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THE TRI-NATIONAL ANIMAL HEALTH RESEARCH PROJECT

FINAL EVALUATION
Project No. 398-0158.21

conducted by:

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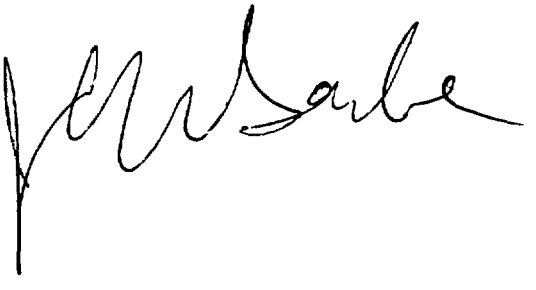
ACKNOWLEDGEMENTS

As Team Leader of the final TAHRP evaluation, I would like to express my sincerest gratitude to my fellow team members. The in-country schedule that we, as a Team, maintained was grueling. We not only met project participants during and after business hours; we, also, worked well into the night discussing, writing, and formulating. During times when we experienced logistics difficulties that would have frustrated most individuals, my colleagues were spirited, accommodating, and resourceful. I found my fellow Team members to be incredibly energetic, hard-working, technically very competent and experienced in the subject areas being evaluated, and completely dedicated to our mission. The Team functioned in an intensely cooperative manner and I found my colleagues a complete joy to work with.

The original purpose in enlisting the participation of regional experts was to provide a local perspective and, further, to encourage the likelihood of future participation in USAID-sponsored activities. These purposes were accomplished. The TAHRP evaluation has a depth and richness that could only be achieved through local perspective. Given the very positive experience of this evaluation, I would recommend that, whenever possible, USAID and its contractors avail themselves of regional participants when composing evaluation teams.



ACRONYMS

AGPT	Agar Gel Precipitation Test
AHRI	Animal Health Research Institute, ARP
ARP	Arab Republic of Egypt
ARRI	Animal Reproduction Research Institute, ARP
BCV	Bovine Corona Virus
BEI	Binary Ethyleneimine
BHK	Baby Hamster Kidney (cell line)
BRV	Bovine Rota Virus
BVD	Bovine Virus Diarrhea
CF	Complement Fixation
CFT	Complement Fixation Test
DDA	Dimethyl Dioctadecyl Ammonium Bromide
ELISA	Enzyme-linked Immunosorbant Assay
FAT	Flourescent Antibody Technique
FMD	Foot and Mouth Disease
FVM/CU	Faculty of Veterinary Medicine, Giza, Cairo University, Arab Republic of Egypt
GOVS	General Organization for Veterinary Services, MOA/ARP
HAHAKLAIT	A cooperative farmer supported insurance company that provides veterinary services to almost all intensive livestock operations in Israel
HI	Hemagglutination Inhibition
KIBBUTZ	Communal settlement of Israel
KSVM	Koret School of Veterinary Medicine, Hebrew University, Israel KVI Kimron Veterinary Institute, MOA, Israel LC Langerhans Cells
MASHAV	Israel Ministry of Foreign Affairs
MERC	Middle East Regional Cooperation Program
MOA	Ministry of Agriculture
MOSHAV	Israeli agricultural system where each family lives in its own home and works its own plot of land, however, markets cooperatively
NAMRU	U.S. Naval Medical Research Unit, Cairo, Egypt
OICD	Office of International Cooperation and Development, United States Department of Agriculture
OIE	Office of International Epizoatics
PASA	Participation Agency Service Agreement
PCR	Polymerase Chain Reaction
PI	Principle Investigator
SNT	Sero Neutralization Test
SOW	Scope of Work
TAHRP	Tri-national Animal Health Research Project
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
VIA	Virus Infection Associated Antigen
VSAH	Veterinary Services and Animal Health, Ministry of Agriculture, Israel
VSVRI	Veterinary Serum & Vaccine Research Institute, Ministry of Agriculture, Arab Republic of Egypt

EXECUTIVE SUMMARY

THE PROJECT

The Tri-National Animal Health Research Project (TAHRP) is a $3.4 million, five-year activity funded under the Middle East Regional Cooperation Program (MERC), an umbrella program administered out of the Global Bureau of the U.S. Agency for International Development (USAID). The TAHRP project brings scientists from Egypt, Israel, and the United States together for the purpose of conducting collaborative research in three main subject areas:

* Neonatal morbidity and mortality in cattle and buffalo calves;
* Diagnosis and control of Brucellosis in sheep and goats;
* Improvement of Foot and Mouth Disease (FMD) control in Egypt and Israel.

This is the first research project, under the auspices of the MERC, to address issues of animal health within the region. The TAHRP project was approved in late 1990, with project work beginning in mid-1991; completion is expected by December 31, 1995.

The TAHRP project main grantee is the Office of International Cooperation and Development, Research and Scientific Exchanges Division, U.S. Department of Agriculture (OICD/USDA), as outlined under a Participating Agency Service Agreement (PASA) grant with USAID. Major sub-grants involve the Israeli Ministry of Agriculture's Veterinary Services (Kimron Veterinary Institute) and the Egyptian Ministry of Agriculture and Land Reform's General Organization for Veterinary Services (GOVS) under the joint Egypt-Israel Animal Health Committee.

A Mid-term Evaluation was conducted in 1993. This report is the Final Evaluation of the TAHRP project.

THE EVALUATION SCOPE

The Scope of Work calls for the Evaluation Team to evaluate four major areas of concern: 1) scientific (technical) merit, 2) cooperation, 3) management, and 4) the social and economic impact of the project. The Evaluation Team consists of three veterinarians. The Team Leader is an American Association for the Advancement of Science, Science and Engineering Diplomacy Fellow at USAID; the Team members include the Chief Veterinary Officer of the Hashemite Kingdom of Jordan and the Director of Veterinary Research of the Republic of Tunisia. The purpose in composing the Evaluation Team in this manner is to provide regional perspective on the activities carried out within this project and to encourage greater regional awareness, collaboration, and participation in the MERC program.

THE METHODOLOGY

The Evaluation Team carried out a review of program documents prior to meeting with Project participants and Country Coordinators in both Israel and Egypt. Additionally, the Team Leader interviewed U.S. participating scientists, personnel from Winrock International, USAID/Washington, and OICD/USDA prior to departure for the Middle East. In country, a variety of Project participants were interviewed. All Principal Investigators and many individuals providing technical support to the project were interviewed. In addition, parties impacted directly, due to participation in the project, or those affected by the results of the research, such as farmers and field veterinarians, were questioned about the project. Site visits were made to a variety of participating entities including both governmental institutes and governmental and/or private farms.

THE SUMMARY CONCLUSIONS

Conclusions Regarding Technical Objectives

The scientific and technical aspects of the TAHRP project were extensive and quite ambitious. Substantial achievements have been made in all three sub-project areas toward reaching project goals. The results obtained clearly have both field and regional application.

The Neonatal sub-project resulted in a decrease in morbidity and mortality of neonatal calves in both Egypt and Israel; the Brucellosis sub-project facilitated the initiation of country-wide control programs; and the Foot and Mouth Disease sub-project has produced rapid identification and surveillance techniques for incorporation into regional control programs. This project allowed work to be conducted on species that had previously not gotten much attention, from a medical standpoint, and so the usefulness and applicability of the results is especially promising.

The TAHRP project promoted scientific research capacity building and, consequently, the scientific level of expertise, in-country, has been elevated. This resulted in a new level of service available to the public and to the producer.

Conclusions Regarding Cooperation Between Institutions and Countries

The TAHRP project has served as an "icebreaker" for collaborative activities in animal health research and disease control between Egypt and Israel. In the beginning, the project was designed solely by the two Country Coordinators and representatives from the United States. Due to the Coordinators' leadership and dedication to this collaborative process, the laboratory scientists began working together. By project's end, the Principle Investigators of

each sub-project were drafting final technical reports collaboratively and were planning future joint activities to reach common goals.

An air of mutual respect and friendship pervaded the relationships developed through this MERC project. Critical to the evolution of these relationships was the contribution of the U.S. scientific collaborators.

TAHRP was a first step toward the establishment of a normal "good neighbor" relationship between groups of scientists facing the same disease problems. The TAHRP project created the nucleus of scientists, within the region, that now attracts others to join in and participate. Field personnel have been incorporated into the implementation phase of the TAHRP and, due entirely to the work of the scientists involved, doors have been opened for collaborative work between veterinary services and public health officials in both Egypt and Israel.

Through the positive experience of TAHRP, real opportunities exist to promote regional cooperation in animal health and related activities and to coordinate regional strategies for the control of animal diseases.

Conclusions Regarding Project Management

The TAHRP project, from an overall standpoint, was managed adequately. Certain administrative activities did create constraints to project success that could be avoided in the future.

There was insufficient transparency in many of the administrative aspects of the project, consequently, there appeared to be a lack of information sharing and decision-making at all levels. Priority activities within sub-projects should be fully articulated from the beginning so that there is not an imbalance and so that follow-on decision-making, delegated to the lowest level, will be productive and insightful.

Researchers, from both countries, often found that contacting each other directly was difficult. Facilitating direct communication between collaborators should be encouraged and barriers should be removed. The preparation and presentation of quarterly, semi-annual, and annual reporting documents seemed a chronic problem in the TAHRP project.

The project sponsored four international workshops that were well attended and improved in quality and content, evolving over time to embrace a more comprehensive perspective. All parties interviewed stated that the friendly exchange of views and experience during meetings resulted in a willingness and desire to work together to develop common research plans.

U.S. scientists have played a major role in helping the program succeed. Project participants want the continued involvement of U.S. collaborators to both facilitate the collaboration and to assist in the research planning.

Overall, the TAHRP project would have benefitted from greater Steering Committee leadership and more active U.S. administrative facilitation.

Conclusions Regarding Economic and Social Impact

The TAHRP project has made significant contributions to the economic well-being of people in both Israel and Egypt through efforts to decrease both the morbidity and mortality impacts of animal disease. Disease knows no boundary and must be viewed from a regional perspective, consequently, control programs are vital to eradicating disease and increasing the livelihood of those persons involved in animal production.

Additionally, TAHRP participants recognize, and are sensitive to, cultural issues which need to be addressed in order for disease control to be successful, e.g., nomadic sheparding. TAHRP participants do have a regional vision which creates benefits in both economic and social arenas.

Other Conclusions

The TAHRP project can be viewed as "just the beginning." There is a clear and present desire on the part of current collaborators to continue fostering relationships developed through this project. The emphasis is on expanding perspective to include other regional parties. Actually, the success of this project is demonstrated by the desire of others within the region to participate.

Creating regional inter-dependence facilitates the Peace Process by requiring that countries collaborate in disease control and monitoring. This could be in the form of regional reference laboratories or the creation of regional vaccine production sites. This regional integration of production of materials will serve regional veterinary needs and will be a natural outcome of more regionally-based projects.

It is the hope of the Evaluation Team that the Egyptian-Israeli cooperation will continue to exist regardless of the availability of external funding. Governments must show their commitment by in-kind contribution to endeavors which have such dramatic and worthwhile outcomes. These types of projects represent the cornerstone of regional cooperation in combating infectious disease. The Evaluation Team has every confidence that TAHRP collaborators will continue relationships developed through the project and will bring in others to control and eliminate disease.

USAID should be pleased by the progress made in this project. Collaborators began with no history together and developed lasting friendships. This project has enabled scientists from three different cultures to work together to solve common problems.

RECOMMENDATIONS

The grantees and all participants who worked in the TAHRP should be commended for their contribution to a successful project.

The TAHRP project, through its successes, has opened the door for more collaborative work to begin on a broader regional basis. To facilitate the control and elimination of disease, the parties must work regionally. The Evaluation Team is enthusiastic in its support for continued work by the current participants and the expansion of opportunity to others. A future project should address or build in the following components:

* Direct participant to participant contact;
* Involvement of additional parties in project activities;
* Continued work in the broad subject areas already a part of the TAHRP Project;
* Long-term personnel exchanges and joint publications;
* Establish an electronics information network;
* Create regional inter-dependence;
* Incorporate full-time U.S. regional representation;
* Build in sustainability.

MAIN LESSONS LEARNED

The MERC program and development, in general, would benefit from coordination with other donor activities, as appropriate.

Equality between country scientists is critical. Future projects should promote exchanges between scientists and field implementors from all countries involved.

The sustainability of project activities would be ensured and enhanced by increased movement toward privatization of veterinary services and livestock production activities in Egypt.

Sustainability depends upon the commitment of each country to providing in-kind contributions either through an institution, the state, or the private sector.

Country Coordinators, administrators or contractors should provide detailed schedules to the Team Leader well in advance of in-country activity. Modifications ould then be made without jeopardizing on-site evaluation time.

On-site monitoring by MERC personnel would help insure that projects meet MERC goals and objectives.

PROJECT IDENTIFICATION DATA SHEET

Project Number: 398-0158.21

PASA Number: ANE-0158-P-AG-0030-00

Title: Trinational Animal Health Research Project

Cost: Five Year Budget ($U.S.)

	DIRECT	INDIRECT	TOTAL
Egypt	1,184,260	177,638	1,361,898
Israel	1,187,595	178,138	1,365,733
U.S.A.	130,369	545,024	675,393
Total	2,502,224	900,800	3,403,024

Life of Project Dates: 6/12/90-6/11/95

The TAHRP consists of three subprojects:

1. Neonatal Death Losses in Bovine (Cattle and Water Buffalo) Calves;

2. Diagnosis and Control of Brucella Melitensis Infections in Sheep and Goats; and

3. Studies on Foot and Mouth Disease.

I. PROJECT BACKGROUND, PURPOSE, AND OBJECTIVES

A. Background

Following the Camp David Accords, Congress developed an initiative to support improvements in Arab/Israeli relations by earmarking funds for activities that would lead to greater peace in the region. One such activity, the Middle East Regional Cooperation (MERC) program, began in 1979 and, since that time, has been administered by the U.S. Agency for International Development (USAID). The founding principle of the MERC program is that people who work together in a truly collaborative manner to solve common problems, substantially enhance their knowledge and understanding of each other and of their respective cultures and heritage. With greater understanding comes easing of tension and opportunity for peaceful dialogue. Further, participating country sectoral development programs are strengthened and enhanced by regional cooperation projects which bring together national experts and expertise in collaborative technological or scientific endeavors.

MERC projects bring together researchers/specialists from Israeli and Arab institutions (be they governmental, university, or non-governmental) to work together, typically, with U.S. research and institutional collaboration. Projects are not restricted to certain sectors and currently include work in the following areas: agriculture, human health, animal health, marine sciences, waste-water treatment, aquifer management, and pest management.

The Trinational Animal Health Research Project (TAHRP) is a project within the MERC program. It was approved for funding in 1990, at the level of $3.4 million to be used over five years (1995). TAHRP is a cooperative research effort involving the participation of Israel, Egypt, and the United States. It is designed to encourage and facilitate cooperation among concerned scientists and institutions; and provide essential information and technology for the control or eradication of three important animal diseases that severely affect the efficiency and economy of production of various livestock species.

Amidst all the other issues in the Middle East, animal husbandry continues to be an integral part of both the culture and the economy of the region. Egypt and Israel have both intensive (mechanized/feedlot based) and traditional (free-ranging/herding) forms of animal husbandry. With the intensification of the livestock industry and yet the continued use of traditional production systems, animal disease hazards have intensified. As a consequence, greater disease preventative measures must be taken.

The three diseases chosen for collaborative research by Israeli

and Egyptian institutions with the participation of U.S. institutions are closely identified with priority disease problems of the region.

The research is carried out in Israel and in Egypt, with consultation from U.S. collaborators, and administrative functions being the responsibility of the U.S. Department of Agriculture, Office of International Cooperation and Development. The project had a mid-term evaluation in 1993, and the project completion date has been extended until December 31, 1995.

B. Program Goals and Objectives

The overall mission of the TAHRP is to increase the awareness in both Egypt and Israel that peaceful cooperation will result in significant social and economic benefit. To this end, then, the goals of this project are to foster scientific collaboration between Egyptian, Israeli, and U.S. scientists and to strengthen institutional linkages among cooperating countries by focusing on animal health problems which are of significance to each country and the region, as a whole.

The objectives of the project are to improve the health status of both animals and humans by creating an effective epidemiological surveillance system and developing advanced diagnostic techniques and vaccination regimens that have practical application within both the modern, intensive animal husbandry industry and the traditional, extensive systems prevalent in the region. The project has concentrated its resources in three sub-project research areas:

* Reduction in morbidity and mortality due to neonatal diseases in bovine calves (both cattle and water buffalo);
* Diagnosis and nation-wide control of Brucella melitensis in sheep and goats; and
* Studies on the epidemiology and control of Foot and Mouth Disease virus.

Within these research disciplines, technical activities have included laboratory investigation utilizing microbiological and serological evaluation techniques, as well as, field work evaluating the applicability of techniques and procedures developed in the laboratory.

II. SCOPE OF WORK AND METHODOLOGY FOR EVALUATION

Purpose of the Evaluation: The TAHRP project is scheduled to terminate at the end of December, 1995. The purpose of this evaluation is to determine how, and the extent to which, the TAHRP project has contributed to the peace process; how adequately the project has been planned; how well work has

progressed toward achieving project objectives; and what impact the project has had, or is likely to have, given its state of accomplishment.

More specifically, the evaluation report will focus on the following four substantive areas (see Appendix A for the Scope of Work, Final Evaluation):

1. Scientific (Technical) Issues and Achievements: this includes not only an analysis of accomplishments with regard to the stated objectives, but, also, a determination as to whether or not recommendations made as a result of the mid-term evaluation were incorporated into subsequent activity;

2. Cooperation: assessment of the level of cooperation between research scientists involved in the project;

3. Management: assessment of the adequacy and effectiveness of a variety of elements of the TAHRP project management and design; and

4. Economic and Social Impact: assessment of the impact of the TAHRP project on the community and the region, as a whole.

Literature Reviewed: Prior to departing for the Middle East, the Team Leader reviewed appropriate project documents provided by Winrock International. The Team Members, who were already in the region, reviewed the same documents prior to the Team Leader's arrival in Jordan. A listing of significant documents reviewed is summarized in Appendix B.

Interviews with U.S. Implementors (including): The Team Leader met with the USAID MERC Project Officer, other representatives within USAID, and with Winrock personnel. Additionally, the Team Leader met with the USDA Project Administrative Coordinator, two of the U.S. institutional collaborators, and spoke by telephone with the other U.S. collaborators. A listing of those interviewed throughout the process is contained in Appendix C.

Regional Activities of the Evaluation Team: The Evaluation Team met in Amman, Jordan, for a preliminary orientation prior to beginning activities in participant countries. The on-site evaluation started in Israel with meetings at the Kimron Veterinary Institute, the Ministry of Agriculture, and the Koret School of Veterinary Medicine. Field activities were reviewed in Beer-Sheba (Abou Ligan Bedouin tribe and District Veterinary Office), Kibbutz Galed, Tiberias Veterinary District, Moshav Sarona, and Shadeb farm (Brucellosis), Beer-Tuvia (Neonatal), and the Hadera Veterinary District Office (FMD).

In Egypt, meetings were conducted at the General Organization of Veterinary Services and the Agriculture Foreign Relations Office

(Ministry of Agriculture), the Animal Health Research Institute, the Animal Reproduction Research Institute, the Veterinary Serum and Vaccine Research Institute, NAMRU, Ain Shams University, and the Ministry of Health. Field activities were reviewed at the El-Tonsi farm (Neonatal), El-Khanka farm (Neonatal), and the Nile Agriculture and Food Company Farm at Nubaria (Brucellosis).

In both Israel and Egypt, Country Coordinators, financial managers, research scientists and technicians, clinicians, and farmers were interviewed, as were members of the Steering Committee. Additionally, input from individuals involved in associated activities, such as professionals in the Health Ministries/Health related fields, was sought out, received, and incorporated into the evaluation strategy. Initial briefings and follow-up de-briefings were conducted at the USAID Missions in Amman and Cairo, as well as, the U.S. Embassy in both Israel and Egypt. The itinerary of the Evaluation Team is contained in Appendix D.

Evaluation Team: The Evaluation Team consisted of the following people:

Dr. Jo Anne L. Garbe, an Attorney/Veterinarian, Team Leader, American Association for the Advancement of Sciences, Science and Engineering Diplomacy Fellow, USAID

Dr. Mukhles Amarin, a Veterinarian, Chief Veterinary Officer and Director, Veterinary Department, Ministry of Agriculture, The Hashemite Kingdom of Jordan

Dr. Khaled el Hicheri, a Veterinarian, Director General, Veterinary Research Institute of Tunisia, Ministry of Agriculture, Republic of Tunisia.

III. MEETING OF TECHNICAL SUB-PROJECT OBJECTIVES

A. Quality of Research

Overall, the quality of the scientific research completed in this project was high and substantial progress has been made toward achieving the goals described in the logical framework. Mid-term evaluation recommendations were, for the most part, incorporated into future planning of research activity and individual collaborators should be complimented on their research efforts. Benefits to those working in the animal health community have already been demonstrated as a consequence of the results of the research involved in this MERC project. All sub-project activities are profiled in greater detail in Appendix E.

B. Sub-Project Objectives

NEONATAL MORTALITY IN BOVINE CALVES (CATTLE AND WATER BUFFALO):

Neonatal loss of cattle and water buffalo is a significant livestock issue in many parts of the world; causing much in the way of economic loss as a result. The etiology of this loss is multifactorial, involving both pathogenic disease-causing agents and farm husbandry/management practices. In Israel and Egypt, neonatal disease is an equally significant problem within the livestock industry. In this context, neonatal disease is defined as occurring in calves from birth until 30 days of age. TAHRP researchers identified, early on, diarrhea as the leading cause of illness and death in newborn calves during the first month of life. The primary agents responsible for neonatal diarrhea in both countries were found to be viral and bacterial in origin. The objectives, then, of this TAHRP sub-project were to:

* to develop and use suitable diagnostic techniques to identify the responsible pathogenic agents;
* to determine the magnitude of the role played by each of the pathogens; and
* to develop a control program to diminish both the incidence and impact of this disease complex.

<u>Meeting Technical Objectives</u>

The neonatal diseases sub-project has met its objectives, overall, in the following ways:

* Epidemiology data have been gathered and damages associated with neonatal mortality have been estimated;
* Both countries are using the improved diagnostic techniques developed as a result of the TAHRP project;
* Major causal pathogens have been identified;
* Vaccines and methods of vaccination have been tested, with efficacy of vaccination protocols being a major focus. The prevention strategies developed were clinically successful;
* A colostrum bank was established and the control procedures utilized in the sub-project (feeding hyper-immune colostrum) reduced mortality substantially;
* Environmental and management influences on calf morbidity and mortality have been determined and issues of herd management and husbandry have been addressed;
* The professional skill of researchers has been improved;
* The capabilities of cooperating institutions were increased;
* The scientific results produced in this sub-project led to the improvement of the health of neonatal cattle and buffalo.

More specifically, in Israel, the research was oriented, from the beginning, toward the determination and understanding of the role, either singly or in combination with other factors such as nutrition and management, of each of the pathogens in the etiology of newborn calf diarrhea. The focus was on dairy cattle, in particular. The research included the isolation and identification of causative agents, the determination of the immunological status of both the neonate and the dam, and the evaluation of management and husbandry techniques.

In order to fully understand this disease complex, researchers first identified the most important pathogens by molecular sero-typing. It was determined that the most significant organisms involved in this disease complex were Rota (BRV) and Corona (BCV) viruses. Additionally, E. coli/K99 was determined to be the significant bacterial component of this disease complex. It was, also, through this research that Rota virus was discovered to be the most common organism found in infections that have a mixed etiology. Given that traditional forms of therapy, such as the use of antibiotics, are ineffective against viral agents, the research team decided to put its energies toward investigating the use of hyper-immune colostrum to convey passive immunity to the newborns. Researchers developed a protocol whereby they vaccinated the dam twice, late in pregnancy, with a vaccine that contained BRV and E. coli/K99, for the purpose of boosting the antibody levels in the colostrum. This same colostrum was fed to the newborn soon after birth. The results confirmed the notion that passive immunity is the primary and most effective way of protecting newborn calves against the agents causing neonatal diarrhea.

Additional new diagnostics were developed (see Appendix E) for rapid identification of pathogens and work was initiated on determining the exact role of Corona virus in this disease complex. The use of molecular biology techniques formed the foundation of this phase of the research.

From an applied research standpoint, the investigators developed an immunization/hyper-immune colostrum feeding protocol that was appropriate for use in a commercial dairy. In addition to procedures outlined above, researchers established colostrum banks in which the unused colostrum from a variety of vaccinated dairy cows was pooled and frozen for use in the future. Tests were performed to determine the efficacy of the frozen colostrum and the results indicated that freezing does not harm the antibody content within the colostrum.

Effective management strategies to control neonatal diarrhea, such as the use of individual calf hutches in intensive dairy farms, were developed and showed excellent results.

The findings of this research permitted the establishment and

implementation of a well designed control program used on an experimental basis in dairies which resulted in a dramatic reduction in calfhood losses due to either illness or death. The methodology utilized in this research has had wider dissemination, via extension presentation programs, throughout the network of kibbutzim, moshavim, and professional animal health organizations. Consequently, there has been a 20% decrease in calfhood mortality in Israel. It is interesting to note that even though there has been significant improvement from a mortality standpoint, no statistical differences were noted in morbidity related to this disease in Israel as a result of the TAHRP research.

In Egypt, the impact of neonatal calfhood diseases is more profound than in Israel due, in part, to the kinds of husbandry commonly practiced and the importance of dairy water buffalo in Egyptian society. Epidemiological studies conducted by the Egyptian neonatal research team indicated that the morbidity and mortality rates in cattle calves were respectively 24.7% and 10-20% while in buffalo calves the rates were 43.3% and 26.6-50%, respectively. Given this preliminary data, the Egyptian Country Coordinator decided to dedicate a greater portion of the MERC research funds to activities within this sub-project (neonatal mortality investigations within Egypt received the most funding compared with the other sub-project component activities). The etiology of this disease complex included the same organisms discovered to be the culprits in Israel. However, in Egyptian Water Buffalo, the most significant cause of disease and death is BCV (Corona virus).

Egyptian researchers working in this sub-project started from the very beginning when conducting their research. Prior to the TAHRP project resources had not been allocated within Egypt to look at this cause of mortality in livestock. Preliminary investigations included virological, bacteriological, mycological, immunological, nutritional, and parasitological studies. The research activity in Egypt involved three institutions and three groups of researchers, investigating the role of different pathogens through systematic sampling and testing using data from experimental farms. This research provided information on the importance of the associated pathogens in newborn diarrhea and the quantitative involvement of each of these organisms. The results obtained show an important difference between Israeli and Egyptian data (neonatal mortality being a more serious and prevalent problem in Egypt) and, in Egypt, between cattle and water buffalo (differing primary etiologies).

Diagnostic assays, as well as, testing methodologies have been utilized throughout the Egyptian portion of this sub-project research (see Appendix E). As an example, Egyptian researchers are currently working on a new rapid test for the detection of E.

coli/K99 which will give the result in less than 5 minutes; this test will indicate the immunoglobulin level in blood samples from calves during the first three days of life. These researchers are, also, trying to find the mono-clonal antibody of E. coli/K99. Standardized diagnostic reagents and assays, including molecular techniques have been developed jointly and are being successfully implemented in both Egypt and Israel.

Additionally, the Egyptians were very much involved in research to verify the control strategy of dam vaccination/hyper-immune colostrum feeding with very positive results (see Appendix E for further detail). Most field activities were conducted on experimental farms, mainly those using intensive husbandry techniques and owned by the government or large livestock producers. For the first two years of the project, the Egyptians used a monovalent vaccine with good results. Now the Egyptians are using a trivalent vaccine with even better results. Due to a variety of constraints, the extension component of the Egyptian research protocol has not been entirely accomplished. Information and assistance in interpreting the research results have not been fully transmitted to local farmers. There is no farmer organization that can act as a disseminator of this type of information. Management practices, also, hinder the use of new resources such as colostrum banks. As a consequence, the researchers in this sub-project have not developed a nation-wide, farmer-based implementation/control strategy.

DIAGNOSIS AND CONTROL OF BRUCELLA MELITENSIS INFECTIONS IN SHEEP AND GOATS:

Infection due to Brucellosis is both a chronic and a significant problem worldwide. Disease associated with this organism is important not only in the livestock industry, but, also, within the human health community. Additionally, control and elimination of this disease in both Israel and Egypt come with tremendous international trade benefits. In countries where Brucellosis is an endemic disease, shipment of animals across borders for trade purposes becomes quite limited. If, on the other hand, these two countries are able to eliminate this disease, then, the shipment of animals and animal products will be enhanced and facilitated. Given that this organism poses a real threat to both humans and non-humans, researchers, under TAHRP auspices, developed a sub-project to address these zoonotic concerns. The specific objectives of the Brucellosis research sub-project were:

* to develop a rapid immunological test for detection of Brucella antigen in test samples;
* to develop a method for rapid identification of infected flocks or individuals by either serology or other field applicable methodology;
* to improve laboratory technique for identification and

typing of field strains;
* to evaluate the use of the techniques developed through this research via a large-scale field pilot project;
* to plan a control program based upon the results obtained from these research activities.

Meeting Technical Objectives

The Brucellosis sub-project has met its objectives, overall, in the following ways:

* Serological methodologies have been standardized between Egypt and Israel such that governmental veterinary services agencies can exchange information characterizing the immune status of a particular flock;
* Similar vaccination protocols are being implemented in both countries for the purpose of controlling this disease;
* The techniques and reagents developed as a consequence of this research facilitate the diagnosis of infected animals within vaccinated flocks;
* The skin test has been standardized and applied in both countries and determined to be an adequate screening test on a herd/flock basis;
* New equipment has been purchased to outfit laboratories in both Israel and Egypt, enabling each country to engage in vital diagnostic work related to this disease;
* The TAHRP project has provided the foundation for the respective governments to initiate extensive, country-wide control programs;
* The impact on human health of this disease has been assessed and work has begun to involve the respective health ministries in the public education and awareness programs necessary for the elimination of this disease in the human population.

In Israel, Brucella research was judged to be of such significance that it received the lion's share of the resources from the TAHRP project. As such, the research emphasis was in developing diagnostic tests effective for the control and eventual eradication of this disease. As a way to enable such investigation, much of the available resource base was used to equip the laboratory located at the Kimron Veterinary Institute and to hire competent technical staff. Extensive microbiological research was conducted to determine which tests were most accurate for use in evaluating the status of particular animals and herds/flocks. In work very similar to that conducted in Egypt, it was determined that both the Immunocomb and the Brucella skin allergen tests would be best utilized as screening devices. The Complement Fixation Test was determined to be the most accurate and valuable test to be used on individual animals. Research, also, focused on attempting to develop a methodology

for differentiating between vaccinated animals and those exposed and reacting to field infection. Although not fully completed, significant progress has been made toward this goal. More detailed information on specific experimental protocols, results, and a description of the control program is in Appendix E.

One of the main achievements of the TAHRP project in Israel has been the establishment of a regional reference laboratory for work on Brucellosis infection. This laboratory has been equipped with very advanced machinery for work in both basic molecular biology (PCR) and in more efficient and accurate processing of field samples for diagnostic purposes. A robot dispenser was acquired for use in field sample assessment. This lab is staffed with highly qualified, competent individuals; enabling the lab to carry out all the up-to-date, sophisticated tests required to identify and diagnose Brucellosis in animals and humans. This TAHRP-furnished laboratory has been recognized by OIE as an international reference laboratory for Brucella, which will reflect positively on the countries of the Middle East to find solutions for their problems within the region and to facilitate better cooperation in battling this disease.

As a consequence of the work conducted in this TAHRP sub-project, Israel has initiated a 20,000,000 Shekel control and eradication program. Both the stimulus for, and the implementation of, this nation-wide control program comes from the work of the TAHRP investigators. This control program is being implemented through the Veterinary Services District offices and reaches those individuals involved in the livestock industry, whether they be using intensive or extensive husbandry practices. High interest on the part of the Israeli citizenry has resulted in high compliance with the practical aspects of the control program. Consequently, good results seem to be on the horizon of this control and eradication program.

Additionally, due to the zoonotic nature of this disease, much effort has been directed toward establishing functional relationships with the Ministry of Health and assisting in the development and implementation of an educational awareness program specifically aimed at nomadic sheep herders who seem, within Israel, to be the greatest sufferers of human Brucellosis.

In Egypt, at the start of the TAHRP funding, a massive survey was initiated by the General Organization of Veterinary Services (GOVS), in cooperation with the Brucellosis research laboratories of the Animal Health Research Institute (AHRI) and the Animal Reproduction Institute (ARRI), testing thousands of animals, to determine the Brucella infection rate in-country. Investigation also included evaluating the status of both swine and camels, as well as, more traditional livestock such as cattle and water buffalo. This survey revealed that B.melitensis, biovar 3 was the overwhelmingly responsible agent of disease and, most

probably, originated from sheep and goats, the primary reservoirs of this particular strain.

The TAHRP project first introduced the B. melitensis vaccine (Rev 1) to Egypt. Tests to evaluate the efficacy of this vaccine were first conducted on guinea pigs with very positive results. This was followed by a variety of tests on livestock species, again with positive results (see Appendix E for greater detail into testing procedures used in Egypt). The TAHRP research team designed and implemented a protocol to evaluate the Brucella allergic skin test. The team concluded that this particular test is best used as a herd or flock screening device, followed by use of more traditional tests if positive animals are found. The Egyptians, also, tested immuno-assay techniques (some like Immunocomb were developed in Israel), again resulting in the determination that these tests could be best utilized as a screening device. Egyptian team members have just begun work on characterizing the electrophoretic pattern of Brucella serum proteins for the purpose of differentiating between vaccinated and unvaccinated animals.

As in the Israeli experience, the TAHRP project helped in upgrading the Central Veterinary Laboratories at AHRI by providing conventional and relevant advanced equipment in addition to required chemicals and consumables. Consequently, laboratories were upgraded and necessary training and experience was obtained by Egyptian scientists.

One of the main activities of the Brucellosis sub-project in Egypt was to determine the extent to which humans were impacted by this animal disease. Through this project, it was discovered that many more cases of human disease existed than previously thought and disease incidence still remains very much under-reported. Exposure was not solely limited to those who work with potentially infected herds or flocks, but was, in fact, due, in large part, to exposure to unpasteurized dairy products.

In conclusion, it is clear that the resources afforded Egypt through the TAHRP project allowed scientific investigators to both develop and test hypotheses concerning Brucellosis infection and spread. As a consequence of such active and informative research, the Egyptian government has come to recognize the need to address this disease on a national and, quite frankly, international level. It is currently in the process of establishing a nation-wide control program that will be comprehensive in both scope and implementation. A desire to consider this disease a regional issue is, also, evident in the serious expression of the Egyptian government in its efforts to control this zoonotic disease.

IMPROVEMENT OF FOOT AND MOUTH DISEASE (FMD) CONTROL IN EGYPT AND ISRAEL:

FMD is an acute, highly communicable, endemic disease of the Middle East. It is of major importance in the region because countries of the Middle East constitute the crossroads between Asia, Africa, and Europe and, as such, animals are continually being transported in and out of the area. Of course, exposure of livestock to either carriers or animals ill with the disease, forms the basis of transmission of FMD. Additionally, since FMD is considered by many countries to be a foreign animal disease, areas with endemic FMD are limited in their ability to participate in international trade of animals and animal products. Consequently, the economic toll of this disease includes not only loss due directly to infection, but loss associated with closed markets and trading opportunities.

Finally, control and eradication of FMD poses a difficult problem because of the number of known sero-types/subtypes and the continuous emergence of new serological variants; the capacity of the virus to spread rapidly over long distances and the presence of carriers among infected animals; and animal husbandry practices that make frequent vaccinations difficult.

The objectives, then, of this TAHRP sub-project were to:

* Conduct epidemiological surveillance of FMD in different ruminant species, as well as, wild boars, gazelles and camels, with special emphasis on carriers and characterization of FMD field isolates;
* Develop rapid and accurate diagnostic techniques for use in field outbreaks and for control;
* Improvement of FMD vaccine and vaccination programs.

<u>Meeting Technical Objectives</u>

The FMD sub-project has met its overall goals in the following manner:

* Epidemiological and immunological procedures to study FMD outbreaks occurring in both countries, and the role of wildlife as a reservoir in the transmission of the disease, have been improved; FMD epidemio-surveillance continues to be carried out;
* Exchange of epidemiological information and collaboration of the veterinary services of the two countries for the control and eventual eradication of FMD is routine;
* Better diagnostic procedures and new diagnostic techniques (PCR, Dot-ELISA, mono-clonal antibodies) are now permitting rapid and accurate diagnosis of FMD outbreaks; (Molecular biology (PCR, cloning, nucleic acid sequencing) has been introduced and is routinely used);

* Effectiveness of the current vaccines and vaccination procedures have been evaluated and more effective methodologies for the production of FMD vaccine and the enhancement of herd immune status have been improved;
* Laboratories in both countries are better equipped improving their scientific capacity, their staffs are better trained and skilled and interactive work between scientists has been facilitated and better procedures to prevent the spread of FMD in the region have been developed.

In Israel, most FMD outbreaks occur in the north near the Lebanese border where there is an abundance of susceptible wildlife species that act as FMD reservoirs. Wild, non-vaccinated animals constitute a natural sentinel and are an excellent monitor for evaluating circulating viruses. During the sub-project period (1990-1995), 40 FMD outbreaks occurred in Israel, mostly in 1994. Work was done to identify and characterize the strain/type of disease involved in each outbreak.

The policy in place to control FMD in Israel, and surrounding countries, is based on prophylaxis, all susceptible animals being periodically vaccinated. The FMD surveillance program in Israel, started with the TAHRP sub-project; first, permitting the purchase of appropriate equipment for the FMD laboratory. The surveillance program, which began in November, 1992, consisted of a long-term field survey aimed at determining the immune response to the FMD annual vaccination. This, then, set up the mechanism to evaluate the vaccine quality under field conditions. As a result of this TAHRP-initiated research, vaccination schedules were modified to take advantage of the most opportune time to inoculate the animals. Again, based on the survey results, the antigen load of the vaccine was increased, thus, boosting the sero-conversion rate.

FMD is a highly contagious disease that can be economically disastrous due to its rapid spread. Rapid, accurate, and highly sensitive diagnostic techniques are, then, of crucial importance to identify the causal agent and administer the proper vaccine to the susceptible animal population. Rapid diagnosis, in Israel, was established, using the PCR technique, to identify and type the causative FMD agent. This methodology was used in the outbreaks of 1994 and its sensitivity was improved to enable accurate identification of the infecting virus. Resources from this sub-project, then, facilitated the development of a rapid diagnostic response protocol for the State of Israel. As an example, while the Evaluation Team was in-country, a sample arrived late one evening. By 8:00 AM the next morning, the sample was identified and typed as FMD; by early afternoon, sequencing, using the PCR methodology, had been completed. The PCR technique, then, proved to be a powerful additional tool, to

be used in conjunction with conventional methodology, for the rapid identification of this disease in the field. This PCR technology was readily shared with TAHRP Egyptian counter-parts and is currently being used in both countries to promote rapid, accurate identification.

Due to the increased research activity in FMD, supported by TAHRP resources, Israel is in the process of completing a P3, FMD containment unit which will enable work to be conducted in a safer and more contained manner.

Additional research was conducted under TAHRP auspices to determine the role of Langerhans cells (LC) in FMD infection. Although this research held the general interest of the investigator and others working in virology, it bore little relationship to the objectives of the TAHRP project. In fact, the Mid-term Evaluators had suggested that the resources being used to facilitate this aspect of the FMD sub-project be re-directed to facilitate the accomplishment of the TAHRP objectives. It would appear that this recommendation from the Mid-term Evaluation was not implemented.

In summary, the epidemiological surveillance is based on the sero-surveillance of herds belonging to farms located on the northern border and on wild boars and gazelles concentrated, also, in these same areas. Dairy cattle were the focus of the farm surveillance, whereas, small ruminants, who are, also, subject to FMD infection, were not part of the surveillance program. Evidence from this investigation has been presented that wild boars and gazelles play a non-negligible role in the transmission of FMD. Research conducted on the diagnostic techniques development is of high quality; but it was all concentrated in the molecular biology sector. It seems that the PCR technology is considered, by these researchers, to be the sole diagnostic technique. It is good to remember that most FMD identification is made through conventional methods which have been neglected in this sub-project. The work executed in the domain of vaccine production is very important even if it has been limited to the inactivation and concentration of antigens. Research on LC could be considered fundamental or basic research and does not meet the immediate objectives of the project. It is apparent to the Evaluation Team that there is a lack of understanding between the two main Israeli scientists, Dr. Yadin and Pr. Becker. Additionally, Dr. Yilma (the U.S. Scientific Advisor) and Pr. Becker do not agree upon the research to be conducted in the framework of this sub-project; was it to be dealing with recombinant vaccine or the pathogenesis of Langerhans cells? In the view of this Team, the more practical approach of Dr. Yilma is recommended.

In Egypt, nine FMD outbreaks have occurred since 1992, mostly in the border areas. The surveillance program is based on

following-up on antibody and virus levels in livestock carrier animals at high risk, in provinces close to Egyptian borders. The effect of repeated FMD vaccination on the susceptibility of cattle to infection has been studied; the repetition of FMD vaccination at very close intervals increases the immune response first then after the third vaccination, there is a decrease of this immune response, so it has been recommended to repeat vaccination only after at least 5 months.

Studies have been carried out on the role of camels in the epizootiology of FMD, particularly susceptibility, contagiousness, and level of immunity. Results indicate that camels may play a role in the transmission and spread of the disease. Random serological sampling of camels, imported from Sudan, revealed 23.5% positive for FMD antibody. Buffalo, as well as, small ruminants, also, appear important in the transmission of the disease. Additionally, meat products, even when frozen, may contribute to the spread of FMD.

In terms of developing rapid diagnostic techniques, there has been much sharing between Israel and Egypt. New techniques using molecular biology skills have been introduced into the Egyptian system. Equally, the TAHRP project facilitated the improvement and standardization of more common diagnostic techniques. During the outbreak in 1993, these new technologies were utilized to make a more rapid and accurate diagnosis of the disease-causing organism. Additionally, comparisons were made between isolates from Israel and from Egypt. Given a high level of consistency, this comparative modality facilitates work being done to control this disease on a regional level.

The control program within Egypt consists primarily of vaccination, however, problems have been encountered using some of the vaccines available. Research, under TAHRP auspices, focused on trying a variety of different compounds to be used in combination with the FMD organism. Tests were conducted regarding safety and efficacy. This work continues.

Research on Foot and Mouth Disease in Egypt seems to have begun with TAHRP. The first step of the project concerned the structural changes to the FMD laboratory; then came acquisition of new equipment, chemicals, and biological products; the constitution of the research teams; the collection of data; then a pilot study on the correlation between SN titers and ELISA readings. Great progress has been made during this period of the project, at least in the matter of training and equipment.

Epidemio-surveillance is done on a very limited scale, considering the size of the country and the number and value of the animal population at risk. The surveillance of potential reservoirs and carriers, such as wild animals like gazelles and the important camel population, is not established. The only

epidemiological study has been conducted on imported camels.

Rapid diagnostic techniques have been achieved, focusing more on the conventional test, while at the same time not ignoring the PCR technology transferred from Israel. The vaccine research followed the objective line, focusing on adjuvants, but too many satellite studies without close correlation with efficacy have been conducted and the results do not give any sensitive advantage. The FMD laboratory has the status of a national reference laboratory, but there is no containment unit or P3 lab for the diagnosis of FMD. Consequently, manipulation of large quantities of virus is difficult. It has been said, by a senior scientist, that Egyptians do not want to compete for a status of regional reference laboratory.

IV. COOPERATION BETWEEN INSTITUTIONS AND COUNTRIES

Background: A basic tenet of the MERC program is to encourage both cooperation and collaboration amongst participating scientists. As such, evidence of cooperative and collaborative activities between Egyptian and Israeli scientists is highly important and fundamental in evaluating the merits and successes of the project.

Each sub-project within TAHRP had as a primary goal the enhancement of scientific cooperation between Israel and Egypt (see initial logical framework (1990)). Due to the nature of the scientific investigation involved in all of the sub-projects, namely, disease identification and control, the possibility of establishing truly collaborative activities was great. Indeed, although the cooperative activities and consequent collaborative success varied somewhat between the sub-projects, the overall intent of both the Country Coordinators and the researchers themselves, was to facilitate cooperative work. In the beginning, intense collaborative activity was difficult due to the political situation in the region. As tensions decreased, however, participants in this project took the opportunity of working together more seriously and, in fact, made this concept a reality. As an example, toward the end of the project, scientists collaborated in planning the final workshop and in developing future activities once the current project terminated.

The Mid-term Evaluation noted the high degree of cooperation existing between scientists involved in this project, especially in dealing with the exchange of scientific knowledge, procedure, and methodology. There was a suggestion that the Foot and Mouth Disease (FMD) sub-project needed additional scientific interaction and exchange, as well as, jointly devised research projects. Additionally, it was suggested that more emphasis needed to be placed on developing joint publications. This suggestion was made in the context of all three of the sub-projects. The Mid-term Evaluators, also, noted the need to

strengthen the participation of the U.S. scientific collaborators in order to both contribute to the scientific endeavors of the region and, more importantly, to facilitate the collaborative activities of the Israeli and Egyptian researchers.

Project Participant Responses: The Evaluation Team questioned participant scientists and administrators, both individually and in groups, about the issue of cooperation and collaboration within the context of the TAHRP project. It was clear that open lines of communication, not available nor apparent at the beginning of the TAHRP, developed progressively throughout the course of the project. These lines of communication were especially apparent between the Country Coordinators, as demonstrated by the ease with which these individuals communicated regarding current disease outbreaks. The Country Coordinators should be complimented on the example they set throughout the term of the project regarding this need to facilitate open and responsive communications channels.

Communications between researchers varied somewhat throughout the project. Scientists working within the participating governmental ministries often found it difficult to directly contact their project counterparts. It was often necessary to pass communications, such as faxes, up through the ministerial hierarchy for approval prior to dispatching to counterpart scientists. It is interesting to note that those scientists associated with academic institutions did not work under the same communications constraints. These participants were able to directly communicate with their colleagues, both in-country and between countries, resulting in significantly greater collaborative activities being conducted.

One of the by-products of this project has been that greater communications now exist between scientists working in different institutes within the same bureaucracy. This is especially true in Egypt. Doors have been opened as a result of TAHRP project endeavors facilitating the ability of scientists to work with one another in areas of mutual concern. This has been especially important in the Brucellosis sub-project due to the disease's zoonotic behavior. Working collaboratively with all of the involved institutes in the Ministry of Agriculture, as well as, coordinating with persons from the Ministry of Health is essential in combating this most serious disease. Although communications channels have been initiated, the Evaluation Team would recommend that more effort be focused on joint planning and facilitating the sharing of laboratory diagnostic techniques and equipment both within ministries and between institutes.

The Neonatal Diseases sub-project can be considered to be the most successful of the three sub-projects in its attempts to conduct collaborative activities. Investigations into the major causes of diarrheal disease in calves resulted in the

establishment of strong cooperative ties between the reference laboratories in the two countries; using common reference microbial strains and diagnostic reagents supplied by the U.S. counterpart. This project, then, involved a continuous exchange of information, data, and protocols. Much of the success of this particular sub-project can be attributed to the will and personality of the investigators. The PIs from both countries jointly planned the studies and exchanged information on management and diagnostic procedures, as well as, vaccines and reagents. The U.S. scientist collaborated actively by supplying reference reagents, backstopping the laboratory work, providing much desired training opportunities, and participating in the evaluation of the results. Scientists from Israel and Egypt repeatedly mentioned their appreciation of the contribution of the U.S. scientist and stated that the Neonatal Diseases sub-project has had excellent support from the U.S cooperator. As a consequence, the Neonatal Diseases sub-project has produced significant scientific results.

The Brucellosis sub-project began with travel by two sets of two scientists from Egypt to Israel. These Egyptians worked in the Israeli Brucella laboratory, learned new techniques, and reconfirmed results reached in their own laboratory by testing identical samples under Israeli laboratory conditions. Other than interaction between the two PIs throughout the sub-project, this initial training opportunity was the only exchange which occurred between the two countries. Persons interviewed by the Evaluation Team indicated a need for advanced training, particularly in molecular biology. There seems to have been insufficient consideration given, in the initial planning stages, to accommodate the need for advanced training and collaborative exchanges. The planning and funding priority appeared to be developing the laboratory infrastructure. At this point, the infrastructure has been established and, thus, there is a need to shift priorities to reach training goals and to include field personnel in collaborative exchanges. Additionally, the Mid-term Evaluators identified the need to combine results and develop joint publications. Although many opportunities occurred throughout this sub-project to develop joint manuscripts none have been forthcoming. This lack of collaborative endeavor singles out this sub-project in a less than positive manner.

The FMD sub-project had a rather turbulent beginning. Guidelines and clear instructions were lacking from the start contributing to both confusion and difficulty in making the sub-project successful. Nothing occurred in the beginning between the involved scientists (PIs, Co-PIs, and researchers) from the three nations that would allow people to get to know one another, define the scope of work, divide and share the scientific activities, and discuss how to reach the objectives. Backstopping support from the U.S. scientific collaborator was limited to such an extent that the Mid-term Evaluators

recommended that a new counterpart be selected. Additionally, not much happened in the early years regarding collaboration and exchange. All of this changed after the mid-term evaluation. Higher priority was given to conducting formal training exchanges, joint publications, and additional collaborative activity. The U.S. collaborator was replaced with an individual committed to greater involvement in the sub-project. More exchange of ideas and planning took place, as well as, the exchange of reagents and laboratory techniques. The PIs and cooperators in this sub-project should be commended for their efforts to address the concerns of the Mid-term Evaluators and, ultimately, "fix" problems that resulted in a more successful collaborative project.

The one failing of this project concerns the lack of involvement and international participation of the field component of these sub-projects. Although the thrust of these sub-projects was to reach a level of field application, those cooperators involved in the implementation of the sub-projects on a field level were not well informed nor integrated into the international aspects of this project. It is critical to the ultimate success of a project such as this, with its regional perspective, to involve the field force in both the initial planning and implementation of the applied aspects of the project. Field implementors often have the requisite experience necessary to plan a field activity for success. The Evaluation Team, then, would recommend that future collaborative activities be planned in such a way that all parties involved in the research and implementation of the project be equally involved in both the planning and exchange aspects of the regional project.

Quantitative Indicators of Cooperation and Collaboration: In terms of the individual sub-projects, the Evaluation Team was able to determine that the following number of scientists participated in an on-going fashion in the TAHRP project:

	NEONATAL	FMD	BRUCELLA
EGYPT	23	20	8
ISRAEL	20	12	9
U.S.	1	2	2

In addition to the numbers listed above, other scientists and students participated in this project on an ad-hoc basis. Both Egypt and Israel had 5 institutions, either governmental or academic, involved in this project.

Training and Workshop Activities: Training activities were conducted in each of the three sub-projects. In the Neonatal sub-project, two scientists from Egypt visited Israel for

training and an additional four individuals went to the United States to complete training in the laboratory of the U.S. collaborating scientist. Seven Israelis working in this sub-project were trained under TAHRP auspices. In the Brucellosis sub-project, four Egyptians journeyed to Israel to complete training of one month duration. This happened early in the project and involved both sharing laboratory techniques and in running samples to verify results. In the FMD sub-project, six Egyptian scientists were trained at KVI in Israel; three of them on molecular biology (PCR) and three others on serological procedures. Two Egyptians travelled to the United States for long-term training and, unfortunately, one of these scientists was asked by his U.S. sponsor to return home before the training was complete.

In addition to the exchange training that took place within the project, graduate level programs benefitted from TAHRP funding. In Israel, one student was awarded a PhD degree due to his participation in the TAHRP research (Brucella sub-project). In Egypt, thirteen Masters degrees (2 Neonatal, 1 Brucella, and 10 FMD) and fourteen PhD degrees (1 Neonatal, 3 Brucella, and 10 FMD) were awarded as a result of TAHRP project research endeavors.

Four TAHRP-sponsored workshops were conducted during the life of this project (1992-1995). The character of these workshops changed as the participants became more accustomed to working together. The quality of the presentations improved and the willingness of the presenters to engage in a lively, yet critical, dialogue increased. The Evaluation Team was told that during the 1995 symposium personnel from a variety of international organizations attended and commented on the degree to which cooperation between the participating parties had been successfully achieved. It appears that, as in other aspects of this project, genuine and respectful relationships developed between those involved in the TAHRP project.

Travel: Travel within the Middle East region, as well as, between the region and the United States occurred with some regularity. The purpose of this travel was to either provide training opportunities, to conduct joint planning, or to present information generated from activities within the project. A detailed accounting of travel in each sub-project is contained in Appendix F.

Number of Joint Publications and Presentations: The Mid-term Evaluation suggested that more emphasis be placed on producing joint publications. As a result, two co-authored manuscripts have been submitted to journals for publication. Although the number of jointly produced scientific articles is not as high as might be expected from this sort of endeavor, especially given the number of publications and presentations authored under the

auspices of this project, the Evaluation Team recognizes the historical constraints under which this project was launched and suggest that now that any barriers to this kind of collaborative activity have been overcome, it is reasonable to expect that further joint work will come out of this project and collaborative activities will continue in the future.

The number of publications resulting from the TAHRP project research:

	NEONATAL	FMD	BRUCELLA
EGYPT	9	7	3
ISRAEL		8	3
JOINT	1	1	

The number of Conference Reports produced as a result of the TAHRP project:

	NEONATAL	FMD	BRUCELLA
EGYPT	5	1	15
ISRAEL	19		
JOINT	2		

Extension lectures provided by TAHRP participants to field recipient implementors, either in livestock production or to veterinarians, occurred in the Neonatal sub-project. Egypt conducted six of these lectures while Israel has provided five such events to communities throughout the country.

Sustainability of Collaboration and Research of the TAHRP Project: Participating scientists and administrators were asked whether the scientific relationships developed as a result of the TAHRP project would continue after project completion. It was apparent to the Evaluation Team that not only was there a desire on the part of each and every participant to continue the collaborative relationship, but, in fact, many of the scientists had already taken steps to insure that the collaborative efforts would continue into the future. Joint proposal planning sessions had occurred prior to the arrival of the Team in the region and, in fact, the last technical report had been drafted cooperatively by the Principal Investigator (PI) teams from each of the sub-projects. In prior years, this reporting work had been conducted by PIs on an individual basis. Clearly, the intent in jointly drafting such a document was to further demonstrate the truly collaborative nature of the activities supported under this MERC project.

All indications, then, are that there is great enthusiasm and promise on the part of the current TAHRP scientists to continue working together and develop this activity into an even more regional concept by endorsing the inclusion of other country participants in follow-on activities.

In summary, the Evaluation Team has great confidence in the likelihood that these scientific collaborators will follow through on their desires to continue working together and will, ultimately, expand the network to include others in like disciplines throughout the region. Further, there is a widespread belief amongst TAHRP participants that the participation of U.S. collaborators is vital to the success of this or future projects of similar design. U.S. counterparts act not only as scientific advisors or providers of technical information or resources but, also, as mediators and networking facilitators which is so important to the success of projects that function to introduce and integrate scientists from different backgrounds and cultures into working and productive relationships.

V. PROJECT MANAGEMENT

Management by the Office of International Cooperation and Development of the United States Department of Agriculture (OICD/USDA) and the U.S. Institutional Collaborators

OICD/USDA was the main administrative body and primary grant recipient of the TAHRP project and all activity was conducted under the auspices of a Participating Agency Service Agreement (PASA ANE-0158-O-AG-0030-00). Sub-grants to both Israel and Egypt reflected the specific activity to be conducted in-country.

From the beginning, USDA has been involved in this project, in one form or another. In fact, Dr. Jerry Walker, from USDA, first introduced the Country Coordinators to one another at a U.S. Animal Health Association Meeting held in the United States. Subsequent to this introduction, Dr. Walker worked ardently to facilitate the development of this project. Participants from both Israel and Egypt expressed to the Evaluation Team their sincere appreciation for the contributions of Dr. Walker in both initiating and facilitating this project and its outcomes. USDA should be commended on its endeavors to promote animal health throughout the world and especially its work in developing the TAHRP project and the lasting relationships that have been a product of this activity.

Research Monitoring and Backstopping

The Mid-term Evaluation both commended the U.S. participants on their research backstopping performance and suggested that more support be forthcoming through the administration of this project

to facilitate greater participation on the part of U.S. scientific collaborators. The only significant problems encountered were in the FMD sub-project where the evaluators suggested either greater participation or a change in U.S. collaborator. Following the Mid-term Evaluation, the FMD U.S. collaborator was, in fact, replaced with an individual who was committed to making active and participatory contributions to the benefit of TAHRP project participants.

It appears that the research backstopping was particularly successful and productive in the Neonatal sub-project. The U.S. collaborator is to be commended on her participation and dedication throughout the life of this project. She played a most vital role; contributing to the success of the project in all aspects, from supplying reagents to training scientists to working with in-country participants in strategic planning activities. The participation of the U.S. country collaborator in this sub-project should be used as a model for future U.S. participatory activity in MERC projects.

The participation of U.S. scientists and institutions in the other sub-projects has been beneficial, especially subsequent to the changes made in the FMD sub-project. In terms of the other issues raised by the Mid-term Evaluators, although the issues may have been discussed by the Steering Committee, it is apparent that not much was done to promote the continued or greater participation of the U.S. component to this project from an administrative standpoint. Clearly, in terms of training, which was recognized to be much needed and a high priority in all sub-projects, resources were not allocated to facilitate such activity within U.S. institutions. Individual commitment, as well as, U.S. institutional contribution seemed to be the mechanism used to provide Middle Eastern scientists with training opportunities in the United States. Additionally, it is not apparent that much effort was made in the direction of facilitating the integration of Middle Eastern scientists nor their research activities into the broader U.S. scientific community. All parties could have gained immensely if this type of connection had been pursued.

Flow of Funds

The flow of funds from the OICD/USDA to the governments of Egypt and Israel was timely and without complication. All parties seemed satisfied with the transfer mechanism which provided lump sums to in-country financial administrators for disbursement to recipient researchers. No complaints were voiced about this procedure.

Report Submission

The preparation and presentation of quarterly, semi-annual, and annual reporting documents seemed a chronic problem in this project. As mentioned in the mid-term evaluation, determining what documents were available, as well as, interpreting the results was a challenge for Evaluation Team members. The Team determined that there were problems in standardization of information, uniformity, and clarity. The Evaluation Team highly recommends the use of a standard reporting form that could be completed by those participating in the project.

Throughout most of this project, both the technical and financial reports were drafted and submitted to USDA individually by Egypt and Israel. No attempt was made to draft reporting documents collaboratively until the annual report of 1995 was submitted. OICD/USDA collected the required reports from sub-project Principle Investigators (PIs), collated the material, and without benefit of technical editing, forwarded the reports to . Further, the participation of U.S. collaborators in this report drafting activity remains unclear.

There are indications that this reporting issue was discussed at Steering Committee meetings and an attempt was made to remedy this problem. Project reports improved slightly by project's end.

Convening Meetings

OICD/USDA coordinated the organization and presentation of four TAHRP Workshops conducted annually from 1992 through 1995. Both the content and scope of these Workshops changed as the project evolved. It was reported to the Evaluation Team that participant presenters became, in recent Workshops, more interactive and willing to discuss and accept criticism regarding their scientific work. Further, these meetings became truly international as the last two Workshops involved investigators from other countries in the region and elsewhere. Field implementors had the opportunity to contribute in 1994 and 1995 when the applied aspects of the TAHRP research were more up and running. This evolution of Workshop character from sedate to rousing and engaging is, indeed, a sign of scientific contribution and mutual respect on the part of project participants. Continued use of this type of forum for expression is valuable and noteworthy. Additional regional meetings, even after the conclusion of the TAHRP project, will do much to maintain the spirit and collaboration achieved in this project.

In addition to these large gatherings, OICD/USDA was to facilitate meetings between collaborators and PIs. Reports suggest that this type of exchange of information and planning opportunities did not occur as regularly as might be desired.

Steering Committee Participation

The Steering Committee in the TAHRP project had overall responsibility for the entire program. It was to review and examine progress to date, provide policy direction, and assure that all technical and cooperative aspects of the program worked at optimal levels (see PASA agreement). The Steering Committee, then, was a vital entity within the on-going activities of the TAHRP project. Three members were from Israel, three from Egypt, and two from the United States. The Steering Committee did not include, specifically, PIs from the sub-projects, however, one member from both Israel and Egypt were coincidentally PIs of their respective projects. This created an unanticipated tension between sub-projects since participants complained of unequal decision-making representation. Additionally, it was suggested that the private sector, beyond the one U.S. Steering Committee representative, be more fully incorporated into the TAHRP decision-making process, especially given the applied nature of the activities conducted under project auspices.

The Steering Committee met one to two times per year to discuss issues pertaining to the project. Although issues of major concern to participants and administrators alike were discussed at these gatherings, e.g., producing joint publications, it seems apparent to the Evaluation Team that implementation of decisions taken at these meetings was slow and inconsistent. Greater fundamental leadership from the Steering Committee would have provided a remedy for many of the administrative problems experienced by project participants.

Peer Review

Peer review as outlined in the PASA agreement was to be an on-going process. Although the annual Workshops did provide an opportunity to have experts from outside the project interact with project participants, it was difficult for the Evaluation Team to determine when and, the extent to which, peer review was conducted concerning the TAHRP project. Independent review and comment is essential to scientific research, thus, adequate provision of a mechanism to facilitate this activity within the TAHRP project would have been beneficial to project outcomes.

Training

Training was one of the activities of the TAHRP project. In the neonatal sub-project, most of this occurred under the guidance of the U.S. collaborator, while in the Brucellosis sub-project, early exchange training took place in Israel. The FMD sub-project activities included exchange of technical scientists between Egypt and Israel and the training of one scientist in the United States. Unfortunately, the Egyptian scientist training in the United States was returned to the Middle East prior to

completion of his training period. As a consequence, the Evaluation Team would recommend that future projects include, from the beginning, articulated criteria for selection of training participants. Prior agreement concerning fundamental qualifications would go far in eliminating this type of unforeseen consequence.

Training is an important aspect of a research project such as the TAHRP. Training activities, as well as, criteria to be used for selection of training candidates should be a major, articulated component of any future project work.

Publications

The TAHRP project resulted in a number of publications and presentations that enhanced the body of scientific knowledge. The Mid-term Evaluation suggested that the successful aspects of this project remained very much untold since publications, to that point, had been geared toward a narrow audience. Given the value of the project to both science and the community, at large, it was felt that more emphasis needed to be placed on publicizing the "successes" of this particular endeavor. As a consequence, in the remaining two years of the TAHRP project, attempts were made to "get the word out" about the activities of this project. The focus was on informing the public, international organizations, and future donors and collaborators of the accomplishments of this collaborative project. The Country Coordinators, as well as, OICD/USDA should be commended on their efforts in this area.

The Evaluation Team would recommend that each team of researchers publish a "Bulletin" periodically which would describe activities and results of the project, to that point. This "Bulletin" could be circulated throughout the world to national, regional, and international veterinary, animal production, animal health, and public health organizations. The results of producing such a publication are two-fold; first, it facilitates further cooperation between participating scientists and it, also, "gets the word out" about project activities, both scientific and collaborative.

Israeli Institutional Participation

Management of the TAHRP project in Israel was satisfactory. The sub-grant involved OICD/USDA and the Ministry of Agriculture, however, it appears as though each sub-project PI had control over his own sub-project budget. No complaints were received involving financial transactions nor equipment purchases or travel, however, sub-project PIs believed that there was too much flexibility on the part of the management to shift funds from sub-project to sub-project. Project participants working in the Ministry of Agriculture system did complain that it was necessary

to use a vertical communications network in order to communicate with their Egyptian counterparts. In other words, approval and permission had to be secured from persons "up the ladder" prior to personal interaction with scientific collaborators. In contrast, those participants working in the Universities were able to communicate directly with their Egyptian counterparts.

Egyptian Institutional Participation

The Egyptian management of the TAHRP project differed, somewhat, from the Israeli style. The sub-grant involved OICD/USDA and the Ministry of Agriculture and Land Reclamation. Appropriations and budgeting decisions were made by the Country Coordinator, thus, acquisition of materials and equipment often lagged behind like activities in Israel and the U.S.. Communications accessibility was vertical and, consequently, direct communications with Israeli counter-parts, on a bench level, was non-existent. Researchers believed that scientific productivity, as well as, the efforts to collaborate would be enhanced and facilitated by the ability to directly communicate with scientific partners, whether they be in Israel or the United States.

The Evaluation Team concluded that delegation of authority to the lowest level possible would be in the best interest of those involved in project activities and would speed the efficiency and productivity of project endeavors.

Management Constraints Limiting Project Success

By and large, all would agree that the TAHRP project has been very successful. There were, however, management practices which did limit the overall success of the project. As examples, the lack of foresight and mechanism for prioritizing and supporting training activities within the United States created a noticeable limitation on the technology transfer that occurred, especially within the Brucellosis and FMD sub-projects. The reporting problem, both in terms of annual required reports and joint publications, created confusion as to the impact of this project, scientifically and from a collaboration standpoint, resulting in a loss of understanding of project successes.

The responsibility for resolving these dilemmas rested with both the OICD/USDA and the TAHRP project Steering Committee. The lack of significant leadership on the part of these two groups in facilitating and promoting this project limited participant development and led to chronic problems of an administrative nature.

VI. ECONOMIC AND SOCIAL IMPACT OF THE TAHRP PROJECT

One important aspect of any MERC-funded project is the extent to which it produces some economic or social benefit. Vital to the

TAHRP project, is a clear understanding of the degree to which animal production and, consequently, animal health impact everyday life. Many people, from both Israel and Egypt, are involved in some aspect of animal production and have daily contact with the animals they care for. There is certainly a significant economic component to animal healthcare, however, economics is not the sole concern. The cultures that thrive in the Middle East have a long-standing historic relationship with animals and animal production. This is especially true of the nomadic sub-cultures that exist in both countries. Consequently, it is important to realize that working with animals is part of the lifestyle and culture of the region. Limiting or preventing disease, then, becomes extremely important in both cultural and economic terms.

It can be presumed from the outset, that a project involved in improving animal health and production will have positive social and economic consequences if it attains its fundamental goals. The Mid-term Evaluation suggested that sufficient resources be diverted from other project activities to focus on evaluating the social and economic benefits of the project. Although this advice was not integrated into subsequent project work in any comprehensive way, preliminary economic data are encouraging in terms of establishing the positive impact of the TAHRP project. Positive social consequences are a natural outcome following economic benefit.

NEONATAL SUB-PROJECT: The results of the basic and applied research conducted in this sub-project have been quite profound, from an economic standpoint. In Israel, calf mortality has been reduced by 20% over the course of this sub-project. If this figure is projected over the total calf population in Israel, when implemented on all farms, the TAHRP project will have saved roughly $600,000 (US) in direct costs and nearly $1,000,000 (US) if pharmaceuticals and other veterinary expenses are included. This estimate of economic impact does not take into account the amount of staff time consumed by neonatal disease incidence so that the dollar figures used here might be quite conservative.

In Egypt, the morbidity of calf diarrhea has decreased substantially from 25.6% to 7% in calves fed with hyperimmune colostrum with antibodies against E.coli/K99, BRV, and BCV. The reduction of calf mortality (which in some cases has decreased to <2%), projected on the total calf population in Egypt, 5 million head of cattle and buffalo, will save the livestock sector, in direct costs, the approximate amount of $20,000,000 (US). This estimate should be at least doubled if we count veterinary expenses, such as pharmaceuticals and fees, and livestock productive potential. The amount of $1,000,000,000 (US) indicated in some Egyptian documents should be scrutinized carefully.

BRUCELLOSIS SUB-PROJECT: The economic impact of this sub-project may be measured directly through increased reproductive performance of animals and the prevention of losses through abortions. Indirect costs incurred include increased need for health care intervention, lost productivity, and decrease in the quality of animal products. In Israel, figures suggest that the cost of this disease in cattle is $764,000 per year and in sheep, the figure rises to $1,445,000. As a consequence of this loss to the livestock industry and the progress made during the TAHRP project, the government of Israel has launched a 20,000,000 Israeli Shekel control program, to run over three years, with the intent to eliminate this disease from the livestock industry.

In Egypt, the government is equally concerned about the impact of this disease and is attempting to gear up a control program with the same desired outcome. Additionally, as a consequence of TAHRP-funded research, it was discovered that the incidence of Brucellosis in humans is far greater than previously suspected. Attempts are being made to develop a closer relationship with the Ministry of Health to try to address this most serious public health problem. At this time, it is clear that the TAHRP project has facilitated the development of faster and more accurate diagnostic techniques (both human and livestock) and more effort is being directed at increasing human awareness of this disease and its serious consequences.

FMD SUB-PROJECT: FMD is truly considered to be a "production" disease, meaning that although mortality may be low, loss in production is high and significant in economic terms. With the advent of the TAHRP project, production losses related to this disease have decreased within certain sectors of the livestock industry. In Israel, for example, the most profound impact has been in the dairy industry, where income has increased 2-3% since 1991 due to increased production.

Additionally, this is a disease about which countries are so cautious, that places in which FMD is endemic are restricted in their ability to trade in animals and animal products on the open market. As a direct consequence of the TAHRP project, vaccination protocols have been changed and diagnosis and control has become more rapid. Although not eliminated as a disease entity from the region as yet, the TAHRP project has provided the mechanism to work toward eradication. With the elimination of this disease comes the opportunity to engage new trading partners and open new, non-domestic markets.

It is clear that the TAHRP project has made significant contributions to the economic well-being of people in the region through efforts to decrease both the morbidity and mortality of animal disease. Additionally, TAHRP participants recognize, and are sensitive to, cultural issues which need to be addressed in order for disease control to be successful, e.g., nomadic

sheparding. Long-held beliefs and practices are slow to change. The TAHRP project has had a significant impact on both the social and economic practices within the region.

VII. ADDITIONAL FINDINGS AND CONCLUSIONS

Contributions of U.S. Scientific Collaborators

United States scientific participation in the TAHRP project encompassed a range of activities, from training to strategic planning. It is the sense of Evaluation Team members that U.S. scientific collaborative activities are vital to the ultimate success of this and other MERC projects.

U.S. collaborators act not only in providing additional technical and scientific expertise to in-country participants, but equally importantly, they serve to catalyze and mediate working relationships between Middle East scientific researchers. U.S. participation can be viewed, then, as the "glue" that both promotes and facilitates collaborative efforts on all sides. Without this input, it is likely that researchers would work independently and the important collaborative aspects of these research projects would be lost. Scientists who advise on such activities should be selected because of their expertise, interest, and willingness to provide continuous service to the project endeavor.

Utilization of Generated Technology

In the beginning of the TAHRP project, the emphasis of project activity was focused in three areas: determining the extent of the problem (incidence), identifying agents of disease, and developing remedies. As the project evolved, it has shifted emphasis toward an applied strategy. The project participants realize that truly meaningful work in disease prevention, control, and elimination necessitates the development of a field component. Encouraging farmers, farmers' organizations, and field veterinarians to utilize the findings of the project seem to be more realistic and easier to accomplish in Israel. This is, in part, due to the organization of the livestock production industry within Israel. Farmers are frequently organized and veterinary care is provided through the Hahaklait so that all who belong receive appropriate medical care for their livestock. Dissemination of information through extension lectures and field contact is well developed in Israel.

By contrast, in Egypt, although almost all veterinarians work for the government, farmers tend to be dispersed with only a small number of animals. Large government or corporate farms are reachable; compliance and participation on the part of these entities in addressing disease control and elimination is quite possible. Additionally, effort is being directed toward

privatizing veterinary services in Egypt. Equally, once producer organizations are formed the task of reaching farmers will be made much easier. Everyone is encouraged by the progress made in Egypt concerning farmer adaptation and usage; emphasis in the future needs to be geared toward this applied goal of acceptance and compliance.

Incorporation of Other Interested Entities into Project Activities

The involvement of additional parties, as a project evolves, is desirable, in terms of, program goals and objectives. Parties that, at first, were either not thought to have an interest in the activities of the project or were simply not involved, should be encouraged to participate, as appropriate. In the early part of the TAHRP project, in Egypt, studies of human Brucellosis were carried out resulting in a call for more cooperation between Veterinary and Health authorities. As a consequence, these agencies are now planning a joint, comprehensive approach to the control of Brucellosis in humans. Other Egyptian governmental institutes, as well as, universities and professional associations, expressed interest in cooperating with Veterinary and Health authorities. Participation could be in the form of training of staff, assisting in research activities, extension and education of the public and field inspectors, and participation in meetings. This participation should be at all levels of activity and structure not only for those agencies based in Cairo, but, also, those in the 27 governorates.

In a more direct manner, the TAHRP project brought governmental institutes, who had previously not communicated, together for collaborative research work, e.g., VSVRI and AHRI. This was equally true between ministries and universities and between governmental entities and producer groups, e.g., KVI and the dairy industry. Encouraging participation by parties unknown at the time of initial planning can result not only in enriching the scientific experience, but can facilitate leveraging of additional funding. It is clear, then, that the TAHRP project promoted the idea of different entities working together, whether they be governmental, academic, or from the private sector.

Oversight Activity of Program Office

The USAID MERC program is administered by the Global Bureau of USAID, located in Washington, D.C.. As such, no program official is located within the Middle East region. The Program Officer has limited ability to travel to the region and, thus, most oversight is based upon reports submitted by project participants.

On-site monitoring of MERC projects by USAID would be a useful addition to MERC projects and would help insure that overall

program objectives are met. For instance, having on-site MERC personnel would facilitate the early detection of problems and would facilitate equally early resolution.

There is significant interest on the part of both the USAID Missions and Embassies within the region to be involved in this program, however, these entities already have programs under their auspices which require direct administrative oversight. Where project objectives coincide with Mission strategies, then, assistance from Mission personnel might be possible. Requesting that either of these diplomatic entities add this program to an already bulging portfolio is not reasonable. Stationing a MERC representative within the Middle East might be expensive, however, if this expense is cost-shared by each individual project, as suggested by Embassy personnel, the benefit more than outweighs the initial outlay of funds.

VIII. SUMMARY OF CONCLUSIONS

Technical Objectives

The scientific and technical aspects of the TAHRP project were extensive and quite ambitious. Substantial achievements have been made toward reaching project goals, even if not all aspects of the research have produced significant results. The results obtained clearly have both field and regional application. There were differences in country priority, in terms of sub-project emphasis, reflected by different allocation of resources. For instance, Brucellosis research was the highest priority in Israel, while Neonatal Diseases utilized more resources in Egypt. Technology transfer was accomplished from U.S. and Israeli collaborators to Egyptian scientists. Laboratories were either built for the first time or significantly remodeled and updated. Collaborators, then, attempted to transfer technology from the laboratory to the field, by initiating field disease control programs. In Egypt, the extension service has been slow to gear up and, thus, this aspect of the TAHRP project remains an area of continual priority. The TAHRP project promoted scientific research capacity building and, consequently, the scientific level of expertise was elevated. This resulted in a new level of service available to the public and the producer.

The Neonatal Diseases sub-project has produced significant scientific results. The major causative pathogens have been identified and immunization and prevention strategies, using vaccination, hyperimmune colostrum feeding, and management procedures, have been developed reducing both cattle and buffalo calf losses. Improved high specificity techniques, such as monoclonal antibody, ELISA, and PCR are presently used in both countries. The TAHRP project, also, created a field service for neonatal activities in Egypt where none had existed previously. Scientists and cooperating scientific institutions were able, as

a consequence of TAHRP participation, to increase their scientific capabilities. As with all productive scientific research endeavors, this sub-project has resulted in scientists discovering more areas of endeavor that need attention. Researchers found that these diarrheal disease problems exist in other species, such as sheep/goats and buffalo; and that other disease complexes, e.g., neonatal respiratory disease, are involved in neonatal calf mortality.

The Brucellosis sub-project has resulted in a number of significant positive benefits to the region and the countries individually. Resources in Israel were used to equip a laboratory with both machinery and trained personnel which, very recently, was named as an international reference facility by the Organization for International Epizootics (OIE). This designation highlights the commitment of TAHRP participants to furthering scientific endeavor within the region. Additionally, as a direct consequence of the TAHRP work and results, the Israeli government has initiated a massive Brucellosis control program nation-wide. In Egypt, the TAHRP project was able to introduce for the first time, in a systematic way, use of the most commonly available Brucellosis sheep and goat vaccine. Efforts in Egypt, also, encompassed an analysis of the Brucellosis problem in humans. Results indicated that incidence is far greater than suspected and, in fact, remains vastly under-reported as a contagious disease. These endeavors have opened the way for collaborative work with the Health Ministries of both countries and a recognition that for true control and elimination of this disease a regional approach is the only alternative.

The FMD sub-project resulted in the development of a rapid diagnostic response protocol and standardization of diagnostic technique, effectively determining the existence of an outbreak of FMD in a very short period of time, e.g., 8-12 hours. This most significant contribution was overshadowed by other events occurring within the sub-project. Much dispute occurred over the level of participation and fundamental focus of the sub-project. Unfortunately, precious time was consumed in this non-productive manner, however, it is the hope of the Evaluation Team that, given that most of the disputed issues have been resolved, future work in this arena will be most productive, especially given the level of competence and scientific commitment on the part of the TAHRP participants.

In conclusion, the TAHRP project allowed work to be conducted on species that had previously not gotten much attention from a medical standpoint and so the usefulness and applicability of the results is especially promising. It is, also, significant to point out that the national control programs instituted recently in both Israel and Egypt are the direct result of the TAHRP project. This project provided the seed money to demonstrate to the participating governments of the need to initiate a control

program.

Cooperation Between Institutions and Countries

In many ways the TAHRP project was ground breaking in its impact. Initially, the project was developed by the Country Coordinators and USDA officials. This project was not initiated by individual PIs nor was there experience on the part of the scientists in working together. The politics of the region had, historically, not facilitated such scientific endeavor. However, this did not prevent the evolution that occurred within the project. Participants developed genuine and mutual respect and friendship for each other. There appeared to be real equity amongst partnering scientists and, thus, the cooperation between both institutions and countries should be considered as exemplary, given the propensity for cultural difference, political instability, and scientific competition. Egyptian and Israeli scientists overcame these handicaps and constructed, stone by stone, a durable route of exchange and cooperation; all with the able assistance of U.S. collaborators.

A healthy challenge exists between these participating TAHRP scientists. Competition can and will facilitate cooperation and collaboration resulting in scientific benefit. With divergence of opinion comes opportunity for further collaborative research. The TAHRP project created the nucleus of scientists, within the region, that now attracts others to join in and participate. As a by-product of the TAHRP activities, governmental institutes within Egypt, in particular, were given the opportunity to work together and begin the process of developing collaborative activities. The project sponsored four international workshops that were well attended and improved in quality and content, evolving over time to embrace a more comprehensive perspective. All parties interviewed stated that the friendly exchange of views and experience during meetings resulted in a willingness and desire to work together to develop common research plans.

The TAHRP project helped younger scientists by providing some training and networking opportunities. There was, however, not much accommodation, within the project structure, to meet short or long-term training needs. Even though there had been an expressed need for long-range training, especially in the U.S. on advanced biological techniques, PI funding priorities were to upgrade laboratory facilities. Additionally, the TAHRP project did not particularly encourage or reward the acquisition and sharing of laboratory equipment. Inter-departmental equipment sharing, along with interactive training would facilitate joint activities and collaboration. Balancing project priorities in a more equitable fashion would have been desirable.

Communications between researchers varied somewhat throughout the project. Scientists working within the participating

governmental ministries often found it difficult to directly contact their project counterparts. It was often necessary to pass communications, such as faxes, up through the ministerial hierarchy for approval prior to dispatching to counterpart scientists. It is interesting to note that those scientists associated with academic institutions did not work under the same communications constraints. These participants were able to directly communicate with their colleagues, both in-country and between countries, resulting in significantly greater collaborative activities being conducted.

There is, also, a need, within this project, to develop counterpart personnel at all levels. Exchange of personnel should include field implementors and laboratory staff rather than solely PIs. Under this new scenario, the long-range benefits of the exchange may be even greater than anticipated. Field workers who are not involved in planning often do not understand the broader issues and regional significance of project activities. Within the TAHRP, these workers have not been incorporated into the planning, training, or development aspects of the project. Especially now, after having already outfitted the laboratories, it would be best to re-order priorities to conduct advanced training to meet the needs of the project participants.

As a way of evaluating the collaborative relationships that exist within a project, notation is often made of the number of articles jointly published. The TAHRP project generated two such jointly published works. This is not an impressive record, however, the Evaluation Team recognizes the constraints underwhich this project was originally developed. To remedy this problem, follow-on projects need to initially make joint publication a high priority.

The participants in the TAHRP project were able to adapt to the changing political realities such that, prior to the arrival of the evaluation team in the region, the PIs of all three sub-projects came together to jointly draft the final project report of activities and achievements. In prior years, this reporting work had been conducted by PIs on an individual basis. Clearly, the intent in jointly drafting such a document is to further demonstrate the truly collaborative nature of the activities supported under this MERC project. These collaborators, then, are ready to move forward into another stage of development -more integrated planning and collaboration.

Project Management

The TAHRP project, from an overall standpoint, was managed adequately. Certain administrative activities did create constraints to project success that could be avoided in the future. Management differed from sub-project to sub-project and

the Evaluation Team would recommend more integration of styles and activities. Additionally, there was insufficient transparency in many aspects of the administration of the project, consequently, there appeared to be a lack of information sharing and decision-making occurring at all levels. In Egypt, for instance, not enough local control was exercised over the sub-project budget and, thus, it was often difficult to procure supplies, equipment, and make small acquisitions. At the same time, PIs often chose to outfit their laboratories with equipment without giving much thought to immediate or future training needs. Priority activities within sub-projects should be fully articulated from the beginning so that there is not an imbalance and decision-making, delegated to the lowest level, will be productive and insightful.

Researchers, from both countries, often found that contacting each other directly was difficult. Facilitating direct communication between collaborators should be encouraged and barriers should be removed. Initially, scientists from each country were asked to submit a "wish list" of projects; planning was not really done collaboratively. The reviewers would like to, also, encourage joint planning of research and joint evaluation at all levels of scientific work.

The preparation and presentation of quarterly, semi-annual, and annual reporting documents seemed a chronic problem in the TAHRP project.

The project has supported successful annual workshops which have enhanced cooperation and information transfer between scientists of the three countries. The most recent Workshop included participants from countries throughout the region creating the opportunity to both share the results of the project research, as well as, encourage the future participation of individuals and governments involved in similar activities and concerns. U.S. scientists have contributed significantly to the success of the project. Project participants would prefer to continue the involvement of the U.S. collaborator to both facilitate the collaboration and to assist in the research planning.

The TAHRP project would have benefitted from greater Steering Committee leadership and more active U.S. administrative facilitation. There clearly was a disconnect between the Steering Committee decision-making and implementation.

Even considering these administrative problems, the TAHRP project can still be considered very much a success. Future projects can overcome these administrative constraints with slight modification of protocol and procedure.

Economic and Social Impact

It is clear that the TAHRP project has made significant contributions to the economic well-being of people in the region through efforts to decrease both the morbidity and mortality impacts of animal disease. Disease knows no boundary and must be viewed from this regional perspective.

Additionally, TAHRP participants recognize, and are sensitive to, cultural issues which need to be addressed in order for disease control to be successful, e.g., nomadic sheparding. TAHRP participants do have a regional vision which creates benefits in both economic and social arenas.

Continuation of Project Work after Project Termination

The TAHRP project can be viewed as only a beginning. There is a clear and present desire on the part of current collaborators to continue fostering these relationships. PIs are doing joint planning for project continuation. The emphasis is on expanding perspective to include other regional parties. Actually, the success of this project is demonstrated by the desire of others within the region to participate.

It is important to recognize that creating regional inter-dependence facilitates the Peace Process by requiring that countries collaborate in disease control and monitoring. This could be in the form of regional reference laboratories or the creation of regional vaccine production sites. This regional integration of production of materials will serve regional veterinary needs and will be a natural outcome of more regionally-based projects.

It is the hope of the Evaluation Team that the Egyptian-Israeli cooperation will continue to exist regardless of the availability of external funding. Governments must show their commitment by in-kind contribution to endeavors which have such dramatic and worthwhile outcomes. These types of projects represent the cornerstone of regional cooperation in combating infectious disease. The Evaluation Team has every confidence that TAHRP collaborators will continue relationships developed through the project and will bring in others to control and eliminate disease.

Success in Meeting Program Objectives

The TAHRP project has been very productive, both technically and collaboratively, especially when compared with other MERC projects. It seems to have travelled much farther faster than other like projects. The participants established strong and fluent scientific and professional relationships in the framework of three research sub-projects, whose results benefitted the

livestock industry and the human population, both in Israel and in Egypt, by reducing losses and improving public health. Inestimable economic and social benefits are in the process of being discovered.

The veterinary services and the teams of researchers of all three countries established a sincere friendship and an intensive and very useful collaboration; achieving scientific developments, exchange of epidemiological information, and progressing toward control and elimination of some very difficult disease complexes. This project demonstrates that different cultures can successfully share equal scientific endeavors. The two countries were at different levels of development and, yet, they were able to work on an equitable level and share information. Animal diseases truly do not discriminate - there are equal consequences for poor people and rich people alike. This project is a good example of cooperation and coordination, even with all of the political difficulties inherent in the region.

Institutions have been brought together because they want to associate and they are able to cooperate without fear. This is a point of attraction for other disciplines and national institutions to encourage participation. USAID gave these collaborators the tools to initiate field work which has had on-the-ground impacts.

Relationships within the TAHRP evolved over time. Research requires even closer contact and more intense exchange of information. The participants in this project are at a point where they can expect to go further, in terms of, joint work and collaboration. It is impossible for true collaboration to be maintained solely by the people at the top. Stronger ties must be developed on a scientist to scientist level to further strengthen the foundation of both the work and the relationship. These participants are at the threshold of greater development, to leap into a situation where they no longer need the people at the top, but are able to network at the scientific level. Through the positive experience of TAHRP, real opportunities are offered to promote regional cooperation in animal health and related activities and to coordinate regional strategies for the control of animal diseases.

TAHRP is a first step toward the establishment of a normal good neighborhood relationship between two groups of scientists facing the same problems; this first step succeeded; it will certainly be followed by others more firm, more secure and more decisive. TAHRP is a model project for other countries of the region who are engaged in the Peace Process.

IX. RECOMMENDATIONS FOR FOLLOW-ON

The TAHRP project has opened the door for more collaborative work on a regional basis. To facilitate the control and elimination of disease, the parties must work regionally. The Evaluation Team is enthusiastic in its support for continued work by the current participants and the expansion of opportunity to others. A future project should address the following components:

* DIRECT PARTICIPANT TO PARTICIPANT CONTACT. This concept can be strengthened and re-inforced if scientists/implementors share the same research - each partner contributing to the overall success of the research endeavor. The Parties to TAHRP have evolved to such an extent in their collaborations that they are ready to conduct joint planning, with a regional vision, and an ability to buy into the process. It is recommended that early in the next project, participants come together in an initial orientation session to better understand team building concepts, what is expected from a leadership standpoint, and how participants can share sub-project activities and responsibilities, e.g., management and scientific output. It is most important to assure that decision-making is conducted at the lowest level possible in order to facilitate the smooth running of the project, e.g., acquisition of equipment, supplies, etc..

* INVOLVEMENT OF ADDITIONAL PARTIES IN PROJECT ACTIVITIES. Expand the country participants to include a greater regional representation. Resources such as NAMRU and the Clinical Services of the Koret School of Veterinary Medicine in Israel are only too eager to provide assistance to projects such as this. Discussions with the Ministry of Health in Cairo suggested their enthusiastic interest in collaborative public health research endeavors. Additionally, field implementors, also, have a desire to be brought into the decision-making process. Involving extension-field personnel in the cross cultural/cross country interactions of the project exposes these professionals, who have mostly been involved with their in-country PIs, to their counterparts in the other project countries. Implementing any program without adequate prior involvement and preparation results in a field force that is not adequately prepared to participate fully in project

activities. In Israel, farmers organizations fund part of the agricultural research conducted within the country. Providing a mechanism for the collective input of these organizations into the project planning, from the beginning, may make the project work more relevant to those ultimately benefitting from project activities and may become a leveraging tool for funding acquisition.

* CONTINUE WORK IN THE BROAD SUBJECT AREAS ALREADY A PART OF THE TAHRP. In both Israel and Egypt, it is important to develop the production of autogenous vaccine with local strains of virus (both Neonatal and FMD). In Egypt, Neonatal diseases need further investigation in buffalo to determine the incidence and impact of corona-virus which constitutes a more significant problem for Egypt than for Israel, particularly in the buffalo population. Investigations should begin in order to identify various strains of this organism. In terms of sheep and goats, fundamental information is still not known and consequently basic research activities will need to be conducted prior to institution of any significant control program. Nearly 10% of the total mortality still occurs without identified pathogens; further investigations are needed to determine what other organisms are involved in newborn diarrhea disease complex. The large population of livestock in Egypt, and the wide diversity of animal management systems, suggest further investigation is needed to find a control package that will suit all breeding systems. Develop a regional perspective on control issues involving other countries of the region and international organizations and funding agencies. Additionally, there are Egyptian regulations that require dairy product pasteurization, however, these requirements are not enforced. It is recommended that this aspect of the control program be strengthened through education of farmers and herdspersons and creating an enforcement staff.

* LONG-TERM PERSONNEL EXCHANGES AND JOINT PUBLICATIONS. Design, and build into the project, long-term personnel exchanges, not just short-term training visits and develop criteria, from the outset, for selection of persons to participate. Place high priority on writing joint publications.

* ESTABLISH AN ELECTRONIC INFORMATION NETWORK. This network, when developed regionally, will create a computer connection between both the field and the researchers and between the researchers and other interested ministries or organizations. The purpose of this network is to share information and facilitate disease control. Much of the hardware is already in place; for instance, it is just a matter of making the appropriate connection to allow individuals in the Health Ministry to communicate with those in veterinary services. Establish information and communications systems at all levels, thus promoting direct interaction between scientists, field implementors, and governmental workers.

* REGIONAL INTER-DEPENDENCE AND INTEGRATION: Develop innovative ways to create regional inter-dependence. Clearly, it is not cost-effective to create redundancy, e.g., every country having its own laboratory and production facilities. Create regional Centers of Excellence in laboratory work, vaccine production, or data base expertise. Regionalizing the activities has not only an economic benefit, but, also, promotes the Peace Process. The MERC program should seriously consider ways such as this in which it can programmatically support such peaceful regional efforts.

* FULL-TIME REGIONAL REPRESENTATIVE: In the interest of appropriately managing the administration, communication, reporting, collaboration, as well as, the involvement of other interested parties, the Evaluation Team recommends that a full-time representative of the U.S. donor be located in a central regional site and be a member of the oversight committee. In order to better facilitate management and administration, the Team would, additionally, recommend that the U.S.-based administrative organization recognize the benefit to having an administrator located within the region and provide that as part of the administrative duties of the project.

* SUSTAINABILITY: Build in sustainability, on the part of the grantee countries, to continue the work after donor support has been utilized. This commitment can come from the government or the private sector or a combination thereof.

X. LESSONS LEARNED

Many donors contribute to development activities within the Middle East. The MERC program and development, in general, would benefit from coordination with other donor activities, as appropriate.

Equality between country scientists is critical to the success of any cooperative development project. Future projects should promote as a priority, reciprocal exchanges between scientists and field implementors from all countries involved.

The sustainability of project activities would be ensured and enhanced by increased movement toward privatization of veterinary services and livestock production activities in Egypt. Currently, there are no farmer organizations within Egypt, compounding the problem of disseminating the positive results of the TAHRP project.

Sustainability depends upon the commitment of each country to providing in-kind contributions either through an institution, the state, or the private sector.

Evaluation time in-country is always short and intensely scheduled. It would be most helpful to the Evaluation Team if Country Coordinators and other involved administrators or contractors could provide detailed, proposed schedules to the Team Leader well in advance of in-country activity. Any modifications or accommodations necessary to finalizing the schedule could then be made without significantly jeopardizing on-site evaluation time.

On-site monitoring by MERC personnel would help insure that projects meet MERC goals and objectives.

APPENDIX A

TRINATIONAL ANIMAL HEALTH RESEARCH PROJECT

AID-USDA PASA No. ANE-0158-P-AG-0030-00
AID Project No. 398-0158.21

Scope of Work
Final Evaluation

WINROCK INTERNATIONAL

TRINATIONAL ANIMAL HEALTH RESEARCH PROJECT

AID-USDA PASA No. ANE-0158-P-AG-0030-00
AID Project No. 398-0158.21

Scope of Work
Final Evaluation

Context of this project and evaluation

The Trinational Animal Health Research Project is a project within the Middle East Regional Cooperation (MERC) program.The goal of the MERC program is to promote peace between Israel and its Arab neighbors and to facilitate development that will improve the well being of the people.

The premise of the MERC program is that people who work together in a truly collaborative manner to solve common problems or to develop shared opportunities substantially enhance their knowledge and understanding of each other, of their respective cultures and heritages, and their common goals and aspirations.

A further premise of the MERC program is that participating country sectoral development programs are strengthened and enhanced by regional cooperation projects which bring together national experts and expertise in collaborative technological or scientific efforts focused on common economic or social development priorities. A corollary is that if successful, regional cooperation projects can help attract additional financial resources, public and/or private, to common economic or social development programs.

Projects supported by the MERC program, the results produced by those projects, and those participating in them are likely to become important examples and focal points for the development and spread of further mutual understanding to colleagues within participating institutions and nations, and to other entities within the region.

Active, focused, and broadly based regional cooperation among the countries of the Middle East is, therefore, the fundamental goal of the MERC program. Thus defined, regional cooperation is the principal goal of MERC projects and cooperation is an integral feature or characteristic of all stages of MERC project activities, from conceptualization and planning through implementation to completion.

Section One: Activity to be Evaluated

Project Number: 398-0158.21 PASA Number: ANE-0158-P-AG-0030-00

Title: Trinational Animal Health Research

Cost: Five Year Budget ($U.S.)

	DIRECT	INDIRECT	TOTAL
Egypt	1,184,260	177,638	1,361,898
Israel	1,187,595	178,138	1,365,733
U.S.A.	130,369	545,024	675,393
Total	2,502,224	900,800	3,403,024

Life of Project Dates: 6/12/90-6/11/95

The TAHRP consists of three subprojects:

1. Neonatal Death Losses in Bovine (Cattle and Water Buffalo) Calves;

2. Diagnosis and Control of Brucella Melitensis Infections in Sheep and Goats; and

3. Studies on Foot and Mouth Disease.

Section Two: Purpose of the Final Evaluation

The purpose of the evaluation is to determine how and the extent to which the activity has contributed to the peace process; how adequately the ongoing research has been planned; how well the work has progressed toward achieving the stated objectives; and, on the basis of the work accomplished, to estimate the potential impact which the project has had, or is likely to have, particularly in terms of economic development. To the extent possible, progress should be measured in quantitative terms. Scientific achievements should be interpreted in terms of their social and economic significance, and evaluated to assess the degree to which they have achieved the research (technical) goals set out in the subproject design, based on the assumptions and objectives developed in the Logical Framework of each subproject (see Annex 1). All three subprojects will be simultaneously reviewed.

An important measure of success will be the probability that work initiated or stemming from the project will be continued in both countries, and the degree to which the project has contributed to generating interest in mutual collaboration among other countries of the region.

Section Three: Description of the project

A) Background

The Trinational Animal Health Research Project (TAHRP) is a cooperative research effort designed to encourage and facilitate cooperation among the concerned scientists and institutions; and provide essential information and technology for the control or eradication of three important animal diseases that severely affect the efficiency and economy of production of various livestock species.

Animal husbandry is an ancient and significant part of the agriculture and economy of the region. The two countries are situated along the trade route connecting Asia and Africa over which animal traffic (and related diseases) still moves. The most widespread and significant domestic animals are cattle, buffalo, sheep, goats, camels, pigs and poultry. Although these domesticated species have, over the millennia, developed adaptive characteristics during their interaction with man and the local environment, the introduction of modern husbandry practices and the need to increase productivity requires the application of improved management, genetic selection and more rigorous disease prevention and curative procedures. An important aspect in the epidemiology of diseases is potential contact with wild animal reservoirs and the role these play in disease transmission. In addition, the close habitation of humans and animals, especially in traditional production systems, tends to accentuate zoonotic disease problems.

Egypt and Israel have both intensive and traditional forms of animal husbandry. With the intensification of livestock husbandry and the intimate contact with traditional production systems, animal disease hazards have intensified. Modern animal breeds have little or no natural defense against endemic diseases and parasites and therefore require that greater disease preventative measures be taken.

The three diseases chosen for collaborative research by Israeli and Egyptian institutions with the participation of U.S. institutions are closely identified with priority disease problems of the region.

B. The Subprojects

The TAHRP consists of three subprojects.

1. Neonatal Death Losses in Bovine (Cattle and Water Buffalo) Calves

This activity includes research on quantitative aspects and economic damage due to neonatal mortality in Egypt and Israel, and on epidemiological aspects of the problem; evaluation of the

environmental influence on neonatal mortality; improvement of diagnostic methods, instrumentation, and the professional skill of staff; improvement of husbandry by organized instruction of the producers; and testing various vaccination methods against major pathogenic agents causing neonatal mortality.

2. **Diagnosis and Control of Brucella Melitensis Infections in Sheep and Goats**
This activity includes production, evaluation and application of allergen for diagnosis; development of a vaccine strain(s) with reduced virulence and added phenotypic marker(s) useful for identification; and the employment of the above in large scale epidemiological studies and control programs in Egypt and Israel. The occurrence of Brucellosis in human subjects is a public health hazard associated mainly by contact with infected animals or the consumption of unpasteurized milk or milk products.

3. **Studies on Foot and Mouth Disease**
These studies include epidemiological surveillance of Foot and Mouth disease in different ruminant species, with special attention to carriers; development of rapid, accurate diagnostic techniques; and promotion of the production of a potent vaccine suitable against the types of virus occurring in the country.

The technical work in the three subprojects has included the following main lines of research:

1. Microbiological investigations, applying different techniques of isolation and identification of microorganisms, and their characterization and typing (which are specific to the organism in question be it viral, bacterial or fungal);

2. Serological techniques for identification, sero survey, sero conversion, and immune status studies, including modern techniques (such as Elisa); the utilization of highly specific monoclonal antibodies; and

3. Planning of step-wise control or eradication programs for the diseases under study.

C) **Project Purposes and Objectives:**

The goals of the project are to enhance scientific cooperation between Israel and Egypt, and to improve the health status of farm animals and thus increase livestock production efficiency.

The purposes of the project are to:

1. Diminish the neonatal mortality of farm animals in Egypt and Israel through the development and application of improved diagnostic procedures and new vaccines;

2. Improve biologicals (antigens and vaccines) for laboratory and mass field application of diagnostic methods to facilitate employment of control programs for Brucellosis in Israel and Egypt; and

3. Develop and adopt rapid diagnostic procedures, a highly potent vaccine and alternative methods of application to reduce and/or eliminate Foot and Mouth Disease in Egypt and Israel.

In addition, the project seeks to promote interaction among various disciplines; enhance the capacity of veterinary services and related professional fields; and build infrastructure of the two countries in ways that will strengthen the technical support available to the animal production and marketing sector.

Section Four: Statement of Work

The evaluation will include four main areas of project activity broadly grouped under management, cooperation, scientific (technical) issues, and economic and social impact. The team should provide both qualitative and quantitative assessment of progress. To the extent that it can, the team should provide quantitative data that is indicative of level of project activity, progress toward the stated goals and the socio-economic impact of the project.

1. Management: Assess the adequacy and effectiveness of the various elements of project management and project design.

a) Assess the level and adequacy of U.S. institutional participation in terms of research backstopping, flow of funds, report submission, research monitoring, equipment purchases, convening of meetings, participation in steering committee meetings, training and publications.

b) Assess the efficacy of management structure at the project implementation level, including supervision and execution of research, participant institutional responsibilities, preparation and distribution of reports, and availability and distribution of resources.

c) Identify management constraints limiting project success.

2. Cooperation: Assess the level of cooperation and interaction of research scientists and others generated by this project as illustrated by the following:

a) The number of institutions and scientists of both countries involved in the project, students trained, farmers participating and other measures of interaction.

b) Number and ease of exchange travel and visitations and of training sessions accomplished.

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c) Level of participation in actual joint research subjects as indicated by division of research task responsibility and publications.

d) Workshops, seminars and project reviews conducted.

3. Scientific (Technical) Issues and Achievements: The review team should refer to the Logical Framework (Annex 1) which outlines the technical parameters of each subproject. It should note the suggested changes made by the previous review team and consider the extent to which such changes have been implemented. A basic question for analysis by the team is, did the framework as modified form a sound basis to achieve the project goals, and do the experience and results suggest any fundamental weaknesses in the planning or execution of the project? The team should assess the progress made toward achieving the goals set out for each subproject, based upon the assumptions given and the means of verification noted in the Logical Framework. Specifically:

a) What diagnostic tools have been developed or improved?

b) How has the scientific capacity of the relevant institutions been strengthened by training, workshops, seminars, cooperative research and publications?

c) Has there been a verifiable impact in the institutional capacity affecting husbandry practices and the incidence of animal disease?

d) Assess the effectiveness of collaboration between the research activity and technology delivery systems.

e) Were there any major impediments affecting the implementation of the scientific work?

f) Assess the need and prospects for continuation of the activities initiated under the project.

4. Economic and Social Impact - To the extent possible, what can be shown of the impact of the research on improvement in production efficiency, increase in market quantity and quality of animal products?

a) What has been the effect on commercial animal production in terms of cost and efficiency (reduced mortality for example)?

b) Has there been any verifiable impact on animal disease incidence and control?

The TAHRP project had an external evaluation at mid-term. The report of that review forms an important context for the present evaluation. The evaluation team will examine the issues

identified in that review, but also use their professional judgement to identify additional items or issues which materially affect the ongoing and future work of the subprojects.

Section Five: Methods and Procedures

The team will follow the format and guidelines established by in the supplement to Chapter 12, AID Handbook 3, entitled AID Program Design and Evaluation Methodology Report No. 7.

The team will use the following document review, data collection, and interview methods:

1) Attend briefing in AID/Washington and in U.S. Embassies in Cairo and Tel Aviv.

2) Review all relevant project and grant papers, progress reports and previous evaluation reports. A partial list appears as Appendix II.

3) Interview members of the USDA, other involved US scientists, and subproject principal investigators; and examine activity records, data analysis, and conclusions.

4) Brief the project coordinator of each country of your findings and then brief AID/Washington before writing the final evaluation report.

A) Specific Preparatory Activities

Before departure for Egypt and Israel, the evaluation team should review all relevant documents, project reports and publications and the report of the mid-term evaluation. The team should identify the main areas identified in the mid-term evaluation that should receive careful scrutiny. The team should meet with AID officials responsible for administering the project and with Winrock International staff to clarify their charge and receive any additional information concerning the review. As possible, team members should have discussions with U.S. cooperating scientists related to each activity under the TAHRP. The team will prepare a tentative report outline and tasks schedule as part of the preparatory phase.

B) Overseas Activities.

A Trinational Steering Committee meeting was held in November, 1994, during the National Animal Health Meetings held in Grand Rapids, Michigan. The team should review the decisions taken by the steering committee, particularly regarding the termination of the subprojects, or plans for their continuance. Additionally, a third symposium is planned for early 1995, which, if timely, may provide an opportunity for the team to meet with the scientists and observe scientific interaction. It will be important to assess the degree to which recommendations made in the previous review have been implemented, and to assess the benefits derived by the animal health scientists and institutions in terms of

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enhancing their capacity to address animal health problems through improved research capacity and technology transfer methodology, now and in the future. The team should meet with each nation's project coordinator, principal investigators and administrative officials at each project headquarters and fields sites in the respective countries. Following the on-site visits, the team will prepare draft reports and brief Israeli and Egyptian officials.

While in Egypt and Israel the team will be under the guidance of the Science Officer, U.S. Embassy/Tel Aviv and the Political Officer, U.S. Embassy/Cairo, whom the team should brief before departing the region.

Section Six: Evaluation Team Composition

The team will consist of two persons, one of whom shall have recognized broad experience in research related to Foot and Mouth disease, neonatal diseases, and with Brucella research and control programs. The professional should have had experience working in one or more North African or Middle Eastern countries. While this team member is likely to be a veterinary scientist, that is not a requirement, however his or her field and laboratory experience should include epidemiology, microbiology and general animal management. The focus of this person's attention will be on the technical aspects of the project. The second individual should be a person with broad experience in agricultural economics and development processes, and with a knowledge of the social-cultural and political context of the region (specifically Egypt and Israel). Their interaction should provide a combined overall assessment of project activities. They will be jointly responsible for preparation of the report, however the designated team leader will have responsibility for organizing, merging drafts and producing the final report.

Language proficiency in Arabic and Hebrew is desirable but not required as most project personnel speak adequate to desirable English, and all relevant information is available in English.

Section Seven: Reporting Requirements

The format of the evaluation report will follow AID guidelines established in the supplement of Chapter 12 of AID Handbook 3.

The report will include an executive summary, project data sheet, table of contents, findings, recommendations, and appropriate appendixes (evaluation scope of work, list of people contacted, bibliography). The body of the report, exclusive of executive summary and appendixes, should not exceed 30 single spaced pages. The evaluation team will formulate their findings and from these prepare a set of conclusions for each of the objectives of the subprojects as well as for management, cooperation and impact.

The final evaluation will concentrate on determining whether the project was successful in meeting its stated end of project objectives.

The report will be written jointly by all members of the team under the coordination of the team leader, who will be responsible for briefing appropriate , U.S. Embassy and host government officials. The team leader is responsible for the timely submission of the final report.

In the report, the discussion of each component commemented on should be concise but thorough; identify important factors that affected the implementation of the project; and place them in the context of the project purposes. Recommendations should relate to significant factors (including the basic premises on which the project is based) affecting the impact and future direction of the project.

A draft of the recommendations to be included in the evaluation report must be prepared prior to the team's departure from the Middle East and is to be discussed with the U.S. Embassy/ in each of the countries. The final report will be completed prior to the team leader's return home or at a reasonable later date negotiated with the contractor, but in no case later than 30 days after completion of the evaluation.

The final report (15 bound copies and one unbound copy) will be due to the AID Project Officer within 15 days of return from Egypt and Israel and shall be accompanied by a copy of the report on computer diskette using Word Perfect 5.1 software.

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ANNEX I LOGICAL FRAMEWORKS FOR EACH SUBPROJECT

(Not repeated here. See original project proposal.)

ANNEX II KEY CONTACT PERSONS

EGYPT:

Prof. Dr. Aly A.M. Moussa
Chairman GOVS/Egypt
Ministry of Agriculture
Cairo, Egypt
TEL w 20-2-348-1764 h 20-2-702-202
FAX 20-2-710-692 360-0037 or 360-4429
FAX 710692

Prof. Dr. N.A. El-Danaf
Animal Health Research Institute(AHRI)
Ministry of Agriculture
Cairo, Egypt
TEL w 20-2-703-520 h 20-2-342-4781

Prof. Dr. S.A. Salama
Veterinary Serum and Vaccine Research Institute
Ministry of Agriculture/Abbasiya
Egypt
TEL w 20-2-827-037 h 20-2-822-491
FAX 20-2-725-240

ISRAEL:

Dr. A. Shimoshony
Director Vet. Services and Animal Health
Beit Dagan 50250
Israel
TEL w 972-3-968-1612 h 972-3-648-1515
FAX 3 9681641
TELEX 381472 VSAH IL POB 12

Prof. Kalman Perk
Dean, Koret School of Veterinary Science
Hebrew University of Jerusalum
Rehovot, Israel 76100
TEL w 972-8-481021 h 972-8-462648
FAX 972-8-468568 TELEX 381331 HUAG.IL

Dr. M. Banay
Kimron Veterinary Institute
Ministry of Agriculture
Beit Dagan

Dr. H. Yadin
Kimron Veterinary Institute
Ministry of Agriculture
Beit Dagan

U.S.A.

Dr. Charles A. Mebus
Laboratory Chief
National Veterinary Service Laboratories
Foreign Animal Diseases Diagnostic Laboratory
P.O.Box 848
Greenport, N.Y. 11944
TEL w 516-323-2500 h 516-765-5572
FAX 516-323-2507

Dr. Linda Saif
TEL w 212-263-3742 h 419-846-3011
Ohio Agricultural Research and Development Center
The Ohio State University
Wooster, Ohio 44691

Dr. Gary Adams
School of Veterinary Science
Texas A&M University
College Station, Texas
TEL w 409-845-3827
FAX 409-845-9972

Dr. Thomas Walton
National Program Staff
USDA, Washington, D.C.
TEL w (410) 535 2225
FAX (410) 535 9507

ANNEX III

Proposed Schedule for the Evaluation:

Review documents at home

Days 1,2,3	Briefing in Washington, develop report outline (includes travel)
Days 4,5	Travel to Egypt
Days 6	Prepare for Meetings with Egyptian scientists and Ministry of Agriculture Officials
Day 7	Off
Days 8 - 13	Review Project, visit laboratories and project field sites in Egypt including Debriefing.
Day 14	Travel to Israel
Days 15-20	Review Project, visit laboratories and project field sites in Israel and Debriefing in Israel
Day 21	Return to U.S.
Days 22-24	Complete report.

APPENDIX B

LIST OF DOCUMENTS AVAILABLE FOR REVIEW BY THE EVALUATION TEAM

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LIST OF DOCUMENTS AVAILABLE FOR REVIEW BY THE EVALUATION TEAM

Draft MERC Program Guidelines (1994);
Evaluation Handbook, Supplement to Chapter 12, Handbook 3, Project Assistance. (1989);
Original Proposal including Logical Framework (1990);
Scope of Work (1990);
PASA (1990);
Mid-term Evaluation (1993);
Steering Committee Reports (1994-1995);
Workshop Proceedings (1994-1995);
Annual Reports: Oct., 1990-Mar., 1991
Oct., 1992-Sep., 1993
Oct., 1993-Sep., 1994
Oct., 1194-Aug., 1995
Scope of Work, Final Evaluation (1995).

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APPENDIX C

LIST OF PERSONS INTERVIEWED DURING THE TAHRP EVALUATION

APPENDIX C

LIST OF PERSONS INTERVIEWED DURING THE TAHRP EVALUATION

/WASHINGTON

John Daly, Edward Lijewski, David O'Brien

WINROCK INTERNATIONAL, WASHINGTON

Floyd Williams, Vicki Walker, John Pino

U.S. ADMINISTRATORS AND SCIENTIFIC COLLABORATORS

Eileen Herrera, Charles Mebus, Linda Saif, Garry Adams, Tilahun Yilma

/JORDAN

Carl A. Dutto and William T. Oliver, Jr., Mission Director, /Jordan

ISRAEL PROJECT MEMBERS/PARTICIPANTS

Hagai Yadin, Arnon Shimshony, Samuel Pohoryles, Kalman Perk, Zeev Trainin, Menachem Banai, Miri Abramson, Aliza Cohen, Samuel Perl, Itzchak Samina, Aaron Tromp, Giora Hoida, Menachem Davidson, Dan David, Yehuda Stram, Elana Bloch

EGYPT PROJECT MEMBERS/PARTICIPANTS

Ali Moussa, Hisham Fahmy, Samira El Sayed, Attiat El Menshawy, Samira El Gibaly, Samy Ismail Ibrahim, Ashraf Sayor, Mohammed Ragab, Mohamed Refai, Kamil Mettias, Amel Rashidi, Ahmed Daoud, Adel Omar, Sami Saber, Momtaz Wasfy, Fadia Sayed Hussin, Nahed Ali Hassan, Samira El Kelany, Hossam Fawzy, Mohamed Shawky, Senan El Nakashly, Magdy Abdelaty Ahmed, Adel Omar Abdel Rahman, Nabil El Danaf, Safwat Saleh, George Barsoum, Adel Farid, Amira Ragheb Iskander, Soheir Showkry Elias, Emad Mekhtar, Ousama Yousif, Hadia Mousa, Hani Michael Aziz, Omnia Fakry Hassan, Abdel Rhahle Montaser

/EGYPT

David Delgado, Director, Office of Agriculture; Nasr El-Deen Rohaiem, Project officer, Agricultural Resources Directorate

US EMBASSY/EGYPT

Hani Hamroush, Scientific Affairs Specialist, Economic Section

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US EMBASSY/ISRAEL

David Mulenex, Science Attache

OTHER CONTACTS

EGYPT: Ahmed Abdel-Gawad, Director of the Animal Health Research Institute (AHRI); Mohsen Sharaf, Director of Public Relations, El Alamia International Livestock Company, El Tonsi Farm; Mohamed Galal Sheha, Veterinarian-in-charge, Dairy Sector, El Tonsi Farm; Prof. Goher, Managing Director, El Tonsi Farm; Ray Arthur, Chair, Virology Branch, US Naval Medical Research Unit (NAMRU); Boulos Bulus, Virologist, NAMRU; Medhet Darweesh, Professor of Virology, Faculty of Medicine, Ain Shams University; Ali M. Saudi, Director of El Khanka Buffalo Farm; Ahmed Shahine, Veterinarian, El Khanka Farm; Abdelaty, Veterinary Officer of the District of El Khanka; Ahmed Taher Ibrahim, Director of Zoonotic Diseases; Said Ahmed El Sharkawy, Veterinarian of NAFCO Farm, Abdel Gihay Ahmed, Agricultural Engineer, NAFCO Farm; Mohamed Aser, Director of NAFCO Farm; El Said Moussa, Feeds Specialist, NAFCO Farm; Nabil Nasser, Ministry of Health; Mamoud Abou El Nasr, Preventive Medicine, Ministry of Health, Said Oun, Director of Communicable Diseases, Ministry of Health

ISRAEL: Ami Naveh, R&D Manager, Biogal-Galed Labs, Kibbutz Galed; Amos Gershony, Commercial Manager of Biogal; E. Pipano, Chair, Division of Parasitology, KVI; Uri Orgad, Director of the Koret Veterinary School; Joram Weisman, Chair, Division of Avian and Fish Diseases; Arieh Sheskin, Director of the Technical Assistance & Foreign Relation Department, Ministry of Agriculture, Foreign Trade Center; Yitzhak Abt, Director, Center for International Agricultural Development Cooperation (CINADCO), Ministry of Agriculture; Yaacov Paran, Director, Training Division, International Cooperation Center, Ministry of Foreign Affairs; Yeshay Folman, Chief Scientist, Ministry of Agriculture; Avshalom Dolev, Managing Director, Israel Dairy Board; Yossi Dror, Chief economist, Israel Dairy Board; Yehuda Efron, Director of the Hahaklait Veterinary Services; Ellis Gross, Public Health Veterinarian, Ministry of Health; Zamir Oved, District Veterinary Officer, Beer-Sheba

PALESTINIAN AUTHORITY: Mohamed Hassuneh, General Director of Veterinary Services & Animal Production

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APPENDIX D

FINAL EVALUATION SCHEDULE IN-COUNTRY

APPENDIX D

FINAL EVALUATION SCHEDULE IN-COUNTRY

Friday, August 11	Dr. Garbe meets with officials from , Winrock, OICD/USDA, U.S. Scientific Collaborators
Sunday, 13 August	Departure of Evaluation Teammember, Dr. Khaled El Hicheri from Tunis to through Rome to Amman; arrival at 9:00 PM. Met by Evaluation Teammember, Dr. M. Amarin; transport to the Amman Intercontinental Hotel, Queen Zein Street, Jabal, Amman, Jordan
Monday, 14 August	Review of TAHRP Project documentation by Drs. El Hicheri and Amarin. Israeli visa formalities conducted for Dr. El Hicheri. Departure of Dr. Garbe from Washington, D.C. to Amman, Jordan.
Tuesday, 15 August	Review of TAHRP Project documentation by Drs. El Hicheri and Amarin. Arrival of Dr. Garbe. First meeting of the evaluation team at 8:30 PM at the Amman Intercontinental Hotel.
Wednesday, 16 August	Visit to to meet with Mr. Carl Dutto, Director, Water, Environment, and Agribusiness. Meeting of the Evaluation Team from 11:30 AM to 3:00 PM at the Vaccine Production Center. Continued review of TAHRP Project documentation.
Thursday, 17 August	Meeting of the Evaluation Team from 9:00 to 11:30 AM in a meeting room of the Intercontinental Hotel. Leave Amman for the King Hussein Bridge (Allenby Bridge); crossing the border into Israel by car. Met at the Israeli check-point by Dr. H. Yadin at 1:00 PM. Transport from Bridge to the headquarters of the Israeli Veterinary Services and Animal Health at Beit Dagan, near Tel Aviv. Meeting from 3:00 to 5:00 PM with Dr. A. Shimshoni, Director of the Israeli Veterinary Services and TAHRP Country Coordinator; Prof. K. Perk, member of the Steering Committee and PI of the Neonatal Diseases Sub-project; Dr. S. Pohoryles, member of the Steering Committee; and Prof. Z. Trainin, Director of the Kimron Veterinary Institute and visit organizer. Transport to Ramada Inn Hotel in Tel Aviv then move to the Hilton Hotel due to lack of sufficient reservations. Meeting of the Evaluation Team at the Hotel from 8:00 to 10:30 PM.

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Friday, 18 August	Depart Hotel at 7:00 AM for the Kimron Veterinary Institute (KVI), to meet with Dr. M. Banai, head of the Brucellosis Reference Laboratory and PI of the Brucellosis sub-project. From 8:30 AM to 3:00 PM visit the Beer-Sheba Veterinary District where a veterinary team was executing the Brucellosis Control Program; meeting with Dr. Z. Oved, District Veterinary Officer and Dr. E. Gross, Public Health Officer in the District of Beer-Sheba; visit to Abou Ligan bedouin tribe flocks; visit to a moshav with 250 cattle dairy. From 4:00 to 6:00 PM, meet with Dr. Banai at KVI for a discussion of the Brucellosis sub-project. Return to the Hotel at 6:30 PM. Meeting of the Evaluation Team from 8:00 to 10:30 PM.
Saturday, 19 August	Depart Hotel at 8:30 AM with Drs. Banai and Yadin for travel to Biogal Labs on the Kibbutz Galed. Meeting with Dr. Ami Naveh, R&D Manager and Mr. Amos Gershony, Commercial Manager of the laboratories. Visit to Biogal laboratories and the on-site dairy. Business lunch at the kibbutz. Visit to the Veterinary District of Tiberias; meeting with the District Veterinary Officer, Dr. Miri Abramson. Visit to the Kokh Brothers Farm in the Moshav Sarona, a sheep dairy farm. Visit to the Shadeb goat farm in the Yavniel Valley. From 3:00 to 5:00 meet with Drs. Abramson, Yadin, and Banai on the subject of TAHRP field operations in Brucellosis and FMD. Return to the Hotel. Meeting of the Evaluation Team from 8:30 to 10:30 PM.
Sunday, 20 August	Depart Hotel at 11:30 AM for the Koret School of Veterinary Medicine (KSVM) and KVI. Meeting with Dr. Z. Trainin, Director of the KVI and Pr. E. Pipano, Head of the Department of Parasitology in the KVI. Business lunch at the KVI restaurant with Pr. Pipano, Pr. U. Orgad, Chair, KSVM, and Dr. Weissman, head of the poultry pathology department. Visit the teaching hospital at KSVM. Visit different Divisions of the KVI: *Division of Pathology, headed by Dr. Perl; *Division of Parasitology, headed by Pr. Pipano; *Division of Bacteriology, headed by Dr. Cohen; *Division of Virology, headed by Dr. Samina. Return to Hotel at 5:00 PM. Business dinner in Old Joffa with Dr. Shimshoni, Dr. Hassuneh, General Director of Veterinary Services and Animal Production, Ministry of Agriculture, Palestinian

	National Authority, Dr. Sheskin, Director, Technical Assistance and Foreign Relations Department, Ministry of Agriculture, Foreign Trade center, Dr. Paran, Director, Training Division of the International Cooperation Center, Ministry of Foreign Affairs and Mr. Abt, Director of the Center for International Agricultural Development Cooperation (CINADCO), Ministry of Agriculture.
Monday, 21 August	Depart Hotel at 7:30 AM for Beer-Tuvia for field operations concerning neonatal diseases in cattle. Meeting with Dr. Perk and Dr. Tromp, veterinarian of the Hahaklait for the Beer-Tuvia Moshav. Visit two dairy farms belonging to the Moshav. Business lunch at Rehovot, Faculty of Agronomy of Hebrew University. At 3:30 PM, meeting with Pr. Yeshay Folman, Chief Scientist, Ministry of Agriculture. At 4:30 PM, meeting with Mr. Avshalom Dolev, Director of the Israeli Dairy Board and Mr. Yossi Dror, the Chief Economist of the Israeli Dairy Board.
Tuesday, 22 August	Depart Hotel at 8:00 AM with Dr. Yadin to visit TAHRP field activities in Hadera. Meeting with Dr. Hoida, District Veterinary Officer. Return to KVI for meeting at 11:30 AM with Dr. Davidson, Director of Veterinary Services Field Division and co-PI of the FMD sub-project. Meeting with Dr. Shimshoni from 2:00 to 5:00 PM. At 8:00 PM, meet with Dr. Yehuda Efron, Chief of the Hahaklait Veterinary Services.
Wednesday, 23 August	Meeting of Evaluation Team in the morning. At 12:30 PM, meet with Mr. David Mulenex, Scientific Attaché, U.S. Embassy/Tel Aviv. From 2:00 to 4:00 PM, tour of the FMD safety containment laboratory of KVI and meet with Dr. Yadin and laboratory personnel. Concurrently, Dr. Garbe met with Elana Bloch, the Accountant of TAHRP. 4:00 to 5:00 PM, meet with Dr. David and Dr. Stram, specialists in molecular biology. 5:00 to 6:30 PM, de-briefing with Dr. Shimshoni. Business dinner from 7:00 to 8:15 PM, with Drs. Shimshoni, Perk, Tainin, Yadin. Transport to airport accompanied by Dr. Trainin. Depart for Cairo. Arrive 11:30 PM, met by met by Mr. Fahmy; transport to Semiramis hotel.
Thursday, 24 August	Meet at 10:00 AM, with Drs. Ali Moussa, El Sayed, General Organization of Veterinary Services (GOVS), Mrs. Attiat El Menshawi, Mr. Fahmy, Foreign Agricultural Relations Technical Office.

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	Meeting from 11:00 AM to 3:00 PM with Dr. Nasr Abdel Gawad, Director of the Animal Health Research Institute (AHRI) and with the Brucellosis sub-project team, composed of: Drs. El Gibaly, Deputy Director AHRI, PI, Ismail Ibrahim, co-PI, Montasser, Sayor, Ragab, with Dr. El Sayed and Mr. Fahmy. From 3:30 to 4:30 PM, met with Mr. Hamroush, Scientific Affairs Specialist, Economic Section, U.S. Embassy/Cairo. Meeting of Evaluation Team, 8:00 to 10:00 PM.
Friday, 25 August	Free day. Write report. Business dinner at 8:00 PM with Dr. Ali Moussa and the Egyptian TAHRP team members.
Saturday, 26 August	Evaluation Team meeting at 8:00 AM. Departure at 9:00 AM for TAHRP Neonatal Diseases sub-project field activities at El Tonsi Farm. Meet with Drs. Refai, co-PI of the sub-project, Mettias, El Rashidi, Animal Reproduction Research Institute (ARRI), Mrs. El Menshawi, Dr. El Sayed and Mr. Fahmy. Meet at El Tonsi Farm with Dr. Sheha, veterinarian-in-charge, dairy cattle sector and Mr. Sharaf, Director Public Relations. Return to Hotel at 3:00 PM. Meeting of the Evaluation Team at 6:00 PM.
Sunday, 27 August	Evaluation Team meeting 7:30-8:30 AM. 9:00 AM departure for the Veterinary Serum and Vaccine Research Institute (VSVRI) at El Abbassia. Meet with Drs. Daoud, Director of the VSVRI, PI of the FMD sub-project; Omar, Head of FMD department; Saber, Chair, Virology Department, Faculty of Veterinary Medicine, Cairo University; Wasfy, U.S. Naval Medical Unit (NAMRU), Cairo; Report presented on the FMD sub-project. Meeting with the entire Egyptian FMD team, including personnel trained or having visited Israel and the United States. Departure at 1:00 PM for the ARRI. Meeting from 1:30 to 4:30 PM with scientists involved in the activities of the Neonatal Diseases sub-project: Drs. Refai, Faculty of Veterinary Medicine, Cairo University, co-PI, Salah, Barsoum, Mettias, Farid, Professor of Microbiology, Deputy Director of ARRI. Meeting with Dr. El Danaf, Director of the ARRI and co-PI of the Brucellosis sub-project. Tour of the ARRI facilities. Return to Hotel at 5:30 PM. Meeting of the Evaluation Team from 9:00 to 10:30 PM.
Monday, 28 August	Evaluation Team meeting 8:00-9:00 AM. 9:00 AM meeting at the U.S. Embassy with Mr. Hamroush.

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	9:30 to 11:00 AM meeting with Mr. Delgado, Director, Office of Agriculture, and Mr. Rohaiem, Project Officer, Agricultural Resources Directorate, . 11:25 AM to 12:20 PM meeting at NAMRU with Drs. Arthur, Head, Virology Branch and Bulus, Virologist in NAMRU. 12:40 to 2:30 PM, meeting with Dr. Darweesh, Professor of Virology at the Faculty of Medicine of Ain Shams University. 2:45 to 4:10 PM meet with Mrs. Menshawi. 4:15 to 5:40 PM meet with Dr. Farid and the researchers on the Brucellosis sub-project team. Return to Hotel at 6:00.
Tuesday, 29 August	Depart Hotel at 7:15 AM to visit El Khanka Farm, a buffalo dairy participating in the Neonatal Diseases sub-project, and the Nile Agriculture and Food Company (NAFCO), participating in the Brucellosis sub-project. Accompanied by Drs. Refai, Saleh, and Mr. Fahmy. Arrival at El Khanka Farm at 8:25 AM. Meet with Mr. Saudi, Farm Manager, Drs. Shahine, Farm veterinarian, and Abdelaty, Veterinary Officer of the district. Tour of the site. Depart at 11:00 AM, proceed to NAFCO Farm at Nubaria, 150 Km west of Cairo on the Cairo-Alexandria Highway. Arrive Nubaria at 1:45 PM, tour NAFCO Farm which specializes in sheep and goat production. Meet with Dr. El Gibaly and the staff of the farm, composed of: Mr. Asr, Director of the farm, Dr. El Sharkawy, farm Veterinarian, Mr. Ahmed, Agricultural Engineer, Mr. El Moussa, Feeds Manager, and Dr. Ibrahim, Director of Zoonotic Diseases. Return to Hotel at 8:00 PM.
Wednesday, 30 August	Meeting of Evaluation Team at 8:00 AM. Depart Hotel at 10:30 AM for meeting with the Undersecretary of the Ministry of Health, Dr. Nasr, and the Director of Communicable Diseases, Dr. Oun. From 1:30 to 3:30 PM meet with Mr. Delgado, /Cairo. Prepare de-briefing. From 6:00 to 7:30 PM debrief the TAHRP Egyptian Team including: Drs. Moussa, Refai, Salah, El Gibaly, Omar, Mrs. Menshawi, Mr. Fahmy. Depart for airport at 9:30 PM. Depart Cairo for Amman at 11:59 PM.
Thursday, 1 September	Arrive Amman at 1:30 AM. Depart airport at 2:30 AM. From 11:45 AM to 1:00 PM meet withrepresentative and Mission Director. Depart Amman at 4:30 PM for Aqaba. Arrive 11:45 PM.
Friday, 2 September	Meeting of Evaluation Team and draft report.

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Saturday, 2 September	Meeting of Evaluation Team and draft report.
Sunday, 3 September	Meeting of Evaluation Team and draft report.
Monday, 4 September	Meeting of Evaluation Team and draft report.
Tuesday, 5 September	Departure of Dr. Amarin for Cairo. Departure of Drs. Garbe and El Hicheri for Amman. Meeting at /Amman for de-briefing.
Wednesday, 6 September	3:30 AM Departure of Dr. El Hicheri for Tunis. Departure of Dr. Garbe from Jordan to Israel. De-briefing conducted by Dr. Garbe in Jerusalem with Mr. Mulenex, U.S. Embassy. Depart for United States.
Thursday, 7 September	Travel Day
Friday, 8 September	De-briefing conducted by Dr. Garbe for and Winrock International personnel.

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APPENDIX E

MEETING OF SUB-PROJECT TECHNICAL OBJECTIVES

APPENDIX E

MEETING OF SUB-PROJECT TECHNICAL OBJECTIVES

SUB-PROJECT - NEONATAL MORTALITY IN CATTLE AND BUFFALO

BACKGROUND

Mortality in newborn calves is of great importance worldwide; causing heavy economic losses to the livestock industry. Diseases associated with mortality constitute a problem under all management systems and especially in intensive systems of husbandry. The causes are multifactorial and interactive and include, in addition to pathogens, factors such as management practices.

In both Israel and Egypt, diarrhea has been identified as the leading cause of illness and death in newborn calves during the first month of life. The TAHRP research group, conducting activities in this area, concluded that the primary causes of diarrhea in both countries are viral enteritis and bacterial infection. Rota-virus, Escherichia coli, Corona-virus, and Salmonella have been identified as the main culprits of this diarrheal disease complex. Appropriate management, feeding regimes, vaccination, and adequate medical therapy can reduce the losses considerably.

FINDINGS AND CONCLUSIONS IN ISRAEL

The sub-project was developed to minimize losses associated with neonatal diarrhea in dairy cattle. The sub-project started in Beer Tuvia, in a Moshav consisting of 80 farms, each having up to 60 high producing dairy cows. The morbidity from calf diarrhea approached 100% with 6-7% mortality. Research has focused on initial epidemiological studies; identification and characterization of pathogens; efficacy of maternal vaccination with available vaccines; evaluation of colostral transfer of antibody to the neonate; and possible development of autogenous vaccines. The impact of current management practices was evaluated, as well.

Role Played by the Causative Pathogens

Viral, bacterial, and protozoal pathogens associated with diarrheal complex of newborn calves have been identified and characterized. The viral pathogens found were:
- Rota-virus (BRV), which has been typed by mono-clonal antibody, ELISA and DNA probes, (G sero-types of this virus have been identified);
- Corona-virus (BCV) which has been detected in both cattle and buffalo neonates; various virus strains were isolated and

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identified.

The bacterial pathogens found were predominantly E. Coli followed by Salmonella. BRV is the most common pathogen diagnosed and predominates in mixed infections. It is important to point out that virus isolated in human infant diarrhea cases in India has, on occasion, been identified as BRV. Consequently, this problem could soon be considered a public health issue.

An epidemiological study was conducted on the effects of vaccination against E. coli/K99, looking at the immunological status of dairy cattle and the kinetics of the antibodies transferred to the neonates through the colostrum. Another study was conducted on 150 samples, revealing the presence of BRV in 80 of the samples. Anti-BRV antibodies in the sera of vaccinated dams and neonate calves were identified and iso-typed by ELISA. E. coli/K99 and BRV antibodies were mostly IgG.

A controlled survey of BCV infection has been started to establish the importance and significance of this virus. Fecal samples and nasal swabs collected from both healthy and symptomatic calves are being examined for BCV using a commercial ELISA kit and indirect immunofluorescent and immuno-chemical detection methods.

Development and Use of Suitable Diagnostic Techniques

The neonatal sub-project reached the objective to develop and standardize diagnostic reagents and assays, including molecular techniques which were successfully implemented in both countries. Major efforts have been directed toward the application of molecular biology techniques used in assessing dairy cattle status; techniques that were used for the analysis of sero-types of circulating BRV in herds and BRV sero-types, not usually included in commercial vaccines, were identified. Assays were also performed on ELISA immuno-plates. Thousands of fecal, sera, and colostral samples were routinely examined in the research-diagnostic laboratory in Rehovot using ELISA and electron microscopic techniques. A foundation for an immuno-peroxidase focus neutralization assay was developed to determine the serotype specificity of rota-virus-specific antibody in colostrum.

Appropriate strains for inclusion in autogenous maternal vaccines have been identified, as well. Major efforts have been directed toward those agents prevalent in clinical cases, e.g., Bovine Rota virus, Escherichia coli, and Bovine Corona virus.

Control Program

According to the Israeli reports, maternal vaccination improves and enhances passive immunity and contributes to the reduction of

calf mortality. Two successive vaccinations in the last two months of pregnancy, using a bivalent vaccine (BRV & E. coli/K99) caused a significant rise in both anti-BRV and anti-E. coli/K99 antibody titers. Colostrum samples from BRV & E. coli/K99 vaccinated dams, examined by ELISA, showed significantly higher titers of anti-BRV antibodies. Calves fed hyper-immune colostrum within 12 hours post-parturition showed the highest titers of anti-BRV antibodies. Experiments demonstrated that freezing colostrum does not effect its anti-BRV antibody content. The practice of using pooled colostrum from mature cows was studied and was found to be of significant benefit in intensive dairy production. The use of supplemental colostrum during the first two weeks of life was, also, studied.

The colostrum feeding technique developed under the research protocol consists of feeding 1.5 liters of a tested hyper-immune colostrum to the neonate in the first 3 hours after birth followed by feeding 4 to 5 liters of hyper-immune colostrum on day 2. The efficacy of using trivalent maternal vaccination for the major diarrheal pathogens (BRV, E. coli/K99, and BCV) was evaluated. Maternal vaccination was noted to be very efficacious, underlining the necessity of feeding high quality colostrum.

Heifers producing hyper-immune colostrum were vaccinated against BRV and E. coli/K99 60 days and 30 days before calving. For the second calving, cows need only one vaccination, 25 days before calving.

The control program, also, included quality control of the colostrum through examination for specific antibodies against BRV and E.coli/K99. Furthermore, sera of calves and dams were examined to determine the immunological response of both vaccination of mothers and hyper-immune colostrum feeding.

Information about these effective veterinary husbandry methods have been disseminated to veterinarians and farmers. One indicator of the success of the control program is the notable increase of the Rota-vaccine sale. Colostrum evaluation has been extended to farmers, as well.

FINDINGS AND CONCLUSIONS IN EGYPT

Bovine neonatal disease is of great concern to the Egyptian livestock industry where development of intensive dairy cattle and buffalo production is anticipated. In addition to cattle, buffalo account for nearly 2.5 million head in Egypt.

Role Played by the Causative Agents

Losses of newborn calves, in intensive farms, ranged from 20% to 50%. Epidemiological studies conducted by the Egyptian team

indicated that the morbidity and the mortality rates in cattle calves are respectively 24.7% and 10-20% while these same rates in buffalo calves are respectively 43.3% and 26.6-50%. The epidemiological studies revealed that the losses are mainly due to diarrhea caused by different pathogens among which Rota-virus, E. coli, and Corona virus play the most important role. A study conducted from 1991 to 1993 revealed the important role of the three diarrheal pathogens; in a total of 113 samples collected, 31 were positive for BRV, 24 positive for E. coli/K99, and 22 positive for BCV. The statistics produced by the Egyptians showed that the main pathogens causing diarrhea in cattle are BRV (37.3%), E. coli/K99 (25.4%), BCV (18.2%) while in buffalo the percentage of these pathogens are BCV (37.7%), BRV (24.7%) and E. coli/K99 (22.7%). Two field types of BRV and BCV related to cattle and buffalo have been identified; the cattle BRV strains are G6 and G10; the identification of BCV strains is still underway. The predominant role of BCV in buffalo could constitute a future field of investigation.

Development and Use of Suitable Diagnostic Techniques

Egyptian scientists have been trained on ELISA techniques and have developed laboratory facilities like those used in Israeli laboratories. Assays were performed on ELISA immuno-plates. Identification of BCV isolates were made by HI, ELISA and FAT; for further identification, the SNT was done using the fluorescent focus neutralization test. Poly-clonal and G-specific mono-clonal antibodies in an ELISA were used for sero-typing group A BRV; BRV was confirmed by dot-ELISA and immunofluorescence. The latex agglutination test has been used for the detection of BRV and proved to be a rapid test, easy to use, and a sensitive technique for the detection of BRV antigen in fecal samples of newborn calves.

Control Program

Vaccination experiments in dairy cows showed higher specific antibody titers in both sera and colostrum of vaccinated cows and in the sera of their newborn calves. The higher level of antibodies in the colostrum and the repeated colostral feedings resulted in higher antibody levels developing rapidly in the sera of the newborn calves. Consequently, greater protection was afforded the newborn calf during this post-calving critical period. E.coli/K99 vaccination experiments in buffalo dams resulted in a striking increase in the E.coli/K99 titers of calves born to these vaccinated dams.

At the experimental farms visited during the evaluation, the control program involved vaccinating heifers and dams, as in Israel, and colostral feeding using a different protocol. Two liters of colostrum are fed to the calves 1 hour after calving, then, the same quantity is fed twice a day during the three first

days of life; this method showed an increase in the quantity of immunoglobulins in the serum, the number of diarrhea cases decreased, and the duration of illness shortened. In the case of Buffalo, given the smaller quantity of colostrum and milk produced by the dam and the consistently high antibody levels detected, current protocols involve feeding colostrum/milk for 20 days.

The TAHRP research in this sub-project has been very beneficial to Egypt. At the El Khanka Buffalo dairy, the calf mortality rate was 15% in 1993, when management started to apply the technology developed in this sub-project. After using the diagnostics and vaccination/colostrum feeding protocol for only one year, the mortality rate dropped to 6.7%. During this year's calving season, from July through the end of August when the Evaluation Team visited, the farm had not recorded any deaths in the 29 calves born during this time-frame. The farm manager, also, stated that the calves were more vivid and experienced better weight gain; the difference in weight between calves born from vaccinated mothers and calves born from unvaccinated mothers was 10 kgs at 37 days of age. Before the experimental use of the new technology, most neonatal death at this farm was due to enteritis and respiratory disease.

According to officials in the GOVS, most large cattle and buffalo farms of the organized sector are convinced of the benefits of the vaccination/hyper-immune colostrum method and are buying the vaccine while the small farmers are still ignorant of the method or not able to pay the vaccination costs. After the discovery of new BRV strains in Israel, Egyptians oriented their research to the production of trivalent multi-strain vaccines which have been used on buffalo with good results; no BRV, BCV, or E. coli/K99 were detected in samples coming from vaccinated calves having diarrhea. The results of this work are in the process of being published.

Four types of commercial vaccines are presently sold in Egypt: an Intervet monovalent vaccine, a Pharmavet Rota-virus and E. coli bivalent vaccine, a Biomerieux bivalent separate vaccines and a Smith & Klein trivalent vaccine. It is important to underline that the cost of a 3 week old buffalo calf is about $120 (US) and the two vaccine shots cost nearly $3 (US) while the average cost of treatment of a diarrhea case is about $5 (US). Even with these low prices, small farmers remain reluctant about using these imported vaccines and the extension of the experiment is dependent on the national production of cheaper vaccines.

LIST OF COUNTRY PARTICIPANTS

The Egyptian team of scientists was composed of 26 investigators and consultants belonging to the GOVS, AHRI, ARRI, and FVM/CU including:

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* Principal and co-Principal Investigators:

- Dr. A.A. MOUSSA, Principal Investigator, Chair, GOVS;
- Dr. M. REFAI, Principal Investigator, Chair, Microbiology Department, FVM/CU;
- Dr. I.M. REDA, co-Principal Investigator, Department of Microbiology, FVM/CU;
- Dr. A.F. ABDEL GAWAD, co-Principal Investigator, Director of AHRI;
- Dr. A.F. FARID, associated co-Principal Investigator (bacteriology), AHRI deputy Director.

* Consultant:

- Pr. A.A. BARAKAT;
- Dr. G. BARSOUM, GOVS;
- Dr. S. SALEH, GOVS.

* Senior Investigators:

Senior Investigators belong to Four Egyptian institutions:

-Faculty of Veterinary Medicine, Cairo University:

Dr. M.S. SOLIMAN (parasitology);
Dr. M.S. SABER (virology);
Dr. M. EL SIRGANY (pathology);
Dr. M. FETHIA;
Dr. A. IKRAM;
Dr. E. KARIM;
Dr. A. BADR;
Dr. R.A. HAMAD;
Dr. W.A. GAD EL SAYD (bacteriology);
Dr. M.A. SHALABY (immunology);
Dr. A.A. FAYED (epidemiology);
Dr. O. EZEL DIN (nutrition).

- Animal Health Research Institute, Ministry of Agriculture:

Dr. N.N. AYOUB (virology);
Dr. A.R. ISKANDER, Head of Parasitology Department;
Dr. M. HAFEZ (pathology).

- General Organization of Veterinary Services, Ministry of Agriculture:

Dr. G. WANIS (bacteriology);
Dr. A. NOUR (epidemiology).

- Animal Reproduction Research Institute:

Dr. K. METTIAS.

The key Egyptian institution in the neonatal diseases sub-project was the AHRI.

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The Israeli team of scientists was composed of 20 investigators belonging to KSVM, KVI, and VSAH including:

* Principal and co-Principal Investigators:

- Prof. K. PERK, Principal Investigator, KSVM;
- Dr. A.M. TROMP, co-Principal Investigator, planning field surgeon, « Hahaklait », Cooperative Farmers' Society for Clinical Veterinary Services and KSVM.

* Senior investigators:

- Kimron Veterinary Institute, Ministry of Agriculture:
  Dr. J. BRENER (immunology);
  Dr. U. KLOPFER (pathology);
  Dr. M. DAVIDSON (epidemiology);

- Koret Veterinary School:
  Prof. H. BERKOVIER (bacteriology);
  Prof. R. WHITE (neonatal diseases);
  Dr. Y. EINUR (epidemiology);
  Dr. U. BARGAY (medicine);
  Dr. N. SAFRAN (molecular virology);
  Dr. A. FRIEDMAN (immunology), Faculty of Agriculture and KSVM;
  Dr. O. GALLILY-ABRAMOVITCH (immunology);
  Dr. O. FIDGUT;
  Dr. B. ROSEN (molecular biology), Ohio State University and KSVM;
  Dr. R. CHEN (bio-statistics), Biological Institute, Nes Ziona.

* Consultant:

  Mr. A. SIMCHA (economics).

* Student-Investigators (Thesis):

  Mr. N.S. STEYER;
  Mr. T. LEVINE;
  Mr. G. ZOHAR;
  Mr. S. RACHMILEVITZ.

The key Israeli Institution in the neonatal diseases sub-project was the KSVM.

The U.S. cooperating scientist was Dr. Linda SAIF, Ohio State University, Wooster, Ohio.

SUB-PROJECT - DIAGNOSIS AND CONTROL OF BRUCELLA MELITENSIS INFECTIONS IN LIVESTOCK

FINDINGS AND CONCLUSIONS IN ISRAEL

Scope of the Brucellosis Problem in Israel

Brucella abortus has been eliminated from Israel's dairy and beef herds. Brucella melitensis represents the major challenge of Israel's livestock industry as it is endemic in humans, cattle, and in small ruminants; the latter being the primary reservoir of disease. Sheep and goats continue to harbor this disease due to many factors, i.e., the nature of breeding (especially in extensively managed operations), the uncontrolled movement and grazing patterns of these flocks, and the level of education and standard of living of Bedouin farmers who are the primary users of the extensive husbandry system. The Israeli dairy cattle industry is highly developed, sophisticated, computerized (which means up-to-date record systems), and has a unique insurance system which offers veterinary services around the clock. Human cases of Brucellosis are declining. Most cases are reported to be among livestock owners of extensively raised small ruminants which represent approximately 50% of the sheep and goats in Israel. Ministry of Health officers are intensifying their efforts to educate farmers; using materials which address Brucellosis awareness, the socio-economic impact of this disease, and how to safely handle animals and their products.

The Israeli Research Program

The objectives of the Israeli research program are to do the following:

- *conduct comparative studies between serological and allergic tests,
- *develop immunological methods for rapid identification of infected flocks for mass application,
- *improve the Brucella allergic skin test by characterizing the allergic Brucella immuno-dominant protein and adapt the test to be used in cattle and buffalo,
- *plan a stage-wise, general scheme for control of B. melitensis in animals using an attenuated low-hazardous-to-human vaccine strain that is phenotypically different from field strains,
- *strengthen Egyptian - Israeli scientific relations.

This last objective represents the major goal of the TAHRP research project and is demonstrated through the pursuit of work in a cooperative and coordinated manner.

In terms of improving serological techniques, several achievements were made including the production and

standardization of antigens in the laboratory; enhancing the implementation of CFT through introduction of a robot dispenser used in the preparation of the micro-plates thus reducing the time and work consumed in performing this test which is recognized to be the confirmatory test for the control program (this laboratory is receiving 5000-6000 samples a week); the development of a micro-plate for the agglutination test; the development of an ELISA test, in collaboration with a private company, in which researchers provided the company with standardized antigen to manufacture a kit known as Immunocomb(R). Immunocomb(R) can be used, with good results, in screening flocks.

The Allergic Skin test was evaluated under various conditions involving both vaccinated and infected animals. Similar work was conducted in Egypt, with similar results. The test proved to be highly specific, but of low sensitivity in sheep and goats. Field veterinarians welcomed the test and good results were achieved in sheep. The test, also, proved to be useful in cattle, but with lower sensitivity than that experienced in sheep.

An outbreak of Brucella melitensis, biotype I, did occur in cattle during the course of the TAHRP project. The Milk Ring test failed to detect the infection by giving false results and many human cases were recorded as a result of that outbreak. The economic losses were enormous as slaughtering of the whole herd was necessary. This is a clear example of the importance of developing a more sensitive test.

A study was initiated and completed on the identification of brucellergen immuno-dominant ribosomal (allergenic) protein (L7/L12). This research was partly financed by TAHRP. The related gene was cloned and expressed in E. Coli. This work has been published in a regional scientific journal.

Brucella strain isolation was greatly improved, leading to good correlation between positive serological reactions and isolation of the organism. This, also, led to the identification of atypical Brucella melitensis strains. Work being conducted on the research objective involving the development of a new vaccine for use in the control program has, as yet, not resulted in any positive outcomes.

One of the main achievements of the TAHRP project in Israel was to establish a new Brucella laboratory, which had not previously existed. This lab is now considered to be an international reference laboratory.

The Israeli Control Program

Israel has an efficient and highly organized veterinary services supported by both sufficient budget and contributions of farmers.

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Ten district veterinary offices are located all over the country; there are only short distances to work with, and there is a good network of roads and excellent public transportation. The central laboratory is both competent and linked with the district offices. This computer network allows for the immediate transfer of information and laboratory testing results from the lab to the field, with little or no delay.

As a result of the work conducted in the TAHRP project, and with the contribution of those same investigators, Israel has initiated a Brucellosis country-wide control program. The control program is composed of the following components:

*Vaccination of 3-6 month old heifers with B. abortus (S19) and 3-6 month old ewe lambs and female kids with attenuated Brucella melitensis Rev I Vaccine;

*Test and slaughter based upon the results of the CFT, the basic confirmatory diagnostic method (flocks that have more than 10% reactors are slaughtered and owners compensated while flocks with less than 10% reactors, the reactors are slaughtered with farmer compensation;

In the first year of this three year program, 50% of the sheep population will be tested. Most program resources, in this first phase, will be used for farmer compensation and recruiting of personnel. Israel intends to introduce strict measures to control animal movement all over the country and only one laboratory (Kimron Veterinary Institute, the main governmental laboratory) will be authorized to diagnose the disease and provide official interpretation of results. The Department of Veterinary Services is, also, linked with Ministry of Health, Public Health Officers to exchange information.

The Brucellosis Control program appears to be progressing nicely, as farmers are responding very well to the parameters and restrictions of the program. Additionally, individuals involved in extensive husbandry practices expressed their commitment to cooperate with Veterinary District Officers by following their advice and complying with their instructions to protect both their animals and themselves.

FINDINGS AND CONCLUSIONS IN EGYPT

Scope of the Brucellosis Problem in Egypt

In order to determine the extent of the Brucella problem in Egypt, a nation-wide program of surveillance was carried out by the General Organization of Veterinary Services (GOVS), in collaboration with the Brucellosis research laboratories of the

Animal Health Research Institute (AHRI) and the Animal Reproduction Research Institute (ARRI). This study began in 1990 and continued throughout the five years of the sub-project. It involved testing 287,987 cattle (average incidence rate of .32%), 98,249 buffalo (average rate .24%), 230,502 sheep (incidence rate varied between .45% to 3.16%), and 284,181 goats were examined with an average incidence rate between .11%-.53%.

The study demonstrated that Brucella melitensis Biovar -3- is the major cause of Brucellosis in animals in Egypt; Brucella abortus is of less importance. Swine Brucellosis was investigated and resulted in even more striking conclusions: swine do, in fact, have the infection; serological testing revealed an incidence rate of 32.2% in females and 25.3% in males. Bacteriological examination resulted in isolation of 7 strains of B. Suis.

In terms of human Brucellosis, the TAHRP sub-project was instrumental in discovering that, in fact, the incidence of human disease is far greater than previously anticipated. In 1994, 309 cases were confirmed by isolation at the Imbaba Medical Center. This is a substantial increase in numbers over previous years, however, officials indicated that only 10% of cases were reported, thus, the incidence is far greater than that revealed by this sub-project research. Additionally, deaths among professionals involved with this disease were reported, as well.

Imbaba Medical Center is considered a national reference center for human Brucellosis meaning that provincial laboratories send samples for confirmation to this institution. A computerized network is being developed to connect the Department of Communicable Diseases with health centers in the governorates for case reporting and exchange of information.

The Egyptian Brucella Research Program

The goals of the Egyptian B. melitensis research program are:

*to improve the health status of farm animals and to lower the transmission rate of disease between animals;
*to lower the transmission of this disease to humans, due to either contact with infected animals or consumption of infected animal products; and
*to enhance the scientific cooperation between Egypt and Israel.

Success of this research program was to be based upon lowering the incidence of the disease throughout and by jointly planning and working with Israeli scientists to achieve these ends.

Research involving evaluation of Rev.1 and S19 vaccines against standard B. abortus 544, B. melitensis 16m, and the local strain

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B. melitensis biovar 3 was completed and the results showed the superiority of Rev.1 in protecting guinea pigs against the challenge strains.

Impressive work has been done with the Brucellin Allergic Skin Test; an allergic test suggested as a screening method in both Israel and Egypt. In cattle, one group was vaccinated with 45/20 and a second group was infected with a field strain of B. abortus biovar I. In the first group, 42 animals (out of a possible 515) showed strong serological responses. All animals were positive to the Buffered Acidified Plate Antigen and only one was negative to Rose Bengal Plate test. In the second group, 140 animals were used. The Allergic Skin Test (AST) correlated in 72.7% of the tested animals; nine bacteriologically positive animals (13%) were negative to the Allergic test while another 9 animals were negative in both isolation and Allergic tests.

The AST was evaluated in sheep and goats through two experiments. The first experiment was conducted in sheep known to be from an infected flock and in sheep from a Brucellosis-free flock. The correlation between serological and allergic tests averaged 88.71%. The second experiment used fewer sheep (25 Brucella-free ewes and 10 naturally infected ewes). Both groups were examined serologically and using the allergic test. The AST proved to be valuable in detecting infected animals. In the case of buffalo, an experiment using 110 animals found that serological and allergic tests correlated in 86.4% of the animals. Allergic reactions, using the AST, in guinea pigs appeared in the 6th week post inoculation in vaccinated groups and in the 9th week in the infected group, but lasted longer.

The experiments were designed jointly by the Egyptian and Israeli scientists and implemented simultaneously in both countries. The work done by both groups was impressive; the results demonstrated a high degree of agreement between the Allergic Skin Test and conventional methods. The research, also, showed that the Allergic Skin Test could be used as a tool for flock screening against Brucella infection since it is highly specific, but less sensitive. Further studies could be done in both countries on isolating the protein responsible for initiation of the allergic reaction. The Israeli team has started to work on that issue in order to increase the test sensitivity.

Other serological methods were evaluated to differentiate between vaccinated and infected animals. Two ELISA techniques were tested for improved sensitivity and/or specificity. The tests included D-Tec(R) Brucella A, a mono-clonal antibody-based competitive ELISA for identifying B. abortus in bovine and Immuno comb(R), both bovine and ovine Brucella antibody test using an indirect dip stick ELISA for detecting antibodies to Brucella in cattle and sheep. Serological results were compared with those of conventional tests, together with bacteriological status of

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animals wherever possible. The study showed that those tests could be used for flock interpretation rather than individual interpretation of immuno assays due to the higher sensitivity of the tests. Both tests worked best in B. abortus infected cows followed by B. melitensis infected cows and, finally, in B. melitensis infected ewes. Hence, these immuno assays can be considered as flock screening tests, to be used side by side with the CFT, as a confirmatory test, if a program for control or eradication is to be implemented using the test and slaughter approach. The Director General of the GOVS, expressed his interest in the results of the Immunocomb experiment carried out in Egypt and will urge his department to use the test in the field. Egyptian researchers consider the Immunocomb test to be fairly expensive for use on a large scale. Immunocomb is a product developed by Biogal, an Israeli company, in cooperation with the Brucella research team at the laboratory at Kimron Veterinary Institute. Further experimentation on this test could be done to facilitate the practical use of this product in field situations. Other parties may come to use the Immunocomb test since it is a quick test that can be used not only on serum, but on whole blood or milk and on samples kept for years. The reaction persists for long periods of time.

Other research was carried out using electron microscopy to study the pathological profile of Brucella-infected and vaccinated guinea pigs. This work revealed that Brucella micro- organisms attach to the cell membrane of phagocytic cells and adhere to the receptors where engulfing occurs. This is followed by multiplication of the microorganisms and adherence to the rough endoplasmic reticulum. A study was conducted on the pathological profile of naturally infected sheep and goats. These animals had acute lesions in the form of activation of lymphoid follicles, hyperplasia of the white pulp of the spleen, and coagulative necrosis of the cotyledons (the principal reason for abortions). This was especially noticeable in high-titre animals. Pathological studies are important to investigate the pathogenesis of the organism and its behavior in the animal body for further research on the treatment and control.

Egyptian researchers, like their Israeli counter-parts, engaged in important research to investigate the electrophoretic pattern of serum proteins in Brucella-infected and Brucella-vaccinated animals for the purpose of differentiating between vaccinated and non-vaccinated animals. Further investigations need to fully explore the serum protein make-up of this organism.

The Egyptian Control Program

Surveillance of animals for Brucellosis was an extended activity throughout the five years of this sub-project. It revealed that all ruminants are exposed to Brucellosis. Camels and swine are, also, exposed and infected with varying rates of infection. The

predominant strain in Egypt is B. melitensis biovar-3, originally isolated from small ruminants, thus, indicating that sheep and goats are responsible for transmitting the disease to other animals and humans.

Use of Rev I vaccination protocols in the field was first introduced to Egypt through this TAHRP sub-project. The field protocol involved vaccinating a total of 10069 ewe-lambs (3-5 months old), 292 ewe-lambs (9-11 months old), and 1340 adult non-pregnant ewes. Post-vaccination serological profile was monitored in 1602 ewe-lambs and 292 adult ewes to determine the relevant time of vaccination and the expected response.

The Egyptians conducted another serological study of an infected sheep flock which started at the beginning of the project in 1990. The control protocol used on the farm involved testing and slaughtering all seropositive animals coupled with vaccination of ewe-lambs and non-pregnant ewes with Rev.1 vaccine using full dose of 1×10^9 for the first vaccination and 1×10^8 as a reduced dose for the second. All seropositive lambs and ewes were culled before vaccination. Encouraging results were obtained and the farm is considered to be almost entirely free of disease at this point.

SUB-PROJECT CONCLUSIONS

The TAHRP project offered an opportunity for cooperation and coordination amongst various Egyptian parties in working together in the Brucella control program. TAHRP, also, offered the opportunity for close cooperation and coordination between the Egyptian research team and Institutes and their Israeli counterparts, in the form of facilitating the exchange of information, transfer of know-how and technology, and training and exchange visits at all levels.

A Brucella control program was developed in Egypt which was based upon the research findings of this sub-project. These findings involved activities conducted on an intensive farm; a husbandry style which represents only a small segment of the way animals are cared for in this country. Most livestock are raised under traditional systems involving everything from one to two animals to large flocks in a nomadic lifestyle. Although successful in the intensive farm, resulting in clearing the facility of disease, this control program may or may not be successful in the traditional husbandry arena. These results, coupled with the Israeli research, led to a Brucellosis control program which is currently being presented to the GOVS for consideration. At the same time, Israel started to implement a similar plan (after allocation of the necessary funds by the government). Brucellosis control, however, needs regional perspective through the cooperation of the countries of the region in combatting this important disease.

Additionally, the TAHRP sub-project contributed to the efforts to study the incidence of human Brucellosis. In Egypt, increased awareness of the disease, its importance, and serious impact on humans became evident during the course of this sub-project. Studies of human Brucellosis were carried out and resulted in a call for more cooperation between Veterinary and Health authorities. The respective Ministries are now planning for more joint and comprehensive activities to control Brucellosis in humans. Other Egyptian Institutes expressed their interest in cooperating with Veterinary and Health authorities in these endeavors. Universities, NAMRU, and professional associations could participate by offering training for staff, research, extension activities, and education of the public and field inspectors. Participation in meetings could be at all levels, not only in Cairo, but, also, in the 27 governorates.

For control of Brucellosis, international organizations like WHO, FAO, OIE, and donors always seek and encourage regional efforts. The Egyptian-Israeli research and experience represents the cornerstone for any regional control program. It will facilitate international trade and the smooth flow of animals and their products across the borders within the region and to other countries. Finally, the TAHRP sub-project is believed to be the vehicle to bring all of this valuable work together.

LIST OF COUNTRY PARTICIPANTS

The Israeli team of scientists for the Brucellosis sub-project was composed of 9 investigators and consultants belonging to the Israeli Veterinary Services and Animal Health (VSAH), the Rural Planning & Development Authority (RPDA), the Koret School of Veterinary Medicine (KSVM), and the Kimron Veterinary Institute (KVI). It included:

* Principal and co-Principal Investigators:

- Dr. M. BANAY, Principal Investigator, KVI;
- Dr. M. DAVIDSON, co-Principal Investigator, VSAH;
- Ms. A. COHEN, KVI.

* Consultants:

- Mr. M. SIMCHA, Economist, RPDA;
- Pr. H. BERKOVIER, KVI;
- Dr. G. BACHRACH.

* Senior investigators:

- Dr. G. HOIDA, VSAH;
- Dr. E. RAPOPORT, VSAH;
- Dr. M. ABRAMSON, VSAH;
- Dr. S. BARDENSTEIN, KVI.

The key Israeli institution in this sub-project was KVI.

The Egyptian team of scientists was composed of 6 investigators belonging to the Animal Health Research Institute (AHRI). It included:

* Principal and co-Principal Investigators:

- Dr. S. EL-GIBALY, Principal Investigator, AHRI;
- Dr. N. EL-DANAF, co-Principal Investigator, AHRI;
- Dr. S. IBRAHIM, co-Principal Investigator, AHRI.

* Senior investigators:

- Dr. A. MONTASSER, AHRI;
- Dr. A. SAYOR, AHRI;
- Dr. M. RAGAB, AHRI

* Consultants:

- Dr. A. SALEM;
- Dr. A. MOUSTAFA.

The key Egyptian institution in this sub-project was AHRI.

The U.S. Cooperating Scientists for the Brucellosis sub-project were Dr. G. ADAMS and Dr. T. FICHT, Texas A & M University at College Station, TX.

SUB-PROJECT - IMPROVEMENT OF FOOT AND MOUTH DISEASE CONTROL IN EGYPT AND ISRAEL

BACKGROUND

Foot and Mouth Disease (FMD) is an acute, highly communicable disease. Movement of infected animals can rapidly spread the disease over long distances and, thus, FMD is a major epizootic disease and an important economic problem in the Middle East region. This area is considered a crossroad between three continents and the volume of trade in animals and animal products is one of the most important in the world. That makes the countries of the region permanently exposed to exogenous pathogens of all types. During the last five years, 21 countries in the region have reported FMD. Israel and Egypt, in particular, are constantly exposed to contamination through their borders by various types of FMD virus. FMD virus type O remains endemic in the area and continuous emerging new serological variants are threatening the animal production of both of the countries involved in the TAHRP project. In addition, animal carriers and reservoirs within country constitute a permanent source of infection. The health of the livestock population of the two countries and their international trade are thus greatly

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affected by this disease.

FINDINGS AND CONCLUSIONS IN ISRAEL

Epidemiological Surveillance of FMD

FMD outbreaks in Israel are mostly confined to the northern part of the country at the Lebanese border. An abundant population of wild boars and gazelles in these areas appear to be the reservoir of the virus, disseminating it to other parts of the country. In the first year of the TAHRP project, the Israeli team reported that sera (127) and probangs (112) from mountain gazelles, from the northern part of the country, were examined serologically for the presence of virus and proved negative except for one sample which was positive for O1 Dalton strain. Wild boars from the same area were found to be infected; some were serologically positive (8%). According to the Israeli report, the isolates analyzed at the Institute for Animal Health, Pirbright Laboratory in the United Kingdom, were shown to be most closely related to those from Bahrain and Oman. This result might indicate repeated introduction of FMD strains from neighboring countries.
The epidemio-surveillance conducted on nomad sheep, as carriers, involved 40 animals in 4 Bedouin sheep herds and proved negative. Two FMD outbreaks were recorded in 1992; samples were analyzed using rapid diagnostic techniques, such as micro CF and PCR, resulting in the isolation of type O1. Two FMD outbreaks were recorded in 1993; isolates from clinical cases were analyzed by micro CF, ELISA, tissue culture passages, and PCR and, again, revealed that the causative FMD strain was type O1. PCR and more conventional techniques revealed that the outbreaks that occurred in 1994 were caused by an FMD type O. Sequencing and homology studies suggested two separate outbreaks, caused by two different viruses, starting from two different places. Further investigation demonstrated that the infection came from Jordan through the West Bank and from south Lebanon. These viruses revealed, by VPI sequences of samples from previous outbreaks in neighboring countries, to be very similar.

In March, 1995, two outbreaks of FMD were reported. Type O1 was isolated, being characterized by different methods such as CF, ELISA and PCR. Simulated computer analysis of these outbreaks suggests that their origin could have been an airborne transmission of type 1 strain from a preceding outbreak in Jordan.

During the project period, 40 FMD outbreaks occurred in Israel, mostly in 1994. Most of the isolates were from type O1 except one from type Asia 1. The isolates were characterized and sub-typed and found to be closely related to the 1985 isolates.

The policy of FMD control in the countries of the region is generally based on prophylaxis; all susceptible animals being

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periodically vaccinated. This policy generally succeeded in protecting animals against the disease and preventing outbreaks, however, it, also, masks the presence of circulating virus in the animal population. It happens that wild, non-vaccinated animals constitute natural sentinels and are an excellent monitor for circulating viruses.

The FMD surveillance program in Israel, started with the TAHRP project by facilitating the acquisition of equipment for the FMD laboratory for such procedures as PCR and sequencing. The surveillance program, which began in November 1992, consists of a long-term field survey to determine the immune response to the FMD annual vaccination in order to evaluate the vaccine quality under field condition. The survey was conducted on 6 farms located near the borders and concerned determining antibody levels of 4 different groups of animals of different ages, which had been vaccinated 3 times a year. The program, also, concerned the surveillance of the incidence of disease in wild boars and gazelles. An FMD-epidemiological survey in wild boars conducted through July, 1995, demonstrated that, out of 261 samples, 21 were positive for antibodies against O1 Dalton. The blood samples received in the FMD laboratory on gazelles revealed that 7.3% **(please use either % or actual numbers for comparison with boar info)** of the animals carried FMD-type O antibodies and 2 were positive for type Asia 1. A similar survey was conducted in nomadic sheep flocks **(what were the results?)**.

The midterm results of this survey led to the following change in the vaccination schedules: all animals older than three months should be vaccinated in late autumn or re-vaccinated in late winter, consequently all cattle are to be immunized before the beginning of the FMD season which starts in March. Additionally, on the basis of the survey data, the antigen load of the vaccine was increased which has had a positive effect on sero-conversion.

Development of Rapid, Accurate Diagnostic Techniques

FMD is a highly contagious disease that can be economically disastrous due to its rapid spread. Rapid, accurate, and highly sensitive diagnostic techniques are, then, of crucial importance in identifying the causal virus and administering the proper vaccine to the susceptible animal population.

Rapid diagnosis was established in 1992 using the micro CF test and the PCR for the identification and typing of the causative FMD virus strain. Determining the concentration of antigen in field samples was attempted to improve the sensitivity of the conventional CF test. This was especially important in cases of false negative results due to low antigen content in the field samples. Mono-clonal antibodies against Asia 1 antigen have, also, been prepared.

A PCR test adapted for the detection of FMD in field samples, along with a determination of the difference between Asia 1 and O sero-types, has been developed and is presently routinely used with great success. In fact, it was used in the 1994 outbreaks in Israel and the test's sensitivity has been improved to enable accurate identification of the infecting virus (the VPI amplification product is purified and sequenced by automatic sequencer and data is analyzed to produce a dendogram representing the relationship between isolates and indicating their origin). The results of the PCR technique are compared to those of the Pirbright Laboratory and are always similar. The PCR technique proved to be an excellent tool for diagnosis and greatly assisted efforts conducted throughout the epidemiological surveillance of the disease.

The TAHRP project facilitated the development of a rapid diagnostic response which allows veterinary authorities to make more accurate decisions on appropriate control measures. For instance, one sample arrived to KVI late the night of the 21st of August while the Evaluation Team was in Israel. By 8:00 AM the next day, the FMD was identified and typed as O Manisa by CF which was followed up by ELISA testing and sequencing by PCR which was made the same day. The PCR technique proved to be a powerful diagnostic tool for rapid diagnosis in addition to the conventional methods.

Four years of work in the TAHRP project permitted the development of a molecular biology approach to the diagnosis of FMD by PCR technique. This technology was transferred to Egypt. The method is very sensitive; theoretically, one virus particle can be detected. The method, also, provides a mechanism to trace the origin of the virus threatening the country, at large. Even if the samples arrive in a poor condition, the PCR technique can detect the virus and sequence the chain. The cDNA for nucleotide sequencing of the VP1 genome is produced by PCR and enables it to establish a relationship between isolates, indicating their origin and furthering epidemiological studies. The method is presently routinely used in both countries. Nested PCR and molecular hybridization were employed to increase the RT-PCR sensitivity for FMD detection making the method able to detect FMD in the first stage of infection and in carrier animals with low virus infection rate. The work on molecular biology resulted in the production of four publications among which was one joint communication.

One of the main objectives of the project, the development of rapid and accurate diagnostic techniques, has been realized. CF and ELISA provide identification and typing in 3 hours and confirmation, sub-typing, and characterization can be obtained in 24 hours by the PCR technique. Dr. Yehuda STRAM has been recruited by KVI for the molecular biology component of the project.

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Research on the role of LC/DC in FMD infection was conducted and is still in progress; the ability of FMD to infect and replicate in migrating DC after 48 hours incubation of bovine epidermis is under investigation. Other research on the role of the bovine skin LC in the priming of cytotoxic T cells in response to viral peptides shows that the LC/DC interact with a synthetic peptide. The TAHRP project research offered the possibility of obtaining information concerning the immunological process through the research on the Langerhans cells. More research should follow to obtain practical implementation of the LC stimulation of the immune response when synthetic peptides are used as immunogens. Unfortunately, the results of these studies do not meet the immediate objectives of the FMD sub-project in terms of epidemio-surveillance, diagnostics and vaccine production.

Promotion of the Production of a Highly Potent Vaccine

The TAHRP project facilitated the FMD sub-project in developing a technology for the production of a safer and more efficient vaccine. On a small scale, 5,000 doses have already been prepared and the antigens are concentrated and stocked. These antigens will be inoculated into BHK cells in suspension, then in lamb kidney cells to allow them to multiply. Three virus stocks have been adapted to suspension cells for the production of higher virus yield. Inactivation procedures have been successfully achieved while double oil emulsion methodology seems no more attractive to the Israelis. New adjuvant compounds, Dimethyl Dioctadecyl Ammonium bromide (DDA) and « Acemennen », were tested in vivo with inactivated FMD vaccines and compared with the standard aluminum hydroxide and saponin adjuvants. It seems that DDA does not have superior efficacy or safety.

FINDINGS AND CONCLUSIONS IN EGYPT

FMD outbreaks have been reported in throughout the Middle East. The geographical location of Egypt exposes it to all types of contamination, through its Mediterranean shore and its African and Asian borders. Thanks to the TAHRP project, it is now possible to identify the causative virus by conventional standard methods and by PCR techniques.

Epidemio-surveillance of FMD

The rapid spread of disease in FMD outbreaks is partly due to the vulnerability of the animal population at risk. This vulnerability is usually attributed to a lack of immunity or the use of inefficient vaccines. Nine outbreaks occurred in Egypt during the last 3 years; most were on the borders in the governorates of Sharquia, Dakhalia, and Ismaelia. 23,000 sera and probangs, collected from cattle, buffalo, and camels, have been tested for neutralizing antibodies in the sera and for potential virus carriers, by CFT, Dot-ELISA and RT-PCR. A sero-

survey was carried out on cattle in lower Egypt where 5 million cattle and buffalo are vaccinated at least two times each year. Additionally, studies on FMD excreted from experimentally infected buffalo and goats were conducted and have shown that these species can act as carriers of FMD through their esopharyngial secretions for a period of 7 weeks and through their fecal droppings for a period of 7 days. Dripping saliva in buffalo may, also, transmit the disease during the first 6 days of the disease.

Studies on FMD neutralizing antibodies in sera collected from male buffalo calves have been conducted. A study on the duration of maternal immunity in buffalo calves born from FMD-vaccinated dams has been conducted and demonstrated that the decrease of antibody titers is greatest 6 months after calving. Consequently, it has been suggested that buffalo calves born from vaccinated dams should be vaccinated at 5-6 months of age.

The role of meat and organs from infected cattle and sheep in the spread of the disease has been studied. Lactic acid normally destroys the virus, but the freezing of meat and organs may actually contribute to the spread of the infection.

Development of Rapid, Accurate Diagnostic Techniques

Methods for identification of FMD play an important role in the disease diagnosis, the detection of carriers, and subsequent control. Through the TAHRP project, new techniques have been introduced and local techniques have been improved. A transfer of technology from Israel to Egypt concerning molecular biology has been made. Many young Egyptian scientists improved their careers by learning and practicing new technologies.

Over the life of the project, Egyptian scientists have tested 25,000 serum samples by ELISA, SNT, CFT and VIA; 750 samples were screened by tissue culture, CFT, dot-ELISA and FA, and recently, 30 samples were screened by PCR. Concerning the improvement of FMD diagnostic techniques, the project has facilitated both the improvement and the standardization of available common diagnostic techniques. For instance, evaluation of the following tests has been conducted:

*the Agar Gel Precipitation Test (AGPT) has been widely used in the field to detect antibodies developed against a viral antigen;

*the ELISA Test for the detection of viral antigen;

*the Co-agglutination Test utilizing Staphylococcus Aureus protein A. This test was found to not be sufficiently sensitive and so was determined to not be useful; and

*the Dot-ELISA Test which proved superior to CFT H100 in the detection of virus in probang samples.

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The following research was conducted and reported by the Egyptian team:

*the standardization and use of the Serum Neutralization Test (SNT) and the comparative detection of FMD virus by standard conventional methods in carrier cattle;

*the production of mono-clonal antibodies, which proved a powerful versatile tool for studying the antigenic structure of FMD;

*the isolation of FMD using lamb kidney primary cell culture lines which proved less susceptible than bovine kidney primary cells or BHK cells.

During the FMD outbreak of March, 1993, FMD was isolated and identified by CF, Fluorescent Antibody (FA), sandwich-ELISA, Dot-ELISA and PCR. The project facilitated the development and evaluation of rapid methods for the identification of FMD that demonstrated the advantage of FA technique in detecting fewer virus particles, Dot-ELISA technique, use of lamb kidney primary cell culture for the isolation of FMD virus from field samples (this technique can be used until the 4th passage then it loses sensitivity) and the development of mono-clonal antibodies. Molecular and immunological studies on FMD virus concerned sequencing of VP1 and comparison of the Egyptian and Israeli isolates of FMD virus type O, in joint work, using dendogram analysis.

Promotion of the Production of a Highly Potent Vaccine

Egyptians consider that the only way to control FMD in Egypt is through vaccination. They insisted on vaccination, produced vaccine, and are vaccinating dairy cattle 3 times a year and fattening cattle 2 times a year. The vaccine produced and used is a formalin inactivated vaccine which produces innocuous preparations with traces of infective virus. The vaccine virus, if not inactivated properly, may cause outbreaks of disease and for this reason other inactivators have been suggested. Two aluminum hydroxide adjuvants, Rehydrogel and the regular aluminum hydroxide, have been studied comparatively. The Rehydrogel was found superior to the standard, enhancing the immune response for a longer duration. Unfortunately, the Rehydrogel is 20 times more expensive than the standard Aluminum hydroxide adjuvant which gives rise to the question of the appropriateness of this study. This particular endeavor was criticized during the mid-term evaluation.

Comparative studies were conducted on a double oil emulsion vaccine containing different protein concentrations, sero-types, and aluminum hydroxide gel vaccines. The double oil emulsion vaccine is characterized by a better immune response since it elicited a higher antibody titer (field experiences conducted in South Africa demonstrated that this type of vaccine induces a longer lasting immunity and protects better against variants

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occurring in the field). The results of this study, also, demonstrated that the potential role of crowding out and immuno-dominance of FMD antigens should be evaluated prior to vaccine preparation. Concerning the production facilities required for this type of vaccine, since it is a different technology, new equipment is necessary. This may be a major handicap in Egypt, at a time when privatization is just beginning and the future status of vaccine production facilities is still unknown.

A lyophilized FMD vaccine has been developed for the purpose of prolonging storage. The great benefit of freeze dried vaccine is its long lasting quality when it is strategically stored. This vaccine can cover emergency situations in which large amounts of vaccine are needed. The TAHRP experiment demonstrated that the vaccine produced was immunologically promising although further studies are needed. The suitability and efficacy of this type of vaccine has not yet been studied.

The use of Binary Ethylenimine new inactivators (BEI) and the gel adjuvant, Al-Hydrogel, as part of the locally produced FMD vaccine have been evaluated. Comparison of the safety and efficacy of FMD vaccine inactivated with BEI to that inactivated with formalin, revealed that BEI induced more complete inactivation of the FMD virus without reduction of immunogenicity.

The effect of BVD vaccine on the immune response to FMD vaccination has been studied. Studies for the determination of antigen concentration of FMD virus, by ultracentrifugation, have been carried out for the immunization of sheep. Trials for preparing FMD-DOE-BEI vaccines are currently being conducted. Levamisol has been used as an immuno-stimulator and gave good results when combined with the local, formalized, gel-absorbed vaccine, enhancing the resistance of debilitated animals and increasing the vaccine immune response. Studies on the effect of some other drugs (Gentamicin and Ivermectin) on the immune response to FMD vaccine were, also, conducted while further studies are required to evaluate other commonly used antibiotics.

LIST OF COUNTRY PARTICIPANTS

The Israeli team of scientists for the FMD sub-project was composed of 12 investigators and consultants belonging to the Israeli Veterinary Services and Animal Health (VSAH), the Koret School of Veterinary Medicine (KSVM), the Department of Molecular Biology of the Hebrew University, and the Kimron Veterinary Institute (KVI). It included:

* Principal and co-Principal Investigators:

- Dr. H. YADIN, Principal Investigator (PI), chief of the FMD laboratory at KVI;

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- Dr. B.A. PELEG, co-Principal Investigator (co-PI), KVI.

* Consultants:

- Prof. Y. BECKER, Molecular Virology Department, Hadassah School of Medicine, Hebrew University;
- Prof. A. SHIMSHONI, Director of VSAH, Technical Coordinator and Steering Committee member of the TAHRP;
- Dr. D. KATZ.

* Senior investigators and researchers:

- Dr. Yehuda STRAM, Molecular Biology Specialist in the Virology division of KVI;
- Dr. N. SAFRAN, KSVM;
- Dr. Y. SAMMINA, KVI;
- Dr. Dan DAVID, collaborator of Prof. BECKER at Hebrew University;
- Dr. B. GELMAN;
- Mrs. Dalia CHAI, Technical Assistant, technician in the FMD laboratory at the KVI.

The key Israeli institution in this sub-project was the FMD Laboratory of the KVI.

The Egyptian team of scientists was composed of 20 investigators and consultants belonging to the General Organization of Veterinary Services (GOVS), the Animal Health Research Institute (AHRI), the Animal Reproduction Research Institute (ARRI), the Faculty of Veterinary Medicine of Cairo University (FVM/CU), and the Veterinary Serum and Vaccine Research Institute (VSVRI). It included:

* Principal and co-Principal Investigators:

- Prof. S.A. SALAMA, Principal Investigator (PI), VSVRI, presently project consultant, replaced, in 1995, as PI by Prof. Dr. A.M. DAOUD, VSVRI;
- Prof. Adel Omar ABDEL RAHMAN, co-Principal Investigator (co-P.I.), VSVRI;

* Consultants:

- Prof. Ali MOUSSA, Chair, GOVS; Technical Coordinator and Steering Committee member of the TAHRP;
- Prof. S. DEEB, Faculty of Veterinary Medicine, Pathology Department, Beni Suef University;
- Dr. Montaz O. WASFY, member of U.S. Naval Medical Research Unit (NAMRU).

* Senior investigators and researchers:

- Prof M. Sami SABER, Chair, Virology Department, FVM/CU;
- Dr. A.A. EL SANOUSSI;
- Dr. N.S. METWALLY;
- Dr. A.A. BAKR, FMD specialist;
- Dr. Sanan.A. EL NAKASHLY, FMD specialist;
- Dr. F.H. FAHMY, FMD specialist;
- Dr. Samira A. EL KILANI, FMD Department, VSVRI;
- Dr. I. ISMAIL, Virology Department, AHRI;
- Dr. L. EL SHEHAWI, FMD specialist;
- Dr. N. A HASSAN, FMD specialist;
- Dr. W. KOURAIM, Epidemiology specialist, GOVS;
- Prof. A. SOLIMAN, Virology Department, Faculty of Veterinary Medicine, Zagazig University;
- Dr. H. G. EL DEEN, Research Scientist;
- Dr. M. ABDEL ATI, Research Scientist.

The key Egyptian institution in this sub-project was the department of FMD in the VSVI.

The U.S. Cooperating Scientist of the FMD sub-project was initially Dr. James a. HOUSE, Foreign Animal Disease Diagnostic Lab., Plum Island Animal Disease Center, USDA/APHIS (Greenport/Orient Point, NY). In 1993, Dr. Tilahun YILMA, University of California at Davis, replaced Dr. House as the U.S. Cooperating Scientist.

APPENCIX F

TAHRP PROJECT TRAVEL SUMMARY

APPENDIX F

TAHRP PROJECT TRAVEL SUMMARY
(Life of Project)

NEONATAL SUB-PROJECT

	by EGYPT	by ISRAEL	by U.S.
to EGYPT		4	6
to ISRAEL	14		5
to U.S.	9	7	

BRUCELLOSIS SUB-PROJECT

	by EGYPT	by ISRAEL	by U.S.
to EGYPT		14	5
to ISRAEL	4		
to US	2		

FMD SUB-PROJECT

	by EGYPT	by ISRAEL	by U.S.
to EGYPT		16	3
to ISRAEL	17		2

APPENDIX G

QUESTIONS OF U.S. COLLABORATORS

APPENDIX G

QUESTIONS OF U.S. COLLABORATORS

1. Were you involved in the initial planning of the TAHRP project?
2. What has your role been in the project?
3. How has your role changed during the life of the project?
4. How did you support the planning and implementation of the project? by what means?
5. What has worked well in the project?
6. What has been problematic about the project?
7. Has this project been a success? If so, why, if no, then why not?
8. Is animal health an issue of such importance that limited foreign aid resources should be devoted to research and application?
9. How would you suggest future animal health projects be designed?
   A. what role should U.S. scientists have in these types of projects?
   B. do scientists facilitate or hinder cooperation and collaboration?
   C. what about co-authored papers?
10. What is your working relationship with the Israeli and Egyptian scientists?
11. Does this project demonstrate collaboration between three countries?
12. How have things changed since the beginning of the project?
13. Do you have publications as a result of this project?
   A. what about joint publications?
14. What would you do differently in the project?
15. How many times did you travel to the site?
16. Management: How would you assess the U.S. institutional participation in terms of:
   *research backstopping?
   *mid-term suggested that U.S. collaborators have increased role - did this happen?
   *flow of funds?
   *report submission?
   *USDA participation in processing reports?
   *research monitoring?
   *equipment purchases?
   *convening meetings?
   *participation in steering committee meetings?
   *training?
   *publications?
17. Can you comment on Israeli and Egyptian management administration?
18. Are there management constraints limiting project success?
19. COOPERATION:

*how many collaborators were there in the project?
*how many farmers participated?
*how many students were trained?
*number of training workshops conducted?
*amount of travel and exchange?
*level of participation in actual joint research?
*neonatal worked on parallel tracks?????
*brucellosis parallel or shared?
*FMD more interaction and travel/exchanges suggested by mid-term - did this happen?
*what is overall relationship between Israelis and Egyptians?
*probable sustainability of cooperative research activities after completion of the project?

20. SCIENTIFIC/TECHNICAL ISSUES:
*what changes were recommended by the mid-term review team and were those changes implemented?
*did the framework form a sound basis to achieve project goals?
*do experience and results suggest fundamental weakness in planning or implementation?
*please explain the FMD backstop support problem?
*what diagnostic tools have been developed or improved?
*how has the scientific capacity of institutions been strengthened (training, workshop, seminars, cooperative research and pubs)
*has there been a verifiable impact in the institutional capacity affecting husbandry practices and incidence of disease?
*what is effectiveness of collaboration between research and technology delivery system?
*were there any major impediments to the successful implementation of this project?
*what about public health issues of brucellosis?
*what is the need and prospect for continued work in this area after the close of the project?

21. ECONOMIC and SOCIAL IMPACT:
*what can be shown in production efficiency as a consequence of project?
*what has been the effect on commercial animal production in terms of cost and efficiency?
*has there been verifiable impact on animal disease incidence and control?

TAHRP EVALUATION QUESTIONNAIRE FOR SUB-PROJECT PIs

Please respond to the following questions concerning your activities (the activities of your team) in the TAHRP project:

1. A. What is your sub-project budget for the life of the project)?

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B. What is the annual budget for the following:

*equipment:
*consumables:
*training:

2. What equipment was purchased under the TAHRP? Please list.

3. What are the major activities of your sub-project?

*Basic
*Applied

4. If your sub-project involved the use of diagnostic laboratory techniques, please list what techniques were used and how many samples were tested over the life of the project.

5. Were new technologies applied under this sub-project? If so, please specify list.

6. Who within this sub-project participated in training activities? Please provide the following information:

NAME	YEAR TRAINED	NATIONALITY	SUBJECT	LOCATION	DURATION

7. Throughout the life of the TAHRP project, who visited your laboratory? Please provide the following information:

YEAR OF VISIT	NAME	NATIONALITY	DURATION	PURPOSE OF VISIT

8. Did persons from your lab travel to the United States? If so, please provide the following information:

NAME	PURPOSE OF VISIT	DURATION

9. What reports and publications were produced as a result of the TAHRP project? Please provide the following information:

NAME PUBLICATION	AUTHORS	WHERE PUBLISHED	DATE OF PUBLICATION

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