



U.S. AGENCY FOR
INTERNATIONAL
DEVELOPMENT

Mr. Robert Smith
Vice President for Finance and
Administration
Texas A&M University
College Station, TX 77842-3121

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SEP 29

Subject: Cooperative Agreement No. PCE-5063-A-00-2045-00

Dear Mr. Smith:

Pursuant to the authority contained in the Foreign Assistance Act of 1961 and the Federal Grant and Cooperative Agreement Act of 1982, as amended, the Agency for International Development (hereinafter referred to as "A.I.D.") hereby provides to Texas A&M University (hereinafter referred to as "Texas A&M" or "Recipient") the sum set forth in Section 1C.2. of Attachment 1 of this Cooperative Agreement to provide financial support for the program described in Attachment 2 of this Cooperative Agreement entitled "Program Description."

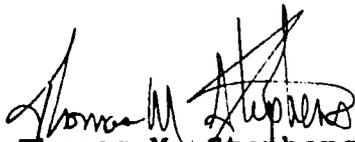
This Cooperative Agreement is effective as of the date of this letter and funds obligated hereunder shall be used to reimburse the Recipient for allowable program expenditures for the period set forth in Section 1B. of Attachment 1 of this Cooperative Agreement.

The total estimated amount of this Cooperative Agreement is the amount set forth in Section 1C.1. of Attachment 1, of which the amount set forth in Section 1C.2. is hereby obligated. A.I.D. shall not be liable for reimbursing the Recipient for any costs in excess of the obligated amount. However, subject to Section 1C.4. of Attachment 1, additional funds may be obligated by A.I.D. until such time as the obligated amount may equal the total estimated amount of this Cooperative Agreement.

This Cooperative Agreement is made to the Recipient on the condition that the funds will be administered in accordance with the terms and conditions as set forth in the attachments listed under my signature below, which together constitute the entire Cooperative Agreement document and have been agreed to by your organization.

Please acknowledge receipt and acceptance of this Cooperative Agreement by signing all copies of this Cover Letter, retaining one copy for your files, and returning the remaining copies to the undersigned.

Sincerely,



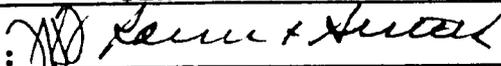
Thomas M. Stephens
Agreement Officer
Chief, FA/OP/B/PCE Branch
Office of Procurement

Attachments:

1. Schedule
2. Program Description
3. Standard Provisions
4. Special Provision entitled "Restrictions on Lobbying"

ACKNOWLEDGED:

TEXAS A&M UNIVERSITY

BY: 

TYPED NAME: Robert Smith

TITLE: Vice President for Finance and Administration

DATE: December 10, 1992

A. GENERAL

- A.1. Total Estimated A.I.D. Amount: \$500,000
- A.2. Total Obligated A.I.D. Amount: \$100,000
- A.3. Cost-Sharing Amount: \$1,105,693
- A.4. Other Federal (non-A.I.D.) Amount: \$ N/A
- A.5. Project No.: 936-5063
- A.6. A.I.D. Project Office: R&D/UC, R. Frischer
- A.7. Funding Source: A.I.D./W
- A.8. Tax I.D. No.: 74-6000531-A1
- A.9. DUNS No.: 04-291-5991
- A.10. LOC No.: 72-00-1359

B. SPECIFIC

- B.1.(a) PIO/T No.: 936-5063-2691866
- B.1.(b) Appropriation: 72-112/31021.3
- B.1.(c) Allotment: 263-36-099-00-20-21
- B.1.(d) BPC: DDNA-92-16900-KG11
- B.1.(e) Amount: \$100,000

ATTACHMENT 1 - SCHEDULE

SCHEDULE**1A. PURPOSE OF COOPERATIVE AGREEMENT**

The purpose of this Cooperative Agreement is to provide financial support for the program described in Attachment 2 of this Cooperative Agreement entitled "Program Description."

1B. PERIOD OF COOPERATIVE AGREEMENT

The effective date of this Cooperative Agreement is the date of the Cover Letter and the estimated completion date is September 29, 1997. Funds obligated hereunder (see Section 1C.2. below) shall be used to reimburse the Recipient for allowable program expenditures incurred by the Recipient in pursuit of program objectives at any time during the period beginning on the effective date of this Cooperative Agreement and ending on the estimated completion date. However, because this Cooperative Agreement is incrementally funded (see Section 1C.4. below), funds obligated hereunder are only anticipated to be sufficient for program expenditures through September 29, 1993.

1C. AMOUNT OF COOPERATIVE AGREEMENT AND PAYMENT

1C.1. The total estimated amount of this Cooperative Agreement for its full period, as set forth in Section 1B. above, is \$500,000.

1C.2. A.I.D. hereby obligates the amount of \$100,000 as partial funding of the total estimated amount set forth in Section 1C.1. above for program expenditures during the indicated period set forth in Section 1B. above. Notwithstanding said total estimated amount, A.I.D. shall not be liable for reimbursing the Recipient for any costs in excess of the obligated amount, except as specified in paragraph (f) of the Standard Provision of this Cooperative Agreement entitled "Revision of Grant Budget" (see also Section 1C.4. below).

1C.3. Payment shall be made to the Recipient in accordance with procedures set forth in the Standard Provision of this Cooperative Agreement entitled "Payment - Letter of Credit," as shown in Attachment 3.

1C.4. As indicated in Section 1C.2. above, this Cooperative Agreement is partially funded. Until such time as the obligated amount (see Section 1C.2. above) shall equal the total estimated amount (see Section 1C.1. above) of this Cooperative Agreement, additional increments of funds may be obligated by A.I.D. under this Cooperative Agreement (by a Cooperative Agreement modification), subject to availability of funds, possible evaluation of the program, sufficient progress toward attainment of program objectives, program priorities at the time, and the requirements of the Standard Provisions of this Cooperative Agreement entitled "Revision of Grant Budget" and "Cost Sharing (Matching)," as set forth in Attachment 3.

1C.5. The total estimated amount of the program described in Attachment 2 of this Cooperative Agreement is \$1,605,693, of which A.I.D. may provide the amount specified in Section 1C.1. above, and the Recipient and/or others will provide \$1,105,693 in accordance with Sections 1D.2. and 1L. below.

1D. COOPERATIVE AGREEMENT BUDGET

1D.1. The following is the Budget for the total estimated amount of this Cooperative Agreement (see Section 1C.1. above) for its full period (see Section 1B. above). The Recipient may not exceed the total estimated amount or the obligated amount of this Cooperative Agreement, whichever is less (see Sections 1C.1. and 1C.2., respectively, above). Except as specified in the Standard Provision of this Cooperative Agreement entitled "Revision of Grant Budget," as shown in Attachment 3, the Recipient may adjust line item amounts within the budget for each objective and between objectives as may be reasonably necessary for the attainment of program objectives. The Recipient shall notify the A.I.D. Project Officer specified in the Cover Letter of this Cooperative Agreement of such adjustments by providing five (5) copies of a revised budget (following the form of section 1D.2. below) and a brief explanation of the reason for the adjustment and any impact on program objectives. Revisions to the budget must be in accordance with Section 1C. above and the Standard Provisions entitled "Revision of Grant Budget" and "Cost Sharing (Matching)."

1D.2. Budget

OBJECTIVE 1: Management

<u>Cost Element</u>	<u>A.I.D.</u>	<u>Recipient/ Others (Non-Federal)</u>	<u>Recipient/ Others (Federal)</u>	<u>Total</u>
Salaries & Wages	\$ 20,738	\$ 46,466	\$ - 0 -	\$ 67,204
Fringe Benefits	3,856	10,985	- 0 -	14,841
Indirect Costs	- 0 -	20,205	- 0 -	20,205
Consultants	- 0 -	- 0 -	- 0 -	- 0 -
Travel, Trans- portation & Per Diem	9,539	- 0 -	- 0 -	9,539
Nonexpendable Equipment	3,078	- 0 -	- 0 -	3,078
Participant Training	- 0 -	- 0 -	- 0 -	- 0 -
Other Direct Costs	41,598	- 0 -	- 0 -	41,598
Subcontracts/ Subagreements	<u>- 0 -</u>	<u>- 0 -</u>	<u>- 0 -</u>	<u>- 0 -</u>
SUBTOTAL	\$ 78,809	\$ 77,656	\$ - 0 -	\$ 156,465

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OBJECTIVE 2: Develop improved diagnostic tests for tuberculosis in cattle, deer and other wildlife.

<u>Cost Element</u>	<u>A.I.D.</u>	<u>Recipient/ Others (Non-Federal)</u>	<u>Recipient/ Others (Federal)</u>	<u>Total</u>
Salaries & Wages	\$ - 0 -	\$ 217,690	\$ - 0 -	\$217,690
Fringe Benefits	- 0 -	50,195	- 0 -	50,195
Indirect Costs	- 0 -	91,930	- 0 -	91,930
Consultants	- 0 -	- 0 -	- 0 -	- 0 -
Travel, Transportation & Per Diem	18,050	- 0 -	- 0 -	18,050
Nonexpendable Equipment	63,425	- 0 -	- 0 -	63,425
Participant Training	31,525	- 0 -	- 0 -	31,525
Other Direct Costs	21,500	- 0 -	- 0 -	21,500
Subcontracts/ Subagreements	<u>- 0 -</u>	<u>- 0 -</u>	<u>- 0 -</u>	<u>- 0 -</u>
SUBTOTAL	\$134,500	\$ 359,815	\$ - 0 -	\$ 494,315

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OBJECTIVE 3: Develop beef breeding and management systems to respond to current market changes.

<u>Cost Element</u>	<u>A.I.D.</u>	<u>Recipient/ Others (Non-Federal)</u>	<u>Recipient/ Others (Federal)</u>	<u>Total</u>
Salaries & Wages	\$ - 0 -	\$ 155,442	- 0 -	\$155,442
Fringe Benefits	- 0 -	38,334	- 0 -	38,334
Indirect Costs	- 0 -	71,650	- 0 -	71,650
Consultants	- 0 -	- 0 -	- 0 -	- 0 -
Travel, Trans- portation & Per Diem	45,350	- 0 -	- 0 -	45,350
Nonexpendable Equipment	12,000	- 0 -	- 0 -	12,000
Participant Training	33,025	- 0 -	- 0 -	33,025
Other Direct Costs	17,500	- 0 -	- 0 -	17,500
Subcontracts/ Subagreements	<u>- 0 -</u>	<u>- 0 -</u>	<u>- 0 -</u>	<u>- 0 -</u>
SUBTOTAL	\$107,875	\$ 265,426	\$ - 0 -	\$ 373,301

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OBJECTIVE 4: Implement Salmonella species eradication programs and practical application of non-antibiotic prophylaxis to zoonotic and avian-specific salmonellosis in commercial poultry.

<u>Cost Element</u>	<u>A.I.D.</u>	<u>Recipient/ Others (Non-Federal)</u>	<u>Recipient/ Others (Federal)</u>	<u>Total</u>
Salaries & Wages	\$ - 0 -	\$ 151,598	- 0 -	\$151,598
Fringe Benefits	- 0 -	36,537	- 0 -	36,537
Indirect Costs	- 0 -	67,761	- 0 -	67,761
Consultants	- 0 -	- 0 -	- 0 -	- 0 -
Travel, Transportation & Per Diem	25,850	- 0 -	- 0 -	25,850
Nonexpendable Equipment	- 0 -	3,000	- 0 -	3,000
Participant Training	- 0 -	- 0 -	- 0 -	- 0 -
Other Direct Costs	45,000	- 0 -	- 0 -	45,000
Subcontracts/ Subagreements	<u>- 0 -</u>	<u>- 0 -</u>	<u>- 0 -</u>	<u>- 0 -</u>
SUBTOTAL	\$ 70,850	\$258,896	\$ - 0 -	\$ 329,746

OBJECTIVE 5: Develop molecular probes for specific detection of viral, bacterial and fungal diseases of plants.

<u>Cost Element</u>	<u>A.I.D.</u>	<u>Recipient/ Others (Non-Federal)</u>	<u>Recipient/ Others (Federal)</u>	<u>Total</u>
Salaries & Wages	\$ - 0 -	\$ 88,028	- 0 -	\$ 88,028
Fringe Benefits	- 0 -	19,933	- 0 -	19,933
Indirect Costs	- 0 -	35,939	- 0 -	35,939
Consultants	- 0 -	- 0 -	- 0 -	- 0 -
Travel, Transportation & Per Diem	20,865	- 0 -	- 0 -	20,865
Nonexpendable Equipment	9,000	- 0 -	- 0 -	9,000
Participant Training	33,101	- 0 -	- 0 -	33,101
Other Direct Costs	45,000	- 0 -	- 0 -	45,000
Subcontracts/ Subagreements	<u>- 0 -</u>	<u>- 0 -</u>	<u>- 0 -</u>	<u>- 0 -</u>
SUBTOTAL	\$107,966	\$143,900	\$ - 0 -	\$ 251,866
TOTAL ESTIMATED COST	\$500,000	\$1,105,693	\$ - 0 -	\$1,605,693

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1D.3. Inclusion of any cost in the budget of this Cooperative Agreement does not obviate the requirement for prior approval by the Agreement Officer of cost items designated as requiring prior approval by the applicable cost principles (see the Standard Provision of this Cooperative Agreement set forth in Attachment 3 entitled "Allowable Costs") and other terms and conditions of this Cooperative Agreement, unless specifically stated in Section 1I. below.

1E. REPORTING

1E.1. Financial Reporting

1E.1.(a) Financial reporting requirements shall be in accordance with the Standard Provision of this Cooperative Agreement entitled "Payment - Letter of Credit," as shown in Attachment 3. The "Long Form" version of the Financial Status Report (Standard Form 269 dated 4/88) shall be utilized.

1E.1.(b) All financial reports shall be submitted to A.I.D., Office of Financial Management, FA/FM/CMPD/DCB, Room 700 SA-2, Washington, D.C. 20523-0209. In addition, three copies of all financial reports shall be submitted to the A.I.D. Project Officer specified in the Cover Letter of this Cooperative Agreement, concurrently with submission of the Quarterly Technical Reports (See Section 1E.2. below).

1E.1.(c) The frequency of financial reporting and the due dates of reports shall be as specified in the Standard Provision of this Cooperative Agreement referred to in Section 1E.1.(a) above.

1E.1.(d) The Recipient's financial reports shall include expenditures of A.I.D. Cooperative Agreement funds provided hereunder, as well as non-federal matching funds and other federal (non-A.I.D.) funds in accordance with Section 1L. below.

1E.2. Program Performance Planning and Reporting

1E.2.(a) Project Implementation Plan

Not later than ninety (90) days from the effective date of this Cooperative Agreement (see Section 1B. above), the Recipient shall prepare and submit to the A.I.D. Project Officer specified in the Cover Letter of this Cooperative Agreement five (5) copies of a project implementation plan, in a Gantt Chart format, covering the full term of this Cooperative Agreement.

1E.2.(b) Annual Workplans

1E.2.(b)(1) The Recipient shall submit annual workplans for this Cooperative Agreement. Each annual workplan shall contain the following:

1E.2.(b)(1)(A) An action-oriented workplan describing planned activities for each linkage objective during the next year, delineated by calendar quarter, and tied to the project goals and objectives, which describes and quantifies the individuals to be involved, the activities to be conducted, and where and when they will be conducted. Planned activities shall be grouped by and related to project objectives;

1E.2.(b)(1)(B) A projected budget, utilizing the same budget line items as are set forth in the budget of this Cooperative Agreement, for each half-year, corresponding to the workplan, using a computer spreadsheet template provided on diskette by the A.I.D. Project Officer; and

1E.2.(b)(1)(C) Publications, reports, workshops, seminars, and other information dissemination activities planned, by calendar quarter.

1E.2.(b)(2) The Recipient may develop the annual workplans in consultation with the A.I.D. Project Officer for this Cooperative Agreement.

1E.2.(b)(3) Five (5) copies of each annual workplan will be submitted to the designated A.I.D. Project Officer for this Cooperative Agreement and one copy submitted to the Agreement Officer. One diskette copy of the workplan budget will also be submitted to the A.I.D. Project Officer. The first annual workplan covering the first year of this Cooperative Agreement shall be submitted by the Recipient not later than ninety (90) days from the effective date of this Cooperative Agreement (see Section 1B. above). Thereafter, the annual workplan for each successive year of this Cooperative Agreement shall be submitted by the Recipient not later than July 30 of each year.

1E.2.(c) Quarterly Reports

1E.2.(c)(1) The Recipient shall submit five (5) copies of brief quarterly program performance reports, which coincide with the financial reporting periods described in Section 1E.1. above, to the A.I.D. Project Officer specified in the Cover Letter of this Cooperative Agreement. In addition, two copies shall be submitted to A.I.D., POL/CDIE/DI, Washington, DC 20523-1802. These reports shall be submitted at the same time the financial reports are submitted (within 30 days following the end of the reporting period), and shall briefly present the following information:

1E.2.(c)(1) A statement of accomplishments and a comparison of those accomplishments with the objectives and activities established for the reporting period in the Annual Workplan;

1E.2.(c)(2) A description of any problems or barriers affecting the accomplishment of established objectives and activities, if applicable; and

1E.2.(c)(3) Any other pertinent information.

1E.2.(c)(4) Five (5) printed copies and one diskette copy of expenditure information shall be submitted semiannually to the A.I.D. Project Officer in conjunction with the second Quarterly Report and the Annual Activity Report (see section 1E.2.[d] below), detailing the status of expenditures for each specific linkage objective, utilizing a computer spreadsheet template provided by the A.I.D. Project Officer, and, when appropriate, analysis and explanation of expenditures which differ significantly from those projected in the Annual Workplan budget.

1E.2.(c)(5) The Annual Activity Report (see section 1E.2.[d] below) will be submitted in place of the fourth quarterly report each year.

1E.2.(d) Annual Activity Reports

Within thirty (30) days following the annual anniversary date of this Cooperative Agreement, the Recipient shall submit to the A.I.D. Project Officer specified in the cover letter of this Cooperative Agreement five (5) copies of an annual activity report. In addition, two copies shall be submitted to A.I.D., POI/CDIE/DI, Washington, DC 20523-1802. This report shall include the following:

- a description of the past year's activities under each linkage objective;
- a description of progress toward the completion of each linkage objective;
- a description of any problems or barriers affecting the progress toward achieving the linkage objectives;
- a description of progress toward ensuring the sustainability of the linkage;
- quantitative outputs of the linkage activities;
- an assessment of the impact of the linkage on internationalization of the Recipient institution and any U.S. linkage partners;
- an assessment of the impact of the linkage on strengthening each developing country linkage partner institution's capabilities to meet its societal development needs; and
- a statement satisfying the requirements of 1I.6.(b) below.

The Annual Activity Report shall also include a semiannual expenditure report described in 1E.2.(c)(4) above.

1E.2.(e) Special Reports

Between the required program performance reporting dates, events may occur that have significant impact upon the program. In such instances, the Recipient shall inform the A.I.D. Project Officer as soon as the following types of conditions become known:

1E.2.(e)(1) Problems, delays, or adverse conditions that will materially affect the ability to attain program objectives, prevent the meeting of time schedules and goals, or preclude the attainment of work units by established time periods. This disclosure shall be accompanied by a statement of the action taken, or contemplated, and any A.I.D. assistance needed to resolve the situation.

1E.2.(e)(2) Favorable developments or events that enable time schedules to be met sooner than anticipated or more work units to be produced than originally projected.

1E.2.(e)(3) If any performance review conducted by the Recipient discloses the need for change in the budget estimates in accordance with the criteria established in the Standard Provision of this Cooperative Agreement entitled "Revision of Grant Budget," the Recipient shall submit a request for budget revision to the Agreement Officer and the A.I.D. Project Officer specified in the Cover Letter of this Cooperative Agreement.

1E.2.(f) Technical and Research Reports and Publications

The Recipient shall summarize technical and research activities of the project in reports, and distribute such reports to the appropriate USAID Missions, LDCs, and host country and international institutions in order to encourage use of the technology developed. Such reports will be completed within 60 days after completion of the activity. Journal articles and other publications are encouraged. See also Section 1I. of this Cooperative Agreement pertaining to publications.

1E.2.(g) Environmental Impact

If it appears that outputs of this project will result in an adverse environmental impact, the Recipient shall notify the A.I.D. Project Officer prior to implementation, in order to allow for orderly preparation of an environmental impact statement. The Recipient shall assure that appropriate U.S. Government and/or host country procedures are followed.

1E.2.(h) Trip Reports

Within 30 days following the completion of each international trip, including trips to the United States by personnel of the Recipient's linkage partner institution, the Recipient shall submit 3 copies of a trip report summarizing the accomplishments of the trip to the A.I.D. Project Officer specified in the cover letter of this Cooperative Agreement. If several individuals are travelling together to one site, a single report representing the group will suffice. The report shall include the purpose of the trip in terms of specific linkage objectives, accomplishments, any problems encountered, and a list of persons visited with their title and organizational affiliation.

1E.2.(i) Training Reports

1E.2.(i)(1) If participant training is conducted under this Cooperative Agreement (see the Standard Provision set forth in Attachment 3 entitled "Participant Training"), the Recipient shall comply with reporting and information requirements of said Standard Provision, as well as Chapters 5 and 24 of A.I.D. Handbook 10.

1E.2.(i)(2) The Recipient shall also provide five (5) copies of quarterly training reports to the A.I.D. Project Officer, covering this Cooperative Agreement. The report shall include the following information:

- Total number of new trainees during the period; and
- The following information for each LDC trainee:
 - name
 - citizenship
 - gender
 - training site
 - beginning and ending dates of training
 - purpose of training
 - type of training activities
 - source of funding

1E.2.(i)(3) The Recipient shall provide two (2) copies of all training manuals produced under this Cooperative Agreement to the A.I.D. Project Officer.

1E.2.(j) Care of Laboratory Animals

If the Standard Provision entitled "Care of Laboratory Animals" applies to this Cooperative Agreement (see Section 1K. for applicability), the Recipient shall include the certificate required by paragraph (c) of said Standard Provision in all of its reports which pertain to the use of laboratory animals.

1E.2.(k) Research Involving Recombinant DNA

If any research involving recombinant DNA is being funded hereunder, the Recipient shall comply with the reporting requirements set forth in Section 1I.2.(d) of this Cooperative Agreement.

1E.2.(l) Final Report

Within 90 days following the estimated completion date of this Cooperative Agreement (see Section 1B. above), the Recipient shall submit five (5) copies of a final report to the A.I.D. Project Office specified in the cover letter of this Cooperative Agreement. In addition, two copies shall be submitted to A.I.D., POL/CDIE/DI, Washington, DC 20523-1802. It will cover the entire

period of the Cooperative Agreement and include all information shown in Sections 1E.2.(b) through 1E.2.(f) above.

1F. SUBSTANTIAL INVOLVEMENT UNDERSTANDINGS

It is understood and agreed that A.I.D. will be substantially involved during performance of this Cooperative Agreement as follows:

1F.1. Annual Workplan - The A.I.D. Project Officer will be consulted during the development of the annual workplans and have the right of final approval of all areas of the workplan where A.I.D. funds are included.

1F.2. Workplan Revisions - The A.I.D. Project Officer will be consulted and have the right of approval for revisions of the annual workplan which involves the use of A.I.D. funds.

1F.3. Field Visits - Pursuant to the standard provision of this Cooperative Agreement entitled "Air Travel and Transportation," the A.I.D. Project Officer must provide advance approval of all international travel.

1F.4. Participants - Where A.I.D. funds are used, the A.I.D. Project Officer must approve, in advance, the selection of technical trainees or scientists for participation in training activities.

1F.5. Key Personnel - The A.I.D. Project Officer must approve, in advance, the substitution of any key personnel.

1F.6. Subcontracts and Subagreements - In furtherance of Section 1D.3. above, the Agreement Officer must approve all subcontracts (see the Standard Provision entitled "Procurement of Goods and Services") and subagreements (see the Standard Provision entitled "Subagreements").

1G. PROCUREMENT AND (SUB)CONTRACTING

1G.1. Applicability

This Section 1G. applies to the procurement of goods and services by the Recipient (i.e., contracts, purchase orders, etc.) from a supplier of goods and services (see the Standard Provisions of this Cooperative Agreement entitled "Procurement of Goods and Services" and "AID Eligibility Rules for Goods and Services"), and not to assistance provided by the Recipient (i.e., a [sub]grant or subagreement) to a subrecipient (see the Standard Provision of this Cooperative Agreement entitled "Subagreements").

1G.2. Requirements

In addition to other applicable provisions of this Cooperative Agreement, the Recipient shall comply with paragraph (b)(1) of the Standard Provision of this Cooperative Agreement entitled "AID Eligibility Rules for Goods and Services," concerning total procurement value of less than \$250,000 under this Cooperative Agreement. If, under the order of preference set forth in paragraph (b)(1)(i) of said Standard Provision, the Recipient procures goods or services from cooperating country sources, the Standard Provision of this Cooperative Agreement entitled "Local Cost Financing" shall also apply. However, paragraph (b)(1) of the Standard Provision entitled "AID Eligibility Rules for Goods and Services" does not apply to: the restricted goods listed in paragraph (a)(3) of said Standard Provision and paragraph (e) of the Standard Provision entitled "Local Cost Financing," which must be specifically approved by the Agreement Officer in all cases, except to the extent that such approval may be provided in Section 1I. below; or to paragraph (d) of said Standard Provision pertaining to air and ocean transportation, to which the Standard Provisions entitled "Air Travel and Transportation" and "Ocean Shipment of Goods" apply, respectively. Paragraph (b)(2) of the Standard Provision entitled "AID Eligibility Rules for Goods and Services" does not apply.

1G.3. Approvals

Inclusion of costs in the budget of this Cooperative Agreement for the purchase of nonexpendable equipment obviates neither the requirement of Section J.13. of OMB Circular A-21 (for educational institutions) or Section 13 of Attachment B of OMB Circular A-122 (for nonprofit organizations other than educational institutions) for prior approval of such purchases by the Agreement Officer, nor any other terms and conditions of this Cooperative Agreement, unless specifically stated in Section 1I. below.

1G.4. Title to Property

Title to property acquired hereunder shall vest in the Recipient, subject to the requirements of the Standard Provision of this Cooperative Agreement entitled "Title To and Use of Property (Grantee Title)" regarding use, accountability, and disposition of such property, except to the extent that disposition of property may be specified in Section 1I. below.

1H. INDIRECT COST RATES

1H.1. No indirect costs will be charged to this Cooperative Agreement. The Recipient understands and agrees that indirect costs attributable to this Cooperative Agreement will be absorbed by the Recipient and considered cost-sharing.

1I. SPECIAL PROVISIONS

1I.1. Limitations on Reimbursement of Costs of Compensation for Personal Services and Professional Service Costs

1I.1.(a) Employee Salaries

Except as the Agreement Officer may otherwise agree in writing, A.I.D. shall not be liable for reimbursing the Recipient for any costs allocable to the salary portion of direct compensation paid by the Recipient to its employees for personal services which exceed the highest salary level for a Foreign Service Officer, Class 1 (FS-1), as periodically amended.

1I.1.(b) Consultant Fees

Compensation for consultants will not be reimbursed under this agreement.

1I.2. Compliance With Federal Guidelines and Regulatory Procedures Pertaining to Recombinant DNA

1I.2.(a) The Recipient shall implement any research activities under this Cooperative Agreement which involve recombinant DNA in accordance with:

1I.2.(a)(1) The National Institutes of Health Guidelines for Research Involving Recombinant DNA Molecules;

1I.2.(a)(2) Procedures issued by the U.S. Department of Agriculture (USDA), the Environmental Protection Agency (EPA), or other appropriate Federal agency;

1I.2.(a)(3) A.I.D.'s environmental procedures; and

1I.2.(a)(4) Such other Federal guidelines and procedures as may apply during the course of research.

1I.2.(b) The Recipient cannot commence testing in any foreign location until written approval for such testing is obtained from the A.I.D. Project Officer and the government of the country where testing is planned. Testing shall be conducted in accordance with all applicable regulations of that country.

1I.2.(c) In addition, and prior to commencement of any such testing, the Recipient shall make a judgement and communicate same to the A.I.D. Project Officer as to whether the regulations, procedures, or facilities of the country in

question are adequate to ensure testing in an environmentally sound manner. In the event such judgement is that they are not, the Recipient and the A.I.D. Project Officer will consult and agree on the conditions to be applied to the testing which will have such environmental effect.

1I.2.(d) Reports submitted to A.I.D. under this Cooperative Agreement will address regulatory issues as noted above related to the activity.

1I.3. Publications

1I.3.(a) The Recipient agrees to provide one copy of the manuscript of any proposed publication to the A.I.D. Project Officer not later than submission to the publisher, and to give serious consideration to any comments received from the A.I.D. Project Officer.

1I.3.(b) In the case of publication of any of the reports described in Section 1E.2. of this Cooperative Agreement, A.I.D. reserves the right to disclaim endorsement of the opinions expressed. For other publications, A.I.D. reserves the right to dissociate itself from sponsorship or publication. In both cases, the Recipient will consult with the A.I.D. Project Officer as to the nature and extent of any A.I.D. disclaimer of endorsement or dissociation from sponsorship or publication.

1I.3.(c) If A.I.D. does not choose to disclaim endorsement or dissociate itself from sponsorship or publication, the Recipient shall, in accordance with the Standard Provision of this Cooperative Agreement entitled "Publications," acknowledge A.I.D. support as follows:

"This publication was made possible through support provided by the Center for University Cooperation in Development, Bureau for Research and Development, U.S. Agency for International Development, under Cooperative Agreement No. PCE-5063-A-00-2045-00."

1I.3.(d) In addition to providing one copy of all published works and lists of other written work produced under this Cooperative Agreement to the A.I.D. Project Officer, as required by paragraph (b) of the Standard Provision of this Cooperative Agreement entitled "Publications," the Recipient shall also provide two copies of such publications and lists to A.I.D., POL/CDIE/DI, Washington, D.C. 20523-1802.

1I.4. Equipment and Other Capital Expenditures

1I.4.(a) Requirement for Prior Approval

Pursuant to Sections 1D.3. and 1G.3. above and the Standard Provisions of this Cooperative Agreement entitled "Allowable Costs" and "Revision of Grant Budget," and by extension, Section J.13. of OMB Circular A-21, the Recipient must obtain A.I.D. Agreement Officer approval for the following:

1I.4.(a)(1) Purchase of General Purpose Equipment, which is defined as an article of nonexpendable tangible personal property, the use of which is not limited only to research, medical, scientific, or other activities [e.g., office equipment and furnishings, air conditioning equipment, reproduction and other equipment, motor vehicles, and automatic data processing equipment, having a useful life of more than two years and an acquisition cost of \$500 or more per unit);

1I.4.(a)(2) Purchase of Special Purpose Equipment, which is defined as an article of nonexpendable tangible personal property, which is used only for research, medical, scientific, or other technical activities, and which has a useful life of more than two years and an acquisition cost of \$1,000 or more per unit); and

1I.4.(a)(3) Other Capital Expenditures, which is defined as the cost of the asset, including the cost to put it in place).

1I.4.(b) Approvals

In furtherance of the foregoing, the Agreement Officer does hereby provide approval for the following purchases, which shall not be construed as authorization to exceed the total estimated amount or the obligated amount of this Cooperative Agreement, whichever is less (see Section 1C. above):

<u>Quantity</u>	<u>Description</u>
4	Computers
3	Computer Printers

1I.4.(c) Exception for Automation Equipment

Any approval for the purchase of automation equipment which may be provided in Section 1I.4.(b) above or subsequently provided by the Agreement Officer is not valid if the total cost of purchases of automation equipment (e.g., computers, word processors, etc.), software, or related services made hereunder will exceed \$100,000. The Recipient must, under such circumstances, obtain the approval of the Agreement Officer for the total planned system of any automation equipment, software, or related services.

1I.4.(d) Compliance with A.I.D. Eligibility Rules

Any approvals provided in Section 1I.4.(b) above or subsequently provided by the Agreement Officer shall not serve to waive the A.I.D. eligibility rules described in Section 1G. of this Cooperative Agreement, unless specifically stated.

1I.5. Restricted Goods

Pursuant to Section 1G. above, paragraph (a)(3) of the Standard Provisions of this Cooperative Agreement entitled "AID Eligibility Rules for Goods and Services," and, if applicable (see Section 1K. below for applicability), paragraph (e) of the Standard Provision of this Cooperative Agreement entitled "Local Cost Financing," the Agreement Officer's approval is required for purchase of the restricted goods described therein. In furtherance thereof, the Agreement Officer does hereby provide such approval to the extent set forth below. The Agreement Officer's approval is required for purchases of such restricted goods if all of the conditions set forth below are not met by the Recipient. Any approval provided below or subsequently provided by the Agreement Officer shall not serve to waive any terms and conditions of this Cooperative Agreement unless specifically stated.

1I.5.(a) Agricultural Commodities

Agricultural commodities may be purchased provided that they are of U.S. source (generally, the country from which the commodities are shipped) and origin (generally, the country in which the commodities are mined, grown, or produced) and purchased from a U.S. supplier, except that wheat, rice, corn, soybeans, sorghums, flour, meal, beans, peas, tobacco, hides and skins, cotton, vegetable oils, and animal fats and oils cannot be purchased under any circumstances without the prior written approval of the Agreement Officer.

1I.5.(b) Motor Vehicles

Motor vehicles, if approved for purchase under Section 1I.4.(b) above or subsequently approved by the Agreement Officer, must be of U.S. manufacture and must be of at least 51% U.S. componentry. The origin of the motor vehicles, and the nationality of the supplier of the vehicles, must be in accordance with Section 1G.2. above. Motor vehicles are defined as self-propelled vehicles with passenger carriage capacity, such as highway trucks, passenger cars and busses, motorcycles, scooters, motorized bicycles, and utility vehicles. Excluded from this definition are industrial vehicles for materials handling and earthmoving, such as lift trucks, tractors, graders, scrapers, and off-the-highway trucks.

1I.5.(c) Pharmaceuticals

Pharmaceuticals may be purchased provided that all of the following conditions are met: (1) the pharmaceuticals must be safe and efficacious; (2) the pharmaceuticals must be of U.S. source and origin (see Section 1G. above); (3) the pharmaceuticals must be of at least 51% U.S. componentry (see Section 1G. above); (4) the pharmaceuticals must be purchased from a supplier whose nationality is in the U.S. (see Section 1G. above); (5) the pharmaceuticals must be in compliance with U.S. Food and Drug Administration (FDA) (or other controlling U.S. authority) regulations governing United States interstate shipment of pharmaceuticals; (6) the manufacturer of the pharmaceuticals must not infringe on U.S. patents; and (7) the pharmaceuticals must be competitively procured in accordance with the procurement policies and procedures of the Recipient and the Standard Provision of this Cooperative Agreement entitled "Procurement of Goods and Services."

1I.5.(d) Pesticides

Pesticides may only be purchased if the purchase and/or use of such pesticides is for research or limited field evaluation by or under the supervision of project personnel. Pesticides are defined as substances or mixtures of substances: intended for preventing destroying, repelling, or mitigating any unwanted insects, rodents, nematodes, fungi, weeds, and other forms of plant or animal life or viruses, bacteria, or other micro-organisms (except viruses, bacteria, or other micro-organisms on or living in man or other living animals); or intended for use as a plant regulator, defoliant, or desiccant.

1I.5.(e) Rubber Compounding Chemicals and Plasticizers

Rubber compounding chemicals and plasticizers may only be purchased with the prior written approval of the Agreement Officer.

1I.5.(f) Used Equipment

Used equipment may only be purchased with the prior written approval of the Agreement Officer.

1I.5.(g) Fertilizer

Fertilizer may be purchased if it is either purchased in the U.S. and used in the U.S., or if it is purchased in the cooperating country with local currency for use in the cooperating country. Any fertilizer purchases which do not comply with these limitations must be approved in advance by the Agreement Officer.

1I.6. Limitation on Use of Funds

1I.6.(a) The Recipient shall not utilize funds provided by A.I.D. for any testing or breeding feasibility study, variety improvement or introduction, consultancy, publication, conference or training in connection with the growth or production in countries other than the United States of an agricultural commodity for export which would compete with a similar commodity grown or produced in the United States.

1I.6.(b) The Annual Activity Report (as set forth in Section 1E.2.[d]) shall contain a statement indicating the objectives and activities to which United States funds have been attributed, together with a brief description of the activities adequate to show that United States funds have not been used for the purpose in Section 1I.6.(a) above.

1I.6.(c) The Recipient agrees to refund to A.I.D. upon request an amount equal to any United States funds used for the purposes prohibited by Section 1I.6.(a) above.

1I.6.(d) No funds provided by A.I.D. under this Cooperative Agreement shall be used to provide assistance, either directly or indirectly, to any country ineligible to receive assistance pursuant to the Foreign Assistance Act as amended, related appropriations acts, or other statutes and Executive Orders of the United States (also see the Standard Provision of this Cooperative Agreement entitled "Ineligible Countries").

1I.7. Disposition of Property

With reference to Sections 1G.4. and 1I.4.(b) above, disposition of nonexpendable property acquired hereunder shall be as follows:

To be Donated to Host Country Institution

1I.8. Failure to Make Sufficient Progress

If, at any time, the Assistant Administrator of the A.I.D. Bureau for Research and Development (AA/R&D) determines that the Recipient has failed to make sufficient progress toward attainment of program objectives such as to warrant the discontinuation of A.I.D. funding, this Cooperative Agreement may be unilaterally terminated by A.I.D. for its convenience, unless such failure was without the fault or negligence, or beyond the control, of the Recipient. In such circumstances, the procedures for settling a termination, as set forth in the Standard Provision of this Cooperative Agreement entitled "Termination and Suspension," will apply. The AA/R&D's determination will be final and not subject to appeal.

1J. RESOLUTION OF CONFLICTS

Conflicts between any of the Attachments of this Cooperative Agreement shall be resolved by applying the following descending order of precedence:

- Attachment 1 - Schedule
- Attachment 3 - Standard Provisions
- Attachment 4 - Special Provision entitled "Restrictions on Lobbying"
- Attachment 2 - Program Description

1K. STANDARD PROVISIONS

The Standard Provisions set forth as Attachment 3 of this Cooperative Agreement consist of the following Standard Provisions denoted by an "X", which are attached hereto and made a part of this Cooperative Agreement:

1K.1. Mandatory Standard Provisions For U.S., Nongovernmental Grantees

- (X) Allowable Costs (November 1985)
- (X) Accounting, Audit, and Records (September 1990)

- (X) Refunds (September 1990)
- (X) Revision of Grant Budget (November 1985)
- (X) Termination and Suspension (May 1986)
- (X) Disputes (November 1989)
- (X) Ineligible Countries (May 1986)
- (X) Debarment, Suspension, and Other Responsibility Matters (March 1989)
- (X) Nondiscrimination (May 1986)
- (X) U.S. Officials Not to Benefit (November 1985)
- (X) Nonliability (November 1985)
- (X) Amendment (November 1985)
- (X) Notices (November 1985)

1K.2. Additional Standard Provisions For U.S.,
 Nongovernmental Grantees

- (X) Payment - Letter of Credit (November 1985)
- () Payment - Periodic Advance (January 1988)
- () Payment - Cost Reimbursement (November 1985)
- (X) Air Travel and Transportation (November 1985)
- (X) Ocean Shipment of Goods (May 1986)
- (X) Procurement of Goods and Services (November 1985)
- (X) AID Eligibility Rules for Goods and Services (November 1985)
- (X) Subagreements (November 1985)
- (X) Local Cost Financing (November 1988)
- (X) Patent Rights (November 1985)
- (X) Publications (November 1985)
- () Negotiated Indirect Cost Rates - Predetermined (May 1986)
- () Negotiated Indirect Cost Rates - Provisional (May 1986)
- (X) Regulations Governing Employees (November 1985)
- (X) Participant Training (May 1986)
- (X) Voluntary Population Planning (August 1986)
- (X) Protection of the Individual as a Research Subject (November 1985)
- (X) Care of Laboratory Animals (November 1985)
- () Government Furnished Excess Personal Property (November 1985)
- (X) Title To and Use of Property (Grantee Title) (November 1985)
- () Title To and Care of Property (U.S. Government Title) (November 1985)
- () Title To and Care of Property (Cooperating Country Title) (November 1985)
- (X) Cost Sharing (Matching) (November 1985)
- (X) Use of Pouch Facilities (November 1985)
- (X) Conversion of United States Dollars to Local Currency (November 1985)

1L. COST-SHARING AND OTHER NON-A.I.D. CONTRIBUTIONS

1L.1. The Recipient agrees to expend an amount not less than (a) the amount shown in the budget of this Cooperative Agreement for financing by the Recipient and/or others from non-federal funds, and (b) the amount shown in the budget of this Cooperative Agreement for financing by the Recipient and/or others from other (non-A.I.D.) federal funds (see Section 1D.).

1L.2. Direct costs to be funded by non-federal funds must constitute at least 25% of the total costs to be funded by A.I.D.

1L.3. The Standard Provision of this Cooperative Agreement entitled "Cost Sharing (Matching)" makes reference to project costs. "Project Costs" are defined in Attachment E of OMB Circular A-110 as all allowable costs (as set forth in the applicable cost principles [see the Standard Provision of this Cooperative Agreement entitled "Allowable Costs"]) incurred by a Recipient and the value of in-kind contributions made by the Recipient or third parties in accomplishing the objectives of this Cooperative Agreement during the program period. In this context, "objectives" refers to the specific objectives of the linkage (as set forth in Attachment 2 [Program Description] of this Cooperative Agreement), and not to the objectives of the University Development Linkages Project (936-5063), under which this Cooperative Agreement is funded.

1L.4. The restrictions on the use of A.I.D. funds set forth in this Cooperative Agreement do not apply to cost-sharing (matching) unless such restrictions are stated in the applicable federal cost principles.

ATTACHMENT 2 - PROGRAM DESCRIPTION

ATTACHMENT 2

PROGRAM DESCRIPTION

The Recipient's proposal entitled "Solutions to Some Livestock, Poultry and Plant Health and Production Problems That are of Concern to Free Trade Between Mexico and the United States" is attached hereto as the Program Description (Attachment 2) and is made a part of this Cooperative Agreement.

University Development Linkage Program

Title: "Solutions to Some Livestock, Poultry and Plant Health and Production Problems that are of Concern to Free Trade between Mexico and the U.S."

Application No.: 102

Linked Institutions: Texas A&M University, Universidad Nacional Autonoma de Mexico

Principal Investigator: Dr. G. G. Wagner

Technical Summary

Agriculture in Mexico is on the verge of a renaissance as free trade with the United States promises access to the scientific and technological advances that have made the food and agriculture the largest of all U.S. industries. However, free trade includes hazards posed by infectious disease agents and ectoparasites to the livestock, poultry and horticulture industries in both countries. Agriculturalists, ranchers and scientists in both countries are concerned because such diseases cause increasing pressure on disease surveillance and diagnostic services and stifle revitalization of agriculture and livestock industries.

For free trade to become safe trade of agricultural commodities, scientific knowledge is needed to eliminate the threat that infectious diseases pose. Through the University Development Linkage Project (UDLP) cooperative agreement, the Universidad Nacional Autonoma de Mexico (UNAM) and Texas A&M University (TAMU) intend to assume a critical role in the free trade process, by developing collaborative training and research programs that address specific, priority animal and plant health and production issues and needs. In doing so, both universities will be responsive to societal needs through the advanced training and problem-oriented research aimed at eliminating non-tariff trade barriers.

Mexico is recognized as the leader in economic, social and technological advances within Latin America. Within Mexico, UNAM is the flagship university for scientific and technical development in a number of areas, including agriculture. Similarly, TAMU, being first in research in the southwest and eighth nationally, is recognized regionally as the leading university in research in agriculture and veterinary sciences. Because many agricultural and veterinary problems are linked geographically, many faculty at TAMU have had strong collaborative research and graduate student training programs with the College of Veterinary Medicine and Animal Science and the Institute of Biotechnology at UNAM for more than 10 years. Their experiences have given TAMU scientists an understanding of some of the animal and plant health and production needs of Mexico.

The overall goals of the linkage are:

- To strengthen the technical capabilities of UNAM scientists in diagnosing disease and in developing management systems that include appropriate disease control strategies; and
- To support the internationalization objectives of TAMU.

The strategy proposed involves the use of modern, highly useful biotechnology-based methods for the detection and control of plant and animal diseases. The approach will also provide major opportunities for the assessment of interactions between infection and disease, between disease control and natural disease resistance, and between various nutrition and management decisions that affect production and reproductive performance. The research endeavors will also lead to opportunities for additional outside funding to initiate other interdisciplinary research programs in such areas as the genetic basis for resistance to parasites and infectious diseases.

Training will emphasize interdisciplinary approaches to problem solving and will take place in laboratories at both universities. Through faculty exchanges, TAMU faculty will conduct short courses at UNAM. Selected UNAM faculty and post-doctoral fellows will spend 3 to 6 months at TAMU training in current research techniques and interacting and developing collaborative proposals.

Sustained research productivity will be assured by the strong binational scientific capability developed through this cooperative agreement, operating through a network of active laboratories at both universities. By the end of 5 years, functional scientific linkages will be in place, involving Mexican and U.S. scientists working on common problems, with a shared philosophy of research and continuity of programs. The research collaborations established with this project will lead to competitive research proposals to sustain the funding necessary for continued research.

SOLUTIONS TO SOME LIVESTOCK, POULTRY AND PLANT HEALTH AND
PRODUCTION PROBLEMS THAT ARE OF CONCERN TO FREE TRADE
BETWEEN MEXICO AND THE UNITED STATES

Executive Summary [C.3(b)(4)]

LINKAGE RATIONALE

Agriculture in Mexico is on the verge of a renaissance as free trade with the United States promises access to the scientific and technological advances that have made the food and agriculture the largest of all U.S. industries. Similarly, U.S. farmers and ranchers expect increased benefit from free trade as new markets open and commodity and food sales increase. However, free trade includes hazards posed by infectious disease agents and ectoparasites to the livestock, poultry and horticulture industries in both countries. Tuberculosis in cattle, hog cholera, and Karnal bunt of wheat are examples of serious threats. Agriculturalists, ranchers and scientists in both countries are concerned because such diseases cause increasing pressure on disease surveillance and diagnostic services and stifle revitalization of agriculture and livestock industries.

For free trade to become safe trade of agricultural commodities, *scientific knowledge is needed to eliminate the threat that infectious diseases pose.* Through a United States Agency for International Development (USAID) University Development Linkage Project (UDLP) cooperative agreement, the Universidad Nacional Autonoma de Mexico (UNAM) and Texas A&M University (TAMU) intend to *assume a critical role in the free trade process*, by developing collaborative training and research programs that address specific, priority animal and plant health and production issues and needs. In doing so, *both universities will be responsive to societal needs through the advanced training and problem-oriented research aimed at eliminating non-tariff trade barriers.*

Mexico is recognized as the leader in economic, social and technological advances within Latin America. Within Mexico, UNAM is the flagship university for scientific and technical development in a number of areas, including agriculture. Similarly, TAMU, being first in research in the southwest and eighth nationally, is recognized regionally as the leading university in research in agriculture and veterinary sciences. Because many agricultural and veterinary problems are linked geographically, many faculty in both the College of Agriculture and Life Sciences and the College of Veterinary Medicine at TAMU have had strong collaborative research and graduate student training programs with the College of Veterinary Medicine and Animal Science and the Institute of Biotechnology at UNAM for more than 10 years. Their experiences have given TAMU scientists an understanding of some of the animal and plant health and production needs of Mexico and have demonstrated our interest in long-term relationships of mutual benefit. *The proposed linkage is designed to enhance already existing collaborations and to address issues important to the success of free trade.*

The overall goals for the linkage are:

- o To strengthen the technical capabilities of UNAM scientists in diagnosing diseases and in developing management systems that include appropriate disease control strategies; and
- o To support the internationalization objectives of TAMU by fostering self-sustaining collaborative research programs of mutual benefit to scientists at both institutions.

RESEARCH STRATEGY

The strategy that we propose will use modern, highly useful biotechnology-based methods for the detection and control of plant and animal diseases. The science will also provide major opportunities for the assessment of interactions between infection and disease, between disease control and natural disease resistance, and between various nutrition and management decisions that affect production and reproductive performance. Finally, *the research endeavors will lead to opportunities for additional outside funding to initiate other interdisciplinary research programs in such areas as the genetic basis for resistance to parasites and infectious diseases.*

SPECIFIC OBJECTIVES

The specific research objectives are to:

1. Develop improved diagnostic tests for tuberculosis in cattle, deer and other wildlife;
2. Develop beef breeding and management systems to respond to current market changes;
3. Implement *Salmonella* species eradication programs and practical application of non-antibiotic prophylaxis to zoonotic and avian-specific salmonellosis in commercial poultry; and
4. Develop molecular probes for specific detection of viral, bacterial and fungal diseases of plants.

Specific *objective 1* deals with development of improved diagnostic tests for tuberculosis in cattle, deer and other wildlife. The approach to the problem will be similar to that used successfully by TAMU scientists studying bovine brucellosis, and will include assessment of existing diagnostic tests, as well as the development of new assays. The project will begin with advanced biotechnology training at the brucellosis laboratories at TAMU. Then, UNAM and TAMU scientists working at UNAM will develop methods of detecting *Mycobacterium bovis* infections in livestock that should be more accurate, since the proposed methods will directly detect the presence of the disease organism. Also, the new methods will be faster (one day versus three for the skin test) and require the animal to be handled only once. Accurate tests for deer will also be *important in reducing the potential threat of the spread of TB from deer to cattle and humans.*

Specific *objective 2* focuses on integrated management strategies. Interdisciplinary projects will be conducted at the UNAM research station near Martinez de la Torre, in the state of Vera Cruz and at TAMU. Studies will examine interactions between nutrition, disease and management as they affect productivity and reproductive performance. TAMU systems analysis models for beef cattle, sheep and goats that have been successful in other parts of the world will be adapted to the study area *to identify optimal strategies for enhanced livestock production while maintaining the natural resource base.*

Specific *objective 3* will concentrate on the implementation of *Salmonella* species eradication programs and practical application of non-antibiotic prophylaxis to zoonotic and avian-specific salmonellosis in commercial poultry. At TAMU and UNAM, Mexican veterinarians and technicians will be trained in the methods and strategies used successfully by the U.S. National Poultry Improvement Program to eliminate avian-specific salmonellosis in commercial poultry in the U.S. The second phase of the research, to be conducted at UNAM, will test recent TAMU and USDA research findings that dietary administration of plant extracts induces a marked resistance to both zoonotic and avian-specific salmonellosis in poultry. Inherent in this approach will be the training necessary *to allow UNAM scientists to develop specific disease eradication programs, thereby increasing the level of food-safety and reducing the reliance on expensive and adulterating antibiotics.*

Specific *objective 4* concerns the development of molecular probes for the detection of plant diseases. Development of practical diagnostic methods and training of personnel will be coordinated between UNAM and the Plant Disease Diagnostic Laboratory at TAMU. These *DNA-based detection methods will replace those that rely on visual identification or immunoassays that are limited by their expense and inability to detect low levels of infection.* The methods will also allow changes in sampling technique to take advantage of the very low detection levels possible with these new assays.

TRAINING

Training will emphasize *interdisciplinary approaches to problem solving* and will take place in laboratories at both universities. Through faculty exchanges, TAMU faculty will conduct short courses at UNAM. Selected UNAM faculty and post-doctoral fellows will spend 3 to 6 months at TAMU training in current research techniques and interacting and developing collaborative proposals. Although training opportunities within the technical objectives will focus on post-doctoral research associates and junior faculty, project activities are intended to provide research projects for graduate

the U.S. and Mexico. In this way both TAMU and UNAM will benefit from improved relations with industry groups and federal agencies.

MONITORING AND EVALUATION

Project monitoring and evaluation will be conducted at several levels in order to minimize differences in the operating environments between UNAM and TAMU. The Principal Investigator (PI) at TAMU will be responsible for the overall coordination of all activities specified in the UDLP cooperative agreement for the implementation of the project. The TAMU PI and the Co-Principal Investigator (Co-PI) at UNAM will also be responsible for resolving major administrative or policy issues associated with the agreement. Four TAMU Co-PIs, one for each research objective, will be responsible for the technical aspects of each objective, as well as all expenditures budgeted for their research objective. A UNAM Co-PI for each objective will be responsible for technical activities in Mexico. The TAMU Office of University Research Services will be the contracting entity representing TAMU. It will handle the accounting and reporting responsibilities and will provide budget reports and other fiscal information as requested. Final approval for all expenditures will rest with the PI. The financial management in Mexico will be the responsibility of the Mexican Co-PI.

Two committees, *the Technical Steering Committee (TSC) and the Program Advisory Committee (PAC)* will be formed. The TSC will be composed of all investigators representing TAMU and UNAM. The TAMU PI will chair the group. Responsibilities of the TSC will include developing workplans and budgets, policies on publication and dissemination of research results, selection of applicants for training, and major problem resolution.

The first TSC meeting will be pre-implementation to establish lines of communication, report format and schedule, problem resolution guidelines and other issues. Subsequent meetings will be held annually, within two months after completion of each 12-month workplan.

The PAC will meet annually with the TSC and will include all investigators representing TAMU and UNAM, plus designated representatives from USAID Mexico, USDA Animal and Plant Health Inspection Service (APHIS) Mexico, Secretario Agricultura y Recursos Hidraulicos (SARH) Mexico, and the Director of International Coordination for TAMU. Most importantly, the PAC will include representatives from selected private sector, non-governmental organizations, private voluntary organizations and foundations from both the U.S. and Mexico. The PAC will act in an advisory capacity to the TSC to assess whether particular project goals and program activities are being accomplished. The PAC will also recommend other collaborative programs beneficial to both institutions and to the U.S. and Mexico, and *to ensure that the linkage is exploited for its internationalization potential and that all spinoff opportunities are taken advantage of fully.*

SUSTAINABILITY

Sustained research productivity will be assured by the *strong binational scientific capability developed through this cooperative agreement*, operating through a network of active laboratories at both universities. By the end of 5 years, functional scientific linkages will be in place, involving Mexican and U.S. scientists working on common problems, with a shared philosophy of research and continuity of programs. The research collaborations established with this project will lead to competitive research proposals to sustain the funding necessary for continued research.

The linkage also supports an international priority of the State of Texas, that of collaborative work with Mexico. The results of the linkage will further support the state's goal of economic opportunity in Mexico, since:

- o Producers will purchase more U.S. livestock if they know that diseases transmissible to animals and man are being controlled and that production is more efficient;
- o The approach of identifying optimal production while balancing the environmental characteristics of stability, sustainability and equitability will be important to revitalizing the Mexican economy, particularly in tropical areas;
- o The study will help Mexican and U.S. farmers understand and implement integrated production systems that will result in livestock that conform to the changing market demands; and

Solutions to Free Trade Problems

- o Free importation of plants between Mexico and the U.S. can be carried out with confidence that the plants are free of disease.

INSTITUTIONAL CAPABILITIES

During the last 30 years, TAMU has implemented more than 50 major international projects in 21 countries. More than 800 TAMU faculty have significant international experience, amounting to more than 500 person-years of long-term educational or technical exchange. The University has a strong internationalization program in place, involving all 41,000 students at the University. The more than 2700 international students at TAMU come from 110 different countries. Among these are 110 students from Mexico. Recently, TAMU has made a major institutional commitment to efforts in Mexico and Latin America, and now has 16 formal agreements with Mexican institutions including UNAM and SARH.

Since 1983, agreements with UNAM and with SARH/Direccion General de Salud Animal (DGSA), have provided for mutually beneficial training and research. Major portions of the work under these agreements were supported by the USAID Mission in Mexico, and the USDA Office of International Coordination and Development (OICD). So far, 18 technicians from Mexico and 4 from the U.S. have been trained in a variety of scientific procedures. Two M.Sc. (Mexican) and 3 Ph.D. degrees (2- U.S., 1-Mexican) based on work done in Mexico have been awarded by TAMU. At least 17 scientific publications have resulted from the collaboration. More than 8 TAMU faculty members and many TAMU and UNAM graduate students are now engaged in either the original line of research or spin-off projects.

Recently, as President Salinas de Gotari has liberalized the agricultural and economic policies in Mexico, UNAM has become central to the education and research needed to revitalize the agricultural sector. The University now conducts more than 50 percent of the research in Mexico. During the past five years, the UNAM research budget has averaged nearly \$125 million annually with nearly 80 percent coming from external sources including the European Economic Community, several agencies in the U.S., the World Bank, the Interamerican Development Bank, and various agencies of the United Nations. As is the case with TAMU, UNAM is key to the research and education needed to fulfill the promise of the free trade agreement.

Section I—The Linkage [C.3(b)(6)(A)]

A. RATIONALE [C.3(b)(6)(A)(i)]

Planning for free trade between the U.S. and Mexico requires judgments about the hazards posed by infectious disease agents and ectoparasites to the livestock, poultry and horticulture industries. Tuberculosis in cattle, Newcastle disease in chickens, hog cholera, fruit flies, and Karnel bunt of wheat are examples of serious threats. Ectoparasites such as ticks seriously affect the livestock industry by the diseases they transmit and the debility caused by their infestation. Agriculturalists, ranchers and scientists in both countries are concerned because these *diseases cause increasing pressure on disease surveillance and diagnostic services and stifle revitalization of the agricultural and livestock industries.*

As part of the long term planning for the free trade agreement, talks between the USDA/APHIS and the counterpart agencies in Mexico, SARH/DGSA and SARH/Direccion General Sanidad Vegetal (DGSV), have focused on three areas: trade policy, regulatory issues and research collaboration. The discussions on research collaborations have centered on the scientific knowledge needed to eliminate the threat that infectious diseases and ectoparasites pose to the horticulture and livestock and poultry industries in both countries. The planners have anticipated *a critical role for universities to address specific, high priority training and research programs relative to the free trade agreement.* They see university-based *research adding a scientific basis* for decisions concerning non-tariff barriers; whether to enforce regulations more stringently or to eliminate them.

Thus, the free trade agreement provides a challenge to the universities to identify new ways to better serve the public. The USAID/UDLP provides the mechanism for developing and implementing such *a plan for a university-based, mutually beneficial and sustainable collaborative research and training program that addresses specific priority animal and plant health and production problems and needs important to free trade.*

The Universidad Nacional Autonoma de Mexico (UNAM) and Texas A&M University (TAMU) enjoy a partnership spanning more than 10 years. Successful collaboration between UNAM and TAMU has included work on:

- o Brucellosis
- o Pullorum
- o *Boophilus ticks*
- o Anaplasmosis
- o Ascites syndrome in poultry
- o Babesiosis
- o Fowl typhoid
- o Salmonella

Numerous projects which relate directly to the proposed cooperative agreement are currently operating. Examples include graduate student MSc and PhD projects in poultry science, animal science, infectious diseases, biotechnology, reproduction and epidemiology. Several students from both UNAM and TAMU complete the academic portion of their degrees at TAMU and conduct their research at UNAM. Thus, *scientists from both institutions bring a strong commitment and experience to the proposed cooperative agreement.*

The *program will optimize and capitalize on TAMU's international reputation in biotechnology,* and enhance the capability of TAMU faculty to adapt, organize and implement implementing comprehensive international research, training and extension programs such as the proposed UDLP project in Mexico. The program will complement and strengthen several on-going international projects. For example, some of the core personnel on this

project are involved in projects in Africa on genetic improvements of small ruminants under stressful tropical environments, and genetic resistance to internal parasites; and in Mexico on brucellosis and tick borne diseases such as babesiosis and anaplasmosis. These on-going projects have objectives which overlap those of the proposed project. Thus, *the program will provide a vehicle for attracting more faculty*, and will permit sharpening skills in these areas as well as build on the foundation for agricultural technology transfer.

The UDLP activities at UNAM will optimize and capitalize on the availability of field material and the network of experimental stations and research centers. The linkage will also take advantage of the close relationships between UNAM and SARH, and between UNAM and private sector, non-governmental organizations (NGOs), making it possible to work closely with UNAM on several key technical issues and, at the same time liaise effectively with both government and NGOs to implement the results of the technical objectives within the 5-year timeframe. Benefits to UNAM include *trained and competent UNAM scientists* to conduct research, to educate and to provide advice to the farming and ranching community on appropriate plant and animal health and animal husbandry practices. Training programs in each of the above areas should assist in alleviating the constraints imposed by disease on plant and animal production in Mexico, since individuals attracted to the program will themselves assume diagnostic, research and training responsibilities. *Both institutions will be seen as responsive to societal needs and development goals through the advanced training and problem-oriented approach to research aimed at eliminating non-tariff trade barriers.*

Although past and current projects will assist in focusing the research objectives, *the emphasis of the proposed linkage is on developing a long term unified approach.* Past programs have largely been "vertically" focused, with specialization defined by subject matter or commodity, with insufficient consideration for how recommendations may create undesirable interactions when implemented. *This proposal is intended to provide more of a "horizontal" focus, in which collaborating scientists from TAMU and UNAM begin to evaluate decisions on the synergistic subsystems of animal health, nutrition, reproduction, genetics, economics and crop production to ensure that serious imbalances are not created thus providing a sustainable agriculture.* In some instances technical solutions to the problem are available but at uneconomical cost, such that opportunity for alleviating the problem lies in improved management rather than in biotechnology. It is important to discover such management methods rather than in developing alternate treatments or preventive measures. The strategy will consist of applying the existing knowledge on the diseases present and focussing the research effort on those disease problems that directly impact the success of free trade. The solutions will be many faceted, involving interdisciplinary research inputs generated ultimately by the fields of genetics, nutrition, management and animal health. The proposed project will demonstrate that these fields are so interrelated and interdependent that it is undesirable to separate them for implementing a comprehensive animal and plant health program. *Since sustainable development is such a vital issue to both countries, TAMU and UNAM scientists will work closely throughout the project duration with federal agencies, NGOs and foundations to identify funding packages that effectively leverage USAID resources to ensure the endurance and sustainability of the linkage.* This aspect is discussed more fully in Section D. Sustainability, below.

The proposed UDLP cooperative agreement intends to provide *solutions to some livestock, poultry and plant health and production problems that are of concern to free trade between Mexico and the U.S.* The objectives of the proposed research will be achieved through a combination of programs and facilities that optimizes the strengths of each

institution. Simply stated, TAMU has developed the appropriate biotechnology to transfer, and UNAM has the field material and experimental farms and ranches on which to conduct the proposed studies and validate the research strategy. The project will capitalize on the current programs of the faculty at both institutions by implementing research objectives with a high probability of success.

The solution to animal and plant health problems that are constraints to free trade also depends upon knowledge of the total production system within which the animals are produced. Problems must be understood from the government policy and producers' points of view in both countries, and must be resolved in ways acceptable to them. This lesson has underscored the program's commitment to multidisciplinary research and active involvement of private sector non-governmental organizations and institutions in both countries. *The approach allows identification of optimal strategies agreeable to both countries and institutions thus creating support for the success and endurance of the program.* Oversight committees are proposed that will bring together individuals from governmental organizations and from NGOs and commodity groups to discuss and plan additional livestock sector relationships. These individuals will include livestock and horticulture producers and traders, food processing and service providers, extension organizations operating at the community level, and others that will benefit from project activities and will identify and build on emerging opportunities. This process will also serve to identify mutually beneficial partnerships with various public and private institutions in the U.S., Mexico, and perhaps other countries, which will not only leverage resources during the project but will be sustained beyond the life of the project. Examples include the EEC, the International Atomic Energy Agency, and the NIH, all of which support research at UNAM.

Finally, in achieving its objectives, the linkage should also:

- o Encourage the scientific synergy that will expand the scientific capabilities of UNAM faculty and to enable them to develop sustainable research programs;
- o Further the internationalization process at TAMU by clearly demonstrating how international collaboration results in knowledge greater than what might be gained separately;
- o Develop a TAMU-UNAM research axis aimed at generating knowledge which will augment and strengthen health and safe trade of livestock, poultry and horticulture in both countries; and
- o Provide a strong binational scientific capability, operating through a network of active laboratories at both universities, involving scientists with a shared philosophy of research and continuity of the program beyond the 5 years.

B. IMPLEMENTATION AND MANAGEMENT [C.3(b)(6)(A)(ii)]

The overall goals for the proposed cooperative agreement are:

- o To strengthen the technical capabilities of UNAM scientists in diagnosing diseases and in developing management systems that include appropriate disease control strategies;
- o To support the internationalization objectives of TAMU by fostering self-sustaining collaborative research programs of mutual benefit to scientists at both institutions.

The proposed UDLP cooperative agreement is designed to enhance already existing collaborations to address issues important to the success of free trade. *The strategy that we*

propose will use modern, highly useful biotechnology-based methods for the detection and prevention of plant and animal diseases. The science *will also provide major opportunities for the assessment of interactions* between infection and disease, between disease control and natural disease resistance, and between various nutrition and management decisions that affect production and reproductive performance. Finally, the research endeavors *will lead to opportunities for additional outside funding to initiate other interdisciplinary research programs*, such as studies in plants and animals on the genetic role of resistance to various diseases and ectoparasites.

SPECIFIC OBJECTIVE 1 – DEVELOP IMPROVED DIAGNOSTIC TESTS FOR TUBERCULOSIS IN CATTLE, DEER AND OTHER WILDLIFE.

Background – In Mexico, as in the United States, brucellosis and tuberculosis (TB) cause significant losses to livestock industries as well as threatening human health. Given that the ultimate mission of research on infectious diseases is their prevention, accurate diagnosis and protection of susceptible hosts by vaccination remain the best methods to accomplish this goal.

Control of brucellosis and TB in domestic livestock currently relies on either serologic diagnosis or skin tests coupled with quarantine and slaughter, as well as vaccination in the case of brucellosis which may be ineffective under compromised field conditions such as exist in some parts of Mexico. Mexican cattle, deer and other wildlife populations, as well as swine, sheep and goat populations are all at risk to infection with both of these pathogens. Clearly, a better understanding of the immune response to infections with either or both of these pathogens will be fundamental to developing improved diagnostics, especially for TB, in these livestock species. Every effort will be made to transfer the products generated by this research to private enterprise for commercialization and marketing.

Brucella and *Mycobacterium* species antigens or epitopes and their associated genes can be used to construct improved, cost-effective, definitive diagnostic reagents for rapid identification of brucellosis and TB infected livestock. The scientific approach to improved brucellosis and TB diagnostic assays will be to: (a) detect *Brucella* or *Mycobacterium* spp. DNA in animal tissues or secretions by the use of highly specific enzyme- or radio-labeled PCR-based DNA hybridization probes, (b) detect antigens specific to *Brucella* or *Mycobacterium* spp. in animal tissues or secretions by the use of mouse monoclonal antibodies recognizing antigenic determinants of these pathogens in competitive or conventional antigen capture enzyme-linked immuno-assays (ELISA), and (c) detect bovine serum antibodies reactive with highly purified species-specific *Brucella* or *Mycobacterium* spp. antigenic determinants by the use of competitive ELISA and/or nitrocellulose-based dot blot techniques.

Activities – The first two years will involve training at TAMU on brucellosis methodology, and the last three years will concentrate on development of similar methods for the diagnosis of TB at UNAM.

Initial tests of the PCR hybridization DNA probe and antigen capture methods will use tissues from control (non-infected, non-vaccinated) animals spiked with known quantities of *Brucella* or *Mycobacterium* spp. ⁶⁰Co gamma radiation killed bacteria, isolated DNA, cloned or highly purified *Brucella* or *Mycobacterium* spp. proteins, or highly purified carbohydrate antigens. Candidate antigens will be isolated and purified on SDS-PAGE and characterized by examining immunoprecipitates of radio labeled *Brucella* or *Mycobacterium* spp. by 2-D gel electrophoresis. These protein data will then be examined to provide antigenic amino acid sequences of conserved, species- and strain-specific epitopes.

Mouse hybridoma monoclonal antibodies specific for the antigens to be studied will

been made and tested by Western blots for specificity against a panel of antigens isolated from *Brucella* or *Mycobacterium* spp. Isotyped mouse monoclonal antibodies against these antigens will be used as the primary antibodies in the antigen capture assays.

Tissues or secretions from affected animals to be examined for the presence of *Brucella* or *Mycobacterium* spp. DNA or antigens will include: blood leukocytes (lysed by detergent, osmotic shock and sonication), serum, lacteal secretions including milk, colostrum, and dry period secretions, urine, reproductive tract secretions, placenta, and lymphatic tissues, e.g. supramammary and supratharyngeal lymph nodes. Dot-ELISA following the same rationale as used above in which synthetic or highly purified antigens are applied in dots to nitrocellulose may have more utility as tests conducted in more demanding environments. These nitrocellulose dots will then be cut out and placed in conventional multi-well plates.

The polymerase chain reaction (PCR) will be used to identify *Brucella* or *Mycobacterium* spp. in secretions or tissue samples obtained from infected animals. Oligonucleotide primers synthesized at TAMU will be used to amplify DNA from genes of all *Brucella* species. Published insertional repeats for some *Mycobacterium* spp. will be used as a starting point for synthesized primers for detecting and differentiating several *Mycobacterium* spp.

For *Brucella* or *Mycobacterium* spp. antigen detection, two antigen capture techniques will be employed; the first a Modified Double Antibody Sandwich and the second a Competitive Binding Assay. Each of these procedures will use a multi-well plate to bind the primary protein (in this case the selected mouse monoclonal antibodies described above) as well as with nitrocellulose sheets. To obtain increased sensitivity and greater utility in the field, primary antibody(s) or antigens demonstrating utility may be used in a dot assay.

Bacteriologic data will be the standard against which the DNA probe and antigen capture methods will be compared with the standard serological methods.

Anticipated Outcomes – The project activities will concentrate on assessing current diagnostic tests for brucellosis at TAMU, while developing technical protocols and reagents for the development and assessment of comparative diagnostic tests for TB at UNAM. In this way, scientists at UNAM will receive a double benefit from the collaboration; improved diagnostic tests for both brucellosis and TB. The diagnostic tests for TB developed by the TAMU and UNAM collaborators should be more accurate, since the proposed methods will directly detect the presence of the disease organisms. Also, the new methods will be faster (one day versus three for the skin test) and require the animal to be handled only once. Accurate tests for deer will also be *important in reducing the potential threat of the spread of TB from deer to cattle and humans.*

SPECIFIC OBJECTIVE 2 – DEVELOP BEEF BREEDING AND MANAGEMENT SYSTEMS TO RESPOND TO CURRENT MARKET CHANGES.

Background and Activities – Decision support system - Fundamental to an effective health program will be definition of the health problems which most commonly limit production and safe trade. The choice of control strategies, public health decisions, and the evaluation of possible interventions depends on having information that is accurate and reliable. A PC-based computerized data management system identifying the key diseases of economic importance to safe trade will be developed. Standardized data systems will be implemented that include recording of occurrence and incidence of diseases, morbidity and mortality, regional, seasonal and age incidence, relationships and economic impact. The system will comprise (a) data storage files containing information on disease characteristics; (b) data analysis models to access selected data files, given the type of output to be provided; and (c)

a display and interactive component which will allow linkage between the user and machine and for retrieval of selected data files and model computations in a desired format. The output format, e.g., plotting and graphical tables will be displayed via the interactive component.

When the decision support is fully operational, we expect to regularly output and provide to the industry summary information on reproductive performance, diseases of young and growing animals, management practices, nutritional profiles, and infectious and non-infectious diseases including external and internal parasite cyclic burdens and their relationship to environment and impact on production.

The first three years will involve designing and setting up the information system, and initial processing of data collected by UNAM scientists at the research station at Martinez de la Torre (MT) in the state of Vera Cruz. MT is a livestock multiplication center and is responsible for distributing livestock to the farming community in Vera Cruz. Records on production and health are available from the farming community and the station animals. MT provides an ideal data source and organization to initiate and demonstrate the importance and usefulness of this program to Mexico with the idea of extending the program to involve at a later date other states in Mexico. The last two years will involve data analyses and providing updated adoption reports and extension seminars on the usefulness of decision support system as a management tool for production and health.

Application of Systems Analysis — Simulation models have proven useful in identifying knowledge voids in scientific fields and identifying production optima and locating production constraints. The TAMU systems analysis group in the Department of Animal Science has been a leader in the development of livestock models to address these problems. Several basic concepts which prevail through the TAMU beef, goat and sheep models tend to make these models uniquely flexible and comprehensive: (a) TAMU models simulate individual response to the environments imposed upon it, eg. the models calculate nutrient requirements to meet the animals potential demand. If forage quantity or quality is not sufficient then only a fraction of this potential is met as in real life; (b) each animal has a genetic potential which allows it to respond in a particular way; (c) forage quality and quantity are input parameters to the models that allow the models to be used in any type of environment; and (d) the interaction of body functions contained in the models help to realistically simulate growth, reproduction and mortality factors which are often considered fixed in other simulation models. Having this flexibility allows the models a wide range of use in projecting animal performance. The models are designed so that they can be reparameterized for simulating production systems of any agroecosystem in any country. The models have been successfully applied in Botswana, Guyana, Venezuela and U.S. to determine optimal beef production management strategies; in Columbia for milk-beef production; in Kenya to examine drought effects and helminths burden on productivity; and in Tanzania to examine the economic viability of integrated milk-beef production at village level. Experience has shown these models to be robust with respect to the diverse environments and genotypes in which animal performance has been characterized. The past successes suggest that these

models can be applied successfully in Mexico for examining livestock production systems in various agroecosystems.

Before experimental simulations are performed, each model will be validated for each particular setting. The initial simulations will concentrate on simulations for Vera Cruz using the data collected at MT. These types of data are necessary to validate the models.

Upon successful validation, experimental simulations will be designed by UNAM and TAMU personnel.

The first two years' activities will involve collecting and collating production data specific to each location and management system and fine tuning the models. The analyses and simulations will begin during the third year, intensify during fourth, and continue throughout the project. Simulation of production systems will be conducted utilizing the baseline (validation) results with some changes imposed. The changes examined would include such practices as disease control programs, the value of exotic breeds and crossbreeding, weaning, culling and marketing at young ages, and breeding seasons of different lengths at different times of the year. The results will provide information concerning nutritional limitations, optimal genotypes and potentially promising management alternatives. Economic evaluation will be necessary to determine if the advantages conferred on the biological system will translate themselves into an increased monetary incentive. Interpretation of simulated results will provide direction and focus for within and between discipline research to improve livestock productivity. UNAM and TAMU personnel will be involved in analyses and final conclusions drawn from the systems studies. The results will form the basis of management packages to provide an optimal balance between production, sustainability and stability for the agroecosystem for livestock production.

Genetics of Disease Resistance – Haemonchosis and other gastrointestinal helminth infections are a major problem in Mexico, thus, developing animals less susceptible is highly desirable. There is evidence that genetic control of helminth infections is possible. The goal is to initiate a program for screening breeds of goats, sheep and cattle possessing high and low resistance to these parasites, and to begin identification of markers associated with resistance and other productive traits (eg. lactation and milk secretion in cattle, multiple births in goats and adaptation to climatic and nutritional stress).

Presently, gastrointestinal helminth infections are controlled by use of drugs. Although this approach has proven satisfactory when combined with appropriate management methods, the option is of concern due to drug resistance, high costs, risks to environmental contamination and hazards to human health. Of the control options available, increasing host resistance via traditional and molecular genetics to identify genetic markers and select resistant strains is receiving attention and appears viable. The rationale is that incorporation of resistance to disease into ruminant hosts will decrease the need for drugs, thus providing immediate savings to the livestock producers.

Under USAID sponsorship of the Small Ruminant Collaborative Research Support Program in Kenya, TAMU scientists have begun searching for genes associated with parasite resistance. The genetic research has the potential to identify genes or genome fragments responsible for parasite resistance which would have world-wide application for sustainable agriculture. Because of the significant results and the expertise available at TAMU, this is a research program using biotechnology techniques that are accessible to UNAM. The combination of interest, progress, importance and extensive support received from the work

in Kenya offers a unique opportunity to expand the research on genetics of diseases to Mexico.

The intensity of activities in this area will depend on outside sources of funding. Under this program, only preliminary data collection will be initiated in the third year. For the helminth resistance study, 15 to 20 farms will be identified in Vera Cruz and fecal samples collected on sample goats, sheep and cattle for parasite egg counts at monthly intervals for

a cycle of one year. The data will be analyzed to determine the seasonality and the predominant helminth species and to determine the amount of variation existing in populations. The preliminary data will form a basis for collaborative proposals for long-term external funding. Subsequent, funded research activities will involve purchasing animals showing resistance and initiating molecular work on genetics of disease resistance. It is expected that this work could begin in 5th year and continue after the linkage program is terminated.

Anticipated Outcomes – Reports and publications will be distributed in Mexico to update the public on diseases of economic significance and the status of current research to improve control. After model development and validation, the principal applications or output will be simulation of production systems for specific areas in order to predict the effects of implementation of new practices on various components of the system, or to determine optimal order and timing for establishing a series of proven practices. Biological efficiency will be evaluated through examination of effects on each production component across time. The constraints to efficiency will be detected and analyzed, and prescriptive measures developed and published as technical packages.

SPECIFIC OBJECTIVE 3 – IMPLEMENTATION OF SALMONELLA SPECIES ERADICATION PROGRAMS AND PRACTICAL APPLICATION OF NON-ANTIBIOTIC PROPHYLAXIS TO ZONOTIC AND AVIAN-SPECIFIC SALMONELLOSIS IN COMMERCIAL POULTRY.

Background – During the last decade, the importance of poultry and eggs as vehicles for human salmonellosis has become a major concern of the World Health Organization, United States regulatory agencies, the poultry/egg consuming public, and the poultry industry. Indeed, control of salmonellosis in commercial poultry has been identified by the Southeastern Poultry and Egg Association and the National Broiler Council as one of the major problems facing the United States poultry industry. The more recent emergence of egg-borne *Salmonella enteritidis* (SE) infections in humans has increased industry and regulatory agency interest in this particular strain of *Salmonella* in egg production poultry. Furthermore, the emergence of *S. enteritidis* phage type IV in Europe and a number of developing countries (including Mexico) continues to cause concern not only because of the zoonotic potential of this isolate, but also due to the animal health problems associated with this more virulent organism.

Mexico not only faces serious food-borne salmonellosis problems but also several strains of salmonellae (eradicated in the U.S.) which are highly pathogenic for poultry (*S. gallinarum*, *S. pullorum*, and more recently *S. enteritidis* phage type IV). Diseases caused by these strains of salmonellae are responsible for tremendous losses to poultry and egg production in Mexico. The continued wide-spread persistence of these virulent salmonellae strains in Mexico causes continued risk to the U.S. poultry industry. Thus, the persistence of these diseases (exotic to the U.S.) not only causes economic and food- production losses in

Mexico, but also pose a substantial barrier to free trade between Mexico and the U.S. and Canada with regard to poultry and poultry products.

Activities – The initial focus will be training of Mexican veterinarians and technicians in the methods and strategies required for the elimination of avian-specific salmonellosis in commercial poultry. The program will be modeled after the U.S. National Poultry Improvement Program which has been successful in eradicating these diseases in the U.S. The training

will be conducted at UNAM during the first year of the project. Implementation will be carried out during the second through fifth year.

The second phase of the project will test recent results of collaborative research between TAMU and USDA scientists at the Food Animal Protection Research Laboratory at TAMU. Experiments will include dietary administration of plant extracts to induce resistance to both zoonotic and avian-specific salmonellosis in poultry. Training in this latter activity will be conducted at TAMU during the first year; and will focus on experimental design and data analysis, food safety and non-immunological approaches to problems in poultry diseases.

Experiments at UNAM during the second through the fifth year will include administration of selectively cultured cecal material from adult hens in experiments to reduce cecal colonization and septicemia when chicks are challenged with either *S. enteritidis* or *S. typhimurium*, the most common causes of food-borne salmonellosis in the U.S. and Mexico. Using continuous-flow culture methodologies, 6 beneficial and non-pathogenic organisms from protective cecal cultures will be tested for protection against cecal colonization and organ invasion by *S. enteritidis* or *S. typhimurium*.

An alternative approach to reducing systemic salmonellosis in poultry, developed by TAMU scientists in conjunction with a visiting scientist from UNAM, will involve stimulating the enteric exclusion of salmonellae by the chicken. In these studies, dietary administration of capsaicin, an irritant and vasoactive compound found in red peppers of the plant genus *Capsicum*, will be evaluated for effects on *S. enteritidis* colonization and organ invasion in egg-type chickens. Following each of a series of 8 experiments, we will observe the effect of dietary capsaicin administration to Leghorn chickens on the resistance to SE organ invasion following oral challenge, but without adverse effects on body weight. Preliminary experiments indicate that similar protection is obtained by dietary administration of raw capsaicin-containing plant materials. These materials, by-products of red pepper production, are readily available in Mexico.

While substantial efficacy for the prevention of salmonellosis has been demonstrated with both competitive exclusion culture administration and dietary capsaicin treatment, the effects of these methods on the more virulent strains of salmonellae (e.g. *S. gallinarum*, endemic in Mexico) have not been evaluated. The virulence of this organism precludes testing in the U.S., where the disease is considered exotic. These experiments will be conducted at UNAM. Chicks will be housed in restricted access isolation facilities at UNAM. Native *S. gallinarum* field isolates, identity confirmed by the USDA National Veterinary Services Laboratory in Ames, Iowa, will be used for these experiments. Treatment groups will consist of 1) defined competitive exclusion cultures, 2) dietary inclusion of capsaicin-containing (18 ppm) plant by-product (local source identified), 3) groups 1 and 2 combined, and 4) non-treated controls. Groups will be housed in individual rooms within the isolation buildings (3 replicates per treatment). All animals will be challenged. The experiment will be repeated with modifications as indicated. Weekly morbidity, mortality, feed consumption and body weights will be determined. Infection of internal organs and cecal colonization will be determined at termination of each experiment. Following confirmation of efficacy, treatments will be applied to commercial flocks with native infections for evaluation of effects on the parameters listed above.

Anticipated Outcomes – Based on the efficacy of both the defined competitive cultures and the capsaicin-containing plant additives for preventing infection with invasive strains of *S. enteritidis*, it is anticipated that these treatments will attenuate natural or experimental infections with the more virulent pathogen *S. gallinarum*. In Mexico, this is likely to

tremendously increase productivity of infected flocks, decrease the local spread and persistence of the disease, and aid in the ultimate eradication of these diseases. An additional benefit to the commercial utilization of these methods lies in the reduction of food-borne salmonellae by reduction of *in vivo* amplification of the zoonotic salmonellae. From the U.S. perspective, reduction and eradication of diseases such as Fowl Typhoid (*S. gallinarum*) in Mexico will reduce the threat of reintroduction of the disease into the U.S., thus promoting the long-term viability of the NAFTA and will eventually augmenting Mexican utilization of U.S. grain through increased poultry production. Since the methodologies presently proposed utilize renewable products (plant by-products or microbial cultures) and since they are anticipated to improve the economic efficiency of poultry production, it is most probable that commercial sponsorship and adoption of these techniques by industrial partners will be forthcoming.

SPECIFIC OBJECTIVE 4 – DEVELOP MOLECULAR PROBES FOR SPECIFIC DETECTION OF VIRAL, BACTERIAL AND FUNGAL DISEASES OF PLANTS.

Activities — This project will establish a working collaborative arrangement between scientists at the UNAM Plant Molecular Biology Institute in Cuernavaca and the Department of Plant Pathology at TAMU in order to develop molecular technology for detection of disease causing organisms that are current or potential hazards to free exchange of plant materials between Mexico and the United States. A secondary goal is to utilize the probes to enhance breeding programs and to discern the mechanisms of infection and ecological spread of each pathogen.

Several organisms that are of immediate concern to exchange of agricultural products between Mexico and the US have been tentatively targeted for investigation. These are *Tilletia indica*, the causal agent of Karnal bunt of wheat, *Monosporascus*, which causes wilt or "vine decline" of melons, and peanut stripe virus, which is a problem in soybeans as well as peanuts. The basic procedures for creating molecular probes and development of diagnostic assays are quite similar for each pathogen, whether it is a virus, bacterium, or fungus. Thus, procedures which should be generally applicable to each identified species and to other pathogens that might prove to be even more critical during the course of the project will be developed.

A procedure that has successfully been used to develop DNA probes for pathogenic organisms will be employed, along with several experimental methods that have the potential to greatly speed the process. The general procedure is to develop a clone library of DNA fragments from the target pathogen, identify and eliminate any clones that also hybridize to DNA from a closely related species, and then to test prospective clones for strength of hybridization signal when used as a labeled probe to DNA extracted from 1) the pathogen, 2) the host, 3) related species, and 4) other organisms that may be expected to be present in test samples. Based on prior experience for fungi, a clone that hybridizes only to DNA from the target pathogen can generally be identified from fewer than 3,000 original clones. For Karnal bunt, the first screens will use DNA from the rice bunt fungus, and from the pathogens that causes dwarf bunt in winter wheat (*T. controversa*) and common bunt in spring wheats (*T. caries*) to eliminate clones that hybridize to the nearest relatives.

Two alternative methods that may result in more rapid identification of species-specific sequences will also be tested. Non-transcribed sequences between the ribosomal DNA repeats will be amplified from *T. indica* DNA using primers that hybridize to universally conserved flanking sequences. The amplified sequence will then be used as a hybridization probe against DNA from the other bunts and wheat DNA to determine if it has diverged sufficiently to serve as a species-specific probe. Likewise, sequences that are amplified (RAPDs) by single

short PCR primers from a mixture that includes DNA from *T. indica* and the other bunts, but not when *T. indica* DNA is absent from the template mixture, will be extracted from soft agarose gels following electrophoresis. They will be labeled and tested for the ability to hybridize to DNA from other species.

Once a Karnal bunt-specific clone has been identified, the ends will be sequenced so that primers suitable for use as PCR (polymerase chain reaction) assays can be synthesized. Development of prospective diagnostic tests based on dot-blot hybridization and PCR amplification will utilize mixtures of infected and healthy wheat kernels, so that limits of detection can be established, and prospective quantitative methods evaluated. Simplified tests such as shaking a seed sample in extraction buffer for direct lysis and PCR analysis, or collecting and lysing the spores on a nitrocellulose filter for dot blot assays will be evaluated.

In the case of the canteloupe melon pathogen, which was only recently discovered in the Rio Grande Valley in Texas, probes now being developed by a TAMU scientist should be available for use in Mexico. The first priority will be to establish whether or not the pathogen is already established in Mexico. If not, the probe should be useful in helping to prevent the spread through contaminated melons or seedstocks. If the disease is established, the probe should prove useful in collaborative breeding efforts to identify sources of genetic resistance. The symptoms produced by *Monosporascus* are common to those of other wilt and damping off diseases, making the use of a DNA-based probe especially valuable in diagnosis.

Monoclonal and polyclonal antibody assays have proven to be most useful for virus detection and are adaptable to simplified diagnostic procedures. Thus, initial attempts to develop a diagnostic probe for peanut stripe virus will focus on antibody assays. Standard protocols will be utilized to extract virus particles from infected soybeans. Since the pathogen is restricted from entry to Mexico, for this portion of the research it will be essential for the Post doctoral associate (Mexican National) to work at Texas A&M. Once purified, advantage will be taken of the association of this project with the Veterinary College to utilize their monoclonal antibody facilities. As with the fungal species, nucleic acid sequence information will also be utilized to develop PCR primers. This will permit direct comparisons of DNA-based and monoclonal antibody tests for the detection of the virus.

Anticipated Outcome – We anticipate that molecular probes and methods for the detection of plant pathogens will be developed that will be used to replace those based on visual identification or immunoassays that are limited by their expense and inability to detect low levels of infection. The new detection methods will also allow changes in sampling methods to take advantage of the very low detection levels possible with these new methods.

PROJECT IMPLEMENTATION

As indicated in the preceding sections, the *project objectives will be implemented at the UNAM College of Veterinary Medicine and Animal Science in Mexico City (Objectives 1 and 3), at the UNAM research center at Martinez de la Torre (Objective 2), and at the UNAM Biotechnology Institute in Cuernavaca (Objective 4)*. These locations were chosen because they represent the best facilities for the key issues being worked on and because scientists at these locations have ongoing research projects that support the linkage objectives. *The workplan, outlined in Annex 2, presents UDLP activities targeted to achieving specific goals and objectives*. Desired outcomes are based on the technical and institutional feasibility, including consideration of the various groups that will most benefit. Therefore, *a major milestone is reached at the completion of each activity*. *The timing, location and duration of the activities within each objective are discussed in the presentation of each specific*

objective. The personnel roles and time commitments are outlined and described in Annex 4. The supplies and equipment needed to implement each objective are presented in Annex 6.

RESOURCES

UDLP program development, implementation, monitoring and evaluation will be undertaken with the knowledge and understanding that the USAID resources will be primarily intended to provide needed supplies and equipment for UNAM and frequent faculty exchange and interaction to support the internationalization process at TAMU. Additional technical input and financial support from ongoing projects funded by public and private sector organizations and foundations will be solicited. These latter organizations will also be consulted from time to time to make them aware of additional opportunities in their sphere of interest in Mexico. *The goal is to ensure that collaborative and sustainable research programs evolve from UDLP resources and become an integral component of further institutional development at both universities.*

Estimates for research equipment and supplies being requested are based on prior experience of each TAMU Co-PI within their research expertise. All equipment and supplies will be purchased from U.S. suppliers. The equipment will be of U.S. manufacture if possible and ordered immediately after funding of each year's activities. Whenever possible, purchases will be handled by the UNAM office in Houston for delivery to TAMU. Each TAMU Co-PI will then arrange direct shipment to Mexico where its appropriate installation in the various labs at UNAM will be overseen directly by the Mexican Co-Is. At the beginning of Year 2 and upon the return of the first Mexican scientists fresh from their post-doctoral training, the post-doctoral in conjunction with the Co-I in Mexico will complete the first phase of equipping and staffing the biotechnology research laboratories at UNAM. This sequence of implementation of the facilities, equipment and personnel is planned to expedite functional and productive scientific work. With the availability of increasingly functional laboratories, the research efforts begun at TAMU will be continued in the laboratories at UNAM.

INSTITUTIONAL CONCURRENCES

Letters of concurrence and support from the Presidents of both UNAM and TAMU are included in Annex 1.

GENDER ISSUES

All personnel associated with the project will be selected on the basis of merit. Women play prominent scientific roles in Mexico. At the College of Veterinary Medicine and Animal Science at UNAM, for instance, 7 of the 19 department heads are women.

TRAINING OPPORTUNITIES

The UDLP will provide the opportunity for a strong training program. We expect to solicit extra sponsorship for training from outside sources such as the USAID Mission in Mexico, the USDA/OICD, SARH and various NGOs and foundations.

Suitable candidates for post-graduate training will be selected from written applications to the TSC. The training will take place primarily at TAMU and will emphasize the basic biology of infectious diseases, biotechnology, natural resources conservation, range management, genetics, extension, production economics, and integrated animal agriculture (systems analysis). The UNAM trainees and TAMU investigators will develop interdisciplinary research proposals for submission to potential donor agencies for funding. On return to Mexico, the scientists will continue research programs and collaboration as

specified by the UDLP objectives. As additional funding becomes available, other lines of research may be developed, especially in areas that support the ongoing UDLP program. Areas of interest might include parasitic diseases such as babesiosis and fascioliasis, diseases of reproduction and the newborn, molecular diagnosis of infectious diseases, development of recombinant vaccines, decision models, conservation and improvement of indigenous breeds of cattle and goats. These latter projects should also provide support for graduate students interested in the project.

TAMU faculty will be encouraged to develop extension-type seminars and international enhancement proposals to support course development and presentation at UNAM. The UNAM faculty selected by the TSC for post-graduate training will not only be working with TAMU colleagues to develop the techniques necessary for continuing the UDLP research at UNAM, but will also be encouraged to organize their technical deliberations for eventual publication. Each scientist will prepare a detailed proposal of activities to be accomplished, a project time frame and a final report on completion. We consider the UNAM faculty members to be visiting professors/scholars on a par with TAMU faculty members, and that such involvement enhances both the learning experience and the probability of a shared research philosophy and desire for continuation.

PROJECT MANAGEMENT

The TAMU Office of University Research will be the contracting entity representing TAMU. It will handle the accounting and reporting responsibilities and will provide budget reports as well as other fiscal information as requested. The TAMU PI will be responsible for the overall coordination of all activities specified in the UDLP cooperative agreement for the implementation of the project. The TAMU PI and the Co-PI at UNAM will also be responsible for resolving major administrative or policy issues associated with the agreement. Four TAMU Co-PIs, one for each research objective, will be responsible for the technical aspects of each objective, as well as all expenditures budgeted for their research objective. A UNAM Co-I for each objective will be responsible for technical activities in Mexico. Final approval for all expenditures will rest with the PI. The financial management in Mexico will be the responsibility of the UNAM Co-PI. The Office of International Programs at TAMU will be relied upon for advice as to opportunities that further the internationalization goals of the University.

C. MONITORING AND EVALUATION [C.3(b)(6)(A)(iii)]

The UDLP will be viewed as a process in order to effectively evaluate each research activity. The activities within each specific objective will be monitored for achievement of major milestones, as discussed in Section B, above. Throughout the process, the monitoring system will track the flow of activity occurring in each specific objective through sets of indicators which reflect the technical and institutional feasibility at each location.

Project monitoring and evaluation will be conducted at several levels in order to minimize differences in the operating environments between UNAM and TAMU. Two committees, *the Technical Steering Committee (TSC) and the Program Advisory Committee (PAC)* will be formed. The TSC will be composed of all investigators representing TAMU and UNAM. The TAMU PI will chair the group. Specific responsibilities of the TSC will include:

- o Development of workplans and reports for research and training programs;
- o Development of annual budget plan;
- o Development of policies on publication and dissemination of research results, including joint publications;
- o Selection of applicants for training; and
- o Advice concerning major problem resolution.

The first formal meeting will be a pre-implementation meeting to establish lines of communication, report format and schedule, problem resolution guidelines and other issues. Subsequent meetings will be held annually, within two months after completion of each 12-month workplan.

The PAC will meet annually with the TSC and will include all investigators representing TAMU and UNAM, plus designated representatives from A.I.D. Mexico, USDA/APHIS Mexico, SARH (Mexico), and the Director of International Coordination for TAMU. Most importantly, the PAC will include representatives from selected private sector, non-governmental organizations, private voluntary organizations and foundations from both the U.S. and Mexico. The PAC will act in an advisory capacity to the TSC to assess whether particular project goals and program activities are being accomplished. The PAC will also recommend other collaborative programs beneficial to both institutions and to the U.S. and Mexico, and *to ensure that the linkage is exploited for its internationalization potential and that all spinoff opportunities are taken advantage of fully.* Finally, the PAC will organize a workshop/conference toward the end of the project to present the results and recommendations of the linkage project.

Monitoring and evaluation will take place through 3 elements:

1. Financial - Are project resources being provided on time and are the resources allocated for each specific objective adequate for the conduct of those programs? If not, what can be done to improve the management and possible reallocation of resources? Are project resource being adequately accounted for at all levels and at both UNAM and TAMU?
2. Management - Do reports outlining project accomplishments and problems reflect efficient management? Is the project management effective in coordinating and supporting the research objectives with the identified personnel? Are the project activities being adequately reported to the beneficiary groups?
3. Technical - Are experimental protocols, technical reports and research publications being vigorously developed and rigorously peer-reviewed? Are identified post-graduate UNAM faculty receiving the intended training?

- End of project indicators for use in evaluating the success of the project will include:
- o Evidence of strengthened capabilities at UNAM and enhanced support for internationalization of TAMU;
 - o Viable and functioning collaborative research projects at TAMU and UNAM with identified personnel;
 - o Availability of published information on the new knowledge developed.
 - o Improved diagnostic tests and management practices in place;
 - o Evidence of the sustainability of research programs, management packages and appropriate technologies; and
 - o Evidence of the practical application of knowledge gained and its methods of implementation by publication, consultation, active workshops and trained manpower.

D. SUSTAINABILITY [C.3(b)(6)(A)(iv)]

As stated in the project goals, our interest is to provide UNAM with the means to effectively manage research resources to assist SARH achieve the eventual elimination of non-tariff trade barriers in agriculture. To this end, *the linkage will gain from prior relationships between TAMU, UNAM, SARH, USDA and USAID.* A good example is the work done to develop a diagnostic test for anaplasmosis, an economically important disease of cattle. Active participation by Mr. Sam Taylor, the previous Director of the USAID Mission in Mexico, by Mr. Gerard Bowers, the current Director, and by Ms. Patricia Santos, the Senior Training Officer at the USAID Mission, in the planning and implementation of USDA-funded TAMU project on anaplasmosis included USAID support for short-term training for UNAM and SARH scientists at USDA and TAMU laboratories, effectively transferring appropriate technology to Mexico. As a result, Mexican scientists are now preparing the diagnostic reagents, to USDA standards, for distribution to all regional diagnostic centers in Mexico as well as to several countries in Central America. The success of the above program *demonstrates our ability to leverage funds from an agency such as USAID to produce synergistic and additive results.* To the extent that the linkage project will complement the initiatives of USAID and USDA/APHIS, we will continue to seek financial assistance in particular for advanced training in food safety and meat inspection, and extension programs. Additional leveraging of funds will be exploited in the proposed project and will continue to sustain the linkage relationships beyond the 5-years duration of the cooperative agreement. **Already, discussions with USAID and other public and NGOs are underway concerning a larger follow-on project that will capitalize on the significant progress anticipated under the UDLP activities.**

The ability of TAMU to establish successful and productive relationships with private sector organizations is well known. Currently, a major Mexican company producing poultry rations is supporting the implementation of prophylactic methods against *Salmonella*, developed at TAMU, for protection against *S. gallinarum* infection in poultry in Mexico. A group of Mexican cattlemen in northeastern Mexico are supporting similar studies on a vaccine against a hemoparasite infection of cattle, also developed at TAMU. Recently, a U.S. pharmaceutical company sponsored the field testing of a vaccine against anaplasmosis, using cattle provided by a private rancher in Texas and shipped to a buyer in Mexico. The involvement of such NGOs stems from the frequent participation of TAMU scientists in conferences in Mexico sponsored by private industry and commodity groups, associations,

UNAM, and other universities. *Such relationships form the basis for an informal network of individuals and NGOs interested in supporting problem-based research with obvious economic implications.*

Private sector associations are very well organized in both the U.S. and Mexico. The activities of the U.S. Animal Health Association and the National Council of Animal Health in Mexico demonstrate how the private sector assists the USDA and SARH, respectively, to define needs related to free trade, and exemplifies *the influence of the private sector on the development of a national agriculture agenda*. The linkage project will capitalize on the interests of the private sector and other NGOs and foundations by including their representatives on the PAC (see Section B. above). This committee will assist in implementing, and where appropriate, marketing the new diagnostic methods and strategies, and in maximizing our efforts to disseminate the research results to the people who can most benefit. In turn, these *important private sector relationships will result in expanded support for the problem-based research initiatives begun by the linkage project.*

One of the linkage objectives uses systems analysis simulation models to provide guidelines regarding livestock production and management *strategies that are optimal for different ecological regions and that maintain the natural resource base*. Several foundations and private voluntary organizations have expressed an interest in proposals that address environmental concerns and provide alternative strategies for agriculture in ecologically-fragile areas. As alternative strategies are developed within the proposed linkage, representatives from these organizations will be involved in annual reviews of the project (see Section B, above), *assuring that all opportunities for additional funding of appropriate projects are taken advantage of.*

An internationally publicized workshop/conference in Mexico is planned during the last year of the linkage to present the findings and the strategies for improving free trade through better animal and plant health and production. Representatives from potential donor agencies such as USAID, the World Bank, the European Economic Community and public and private industry groups will be invited. One of the goals of the workshop will be to *sensitize these donors to the importance of the linkage program* to animal and plant health and production in Mexico and possibly in Central America in general, and to demonstrate the *benefits of an international collaborative effort that could only have been achieved by the linkage project.*

The linkage aims to strengthen the *internationalization process at both TAMU and UNAM* in two ways. First, the project has a well-defined set of objectives, within which there are a variety of identified needs for additional, collaborative research. In this way, achieving linkage objectives will result in *spin-off projects* that will attract additional and necessary input from other TAMU and UNAM scientists. Second, linkage scientists will be expected to *initiate more collaborative projects by writing and submitting competitive grant proposals to appropriate funding agencies and interested private sector organizations for funding*. Together, the complementarity of the project goals to the research interests of both the investigators and others at their institutions will *enhance the success and continuation of the linkage and exploit the new opportunities.*

The proposed research meshes well with ongoing TAMU and UNAM research projects. For example, some of the TAMU core personnel on this project are involved on projects in Africa developing small ruminants adapted to tropical conditions, and are involved in studies of genetic resistance to internal parasites. Others are involved in Mexico on projects aimed at improving diagnostic tests for brucellosis and tick borne diseases such as babesiosis and anaplasmosis. Several UNAM core scientists are involved in projects in Central America

on ectoparasite control. These projects have objectives which *overlap and complement those of the proposed linkage, leading to better skills in these areas as well as building the foundation for technology transfer.*

Scientists are realizing that solutions to today's complex problems require a shift from conventional reductionist research to more collaborative and multidisciplinary research strategies. The linkage project provides a multidisciplinary research and training experience for TAMU and UNAM scientists. The project will significantly enhance general education at TAMU. *Professors involved in the project, who represent a breadth of academic disciplines, will provide both graduate and undergraduate students with a broadened information base within an important international perspective.* This expanded understanding of applied international issues is important for TAMU in order to maintain a competitive edge in the expanding global economy.

With the current ease of transportation and widespread movement of animals throughout the world, there is an increased chance of introducing foreign animal diseases into both the U.S. and Mexico. The project will minimize this risk in a number of ways. First, by working in an international setting, the research will enable scientists from both institutions to *gain a broad understanding of diseases* that could potentially be introduced into either country. Protective measures such as vaccines, and new work on the genetic resistance of animals and plants to disease, are some of the spin-off opportunities of this linkage. Second, the results of the linkage activities will help control cross-transmission of diseases between the U.S. and Mexico by assuring regulatory agencies that exported plants and animals are disease-free.

Section II—USIHI Institutional Characteristics and Capabilities Related to the Linkage [C.3 (b)(6)(B)]

TEXAS A&M UNIVERSITY

Established in 1876, Texas A&M University was the first public institution in Texas and is one of the few U.S. institutions with the triple designation as a land-grant, sea-grant and space-grant university.

Texas A&M is an important research university, ranking eighth in the nation in terms of research expenditures and first in the southwest. In addition to basic research, Texas A&M places *a strong emphasis on applied research*, which over the years has brought technology from the laboratory to the producer in Texas, the United States and around the world.

Texas A&M is also an international University. Successful competition in the "global village" today requires people with the technical, cultural and problem-solving ability to be effective leaders and citizens. *Texas A&M University recognizes it can play an important role in preparing our future leaders and citizens and in building cultural and economic linkages with foreign countries that are crucial to the economic development of Texas and the nation.*

In fulfilling its mission as one of the nation's leading public institutions of higher education, Texas A&M University has made the deliberate choice to infuse an international perspective into the teaching, research and public service programs of the University.

Currently, Texas A&M has 41,000 students. About 2,700 are international students that come from 110 different countries. Of these, 110 students are from Mexico. In addition to these important ambassadors that educate the campus about their countries, Texas A&M sends students to other countries to further internationalize the campus. About 500 students from the University travelled abroad last year, more than any other public university in the state.

Internationalization is also taking place at the faculty and administrative level. Texas A&M has almost 3,000 faculty, 800 of which have significant international experience. In addition, *major collaboration with international organizations and institutions of higher education* is illustrated in the University's more than 100 formal agreements, which allow for research collaboration or faculty and student exchanges (see annex 5A).

Linkages with institutions in developing countries, such as this proposal with the Universidad Nacional Autonoma de Mexico (UNAM), provide an excellent opportunity to further the internationalization of Texas A&M's teaching and research programs, as well as provide an opportunity for public service by helping solve one of the states major agricultural import problems.

INSTITUTIONAL COMMITMENT TO INTERNATIONAL PROGRAMS

A centralized administrative structure was created in 1990 under the Assistant Provost for International Programs to provide overall coordination of the international efforts of Texas A&M. The Office of International Programs oversees five units that have campus-wide responsibility: the Office of International Coordination, Study Abroad Programs, International Student Services, the Institute for Pacific Asia, and Mexican and Latin American Programs.

Reporting directly to the Provost and Senior Vice President, the Assistant Provost is a member of the Provost's staff and the Academic Program Council. This administrative arrangement allows the Office of International Programs to become an integral part of the University's academic programs (see annex 5B and 5C). *This close relationship, combined with the institutional commitment demonstrated by both the President and the Provost in*

policy and structural changes as well as resource allocation (see budget in annex 5G) provide the critical leadership to galvanize support for international program activities throughout the campus.

Established in 1990, the International Programs Enhancement and Coordination Committee (IPECC), made up of representatives from all academic units on campus, assists and advises the Office of International Programs. The committee provides a mechanism that allows for regular, systematic information exchange and coordinated planning among all campus units concerned with international programs.

In addition to the centralized administrative structure and the establishment of IPECC, a strong commitment to internationalization has been demonstrated in other ways. Based on the recommendation of IPECC and the Texas A&M Faculty Senate, the Provost is in the process of implementing a policy that will make *international involvement a criteria for faculty promotion and tenure*. The IPECC is also studying the feasibility of making *foreign language requirements* part of the core curriculum and the possibility of establishing a degree in *international studies*. The University also has a policy to offer *supplemental funding to those selected as Fulbright Scholars*.

Furthermore, *Texas A&M provides funds through two competitive grants to faculty who are travelling abroad for research collaboration or who wish to internationalize the curricula*. Faculty have exhibited their interest in international curriculum development and foreign research projects in that four times as many proposals have been submitted to these grants programs than could be funded. Likewise, *faculty commitment to international activities is evidenced* by their teaching of multi-cultural courses, service on numerous international-related committees, participation in an annual week-long international festival and service as advisers to international student organizations.

Students at Texas A&M also recognize the need for internationalization. In addition to the 500 students that travel abroad annually, many students take advantage of the University's diverse foreign language offerings. Texas A&M's Department of Modern and Classic Languages offers *more than 70 courses on nine different foreign languages each semester*. The University also operates an English Language Institute for students who wish to study English as a second language. In addition, a student-operated program that offers "after-hours," short-term, non-credit classes, provides nine conversational foreign language courses that are popular with students, faculty and staff, alike.

Furthermore, many of the courses offered throughout the University have an international dimension. Through a survey of faculty next year, the Office of International Programs will develop and distribute a listing of all Texas A&M's international-related classes.

A COMMITMENT TO MEXICO

Texas A&M has a long and rich history of activity in Latin America. Texas A&M faculty have been involved in more than 90 educational and research projects with Latin American institutions. More than 1,000 former students from Mexico have graduated from the University. Many of these Aggies are now in positions of leadership within the political and business sectors of Mexico.

In 1990, an analysis of Texas A&M's international involvement was conducted. Based on this information, on key changes in certain regions of the world, and on the economic development goals of the State, Texas A&M identified three priority regions in which it will focus its efforts in the future: Mexico and Latin America, Pacific Asia and Europe.

Following the University's designation of the region as a target area, the Mexican and Latin American Programs (MELAP) office was established. This program provides support

and assistance in identifying research and business development opportunities as well as funding potential for projects in Mexico and Central and South America especially those identified by state officials and former students.

Texas A&M has extensive and broad experience in research collaborations with institutions throughout Mexico. Cooperative research with Mexican institutions includes the areas of binational trade, agricultural economics, nuclear research, ecology, aquaculture, biotechnology, and wildlife management — to name a few. (For more information on international agricultural programs see annex 5D.)

The University currently has 16 formal agreements with institutions in Mexico that allow for cooperative research or faculty or student exchanges. One of these is with the Universidad Nacional Autonoma de Mexico (UNAM), which has been in existence since February 1983.

Of the three University-designated priority regions, *Mexico has been the recipient of most of the outreach efforts in the past year by the University.* This has primarily been due to efforts to create linkages that would better prepare the state for the proposed North American Free Trade Agreement. The research project proposed in this document would be another important opportunity for MELAP to assist the University in continuing its development assistance in Mexico. (For more information on Mexican and Latin American Programs see annex 5E.)

A UNIVERSITY-WIDE COORDINATION MECHANISM

The programs and projects coordinated by the five units reporting to the Office of International Programs serve to create a positive attitude on campus concerning international involvement and to provide opportunities for faculty, staff and students to learn more about the world outside the United States.

Working closely with IPECC, the Office of International Coordination provides support to the Office of International Programs and the other four units by promoting international opportunities to faculty, staff and students at Texas A&M. *Through the International Management Information System, the office acts as a clearinghouse by tracking and monitoring Texas A&M's international programs, research projects and faculty and staff expertise.* This information is shared with faculty and staff on request to facilitate networking and collaborative international efforts. The Office of International Coordination also assists faculty by locating and facilitating international funding opportunities and by coordinating all agreements with foreign institutions.

In addition to the networking facilitated by the Office of International Coordination, most faculty with international projects take advantage of *Bitnet and other computer systems* to network with colleagues and find out about opportunities. Texas A&M also offers a great number of courses in Latin America through the "AGSAT" teleconferencing network that the University operates. Texas A&M also is home to the world-class Sterling C. Evans Library that serves faculty needs for research. The library is especially strong in its collections on applied research. In addition, Texas A&M has the only medical library in Texas specifically tailored to meet the needs of the veterinary medical community.

Texas A&M further fosters internationalization of the campus by providing international research and curriculum development support to faculty by operating the two competitive grants programs, mentioned earlier. To help accommodate visits of international scholars to Texas A&M, International Programs operates a housing program that provides apartments for short-term international visitors.

MISSION AND STRATEGIC INITIATIVES OF THE OFFICE OF INTERNATIONAL PROGRAMS

In 1990, under the guidance of the IPECC, Texas A&M adopted a mission statement for the international programs thrust of the University (see annex 5F). To summarize, *the long-term goal of the Office of International Programs is to develop a campus community that fosters international involvement of students, faculty and staff and that welcomes and attracts international scholars and visitors.* In coming years, the priorities of the Office of International Programs will be to bring down barriers to and create ownership of international efforts among all units on campus. To do this, the Office of International Programs will be a catalyst, coordinator and advocate for the continued internationalization of Texas A&M.

In May 1992, the Office of International Programs established a strategic plan for the next two years (see annex 5G). In carrying out this plan, International Programs will implement the following strategic initiatives.

- o Increasing *international opportunities for students* including both study abroad and internship programs;
- o Enhancing *international awareness on campus* through cultural events *and in the community, including public schools*, through outreach projects;
- o Creating a *positive campus environment* for international students, faculty and staff;
- o Developing a *coordinated policy* and process in the admission and reception of international students and faculty;
- o Enhancing the *international dimension of the curriculum*;
- o *Expanding international services* for faculty such as funding opportunities, information dissemination and support programs for international faculty;
- o Providing funding and *networking opportunities for focused research and exchange projects in Mexico and Latin America*, Pacific Asia and Europe;
- o Supporting international programs with external resources; and
- o Promoting and publicizing *international education and program development* at the state and national level.

INTERNATIONAL PROGRAM'S RELATIONSHIP TO THIS LINKAGE

The Office of International Programs supports and endorses this proposal because it complements the mission and strategic initiatives of the University's internationalization effort. The proposed project allows for a linkage in one of Texas A&M's designated target regions. Expanding opportunities in these areas is one of the primary goals of the University's international programs. Furthermore, the linkage will provide another collaborative opportunity under Texas A&M's Memorandum of Agreement with UNAM (see annex 5H).

In addition to providing for collaboration with a foreign institution, the project would allow for internal collaboration. This proposal represents the largest collaborative effort that has ever taken place between Texas A&M's College of Veterinary Medicine and the College of Agriculture and Life Sciences in conjunction with a foreign institution.

The Office of International Programs also anticipates and looks forward to the *many "spin-off" opportunities*, occurring from this proposal, *that will support and help fulfill the international mission and strategic initiatives of the University.* Some of the international opportunities expected include the following.

Faculty exchanges — Helping fulfill one of our strategic initiatives, this proposal will allow for exchanges of faculty that are directly involved in the research linkage project. Heretofore, most faculty exchanges with Mexican institutions have been short-term visits. This

linkage will offer long-term opportunities that will provide for more in-depth involvement of faculty at the UNAM and Texas A&M campuses, such as the teaching of semester-long courses or a series of seminars. It is hoped that this will lead to the University's recognition of certain courses at UNAM that would apply toward degrees at Texas A&M and vice versa.

Transfer of technology and knowledge — Texas A&M is a leader in biotechnology and its applications in agriculture and veterinary medicine. The advantage of this linkage proposal is that the scientists involved will have the opportunity to determine the appropriate biotechnology that should be transferred to the public in general and Mexico specifically to assist with developing regulations for safer trade. The new knowledge generated through this research project also would be transferred to the students of Texas A&M, fulfilling another strategic initiative to enhance the curriculum.

Graduate student training and research — Texas A&M also will benefit from this linkage project through the opportunities it will provide graduate students. Although, because of budget constraints, this project is primarily aimed at the training of post-graduate scientists and junior faculty at UNAM, as mentioned previously, one of the primary factors of the sustainability of this project will be the identification of additional projects within the research objectives, each of which could be suitable for masters- and doctoral-level research projects. These focused projects could provide not only for research but also jobs and competitive positioning for future grants.

Study abroad opportunities — Very few study abroad programs are designed around a research project. This linkage proposal offers the opportunity to establish a program specifically targeted to science majors, a field currently under-represented in study abroad programs at Texas A&M. Implementing this type of program would help fulfill one of the objectives of international programs, which is to provide more opportunities for currently under-represented ethnic groups and disciplines (see strategic plan annex 5G).

Once again, the University and the Office of International Programs supports this proposal and looks forward to its potential implementation, not only for the quality research it will provide but also because it helps fulfill the primary initiatives the University is seeking to develop in the next two years under its strategic plan for international programs.

SUMMARY

The world is in a time of unprecedented change, with major historical events occurring almost daily. The changing political order of the former Soviet Union and Eastern Europe, the emerging economic unity of Europe, the phenomenal economic and technological growth of Pacific Asia, the political upheavals in Latin America, and the negotiations for a North American Free Trade Agreement present many challenges and opportunities for both the United States and Texas.

These international developments provide evidence that it is more important than ever for Texas to prepare its future leaders to meet the challenges of a rapidly changing world. ***Texas A&M's College of Veterinary Medicine and College of Agriculture and Life Sciences can assist the Office of International Programs in the University's mission to internationalize the campus and the state through this linkage project with UNAM.*** This project and others like it will help ensure a population of graduates and citizens of Texas that are better prepared to face competition in the global village.

Section III – Developing Country Institution Characteristics and Capabilities Related to the Linkage

UNIVERSIDAD NACIONAL AUTONOMA DE MEXICO

Considered Mexico's most important cultural project of the twentieth century, the National Autonomous University of Mexico (UNAM) educates nearly 250,000 students in 30 colleges with a 28,000 member academic staff. UNAM conducts more than 50 percent of Mexico's research in its 25 institutes and 14 centers. As well as housing the National Library and operating as the nation's major editorial institution, UNAM maintains the most important zoological and botanical collections in Mexico. It also quarters one of the largest art collections. In addition to academic efforts involving every state in Mexico, UNAM has two oceanographic ships which conduct research in the territorial seas.

The College of Veterinary Medicine and Animal Science, originally founded in 1853, is the oldest on the American Continent. Previously under the Ministry of Agriculture, the College joined UNAM in 1929. The College of Veterinary Medicine and Animal Science has 200 full-time professors, 150 part-time lecturers, as well as technicians and the administrative staff to accommodate 2,800 undergraduate students and 150 postgraduate students. The College consists of 19 academic departments, a unit of continuing education, a computing center, a museum and a central library on the university campus. Off campus, in the states of Morelos, Veracruz and Mexico, seven centers for teaching, research and extension offer instruction on modern animal production methods, as well as the marketing and processing of different animal products. Centers such as the sheep production farm in Morelos and the tropical cattle production station in Veracruz, offer local producers training, technology transfer and valuable genetic material. The funds generated by these seven centers coupled with those raised by the services of the nineteen academic departments provide significant financial support, enough to cover one-third of the annual budget.

INSTITUTIONAL COMMITMENT

Realizing the need to ensure competent and well-qualified faculty, the College constantly seeks to train future professors. Presently 50 veterinarian students are doing master or doctoral studies, 20 outside of Mexico, mostly in the United States, and 30 within the country. UNAM's Rector established the External Academic Committee in April 1991 to ensure that veterinary education meets Mexico's needs. The 17 member committee, consisting of leaders in the veterinary sciences and animal industry, helped modify the doctor of veterinary medicine and animal science degree requirements to better fit Mexico's work market expectations. The new program will go into effect in November 1992. The recently created five-member External Academic Committee for Postgraduate Studies, consisting of respected researchers from the colleges of veterinary medicine at Texas A&M University, Cornell University and the Atlantic Veterinary College in Canada, as well as Mexican researchers from institutions not related to UNAM, evaluates accomplishments and suggests future directions for postgraduate studies.

In addition to these external advisory committees, UNAM has adopted programs of internal evaluation. Students evaluate faculty member performance at the end of each semester and a computerized system provides feedback to the instructor and the department head. To strengthen the program, the best teachers are awarded academic distinctions and financial benefits. Lecturers are evaluated on their overall productivity every two years and receive bonuses based on their performance.

financial benefits. Lecturers are evaluated on their overall productivity every two years and receive bonuses based on their performance.

The College also maintains close links with federal government programs. For example, UNAM grants veterinarians official accreditation from the Department of Agriculture to perform regulatory activities in the national campaigns to control various animal diseases. Also, last year the Minister of Agriculture moved the official seat of the National Council on Animal Health to the College. The Council consists of 25 independent committees including national experts on particular areas. It advises the federal government on subjects related to animal health, industry, trade and welfare.

RELATIONSHIP OF THIS LINKAGE TO UNAM'S INTERNATIONAL INTERESTS

This general overview of the College demonstrates the solid structure that enables UNAM to commit the academic, financial and structural resources needed for a sustainable international partnership with Texas A&M University. Furthermore, as the leading veterinary college in Mexico, the trends developed at UNAM College of Veterinary Medicine and Animal Science are always followed by other universities. UNAM considers the linkage project with Texas A&M University of paramount importance. It is framed according to the national policies of the free trade agreement concerning the international trade of healthy animals and reliable animal products. In order to accomplish these goals, some important cattle diseases such as tuberculosis and brucellosis have to be efficiently detected and effectively eradicated. Mexico will then be able to safely export animals and their products to international markets, as well as to import and raise superior genetic breeds to improve its national herd.

Approval of this program and the resultant addition of new human resources to the College's faculty, will enable UNAM to develop new research lines related to actual national problems. The use of modern equipment and the introduction of more reliable and faster techniques will also enable improvement of UNAM's laboratories.

The External Academic Committee, representing important leaders in the Mexican animal industry, the strong relationship with the Ministry of Agriculture, the connection with the Mexican veterinary profession through our Department of Continuing Education, and the relationship maintained with Mexican society through the various services our college provides, all guarantee the spread of the beneficial effects of generating this new knowledge throughout the nation.