices, breeding of special stock or sub-

sistence of creole or mixed breeds without any selection, etc.

Our experience shows that livestock owners should participate in all aspects of the preparation of the program from the outset, by means of discussions of the objectives, strategy to be followed, possible sources of financing, especially if any kind of tax is to be levied on livestock production, etc. In this way, awareness is slowly generated in the leaders of livestock associations and they are made to feel an integral part of the administrative steps being taken to formulate the plan. At the same time the Government will have the benefit of the experience and opinions of the persons who will be taking part in the program, and quite possibly they will help in determining suitable criteria and methods that can be used in the environment in which the campaign is to take place.

Role and Level of Organization of State Health Services; Availability of Skilled Manpower

This aspect is so important that it should be examined in detail, since frequently the position of the animal health services in the governmental structure is not very high, in which case it is necessary to convince and demonstrate to the highest authorities the importance of the health control of animals. On the other hand, if these services are assigned a high category and have successfully undertaken major projects in the health field, it is much easier to obtain the necessary support of the authorities for the implementation of a foot-and-mouth disease or any other control program.

Another closely connected point is the availability of veterinarians in the country to undertake a vigorous control program, since only veterinarians can discharge specific veterinary functions. An accurate and realistic evaluation should therefore be

made of the number of veterinarians available, bearing in mind the activity in which each of them is engaged and whether or not they can assist in the campaign, as well as the number of veterinarians who will be graduated in the years to come. The level of specialization of those professional personnel and the cost of putting them under contract should also be borne in mind.

Coexistence of Other Programs of Benefit to the Sector

When a program is being drawn up, sufficient attention is often not given to other programs or policies aimed at the same sector which, though they deal with completely different fields, bear some relation to the new program and can be of decisive importance in some cases. Thus, for example, if the availability of adequate facilities for vaccination in livestock establishments is low, the foot-and-mouth disease control program must necessarily give thought to a mechanism or procedure for ensuring that livestock owners construct such facilities. If there is a credit policy by means of which cattle owners can obtain the funds they need at reasonable interest rates and repayment periods, these improvements will be quickly introduced and rapidly expanded. If, on the other hand, the owners cannot obtain financing for these fixed investments, pressure will be of no avail, since the argument that they have no money for building them cannot be defeated by coercive measures. If credit is available for these purposes, it may even be possible to coordinate the foot-and-mouth disease program with the credit program and to assign priority to those zones in which compulsory vaccination is to be introduced; at the same time livestock owners who are clients of financing institutions may be required to comply with the regulations of the foot-and-mouth disease program.

Other programs that may be of importance are those for the control or eradication of livestock diseases, programs for raising the technical level of animal husbandry, improvement of grazing lands, etc.

Priority to be Assigned to Animal Health Problems in National Development Strategy

Our countries have become fully aware of the need to accelerate national development so as to narrow the gap between them and the highly industrialized countries and to provide their peoples with the benefits of science and technology which in other countries are already available to the majority. They are also aware of the need to deal with the problems of development by means of a plan and, to substantiate this assertion, it is enough to mention that most of the countries represented here have comprehensive and sectoral plans in operation that serve as the framework for the activity of the Government and the private sector and, within it, a program for foot-and-mouth disease control would also have a place as a specific project.

In evaluating problems of livestock development it is necessary to ascertain the seriousness of the damage caused by livestock diseases and plagues and, in defining the strategy for the development of the sector, to assign health control a top priority. Otherwise the resources available for carrying out development programs—which are always limited or insufficient—will be assigned to higher priority programs with the result that a foot-and-mouth disease program would be relegated to a secondary level and receive no funds. Of equal importance is the priority this type of program receives in the matter of external financing. For some time external financial aid has been channeled through the Inter-American Committee on the Alliance for Progress

(CIAP), which makes country reviews each year and establishes priorities for external financing. This is the case, for example, of the foot-and-mouth disease control plan of Paraguay. Since the first studies were made by the Planning Office, emphasis has been put on the importance of the problem. The first estimate of the losses due to foot-and-mouth disease was made by that agency, and that was the starting point for creating an awareness in many people of the seriousness of the problem. Thus, in the two development plans prepared up to 1968, foot-and-mouth disease control was included among the priorities for livestock development; that position was accepted by the Government and was confirmed in the review made by CIAP. Thanks to these successive confirmations of priority and importance, the Paraguay plan was carefully examined by the Inter-American Development Bank, which has already completed its processing of its financial contribution and those funds are being used. A positive factor was clearly the interest and decision of the Government, which had already established an independent agency for implementing the plan, designated its authorities, and established the domestic funds which the country would contribute to it and which would also constitute the necessary counterpart funds of any possible external financing.

In this way, together with the awareness which has been created among the leaders of the country, the priority assigned to the program is of enormous importance in the context of development projects, both of the sector and of the economy as a whole; it is of crucial importance in obtaining the external financing which our countries need if they are to achieve foot-and-mouth disease control.

All the above-mentioned aspects are involved in something we technicians often

overlook or do not give sufficient importance to: *the political decision*. This decision determines the success or failure of a plan and, in order to obtain it, the experts initially responsible for a health problem must come with clear ideas, concrete proposals, and convincing evidence to the highest authorities of the Government and explain to them the importance of the problem. This effort, which is sometimes rather difficult, must be made by several persons, not just one or two—for example, only by the Minister concerned, who often is the only standard-bearer of the cause and who, despite his good intentions, cannot enlist support of other very influential persons. Because of that, the work of convincing national leaders should be undertaken by as many people as possible. And here it should be borne in mind that it is advisable to study the situation before requesting a decision by the Government. It must be fairly certain that the decision will be favorable. Otherwise it is preferable to wait for another opportunity rather than to risk rejection. A program which is not carried out because it has not taken shape is much better than one that is not carried out because it has been rejected.

All these rather heterogeneous requirements must be satisfactorily examined and evaluated early in the negotiations leading to the formulation of a foot-and-mouth disease control program. The evaluation must be objective, realistic, free from exaggerated optimism as well as excessive pessimism. Often we animal health experts allow ourselves to be put off by the difficulties we encounter in trying to put ideas and actions into practice and we think that nothing can be done. Because of this obvious surrender we sometimes fail to notice the existence of new situations, of more favorable conditions, of different attitudes on the part of some agencies or persons with respect to

the problem, and if we do not take note of them we cannot emphasize the steps needed in order to move ahead. For this reason it is advisable for the whole situation to be assessed rationally and objectively, if possible, by a team of persons, including technicians, directors, administrators, from different levels and different organizations.

II. PLANNING PROPER

Every plan consists of two well-defined parts: the diagnosis and the plan itself. Diagnosis is a calm analysis of the situation prevailing at the time the plan is formulated, and the plan itself is a clear and accurate definition of the activities to be undertaken in order to achieve the objectives and reach the targets proposed, and to change the status quo.

A. *Diagnosis*

The analysis of the situation with respect to the problem to be faced, in this case foot-and-mouth disease, is of signal importance for a correct assessment of the facts that must be taken into account in formulating the plan. Some but not all of the aspects to be considered are these:

1. *Geographic distribution of the disease.* It is advisable to delimit accurately, to the extent the available information permits, the areas or zones in which cases of foot-and-mouth disease have occurred, including endemic areas and disease-free areas, if any; and other pertinent data should also be taken into account. Often, sufficient statistical information is not available, but a good way of compensating for it is to draw on the practical knowledge of livestock owners, veterinarians in private practice, regional authorities, and other persons with experience in the livestock sector.

2. *Frequency and persistence of outbreaks.* To ascertain the mode of presenta-

tion of the epizootics, it is important to know the frequency with which outbreaks occur, by area, and whether they are regular or sporadic. It is also important to know the types and subtypes of virus involved, specifically whether there is one or more types and whether over the years any one of them has predominated. Often this kind of information is fragmentary, because no exhaustive study of the problem has been made. Nevertheless, all available knowledge must be used.

3. *Climate, topography, and hydrography.* Data on climate, by ecological area, are of special help in formulating a plan; information on rainfall, cold weather, or intensely hot weather is important in establishing the periods of vaccination, census-taking, etc. An accurate knowledge of hydrography and topography will also make it possible to define and delimit campaign areas. A river or a mountain range is an important natural barrier to an epizootic wave, and when fixing the limits of the campaign area the advantages offered by the geography of the country must be taken into account. These data will also be of use in defining the means of transport to be utilized, so as to ensure easy access to specified areas and the most appropriate route.

4. *Transport.* It is necessary to have an accurate knowledge of the means of transport in the country. The following data will be important in defining campaign areas, in locating operations and control centers, and in meeting other needs of the program: (a) *roads*: length, type, period of use, type of vehicle they are suitable for, itemized by area; (b) *navigable rivers*: length, type of craft required; (c) *railroads*: length, frequency of traffic, regularity, costs; (d) *airstrips*: internal flights, frequency, regularity, costs.

5. *Communications.* A foot-and-mouth

disease control campaign deploys a considerable number of personnel who must be in constant movement. They must be in permanent contact with one another and the higher or lower levels of organization. It is therefore necessary to make a detailed study of the means of communication between specified points, so that during operations needs and requirements can be adequately met. Accurate information is needed on: (a) telephones, (b) telegraphs, (c) radios, and (d) postal services.

6. Livestock production and slaughtering.

As a basis for the economic study of the plan and for the purpose of stressing the importance that the results of the foot-and-mouth disease control program will have for the economy, it is necessary to collect and classify the available data on the micro- and macro-economic aspects of the livestock economy. We must not forget that we are involved in the process of development and that what is really important as an argument for priority consideration are the financial advantages an activity will bring or, in default thereof, the fact that it will have a considerable social impact. Therefore it is advisable to have complete data on the following: (a) total gross production and gross national product; (b) volume and value of the annual production of cattle, sheep, hogs, and goats; (c) imports and/or exports of livestock products; (d) total slaughterings and, by area or localities, average live weight of animals slaughtered, by sex and type of animals; (e) extraction rate, reproductive efficiency rate, slaughtering rate, mortality rate by cause; (f) average age of animals at time of sale.

7. Movement and concentration of animals. For the purpose of planning an adequate system of vaccination and establishing methods and sites for the control of

animal movement, it is essential to know the main markets to which livestock move from the production areas; the season or seasons in which most sales take place; the cattle markets; the location of meat industries, fairs, and exhibitions that are held; and everything relating to the movement or concentration of animals. This information may be entered on a map, with arrows indicating the direction of the movement of animals and the places of origin and destination.

8. Production, import, and export of vaccines.

A foot-and-mouth disease campaign is primarily based on periodic, obligatory, and supervised vaccination. It is therefore essential to know how much vaccine is being produced in the country. The individual laboratory must be identified, as must be its location, volume of production, technique used, plans for expansion, if any. If vaccine is not produced in the country, detailed studies must be made of possible sources of supply and the advantages and disadvantages of each; and whether neighboring countries have a surplus they can export. The cost of imported vaccine may be of importance. Finally, the size of the surplus if a country produces more than it needs, for the purpose providing for the possible consequences of that situation.

There are still other aspects which may be taken into account in this part of the diagnosis. Often particular situations in a country make it necessary to study other factors. In this outline we have tried to bring to your attention only aspects which experience has shown to be of importance for a well-formulated program.

It must also be stressed that the diagnosis should be made by persons who are familiar with the situation in the country concerned, since in the absence of systematic written information they must often draw upon the

practical knowledge of the people in order to fill in gaps. If the work must be done by a foreign firm, it is advisable to require it to have national experts take part in it. And here we shall mention an experience which may illustrate this point. The first attempt at a diagnosis and formulation of a plan in Paraguay was made by a group of national experts. Subsequently a firm of consultants was employed to prepare a definite project to be submitted to financing agencies abroad. The work of this firm was almost completely based on that already done in the country, and added little to it. Furthermore, when translated into reality some forecasts in the plan turned out to be incorrect; that was the result of lack of knowledge of the environment in which the activity was to take place.

B. Plan Formulation

One of the basic requirements of a plan is that it should be concrete, clear, objective, and realistic. Some of the aspects that must be taken into account when a foot-and-mouth disease control plan is being drawn up are the following:

1. *Objectives.* It is advisable to define over-all and long-term objectives and then to spell out specific or short-term objectives. For example, a short-term objective might be "to control foot-and-mouth disease throughout the national territory" or "in specified areas." A long-term objective might be "to eradicate foot-and-mouth disease from the country and to declare it free of the disease."

2. *Targets.* The establishment of targets is of great importance in a program or plan; human activity always needs goals if it is to be conducted at the pace and with the consistency desired. The targets may be a reduction in the incidence of foot-and-mouth disease; vaccination rates to be

achieved, in the entire country and by area; and, if possible, economic targets, expressed as an increase in production, increase in exports, etc. This last type of target is attractive for many persons, especially those responsible for the financing, who wish to see the benefits derived from the investments expressed in monetary values. Those benefits are rather difficult to quantify, but if it is possible to do so, it will be very advantageous for the program.

3. *Stages of the program.* The main stages of a foot-and-mouth disease control program are (1) control of the disease (which may be total or partial), and (2) eradication.

During the control phase it is advisable to define stages in the light of the following criteria: (a) progress of the program in a geographic sense (areas or regions to be successively incorporated into the program), and (b) targets to be achieved, by specified periods of time (one year, two years, or longer).

It is very important for the stages of a program to coincide in time and place with the dates fixed for a total evaluation of the program; in that way, the results of the evaluation will show whether or not the targets fixed for that stage have been achieved, and the data compiled on completing that stage will be very helpful for the evaluation.

4. *Methods of work.* In preparing a program for the control of foot-and-mouth disease, which is characterized by a great deployment and a great mobility of manpower, it is advisable to clearly define the mechanisms that will be used to translate the plan into positive achievements.

The correct definition of the means and methods of work may be decisive in determining the success of the program. An incorrect assessment may result in failure,

which in a health program would be equivalent to aggravating the problem. Or else, it would require the persons responsible for the direction and execution of the campaign to reformulate the plan, with the risk of disrupting over-all planning.

The principal means for carrying out the campaign are the following:

a. *Compulsory, systematic, periodic, and supervised vaccination of susceptible cattle.* The basic requirement of vaccination is that it should be compulsory. Vaccination should primarily be the responsibility of the livestock owner himself. It entails work, money, and trouble, for which reason supporting legislation should be enacted, laying down the necessary procedures for ensuring that vaccination is administered. It should clearly define the species of cattle to which compulsory vaccination applies, and that decision will depend directly on the numerical composition of the livestock in the country. In Paraguay, this requirement applies only to cattle, which constitute most of the livestock and which represent the greatest economic wealth of the country. The legislation should also define the age at which vaccination is to be administered. It is essential that from the very beginning all cattle be vaccinated, even though in the early phases of vaccination that goal is, admittedly, very difficult to achieve. In Paraguay we set ourselves that target and, as a result, in the first phase of vaccination we vaccinated more than 90 per cent of cattle and, in the second, 96 per cent.

The periods for compulsory vaccination must be prescribed, and must be related to the duration of the immunity conferred by the vaccine used. In our country this period is four months, and the expiration date of immunity has been established by the Executing Agency, by zone, taking into account particular environmental conditions such as climate, periods of calving, weaning, and marketing of cattle.

Another important aspect is supervision of vaccination. It is to be expected that at the beginning of the campaign some proprietors will not be familiar with the methods to be used and the care to be observed in vaccination or will be reluctant to carry it out; in both cases, the technical staff of the Executing Agency can help prevent vaccinations from being badly administered, teach livestock owners the correct tech-

nique, and see to it that they do vaccinate. During the campaign in our country, vaccination by all owners of more than 100 head of cattle was supervised by a veterinarian or by auxiliary personnel. It has been very gratifying to observe the acceptance accorded such practice and its usefulness. There has been a notable improvement in the handling and storage of vaccines, the sterilization of instruments, and the administration of vaccine. In order to supervise the vaccination of animals of small livestock owners in suburban and rural areas, it has been made the responsibility of personnel trained by the service, who are selected from among the residents of each community. After having successfully completed a short theoretical and practical course, they are authorized to vaccinate in a specified area and are responsible for collecting data, vials, and bills for vaccines for record purposes. By adopting this method our country has been able to overcome the drawback involved in the lack of vaccination practice of small owners and to achieve very high vaccination rates.

b. *Control of national and imported vaccines.* If a campaign is to be successful, it is essential to know the quality and effectiveness of the vaccine used. While a vaccine production method may be correctly used, the products in each batch may differ; also, vaccine control is expensive. It is very difficult for such tests to be made by the producing laboratories and consequently they have to be made by the State. Finally, the purpose of vaccine-producing laboratories is to earn profits for the owners, so that the technical rigor they exercise may be relative. For that reason it is essential for the State to have an official control laboratory which tests for safety and potency the vaccines that are to be used by livestock owners. This control should be properly supported by regulations designed to prevent personal assessments being made by experts working in the national laboratory. Control should be rigorous and stringent; the damage that a bad vaccine can cause to a campaign is enormous.

Apart from this type of control there must be supervision of the movement, storage, and transportation of vaccine from the time it leaves the production laboratory to the time it is administered to the animal. There should also be regulations governing the confiscation and destruction of any batch which is suspected to have

been incorrectly stored in any phase of its marketing.

c. *Control of foci and continuing epizootiological investigation.* When mass vaccination is initiated, foci of the disease will continue to occur for some time in the vaccination area. The measures to be taken by the Executing Agency to deal with such cases must be clearly established. They should include disinfection, isolation of sick animals or animals that have been in contact with sick animals, interdiction of areas, perifocal revaccination, and prohibition of the movement of susceptible animals in or out of the affected areas. In addition, the virus involved must be identified as soon as possible so that the pertinent vaccine can be prepared and administered to animals which may contract the disease in the area of the focus.

It is necessary to investigate all foci in the country to ascertain the geographic distribution of the viruses concerned, since such information is of use for vaccine production. Continuous typing of the virus from all cases is an important factor in the success of the campaign.

d. *Control of the movement of animals and concentration centers.* As soon as a vaccination system has been set up, it must be made compulsory for every animal that is to be taken from one place to another to be vaccinated, such vaccination being duly substantiated by means of a document issued by the Executing Agency. This will ensure that animals in transit are not disseminators of foot-and-mouth disease virus, and that no unvaccinated animals will contract the disease during their movement. It is also necessary to establish control posts, since no measure of this kind is effective unless checks are made to see that it is being complied with. It is also necessary to institute measures aimed at the compulsory immunization of all animals taken to exhibitions, shows, cattle markets, cattle auctions, and any other concentration of cattle.

In addition to the rules and regulations making these measures compulsory, the legislation must make provision for the penalties to be applied in the event of infringements, for if that is not done the measures will not be effective. The fear of penalties, especially of fines, is a spur to obtaining compliance with the regulations in force.

e. *Frontier control.* Another indispensable measure for a good campaign is control of the

frontiers of a country, in order to cope with the movement of susceptible animals across them. Stringent measures governing the movement of animals across borders must be established, such as the requirement to produce appropriate health certificates proving that the animal has been vaccinated against foot-and-mouth disease; direct inspection of animals entering the country; and disinfection of cattle transport at the point of entry. If the adjoining country has a foot-and-mouth disease program in operation, it is advisable for the countries concerned to coordinate the measures to be adopted and to pledge themselves to comply with them. Bilateral and border agreements are extremely helpful in ensuring the effectiveness of and compliance with requirements.

b. *Application of stringent health measures.* The aggregate of health measures, both those aimed at prevention and those aimed at the elimination of the virus, must be sufficiently efficient to ensure that the spread of the disease is stopped and that its incidence is eventually reduced. It is hardly possible for a program to specify what those measures should be; but during the conduct of the program it will be necessary to define clearly and accurately the actions to be carried out in each case. It is advisable to establish the principle that it is always more advisable and useful to take too much rather than too little health care. Because of the great capacity for spread of the foot-and-mouth disease virus and the various ways in which it can be transported from one place to another, all necessary precautions must be adopted in each case and on each occasion.

An indispensable element for rapid and effective action is good disinfection equipment, sufficient quantities of disinfectants of various types, and persons trained to handle them.

5. *Geographic planning of the campaign.* The geographic characteristics of the country will determine how the campaign is to be conducted. It is very difficult for the entire territory to be covered at the outset, even though it is small and uniform. Factors such as financial resources, manpower, and often experience are limiting factors in achieving total coverage. For that reason it is advisable to establish campaign areas or zones in the light of the availability of

resources, and to clearly define how and when they will be successively incorporated into the campaign.

a. *Campaign zones.* In delimiting these it is necessary to take into account, first, the political subdivisions of the country; then, such geographic features as rivers, mountain ranges, and forests. It must not be forgotten that a river or another of these features is a good barrier for preventing the spread of the disease, both in and out of the zone delimited.

Next, attention must be given to the road network; all the localities and areas included in the zone must be accessible within it, since the operating units must be established inside each zone.

The population density in each zone should also be known, in order to calculate how many persons are needed to operate efficiently in it. Often budgetary limitations and even lack of trained personnel may prevent good coverage of a specified zone in which there is a large number of livestock owners. The cattle density in each zone and the distribution of cattle by size of the herds—that is, the productive structure according to the number of animals each livestock owner has—should also be determined, since there is a great difference between a zone that has large ranches but only a few owners with small herds, and a zone in which most of the owners have only a few animals and the number of large ranches is relatively small; or a zone in which both types of structure exist.

It is also necessary to know the population centers with communication and other basic facilities in which operating services can be set up.

Finally, it must be emphasized that this delimitation of campaign zones is provisional; it will not be final until the program is under way and the field data collected show whether or not the limits of the campaign zones marked out should be changed. That is advisable since lack of flexibility in planning may result in the Executing Agency having to carry out the program in unsatisfactory conditions.

b. *Organization of the service.* After establishing the campaign zones and the timing of their incorporation into the campaign and after collecting basic data on livestock density, access, etc., it is necessary to specify for each zone how the campaign service will be organized, an element of enormous importance in subse-

quently calculating operating and equipment costs and budgets.

Within each zone the following operational subunits should be established: office of zone chief; office of regional veterinarians; inspectors' offices; movement control posts; official vaccination posts; disinfection posts.

When these units are being set up it will be necessary to delimit the area or districts under the jurisdiction of each and the chain of command between them. The type of organization to be established will, of course, depend on the administrative experience of each country and the organizational pattern adopted in the Executing Agency.

6. *Executing Agency.* The establishment of the executive responsibilities is a fundamental part of the planning of the program. In the first instance, the assignment of responsibility for executing the program lies with the Government, but it is the duty of the planner to establish the requirements to be met by the agency to ensure that the plan will be viable.

Experience in our countries shows that the Executing Agency must meet certain fundamental requirements because of the particular characteristics of this type of program. First, it must be situated at a sufficiently high level in the administrative hierarchy so that decisions that have to be adopted at higher levels are not lost in a long and costly bureaucratic process. This is most important, since the main characteristics of the program must be flexibility and quick action. The proper position for the campaign in the administrative hierarchy is that of an independent agency directly attached to the Minister's private office; it should have sufficient authority to make most decisions and it should be relatively easy for it to obtain decisions from a higher level. In Paraguay the Executing Agency of the campaign is an independent agency with a legal personality, specifically established by law and with broad authority to take decisions in all matters within its ju-

risdiction. It is attached to the Executive Branch through the Ministry of Agriculture and Livestock Production.

Another important requirement is a clear definition of the responsibility for the direction of the campaign. The law must specify the requirements to be met by the person who is the director of the campaign, such as minimum age, profession (preferably a veterinarian), full-time employment, and his duties and responsibilities.

In organizing the Executing Agency, it is essential to make provision for proper decentralization of activities. It is very useful to establish four subunits at the departmental level: (1) field service, (2) laboratory service, (3) administrative and financial service, (4) support services (public information, statistics, library, etc.).

Field service. This constitutes the operational unit of the program. At the central level it should have administrative services capable of moving instructions, data, and reports between the field units. It would also be advisable to have technical supervisors to keep an eye on and guide activities in the operational zones. At the campaign zone level the responsibilities of the chief, of the veterinary inspectors, and of subordinate levels should be defined.

Laboratory service. One of the most important units is that responsible for the testing of foot-and-mouth disease vaccines, for epizootiological research, and for the typing of field viruses. The laboratory must have a flexible structure and the decision-making levels must be clearly defined. Specialists must have sufficient authority in their respective fields. It is also essential to have a proper administrative service, since the movement of papers, materials, and equipment in that unit is considerable.

Administrative and financial service. The principal characteristic of this service is great flexibility and speed in making decisions and carrying them out. It must have a system of preplanning of the stocks needed by the executive branch of the service, and also a control system, and modern accounting.

Support service. The service comprises such very important units as that responsible for collecting and processing data which are produced

by the program and which will be used to ascertain the results and evaluate the conduct of the program; in other words, the statistical unit, which must have experts in such fields as sampling, census, surveys, mechanical tabulation, compilation, and publication of data, and statistical analysis.

Another important unit is that responsible for publicity, press, and health education; through it the necessary publicity and information will be communicated to the beneficiaries of the program at the time and with the intensity necessary to achieve the desired effect. This unit should cover the following fields: radio, television, press, publications, cinema, and educational material for field veterinarians and rural livestock owners. One of the most valuable tools of the campaign is the broadcasting of information and educational material.

Experience has shown us that in the rural areas information broadcast by local transmitters makes it possible to undertake any action in specified zones and areas; when supplemented by well-produced, easily understood illustrated material it is very useful in predisposing the population in favor of the program.

I have attempted to comment on some aspects related to the Executing Agency, but in each country it is necessary to choose those structures which suit its distinctive characteristics. If what is said here can be helpful in any way, I shall be satisfied, since this has been the purpose of this statement.

7. Legislation. Every foot-and-mouth disease program must have legislative support. This principle is indispensable, since the activities involved in a plan of this kind must be complied with by the community, and when collective obligations are instituted they must be protected by the law; otherwise, troublesome situations may arise between the persons affected and the officials responsible for the plan, and even reach the stage of legal proceedings, which are very detrimental to the program.

The planners must therefore review and evaluate all existing health legislation and

decide whether or not new laws are needed. If necessary, the draft must be prepared beforehand and cover all the elements necessary to establish the compulsory nature of and compliance with collective measures, together with a definition of the infringements and the penalties to which the persons concerned will be liable. It will be advisable also for the law to cover all those aspects on which the execution of the campaign is based, such as compulsory vaccination of specified species; responsibility and authority of the Executing Agency to intercept, detain, and disinfect animals in transit; to interdict infected areas, prohibit the entry of animals into certain areas if they do not satisfy the required conditions; to confiscate the vaccines if they do not meet the requirements with respect to quality and effectiveness, etc. And finally, it is advisable for the law to stipulate the jurisdiction in which cases arising from its application will be settled, and establish the authority entitled to give rulings in cases that need amplification or clarification. In Paraguay, Law No. 1267 illustrates the type of provisions it has been found necessary to incorporate in the law in our country.

8. *Vaccines.* When the annual global requirements and the seasonal requirements for vaccines, which will be geared to the vaccination plan drawn up, have been established, it is necessary to study possible sources of supply. If vaccines are produced in the country, the present production must be ascertained and compared with the estimated demand. Then the steps to be taken to ensure a regular supply of vaccine must be established and provision made for the control of the product in order to be sure the vaccine is of good quality. The official control laboratory must therefore have all the necessary equipment for proper control tests.

A system of distribution should be established to ensure a good supply of vaccine in the campaign zones, in the periods of compulsory vaccinations. Its main responsibility will be the shipping of large quantities in a short period of time. It is therefore advisable to provide for a good network of distributors in the rural communities themselves, since they are to be preferred to ambulant distributors who, although they ensure higher sales, do not provide continuity of supply.

If sufficient vaccine is not produced in the country, possible sources of vaccine must be studied, as must be its guaranteed supply and the advisability of carrying out a campaign with imported vaccines, and the necessary guarantees as to the quality and effectiveness of the product. The case of Paraguay is representative; the vaccine we are using in our campaign is imported and comes certified by the official control agency of the country in which it is manufactured. After it has entered the country, its storage, sale, and transportation come under the authority of the foot-and-mouth disease service.

9. *Cost and financing.* A chapter of vital importance for the foot-and-mouth disease control program is that relating to the financial aspects, both the feasibility of obtaining funds for carrying it out and correct budgeting, which will make smooth operation possible.

It is therefore necessary from the very outset to draw up a budget for the program, quantifying all the visible needs and then studying how they are to be financed. The practice of estimating costs on the basis of an aggregate figure already known should be avoided, since otherwise there is a great risk that insufficient allotments will be provided and the smooth operation of the program impaired.

Costs. To determine the costs of the program a good budget must be prepared, and there is no better way of doing that than to adopt the budget technique used in our countries. It is necessary to work on the basis of cost modules, that is to say, to use predetermined monetary units to calculate the amounts of the allotments under certain heads, such as monthly costs of maintaining a vehicle, travel, and accommodation of a field technician per month, etc. In this way sufficiently accurate estimates can be made, and when adjustments have to be made it is easy to add or subtract cost modules.

The budget must be on an annual basis and for the whole duration of the program. It is advisable to separate items which constitute investments from those which are for current expenditures. A model budget for this type of program is shown in Annex I.

Financing. How the financial resources for the program are to be obtained is one of the most difficult aspects at the planning stage. The costs of the plan are often established without mention of financing; such a plan is not complete. To structure a good system of financing the plan, we must begin by consulting the competent State agencies about possible sources of funds, bearing in mind that there will be new resources, or unobligated funds, which will have to be earmarked for that purpose. There may be various alternatives, for example: (a) that the plan be completely financed with resources from the general budget of governmental expenditures; (b) that a new source of financing be established, such as a tax on livestock; (c) that funds come from both sources; (d) that a proposal be made to use external financing to cover part of the costs.

In any case the amounts to be covered by the various sources of funds must be clearly defined by year and globally, as must be the amounts to be obtained from foreign sources and counterpart funds in local currency. It is also necessary to establish a table which specifies the heads under which the funds coming from each source are to be used, that is, a table of source and use of funds, since we know, for example, that external loans cannot be used for certain heads. Consequently, if this is not done, confusion will ensue and make it difficult to secure financing. Annex 2 contains models of financing that can be used for that purpose.

In the financing table it is also necessary to show where external resources are going to be

used, and the currency to be used for these resources, since there will be investments and expenditures which must be made in the country and for which local currency will be needed, whereas to import goods it will be necessary to have hard currency (foreign exchange). Care must be taken to ensure that the execution of the program does not affect the availability of foreign exchange in the country. Annex 3 contains a model that can be used to show that breakdown.

Another aspect to be taken into account is that related to the seasonal nature of certain resources, for example a tax on the export of meat and meat products. There are certain months of the year in which the amounts collected will be greater than others. This possibility must be borne in mind so that provision can be made for other resources if those amounts prove insufficient.

If external financing for the program is to be sought, it is necessary for the higher governmental authorities to guide planners by indicating which agency they intend to submit the program to. Each financing agency has its own credit policies and they must be known so that the program may be fitted to them and therefore be more likely to be approved. Thus, for example, the ratio between the size of the loan and the internal resources must not exceed a certain limit; also the loan funds cannot be utilized for certain heads, for example, payment of personnel, travel expenses, office furniture, and supplies, etc. Annex 4 contains a table of the heads for a foot-and-mouth disease control program, based on the Paraguayan program for which a loan was obtained from the IDB.

10. *List of goods and services.* Once the costs and the financing of the program have been defined, it is extremely useful to draw up the most detailed list possible of the goods and services that will be purchased during the campaign. This is more necessary still in the event of external financing since those data will be used in the analysis of the program by the financing agency. The detailed list should be arranged under budget heads, together with an indication of the resources with which it will be financed and the currencies in which the expenditure is to be made. One point to be

taken into consideration in preparing this chapter is the cost of different materials and services. In the early years current values must be used but an increase in prices in the years ahead must be allowed for; otherwise, there is a risk that allotments will be insufficient to cover actual needs, especially if the country is beset by inflation.

For imported articles provision must be made for freight costs, insurance, and taxes, and it is advisable to overestimate rather than to underestimate them, in order to hedge against any contingency which may make international prices vary (new taxes in the manufacturing country, dock strikes, etc.).

11. *Financial justification of the program.* A foot-and-mouth disease program is primarily an economic program. Thus understood, it is obviously necessary to clearly demonstrate the benefits it will bring to the economy of the country.

One of the first things that needs to be known is the level of economic efficiency of the livestock economy, so that from that baseline it will be possible to measure the changes produced by the program. In our countries reliable information on this point is difficult to obtain, but in any event the available data must be translated into parameters for estimating the increases that can be obtained as a result of the program.

In the early years of the plan it is essential to make a complete study of the livestock economy to determine the levels of productivity, efficiency, and profitability as a starting point for obtaining realistic results when the financial evaluation of the program is made.

In this connection the following aspects should be studied: (a) increase in the production of beef cattle; (b) increase in milk production; (c) increase in slaughtering availabilities; (d) increase in production of wool; (e) increase in competition on the international market.

All these studies, on which we will not enlarge because this paper is already over long, will give a set of financial magnitudes which, when expressed in monetary terms, show the global amount of benefits that will be achieved if the program targets are reached.

Once these data are obtained, the cost-benefit ratio must be determined since it is so essential in evaluating the importance of the program in the context of national development.

12. *Evaluation of the campaign.* Because its activities can be measured in physical terms it is necessary, in a program of this type, to establish the periods of time at which evaluations will be carried out. To ensure that the evaluations are accurate, it is necessary to establish which indicators are to be used in this review of the results, for example, infection rate, attack rate, number of foci, increase in meat production, increase in milk production, increase in reproductive efficiency, etc., as well as the baseline data.

13. *Campaign projection.* The control program generally covers a specified number of years, from the beginning of systematic activities until the attainment of certain targets such as the reduction of the incidence to controllable levels, throughout the country. For the purpose of ascertaining the long-term prospects, it is advisable to project values related to livestock production, its productivity, annual volume, rates of efficiency, and also probable costs required for the continuation of the program, at least in the intensity established in the last year of the first phase.

14. *Reformulation.* A plan or program is a set of approximations defining an idea or method that is to be translated into reality. Its values and forecasts are always relative and are in direct relation to the criteria and data used in preparing them. During implementation fresh, accurate, and realis-

tic information is collected which may throw new light on various aspects of the plan. If that information and data reveal that there were errors in the appreciation of facts in the planning phase, it will be necessary to revise the whole program. The same would happen if the results achieved early differed from the plan forecasts.

We therefore wish to emphasize that we must always be ready and willing to reformulate the program. If this reformulation

gives rise to new elements that must be thoroughly analyzed, or to changes in orientation, in costs, and assistance, etc., we must be honest and face the facts of the real situation before our eyes.

Hence it is advisable to have in the Executing Agency of the program a group of planning specialists, since from what has been said it is clear that planning is a dynamic process and that a plan is not a static and unchangeable document.

ANNEX 1. BUDGET FOR THE PROGRAM

(In thousands of guaranis)

Specifications	Year 1	Year 2	Year 3	Year 4	Year 5	Total
<i>I. Investments</i>	XXXX	XXXX	XXXX	XXXX	XXXX	XXXXXXX
1. Fixed	XXX	XXX	XXX	XXX	XXX	XXXXX
2. Semi-fixed	XXX	XXX	XXX	XXX	XXX	XXXXX
<i>II. Current expenditures</i>	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXXXX
<i>III. Contingencies</i>	XXX	XXXXX	XXXX	XXX		XXXXX
Total	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXXXXX

Details of Budget Heads

I. Investments

1. Fixed

Land (real estate)

Constructions

Facilities for laboratories

Facilities for central office

Facilities for field office

Facilities for storage of materials and vaccines

Works in the cattle yard attached to the laboratory

Quarantine stations

Public corrals and cattle runs

Corrals and cattle runs on the properties of livestock owners

2. Semi-fixed

Vehicles and boats

Laboratory, vaccination, and disinfection equipment and apparatus

Laboratory animals

Laboratory materials and agents

Insurance

Office furniture and supplies

II. Current Expenditures

1. Wages and salaries

2. Basic services (light, water, electricity, telecommunications)

3. Per diem allowances and travel expenses

4. Rent of buildings and furniture

5. Commercial service (publications, etc.)

6. Fuel and lubricants

7. Office equipment and printing

8. Repair of transport and office equipment

9. Chemical products (disinfectants, etc.)

10. Miscellaneous

ANNEX 2. FINANCING OF THE PROGRAM

Source of Funds

Model 1

Source	Year 1	Year 2	Year 3	Year 4	Year 5	Total
1. Budgetary allotment	xxx	xxxx	—	—	—	xxxxx
2. Special Law No. xxx	—	—	xxx	xxx	xxx	xxxx
3. Own resources (Taxes, etc.)	—	—	xx	xx	xx	xxx
Total	xxxxx	xxxx	xxxx	xxxx	xxxx	xxxxxx

Model 2

Source	Year 1	Year 2	Year 3	Year 4	Year 5	Total
1. Own resources	xxxx	xxxx	xxxx	xxxx	xxxx	xxxxxxxx
2. External loan	xxxx	xxxx	xxxx	—	—	xxxxxxxx
3. Donations	xx	xx	xx	—	xx	xxxxx
Total	xxxx	xxxx	xxxx	xxxx	xxxx	xxxxxxxx

Source and Use of Funds

Model 1

Use	Source		Total
	External	Internal	
<i>I. Investments</i>	xxxxx	xxxx	xxxxx
1. Fixed	xxxx	xxx	xxxx
2. Semi-fixed	xxx	xx	xxxx
<i>II. Current expenditures</i>	xxxxx	xxxx	xxxxxx
1.	xxx	xx	xxxx
2.	xx	xxx	xxxx
3.	xxx	xx	xxxx
<i>III. Contingencies</i>	xxxx	xxxx	xxxxxx
Total	xxxxxx	xxxxx	xxxxxxx

Model 2

Use	Source					
	1st Year		2nd Year		Total	
	External	Internal	External	Internal	External	Internal
<i>I. Investments</i>	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx
<i>II. Current expenditures</i>	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx
<i>III. Contingencies</i>	xxxx	xxx	xxx	xxx	xxxxx	xxx
Total	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	xxxx

ANNEX 3. FINANCING THE PROGRAM
Currencies to be Used According to Source of Funds
(In equivalent of US\$)

Heads	External			Internal	Total
	US\$	Local currency	Total	Local currency	
1. Land				XXXXX	XXXXXXX
2. Constructions	—	XXXXX	XXXXXXX	—	XXXXXXX
3. Office furniture and equipment				XXXXX	XXXXXXX
4. Laboratory equipment and disinfectants		XXXXX	XXXXXXX		XXXXXXX
5. Vehicles	XXXX		XXXXXXX		XXXX
6. Etc.					
Total		XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX

Note: The same table may be itemized by year of program execution.

ANNEX 4. FINANCING OF THE PROGRAM
External and Internal Financing

Heads	IDB	SENALFA *	Total
1. Land	—	XXXXX	XXXXXXX
2. Constructions	XXXXXXX	—	XXXXXXX
Laboratory	XXXXX	—	XXXXX
Cattle yards	XXXXX	—	XXXXX
Stores	XXXXX	—	XXXXX
Corrals and cattle runs	XXXXX	—	XXXXX
3. Office furniture and equip.	—	XXXXX	XXXXXXX
4. Laboratory, vaccination, and disinfection equip.	XXXXX	—	XXXXXXX
5. Laboratory substances, reagents, and animals	XXXXX	XXXXX	XXXXXXX
6. Vehicles and boats	XXXXXX	—	XXXXXXX
7. Publicity equip. and material	XXXXXX	—	XXXXXXX
8. Vaccines	—	XXXXX	XXXXXXX
9. Wages and salaries	—	XXXXX	XXXXXXX
10. Operating expenses	—	XXXXX	XXXXXXX
11. Technical assistance (experts and fellowships)	XXXXX	—	XXXXXXX
12. Contingencies	XXXXX	XXXXX	XXXXXXX
Total	XXXXXXX	XXXXXX	XXXXXXX

Note: The same table may be itemized by year.

* National Foot-and-Mouth Disease Control Service.

FOOT-AND-MOUTH DISEASE CAMPAIGN IN ARGENTINA: RESULTS, BENEFITS, AND PROJECTIONS

DR. JORGE BORSELLA*

GENERAL

The foot-and-mouth disease campaign was begun in the Republic of Argentina in 1960 and gradually extended until by 1968 more than 45 million head of cattle had been vaccinated in the campaign area north of the Negro and Limay Rivers (Figures 1 and 2).

A mass systematic national campaign, based on the compulsory vaccination of cattle and sheep against foot-and-mouth disease, is being carried out.

North of the Negro and Limay Rivers, which demarcation line will soon be moved further north up to the Colorado River, National Highway 151, and the Limay River, all cattle are vaccinated at birth and all sheep at age 3 months.

Cattle are vaccinated three times a year, once every 120 days, and sheep every 180 days or twice a year; they may be vaccinated at shorter intervals, since the periods stated are the maximum intervals.

The Province of Santa Cruz and the National Territory of Tierra del Fuego were declared free of the disease in 1968, and in the near future the remainder of Patagonia located south of the Colorado and Barrancas Rivers will be free of the disease.

The campaign is directed by 265 local

commissions which are composed of representatives of livestock owners (rural associations, cooperatives, etc.) and of which the local veterinary officers of the Health Control Service (SELSA) are the chairmen.

As more personnel have become available, outbreaks have been quickly brought under control. The extent of the spread of the disease is much less, because of vaccination, control, and the awareness of livestock owners, who are reporting cases as soon as they are discovered.

In 1968 there were 356,454 registered livestock owners; 1,427 specimens were typed, which means that the annual incidence was 0.4 per cent (Figures 3 and 4).

RESULTS

In 1968 the disease persisted in the spring and summer months, especially in the central provinces, where the movement and density of cattle is greater and cattle marketing is more frequent (west of Buenos Aires, south and center of Santa Fe, south of Córdoba, and west of Entre Ríos).

On the other hand no cases were recorded in Formosa, Jujuy, Misiones, and Patagonia, and the disease appeared only sporadically in other parts of the country. These cases were rapidly brought under control by prohibiting the movement of animals and by barrier vaccination.

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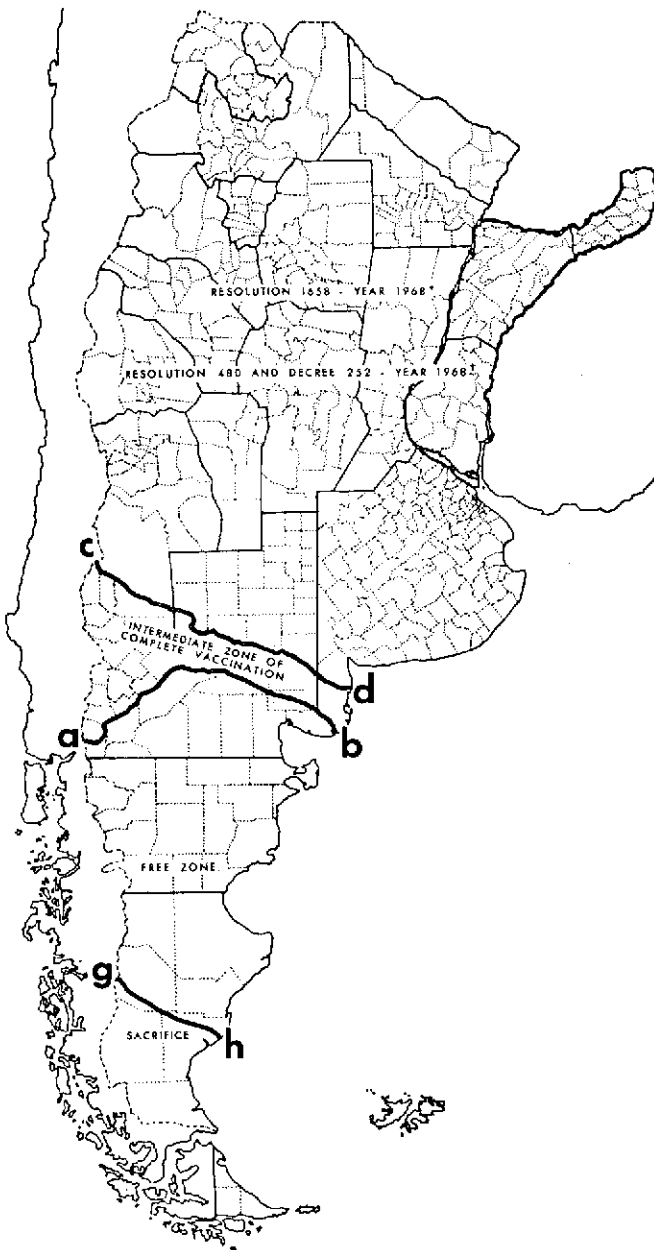


FIGURE 1—Progress of the Foot-and-Mouth Disease Control Campaign.

* Vaccination of cattle, all ages, north of c-d.

† Compulsory vaccination of sheep every 180 days, north of Colorado and Barrancas Rivers, north of c-d.

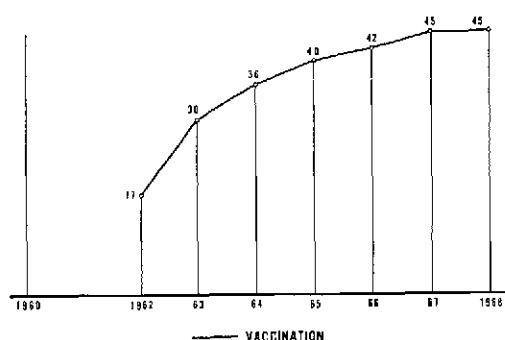


FIGURE 2—Yearly Average of Vaccinations (in millions of head of cattle).

The immunity conferred by vaccination does not last for more than 90 days, after which outbreaks occur. For this reason it is advisable for animals to be vaccinated every 90 days instead of 120 days, and this practice has been followed by many livestock owners with good results.

The most susceptible animals are those up to the age of 18 months, and the highest incidence in this age group is in unweaned animals, whose defenses are reduced by the cold, lack of pasture, and infrequent vaccination.

Oil-adjuvant vaccines, which appear to confer more immunity, are being studied. If they prove successful, they would be the solution to the problem; for to require a further vaccination whose results are not certain would be detrimental to the campaign.

The most frequent type of virus found in 1968 was type A, which accounted for 76 per cent of all cases; type O accounted for 23 per cent and type C for only 1 per cent. It should be pointed out that in earlier years type O virus predominated (Figure 5).

It is worth mentioning that at the International Exhibition of the Argentine Rural Association held in 1968 no cases of foot-and-mouth disease occurred, a situation

which was very unlike that in earlier years. This was the result of the stringent health measures taken in the establishment, and on entry to the show, as well as the control of the vaccination of the animals at this point of origin. The same procedure was followed with the breeding animals which were sent in 1968 to the Seventh Agricultural Fair at Madrid, and there were again no problems.

The results of eight years of the campaign may be summarized as follows:

1. An organized campaign is under way and, according to the Seoane-Palacios Mission of the Organization of American States and the Pan American Health Organization, it is the best in South America.

2. An average of 170 million doses of trivalent (A, O, and C) officially controlled vaccines are produced each year in private laboratories (Figure 6). This amount will increase in 1969, when it will become compulsory to vaccinate sheep, of which there are more than 25 million head in the campaign area (north of the Colorado and Barrancas Rivers). The State does not produce vaccines but controls them, and issues permits for the sale of the vaccines it approves.

3. The incidence, attack rate, and case-death rate have been markedly reduced and, as a result, also the morbidity rate, in comparison with the years prior to 1960, when it was between 10 and 30 per cent.

	1963	1964	1965	1966	1967	1968
Attack rate	15.30	16.39	14	13.50	9.79	10.60
Case-death rate	1.36	0.88	0.72	0.039	0.22	0.045

4. The present epizootiological waves are not as serious and do not cause the same losses as in earlier years, since the defense created by vaccination in the animal makes for a rapid course of the disease and prevents complications.

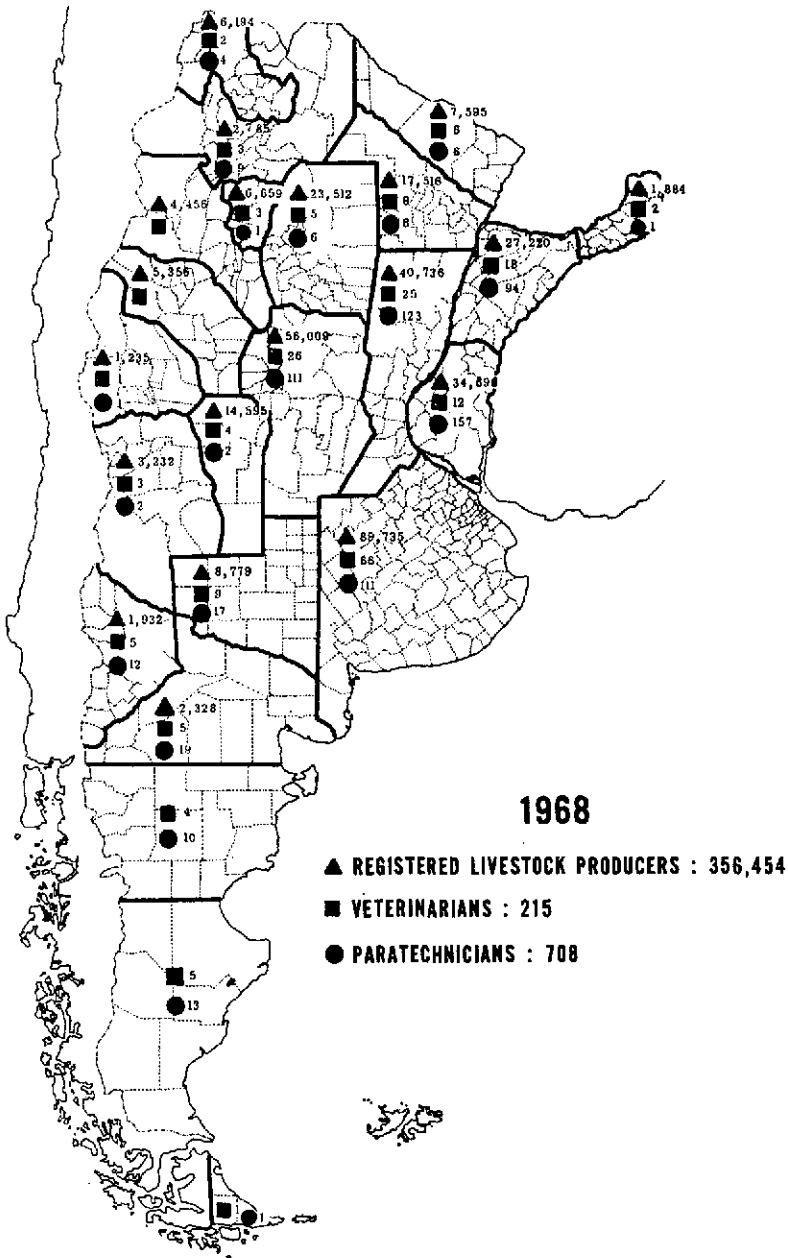


FIGURE 3—Distribution of Registered Livestock Producers, Veterinarians, and Paratechnicians, 1968, by Campaign Zones.

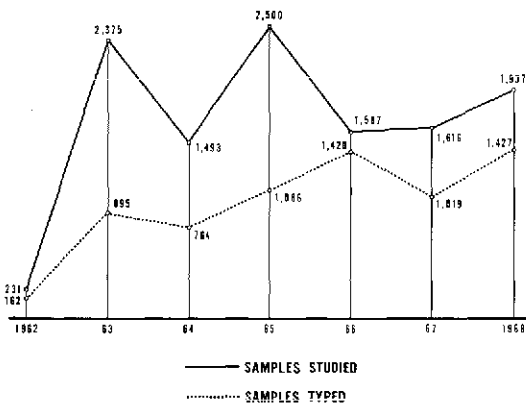


FIGURE 4—Number of Specimens Studied and Number Typed, 1968.

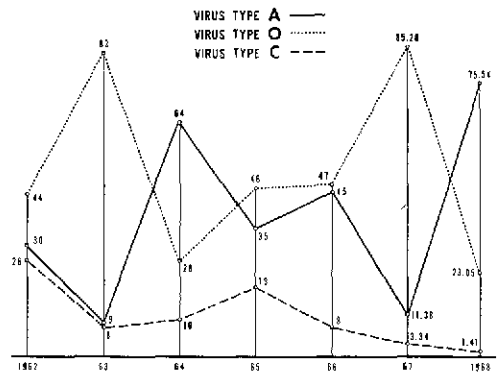
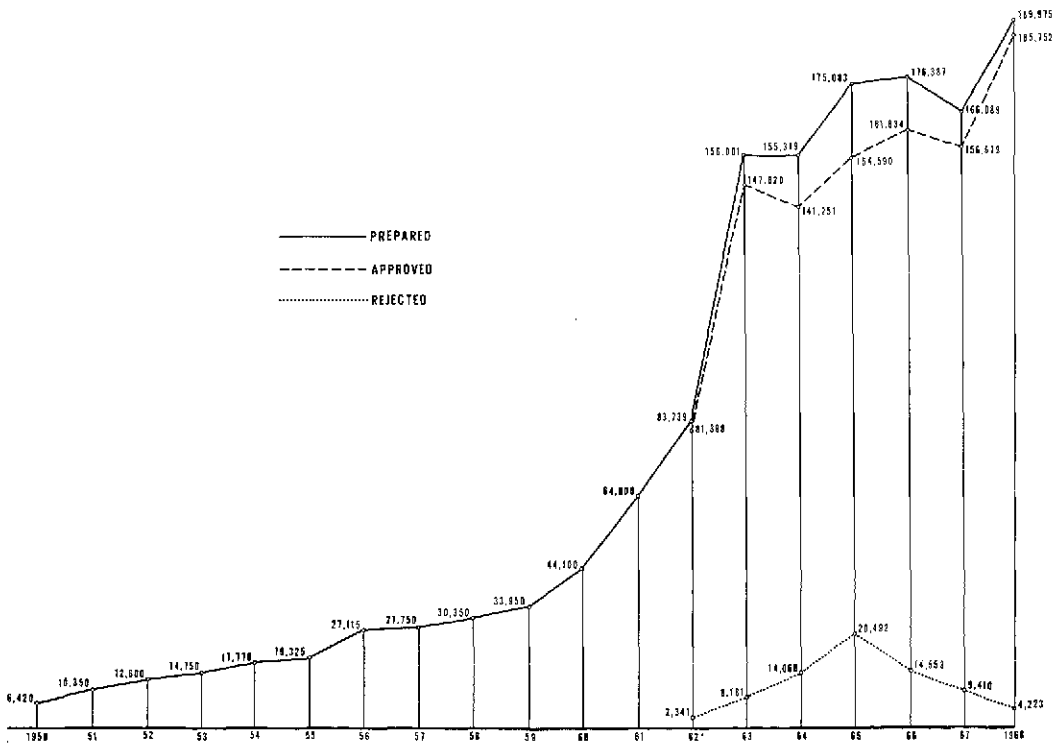


FIGURE 5—Percentage Distribution of Specimens Typed.



*SELSEA control began in 1962.

FIGURE 6—Production and Control of Foot-and-Mouth Disease Vaccine, 1950-1968. (Up to 1961, figures are derived from the anonymous production declaration from each producing laboratory; from 1962 onwards, from the tests made by the SELSEA Reference and Control Laboratory.)

5. If vaccination had not been undertaken, there would have been created in our country, because of its agricultural system and movement of livestock, a very serious situation which would have occasioned enormous losses had there been epizootics like those in Europe in 1965-1967. The percentage of vaccinated cattle in the campaign area exceeds 90 per cent of the cattle population, which represents good coverage.

6. Livestock owners are aware of the need for vaccination, and their support can be counted on because they are of the opinion that the outlook with respect to this disease has become more promising.

BENEFITS OF THE CAMPAIGN IN ARGENTINA

Argentina is a meat-producing country which is self-sufficient in its meat supply and exports its surplus. These exports are its most important source of foreign exchange. It exports not only meat but also cattle on the hoof, especially to adjacent countries. Hence the enormous importance of foot-and-mouth disease control activities, which as they become better known and appreciated by importing countries result in the opening up of new markets.

Because of the extent of its range lands and its system of livestock production, Argentina can offer the world, which needs animal protein, large amounts of beef and other meats at highly competitive prices.

The foot-and-mouth disease campaign is justified by the fact that the expenses it entails are far inferior to the economic losses caused by the disease.

An estimate of the damage and losses caused by the disease will give some idea of the benefits an organized massive and continuing campaign brings with it. In the following summary estimates are given both for financial damage and direct loss, and for annual costs and investments.

Estimate of the Financial Damage Directly Caused by the Disease in Cattle

This estimate, which is shown in detail in Table 1, is based on the incidence and costs in 1968.

Cattle population. This is based on the estimates made in June 1968 by the Department of Agricultural Economics of the Secretariat of State for Agriculture and Livestock Production from foot-and-mouth disease vaccination figures provided by SELSA: 51,465,000 head of cattle.

Distribution of cattle population. The averages, expressed as percentages, of the composition of the livestock in the Provinces of Buenos Aires, Córdoba, Corrientes, Entre Ríos, La Pampa, and Santa Fe, in relation to the estimated total and the age structure of the cattle population, are as follows:

	Per cent
<i>Up to 1 year of age</i>	
Calves	21
<i>From 1 to 2 years</i>	
Heifers, steers, and young bulls	27
<i>Over 2 years</i>	
Cows, bulls, oxen, and castrated bulls	52

Morbidity rate: The 1968 morbidity, 0.6 per cent, and two hypothetical rates of 1 per cent and 10 per cent are included in Table 1 for the sake of comparison, the values and costs being the same.

Mortality rate: The 1968 estimated rate 0.0013 per cent, and two rates of 0.002 and 0.02 per cent have been taken for the sake of comparison, for a morbidity of 1 per cent and 10 per cent, respectively, deduced from the case-death index for this disease. Unit value of each dead animal 20,000 pesos.

The following data are given in connection with each of the headings appearing in Table 1.

1. *Financial damage due to shortfall in meat production.* For these estimates the following values have been taken into consideration:

TABLE 1—Estimated Direct Economic Loss Caused by Foot-and-Mouth Disease in Cattle.

	Morbidity 0.6 %			Morbidity 1 %	Morbidity 10 %
	Sick animals	Kilos	Pesos	Pesos	Pesos
1. <i>Damage due to shortfall in meat production</i>					
In animals under 1 year	64,764	3,238,200	220,197,600	366,996,000	3,669,960,000
In animals from 1-2 years	83,268	6,245,100	393,441,300	655,735,500	6,557,355,000
In animals over 2 years	160,368	16,036,800	801,840,000	1,336,400,000	13,364,000,000
Total	308,400	25,520,100	1,415,478,900	2,359,131,500	23,591,315,000
2. <i>Damage due to shortfall in milk production</i>	Sick cows	Liters milk	Pesos	Pesos	Pesos
Decrease in milk production	12,960	1,994,000	29,121,120	48,535,200	485,352,000
Loss due to sterility in cows	518		2,590,000	4,320,000	43,200,000
Total			31,711,120	52,855,200	528,552,000
3. <i>Losses due to mortality</i>	Dead	Unit Value (pesos)	Pesos	Pesos	Pesos
	668	20,000	13,360,000	20,560,000	205,600,000
4. <i>Losses due to convalescence</i>	Sick Animals		Pesos	Pesos	Pesos
	308,400		185,040,000	308,400,000	3,084,000,000
Grand total			1,645,590,020	2,740,946,700	27,409,467,000

	% of total population	Morbidity	Short-fall in kilos	Live-stock value kilo (pesos)
Up to 1 year	21	(0.6) (1.0) (10)	50	68
From 1 to 2 years	27	" " "	75	63
Over 2 years	52	" " "	100	50

2. *Financial damage caused by shortfall in production of dairy cows.* For these estimates the following values have been taken into consideration:

Dairy population: 15% of the total population
Cows: 40% of the dairy population
Cows in production: 70% of the total

Losses in milk production: 50 liters per sick cow in production at 14.98 pesos per liter.

Sterility: 4 per cent of sick cows in production

Value of the animal as a dairy animal 30,000 pesos

Sold as meat (500 kilos) at 50 pesos a kilo 25,000 "
Difference (loss per animal) 5,000 "

3. *Loss due to mortality:* Calculated from the rates given above.

4. *Financial losses due to cost of convalescence.* These are calculated on the basis

of 60-75 days on pasture for convalescence (weight, production of milk). The estimated cost for this period is 600 pesos per animal (personnel, capital invested in facilities, value of the land, etc.); this is applied to the morbidity rate over the total population.

Estimated Annual Costs and Investments in 1968

These estimates are presented in Table 2, under the following headings:

Vaccine. The average price in that year was 22.40 pesos per dose, for three annual vaccination periods, 45 million head being covered in each.

Vaccination. The cost of administering it based on 2 farmworkers at 15,000 pesos per month, each vaccinating 300 animals per day (1,000 pesos for each 300 doses administered).

Investments made by SELSA in conduct-

ing the campaign. 61.3 per cent of the annual budget.

TABLE 2—Estimated Annual Costs and Investments (1968).

	Doses administered	Pesos
Cost of vaccines	135,000,000	3,024,000,000
Cost of vaccination		450,000,000
Investments made by SELSA		1,388,935,400
Total		4,862,935,400
Damage Prevented through the Conduct of a Control Campaign (in Argentine pesos)		
	Morbidity 0.6 %	Morbidity 10 %
Damage and losses	1,645,590,020	27,419,467,000
Costs and investments	4,862,935,400	—
Total	6,508,525,420	27,419,467,000

Difference: Losses and damage prevented: 20,910,941,580 pesos.

PROJECTIONS OF THE FOOT-AND-MOUTH DISEASE CAMPAIGN

In connection with the program for the improvement of animal health and the control of foot-and-mouth disease, the Republic of Argentina has submitted a request for a loan to the Inter-American Development Bank.

To improve the campaign, SELSA obtained a US\$10.5 million loan from IDB. It is intended for the following purposes:

1. Construction and equipment of physical facilities for the National Reference and Control Laboratory of SELSA.
2. Construction and equipment of quarantine stations, livestock movement control

posts, and car washes for cattle transport trucks.

3. Training of selected technical personnel.

4. Completion of the equipping of field work groups.

5. Technical assistance and training.

Research is carried out by the National Institute for Agricultural Technology (INTA), while the application of the results to control methods or means for putting them into practice is the responsibility of SELSA.

INTA has also requested a loan to enable it to enlarge its laboratory facilities and to undertake more research and experiments.

At this time SELSA is working with INTA on the preparation of a foot-and-mouth disease oil-adjuvant vaccine with the assistance of experts from the U.S. Department of Agriculture Laboratory at Plum Island, New York, the Pan American Foot-and-Mouth Disease Center, and the Joint Argentine-United States Commission.

On the Valdés Peninsula, animals will be vaccinated with the oil-adjuvant vaccine prepared by INTA and Plum Island and the virus will be challenged in the SELSA laboratory.

For these field trials 120 million pesos have been allotted by Ministerial Resolution 1548 of 9 December 1968.

The Valdés Peninsula is situated in an area free of foot-and-mouth disease. It is connected to the mainland by a narrow isthmus five miles wide at its broadest part and thus satisfies the isolation requirements for this type of trial.

FOOT-AND-MOUTH DISEASE CAMPAIGN IN BRAZIL: RESULTS AND BENEFITS

DR. JOSÉ FREIRE DE FARIA*

The campaign against foot-and-mouth disease was launched in Brazil in August 1963, as a logical sequel to the valuable work carried on by Brazilian veterinarians, who with other competent technical workers and governmental authorities had been giving special attention to the impact of this virus disease on the national livestock industry for many years. The results obtained since that time are highly significant. They include, among others, a growing awareness among our stock breeders of the need to carry on a systematic campaign to control the disease.

Operations under the campaign were based on the principle of selecting areas or zones within priority regions, according to the relative importance of their livestock activities, for the obvious reason that we do not have available either the financial or manpower resources for simultaneous coverage of an entire region, much less for a nation-wide campaign, given the vast area of Brazil.

Once this criterion was adopted, members of the team responsible for directing the campaign devoted their entire efforts to activities that can be described as the establishment of the essential infrastructure on which to base anticipated operations. This effort occupied their time from August 1963 to December 1965. Special emphasis during this period was placed on installing and

equipping a network of laboratories to supplement production and ensure quality control of vaccines; providing general training and specialized courses for personnel engaged in the campaign; stimulating the private sector to increase commercial production of vaccines; and laying the groundwork for the various understandings and agreements with the states interested in introducing the campaign into their territories.

It is important to note that one of the results of these efforts in developing infrastructure can already be observed in the improved utilization of manpower, as reflected in the creation of new positions for veterinary and technical personnel and other auxiliary workers. This has been particularly noticeable in the private sector, which has been motivated by the importance of the work the Government is undertaking.

During the entire period, diplomatic notes were exchanged and agreements concluded with neighboring countries, looking toward multinational action in controlling a disease that is causing such serious losses to some of the countries in the Hemisphere. Special mention should be made of the bilateral agreement signed with Uruguay, a similar instrument about to be concluded with Paraguay, and another with Venezuela and Guyana, which will be concluded in the near future.

* Director General, Animal Production Section, Ministry of Agriculture, Brazil.

On a par with the results of laboratory and field work—all highly successful as is shown in the accompanying tables—the progress made after 1965, when the campaign became fully operational, has also made it possible for us to offer work-training opportunities in specialized Brazilian establishments to technical personnel from other countries. At the same time we were becoming equipped to export vaccines to the most demanding world markets, the countries of Europe, thanks to the continuing supervision and control of our vaccine-producing laboratories.

By 1967, on the basis of the progress achieved—and especially the prospects opened up by results we were beginning to obtain in Rio Grande do Sul (where the operational phase of the campaign had been initiated)—technical and financial plans were made to extend the campaign to cover the States of São Paulo, Paraná, Santa Catarina, and Rio Grande do Sul, comprising the entire southern region of the country. The project envisages eventual extension of the campaign to other areas, under an ambitious plan to be implemented in successive four-year periods, and to obtain complete country-wide coverage in 16 years.

The project, which will have financial aid from the Fund for Special Operations of the Inter-American Development Bank, will be revised on the basis of the preliminary examination being made by that institution. This study is now in its final phase, so that the instruments essential to its full implementation will soon be ready for signature.

Foot-and-mouth disease is a major factor inhibiting our exports of meat and live animals. The serious losses it causes include an estimated mortality of 6.5 per cent for bovine stock, loss of weight in meat production, severe decreases in milk production, and lowered fertility in those animals affected by the disease, which on an average

TABLE 1—Estimated Losses Caused by Foot-and-Mouth Disease: Cattle Deaths (1966-1968).

(In thousands of head)

Year	Estimated cattle population	Number infected ^a	Number of deaths ^b
1966	61,621	12,324	801
1967	62,669	12,534	815
1968	63,734	12,747	829

^a 20% of the total cattle population.

^b 6.5% of infected animals.

TABLE 2—Estimated Losses in Meat Production (1966-1968).^a

Year	Dry cows ^b (1,000 head)	Meat ^c (1,000 arrobas)	Steers ^d (1,000 head)	(1,000 arrobas) ^e		
				Meat ^c	Total carcass	Total losses ^f
1966	913	10,043	1,971	27,463	37,506	5,625
1967	928	10,208	2,005	27,936	38,144	5,721
1968	944	10,384	2,039	28,410	38,794	5,819

^a Calves slaughtered for meat are excluded from the computation since there are no reliable indices on the percentage of this category to the total slaughter.

^b Studies made by the Ministry of Agriculture estimated this category at 19.5% of all cows. They are animals that are no longer of breeding age and are hence slaughtered for meat.

^c Average weight of carcasses: steer, 209 kg; cow, 165 kg.

^d 16% of the infected animals (indices from SEP).

^e Arroba = Approximately 11.5 kg.

^f 15%.

TABLE 3—Estimated Losses in Milk Production (1966-1968).

Year	(In 1,000 head)		(In millions of liters)	
	Estimated no. of cows ^a	Milking cows ^b	Milk production ^c	Losses ^d
1966	4,683	1,278	920	138
1967	4,763	1,300	936	140
1968	4,844	1,322	952	143

^a 38% of the infected animals (indices from SEP).

^b Studies sponsored by the Ministry of Agriculture estimated this category at 27.3% of total cows.

^c An average of 3 liters of milk per cow/per day was assumed and the average period of milk production at 8 months for an average of 720 liters per cow/per year.

^d 15% of total production, according to studies made by the Pan American Foot-and-Mouth Disease Center.

TABLE 4—Estimated Losses Caused by Foot-and-Mouth Disease: Summary (1966-1968).

Year	Deaths (1,000 head)	Losses in meat (1,000 arrobas)	Losses in Milk (millions of liters)
1966	801	5,625	133
1967	815	5,721	140
1968	829	5,819	143

TABLE 5—Financial Losses Caused by Foot-and-Mouth Disease (1966-1968).^a

(in thousands of new cruzeiros)

Year	Losses			Total
	Deaths	In meat	In milk	
1966	150,588	101,250	27,600	279,438
1967	153,220	102,978	28,000	284,198
1968	155,852	104,742	28,600	289,194

^a The following prices were used as a base:

Meat, per arroba	18.00 new cruzeiros.
Liter of milk	0.20 " "
Average price of animal . .	188.00 " "

TABLE 6—Rio Grande do Sul (1966-1968): Estimated Benefits Obtained by Eliminating Losses (Morbidity).

(in head of cattle)

Year	Cattle vaccinated	Morbidity		Losses eliminated
		Without campaign (estimate) ^a	With campaign ^b	
1966	3,399,824	679,964	160,506	519,458
1967	6,446,575	1,289,303	8,615	1,280,688
1968	8,288,303	1,657,660	20,873	1,636,787

^a 20% of total population.^b Actual figures from epizootiologists' reports.

TABLE 7—Rio Grande do Sul (1966-1968): Estimated Benefits Obtained by Eliminating Losses (Deaths).

Year	Cattle vaccinated	Deaths		Losses eliminated
		Without campaign (estimate) ^a	With campaign ^b	
1966	3,399,824	44,197	2,649	41,548
1967	6,446,525	107,748	95	107,653

^a 6.5% of infected cattle.^b Actual figures from epizootiologists' reports.

Note: It may be observed from the above that since the beginning of the campaign in Rio Grande do Sul the death of approximately 232,000 animals has been prevented, and 3.5 millions have failed to contract the disease.

TABLE 8—Rio Grande do Sul (1966-1968): Area Covered by Campaign.

Animals	1966	1967	1968
Vaccinated	3,399,824	6,446,575	8,288,303
Infected	160,506 (4.72%)	8,615 (0.13%)	20,873 (0.25%)
Deaths	2,649 (1.65%)	93 (1.08%)	95 (0.46%)

Note: Morbidity and mortality indices, which we have seen to be approximately 20 and 6.5 per cent, respectively, for the total cattle population in Brazil, dropped to the percentages shown in the table, in the area where the campaign was fully operative.

attacks 20 per cent of the cattle. It can easily be seen that the first direct benefits obtained from control of the disease in Brazil—and these will inevitably increase as the campaign develops—will be an increase in the flow of exports of meat, meat products, and live animals, which will result both from control of the disease itself and from the general improvement its elimination will bring to the entire livestock sector.

It is generally recognized that foot-and-mouth disease is not the only factor responsible for the low productivity of our herds, but there should be no doubt that any improvement in Brazil's position in the present world market for meat, meat products, and live animals depends primarily on our success in maintaining effective control of this serious virus disease.

Tables 1-8 covering the three-year period 1966-1968 give in full detail the quantitative picture of the problem in Brazil, showing both direct losses attributable to the disease and the important savings already obtained by the campaign. The evaluation is based on the work done in the State of Rio Grande do Sul, where for a number of reasons it was feasible to direct our major attention.

One additional fact merits mention: production and marketing of officially controlled specific vaccines amounted to slightly over 80 million doses in 1968. Only a part of this output was utilized over this same period to vaccinate approximately 12 million animals in the areas where the campaign was in effect, or where its influence extended. It is clear that a considerably larger number of animals, not included in the official tabulation, must have been vaccinated in other areas of the country, to utilize the remaining doses. It must be assumed that no livestock farmer would acquire the vaccine for any other purpose than its prompt utilization.

FOOT-AND-MOUTH DISEASE CAMPAIGN IN VENEZUELA: RESULTS, BENEFITS, AND PROSPECTS

DR. MIGUEL VILLEGAS DELGADO *

The pressing need in all countries of Latin America to achieve an efficient level of agricultural development at the earliest possible moment is clear to all. In Venezuela, as in most of the southern part of the Continent and, indeed, in all developing areas of the world, we are exerting every effort to step up our production of animal protein and to bring it into line with the continuing increase in population.

We consider that, in our own case, impressive progress has been made in meat, milk, and egg production, to mention only the major items of food. We have supplied ourselves with the necessary guides to measure the cost of protein production, and we are also aware of the nutritional deficiencies affecting our human population.

World protein production figures, expressed in kilograms per hectare, compared to similar figures for Venezuela show us that we are obtaining a very low yield in natural proteins from our agricultural and livestock activities. When we add to this the losses caused by animal diseases, in terms of both the monetary losses and the loss of protein-tons available to feed our population, it is not difficult to understand why the Pan American Health Organization continues to be gravely concerned, as we have already had occasion to recognize at

the I Inter-American Meeting on Foot-and-Mouth Disease and Zoonoses Control, in Washington in April 1968.

It is my purpose to present at this time some observations on the foot-and-mouth disease problem in Venezuela, but first I shall give a brief account of the situation in my country as regards the relation of animal-protein production to the continuing population increase.

LIVESTOCK DEVELOPMENT IN RELATION TO POPULATION INCREASE

If we compare the figures on population increase with those on protein production related to the development of livestock resources, we see that, instead of decreasing, the enormous imbalance is continuing to increase.

The population of Venezuela is increasing at an annual rate of 3.5 per cent. In 1961 the total was 7,612,327 and in 1968 it had reached 9,686,486 inhabitants.

As to the rate of growth in the cattle population (Table 1), it is evident that this rate is running about 2.20 per cent less than that of the human population, thus bringing out with impressive clarity the urgency and absolute necessity of increasing our livestock production so as to prevent any further widening of the gap between supply and demand, and helping by this means of

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TABLE 1—Cattle Population in Venezuela.

Year	No. of head	Rate of increase (%)
1961	6,440,708	—
1962	6,502,237	0.95
1963	6,571,885	1.07
1964	6,649,501	1.18
1965	6,734,782	1.28
1966	6,822,334	1.30
1967	6,911,024	1.29
1968 ^a	8,984,331	1.30
1969 ^b	11,679,630	1.30

^a The total cattle population for 1968 was estimated on the basis of the actual rate of increase, 1.30%, in 1967. The same procedure was used in the estimate for 1969, in which year the rate of growth is expected to be higher and accordingly there will be a higher figure for 1970.

horizontal development to reduce the problem.

We are aware that there are other courses to be followed and we are working along other lines such as genetic improvement of our livestock resources, improved nutrition, and changes in old animal husbandry practices through the introduction of new techniques to (a) facilitate management of herds with increased productivity, (b) increase yield per animal, and (3) provide preventive health and medical campaigns of maximum efficiency.

Through all of these means it will be possible to place our livestock sector on a sound basis at a higher level of productivity that will make it possible to attain a rational ratio to population growth. This objective is essential to the over-all economic development which Venezuela hopes to achieve and which, in turn, demands an adequate supply of wholesome, nutritious foodstuffs.

I am optimistic about the progress we will achieve along these lines. However, I have attempted to point out the facts of our present situation in the livestock sector, in the interests of a fuller understanding of the need we now face to control cattle diseases, with particular attention to foot-and-

mouth disease, for two very basic reasons:

1. The disease can be eradicated. This has been demonstrated in a number of our Sister Republics, specifically, the United States of America, Mexico, and Canada.

2. Its eradication will put an end to enormous losses in money and in protein yield that the endemic infection of this animal disease causes to the economy and the nutrition of our people.

ECONOMIC ASPECTS OF FOOT- AND-MOUTH DISEASE

When I had the honor of participating, as a consultant to the Pan American Foot-and-Mouth Disease Center, in the XVI Training Course held in Bogotá, Colombia, in November 1961, I presented my first paper on the economic impact of foot-and-mouth disease ("Characteristics and Economic Consequences of Foot-and-Mouth Disease with Special Reference to Venezuela").*

I emphasized on that occasion the fact that this is an insidious disease, the importance of which lies not so much in the deaths it produces but in the speed with which it is disseminated and the high rate of infection, resulting in great debility in the affected animals and substantial losses in milk production; the long period of recuperation required, with the high incidence of secondary complications, abortions, sterility, chronic mastitis and no less chronic lameness, loss of weight that is often irremediable, and other lamentable sequelae caused by bacterial or fungus infections.

Moreover, after the disease has been enzootic for several years it is practically impossible to estimate what state the livestock would have been in had the disease

* *Revista Veterinaria Venezolana*, Vol. XII, No. 67:96-109 (February 1962).

not existed, or what progress could have been made in increasing the quality and quantity of production.

With specific reference to Venezuela, I mentioned the statement of the Ministry of Agriculture and Livestock Production, when reporting the appearance of the disease in 1950, that 48,788 infected animals had been detected at that time, with 1,878 deaths, or a mortality of 3.85 per cent. These figures were based on data compiled for the central region only, and covered a period of five months. In the Apure plains, however, the outbreak assumed uncontrollable characteristics.

In 1953, a report made by Dr. Armando Gámez, President of the Foot-and-Mouth Disease Institute, indicated that the "foot-and-mouth disease epizootic affected animals on 800 stock farms, principally attacking the calf crop, around 60 per cent of which was destroyed."

On the "Los Cristales" farm (Barquisimeto, Lara State), one of the first establishments in which the disease was detected, in May 1950, 60 cows and 140 calves died in the first weeks. Milk production dropped from 2,000 liters per day to around 300 liters, and it was two years before the production level was recovered. It was necessary to dispose of 200 cows for slaughter, at reduced prices. The loss was estimated at 800,000 bolivars.

Dr. Galloway's report on his visit to Venezuela gave some unusually interesting data, compiled by Dr. Claudio Muskus, on the Maracay region (Aragua State). Deaths were around 5 per cent, with about the same mortality in pure-bred animals as in native stock; 50 per cent of the cows developed mastitis; milk production in the period of acute infection dropped 80 to 100 per cent. The Maracay pasteurizing plant, normally receiving 50,000 liters of milk daily, was

not receiving more than 35,000 to 39,000, after a number of months.

Drs. Divo, Palacios, and Lugo—in the bulletin of the Institute of Veterinary Research, December 1950—reported that the disease had affected virtually 100 per cent of the animals, that milk production had fallen off by 60 per cent, and that there had been severe mortality in calves.

A report by Ruiz Martínez to the International Office of Epizootics observed that morbidity over the period November 1950 to November 1951 rose as high as 48 per cent of the animals in the infected zone, and that in 1952 it ranged from 70 to 90 per cent in five states, while at the same time it had been reduced to zero in two states. Mortality over this same period had been reduced to 0.26 per cent.

Between July 1950 and July 1953 (approximately three years), in the first phase of the foot-and-mouth disease outbreak in Venezuela, initial losses must have been as high as 210 million bolivars. The investment over the same period in setting up laboratories, vaccine production, vehicles, equipment, and personnel would have to be added to this figure, so that the total losses would have to be put at around 225 million bolivars.

In the nine years after 1953, expenditures, in particular, and losses, to a certain degree, were stabilized, and amounted to some 82 million bolivars in that period, including both losses attributable to the disease and the cost of combating it.

If, however, we estimate the losses that would have occurred, assuming that the foot-and-mouth disease campaign had been suspended and that there had been a 30 per cent morbidity, we would arrive at the figures shown in Tables 2 and 3.

If we compare the figures on the yield per carcass for the years preceding and following the appearance of foot-and-mouth

TABLE 2—Deaths (2% of infected animals).

Animals	Infected ^a	Deaths	Value in bolivars ^b
Cows	799,019	15,980	9,588,000
Calves	348,302	6,966	1,393,200
Young stock under 2 years	432,917	8,658	2,597,400
Young stock, 2 years and over	237,870	4,757	3,805,600
Bulls	52,752	1,055	1,582,500
Total	1,870,860	37,416	18,966,700

^a Estimated from livestock population in 1954.

^b Average prices: cows, 600 bolivars; calves, 200 bolivars; yearling stock, 300 bolivars; young stock (2 years and over) and young bulls, 800 bolivars; bulls, 1,500 bolivars. (Conversion at the rate 4.50 bolivars = US\$1.)

disease, we can see the impact of the disease in reducing the average yield by 21.3 kg. Recovery of the average yield of 1950 required nearly 10 years and was accomplished only at cost of great effort and expense.

Milk

Following the practices of the Milk Registry and Development Division of the Ministry in calculating milk production, we divided the territory of Venezuela into zones that are considered to be similar in terms of percentages of lactating animals and average milk production. All cows of breeding age were included, the production figures for milch cows in each region were compared with figures given here, and an acceptable correlation was obtained.

TABLE 3—Losses in Meat.

Annual slaughter (No. of head) ^a	No. of animals infected	Losses	
		Kg of live wt.	Bolivars
701,481	210,444	7,365,540	11,784,864

^a Slaughterhouse production in the country, 1960. Source: Ministry of Agriculture and Livestock Production.

^b Estimated on the basis of an average of 35 kg live weight lost for each infected animal, at 1.60 bolivars per kg live weight.

The detailed data, by zone, are given in Table 4. Total milk losses by regions are shown in Table 5, and the summary of estimated losses is given in Table 6.

The figures given for cattle population and prices in Venezuela are those applicable to the period studied. Today the losses would certainly be augmented by at least 25 per cent. Therefore, we can calculate that for the period studied the current value of the losses would be at least 53,075,780 bolivars (US\$11,588,055) yearly.

Fortunately these figures are merely hypothetical inasmuch as the assumption that the disease had been allowed to run its course was not the case. Rather we gave it our maximum attention, and are continuing to do so. However, these figures lead us to recognize how valuable our efforts have been, since we have been able to keep the disease under control and have thereby succeeded in preventing these tremendous losses which—I emphasize the point—refer only to bovine stock and do not include figures for losses that would have been obtained had we included swine and small ruminants, or the invisible and indirect losses.

I conclude these observations on the economic impact of foot-and-mouth disease with the following summary of our experiences in Venezuela.

Over the nine-year period 1951–1960 the cost of foot-and-mouth disease campaigns in Venezuela amounted to approximately 55 million bolivars, which made it possible for us to keep the direct losses over this same period to 27 million bolivars. Had we not made the required investment for these campaigns, losses for the same period would have run as high as 382,145,616 bolivars. Accordingly, we can affirm most emphatically that foot-and-mouth disease campaigns in the period cited made possible a savings of around 355 million bolivars to

TABLE 4—Milk Production, according to Different Zones of the Country.

Zone	Milking cows %	Total cows of breeding age	Infected	Started milking	Eliminated by mastitis		Loss		Annual milk prod. in 365 days campaign (liters)	Average per cow per day (liters)
					No. and %	Equivalent in liters	Liters and %	Total		
Western (Zulia)	60	301,568	90,470 (30%)	54,282 (60%)	2,714 (5)	2,371,830	75 per cow (95%)	51,568	3,867,600	3
Middle-Western (Lara, Falcón)	60	174,051	52,215 (30%)	31,329 (60%)	1,566 (5)	1,428,975	75 per cow (95%)	29,762	1,860,188	3.5
Central (Yaracuy, Carabobo, Aragua, Miranda, Fed. Dist.)	65	124,900	37,470 (30%)	24,356 (65%)	1,218 (5)	1,556,604	87.5 per cow (95%)	23,138	2,024,575	2
Eastern (Nueva Esparta, Sucre)	50	17,730	5,319 (30%)	2,660 (50%)	133 (5)	97,090	50 per cow (95%)	2,527	126,350	2
Los Andes (Táchira, Mérida, Trujillo)	50	209,210	62,763 (30%)	31,382 (50%)	1,569 (5)	859,028	37.5 per cow (95%)	29,813	1,117,988	1.5
Los Llanos (Apure, Barinas, Guárico, Portuguesa, Cojedes, Anzoátegui, Monagas, Bolívar, Fed. Territorios)	40	1,834,960	550,488 (30%)	220,195 (40%)	11,010 (5)	4,018,659	37.5 per cow (95%)	209,185	5,229,625	365

TABLE 5—Total Milk Losses by Region.

Zone	Liters	Bolivars	Bolivars/ liter
Western	6,839,430	2,735,772	0.40
Middle-			
Western	3,289,163	1,644,581	0.50
Central	3,581,179	2,506,825	0.70
Eastern	223,440	134,064	0.60
Los Andes	1,977,016	988,508	0.50
Los Llanos	9,248,275	3,699,310	0.40
Total	25,158,503	11,709,060	

our livestock industry, our food supply, and the public treasury.

At the same time the work related to the foot-and-mouth disease campaign has been of incalculable value in improving herd management practices in many zones of the country. Campaign immunization activities, especially in areas of the most intensive operations, have served as an educational tool not only with regard to the disease itself but also with regard to other animal health problems and the introduction of improved management techniques.

There is another and extremely valuable return: the campaign against the disease has had a positive impact on members of the veterinary profession in general, and the important achievements in research and field work that have resulted from their efforts constitute one of the greatest gains to the profession.

It may be inferred from the foregoing that it is bad business to live with foot-and-mouth disease, for a number of valid reasons:

- a. It causes enormous direct losses.

TABLE 6—Summary of Estimated Losses.

Cause	Bolivars	US\$ *
Deaths	18,966,700	4,141,203
Meat	11,784,864	2,572,678
Milk	11,709,060	2,556,563
Total	42,460,624	9,270,444

* Conversion made at the rate of 4.50 bolivars = US\$1.

- b. It poses difficulties to the domestic market and restricts foreign trade in livestock, apart from the other indirect losses attributable to countless imponderable factors.

- c. The presence of the disease inhibits development of programs designed to improve herd productivity.

- d. It reduces fertility and productivity of the herds, with the resultant increase in production costs.

- e. It has serious economic repercussions in stockraising areas where growers have small, if any, profits, thus reducing the possibility of maintaining adequate wage levels for rural workers and weakening the livestock sector, which in turn leads to abandonment of the industry and exodus from the area. It ultimately contributes to a reduction in food supplies available to the consuming public.

WORK IN PROGRESS IN VENEZUELA

The fight against foot-and-mouth disease in Venezuela has been carried on without interruption since the disease first appeared in 1950, based on systematic, obligatory, and free immunization and on control of internal movement and importation of animals.

We have made numerous reports on the characteristics, development, and evolution of the campaign in Venezuela in papers presented at meetings sponsored by the Pan American Foot-and-Mouth Disease Center, the Pan American Sanitary Bureau, the International Office of Epizootics, and at numerous hemispheric and world-wide congresses of veterinarians.

In the conviction that new approaches must be found to control the disease, we have been carrying on studies, in close cooperation with the Pan American Foot-and-Mouth Disease Center, on preparation

of new forms of vaccines to provide more effective and lasting immunity. Up to the present time this has led us to utilize modified live virus vaccines, which are being employed on a large scale for the causal viruses O and A, and the strains in use are showing an unusual capacity to cover various causal subtypes.

Multiple studies at the field and laboratory level have been made and are continuing, in close cooperation with the Center, to improve this type of vaccine and to learn more about its characteristics. Along these lines, plans are now being made to study the protection afforded to young animals by modified live virus vaccines, in terms of the timing and number of doses. This important study will give us a definitive criterion on the most effective vaccination schedules.

We may also note that the volume of bivalent type "A" and "O" vaccines administered in the past year (1968) totaled 6,369,200 doses, thereby increasing the cumulative figure for the campaign, through December 1968, to 145,667,020.

Our current budget for the foot-and-mouth disease campaign is approximately 9,382,233 bolivars (US\$2,084,940) and we have around 80 veterinarians and some 400 vaccinators working in the campaign, on either a full-time or a part-time basis.

QUARANTINE STATION

The Quarantine Station, located on the west coast, has proved to be one of the most important practical achievements in efforts to solve the problem of imported foot-and-mouth disease virus, either of strains already present or those totally foreign to Venezuela, while at the same time it makes it possible to allow the entry of the essential genetic material for the improvement of our herds. The station was inaugurated in February 1968, and is designed to handle 140

head of cattle, with all necessary installations to enforce an effective quarantine. It should be pointed out, however, that this process is not limited to observation of the cattle and of susceptible animals that might be used as contact detectors; in cooperation with the Pan American Foot-and-Mouth Disease Center and the Brazilian Government, systematic procedures have been carried on for the detection of carriers by testing for the presence of foot-and-mouth disease virus in the esophagopharyngeal material. These tests are initiated at the time of the prequarantine examination in the country of origin and are repeated in our station, until a total of six tests have been made for each animal, over a total period of approximately seven months.

The results of these experiments, of extraordinary interest in increasing knowledge of the epizootiology of the disease, will shortly be released in a joint study to be published by the Pan American Foot-and-Mouth Disease Center, inasmuch as the honor of presenting it belongs, in all justice, to that institution. I should only like to add that, thanks to these studies, the value of these tests has been amply demonstrated. Without them, the type C virus of foot-and-mouth disease, hitherto non-existent in Venezuela, might have entered the country. The use of these techniques opens new directions and possibilities for the exchange of livestock among our countries, with all of the benefits this affords.

We are following the work being done in the Quarantine Station with particular interest because it is minimizing risks of animal diseases and because, at the same time, it permits importation of one of the essential tools in our stock improvement programs with a reasonable margin of safety. Although it is difficult to evaluate these benefits at the moment, it is unnecessary to emphasize their obvious importance.

FOOT-AND-MOUTH DISEASE: ERADICATION AND PREVENTIVE MEASURES IN CANADA

DR. KENNETH F. WELLS *

While we, in Canada, cannot speak from vast experience in terms of our foot-and-mouth disease problems, I am pleased to discuss with you our 1952 outbreak and the precautions we take against the introduction of this and other serious exotic diseases into the country.

Foot-and-mouth disease first appeared in Canada in 1870; it was introduced by imported cattle and spread to a number of herds in the Provinces of Quebec and Ontario. According to scant records, the outbreak was self-limiting as a result of the curtailment of the movement of cattle during the winter season.

Again, in 1875, the disease appeared near Toronto, Ontario, in imported sheep and in this case was eradicated by slaughter methods. In 1884 an outbreak occurred in imported cattle in the Levis Quarantine Station, but fortunately the disease was promptly diagnosed and the entire shipment slaughtered. The disease did not spread beyond the station. From that date until 1952, Canada had been free of foot-and-mouth disease.

Prior to 1952, Canada was conscious of the dangers and possibilities of the introduction of foot-and-mouth disease, but our preventive measures dealt primarily with livestock and commercial shipments of live-

stock products, such as hides and wool, along with meat, meat products, and products of the soil capable of carrying the infective agent, such as hay, straw, and animal feeds.

I presume this lack of a realistic approach was due, in part, to our remoteness from the European areas of serious infection and the long sea voyage from Europe. This picture began to change significantly after the War, with the advent of regular Atlantic air travel, heavy immigration, and a more accurate knowledge of European foot-and-mouth disease conditions.

The first formal animal quarantine procedures were developed in 1876 with the establishment of a quarantine station on the south shore of the St. Lawrence River, opposite Quebec City. Control of imported goods at ports of entry commenced with the assignment of port veterinary officers at our eastern seaboard ports of Halifax, Nova Scotia, and Saint John, New Brunswick, in 1919. Primarily, these officers dealt with commercial shipments of the items discussed above.

As was indicated previously, the approach to preventive measures against the introduction of serious exotic diseases in the early postwar years was in the process of change and, of course, the intensification of the change was brought about quickly by the 1952 outbreak of foot-and-mouth disease.

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These changes will be discussed later, but before examining in detail the foot-and-mouth outbreak and its control, may I briefly set the scene with respect to contagious diseases control in Canada.

Parliamentary authority for the control of contagious diseases of animals is embodied in the "Canada Animal Contagious Diseases Act." This Act, being a federal statute, provides for federal or national control of serious animal diseases and the necessary measures to prevent their introduction. The Act is administered by the Health of Animals Branch of the Canadian Department of Agriculture. That Branch, which is basically the veterinary agency of the Government of Canada, has federal responsibility in animal contagious diseases control, meat inspection, humane slaughter of food animals, animal disease research and diagnosis, import inspection, and export certification of all livestock and livestock products.

The Branch, with headquarters in Ottawa, is divided into three divisions: Contagious Diseases, Meat Inspection, and Animal Pathology. For veterinary administration purposes, the country is divided into seven districts, with a senior district veterinary officer in charge of each and responsible to the Divisional Directors in Ottawa. Each district is divided into subdistricts, each of which has a veterinary officer responsible to a district veterinary officer. There are 135 of these subdistricts.

In the Meat Inspection Division, each registered packing plant operating under inspection has a resident veterinary officer in charge, who is responsible to a district veterinary officer.

In the Animal Pathology Division there are, in addition to the main laboratory at Hull, Quebec, eight Branch laboratories across Canada. Each has an officer in

charge who is responsible to the Director of the Animal Pathology Division.

All three Divisional Directors are responsible to the Veterinary Director General, who in turn is responsible for Branch operations to the Deputy Minister of Agriculture. Thus, all federal veterinary responsibilities are brought together in one organization.

In our view, the success of all regulatory veterinary responsibilities, which are interdependent, requires full cooperation, co-ordination, and mutual understanding. This can only be achieved if all functions come together under one veterinary agency.

Foot-and-mouth disease was officially diagnosed in the area of Regina, Saskatchewan. Regina is located in the center of our grain-growing area, 2,000 miles from the seaboard. The country was declared infected on 25 February 1952.

Official diagnosis had been delayed by two attempts at field differential diagnosis. The belief at that time was that suspected foot-and-mouth material should not be sent to a laboratory for fear of infecting new areas. Therefore, differential diagnosis—that is, inoculation in the tongue of horses, cattle, and swine, of the suspected foot-and-mouth material—took place in the Regina area.

These field diagnostic trials were inconclusive and finally, on 18 February, suspected foot-and-mouth material was forwarded by air to the Animal Diseases Research Institute at Hull, Quebec, where the official diagnosis was established on 25 February 1952.

While we, in Canada, were virtually without experience in foot-and-mouth disease control, we had eradicated many outbreaks of hog cholera by the slaughter method over a period of 40 years, and we were therefore well acquainted with the principles and organization of dealing with a slaughter program.

On 25 February, when the disease was officially diagnosed, there were 32 premises under quarantine, 26 of which were infected and six considered as contact premises. Despite sub-zero weather, with temperatures often down to -30°F , and with $5\frac{1}{2}$ feet of frost or frozen earth, heavy digging equipment was moved in and within 17 days all livestock on the initial 32 premises (more than 400 animals) were destroyed and buried.

Investigating crews worked steadily, examining all livestock in the district. Following a five-week period during which no new infection appeared, another group of infected premises was uncovered. This second and last group comprised three infected and seven contact farms. All livestock in this group of premises were destroyed and buried by 4 May, that is, 70 days after the official diagnosis.

It is of interest to note that the apparent virulence of the infection was considerably greater in the latter group than in the initially infected premises.

Investigation proved that the infection had been carried to the second group of premises by the purchase of a quarter of beef from one of the infected premises. The purchaser had kept the quarter of beef frozen and when the weather became too warm, and he was unable to keep it frozen solid any longer, the remaining meat was stripped off the bone and cooked, the bone being thrown out for the dogs. The dogs carried the bone down to the stables, where the swine got hold of it. The swine were the first to come down with the disease, and then spread it to the other livestock.

A total of 42 premises were involved in the outbreak, 29 of which were infected and 13 were contact premises. The livestock destroyed included 1,343 cattle, 294 swine, 97 sheep, and 2,142 poultry. The poultry were destroyed in order to eliminate the

danger of moving eggs from infected and contact premises.

The quarantine measures to prevent the spread of the disease were of three classes. The first and most rigid was the individual quarantine on infected and contact premises. This quarantine prohibited the removal of anything from the infected or contact premises. While the cooperation of all owners was excellent, guards were placed at these premises in order that no one would accidentally enter or leave until the first rough cleaning and disinfection had been completed.

The second type was a general quarantine imposed on 21 contiguous rural municipalities in the Province of Saskatchewan. All of the infected and contact premises were within these 21 rural municipalities, which comprised what was known as the quarantine area.

In the quarantine area, movements of all livestock and livestock products were prohibited without a permit first being obtained from the Health of Animals Branch office, and the issuance of permits was strictly controlled. This quarantine also prohibited the bringing in of meat or livestock into the area. Two large packing plants in the area were closed by quarantine until they had been completely emptied of all meats which may have been infected. All these meats were destroyed by deep burial. In order to supply meat for the quarantine area, small slaughter houses were set up in the country and these were kept under strict veterinary supervision. All animals brought to them were first examined on the home premises with veterinary post mortem being conducted at the time of slaughter. This system provided an outlet for some of the swine and other livestock within the quarantine area and prevented the accumulation of surplus stock of meats within the area

which would subsequently have had to be dealt with when the quarantines were lifted.

The third class of quarantine was imposed on 41 rural municipalities surrounding the infected or quarantined area. This area was known as the buffer zone. Movement of livestock and livestock products, with the exception of livestock for slaughter, was prohibited without a permit. Of course, livestock and livestock products were not permitted in or out of this area.

These three types of quarantines, while entailing a vast amount of administrative work, provided a gradual de-control system from the most strict quarantine on the infected and contact premises down to a semiquarantine in the buffer zone. The particular value here was that wherever a quarantine line is drawn, there are bound to be small leakholes which are difficult to close and if, instead of just having one line, there are three lines coming into gradual de-control the possibility of the disease getting away is much less.

While the quarantines were imposed under the authority of the Animal Contagious Diseases Act, their enforcement and policing was handled by officers of the Royal Canadian Mounted Police. It should also be mentioned that the actual destruction or shooting of the infected animals was handled by officers of the Mounted Police.

Frequent inspections of all livestock in the area were carried out in order to uncover any unreported infection. Veterinarians operating in the program, approximately 70 in number, were divided into three main groups, the largest group carrying on farm-to-farm inspections. If any members of this group found anything that was not normal they immediately reported it and one of the investigating group, which was considerably less in number, went out and conducted a thorough investigation of the premises. If the investigator was of the

opinion that there was any possible chance of the condition being foot-and-mouth disease, the diagnostician then took over and his say in the matter was final. Fortunately, the outbreak did not become extensive and we were able to get along with one senior diagnostician. All personnel were, of course, equipped with complete rubber clothing, which was washed with 2 per cent sodium carbonate solution before and after visits to all premises.

Following destruction of all infected livestock on the infected and contact premises, a thorough cleaning and disinfection was carried out. The only disinfectant used for the cleaning up of premises was 2 per cent sodium hydroxide solution. Where it was obviously more economical to destroy the buildings in order to render the premises safe, rather than cleaning and disinfecting them, they were burned. All wooden floors were removed from infected and contact premises and burned.

Owners of infected and contact premises were compensated at full value for livestock destroyed. All buildings and lumber destroyed in the cleaning and disinfection program were paid for. All costs of cleaning and disinfection were borne by the Department of Agriculture and the work was done by a cleaning and disinfection crew hired and paid by the Department.

A central cleaning and disinfection center was set up in the city of Regina. All vehicles moving necessary livestock and livestock products within the quarantine area, in order to feed the population, were put through the cleaning and disinfection unit after each use. All hides produced in the area were disinfected in large cement vats built in Regina for this purpose.

Road blocks with power disinfection equipment were set up at all 17 highway outlets from the quarantine zone. The undercarriages and floors of all vehicles

leaving the zone were sprayed with 4 per cent sodium hydroxide solution.

Following cleaning and disinfection of all infected and contact premises, they were left vacant for a period of at least 30 days. Calves and young swine were then placed on these premises, which had been fenced in, using snow fences and steel posts. These test animals were maintained on the premises for 60 days. When none of the test animals came down with infection, it was assumed the premises were clean.

Fortunately, the adequate quarantine and rapid destruction and burial of infected cattle prevented the outbreak from becoming extensive and, as stated earlier, only 42 premises were involved, 29 of which were infected and 13 contact. The area quarantined for the control measures was approximately 6,480 square land miles—which in comparison to 239,975 square land miles in the Province of Saskatchewan, and approximately 4,000,000 in all of Canada, was certainly a small proportion of the country.

One phase of the project which received little publicity, and yet was of great help in controlling the outbreak, was the price support measures instituted by the Department of Agriculture in the quarantine area. It is obvious that in such a small quarantined area where meats or livestock are in surplus, supply prices could be driven down to where the farmers would get a very low return for their animals. This might encourage owners to bootleg their livestock out of the area. In order to overcome this danger, the Department instituted price support in the area. All livestock were paid for on a graded basis, with livestock officers of the Department doing the grading. Each owner was therefore assured adequate return for his livestock. Veterinarians generally do not look upon this phase of the work as part of their responsibility but, nevertheless, if diseases are to be controlled the economics of

the situation, insofar as the livestock owners involved are concerned, must be considered as part of the responsibility.

On 19 August 1952, 175 days following the official declaration of foot-and-mouth infection on 25 February, Canada was declared free of the disease, and to date this declaration has been justified.

The virus involved was type A and was, to the best of our knowledge and belief, accidentally introduced by a farm worker immigrating to Canada. This immigrant, on the day of his arrival in Regina, started to work on the farm where the infection first commenced. By his own story, when he put on his overalls, which he had brought with him, he found a piece of dry sausage in the pocket. On tasting the sausage, he found it dry and stale as it had been in the overalls' pocket for over two weeks. He therefore threw the sausage in the pig trough. These pigs, according to the farm owner, were the first animals to get sick.

While this is not conclusive evidence, the circumstances are sufficiently conclusive to suggest this as the route of infection. This is supported by evidence that there was a serious outbreak of type A foot-and-mouth infection in his country of origin during the weeks prior to his departure to Canada.

The cost of the outbreak in real and economic values was staggering. The actual eradication costs, including all compensation, salaries, travel and equipment, etc., were \$1,000,000. However, our exports of livestock, livestock products, and meats were cut off and, as a result, all of these products came into surplus supply, thus driving down their value. According to our Bureau of Statistics, the actual drop in cash inventory value of our livestock was \$654,000,000 during the three-month period following the outbreak. In addition, the Government spent another \$70,000,000 in support prices. Therefore, the total cost,

both real and economic, amounted to \$724,996,000, plus one year's loss of livestock and livestock products export trade.

During and following the outbreak, our measures against possible introduction of such diseases were strengthened.

All products capable of carrying the infective agent of exotic diseases from countries where such diseases exist are either prohibited or enter Canada under severe restrictions. As an example, uncooked meats are totally prohibited from foot-and-mouth disease infected countries. Hides from such countries are subject to disinfection and straw used as packing is subject to fumigation. Livestock are either prohibited or subject to long quarantine and testing requirements, depending upon the country of origin.

Veterinary officers are stationed at all ocean ports and international airports. All incoming passengers are questioned with respect to meats and immigrants' baggage is closely checked for foreign meats. All mail parcels from foot-and-mouth disease infected countries are checked. During the period just prior to last Christmas, we were removing and destroying an average of 75 pounds of meat daily from incoming mail parcels in the city of Montreal. The same was taking place in Toronto and, to a lesser degree, in smaller cities where international mails are handled.

Garbage and refuse from all ships and aircraft arriving from foot-and-mouth dis-

ease infected countries is removed and incinerated under direct supervision. Foreign meat supplies on ships entering Canadian ports or the St. Lawrence Seaway are sealed in the ships' lockers and, of course, garbage cannot be discharged in Canadian waters. In short, every effort is made to intercept and control all agricultural products capable of introducing exotic disease into Canada.

In closing, I would like to mention the development in 1965 of our maximum security quarantine station for the importation of cattle from certain approved European countries. The requirements for these importations involve examination and tests, along with quarantine in the country of origin, and additional exhaustive tests along with five months' quarantine on arrival in Canada. To date, close to 900 cattle have been imported from France and Switzerland through this maximum security quarantine station.

Finally, I am sure you may consider that our control, eradication, and preventive procedures are very detailed and difficult. Truly, it is a monumental task, but when one considers the over-all cost in livestock morbidity and mortality and international trade loss resulting from foot-and-mouth infection, to a country like Canada which is dependent on agricultural exports, our efforts are seen to be justified.

FOOT-AND-MOUTH DISEASE PREVENTION PROGRAM IN THE DARIEN AREA, PANAMA

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The foot-and-mouth disease prevention program being undertaken in the Darién area is the outcome of a series of studies and negotiations that have been taking place for many years between the Republic of Panama and other member states of the International Regional Organization for Health in Agriculture and Livestock (OIRSA), with the advice and assistance of international agencies, among which the Pan American Foot-and-Mouth Disease Center has played the major role.

The motive for these studies of the foot-and-mouth disease problem was the appearance in 1950 of this dread disease in the cattle ranches of the northern region of the South American continent.

It would take too long to tell the complete story of all the events connected with the anti-foot-and-mouth disease policy in the Darién area, but it is nevertheless worth while to recount briefly some of the most significant facts that have led to the prevention program in this area.

At the time of the appearance of foot-and-mouth disease in Colombian and Venezuelan herds in the early fifties, a hemispheric meeting was held in Panama, attended by high-level representatives of the various countries of the Americas, to examine the foot-and-mouth disease problem

in the Hemisphere and seek solutions to it. The need to combat this disease wherever it existed and to prevent its spread to regions free of it was established. It was proposed to set up a fund for combating the disease and take other steps to eradicate it. For reasons that it is unnecessary to go into at this time, most of the conclusions reached at the conference in Panama in August 1951 were not acted upon, although they may have made their impact on some few leaders in the Americas who continued to urge that the disease should be combated and its passage across the frontier dividing South America from Central and North America prevented.

From this time onwards the Republic of Panama, for its part, began to review with extreme concern the threat of this disease and, although it possessed at this stage very few veterinarians, took such measures as its resources would permit to prevent the passage of foot-and-mouth disease across its southern frontier. These measures took the form of observation visits to the frontier area to make certain studies on the animal health situation and draw attention to the serious danger presented by the illegal passage of coastal shipping along the Atlantic coast adjoining the frontier region of Colombia and Panama.

Fortunately, Darién region is a vast expanse of rainforest, largely unpopulated and

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in a state almost as primitive and unexplored as it was centuries ago. It constitutes one of the most extraordinary and remarkable regions in the Americas. At the present time, stock farming is in its infancy and the area of settlement extremely small.

Darién, one of the largest provinces of the Republic of Panama, covers an area of more than 16,800 square kilometers and is located between longitudes 77°10' and 78°50' west and latitudes 7°10' and 9°10' north.

For the purposes of the present study, the region is taken to include the entire territory of the province that bears its name, and that part of the district of San Blas located between the frontier with Colombia and the line dividing the Provinces of Panama and Darién.

Its major topographic features are the mountain ranges of Darién in the north, those of El Pirre in the southeast, and those of El Sapo in the south adjoining the Pacific Ocean. These mountains have an altitude of a little over 3,000 feet with a few peaks exceeding 4,500 feet.

The rivers are of major importance to human life in Darién, particularly the Tuira with its major tributary the Chucunaque in the central part of the region, both rivers flowing through the greater part of its territory. The other important rivers are the Balsas, Sambú, Jaqué, and Sabanas.

Most of Darién has a wet tropical climate with heavy rainfall for the greater part of the year and a short period (two to three months) with a monthly average rainfall of less than 6 centimeters, occurring generally between December and April. The average temperature in the coolest month is around 18°C, the hottest month occurring before the summer solstice and rainy season. Variation in temperature between the hottest and coolest months is less than 5°C.

Along the banks of the Tuira, Chucunaque, and Sambú Rivers there are forest

areas and flood land. Throughout the entire province are to be found tropical forests of semi-evergreens, on land at elevations below 600 meters in areas of varying humidity. In all the forests there is abundant marketable timber. There are also small stands of highland evergreens in the areas with an elevation of some 5,000 feet, and to a slightly greater extent forests of subtropical evergreens in very humid areas lying between 2,300 and 4,500 feet with temperatures of between 18 and 24°C.

The population falls into three major groupings: The Cunas Indians, the Chocoes, and the balance, almost entirely of African stock.

The animal life of the forests is both rich and varied. According to a study made by the Battelle Memorial Institute in 1967, the following are the principal animals hunted by the Indians. Mammals and herbivores: tapir, poncho, paca, rabbit, peccary, deer, armadillo, spider monkey, capuchin monkey, marmoset. Carnivorous mammals: jaguar, ocelot, puma, otter. Birds: doves, pheasants, paronias, toucans, parrots. Reptiles: turtle, iguana.

Our intention has been to provide a brief description of the major characteristics of the Darién region. In the course of this report we shall also refer to the northwestern region of the Chocó in the Republic of Colombia which borders on Panama. Its ecological characteristics are practically the same as those described for Darién, except that the Chocó contains more marshy and humid areas with a rainfall exceeding 6 centimeters monthly. The Chocó has no indigenous population similar to that of Panama.

This widely known and celebrated Isthmus of Darién is an area that has been the subject of many studies with various ends in view, among which we might mention those undertaken by the Darién Subcom-

mittee on the Inter-American Highway. The building of this section of the highway would link the Continents of North and South America.

We might pause at this stage to point out that many Panamanians who obtain their livelihood from animal husbandry look with apprehension on the building of this major highway, as an outbreak of foot-and-mouth disease on Panamanian territory would strike a harsh blow at stock-farming interests valued at more than US\$225 million.

Darién or, more correctly speaking, the entire frontier region of Colombia and Panama, is at present the subject of many studies in connection with the possible building of a second interocean canal.

At the end of 1957 the first study made solely with a view to establishing the threat posed by the passage of foot-and-mouth disease from South to North America was completed. The study was carried out jointly by Panamanian and OIRSA experts.

In April 1959 the first of a series of meetings was held at Bogotá, Colombia, to prepare the ground for cooperative efforts to prevent the entry of foot-and-mouth disease into Panamanian territory. This meeting, which was also attended by representatives of other countries bordering on Colombia, such as Venezuela and Ecuador, was organized and supported by the Pan American Foot-and-Mouth Disease Center. The conclusions then reached continue to apply with equal force. Panama would maintain strict surveillance of this frontier region and, in the event of an outbreak, apply the stamping out procedure. Colombia would conduct a protective campaign based on a program of periodic and compulsory vaccination, free of charge, against foot-and-mouth disease of cattle located between the west bank of the Atrato River and the Panamanian frontier, using bivalent vaccine manufactured in Colombia; other quaran-

tine measures would also be taken to ensure that cattle that had previously been moved from other areas of Colombia to the area adjoining the Panamanian frontier were free of the disease and did not become carriers.

This meeting was followed by others such as the one at Maracay, Venezuela, in 1960, in Mexico in 1962, and a number of others at Bogotá that culminated in the signature in 1963 of a Declaration by the Ministers of Agriculture of Colombia and Panama stressing the need to adopt a program to prevent foot-and-mouth disease crossing the frontier between Colombia and Panama and moving northwards. This Declaration formed the basis for the signature in 1964 of a Tripartite Agreement between Colombia, OIRSA, and the Pan American Sanitary Bureau, which established on Colombian territory a "buffer area" free of foot-and-mouth disease, located in the northwestern region of the Department of Chocó along the right bank of the Atrato River. This "buffer area" would be treated as an area free of foot-and-mouth disease and its health policy with respect to vesicular diseases would be guided by the recommendations of the Pan American Foot-and-Mouth Disease Center with respect to countries free of foot-and-mouth disease. The Chocó program would be in the hands of an executive committee formed of representatives of Colombia, Panama, OIRSA, and the Center, and would be financed by equal contributions from Colombia and the OIRSA countries.

At the end of 1964 the Center seconded a consultant to OIRSA, stationing him in Panama to advise the latter agency on questions relating to vesicular diseases and more particularly to evaluate the implementation of the Tripartite Agreement and of the foot-and-mouth disease prevention program in the Darién area. I believe this

is a suitable moment to acknowledge publicly, on behalf of the health authorities and the veterinary profession in Panama, the major technical and professional contribution being made by Dr. Edwin Pércz Chaverri, the Center's Consultant, a contribution to which the success achieved by this program has largely been due.

The Tripartite Agreement between Colombia, OIRSA, and PASB was rescinded in 1966 as it had been based on commitments which it was not possible to carry out, such as obtaining cattle in Central America at the same price as in Colombia to repopulate the "buffer area" in Chocó, and also because of the inability of the Colombian Government to apply the stamping out procedure in the event of an outbreak of foot-and-mouth disease in the "buffer area."

It should be pointed out that in 1960 Panama began to take drastic measures to prevent the passage of foot-and-mouth disease across its frontier with Colombia, and in September of that year a 20-mile strip was established by Executive Decree along the frontier with Colombia in which the farming of livestock susceptible to foot-and-mouth disease was prohibited. This instrument was amended by Decree No. 80 of 1964, which created a livestock inspection area in the frontier region adjoining Colombia, by which time various herds of cattle totaling more than 850 head had been removed from the Panamanian frontier region. This dealt a serious blow to the meager economy of the area. Finally on 12 May 1966, Decree No. 121 was promulgated, establishing the foot-and-mouth disease inspection and control area in the frontier region adjoining Colombia, and was followed by further legal provisions on the same subject.

This decree has been the subject of considerable criticism on account of the serious

harm it has done to livestock development in a region as rich and extensive as is the Province of Darién, but Panama was fully aware not only of its obligation to protect its own livestock industry but also of the overriding need to reduce the risk of infecting livestock in the rest of the free countries. It realized that if the foot-and-mouth disease virus were to cross the almost impassable Isthmus of Darién, it would be easy for it to advance into the rest of North America.

As we indicated before digressing briefly to explain the unilateral measures taken by the Panamanian Government, when the Tripartite Agreement was rescinded both Panama and OIRSA believed it necessary to increase, to the full extent of their capacity, health surveillance measures under the existing foot-and-mouth disease prevention program on the frontier between Colombia and Panama.

It was in this way that the present foot-and-mouth disease prevention program in the Darién area came into being, based on an Agreement signed on 10 January 1967 between OIRSA and the Republic of Panama and financed under Resolution XVIII adopted at the XIV Meeting of OIRSA held at San Salvador in July 1966.

Before entering on a formal account of this program in Darién, reference should be made to an event of great importance to countries free of foot-and-mouth disease; that was the statement by the President of the Republic of Colombia, Dr. Carlos Lleras R., expressing his concern over the problem of foot-and-mouth disease and the danger that this scourge might gain access to the "clean" regions of the Hemisphere, and emphasizing that his Government was prepared to negotiate a new agreement to prevent this.

The Minister of Agriculture of Panama, in his capacity as Chairman of OIRSA for the 1968-1969 period and under its express

authority, is negotiating a new agreement with Colombia. Such an agreement must be based on the realities faced by each country, and each must be asked to undertake to perform only what it can effectively carry out. In this way substantial progress can be made and a decisive step forward will have been made in the fight against foot-and-mouth disease, for we are convinced that the passage of the disease across the frontier with Colombia can only be stopped when we have the firm support of the Colombians themselves. It is only fair to recognize that our professional colleagues in Colombia and the Colombian authorities have always demonstrated their good will and desire to assist us, but we can ask no one to give what they are unable to give, what is beyond their capabilities, however much good will may exist.

July 1967 saw the formal initiation of the activities of the OIRSA-Panama Cooperative Program for the prevention of foot-and-mouth disease in the Province of Darién and on the Atlantic Seaboard. The program has an annual budget of \$105,000 based on annual contributions of \$15,000 paid by the seven member states of OIRSA. The personnel employed on the program are as follows: 1 veterinarian, program chief; 1 secretary; 7 inspectors; and 17 National Guards.

The geographic distribution of the personnel (see Figure 1) is as follows:

El Real de Santamaría, program chief (veterinarian), 1 secretary, 1 inspector, and 1 sergeant of the National Guard.

Puerto Obaldía: 1 inspector and 3 National Guards.

Tupisa: 1 inspector and 3 Guards.

Yaviza: 1 inspector and 3 Guards.

Boca de Cupé: 1 inspector and 1 Guard.

Payita: 4 Guards.

Mamóní: 1 inspector and 4 Guards.

Puerto de Jaqué: 1 inspector and 1 Guard.

Communications between the staff, management, and the Foot-and-Mouth Disease

Prevention Office in Panama are by modern two-way radio, facilities for which exist in the majority of the places mentioned above.

Decree No. 121 of 12 May 1966 provides the legal basis for the operational areas in Darién Province and part of the San Blas district, dividing the Province of Darién into two areas, one for quarantine and inspection purposes and the other for control.

The program has its regulations and is advised by the regional consultant of the Pan American Foot-and-Mouth Disease Center. The responsibilities of each of the various officials are clearly laid down and inspectors are required to report on special forms each visit they are required to make to the various places within their inspection areas.

The raising of cloven-hoofed domestic animals is prohibited within the quarantine area, although some exceptions are made such as in the case of the hogs kept in certain places solely as a source of food for their owners.

Fixed amounts of meat are sent by plane to Puerto Obaldía once or twice a week. The price at which it is sold is very much lower than that obtaining elsewhere in the Republic, the difference being met by the Panamanian Livestock Institute as one of various contributions it is making to national health programs.

Along the Atlantic coast, where a serious threat of infection is also posed by the illegal trading activities of coastal shipping plying between Colombia and Panama, vessels passing Puerto Obaldía are now being inspected and disinfected before they proceed to the San Blas Islands. Patrols are undertaken for this purpose by motor-launches of the National Guard. Over a period of 11 months, 373 vessels have been inspected at this Atlantic port.

Hogs in the quarantine area are tagged with special rings that are also used to

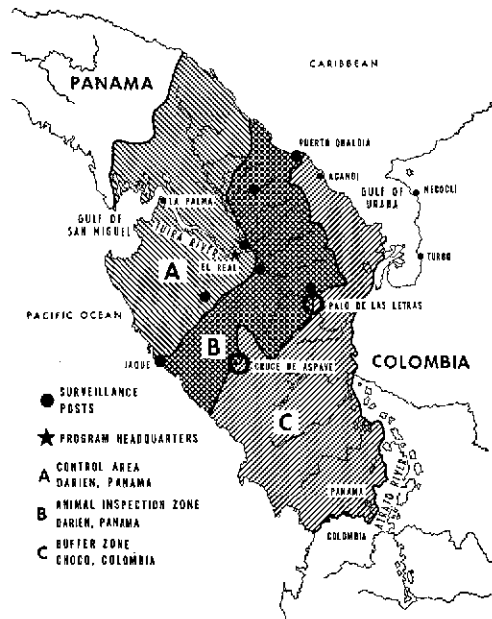
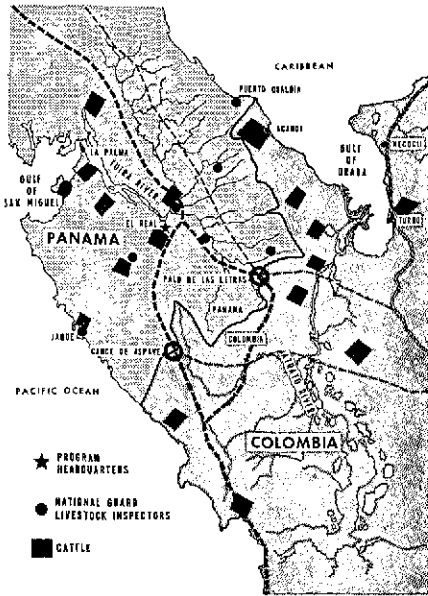


FIGURE 1—Foot-and-Mouth Disease Prevention Program in the Darién Area, Panama.

maintain an updated hog census of the region.

The census for May 1968 shows a total of 2,053 swine at 229 farms on the banks of the various rivers.

Only 168 cattle were in the quarantine area, although there were many more in the Jaqué and Yaviza districts prior to the issue of the current decree.

The inspectors, always accompanied by members of the National Guard, are required, at least twice each month, to inspect the entire area and check the updated livestock census. To enable them to do so, they are provided with outboard motorboats.

Program personnel are selected in the light of the duties the inspectors are to perform. They are preferably graduates in animal husbandry and subsequently receive training in livestock quarantine work. The National Guards are selected from units that have received forest training and they are also trained in quarantine procedures.

There is continual movement of individuals between the Department of Chocó in Colombia and Darién Province in Panama, for the following reasons: some are migrating to Panama to work on the plantations and in the sawmills; others are crossing the frontier to escape the law; others again are engaged in smuggling such products as cheese, coffee, sugar, and other dry goods that fetch a high price in Panama; while others are simply changing their place of residence.

A large number of these persons have no legal credentials, which itself presents a problem as many of them have committed no offense and are traveling to seek work.

The results achieved in the short time the program has been in existence are quite encouraging and have helped reduce the number of smugglers who might be carrying materials infected with foot-and-mouth dis-

ease virus. Although not directly related to the object of this report, it should be pointed out that the inhabitants of Darién Province have derived other important benefits from the establishment of these posts, to which, in addition to livestock technicians, National Guards are attached.

There is much room for improving the program and this is being done. Like all such activities, it remains open to criticism, but we can say with some satisfaction that it is undertaking a task that is by no means easy in an area in which any program of this kind might well have been regarded as hardly feasible.

We can therefore conclude that the Darién program should continue, as should efforts to improve it and make it more effective, although we do not believe that this program alone is sufficient to prevent the passage of foot-and-mouth disease across the frontier between Colombia and Panama. I do not wish either to underestimate the value of such a courageous program or detract from the merits of those who are working so boldly for its success—from the highest officials down to the inspectors and National Guards living in these inhospitable places, where they are exposed to the risk of sickness and poisonous snakebite.

To strengthen my argument I would like to refer to the outbreak of foot-and-mouth disease that occurred in September 1967 in the small village of Balboa in the Chocó Department, Colombia. This village is barely 18 kilometers from the frontier with Panama and, very fortunately, the number of livestock was small and the Colombian authorities took the action they believed would prove effective. Nevertheless this was foot-and-mouth disease and it was very close indeed to Panama, very close to areas so far clean. Without the cooperation of Colombia, we should not have known of

the outbreak, and had the Colombian authorities themselves failed to take certain steps, who knows where the virus might now be. What I want to point out is that the foot-and-mouth disease prevention program in the Darién area has two aspects and both are equally important.

To the health surveillance campaign being conducted on Panamanian territory should be added the efforts being made to prevent foot-and-mouth disease in that part of Colombian territory known as north-western Chocó, which lies between the frontier with Panama and the west bank of the Atrato River and, to the north, runs from the Atlantic coast to Cupica Bay in the south.

I do not think it necessary to give figures indicating the magnitude of the losses that would be incurred by those countries that have so far been free of foot-and-mouth disease, if they were to suffer an outbreak, as this has already been the subject of a number of studies, in which the scope of such a disaster is measured in dollars and cents. I would merely like to add that such estimates cannot take account of many

forms of personal damage and human misery that cannot be measured in money.

In a world that is progressively becoming smaller as a result of the technical strides being made in communications, all large-scale undertakings, including such health campaigns as the Darién foot-and-mouth disease prevention program, should represent the joint efforts of various countries, some participating because of the need to ensure that this scourge never reaches them, and others in the desire to contain within their frontiers the evils with which they are afflicted.

Such a joint undertaking calls for the good will of peoples and Governments and the participation of such agencies as the Pan American Foot-and-Mouth Disease Center, which has continued to make a major contribution in this respect.

In addition to this and to its activities in the fields of diagnosis and research, the Center should continue the training of our professional workers, as the lack of technicians and experts is a major factor in our underdevelopment.

REPERCUSSIONS OF THE OCCURRENCE OF FOOT-AND-MOUTH DISEASE IN A DISEASE-FREE AREA

DR. FRANK J. MULHERN *

Those of us who have major responsibility for the prevention, control, and eradication of livestock diseases in the United States of America live in fear of the day when we wake up and the newspaper headlines proclaim "Foot-and-Mouth Disease Found in the U.S.A." This fear keeps us alert to prevent the disease from entering the country and helps us to be prepared to handle the outbreak should it occur.

Since we have not had the disease in the United States of America since 1929, some of us must rely on experience gained while engaged in the Mexican-United States Foot-and-Mouth Disease Eradication Program. I will try to illustrate what I visualize the consequences might be if foot-and-mouth disease were introduced into the United States and, in some instances, compare them to what they were in Mexico at the time I was there.

I have heard persons from South America say that we in the United States of America are overly concerned with the importance of this disease. Our concern is purely economic. If we get the disease the annual vaccination bill alone would be over \$100,000,000 a year—not to eradicate but to keep epidemics from occurring. We have not had the disease for 40 years, so the savings is quite evident. The cost of vaccine alone for

that period would be over 4 billion dollars. I will now try to project some of the other types of costs. It will not be possible to place specific figures relative to them, but I believe you will realize the magnitude—it could be *in the billions!*

First, let us consider the susceptible livestock populations in the United States of America. There are over 109,000,000 cattle, raised in different parts of the country, over 57,000,000 hogs, and 18,000,000 sheep, whose value amounts to \$19.7 billion. So, when we think of an outbreak, we immediately think of these multimillion populations of susceptible livestock.

Some time ago I tried to show how vesicular exanthema, a virus disease of swine, spread across our country. I began to plot movements from all stockyards during a one-week period. Before I could show movements from several stockyards, it became a confused mass. I had to settle for the movements from three stockyards during one week's time. Now, if you want to get some idea of the total situation, you must multiply this by 56 other stockyards under Federal inspection; then there are over 2,300 smaller auction markets; movements to and from the numerous concentration points, and movements to direct slaughter. So we not only have a multimillion livestock population, but we have multithousands of them on the move daily. All we need to do is to introduce an infected

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animal into that system and before we know it, it could be all over the country.

Stopping Livestock Movements

Our livestock constantly move in all directions. Since infected and exposed animals are the chief sources of spread, the problem lies in trying to slow down or stop the spread of infection. However, in order to bring the disease under control and eradicate it, *this must be done*. The longer it takes to slow down significantly the movement of livestock, the greater the spread. The longer the time to bring the disease under control, the greater the costs.

We have a very complex marketing system which means many different facets, or units, which are all interrelated within the system. Whenever the system is affected, a reaction automatically occurs in some other part. Therefore, when action is taken to slow it down, price fluctuations are bound to occur. Before the disease is gotten under control shifting of markets will occur, that is, people accustomed to shipping to one market will sell to another to try to avoid quarantines. Temporary panic selling develops and prices drop, as large numbers of animals are sold in hopes of not getting caught in quarantines. Likewise, scare-markets can develop where people will hold back marketing of their animals that are ready to go because they are afraid their animals may get caught in quarantine. If this occurs to any degree, the price will skyrocket owing to the lack of animals, which naturally causes a violent reaction from housewives and boomerangs back to the Government.

In Mexico the problem of stopping livestock movements was not as complicated, but various reactions were the same. In addition, fear on the part of small owners who lived in outlying areas caused them to

drive their animals to far-away places. In many cases this was a major cause of rapid spread of the disease to the 17 states involved. In some cases there were infected animals in their herds and they exposed others along the way. I am certain that if we had an epidemic, some owners would try to hide the disease and market the animals that they thought were not affected with it.

When movements are slowed down, many persons will be affected. It does not take too much thinking to realize that when the system slows up, persons lose work, allied industries that have been serving the system suffer, and a chain reaction takes place. The Government receives complaints from all sides.

Our livestock industry is being informed regarding the need to slow or stop movements in time of an emergency. We are jointly planning with their leaders so that everyone realizes what needs to be done should the occasion arise. Now is the time to plan, not after the emergency occurs.

Stopping Meat Movements

So far we have just talked about that part of the system involved in the production and marketing of livestock. Now to look at the end products, particularly *meat*. There are over 3,000 slaughter plants that slaughter more than 2,000,000 pounds of live weight livestock a year, and 4,750 that slaughter over 300,000 pounds but less than 2,000,000 pounds per year, making a total of more than 7,000 establishments. In addition, there are reported to be 4,000 or more locker plants that process meat products for sale.

This industry has a saying, "You either sell it or you smell it." In other words, once the livestock are slaughtered, the resulting products must move with relatively

little interruption into consumption. Modern refrigerator and processing procedures have reduced some of the urgency to sell. However, continued costs of any meat item are too great relative to their profit margin to risk loss from spoilage. So the dilemma is obvious. We desire to slow up the movements, and this is contrary to good working practices of the industry.

Nevertheless, the same principle that applies to movement of meats and other animal products applies to movement of live animals. In areas where the disease has been identified, the sooner movements of meats are slowed and eventually stopped, the better the chance of eradication at the lowest cost and inconvenience to all concerned.

The choice to be made is whether it is better to slow down the movements, or even to bring them to a standstill for a relatively short period of time and get rid of the disease, or to interrupt the system constantly because of outbreaks of the disease that would occur continuously if it was decided to live with it. These added costs resulting from interruptions of trade because of periodic outbreaks would have to be passed on as operating expenses. Thus, the increased operating expenses would have to be charged in the price of meat to consumers. Our decision is to keep the country free of foot-and-mouth disease.

The meat packing industry hires over 229,000 people. When movements are slowed down or stopped, people lose employment and this causes problems.

The meat industry was not as developed in Mexico as it is in the United States of America, but problems in the movement of meat occurred. The Government more or less controlled the larger movements of meat, especially from producing areas to larger cities, so that meat regulation was easier there than it would be in the United

States. However, when shipments decreased because of the disease, prices rose and the people, or consumers, criticized the Government. Persons living in outlying areas did not eat much meat, but when it was taken from them as they were leaving quarantined areas, it was a very sad situation. Meats have been instrumental in causing many serious outbreaks, as we are all aware, and that is why they must be strictly controlled during an outbreak.

When we speak of effects on transportation of livestock and meats we realize fully that transportation companies are greatly affected by our quarantine procedures. We have had experience in trying to control diseases by cleaning and disinfecting vehicles after diseased animals have been hauled in them. When this approach was used we were always behind the disease. During an epidemic, livestock can only move in vehicles that have already been cleaned and disinfected. The same requirements apply to all feed, water, and rest stations where animals are unloaded enroute to their final destination. In the United States this means that close surveillance must be maintained over hundreds of stations. Here again protests would be heard about added costs and inconvenience, but it has to be done if the eradication program is to be successful.

This means that thousands of trucks (the meat industry alone uses 150,000) and railroad cars must be cleaned and disinfected each week during an epidemic. Transportation companies are willing to bear with this as long as dramatic disease reduction occurs and there is a clear understanding that the restrictions will be removed as soon as possible.

In Mexico cleaning and disinfecting stations for trucks and railroad cars were set up throughout quarantined areas, as well as along the borders. An exceptionally fine

job was accomplished. Here again, the railroads were under Government control and good compliance was achieved. Trucks traveling along highways frequently were stopped by police checking for violations; therefore added precautions due to foot-and-mouth disease quarantine were more readily accepted by drivers than they would be by independent transportation companies in the United States.

Stopping Dairy Products

During the last outbreak in England it was learned that milk was a cause for the spread of disease. Foot-and-mouth virus was actually found in exceptionally high quantities in several of the bulk tanks located on infected farms. Here again is another complex industry that must be brought under control during an epidemic.

The rapid method of pasteurization (161°F for 15 seconds) does not kill foot-and-mouth virus, so in areas affected, condemnation of the milk or longer pasteurization temperatures will be required (145°F for 30 minutes). Naturally, the volume will determine the decision to be reached.

Other than the larger dairies around cities in Mexico, the movement of milk did not present much of a problem to the disease control officer. Disturbing our dairy products marketing system could give us many problems. The value of our dairy products (milk and cream) is over \$4,000,000,000. Here again it is essential that those engaged in that industry appreciate the need to restrict movements during an epidemic.

The next area of interest is stopping movement of hay and feed grains (corn, oats, and barley), which must be brought under control during an epidemic period. Their movements are extensive and market prices are quite sensitive to any changes that affect the sale of them. Therefore, great

care must be exercised in applying the necessary controls.

Here again the Mexican Government did a good job in controlling movement of hay and other livestock feeds, and I am sure we would have much more difficulty with our system than they had with theirs.

Four areas have been singled out to give some idea of the scope of the problem. All animal by-products from the species of animals susceptible to foot-and-mouth disease are involved.

All Animal By-Products Controlled

To give an idea of the different types of animal by-products that must be controlled, all that need be done is to study a list that we keep currently controlled when they are imported. During an epidemic there would be similar controls on their movements from quarantined areas.

Diagnosis, Authority, and Funds

The federal Government investigates every suspicious outbreak of a foreign disease in the country. If our specialist determines that a case is highly suspicious, the sample is sent with him to Plum Island, New York, our FMD diagnostic laboratory. If the case proves to be foot-and-mouth disease, the states involved and the federal Government would declare an emergency. Then we would be provided with a special source of funds and authority. It does likewise for the states.

Emergency Disease Organization

There is an emergency disease eradication organization in each state, consisting of both federal and state Government personnel, which would be put in operation whenever necessary. It consists of inspection forces, information specialists, ap-

praisers, diagnostic specialists, heavy equipment operators, enforcement officers, and others. Special arrangements have been made with different departments of the Government so that coordination may be obtained from the different agencies in time of an outbreak.

The logistics of getting thousands of persons and all the equipment in the right places at the right time is a tremendous challenge. As you can imagine, it does not run smoothly but usually works itself out, largely depending on the preplanning done.

Periodically, alert exercises are run to determine problem areas so that adjustments can be made in the program. During these, industry leaders observe operations so they can propose ways to accomplish the goals with the minimum adverse effects on them.

Program Phases

The emergency usually goes through three phases—the first phase, I call the hysterical or panic stage. People cannot understand the rapid spread; it seems to be everywhere. They demand that everything be done to bring the disease under control, and sometimes they carry it to extremes. I recall some of our ranchers demanding that we build a fence along the Canadian border when foot-and-mouth disease was found in Canada in 1952. They wanted this fence built despite the fact that we have always had freedom of movement between our two countries.

Phase two I call the cooperative stage. This is when those in the quarantine areas understand how the disease entered the country, how it was spread, and accept the restrictions being taken to control and eradicate the disease. This is a time when the best cooperation is received and the greatest progress is made.

Phase three I call the impatient and apathetic stage. The disease incidence has been dramatically reduced. In fact, many persons living within the quarantined area believe that it already has been eradicated. Some of them even claim that the only reason for continuance of the program is that control officials have found good jobs and do not want to give them up. They are impatient with controls and want to get rid of them.

Some within the area have become involved in other problems and are indifferent toward the program in this stage. If they are ranchers or producers who at one time inspected their livestock often to be sure they were not coming down with the disease, they do not wish to be bothered now. They have examined them so many times and found nothing wrong that they do not wish to continue the effort.

Yet, this is the time that warrants closest surveillance to find the last remnants of infection. Unless the job is thorough and meticulous, the whole effort and cost are to no avail. Eradication means "to pluck out by its roots," and that means getting to the very core of that which can cause the disease to be perpetuated. It is an exasperating experience, but it determines whether the whole program is successful or not.

Good Information—A Must

How to handle television, radio, and the press can be a major task. Yet, if this is not planned and its importance is not appreciated, repercussions can be tremendous. Because of our concern that those involved in communications not be responsible for spreading disease, it takes a great deal of empathy on the part of control officials to communicate this point when restricting their movements. We know they must obtain their information, and they want to be

where the action is and talk to the people involved. We must give them this opportunity, but in such a manner that it has a minimum effect on our program activities and does not spread infection.

This receives primary attention, especially in the early phase of a program. They can get the program off to a good start, or give program officials so much trouble that more time will be spent trying to placate them than getting the disease under control.

The general public will be eager to know who was responsible for the introduction of the disease. In my opinion, too much time and effort are spent during this phase of the program trying to find and punish the person, or persons, responsible for allowing the disease to be introduced. In the early stages, all the efforts should be directed toward getting the disease under control, and not divided by those who want revenge. There will be time for that later.

Political Repercussions

This is the time when the Government is exercising various controls over commodities mentioned earlier. It is a prime time for those who do not like any infringement or restriction on their freedom to challenge actions of their Government. They want the disease brought under control by any means, but do not want their vested interests restricted.

Quite often during this period there are charges and countercharges made as to how the program is being run. It is unfortunate that this occurs because it sows seeds of doubt in the minds of industry leaders involved regarding those who are conducting the program. This is the time when mutual confidence is essential between industry and its government if the disease is to be

brought under control in the most effective and efficient manner.

Eradication—Not An Easy Goal

There is never a time for compromise if the goal is eradication. What needs to be done must be done. Everyone must be treated the same. If the movement of animals and animal by-products must stop, or be restricted, it must apply equally to all.

Eradication procedures have been well proved in all countries that have gotten rid of the disease. They are very demanding, however, and require sacrifice by all involved, but the rewards are worth it.

There were times in Mexico when we wondered if eradication would be accomplished. There were times when we, the Mexican and U.S. Government officials, could not understand how the situation became so critical. Our people were working day and night to get the disease under control, but it was still spreading. The people, especially those living in outlying areas, did not understand the program—in fact, some of our people were being killed (both Mexican and United States citizens). All we got was criticism from all directions and many times we faced the question: Is it worth it?

Today, since Mexico has not had a single case since 1953, Mexican officials and those who were there from the United States of America know now that it was worth it. Not only that, but it has inspired us to know that despite the odds against eradication it can be done if there is the will to do so.

In summary, this disease can upset the whole economy of a country that is free of it. I have tried to show the complexity of the marketing system of some of our commodities that would be involved. Despite their size and importance, they must be controlled if we are ever to eradicate dis-

eases such as foot-and-mouth, should it enter the United States. We cannot afford to compromise with eradication procedures that have proved successful. Our economy is not willing to live with a disease like foot-and-mouth nor are we willing to accept the costs and losses from such a disease as an operating expense—not when we know it can be eradicated.

There may have been times when you

wondered why we take the approach to this disease that we do. I have heard it said that we do so just to protect our home markets. I can assure you that this is not so. Our position during this presentation is based solely on a decision that we do not want to be faced with the consequences of eradicating the disease. Therefore, we take all measures we believe necessary to prevent it from entering the country.

PART III
ZOONOSES

ZOONoses, PUBLIC HEALTH, AND LIVESTOCK DEVELOPMENT IN LATIN AMERICA

DR. BORIS SZYFRES *

In the developing Latin American countries there is a marked impact of the zoonoses on the economy and public health. The zoonoses, along with other animal diseases, are contributing to a low livestock production in this region. This production must be augmented to offset the need for increased food supplies resulting from the current population explosion and improve the quality of food available, a factor of great importance in health. Considerations such as these, to be discussed in this presentation, emphasize that the control of the zoonoses is not only technically feasible, but is also a sound investment and economically profitable.

Demographic Pressure and Food Supply

Latin America is the geographic area with the most rapid demographic growth. Its population doubled from 1928 to 1969 and it is likely that it will double again during the next 25 to 30 years. It is estimated that there are currently over 200 million inhabitants in Latin America and that by 1975 its population may exceed 300 million (1).

However, it is not plausible to refer to overpopulation in Latin America if the vastness of the territories of most of its countries and the number of inhabitants per square

kilometer are taken into consideration. There is, of course, an uneven population distribution. There are signs that this tendency will persist, and that the density of the most populated areas will increase and that of the less populated will decrease.

The absence of a comparable increase in food production and population is the most critical problem. Total or partial hunger, undernutrition, and malnutrition are not new phenomena in Latin America.

Food and Health

The ratio of the quantity of food to the number of inhabitants, however, is becoming more critical. Protein-calorie deficiencies are widespread among the lower socioeconomic groups in Latin America and principally affect preschool-age children. Diets deficient both in quantity and quality are a prime medical problem. Between 0.4 and 15 per cent of the preschool population suffers from third grade undernutrition (less than 60 per cent of the normal weight) (2).

If economic development aims at increasing the standard of living of the population, securing sufficient and good quality food must be one of its principal objectives. It must be a means to satisfy that fundamental need of the population.

The production of agricultural products, including livestock, will have to be increased in Latin America. This, in addition to other

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important factors, both economic and socio-cultural, will have to be taken into account when planning programs for the purpose of obtaining better food for the population.

The scarcity of proteins of animal origin—meat, milk, cheese, eggs, and fish—is responsible for the serious deficiency diseases in man in the large underdeveloped areas of the world. Livestock production, however, can be greatly increased in Latin America with a relatively small investment in relation to the profits to be obtained.

Livestock Production

Latin America has at present considerable livestock resources, as shown in Table 1.

The number of animals is considerable. But, as Byerly puts it, "The seeming great wealth of livestock in numbers in the less developed countries turns out to be a great poverty. In fact, the paradox is that not only would a much smaller number of well-kept animals produce more meat and milk, but they would need less land for pasturage and forage crops, thus releasing land for growing food for the ever-increasing number of men" (3).

In this respect Cox (4) makes a comparative study of beef cattle productivity between Latin America and the United States, as shown in Table 2.

In this interesting study Cox arrives at the conclusion that Latin America has to feed four times as many animals as the United States to obtain a ton of beef.

TABLE 1—Livestock Resources in Latin America Compared to Those of the United States of America and Canada.

Species	Latin America	USA and Canada
Cattle	235,276,000	120,244,000
Swine	98,879,000	59,034,000
Sheep	132,591,000	24,598,000
Goats	43,841,000	4,018,000

TABLE 2—Comparison of Meat Cattle Productivity between Latin America and the United States of America.

	Latin America	USA
Human population	Approx. 200 million	Approx. 200 million
Land to cattle ratio	2	1
Beef animal per capita	1	$\frac{1}{2}$
Production of beef in tons	5 million	10 million
Productivity ratio	1	4
Slaughtering rate	Brasil—10% Argentina—22%	35%

(Taken from M. L. Cox, reference No. 4).

Zoonoses and Livestock Development

The principal reasons for the low Latin American productivity are: (1) deficient nutrition (quantity and quality of feed and variation according to season), which results from a bad use of pastures and/or forages, and (2) diseases.

Accordingly, an immediate impact on the increase of livestock productivity could be expected with the improvement and adequate use of pastures and forages and, on the other hand, with the control and prevention of animal diseases. At present no thought should be given to increasing the number of head of livestock on lands already occupied by them, but instead to improving productivity. In Latin America, however, there are large areas which are not yet exploited and in which the expansion of livestock production will be possible.

Even though multiple factors are inter-related in the development of the livestock industry, our interest is centered on disease control. The industry will never attain complete development as long as the animals suffer from diseases that cause death or a pathologic status that reduces the production of meat, milk, and wool, and as long as some products are not fit for human consumption because they come from diseased animals.

Among the diseases that cause great losses of livestock are various zoonoses, such as brucellosis, bovine tuberculosis, and rabies. These, together with foot-and-mouth disease and external and internal parasitoses, greatly hinder the development of more efficient livestock production.

Besides lowering the reproduction rates, productivity, and profit of our herds, the zoonoses affect the health of our people directly through the diseases they cause in man, and indirectly as a result of a decrease of available animal proteins. Consequently, the zoonoses, as no other group of animal diseases, harm both the economy and health.

Economic Losses Due to the Zoonoses

With the deficient information available it is difficult to estimate with any degree of accuracy the losses caused by the zoonoses in Latin America. Nevertheless, an indication of their magnitude can be found in the estimates made by various countries in regard to economic damages caused by brucellosis and bovine rabies.

The estimated annual loss due to brucellosis in animals in 11 Latin American countries is more than 216 million dollars (Table 3), the estimated annual loss from bovine rabies is approximately 38 million dollars (Table 4). Few of the countries in the Hemisphere have estimates of the economic losses due to bovine tuberculosis, but its wide-spread distribution and high infection rates, especially in the dairy industry, confirm that the losses are great. It has been estimated that the losses in the United States, before a program for the eradication of tuberculosis was initiated, were approximately 150 million dollars per year for condemnations of meat alone, without taking into account losses through lower milk and meat production. By analogy, and considering that the situation in Latin America,

TABLE 3—Estimated Economic Annual Losses Due to Animal Brucellosis.

(Data from various sources and dates)

Country	Year	Losses	
		National currency	US\$
Argentina	1965	27,580,500,000	154,946,629
Brazil	1955	320,000,000	4,776,119
Chile	1961	7,500,000	2,400,000
Colombia	1958		15,750,000
Costa Rica	1957	9,000,000	1,500,000
Dominican Republic	1967	7,881,000	7,881,000
Mexico	1957	250,000,000	20,000,000
Panama	1965–1966		
	1966	109,572	109,572
Peru	1960		1,830,000
Uruguay	1960	30,000,000	2,752,293
Venezuela	1966	21,521,600	4,803,829
United States of America	1947		100,000,000
	1961		23,000,000

especially South America, is not very different from that which existed in the United States before the control program, we can assume that the losses are not less.

It is difficult to convince those responsible for livestock disease control, as well as economists, to invest in surveys to deter-

TABLE 4—Estimate of Economic Losses Caused by Bovine Rabies in the Americas.

Country	Year	Annual losses in US\$ *
Argentina	1964	10,000,000
Bolivia	1965	1,500,000
Brazil	1965–1966	22,000,000
British Honduras	1961	100,000
Cayenne (F.G.)	1958	60,000
Colombia	1964	1,260,000
Costa Rica	1962	365,000
Ecuador	1963	850,000
El Salvador	1961	108,000
Guatemala	1964	168,000
Guyana	1959	43,000
Honduras	1960	87,000
Mexico	1964	10,400,000
Nicaragua	1962	200,000
Panama	1962	115,000
Paraguay	1963	94,000
Surinam	1963	55,000
Trinidad	1961	5,000
Venezuela	1960	119,000
Total		47,529,000

* Calculated in accordance with the official rate of exchange for local currency during the reported year.

mine the rates of infection and economic losses caused by a disease. In general, this information is available only from those countries which already have implemented active control programs. The initial and periodic determination of rates of infection and economic losses serve as indicators of the progress of control programs. Unfortunately, it is difficult to plan a rational program and establish realistic objectives without previously determining the extent of the problem. Therefore, surveys are a necessity.

Zoonoses Control—A Sound Investment

There is no doubt as to the relationship between investment and profit in the control of diseases such as tuberculosis and brucellosis, for which control methods and results obtained are already well known. The United States considered that through its tuberculosis control program 150 million dollars per annum is being saved in reduced meat condemnations, and that the savings accumulated over two years nearly pay for the cost of the whole control program. The United States estimates that in 1947 it lost 100 million dollars from brucellosis, while in 1961, after a control program was well under way, the loss was only 23 million, an annual saving of nearly 80 million dollars. Even though we do not yet have adequate procedures to control hematophagous vampire bats, which transmit rabies to bovines, studies carried out at the Pan American Zoonoses Center show that vaccines are available that confer a long lasting and a high degree of immunity in cattle. Sources for the supply of this vaccine on an adequate scale must be found, there should be assurances that the vaccines are tested for quality, and administration of the vaccine must reach the necessary coverage.

It is clear that programs for the control

of zoonoses, foot-and-mouth disease, parasitoses, and other animal diseases are a sound investment, both for economy and for public health. A careful planning is needed to: (1) establish priorities on the basis of the effect of the program on the development of the livestock industry; (2) determine objectives and aims in relation to the material and human resources available; and (3) to set up a logical progression of activities toward reaching the objectives.

It is necessary to train veterinarians in the planning, administration, and evaluation of control programs, as is being currently done with regard to control procedures and laboratory techniques.

International Cooperation for the Control of Livestock Diseases

International cooperation for the control of zoonoses, foot-and-mouth disease, and other diseases is necessary, both in the financial and technical aspects. In order for a program of animal disease control to have a tangible effect on the economy and the health of the country, adequate economic and human resources must be available, it must be connected with other national efforts with similar aims, and it must have an appropriate continuity (5). The Inter-American Development Bank, United Nations Development Program, Pan American Sanitary Bureau, Food and Agriculture Organization, and several other international technical and financial agencies, play a significant role in this important activity, which aims at bettering the standard of living and the health of the countries of Latin America.

In most of the Latin American countries there have been and there are limited programs and campaigns for the control of the zoonoses. However, these are isolated efforts that have not had a great effect on the

economy and health and which are subject to continuous interruptions because of reductions or withdrawals of the allotments assigned for this purpose. Only an adequate financial backing, a long-term commitment, and a periodic evaluation of the program can ensure the continuity and efficiency of the effort. A long-term loan from an international financing agency can be the means to achieve the desired aim.

In relation to the human resources necessary to achieve the control of the zoonoses and other animal diseases, various international technical agencies, such as PASB and FAO, with the cooperation of international financing agencies and the United Nations Development Program, should promote the development of veterinary schools in Latin America. An increasing number of veterinarians with better training are needed for a more rational organization and utilization of animal health services and for the development of veterinary public health services in the different countries (6).

The Pan American Zoonoses Center and the Pan American Foot-and-Mouth Disease Center have a specific mission to fulfill in the preparation and implementation of the control of diseases within their plans of operation. Their principal lines of activity in support of foot-and-mouth disease and

zoonoses control programs are: (1) training of personnel in field and laboratory work; (2) advice on the planning, execution, and evaluation of the programs; standardization of reagents and diagnostic tests; reference tests on vaccines and sera; technical assistance in the supply of reference strains and reagents, and for the production of biologicals; and (3) research work to establish the most adequate diagnostic and control methods for Latin America.

The Pan American Zoonoses Center is a young institution with great potential for development. It constitutes an excellent example of inter-American cooperation against the most important animal diseases. Its existence not only implies a pool of material resources from different countries and international technical agencies, but also a pool of scientific talents from various countries to "contribute to the benefit of all countries." In this respect, it is worth while to point out that the Government of Argentina assists other Latin American countries generously. The task of the Pan American Zoonoses Center is widely recognized, but its multinational programs, its direct action, and its services in each of the countries of this vast Hemisphere demand the expansion of its activities, which only the interested countries may provide.

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MYIASES AS ZOONoses OF IMPORTANCE IN THE AMERICAS

DR. ROBERT SHARMAN *

When I was invited to speak on this subject, it did not occur to me to take up the subject of semantics. At the time, the word "zoonosis" did not appear to be a particularly formidable or ambiguous term, but a little research later on revealed some dismaying plurality of opinion among respected scientists and dictionaries about the definition of the word. The second edition of Webster's *International Dictionary* defines it as "a disease communicable from animals to each other or to man, or a disease due to animal parasites." K. Wagener even proposed some new words several years ago to help clarify the term. In summary, he states: "The present significance of zoonosis is investigated. The new words 'anthropozoonosis' and 'zooanthroponosis' are discussed with regard to the epidemiological value and the linguistic significance. In order to distinguish the pathogenic effect on man and animals, diseases of animals infectious for man are zooanthroponoses; anthropozoonoses are those human diseases which are infectious for animals."

With due regard for recent changes in the mores of society associated with such words as "hippie," "yippy," "pot," and "mini-skirt," you are offered the opinion, albeit timorously, that speakers still reflect good taste when they stick to the subject assigned to them. Here, it seemed, was a little problem of determining the scope of the subject.

Obviously, from the above definitions of zoonosis, this discussion could be restricted to myiasis in animals only, or to myiasis peculiar to both man and animals. Fortunately, Webster's Third *New International Dictionary* (1967) gives a more specific definition of the word. In one short phrase, it states: "a disease communicable from animals to man under natural conditions." This definition has been accepted in the preparation of this paper.

In the United States it has been estimated that losses to the livestock industry due to all types of insects, amount to almost one billion dollars annually. This figure does not include losses caused by the *Boophilus* species of ticks or by screwworms, two of the most costly infestations with which most nations in the Western Hemisphere still must contend.

The portion of these losses due to myiasis (the invasion of tissues or organs of man or animals by dipterous larvae) has been estimated at roughly one-third of this figure, or 330 million dollars.

Without regard for the scientific classification of the species involved, for this presentation I have made the following general classification: blowflies; bot flies; warble or grub flies; and screwworm flies.

Blowflies. The blowflies lost much of their significance as producers of economic losses by myiasis with the separation of the screwworm fly (*Cochliomyia hominivorax*) from this group. In a study by Knippling in

* Agricultural Research Service, Washington, D. C.

1937, only 9.6 per cent of the myiasis investigated were caused by blowflies. Another 10.5 per cent were caused by blowfly larvae and screwworms feeding in the same wound. Blowfly larvae are only found feeding on dead or damaged tissue around wounds, or fecal or putrid material adhered to the skin.

Botflies. The botflies are presented here as distinct from the warble or grubs only because the larval migration through the body normally terminates in some part of the gastrointestinal tract, instead of exiting through the skin, as in the case of warbles. Botfly larvae have rarely been incriminated of infesting humans, although a few cases have been documented.

Damage caused by this group is usually in the form of an irritating dermatitis and damage to the gastrointestinal tract, with resulting weight loss and, in rare instances, death. Present control is either mechanical (physically brushing off or removing the eggs attached to the hairs) or by chemical treatment directed at the larvae in the gastrointestinal tract.

Warble flies. As a group, the warble flies probably cause more economic loss to livestock producers in those regions where they occur than any other single insect. This is the result of the tremendous loss to the livestock industry through damaged skins caused by the exit of the larvae, in addition to dead or crippled animals resulting from larval migration through vital organs. This group probably accounts for more documented human cases of myiasis through accidental infestation than the other three groups, with the possible exception of screwworms in those areas where both are found. It includes *Dermatobia hominis*, the tropical warble fly or torsalo. The torsalo has been the object of extensive studies in Central America as to its habits and the possi-

bility of adapting it to a mass rearing technique in order to utilize the sterile fly technique for control and eventual eradication. Those engaged in research on the torsalo may well have one of the most fascinating and challenging projects in the entomological field today. The female torsalo has the odd habit of cementing her eggs to the ventral surface of other insects that feed or rest on the body of livestock. Such a peculiar habit could have been a real obstacle in developing a technique for mass rearing of the torsalo, but researchers have found that the common housefly, *Musca domestica*, can serve as the egg-carrying *Diptera* for the female torsalo under laboratory conditions. A technique for collecting torsalo larvae from host animals has also been developed by them.

Research on the use of systemic insecticides to control warbles or grubs has been going on for a number of years. This approach holds promise for reducing infestations to low levels or even eradicating isolated populations. When humans are infested by members of this group, surgical removal of the larvae is often necessary.

Screwworm fly (*Cochliomyia hominivorax*). This fly is probably the single most destructive species that causes myiasis. Severe economic losses by the screwworms stimulated research and led to the development of the sterile fly technique. Found throughout the temperate and tropical areas of the Western Hemisphere, the seasonal fluctuation of screwworm infestations has probably influenced the management of livestock more than any single insect. In areas where screwworm incidence is high, livestock are bred so that the young are born in periods of low screwworm incidence. Dehorning, castrations, shearing, branding, etc., are also scheduled to coincide with these periods of low incidence. Human infestation is not well documented as to incidence.

Myiasis in Animals in North America

Myiasis—"The condition resulting from the invasion of tissues or organs of man or animals by dipterous larvae." Hope, 1840.

	<i>Technical Name</i>		<i>Common Name</i>
Horses, mules, asses	Gasterophilus	intestinalis	Horse botfly
	G.	nasalis	Throat botfly
	G.	haemorrhoidalis	Nose botfly
	G.	inermis	European horse botfly
	Dermatobia	hominis	Tropical warble fly
	Cochliomyia	hominivorax	Screwworm fly
	C.	macellaria	One of the common blowflies
Cattle	Hypoderma	lineatus	Common cattle grub
	H.	bovis	Northern cattle grub
	Dermatobia	hominis	Tropical warble fly
	Cochliomyia	hominivorax	Screwworm fly
	C.	macellaria	One of the common blowflies
	Phormia	regina	Black blowfly
Swine	Gasterophilus	intestinalis	Horse botfly
	G.	haemorrhoidalis	Nose botfly
	Cuterebra	ssp.	Rodent botfly
	Cochliomyia	hominivorax	Screwworm fly
	C.	macellaria	One of the common blowflies
Sheep, goats	Oestrus	ovis	Sheep botfly
	Lucilia	sericata	Blowflies
	Phormia	regina	Black blowflies
	Cochliomyia	hominivorax	Screwworm fly
	C.	macellaria	One of the common blowflies
	Dermatobia	hominis	Tropical warble fly
Dogs, cats	Cuterebra	ssp.	Rodent botfly
	Cochliomyia	hominivorax	Screwworm fly
	C.	macellaria	One of the common blowflies
	Wohlfahrtia	vigil	No common name
	Dermatobia	hominis	Tropical warble fly
Birds (chickens, turkeys, guinea fowl, ducks, pigeons, geese)	Pseudolynchia	canariensis	Pigeon fly
	Cochliomyia	hominivorax	Screwworm fly
	C.	macellaria	One of the common blowflies

Adapted from "Check List of the Internal and External Animal Parasites of Domestic Animals" (reference No. 6).

Diptera Causing Myiasis in Man in the Western Hemisphere

"Diptera" is an order of the Class Insecta—Phylum Arthropoda. All diptera have only two wings and a pair of knobbed threads called halteres or balancers. All other winged insects have four wings in two pairs.

Family <i>Sarcophagidae</i>	Wohlfahrtia W. Titanogrypha	vigil opaca alata	(Walker) (Coquillett) (Aldrich)
Family <i>Calliphoridae</i>	Cochliomyia C. Phormia Lucilia Cynomyopsis Calliphora	hominivorax macellaria regina illustris cadaverina vicina	(Coquerel) (Fabricius) (Meigen) (Meigen) (Robineau-Desvoidy) (Robineau-Desvoidy)
Family <i>Gasterophilidae</i>	Gasterophilus G.	intestinalis haemorrhoidalis	(Degeer) (Linnaeus)
Family <i>Cuterebridae</i>	Dermatobia	hominis	(Linnaeus Junior)
Family <i>Hypodermatidae</i>	Hypoderma H.	bovis lineatus	(Linnaeus) (Villers)
Family <i>Oestridae</i>	Oestrus	ovis	(Linnaeus)
Family <i>Mucidae</i>	Paregle Synthesiomys Fannia F. F. F. F. Hydrotaea Stomoxys Muscina Musca	radicum nudiseta scalaris manicata incisurata cunicularis fusconotata meteorica calciatrans stabulans domestica	(Linnaeus) (Van du Wulp) (Fabricius) (Meigen) (Zetterstedt) (Linnaeus) (Rondani) (Linnaeus) (Linnaeus) (Fallen) (Linnaeus)
Family <i>Sylviolidae</i>	Sylvicola	fenestralis	(Scopoli)
Family <i>Stratiomyidae</i>	Hermetia	illucens	(Linnaeus)
Family <i>Syrphidae</i>	Tubifera T. T.	tenax dimidiata arbustorum	(Linnaeus) (Wiedemann) (Linnaeus)
Family <i>Piophilidae</i>	Piophilus	casei	(Linnaeus)
Family <i>Phoridae</i>	Megaselia M.	scalaris rufipes	(Loew) (Meigen)

Adapted from "The Flies That Cause Myiasis in Man" (reference No. 10). (Only those that have been documented as causing myiasis in the Western Hemisphere are listed.)

It is known that, as should be expected, more cases occur in humans during periods of high screwworm incidence in livestock. In 1935, 55 human cases were reported in the southwestern part of the United States, and in 1936 eight were reported in a survey made at that time. In 1965, Fox and colleagues reported on 10 cases that were found in a limited survey in Puerto Rico.

In a study conducted in 1935-1936, Knippling found that the larvae of *Cochliomyia hominivorax* were involved in 90 per cent of wound myiasis investigated in man and animals, 79.8 per cent of the time as pure screwworm cultures. The latest documented case in humans occurred in November 1968 in a woman near San Antonio, Texas, in which death resulted. This is the only case documented in humans in the continental United States since the beginning of the screwworm eradication program in the southwest in 1962.

Control and Treatment of Myiasis

Various methods of controlling myiasis have been utilized over the years. In the early part of the twentieth century, control efforts were confined mostly to mechanical methods and chemicals. Physically brushing off eggs of the bot and warble flies, placement of fly traps in areas of heavy infestation, and clothing of animals in hoods or skirts to prevent flies from laying their eggs are all examples of the mechanical controls that were resorted to. In later years, the spraying or dipping of livestock with insecticides and the application of effective ointments or liquids directly to infested wounds proved far more effective. Insecticides continue to provide effective control of insect infestations of domestic livestock, when used carefully and judiciously.

Systemic Insecticides

In 1943, it was observed that some insecticides caused a systemic effect, but it was

not until 1956, after almost 2,000 insecticides were screened, that a practical systemic insecticide was developed. An ideal systemic insecticide, besides having a broad entomological effectiveness, would be safe for livestock and leave no residue in their tissues or in their products to cause a food hazard. All of the presently available compounds fall short of the goal. Currently, there are only four systemic insecticides recommended for use on domestic livestock by the Entomology Research Division of the U.S. Department of Agriculture.

To date, all systemic insecticides administered to lactating cows have been detected in the milk, so they cannot be used to treat lactating dairy animals without discarding several days' milk production. All compounds now recommended for use in the United States as systemic insecticides carry this restriction in regard to lactating animals.

Sterile Male Technique

Perhaps no other breakthrough in the field of insect control has stirred the imagination as much as the development of the sterile male technique. The sterile male theory of insect eradication was first conceived by E. F. Knippling in 1937. It was not until 1955, however, that all major problems involved in the technique were finally resolved and successful field trials conducted. Since then, the basic technique has been modified from time to time to meet changing circumstances and to lower the cost of its application.

The technique has a tremendous advantage over the use of chemicals that may cause development of insecticide-resistant insects. The emergence of a sex-resistant screwworm fly seems quite unlikely. The insect has never been suspected of a faltering libido. Imprudent though it may be

to make positive, dogmatic statements in the field of science, there seems to be little hazard in asserting that the screwworm will continue to demonstrate a boisterous enthusiasm for the siren call of the opposite sex, whether they have been taking the "cobalt-pill" or not. Sex could expect to triumph, even if each screwworm should become resistant to every insecticide. If the screwworm loses his interest in sex, he is doomed anyway.

All this does not mean that insecticides should not be used in conjunction with the sterile fly technique. Insecticides have proved to be most helpful in eradicating screwworms in the United States while sterile flies were being released. Harmful residues are minimal, however, since the amount of insecticide and the time over which it is used in conjunction with eradication are both very limited.

When first proposing his theory, Knipling stated that the following conditions should be met for the sterile male technique to be effective:

1. A method of mass rearing of the insect must be available.

2. An adequate dispersion of the released sterile males must be obtained.

3. The sterilization procedure must not adversely affect the mating behavior of the males.

4. The female of the insect to be controlled must normally mate only once, or if more frequent matings occur, the sperms from gamma-irradiated males must compete with those from fertile males.

5. The population density of the insect must be inherently low or the population must be reduced by other means to a level which will make it economically feasible to release a dominant population of sterile males over an extended period of time.

The mathematics involved in determining the number of sterile males needed to trigger

a population decline have been worked out. Under ideal, predetermined circumstances, one could take two equal populations, one sterile and one fertile, and mix them thoroughly, thereby obtaining a 50 per cent reduction in that generation. For example, 1,000 sterile flies dispersed in an area containing 1,000 fertile flies should result in a breakdown of 250 sterile flies bred to sterile flies, 500 sterile flies bred to fertile flies, and 250 fertile flies bred to fertile flies.

Many uncontrollable factors make it impossible to achieve a screwworm population reduction that coincides with a mathematical formula. Some examples are:

1. Variations in the density of natural populations. While sterile flies may be uniformly dispersed over a given area, extreme concentration of fertile flies in a portion of that area upsets the ratio to sterile flies.

2. Difficulty in precisely determining fertile fly incidence and abundance.

3. Inability, due to climatic conditions, to aerially release sterile flies in a consistent fashion, day after day.

4. The possibility of slight strain differences between the sterile and fertile flies.

5. The unpredictable effect countless combinations of weather patterns can have on a native screwworm population.

6. The number of wounds available for screwworm attack in a given area at different times of the year.

7. The incidence and abundance of the screwworm fly's natural enemies.

8. Livestock management practices and the degree of cooperation by livestock owners in a given area.

There are factors in sterile fly production that also confound the mathematician and his formula. For example, no one really *knows* what the optimum size of a sterile fly should be, and it may well be that different sizes should be produced under dif-

ferent extremes of geography and weather. Diet, stress factors, and inbreeding, among countless other factors, could produce a lethargic, noncompetitive fly, whose conduct in the field could upset the mathematical calculations.

As one might expect, the sterile male technique seems to be more effective when applied to low population densities and at a time of year when the population is declining. Chemical insecticides, on the other hand, produce more striking and economic results when applied to high insect populations, but become increasingly ineffective and uneconomic as population densities decrease. It is by the combination of the two techniques that the greatest potential for control and eradication of insect populations is reached.

The sterile fly technique seems applicable to any given geographic area. Application of the technique without adequate preparatory work could result in excessive program costs, waste, confusion, and perhaps failure, if those expecting benefits from the program are too long denied the success they anticipated. Extensive field surveys to determine the nature of the problem and to accumulate much indispensable data are a must for a sound program. Knowledge about insect population densities during different seasons of the year, and the location of areas where the insect cannot survive all or part of the year, will make it much easier to determine the size of the production plant, the size of the budget, and the number of personnel needed to operate a program.

Future Possibilities

A good screwworm attractant would give a big boost to screwworm eradication efforts. Not only would an attractant make it possible to help reduce screwworm populations through the use of conventional fly

traps, but it would also provide a much more effective means for determining the relative number of native flies in any given area at any time of the year, thus making it possible to release sterile flies quickly and in quantity where they are most needed.

It is pleasant to dream of a good screw-worm attractant combined with a safe, effective chemo-sterilant for field use. Perhaps it is unrealistic to hope that some day we might, in effect, make sterile fly factories of native populations.

Enzymes to prevent or upset diapause (the dormant period of some insects during certain stages) have been used with some success to control the boll weevil. Another potent weapon would be added to the arsenal if flies could be encouraged to emerge into unfavorable climatic conditions. This might be especially applicable to some of the warble or grub flies. Then there are researchers working with growth enzymes, which cause the larvae of some insects to continue growing and never mature. Would one call such an enzyme cocktail a Frankenstein frappé?

These particular approaches may never yield fruit, but we should not become too impatient. The itch of the scientist's foot seems to become more acute with each passing year. With talk of a moon landing, his head is literally now above the clouds, and who had ever heard of a green monkey only a few years ago? Supersonic commercial airlines, heart transplants, tissue culture—the parade of scientific breakthroughs continues. A "trip" sponsored by LSD would probably pale to the dimensions of a visit to the local zoo, if one contemplated at length some recent work done with frogs: Replace the zygote of a frog ovum with a cell from any randomly selected donor frog. A young frog is produced that is a genetic duplicate of the donor.

Now substitute man for the frog. How many Einsteins would the world desire? Or Hitlers? Would you like several carbon copies of yourself?

We can expect as yet unheralded breakthroughs that will enable us to better cope with myiasis. Some, of course, may prove to be duds, as illustrated by the following example: An eminent scientist trained a screwworm fly to perch on the back of his chair and on command to fly around the room and again perch on the chair. His

friends were amazed with his success in training the screwworm fly. One day the scientist wondered what would happen if he plucked the wings off his pet screwworm fly. This he did, and then gave the fly the command to circle the room. Nothing happened, despite repeated commands. The scientist was so intrigued that he wrote a paper about his experiment. His conclusion seemed sound enough: If you remove the wings from a screwworm fly, he becomes deaf!

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THE STATUS OF RABIES IN THE AMERICAS

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Three hundred or more years ago canine rabies was introduced into the Americas. Since then it has found conditions conducive to its propagation in urban areas, where thousands of dogs breed without any control. In Canada and the United States of America, where there is more control over dogs and millions of them have been immunized in the last few years, it has become obvious that canine rabies has spread among the sylvatic fauna to such an extent that in the neoarctic region, foxes and skunks have become the main reservoir and are responsible for most rabies accidents (1). Bats' disease, which was recognized by our most ancient cultures, appears as a major plague in the present century only when the jungle is converted into pasture and the large herbivores are introduced. This change in the ecosystem offers

favorable conditions for a new niche where bats become a pest (2). Rabies in dogs, wild carnivores, and bats are three forms of the same disease which have created a wide variety of problems for man because of their ecological adaptation.

A review of the world rabies situation, as it appears in the World Survey of the World Health Organization for 1967, seems to indicate that the Americas hold first place, because of the largest number of cases of rabies in animals reported, but Asia seems to be the geographic region where the largest numbers of antirabies treatments were applied to man (Table 1). However, when analyzing these figures, we must bear in mind that the level of diagnostic skill and of case-reporting procedures is not the same in the different parts of the world.

The information submitted to PAHO/WHO by 27 countries of the Americas clearly shows that rabies is endemic throughout the Hemisphere and that re-

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TABLE 1.—Number of Cases of Rabies in Humans and Animals and Persons Treated in 1966 and 1967 (World Figures *).

Region	Animal cases		Dogs and cats		Persons treated		Human cases	
	1966	1967	1966	1967	1966	1967	1966	1967
Africa	1,520	1,393	1,224	1,295	64,213	20,418	93	62
Americas	15,351	25,909	9,549	9,716	189,911	232,619	222	312
Asia	5,808	6,388	5,427	6,233	253,036	314,628	369	445
Europe	1,134	6,429	507	702	25,608	6,933	6	5
Totals	23,813	40,119	16,707	17,946	532,768	573,698	690	824

* The disease has not been reported in Oceania.
Source: World Health Organization, World Survey of Rabies IX, 1967 (Document WHO/Rabies/68.167); Annual Report of the Director of the Pan American Sanitary Bureau, 1967 (Official Document PAHO 86).

cently it has been reinvading countries such as Canada, Costa Rica, and Uruguay, which had managed to rid themselves of the disease. The only countries free from rabies are the islands of Jamaica, Martinique, Guadeloupe, Barbados, and St. Vincent, but even in Trinidad, Surinam, Cayenne, Guyana, and Panama, where rabies is to be found in bats, there are no cases of canine rabies on record (Table 2).

Generally speaking, canine rabies constitutes an important public health problem throughout the Hemisphere and sylvatic rabies is a threat to man in Canada and the United States of America. In Latin America, besides the seriousness of the human problem, there is the additional problem of the extremely high mortality rate among cattle due to rabies in bats. These two aspects are so important that, leaving aside the etiologic unity of rabies, we must deal with each of them individually in the context in which it makes its greatest impact, i.e., on human health and animal husbandry.

The Public Health Problem

The seriousness of the problem becomes apparent as soon as the need of providing medical services to thousands of bitten persons and of giving antirabies treatment to all those wounded by rabid animals or stray dogs is recognized. Some idea of the situation may be gained from the fact that in Argentina in 1964, 58,237 bitten persons were treated and treatment had to be given to 15,659 exposed to rabies (3), a figure which rose to 30,528 in 1967 (4).

In the Americas in 1967, antirabies treatment had to be given to 232,619 persons and, if we remember that rabies was detected in only 9,716 dogs and cats, it must be assumed that the large number of treatments was due mainly to contact with un-

known dogs. In Canada, the United States of America, and Mexico, out of a total of 17,258 cases of rabies in animals in 1967, only 2,131 occurred in dogs and cats, whereas in the countries of Central and South America, 80 per cent of the cases of animal rabies were attributable to dogs and cats (Table 2), which clearly identifies the main vector and largest reservoir of rabies (4).

As regards vaccination, it must not be forgotten that human prophylaxis is not without its dangers and that treatment should be limited to persons who have been exposed to direct contact with rabid or potentially rabid animals, e.g. unknown dogs and sylvatic fauna. Postvaccine reactions, so frequent in the past, have decreased considerably with the drop in the number of unnecessary treatments and especially as a result of the use of new vaccines containing no myelin or other encephalitogenic elements. Nevertheless, some accidents of the neuroparalytic types are still recorded in some Latin American countries. In countries where hyperimmune antirabies serum is used for serious bites, serum reactions have been observed in persons so treated. These accidents are liable to occur among 20 per cent of those undergoing the mixed serum and vaccine treatment, but no one should be dissuaded from using it, provided that the explicit recommendations of the WHO Expert Committee on Rabies are followed and the sensitivity test is made beforehand. Reactions are less frequent in the case of children and Negroes (5).

Even though more antigenic vaccines are available in almost all countries and the new antirabies prophylactic schemes make it easier to avoid the disease in man, there are drawbacks and difficulties in applying the antirabies treatment, in time, to those affected. Thus in 1967, out of the reported total of 312 human deaths caused by ra-

TABLE 2—Rabies in the Americas in 1967.

Region and country	Cases of rabies in animals			Cases of rabies in humans	Treatments
	Total	Dogs cats	Other species		
<i>North America</i>					
Canada	1,560	154	1,406	1	2,000
United States of America	4,133	567	3,566	2	30,000
Mexico	11,565	1,410	10,155	40	67,000
<i>Central America and Panama</i>					
Costa Rica	364	334	30	3	1,433
El Salvador	52	41	11	2	1,200
Honduras	101	87	14	2	982
Guatemala	220	203	17	3	2,443
Nicaragua	154	141	13	1	1,395
Panama	—	—	—	—	28
<i>South America</i>					
Argentina	2,391	2,232	159	11	30,528
Bolivia	56	33	23	6	166
Brazil	150	96	54	43	46,087
Chile	54	38	16	—	6,842
Colombia	2,281	2,037	244	127	19,440
Ecuador	291	272	19	33	3,912
Paraguay	83	78	5	7	569
Peru	906	890	16	13	5,401
Uruguay	32	26	6	—	1,803
Venezuela	1,249	843	406	15	10,608
<i>Caribbean area</i>					
Barbados	—	—	—	—	—
Dominican Republic	235	233	2	3	749
Guyana	—	—	—	—	—
Jamaica	—	—	—	—	—
Netherlands Antilles	—	—	—	—	—
Surinam	—	—	—	—	54
Trinidad and Tobago	3	—	3	—	59
West Indies	29	1	28	—	—
Totals	25,909	9,716	16,193	312	232,699

Source: World Health Organization, World Survey of Rabies IX, 1967 (Document WHO/Rabies/68.167); Annual Report of the Director of the Pan American Sanitary Bureau 1967 (Official Document PAHO 86).

bies in the Americas, 282 were of persons who had not undergone treatment, and only in Colombia was the figure as high as 127 (Table 2). Isolation from the educational influence of the school, the distance of medical services from rural areas, and the lack of communications are the causes of this avoidable tragedy.

These are the reasons for reaffirming the need to ensure that both the serum and the vaccine intended for use are systematically checked as harmless, whatever their origin may be, and for testing the antigenic value of these biological products. In this

connection, the efforts being made by the Pan American Health Organization to train the necessary specialized personnel in this field are now making themselves felt in most of the countries, and it is only to be hoped that the medical personnel will try to achieve some consensus on human prophylaxis, especially in the simultaneous administration of antirabies serum and the initiation of a series of 14 doses of vaccine, followed 10 and 20 days later by a booster dose. This recommendation by the WHO Expert Committee has been the subject of careful studies in which the presence of

antibodies was established in persons treated, who had been exposed to rabies, and in many volunteers (5).

In view of the impossibility of providing antirabies treatment in all circumstances, of the disadvantages of vaccination for the patient, and of the possibility of postvaccine accidents, we are forced to agree that the solution to the rabies problem cannot lie in human vaccination and that the health authorities must adopt a more dynamic and determined attitude in the campaign against this zoonosis in order to control or eradicate rabies in its real reservoir which is the dog.

In health administration, it is necessary to try to assess the cost of antirabies treatment and to ascertain what the personnel requirements of these services are, in order to determine what priority should be given to the control of canine rabies, and to decide whether it might be more economical to try to eradicate it.

The number of treatments given in the Americas in 1967 indicates that over 6 million dollars were invested in the purchase and production of serum, vaccines, and topical remedies for wounded persons. To this conservative figure should be added the value in terms of money of the time spent on the necessary services and the fact that, on the same basis, an estimated minimum of 38,770 hours were spent on medical care and 271,389 hours on paramedical services. In assessing the cost of the disease in relation to treatment, it must not be forgotten that those treated need 15 days complete rest, and that the 232,619 persons who received treatment must have thus lost over three million working days. This enormous investment in money and time was still not enough to dispel the concern and anxiety felt by the bitten persons or the sorrow that the innumerable deaths, which we know did not come to the notice

of the authorities, must have caused the families concerned.

The implementation of various control measures has enabled many European countries and Japan to control canine rabies once and for all. In the United Kingdom the systematic use of the muzzle and chain has helped more than anything else to eradicate rabies. In Panama and Trinidad the elimination of stray dogs some years ago produced a similar result and, although this measure is not being applied so rigorously now—many dogs can be seen in the street—there is no canine rabies and strict quarantine regulations prevent its reintroduction. Again, in the United States of America, systematic vaccination with low-passage avianized vaccine has reduced canine rabies to the point where it is officially regarded as an eradicable disease.

The vaccination of millions of dogs in various parts of the world and in the most varied environmental conditions has proved the value of the Flury-type vaccine and there is no doubt that vaccination with this or some other type of properly checked vaccine may, assuming there are no stray dogs, lead to complete control of canine rabies.

The importance of the mass vaccination of dogs was recently established in Europe. The violent epizootic of rabies in foxes did not spread to vaccinated dogs, so that in Denmark, Switzerland, Luxembourg, Belgium, and the Netherlands, the epizootic of sylvatic rabies did not become an urban problem.

In Latin America, the main obstacle to the antirabies campaign is the stray dog, an animal allowed by tradition and custom to wander about, search for food and relieve itself in the public thoroughfare and which has, in some countries, multiplied to an unsuspectedly high figure. It may be said without exaggeration that over 60 per cent of

the dogs in our countries spend most of the day in the streets. The antirabies campaign against such an evasive animal as the stray dog presents the same features and the same difficulties as that of controlling rabies in wild fauna. Hence, dog vaccination is of no value, whatever the system adopted, whether it be house-to-house vaccination, i.e., taking the vaccine to the dog, or the establishment of vaccination centers to which the owner has to bring his dog. Stray dogs will always escape vaccination in numbers which cannot be determined because the stray dog population is actually unknown. In Uruguay in 1966 the dog population of the small Department of Montevideo was estimated at 150,000, on the basis of 10 per cent of the human population. However, after vaccinating 222,886 dogs, it was realized that the number and density of the dog population had been impossible to calculate. In many marginal areas, unbelievable efforts were made to vaccinate vicious dogs which not even their own masters could catch, but it was all to no avail. Although 10,000 strays were caught and destroyed in the urban areas, considerations unconnected with the development of the program prevented a drastic elimination program from being organized, and it proved impossible to stop the propagation of rabies. These results stand in contrast to the sacrificial measures adopted in 1946 which succeeded in controlling rabies in Uruguay for 20 years or until the suspension of the quarantine and control measures caused it to be reintroduced in 1965 (6).

The satisfaction felt by health authorities when they reach a record figure for vaccination very soon turns into frustration when they see that, despite reducing the incidence of cases of rabies in dogs, the number of persons receiving treatment for dog bite by unknown animals continues to

be high, and their disappointment is even greater when the campaign is no longer pursued with the same intensity and cases of canine rabies gradually start to mount again.

Those responsible for rabies control programs become more and more anxious every day about the problem of the stray dog and recently, at a multinational meeting, consideration was given to the need to study the growth dynamics of the dog population. If there are no stray dogs, a direct or indirect census makes it easy to determine the dog population, which is no problem in places where dogs are licensed and registered each year. On the other hand, the problem arises when efforts are made to estimate the number of dogs which mill through the streets and cannot be vaccinated. Experience throughout Latin America has proved beyond all doubt that only where there are no strays can canine rabies be controlled, so that, if control is the aim, there is no alternative but to adopt energetically measures to control and/or destroy stray dogs. Whatever method is adopted—capture or destruction or, as some dog lovers suggest, capture and immunization—there is always the difficulty that the system is contradictory and the operation is slow and costly. But the seriousness of the rabies problem and human life are much more important than the affection that may be felt for dogs, and it will obviously become necessary, through the force of circumstances, to resort to poisoning, as is being done in all countries which have decided to stamp out rabies and where the unduly large number of strays makes vaccination ineffective.

Because of the cultural characteristics of our peoples, who are dog lovers and have kept dogs as domestic animals for 3,000 years, it is necessary to launch effective guidance and educational programs to en-

sure that control measures are systematically and continuously applied. The lack of an adequate budget will often prevent the implementation of more sophisticated and more costly measures and make it necessary to resort to the poisoning of stray dogs and animals which have not been vaccinated. This is a drastic step which makes it possible to attain the objective very quickly and at a very low cost. Even if some opposition is encountered at the planning stage, it can always be carried out without offending the people's natural sensibilities, especially when the cooperation of the public and the press has been enlisted.

The Effects of Rabies in Bats on Animal Husbandry

Rabies transmitted by vampire bats is the tropical plague that is responsible for most mortality among cattle. The disease extends from Mexico to the Argentine Chaco and is present in all inhabited tropical areas where the number of cattle has enabled vampires to proliferate until they have become a pest(2). Ecological conditions have changed considerably for the bat, from the days when there were only isolated colonies feeding on wildlife, up to the time when the presence of thousands of head of cattle supplied them with abundant food. These favorable conditions, for which there would seem to be no limiting factor other than rabies, have enabled the vampires living near cattle areas to multiply to an extremely high density, and it is possible to find as many as 250 bats in a single tree. The predilection which the common vampire bat has developed for the blood of bovine cattle has made the cow the main target of its depredations, and it is not uncommon to find that over 10 per cent of the animals in the field have been bitten. If to this we add the fact that bovines are highly

susceptible to rabies, it will be understood how these animals serve not only as sentinels for rabies but are also the chief victims of the epizootics which develop in the vampire colonies.

Since transmission requires direct contact from animal to animal, rabies in bats is propagated within limited areas and only occurs at one time in one region, without spreading to all regions of a country, and even in the same region it prevails in separate foci which are apparently not inter-related. Because of the self-restricting nature of rabies and the natural recovery of the bat population, the disease has a three-to-five-year epidemic cycle and rabies appears successively in bats and then in cattle at intervals of a few weeks. Outbreaks in cattle generally start during the rainy season, which would seem to indicate that the infection in bats occurs in spring before parturition, when the bat colonies are at their densest and the families disperse.

In the countryside, the sporadic cases of rabies in cattle which start epizootics are confused with intoxication from poisonous plants, which also appear in the spring, and also with the state of coma associated with any other disease. These isolated cases come to the knowledge of the veterinary services only when the number of cattle deaths is so high that the diagnosis is self-evident. An epizootic in a small community often kills even the work animals and the land is frequently left uncultivated. While this is a tragic situation, it is no less tragic in the large cattle-raising areas where the death rate is often in excess of 50 per cent and the economic losses are enormous. The lack of means of communication prevents the health authorities from knowing about the disease in good time and, when they do arrive in the affected areas, they can hardly even find material to send to the laboratories. The confirmed cases are

generally part of an outbreak in which many animals have died and the registration of these cases is usually all the information that can be officially obtained.

These data are the same each year, and in 1960 formed the basis for estimating an annual loss of 900,000 animals (7). On the basis of more recent data a compilation was made in 1967 and appears in synopsis in Tables 3 and 4. The information supplied by the 19 countries gives an annual average of about 87,000 cases but estimated that the total annual losses exceed 500,000 animals (8).

The Food and Agriculture Organization of the United Nations (FAO) has estimated, on the basis of the same information, that rabies in bats is responsible for cattle losses amounting to 350 million dollars per year in tropical America.

The danger to man of bites from blood-sucking bats is another serious subject of concern. Although it is not quite as dramatic as travelers at the beginning of the century depicted it, it is nevertheless a re-

TABLE 4—Estimate of Economic Losses Due to Paralytic Rabies in the Americas.^a

Country	Year	Annual loss in US\$ ^b
Argentina	1964	10,000,000
Bolivia	1965	1,500,000
Brazil	1965-1966	22,000,000
British Honduras	1961	100,000
Cayenne (F.G.)	1958	60,000
Colombia	1964	1,260,000
Costa Rica	1962	365,000
Ecuador	1963	850,000
El Salvador	1961	108,000
Guatemala	1964	168,000
Guyana	1959	43,000
Honduras	1960	87,000
Mexico	1964	10,400,000
Nicaragua	1962	200,000
Panama	1962	115,000
Paraguay	1963	94,000
Surinam	1963	55,000
Trinidad	1961	5,000
Venezuela	1960	119,000
Total		47,529,000

^a Reproduced by permission of P. N. Acha. "Epidemiología de la rabia bovina paralítica transmitida por los quirópteros." *Boletín de la Oficina Sanitaria Panamericana*, Vol. LXIV, No. 5, May 1968, p. 419.

^b Calculated at the official local exchange rate for the year reported.

ality and frequent occurrence. In Trinidad, Mexico, and Peru, we have seen in small jungle settlements many children who had

TABLE 3—Bovine Paralytic Rabies in the Americas.^a

Country	Year the disease was reported and by whom	No. of cases per year (various reports)	Estimated annual mortality	No. of bovines vaccinated per year
Argentina	1928. Acosta, J., Quiroga, S.	18,000 (1964)	50,000	100,000 (1965)
Bolivia	1936. Selles, Alvarado de	20,000 (1965)	50,000	5,000 (1965)
Brazil	1911. Carini, A., Rehaag, H.	32,200 (1965)	200,000	1,300,000 (1965)
British Honduras	1961. Acha, Pedro N.	815 (1962)	2,000	200 (1965)
Cayenne (F.G.)	1955. Hidiroglou, M.	600 (1958)	1,000	
Colombia	1931. Missas, S. Willis	5,300 (1964)	50,000	150,000 (1963)
Costa Rica	1952. Rivera, E.	132 (1964)	10,000	18,000 (1963)
Ecuador	1947. Coba, T., Oliva, G.	930 (1962)	5,000	4,500 (1962)
El Salvador	1950. Sandoval, M.	1,080 (1961)	3,000	7,000 (1964)
Guatemala	1951. Rodas, F., Montemagno, F.	1,120 (1964)	12,000	8,000 (1964)
Guyana	1923. Torres, Silvio	2,000 (1957)	3,000	30,000 (1963)
Honduras	1949. González, F.	348 (1960)	6,000	5,000 (1963)
Mexico	1932. Téllez, Girón	1,502 (1963)	90,000	1,000,000 (1963)
Nicaragua	1951. Málaga Alba, A.	831 (1962)	10,000	8,000 (1964)
Panama	1957. Medina, G.	218 (1962)	8,000	5,000 (1963)
Paraguay	1913. Aranda, S.	320 (1963)	5,000	2,000 (1964)
Surinam	1953. Langelier, E., Collier W.	733 (1963)	2,000	5,013 (1963)
Trinidad	1925. Pawan, J. L.	2 (1965)	500	24,047 (1963)
Venezuela	1938. Gallo, P.	215 (1965)	5,000	53,032 (1963)
Total		86,346	512,500	2,724,792

^a Reproduced by permission of P. N. Acha. "Epidemiología de la rabia bovina paralítica transmitida por los quirópteros." *Boletín de la Oficina Sanitaria Panamericana*, Vol. LXIV, No. 5, May 1968, p. 419.

been bitten at night by the "witches." From 1925 to 1961, these bat bites were responsible for 159 deaths from rabies in Trinidad, Mexico, and Guyana, and since the human deaths have been registered in Brazil, Bolivia, and Argentina (8, 9).

Now that the tropical forest is being traversed by roads and efforts are being made, with the help of all the sciences, to develop its economic and industrial potential, it seems wise to ascertain the real magnitude of the problem and to take immediate steps to avoid the loss of over 77 million kilograms of meat in regions where there is a protein deficiency and where cattle deaths cause disappointment and frustration among those who are striving to conquer the jungle.

Looking ahead at the problems which rabies may create in the future, but also conscious of the reality of the depredations by bats, efforts are being made, and rightly so, to find a way of controlling rabies by specifically reducing the number of blood-sucking bats. Unfortunately, poisoning vampire bats presents more difficulties than reducing the population of other vectors of sylvatic rabies. True, vampire bats can be poisoned with strychnine, but this means treating all the bites on cattle with poison so that the bats die when they reopen the wounds. In addition to this difficult task, other drawbacks include the daily roaming of the animals and the fact that rain often washes away the poison.

When vampire bats nest in the more unsuspected and inaccessible places, it is unbelievably costly and difficult to locate and destroy the colonies, and although the destruction of thousands of bats is reported every year, the truth of the matter is that only a few vampire bats are killed off.

The systematic tracing and destruction of vampires has not produced practical results and the experience of the countries which

have operated well-organized and strictly supervised teams has been negative. In Trinidad, in spite of the systematic destruction of thousands of vampires, rabies kept appearing year after year until the less costly systematic vaccination of cattle gradually made it possible to control rabies cases (10).

In the Pan American Zoonoses Center, recent experimental work has shown that vaccination can generate large numbers of antibodies and protect bovine cattle effectively. This research has not only dispelled all previous misgivings about this possibility but has also demonstrated that both inactivated vaccines and vaccines prepared with attenuated viruses may produce full immunity, although the period of protection varies with the type of vaccine used (11). In the case of inactivated vaccines, the production of antibodies gradually falls off until it disappears, whereas with attenuated vaccines the virus continues to multiply in the animal organism and generates antibodies for a long period (12).

The dose of inactivated vaccines should be capable of giving immunity for a minimum of one year and for this the dose for bovine cattle must be equivalent to 6 grams of nerve tissue (5). However, if new vaccines are used, such as those prepared from the brain tissue of pregnant mice, a minimum of only 50 centigrams of this material is required per dose because of the presence of large numbers of viruses and because of the high antigenic content.

The condition in which the animals breed in the tropics makes it very difficult to assemble them and the problems which this creates constitutes a greater burden for the cattlemen than the cost of vaccine. This is one of the reasons for using attenuated live virus vaccines which, as we have seen, have the advantage of protecting the cattle effectively for periods of over two years and,

from the point of view of health administration, greatly facilitate the development of immunization programs and the preparation of vaccination schedules, which thus become more economical when vaccination no longer has to be repeated every two years. Among the attenuated vaccines displaying these characteristics, the vaccine prepared in cultures of pig kidney cells seems to be the one to be recommended, because it generates more antibodies after immunization and protects the cattle experimentally vaccinated with a dose of infectious virus for a three-year period (11, 13). It has the added advantage of being usable in the same doses on dogs and other animals (14).

The national impact of the problem and even its international implications are such that the protection of a nation's cattle population cannot be left to private enterprise. Official participation is required in the planning and execution of programs for establishing reporting systems—with the active cooperation of the cattlemen, for facilitating diagnosis, and for carrying out epidemiological studies designed to determine in each region the periodicity of the diseases and the times when vaccinations have to be made; and since these programs would be based on the immunization of cattle, the production and/or supply of high-quality vaccines adapted to the conditions in which the immunizations are to be made must be guaranteed. The resources which have been fruitlessly used on the control of bats should be channelled into the study of bat biology and the epizootiology of the disease, because this knowledge will make it possible to establish new criteria and methods, but meanwhile the sureness of an effective vaccine is the best guarantee of the success of the programs.

At a time when all the countries of America are doing their utmost to improve

and develop the sources of their economic resources, especially animal husbandry, it seems that one of the first steps that ought to be taken is to control those diseases which, like rabies, are avoidable and delay the development of the livestock industry and lower its yield. If to this is added the extremely high cost of avoiding the disease in man, we will have sufficient reasons for deciding to adopt the simple measures for eradicating rabies in dogs and avoiding the disease in cattle, which can be summed up as follows: The elimination of stray dogs and the mass immunization of cattle and of dogs who have owners.

If this objective could be attained, it would be possible to avoid the losses caused by cattle rabies, animal husbandry in the tropics would have a new lease on life, and medical care could be diverted to the fight against diseases whose rates of morbidity and mortality are so high that they should be given higher priority. The financing and adoption of these measures, which would mean final victory over canine rabies and the effective protection of livestock, will always be less costly than continuing indefinitely to live with the disease.

The most serious problem facing us is, without doubt, the lack of specific information on the seriousness and extent of the problem in each region and country. We are convinced that, once Governments have this information, they will not hesitate to take the necessary action and will be able to enlist the cooperation of neighboring countries, economic support and the technical assistance necessary to solve a problem which is now the subject of the most serious international concern.

Summary

Although rabies in America has been a subject of great concern, no serious effort

has yet been made to control it once and for all. Over the past 20 years ways and means of control have been developed for eliminating any possibility of man being infected, for eradicating the disease in dogs, and for protecting cattle against rabies from vampire bats. The discovery of new types of vaccine, the control of biological production, and the improvement of antirabies treatment schemes have made this possible.

The campaign against rabies, as against all zoonoses, is based on controlling the disease in the animal reservoir. The immunization of dogs can interrupt the propagation of rabies, provided that stray dogs are eliminated; otherwise rabies will persist in endemic form and all people bitten by stray dogs or animals suspected of harboring the disease will have to undergo prophylaxis. Inactivated vaccines are still being used on man and, for serious bites, the simultaneous

administration of antirabies serum and vaccine is recommended, the treatment to be supplemented by booster doses.

Since it is impossible to develop effective control of bloodsucking bats, the most practical and economical solution is the mass immunization of cattle. For controlling canine rabies and protecting cattle, the best method is to use attenuated vaccines because, as the virus multiplies in the animal organism, it stimulates the production of protective antibodies for a long time.

Given the serious problem of public health and the way in which rabies affects the development of animal husbandry in America and continues to lower output in the livestock sector, Governments must seek to understand and know the problem better. This will certainly encourage national action and a regional effort to find the solution to a problem which has now awakened international interest.

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THE PROBLEM OF HYDATIDOSIS IN THE AMERICAS

DR. A. TREJOS AND DR. J. F. WILLIAMS *

Two species of the genus *Echinococcus* represent public health problems in the Americas: *E. granulosus* and *E. multilocularis*. The former constitutes, in addition, a serious economic problem due to the losses caused by seizure of viscera of sheep, cattle, and swine infected with this parasite. As a result a considerable amount of animal protein is made unavailable for human consumption.

E. multilocularis is widely spread in northern North America and it has been found in Alaska (1), British Columbia, Saskatchewan, Manitoba, the islands of the Hudson Bay (2, 3), and North Dakota (4).

E. granulosus has been found in the central and western regions of Canada, and for some time it has been a problem in Mississippi (5), where up to 4 per cent of the slaughtered swine have been found positive. Schwabe (6) has recently detected a focus of this species in California, with an infection rate of 5 per cent in the sheep examined.

In South America the important foci of hydatidosis caused by *E. granulosus* are located below the Tropic of Capricorn, with the exception of the highlands of Peru. There hepatic cysts have been found in 9 per cent of the sheep, and a very high prevalence of *E. granulosus* occurs in dogs (64 per cent in some areas) (7). The annual

human infection rate is approximately 1 to 100,000 (8).

The most severe problem exists in Argentina, southern Brazil, Chile, and Uruguay, where the human infection rates are 1.9(9), 0.1(10), 8.0(11), and 18.2(12) per 100,000 inhabitants, respectively. However, the geographic distribution of cases within these countries is not even; in Argentina, for example, the morbidity rate in Neuquén during 1966 was 52.4 per 100,000 inhabitants(13).

As a result of a thoracic census performed in the Province of Neuquén, by the Provincial Antituberculosis Center, it was found that 151 (0.43 per cent) out of 35,336 persons examined by abreugraphy had pulmonary hydatid cysts.

It should be borne in mind that, in the majority of cases, rates are calculated on the basis of clinical diagnosis and that the actual prevalence is much higher. In Chile, for example, Neghme and Silva (14) refer to annual morbidity rates that vary between 3.8 and 8.8 per 100,000 inhabitants for the period 1945-1959. Schenone and Reyes (15) have recently published data obtained from 41,799 necropsies performed at the Medical Legal Institute of Santiago, among which 84 cases of hydatidosis were revealed, representing an annual rate of 201 to 100,000, i.e., over 20 times the morbidity rate. It is interesting to note that pulmonary cysts were present in only 11 per cent of these cases, while hepatic cysts occurred in 81 per cent.

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Economic Losses in Public Health

Economic losses due to hydatidosis are difficult to estimate exactly, but data exist which give an idea of the minimum figures involved. In Argentina, a Working Group (Resolution 2408/68 of the Ministry of Public Health) estimated the hospitalization costs for 1965 to be 150,000 dollars.

In Chile, where the annual incidence of hydatidosis is approximately 600 to 800 cases and the mortality 6 to 7 per cent, Neghme and Silva (14) estimate the hospitalization cost to be about US\$300,000 per annum, not taking into account either welfare payments or the loss of man-hours affecting the economy of the country.

In Uruguay, Purriel *et al.* (12) estimate that during 1962, 1963, and 1964 the costs of surgical attention to approximately 500 cases of hydatidosis admitted to five hospitals of the country amounted to nearly US\$200,000, i.e., about 400 dollars per patient.

Economic Losses in the Livestock Industry

Nearly 13.1 million head of cattle and 13.3 million sheep are slaughtered yearly in Argentina, Chile, Uruguay, and Rio Grande do Sul (Brazil). Of these, 2.2 million and 3.52 million, respectively, are parasitized by hydatid cysts. These data are derived from various governmental reports of the countries concerned and the number of parasitized animals is calculated according to the percentage of infection observed in each species in each nation. Seizure of these vis-

cera results in considerable economic losses. For example, losses in Argentina were estimated by the Working Party at over US\$1,000,000 in 1965, but Mayer (16) considers that the total losses for that year amount to 6.3 million dollars.

In Chile, Barriga (17) refers to annual losses of nearly 2.5 million dollars through seizures of cattle, pig, and sheep viscera during 1962-1963 in 30 important abattoirs of that country.

Purriel *et al.* (12) point out that at the National Slaughterhouse of Montevideo, 205,122 bovine livers weighing almost 750 tons were condemned over a period of one year (September 1964 through August 1965), and at 500 dollars per ton this amounts to 375,000 dollars.

Table 1 summarizes the minimum figures previously referred to; we stress that while these figures indicate annual losses due to hydatidosis in Argentina, Chile, and Uruguay to be no less than US\$10,000,000, it is highly likely that actual losses greatly exceed that figure and remain to be determined exactly in each of the affected countries. This fact must be borne in mind by the public and animal health authorities in those countries where ecologic conditions permit the introduction of hydatidosis with the sheep industry.

Control and Prophylaxis of Hydatidosis

The geographic distribution of hydatidosis indicates that the disease constitutes a problem affecting the economy and public

TABLE 1—Estimated Minimum Annual Losses through Hydatidosis in Argentina, Chile, and Uruguay (in US\$).

Losses through	Argentina 1965	Chile 1962-1963	Uruguay 1962-1965	Total
Hospitalization	150,000	300,000	70,000	520,000
Condemned viscera	6,300,000	2,500,000	375,000	9,175,000
Total	6,450,000	2,800,000	445,000	9,695,000

health in those countries where the sheep industry is most developed. It is also clear that the principal developmental cycle of *E. granulosus* depends on the simultaneous presence, in a given area, of sheep and dogs, and that the principal source of infection of dogs is parasitized viscera with which they are fed by man. Thus hydatidosis can be considered largely a problem of human behavior.

It follows that there are two main ways of interrupting the cycle of *E. granulosus*: preventing dogs from eating infected viscera or eliminating the dogs. However, the latter possibility is not considered feasible, and legislation which forbids that dogs be given parasitized viscera is ineffective, since it is impossible to find a means of detecting all cases of violation of the laws.

Owners of dogs feed them with parasitized viscera because in this way they fulfill two requirements; that of feeding the dogs, and getting rid of parasitized viscera in the simplest manner. None of the procedures thus far suggested to avoid infection of dogs have proven effective, because they demand a greater effort on the farmer's part, whether by boiling the viscera prior to feeding the dogs or by burning or burying them. The latter two procedures result in the problem of having to feed the dogs another type of food.

In the majority of cases health education appears to be as ineffective as legislative measures, for farmers do not see clearly the relationship between the dog and hydatid cysts which can produce symptoms many years later, and we believe that even if this were understood, it would have relatively little effect. In this respect it is worth while to recall that the consumption of cigarettes has not decreased substantially, even in the persons at the highest cultural levels, such as certain professional groups, despite the clear correlation that exists between smok-

ing cigarettes and the incidence of lung cancer.

We feel that conventional efforts made to educate farmers on the life cycle of *E. granulosus* generally will not produce the desired effect and that other possibilities should be investigated. In our judgment the application of modern advertising techniques in future health education campaigns, as suggested by the Representative of the Pan American Health Organization in Uruguay, is an example of alternative measures deserving of attention.

We also believe that we might be more successful in avoiding the feeding of parasitized viscera to dogs if the behavior of dog-owners could be changed by more positive means, that is, if some inducement could be offered to use these viscera in a more profitable way. Every year many thousands of tons of parasitized livers are withdrawn from the market, resulting in a great reduction in consumption of animal proteins by the population. However, there appears to be no valid reason why these livers with *E. granulosus* cysts may not be used for domestic animal consumption, once they have been processed by methods which kill the protoscolices, and the possibilities of better utilization of these viscera must be investigated.

Many campaigns against hydatidosis have been conducted in the past in various Latin American countries, apparently without substantially modifying the situation. We say "apparently" because in no case was an accurate diagnosis made before initiating the control programs and therefore their effects cannot be properly evaluated. The urgent need to adopt control measures has resulted in this unsatisfactory approach, but experience has shown that in the long run the procedure is untenable and has brought about the failure of many well-intended efforts, entailing economic losses

and consequent lack of interest on the part of those who determine the priorities of public and animal health programs within the national budget.

We feel it to be of the utmost importance that in each of the affected countries measures be adopted to establish a precise diagnosis of the problem both at the human and animal level, for there is no doubt that the advantages to be derived from these efforts will greatly exceed the expenditure of time and money invested and will avoid wastage of national revenue funds.

Data currently available on human and animal infection rates are both scarce and vague. Diagnostic means are now available which permit reliable seroepidemiologic studies, radiographic thoracic censuses, and mass intradermal reactions, and it is completely unjustifiable to continue making often invalid assumptions and extrapolations when we can obtain objective and exact data on the prevalence of human hydatidosis by country, province, or state, in order to delineate the most important areas or foci.

This will also involve precisely establishing the occurrence of cysts in slaughtered cattle and sheep, according to their place of origin, and will require improved organization of veterinary inspection. The prevalence of infected dogs can be ascertained by means of the administration of arecoline as a purgative. In view of the fact that arecoline as a diagnostic tool is not effective in all cases, and there are experimental data showing that its effectiveness is not much over 60 per cent, it is imperative that a sample of the canine population be sacrificed for the purpose of determining, in a given area, the relationship between the presence of *E. granulosus* in the stools of arecoline-purged dogs and the true prevalence of the parasitosis determined by post-mortem examination of intestines.

Coordination of public and animal health activities is indispensable to conserve efforts and improve performance, but in order for the control measures to be effective and maintained throughout the necessary period, active community participation is essential. Some agency will be required, supported both by public health and animal health authorities, which will be in charge of coordinating and executing all of the activities.

Owing to the lack of basic knowledge in many epidemiologic and biologic aspects of the parasite, areas with a high prevalence must be chosen for the intensive study of the problem at all levels. Trials must be conducted within these areas, not only to adapt classical control measures but also to introduce new methods arising from such studies. Everything possible should be done to determine the feasibility of new control procedures, however unorthodox they may seem.

Indicators which will permit the correct evaluation of the results of the control measures must be established beforehand. It is no exaggeration to say that without previously establishing these evaluation indices, no activities should be undertaken.

Finally, although it may seem redundant, we wish to emphasize that hydatidosis control efforts must follow the general principles of community health planning.

In summary, we believe that the following steps should be taken in each of the affected countries:

- Establishment of an agency in charge of diagnosis and analysis of the problem in quantitative terms. This agency would later be responsible for execution and coordination of the different activities.
- Definition of the aim and the objectives of the control program.
- Determination of the activities which

correspond to each objective, and the annual target for each activity.

- Selection of indicators which will serve to evaluate the activities.

- Definition of a study or pilot area within which epidemiologic studies will be carried out and new control methods ap-

plied before introduction at the national level. An adequately studied experimental control area will be necessary for effective evaluation of such methods.

- Periodic revision and evaluation of the program to introduce those changes which experience indicates are necessary.

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PART IV
ANIMAL NUTRITION

SOME OBSERVATIONS ON ANIMAL FEEDING IN THE TROPICS

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Man has existed in his present biological form for about 1 million years. Except during the last 10,000 years (1 per cent of that period), the world population has never exceeded a few million persons; it is estimated that in that far-distant epoch there were as many lions as there were people. Birth rates and death rates were almost equal. However the discovery of agriculture some 6,000 to 9,000 years ago destroyed the balance between natality and mortality.

It has been calculated that in the period 1600-1 B.C. the population increased at a rate of 0.05 to 0.5 per 1,000 inhabitants. Then, from the figure of 4 per 1,000 in the period 1150 to 1800, it rose to 8 per 1,000 in the short period 1900 to 1950. Today the rate of increase averages 20 per 1,000 throughout the world, but it is much higher in the developing countries. With the present birth rate the population is expected to double before the end of the present century.

There is no doubt that this exaggerated growth is in large part due to improvements in the nutrition, hygiene, and health of the people of the developing countries.

As already noted, the balance between the birth rate and the death rate which existed many thousands of years ago, was destroyed by the invention of agriculture. In line with increases in the human population, significant advances have been made in agricul-

ture, that is, in the production of foodstuffs.

Unfortunately, however, the rise in agricultural production has not been proportionate in all the countries of the world. In most cases population growth has been rapid in regions where agricultural output and productivity have been low. It is estimated that, by the year 2000, three-fourths or possibly four-fifths of the world's population of 6 to 7 billion persons will be living in countries which are at present unable to supply sufficient food to satisfy the needs of their populations. At present, millions of people have insufficient food, especially proteins, and to ensure adequate nutrition, food production must be increased by about 20 per cent.

Those millions include a large majority of the population of Latin America. Of course, several factors can be cited as being responsible for this situation, but it is a little absurd to do so if we bear in mind that most of the countries have 365 days of solar energy a year and an enormous potential for supplying our populations, and many others besides, with the necessary foods for health and life. That solar energy is worth much more in terms of foodstuffs than all the oil in the world; oil can be replaced, food cannot.

Of these foodstuffs those derived from domestic animals should have a more privileged position than that which they have today, and we must not forget that Latin America has the potential to supply these

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foodstuffs in the future. However, as can be seen from the figures in Table 1, the present situation is still far from being acceptable. The daily per-capita consumption of meat, eggs, and milk in the four Latin American countries covered in the table is far below what it is in the five countries in other parts of the world which have been included for purposes of comparison. The conclusion to be drawn is that those countries which have made large investments in agricultural research obviously have been able to provide their inhabitants as well as those of other parts of the world with foodstuffs of animal origin whose nutritional value is significantly greater than those of vegetable origin. It must also be emphasized that some nations such as Denmark and the Netherlands are capable of producing these foodstuffs despite the fact that their natural resources are far inferior to those of many Latin American countries.

There are several factors that play an important part in limiting the development of livestock production. Table 2 contains comparisons which go some way to explaining the reasons for the low consumption of foodstuffs of animal origin in the tropical countries of Latin America. In addition to epizootics, the absence of an appropriate technology, and the low level of development achieved in other economic sectors

TABLE 1—Per-Capita Daily Consumption of Products of Animal Origin, in Certain Countries.^a
(Expressed in grams per edible portion)

Country	Meat	Eggs	Fish	Milk
Brazil	75	9	7	113
Chile	91	12	34	157
Guatemala	34	5	1	92
Panama	93	12	23	110
Germany	166	36	18	565
Denmark	182	31	44	668
Netherlands	126	33	15	594
Canada	210	42	15	680
Australia	298	33	14	572

^aSource: FAO Food Balance Sheets (FAO, Rome, 1960-1962).

TABLE 2—Production of Ruminants in Countries Rich and Poor in Animal Proteins.

	Countries		
	High consumption	Low consumption	Biological limit
Daily increase (lbs.)	2.2	0.6	4
Age at weight 1,000 lbs. (months)	15	40-50	8
Production of calves (% annual)	85	35	100
Animal losses (%)	—	40	—
Extraction rate (%)	30-35	6.5	—
Food conversion (dry materials/increase in weight)	7.2	—	5

related to the livestock industry, a number of nutritional causes may be cited, and are extremely important. Nevertheless those problems have not received the attention they deserve, and instead the veterinary medicine aspects have been stressed. But veterinary medicine is of no avail if animals are basically malnourished. There are many nutritional factors that could be cited, but in a general statement such as this it is not possible for us to go into details. It is enough to cite as an example the short supply and the high cost of animal fodder, the lack of knowledge about the relations between animals and their environment, the poor quality of these feeds and the inefficient use made of them by the animal, and inappropriate animal husbandry practices, all of which results in reduced production of foodstuffs of animal origin. Table 2 also shows that the production of these foodstuffs can be significantly increased (see column "Biological limit").

Report on INCAP Activities in Animal Nutrition

Aware of the enormous importance of promoting the animal industry in our countries, and guided by a desire to contribute as much as it can to its development, the Institute of Nutrition of Central America and

Panama (INCAP) has devoted a considerable part of its research activities to that field.

A fundamental prerequisite for the promotion of the animal industry is a knowledge of the chemical composition and nutritive value of the foods consumed by animals. Consequently, during the last 10 years INCAP has attempted to collect about 4,000 specimens of products from all countries in the Central American Isthmus: cereals, by-products of the vegetable oil industry, oil seeds, or material of animal origin, feeds, agricultural waste, tubers, and many others. All these products have been analyzed in order to determine their approximate chemical composition and the amount of vitamins A, B₁, B₂, and niacin as well as the minerals (calcium, phosphorus, iron) they contain. In a number of cases the amount of essential amino acids they contain has also been determined. The results have been compiled in a chemical composition table of feeds and fodders in common use in Central America and Panama. This table, which is in the final stages of preparation, will contain definitions of ingredients and instructions on how to use them when preparing rations for the feeding of animals, as well as data on a total of more than 150 foods.

It is extremely important to collect information of this kind if we wish to make animal production more efficient. There are a number of problems that may arise, as is shown by Table 3, which contains data on the amount of certain nutrients in various products for animal consumption. But if a producer does not know what type of material is being used to prepare his rations, and therefore supposes that it always contains the same amount of nutrients—as should be the case—whereas in actual fact it contains less, the effect could obviously

TABLE 3—Range of Variation in the Chemical Composition of Products Manufactured in Central America.

	Meal		
	Cotton seed cake	Meat	Fish
Protein (%)	35.8-51.3	36.3-60.1	29.4-66.7
Crude fiber (%)	4.2-14.2	—	—
Fats (%)	2.5-9.1	9.8-13.2	0.3-12.5
Ash (%)	—	7.0-35.1	9.3-54.6
Methionine (Mg/gN)	—	38-100	25-112
Lysine (Mg/gN)	292-350	272-392	407-516

be disastrous as far as his financial investment is concerned.

Even though the protein content is a serious problem, even more important is that relating to the quality of the protein, viz., the proportion of essential amino acids which the protein contains, since the nutritional status of animals with respect to protein, especially monogastric animals, is determined by these amino acids.

It is therefore obvious that the prime purpose of the above-mentioned table of chemical composition of feeds and fodders has been to gain further knowledge of the nutritional qualities of various foods so that they can be used in the formulation of rations for various species of domestic animals. In addition, the table will make it possible to define and standardize each food both chemically and nutritionally, two aspects that have been somewhat neglected in Latin America. No less important is the fact that a knowledge of all these factors and its application is expected to promote a more efficient development of foods of animal origin.

Just as with human beings, animals do not prosper or work efficiently because of the lack of proteins and calories, which is so prevalent in Latin America. In Central America the most abundant source of protein available is cottonseed flour. However,

the use of this product in the feeding of monogastric animals, in particular hogs, is limited because of the presence of gossypol in it and because of the destruction, during the process of the extraction of the oil, of the essential amino acid, lysine. Fortunately these drawbacks have been overcome through an effective control of the oil extraction process, whereby the gossypol content is reduced to nontoxic levels and lysine is protected. Moreover, through the addition of iron salts and calcium to rations with a high content of cottonseed flour, it has been possible to achieve additional protection, since these minerals bind gossypol and thus prevent it from being absorbed by the animal. The result of these studies of cottonseed flour utilization in the raising of hogs, from weaning until the time they weigh 200 lbs. and are ready for slaughter, is shown in Table 4.

The importance of the various studies mentioned here lies in the fact that, by using the resources available in each region, it is possible to produce low-cost animal rations and dispense with expensive imported products. It should be borne in mind, however, that this achievement is a result of intensive research, which requires the wholehearted support of all Governments both in terms of money and in work facilities. This is an indispensable condition for improving the present status of livestock production in Latin America.

TABLE 4—Growth of Hogs Fed on Rations Containing 42% Cottonseed Flour.^a

Treatment	Final weight 12 weeks kg ^b	Food efficiency index	Mortality
Control	38.6	2.98	0/10
Cottonseed flour	20.7	7.50	8/10
Cottonseed flour + 1% Ca(OH) ₂			
+ 0.1% FeSO ₄ ·7H ₂ O	35.0	3.62	1/10

^a Gossypol content: 100 mg/100g.

^b Average initial weight: 9.3 kg.

Source: Jarquin *et al.* *Agriculture and Food Chemistry* 15:275-279, 1966.

The lack of sources of carbohydrates, which are generally obtained from cereals, is another factor that limits animal production. If it is borne in mind that carbohydrates are used directly by the population, and that their production is increasing very slowly, it is obviously necessary to seek other sources in order not to create competition between man and animal, a struggle in which man would be at a decided disadvantage. The possibilities are good, or at least attractive, but again because of the lack of research many of these possibilities cannot yet be realized.

One of the products which is abundantly available, for example, is molasses. Limited use is made of it because it tends to cause diarrhea; its indiscriminate use in ruminants has unfavorable results. Table 5 shows the results of a study of chickens, fed with molasses, in which it replaced an equal amount of maize in the ration. As the data on weight and utilization of the feed shows, that could be done successfully. Another example can be seen in Table 6, which shows the satisfactory results obtained by using molasses in the feeding of fatstock hogs.

Among other products rich in carbohydrates that may be used for the same purpose mention must be made of the banana. Table 7 contains the findings of a study in which that product was used in rations for

TABLE 5—Effects of Replacing Maize by Molasses in Rations for Chickens.

Level of molasses in ration (%)	Final weight 8 weeks g/chicken ^a	Food efficiency index ^b
0	1,410	2.53
5	1,466	2.36
10	1,475	2.56
15	1,372	2.68
20	1,451	2.77

^a Average initial weight: 44 g.

^b Kg of weight increase per chicken/kg of food consumed.

TABLE 6—Use of Molasses in Rations for Fatstock Hogs.

	Rations ^a			
	1	2	3	4
Wheat grain	84.0	84.0	70.0	70.0
Soya bean flour	10.0	—	4.0	—
Cottonseed flour	—	10.0	—	4.0
Molasses	—	—	20.0	20.0
Initial average weight (kg)	43.7	44.0	44.4	42.7
Weight increase (kg) ^b	31.5	30.0	38.1	38.6
Food utilization index	3.6	4.0	4.0	4.2

^a The rations were enriched with vitamins and minerals.

^b Gain observed in a period of seven weeks.

chickens. The results were satisfactory but could be still improved. However, further research is needed for that purpose to determine the factors limiting its use so that they can be corrected.

In many regions of Latin America, cassava or yucca flour is produced, but it has been used relatively little in animal feeding. Nevertheless, the information available on this flour suggests that it has many possibilities. As an example, Table 8 contains the findings of a study in fatstock hogs. From the financial point of view it appears that yucca flour would be cheaper than maize, in view of the fact that the output of that tuber by unit area is almost three times as great. In addition to the studies mentioned, many examples could be cited to corroborate these ideas. Nevertheless, the same denominator must be applied to them all: research and development for a more efficient product.

TABLE 7—Growth of Chickens Fed with Different Amounts of Green Banana Flour.

Banana flour in the ration (%)	Maize flour in the ration (%)	Final average weight ^a (g)	Food efficiency index
0	66	494	2.2
10	56	478	2.4
20	46	459	2.5
30	36	404	2.8

^a Rate gained in a period of five weeks.

TABLE 8—Fattening of Hogs with Rations Consisting of Maize, Wheat Grain, and Yucca Residues.

Ingredients	Rations				
	1	2	3	4	5
Maize flour	87.0	66.0	45.0	23.0	10.0
Cottonseed flour	10.0	10.0	10.0	10.0	40.0
Wheat	—	10.0	20.0	30.0	40.0
Yucca residue	—	11.0	22.0	34.0	47.0
Initial average weight (kg)	56.8	57.0	56.8	56.8	57.0
Final average weight ^a (kg)	93.5	91.0	89.3	84.2	76.8
Food utilization index	4.2	4.2	4.4	4.6	5.7

^a Weight gain in a period of eight weeks.

Another aspect which so far has been neglected in Latin America is the feeding of calves with milk substitutes. This merits special attention in the case of calves of milk cattle. Foodstuffs of this type may be produced economically with local raw materials, and their use makes it possible not only for the milk intended for calves to be used in human nutrition but also for the animal to reach an age at which it is of more use as a source of meat.

INCAP has made exhaustive studies of this problem with good results, and has managed to develop several formulas for the rearing of calves practically without using cow's milk. Some of the results of these studies are given in Table 9. They show that the increase in weight of these animals is slightly below that recorded when they are fed with cow's milk; however, that weight increase was achieved at a significantly lower cost.

TABLE 9—Weight Increase in Three-Day-Old Calves Fed with Milk Substitutes.

Treatment	Amount (kg)	Increase in weight (kg/day) ^a
Milk	439	0.78
Milk + substitute	61	
Milk	45	0.60
Milk + substitute	33	
Substitute	44	0.52
	49	0.51

^a Weight gain obtained in a period of 63 days.

TABLE 10—Weight Increase in Calves Fed with Rations Containing Yucca Residues.

Rations	A	B	C	D
Wheat bran	51.3	34.2	59.8	34.9
Cottonseed flour	16.0	10.7	18.7	12.5
Yucca residue	16.7	37.7	5.5	30.0
Molasses	15.0	15.0	15.0	15.0
Urea	—	1.4	—	1.6
Minerals	1.0	1.0	1.0	1.0
Weight increase/day* (lbs)	2.5	2.5	2.3	2.5
Rations consumed/day (lbs)	13	13	13	14
Cottonseed cover/day (lbs)	1.4	1.3	1.0	1.0

* Average initial weight: 328 lbs. Duration of study: 56 days.

Finally, a very promising area is the use of agricultural waste materials in animal feeding. Rations have also been developed for cows, from the age of two months onwards, using agricultural waste such as maize stalks, cottonseed covers, corncobs, etc. Table 10 shows some representative results of these studies. As may be seen, the weight increases are excellent. The cost of such a study is relatively high, but it may be made profitable by incorporating the feeding methods mentioned into the total system of agriculture.

Recently INCAP initiated studies on the use of coffee pulp. This material, which is abundantly produced throughout Latin America, has been the object of some research as a food for cattle with varying results. Its chemical composition (Table 11) shows that it contains nutrients which

TABLE 11—Chemical Composition of Coffee Pulp.
(In percentages)

Component	Fresh	Dehydrated	Maize
Water	86.1	11.7	10.6
Nitrogen	0.4	2.7	1.5
Ether extract	0.3	2.7	4.3
Crude fiber	2.3	13.9	1.8
Ash	1.3	7.1	1.3
Crude protein	2.5	16.9	9.4
Carbohydrates	7.5	47.7	73.1

might be efficiently used in animal nutrition. Initial studies in mice and chickens, summarized in Table 12, show that the pulp contains toxic substances—so far not identified—which explains why it has not been widely used in animal feeding. Motivated by the desire to determine the toxic substances and to investigate the possibility of devising low-cost procedures that reduce or eliminate their toxicity, INCAP has this product under study.

The examples cited are representative of what can be done in agriculture. However, they cover only a small part of what must be done in animal nutrition. There are many other problems that arise as a result of the indirect effects of the climatic conditions of the region. One of the specific examples is the fluctuation in weight in animals according to the season of the year: in the rainy season, during which grazing is abundant, and in the dry season, when there is no feed or its nutritive value is so low that it cannot maintain the animal and consequently causes high rates of mortality, low indices of reproduction, and antieconomic delays in the production of meat.

To remedy this situation it is necessary to develop appropriate low-cost methods for preserving foodstuffs for times of shortage. This can be done by haymaking, the preparation of silage, and the use of the stubble which remains after the harvest. An ex-

TABLE 12—Response of Mice and Chickens to Different Levels of Dehydrated Coffee Pulp.

Level of pulp in the ration	Final weight ^a (g)	Mortality rate (%)	Final weight g/chickens ^b	Mortality rate (%)
0	231	0	825	0
10	231	0	796	10
20	117	0	557	0
30	0	100	348	30
40	0	100	158	80
50	0	100	0	100

^a Average initial weight: 48 g. Duration of study: six weeks.

^b Average initial weight: 47 g. Duration of study: six weeks.

TABLE 13—Weight Increases in Calves Fed with a Protein Supplement and Various Fodder.

Supplement	Fodder	Weight (lbs)		Increase/ day (lbs)
		Initial	Final	
INCAP "F"	Tazol	478	596 ^a	2.1
	Silage	478	629 ^a	2.7
INCAP "G"	Tazol	479	598 ^a	2.1
	Silage	478	634 ^a	2.8
INCAP "1"	Napier	531	683 ^b	1.8
INCAP "2"	Napier	542	690 ^b	1.8

^a Duration of study: 56 days. Age of animals: 5-6 months.

^b Duration of study: 84 days. Age of animals: 8-9 months.

ample of the benefits of these procedures to young animals is shown in Table 13. The significant increases in weight obtained with silage are obvious. Whatever the method used, it is necessary to carry out research in order to apply to our environment what in other parts of the world is a common and current procedure.

Recommendations

With a view to increasing the availability of foodstuffs of animal origin in Latin America, it is necessary to undertake major efforts in the following areas:

1. Determination and compilation of chemical and nutritional data on feeds and fodders as well as on animal foods.

2. Ascertainment of changes in the nutritional value of grazes, according to the period of the year, the place, and the maturity of those grazes.

3. Further research on the nutritional needs of different genetic varieties of animals, in connection with the environmental conditions in which they live.

4. Further knowledge of the relations between animals and the environment.

5. Chemical and nutritional studies of natural resources and agricultural wastes in the Hemisphere.

6. Since herbivorous animals do not enter into direct competition with man for food—but rather serve him—for without them many foodstuffs would not be available for human consumption, an increase in the livestock population must be encouraged, especially in areas of natural pastures which are not suitable for cultivation.

INCAP could effectively assist agricultural research organizations in such nutritional aspects as those mentioned in general terms in this document and in which it has the necessary experience and competence. Furthermore, it has considerable resources, both technical and material, for the development of this kind of research.

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