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Proj. No. 93100 23.13
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DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C. 20523

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JUN 27 1975
26p

Mr. Samuel M. Weisberg
Executive Director
League for International Food Education
1155 - 16th Street, N.W.
Washington, D. C. 20036

CERTIFIED A TRUE COPY THIS
28th DAY OF July, 1975
BY John Hendtich

Subject: Grant No. AID/ta-G-1235

Dear Mr. Weisberg:

Pursuant to the authority contained in the Foreign Assistance Act of 1961, as amended, the Agency for International Development (hereinafter referred to as "A.I.D." or "Grantor") hereby grants to the League for International Food Education (hereinafter referred to as "LIFE" or "Grantee") the sum of \$95,920 to provide support for a program in a study of Conversion of Food Wastes into Feed or Food Products, as more fully described in the attachment to this Grant entitled "Program Description."

This Grant is effective and obligation is made as of the date of this letter and shall apply to commitments made by the Grantee in furtherance of program objectives during the period June 30, 1975 through January 31, 1977.

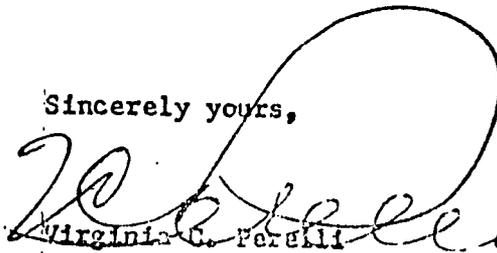
This Grant is made to LIFE on condition that the funds will be administered in accordance with the terms and conditions as set forth in Attachment A entitled "Program Description," Attachment B entitled "Standard Provisions," and Attachment C entitled "Payment Provisions," which have been agreed to by your organization.

Please sign the Statement of Assurance of Compliance, enclosed

herein, and the original and seven (7) copies of this letter to acknowledge your acceptance of the conditions under which these funds have been granted.

Please return the Statement of Assurance of Compliance and the original and six (6) copies of this Grant to the Office of Contract Management.

Sincerely yours,



Virginia C. Ferrelli
Grant Officer
Chief, TA Branch
Central Operations Division
Office of Contract Management

Attachments:

- A. Program Description
- B. Standard Provisions
- C. Payment Provisions

ACCEPTED:

LEAGUE FOR INTERNATIONAL FOOD EDUCATION

BY: *D. Roberts*

TITLE: *Executive Director*

DATE: *July 3, 1975*

PROGRAM DESCRIPTION

A. Purpose of Grant

The purpose of this Grant is to provide support for feasibility study on the conversion of food wastes into feed or food products in the less developed countries.

B. Specific Objectives

The specific objectives of this Grant are to develop methodology for determining technical and economic feasibility of utilizing waste products for food or feed and to prepare a plan for one plant to convert such products to nutrients for human and animal consumption.

C. Implementation

To achieve the above objectives, the Grantees will provide general policy and technical guidance for the Study and coordinate the implementation of the Study activities through its member professional society, the American Institute of Chemical Engineers. The Study will be accomplished in five phases: (1) Literature and Review and Study, (2) Team Visits, (3) Site Selection Planning, (4) Preliminary Pilot Project Design, and (5) Final Report.

Phase 1 - Literature Review and Study

The Study will begin with a state of the art survey, using available literature, personal contacts, correspondence, and conference attendance. Full resources of the LIFE consortium will be enlisted. This Study is aimed at identifying the full range of alternatives available in anticipation of

informed choices. The Study will identify:

(a) Food wastes in lesser developed countries which have the potential of being converted into useful nutrition products, e.g., agricultural wastes, palm and other oil processing wastes.

(b) Feasible feed or food products to fill identifiable needs in specific IDCs which can be generated from the food wastes identified above, e.g., algae, single cell protein, animal feed, etc.

NOTE: (a) and (b) will be studied concurrently.

(c) Technologies for converting specific food wastes into desired nutritional products, e.g., fermentation, enzymatic conversions, separation, etc.

(d) Choice of regions and/or countries and products and technology with greatest potential for subsequent application in pilot project.

Phase 2 - Team Visits

Three (3) site visits are presently anticipated to three regions identified in the scoping study.

Site visits will be made by three-man teams. The collective expertise of each team will include food technology, waste treatment and processing, marketing techniques, and knowledge of local conditions. Each team will include a qualified national from the country to be visited.

Based on (1) consultation with public officials, academics, and individuals from industry and (2) observation of processing plants, factories, and other appropriate facilities, the team will:

a. Identify and evaluate appropriate technologies for convert-

ing waste products to human food and animal feed.

b. Identify local individuals who can participate and take responsibility for decisions made in a subsequent pilot project should their area be selected.

A report covering a. and b. above and oral debriefings will be provided by each team upon completion of each site visit.

NOTE: No country visits will be made without prior AID clearance, in accordance with Standard Provision Clause "1" entitled "Travel and Transportation."

Phase 3 - Site Selection Planning

In consultation with AID a tentative selection of the site for the subsequent pilot project will be made. This will be confirmed in a repeat visit to the most promising area or areas. This visit will be undertaken by a team member and the principal investigator and/or the co-investigator, and preferably an AID official. The team will hold talks with local government officials, industrialists, etc., to lay the groundwork for the pilot project at the site selected. And the team will arrange for the formation of a local working group, including experts from the specific industry involved, to continue the negotiations and planning after the visit.

Phase 4 - Preliminary Pilot Project Design

The working group will make a preliminary design of the process for accomplishing the desired food waste conversion. This will include selection of the specific unit operations, flow sheet, plant size, and an initial economic analysis. The preliminary design will also include a market

2. A report, in thirty (30) copies, upon the completion of each site visit conducted during Phase 2. This report should include the information required in items "a" and "b" of Phase 2.

3. A report, in three (3) copies, on the preliminary pilot project design upon completion of Phase 4.

4. The final report, in thirty (30) copies, as described in Phase 5.

E. Budget

The funds provided herein shall be used to finance the following items:

1. Salaries (A.I.Ch.E.)	\$43,200
2. Consultants	15,100
3. Travel	
International	19,500
U. S.	4,500
4. Per Diem	
International	6,370
U. S.	2,250
5. Other Direct Costs	5,000
Telephone	\$ 900
Supplies, Postage . . .	2,400
Printing	1,000
Miscellaneous	700
	<hr/>
TOTAL GRANT FUNDS	<u>\$95,920</u>

The Grantee may not exceed the total amount of the Budget. Adjustments among the line items are unrestricted.

analysis and an evaluation of the institutional and social barriers to implementation which might be encountered. During this phase the principal investigator will make two visits to the site to provide guidance to the working group.

Phase 5 -- Final Report

On the basis of the preliminary design prepared in Phase 4, the principal investigator will, drawing on his consultation with the local representatives, and U. S. team members, develop a final report which will provide:

a. Pilot-plant plans, specifications, cost accounting, and other engineering and economic data sufficient to build and operate a plant and market the products in the selected LDC.

b. A methodology detailing the steps necessary to determine technical and economic feasibility of utilizing waste products for feed and feed.

The methodology should be suitable for use by LDC planning offices.

D. Reporting

The Grantee will submit the following reports on the various phases of activities described in Article C, entitled "Implementation", to the Project Manager, Office of Nutrition, TA/N, Agency for International Development, Washington, D. C. 20523. The Grantee will attach to each report submitted, a budget appendix showing expenditures to date and detailed expenditure projections for the next reporting period.

1. A report, in thirty (30) copies, on the state of the art survey, upon completion of Phase 1.

DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C. 20523

December 9, 1976

Dr. Hugh J. Roberts
Executive Director
League for International
Food Education
1126 - 16th Street, N.W.
Washington, D.C. 20036

CERTIFIED & TRUE COPY THIS
18th DAY OF Jan. 77
BY E. L. Amis

Subject: Grant No. AID/TA-G-1235

Dear Dr. Roberts:

Pursuant to the authority contained in the Foreign Assistance Act of 1961, as amended, the Agency for International Development hereby amends subject Grant as follows:

To the Grant face page, delete the date "January 31, 1977" and substitute the date August 31, 1977.

Except as expressly amended above this Grant and all its terms and conditions remain unchanged.

Please sign and return the original and seven (7) copies of this letter to acknowledge your acceptance of this amendment.

Sincerely yours,



Morton Darwin
Grant Officer
Central Operations Division
Office of Contract Management

ACCEPTED:

BY Hugh J. Roberts

TITLE Executive Director

DATE Dec 16/76

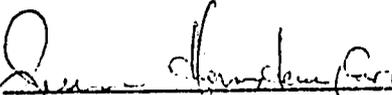
Nutrition Programming Capability -
Voluntary Agencies (PVOs)

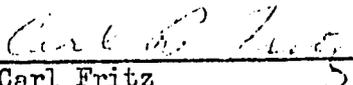
Sub-Project Number 4

Title: Conversion of Food Wastes
into Feed or Food Products

Grantee: League for International
Food Education (L.I.F.E.)

Amount: \$98,920

Approved:  Date: 6/14/75
Martin J. Forman
Director, TA/N

Authorized:  Date: 6/18/75
Carl Fritz
Director, TA/PPU

INTRODUCTION

There has been increasing international interest in the processing of food wastes as a means of generating food and feed products. Less developed countries have been developing methods of processing these wastes. This project is a timely attempt to coordinate some of the efforts and to apply the lessons learned on a wider scale. Because many less developed countries are in ignorance of what is being done, even by their immediate neighbors, the need to accelerate the transfer of information in this field is evident.

Agriculture and food industry efforts are often oriented toward export markets, or to manufacturing products which only produce profit. For this reason, it is imperative to tie food technology to identifiable needs, and to encourage those elements within the country which can produce the desired end products from sources and in forms which will make it economically feasible to sell at a price which those in need of improved nutrition can afford to pay.

AICHE is requesting grant support from A.I.D. totaling \$98,920 over an 18-month period. The grant would provide funding for a principal investigator, a co-investigator, travel for field trip team members as well as costs for LDC local experts and consultants. On its part, L.I.F.E. is able to enlist the expertise of its eight constituent organizations, representing the whole range of food technology, from both academic and industrial worlds, as well as overseas affiliates with whom it has links. This grant will reinforce and widen these overseas links.

The overall aim of the AICHE project is to pinpoint pilot areas in which technologies have been developed which may serve as models for other countries or regions with similar potential for converting food wastes.

This whole project will, if successful, lead to a second phase, i.e., the implementation of the pilot project.

PROJECT GOAL

1. Goal Statement:

- a. Decreased malnutrition among pre-school children and pregnant and nursing women.
- b. Operating plants producing low-cost nutrients for humans and animal feeds from food waste products and materials.
- c. Decreased environmental pollution by substances considered wastes in LDCs.

2. Measure of Goal Achievement:

- a. Nutrition status surveys.
- b. Metric-ton output and local consumption surveys.
- c. Pollution status and environmental situation reports.

3. Assumptions:

- a. Malnutrition is due to lack of nutrients ^{which can be} supplied in part by this project.
- b. There is a sufficient continuous supply of wastes suitable for use as raw material.
- c. Sufficient demand exists and suitable markets can be identified to develop an economically feasible product.
- d. Environmental pollution has sufficient impact on local society to concern government.

PROJECT PURPOSE

1. Purpose Statement:

Development of a methodology for determining technical and economic feasibility of utilizing waste products for feed and food. Design for local plant in one LDC to convert waste products and materials to nutrients for human consumption and animal feed.

2. End of Project Status:

- a) Report containing pilot-plant plans, specifications, cost accounting, and other engineering and economic data sufficient to build and operate a plant and market the products in the selected LDC will be available.

b. A methodology detailing the steps necessary to determine technical and economic feasibility of utilizing waste products for food and feed will be available for use by planners in other LDCs.

3. Assumptions:

a. Local interest, venture capital, and skills available to implement plan and build and operate pilot plant.

b. A product can be developed which will be competitive with other food products.

c. Processes identified will be sufficiently cost effective to compete for investment capital.

PROJECT OUTPUTS

1. Outputs:

a. Evaluation studies of capability of local facilities and entrepreneurs to convert food wastes to nutrients.

b. Feasibility studies of nature and extent of local wastes which may be converted to human or animal nutrients.

C. Methodology

2. Output Indicators:

Published reports.

3. Assumptions:

a. Reports and studies will be shared locally and with the social and capital investment community.

b. Scale of project and range of possibilities widely applicable among LDCs.

PROJECT INPUTS

1. Inputs:

a. Financial support.

b. Technical consultants.

c. Non-capital logistic support.

BUDGET SCHEDULE

Personnel

Principal investigator @ \$28,000/annum	6 man months	\$ 14,000.00
Co-investigator @ \$28,000/annum	6 man months	14,000.00
Secretary @ \$8,000/annum	12 man months	8,000.00
Research assistants @ \$7,200/annum	12 man months	7,200.00
Consultants @ \$125//day	100 days	12,500.00
Site visits honorarium		
2 men x 14 days x 3 visits x \$50		4,200.00
1 man x 14 days x 2 visits x \$50		1,400.00
		<u>61,300.00</u>

Travel

Site visits - transportation

Preliminary - 3 visits - 3-man teams
(\$1500 x 3 men x 3 visits) 13,500.00

Follow-up and final visit - 2-man teams
(\$1500 x 2 men x 2 visits) 6,000.00

Site visits - per diem

Preliminary - 3 visits - 3-man teams - 2 weeks
(\$35.00 x 14 days x 2 men x 2 visits) 4,410.00

Follow-up and final visit - 2 man teams - 2 weeks
(\$35.00 x 14 days x 2 men x 2 visits) 1,960.00

USA travel - transportation

Thirty trips - principal investigator, co-investigator,
consultants to L.I.F.E, universities, national meetings, etc
est \$150.00 4,500.00

USA travel - per diem

Ninety days at \$25.00 2,250.00
32,620.00

Direct Costs

Telephone, \$50.00/month	900.00
Postage, supplies, xerox	2,400.00
Printing	1,000.00
Miscellaneous (visa fees, equipment rental, etc.)	700.00
	<u>5,000.00</u>

Grand Total \$98,920.00

PROJECT TITLE: Conversion of Food
Wastes into Feed or Food Products

PROJECT NO.

SUBMISSION DATE:
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2. Assumptions:

- a. That AID and other multilateral voluntary agency or international donor support will be available.

RATIONALE

The aim of this project is to simultaneously address two problems: environmental pollution from waste products and shortage of quality nutrients. There are examples of this having been done in the past, but there are many more opportunities which are not being grasped. By providing a demonstration of the potential in this area with a specific pilot project and by providing a detailed methodology which interested planners in other LDCs can use to uncover similar opportunities and thus plan and design technical and economic processes, this report should stimulate much wider use of available resources which are now being wasted.

COURSE OF ACTION

1. Implementation Plan:

a. Start of Work - June 1, 1975

Literature Search - June 1-December 1, 1975

First Site Visit - September 1975

Interim Report - January 1976

Remaining Site Visits - December 1975-April 1976

Follow-up Visit to Selected Site - June 1976

Pilot Project Design - January-September 1976

Final Visit to Selected Site - September 1976

Final Report - December 31, 1976

b. Project Principals:

The project will be under the overall administration of AIChE which has tentatively selected a principal investigator and co-investigator (See biographies, Appendix 1). Extensive use will also be made of other L.I.F.E. affiliates as well as industries, universities, research institutes, and government agencies. Outside consultants will be used as necessary. The composition of the visiting teams and local participation is described earlier.

c. Work Plan:

The project will be divided into five phases:

- (1) Literature review and study.
- (2) Team visits.
- (3) Site selection planning.
- (4) Preliminary pilot project design.
- (5) Final report.

(1) Literature review and study:

The project will begin with a state of the art survey, using available literature, personal contacts, correspondence, and conference attendance. Full resources of the L.I.F.E. consortium will be enlisted. This study is aimed at identifying the full range of alternatives available in anticipation of informed choices. The study will identify:

(a) Food wastes in lesser developed countries which have the potential of being converted into useful nutrition products, e.g., agricultural wastes, palm and other oil processing wastes, etc.

(b) Feasible feed or food products to fill identifiable needs in specific LDCs which can be generated from the food wastes identified above, e.g., algae, single cell protein, animal feed, etc.

Note: (a) and (b) will be studied concurrently.

(c) Technologies for converting specific food wastes into desired nutritional products, e.g., fermentation, enzymatic conversions, separation, etc.

(d) Choice of regions and/or countries and products and technology with greatest potential for subsequent application in pilot project.

(2) Team visits:

Three site visits are presently anticipated to regions identified in the scoping study. From these visits a final choice will be made of the specific country or region in which the pilot project will be developed. This site will be revisited to lay the groundwork for the planning stage of the pilot project.

Each team will incorporate members knowledge in food technology, waste treatment and processing, marketing techniques, and local conditions. The teams will be formed in consultation with the L.I.F.E. consortium, industrial firms, and universities, and will combine industrial and academic experience. It is expected that each team will include a qualified national from the country to be visited.

The teams will consult with government officials, academics, industrial people, etc., concerned with and/or having expertise in the relevant fields of activity. They will visit processing plants, factories, and other appropriate facilities. They will identify and evaluate appropriate technologies and the factors which affect their success. They will also identify those local people who can participate and take responsibility for decisions made in the later pilot project, should their area be selected.

The teams will submit a written report and take part in an extensive debriefing session upon their return.

The principal and co-investigator hope, from the results of these visits, to identify a team leader or leaders for the pilot project.

(3) Site selection and planning:

In consultation with A.I.D. and the team members AIChE will then make a tentative selection of the site for the subsequent pilot project. This will be confirmed in a repeat visit to the most promising area or areas. This visit will be undertaken by a team member and the principal investigator and/or the co-investigator, and preferably an A.I.D. official. In talks with local government officials, industrialists, etc., the team will lay the groundwork for the pilot project. A working group which includes local representatives, including experts from the specific industry involved, will be formed to continue the negotiations and planning after the visit.

(4) Preliminary pilot project design:

The working group will make a preliminary design of the process for accomplishing the desired food waste conversion. This will involve selection of the specific unit operations, flow sheet, plant size, and an initial economic analysis. The preliminary design which will be initiated in even earlier stages of the project,

PROJECT TITLE: Conversion of Food
Wastes into Feed or Food Products

PROJECT NO.

SUBMISSION DATE:
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will also include a market analysis and an evaluation of the institutional and social barriers to implementation which might be encountered.

(5) Final report:

The final report will be prepared under the direction of the principal investigator, in close collaboration with team members and local representatives involved.

2. Evaluation:

Evaluation will be carried out on an ongoing basis by the project principals. Periodic reports will be given A.I.D. and its own field staff will have the opportunity to check results obtained.

LOGICAL FRAMEWORK MATRIX - PROP WORKSHEET

Summary	Objectively Verifiable Indicators	Important Assumptions										
<p>A.1. Goal</p> <p>a) Decreased malnutrition among pre-school children and pregnant and nursing women.</p> <p>b) Operating plants producing low-cost nutrients for humans and animal feeds from food waste products and materials.</p> <p>c) Decreased environmental pollution by substances considered wastes in LDCs.</p>	<p>A.2. Measurement of Goal Achievement</p> <p>a) Nutrition status surveys.</p> <p>b) Metric-ton output and local consumption surveys.</p> <p>c) Pollution status and environmental situation reports.</p>	<p>A.3. (as related to goal)</p> <p>a) Malnutrition is due to lack of nutrients supplied in part by this project.</p> <p>b) There is a sufficient continuous supply of wastes suitable for use as raw material.</p> <p>c) Sufficient demand exists and suitable markets can be identified to develop an economically feasible product.</p> <p>d) Environmental pollution has sufficient impact on local society to concern government.</p>										
<p>B.1. Purpose</p> <p>Development of a methodology for determining technical and economic feasibility of utilizing waste products for feed and food. Design for local plant in one LDC to convert waste products and materials to nutrients for human consumption and animal feed.</p>	<p>B.2. End of Project Status</p> <p>a) Report containing pilot-plant plans, specifications, cost accounting, and other engineering and economic data sufficient to build and operate a plant and market the products in the selected LDC will be available.</p> <p>b) A methodology detailing the steps necessary to determine technical and economic feasibility of utilizing waste products for food and feed will be available for use by planners in other LDCs.</p>	<p>B.3. (as related to purpose)</p> <p>a) Local interest, venture capital, and skills available to implement plan and build and operate pilot plant.</p> <p>b) A product can be developed which will be competitive with other food products.</p> <p>c) Processes identified will be sufficiently effective to compete for investment capital.</p>										
<p>C.1. Outputs</p> <p>a) Evaluation studies of capability of local facilities and entrepreneurs to convert food to nutrients.</p> <p>b) Feasibility studies of nature and extent of local wastes which may be converted to human or animal nutrients.</p>	<p>C.2. Output Indicators</p> <p>Published reports.</p>	<p>C.3. (as related to outputs)</p> <p>a) Reports and studies will be shared locally and with the social and capital investment community.</p> <p>b) Scale of project and range of possibilities widely applicable among LDCs.</p>										
<p>D.1. Inputs</p> <p>a) Financial support.</p> <p>b) Technical consultants.</p> <p>c) Non-capital logistic support.</p>	<p>D.2. Budget/Schedule</p> <table border="0"> <tr> <td>Personnel</td> <td></td> </tr> <tr> <td>Travel</td> <td>\$61,300</td> </tr> <tr> <td>Direct costs</td> <td>32,620</td> </tr> <tr> <td></td> <td>5,000</td> </tr> <tr> <td></td> <td>\$98,920</td> </tr> </table>	Personnel		Travel	\$61,300	Direct costs	32,620		5,000		\$98,920	<p>D.3. (as related to inputs)</p> <p>AID and other multilateral voluntary agency or international donor support will be available.</p>
Personnel												
Travel	\$61,300											
Direct costs	32,620											
	5,000											
	\$98,920											

Stanley M. Barnett

Education:

University of Pennsylvania, Ph.D., 1963, Chemical Engineering
Lehigh University, M.S., 1959, Chemical Engineering
Columbia University, B.S., 1958, Chemical Engineering
Columbia College, B.A., 1957

Thesis - Ph.D. - Bubble Motion and Mass Transfer in Non-Newtonian Fluids (1963)
M.S. - Adiabatic Two-Phase Flow of Steam and Water (1959)

Employment Experience:

University of Rhode Island, Dept. of Chemical Engineering, Kingston, R.I., July 1969 to present.

Courses - Short:

Refrigeration and Freezing (for Instituto Centroamericano de Investigacion y Tecnologia Industrial, Guatemala) given in Tegucigalpa, Honduras, March 4-8, 1974.

Courses - Undergraduate:

Introduction to Transport Phenomena
Introduction to Transfer Rates
Ocean Processes
Unit Operations Laboratory
Resource Recycling (Special Projects)
Unit Operations in the Food Industry (2 semesters)
Bioengineering (a mini-course)

Courses - Graduate:

Mass Transfer II
Transport Phenomena I and II
Polymer Chemistry
Polymer Engineering
Advanced Design
Chemical Engineering Seminar
Seminar in Contemporary U.S. Environment I and II
(Community Planning Dept.)
Biomaterials Engineering

Shell Chemical Company, Plastics Technical Center, Woodbury, New Jersey, November 1964 to September 1969:

Applied rheology to commercial polymer processing equipment
Supported technical service effort
Applied for patent on an improved blow molding process

Esso Research and Engineering Company, Process Research Division, Linden, New Jersey, August 1963 to April 1964:

Research on light hydrocarbon fermentations for food supplements
Two patent applications pending
May 1964 to October 1974:
Molecular sieve adsorption studies to find new adsorbents and improve present processes.

General Dynamics Corporation, Electric Boat Division, Groton, Conn. June 1959 to August 1961:

Study of the freeze drying of algae

Publications and Presentations:

- Velankar, S., Barnett, S.M., Hourston, C.W., and Thompson, A.R., "Hydrocarbon Mass Transfer In Fermentation Systems, submitted to Biotechnology and Bioengineering, accepted August 1974.
- Barnett, S.M., Velankar, S., and Houston, C., "Mechanisms of Hydrocarbon Uptake In Microorganisms", Biotechnology and Bioengineering XVI, 863 (June 1974).
- Cullen, J.J., IV, Barnett, S.M. and Flaherty, T.V., Jr., "Indices For Dissemination of Ambient Air Quality Information to the Public", paper #74-221, 67th Annual Meeting of the Air Pollution Control Association, Denver, Colorado, June 9-13, 1974.
- Barnett, S.M., "Bioengineering at the University of Rhode Island", presented at the ASEE Annual Meeting, Rochester, NY, June 1974.
- Barnett, S.M., "Food, Fuel and Fertilizer From Manures", presented at ICAITI, Guatemala City, Feb. 28, 1974.
- Barnett, S.M., "Problems of a Chemical Engineering Dept. in an Engineering School", presented at A.I.Ch.E. Annual Meeting, Philadelphia, November 1973.
- Velankar, S., Houston, C.W., Barnett, S.M., "Mass Transfer Effects in Hydrocarbon Fermentation", presented at Northeastern Regional Meeting of American Society of Microbiologists, May 1973.
- Cullen, J.J., IV and Barnett, S.M., "Air Pollution Indices for Public Use", presented at the New England Consortium for Environmental Protection Workshop, Hartford, Conn., May 1973.
- Barnett, S.M., et al., "The Economics of Resource Reuse for a Small Town", Proceedings of the Fifth Annual Northeastern Regional Antipollution Conference, July 1972.
- Barnett, S.M., "A Correlation for Melt Fracture", Polymer Engineering and Science 7, 3, 168 (July 1967).
- Wallman, H., and Barnett, S.M., "Evaluation of Water Recovery Systems for Space Vehicles", Chapter 9 in Medical and Biological Problems of Space Flight, edited by G.H. Bourne, Academic Press, 1963.
- Wallman, H. and Barnett, S.M., "Water Recovery Systems", Wright Air Development Division Technical Report No. 60-243, March 1960

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Patent Disclosures:

- Romano, D. and Barnett, S.M., "Fuel, Food and Fertilizer From Manures (Dec. 1973)
Adelman, D. and Barnett, S.M., "Polyurethane Foams From Seaweed (Dec. 1973)
Barnett, S.M., Hsu, C.C., and D'Ambra, P., "Wirecoating by Electrochemical Polymerization (Feb. 1974)

Publications in Preparation:

- Romanelli, R.A., Barnett, S.M., Houston, C.W. and Rose, V., "Fermentation of Cellulose Under Pressure", to be submitted to Biotechnology and Bioengineering, August 1974
Romanelli, R.A., Houston, S.M., and Barnett, S.M., "Studies On Thermophilic Cellulolytic Fungi", to be submitted to Biotechnology and Bioengineering, August 1974
Mou, D.G., Barnett, S.M., and Houston, C.W., "Fermentation and Enzymatic Saccharification of Cellulose, in preparation

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Professional Societies:

- American Institute of Chemical Engineers (A.I.Ch.E.)
Food and Bioengineering Division
Environmental Division
Membership Coordinator, National Membership Committee
American Chemical Society
Society of Rheology
Society of Plastics Engineers
R.I. Chapter of the A.I.Ch.E.
Secretary 1973-1974
Vice President 1974-1975
Professional Development Committee, Chairman 1973-1975
Membership Chairman 1973-1974
Institute of Food Technologists

Continuing Education Courses Taken:

- Enzyme Technology, University of Pennsylvania, 1973
Industrial Applications of Plastics, Rice University, 1973

Harvin Fleiselman
1706 Applewood Lane
Louisville, Kentucky 40222
502-426-4195 (Home) 502-636-4550 (Work)

Born: May 19, 1937
Married, three children

EDUCATION

- B.Ch.E. - Chemical Engineering - City College of New York - 1959
- M.S. - Chemical Engineering - University of Cincinnati - 1965
- Ph.D. - Chemical Engineering - University of Cincinnati - 1968

Other

U.S. Public Health Service Environmental Engineering Courses, Graduate
Biochemistry Course

EXPERIENCE

- 7/72-present University of Louisville, Associate Professor
- 1/70-6/72 Assistant Professor of Chemical Engineering
Teach courses in chemical, environmental, and bio-medical engineering programs. Research areas include blood oxygenation, water pollution control, and waste disposal and recycling. Active in career guidance.
- Summer 1974 Exxon Chemical Co., U.S.A., Baton Rouge, La., Environmental Consultant
Evaluated reuse of treated wastewater effluent as cooling tower make-up water.
- 1/72-present Outside Consulting
Chemical hazards and accident cases.
- 2/68-1/70 Esso Research and Engineering Co., Florham Park, New Jersey
Engineering research and consulting in fluid flow, separations, and pollution control. Projects included gasoline vapor recovery, sulfur recovery, non-Newtonian flow and heat transfer, gas pipeline roughness, and liquid-liquid extraction.
- 7/68-5/70 The County College of Morris, Dover, New Jersey Assistant Adjunct Professor of Mathematics

Resume
Marvin Fleischman

EXPERIENCE (continued)

- 6/66-6/67 Stroke Research Clinic, Cincinnati General Hospital,
Cincinnati, Ohio
- Part-time while in graduate school, advising neurologist on methods to measure cerebral blood flow rates and oxygen saturation for arteriosclerosis treatment.
- 10/64-8/65 University of Cincinnati, Chemical Engineering Department,
Teaching Fellow
- 1/61-8/63 U. S. Public Health Service, Sr. Assistant San. Engineer
(Retain commission in inactive reserves)
Rockville, Maryland; Washington, D. C.; and Cincinnati, Ohio
- Advanced Waste Treatment Research - Exploratory research on oxidation of wastewater by the hydrogen peroxide-iron system
- Radiological Health Training - Instructor in short term courses.
- Division of Radiological Health - Design of radioactive waste treatment pilot plant and other training and research facilities.
- 8/59-1/61 Monsanto Research Corp., Miamisburg, Ohio
Research Chemist
- perated an isotopes separation pilot plant.

FUNDED PROJECTS PARTICIPATED IN AT UNIVERSITY OF LOUISVILLE

- NSF Research Initiation - Diffusion of Oxygen in Intact Red Blood Cells,
April 1971 - Director
- NSF Summer Institutes in Biomedical Engineering Sciences, 1972, 1973
staff member
- NSF Institute in Environmental Science and Engineering, 1973
co-director
- Kentucky Heart Association - "Oxygen Transport in Blood" July 1973
Director
- U. S. Army Corps of Engineers, Environmental Impact Study on Cannelton Dam
1973, - staff member
- Liquid Transporters, Inc., Louisville, Kentucky - "Wastewater Treatment"
Sept. 1973 - Director

FUNDED PROJECTS (continued)

Metropolitan Council of Governments (Under contract to Schimpeler-Carradino Associates, Louisville, Ky.) "Water Quality Management Plan" - Staff

Institute of Mining and Minerals Research, University of Kentucky.
"Disposition of Wastes from Sulfur Dioxide Stack Gas Removal Processes" - 1974

Kentucky Heart Association, "Liquid-Liquid Oxygenators for Heart-Lung B Pass Systems", July, 1975, Director

Colgate-Palmolive Co., Jeffersonville, Indiana, "Sludge Disposition at Soap and Detergent Manufacturing Facility," March, 1975, Director

PUBLICATIONS (see attached list)

HONORS AND PROFESSIONAL SOCIETIES

U. S. Department of Health, Education and Welfare Environmental Health Graduate Traineeship

Phi Lambda Upsilon

Sigma Xi

American Chemical Society

American Society for Engineering Education

American Institute of Chemical Engineers - Chairman of the Louisville Section, Career Guidance Committee; Chairman, AID/LIFE Committee, National Environmental Division and Food, Pharmaceuticals, and Bioengineering Division

LIST OF PUBLICATIONS

- Fleischman, M., Price, R. H., "Gamma Irradiation of Dilute Aqueous Alkyl Benzene Sulfonate Solutions," *Environmental Science and Technology*, 1, 573-577, July 1967.
- Fleischman, M., Hershey, D., "Unsteady State Diffusion plus Simultaneous Reversible Reaction Within the Solid Phase of a Liquid Suspension," AICHE National Meeting, New Orleans, La., 1967
- Bishop, D. F., Stern, G., Fleischman, M., and Marshall, L.S., "Hydrogen Peroxide Catalytic Oxidation of Refractory Organics in Municipal Waste Waters," *Ind. Eng. & Chem. Proc. Des. and Dev.*, 7, 110-117, Jan. 1968.
- Fleischman, M., Hershey, D., "Estimation of the Rate Constants for the Oxygen-Hemoglobin Reaction," *Chem. Eng. Prog. Sym. Ser.* 66, 77 (1970)
- Fleischman, M., Hershey, D., "In Vitro Measurement of Uncombined Oxygen Concentration in Intact Red Cells," p. 107-115 in "Blood Oxygenation," D. Hershey, ed.; Plenum Press, (1970).
- Pavoni, J. L., Tittlebaum, M. E., Spencer, H. T., and Fleischman, M. "Ozone Disinfection of Viruses," *Water and Sewage Works*, 119 (12) 59, 1972.
- Spencer, H. T.; Fleischman M., "Ozonation of Secondary Wastewater Effluents," *Proc. Sec. Ann. Env. Eng. & Sci. Conf.*, Louisville, Ky. April 1972.
- Fleischman, M., Pavoni, J. L., "Environmental Science and Technology for Pre-College Teachers," *Engineering Education*, p. 613, May 1973.
- Contributor to Endelman & Prober, "A Series of Problems on Industrial Water Processes for Use by Chemical Engineers," Water 1972 AICHE Symp. Ser. 129, Vol. 69, p. 465 (1973).
- Cleaver, T. G., Fleischman, M., Pierce, W. H., and Spencer, H. T. "Summer Institute in Biomedical Engineering Sciences for College Teachers," *Eng. Educ.*, Dec. 1973, pp. 186-189.
- Fleischman, M., Pavoni, J. L. "Growing Interactions of Engineering and Society," *J. Env. Educ.* 5 (2), pp. 13-19, 1973.
- Nebel, C. et al. "Ozone Disinfection of Industrial Municipal Secondary Effluents," *J. Water Pollution Control Fed.* 45 (12), pp. 2493-2507 (Dec. 1973).

Chang, B., Fleischman, M., Miller, C. E. "Oxygen Mass Transfer Rates in Intact Red Blood Cells," in Oxygen Transport to Tissues H. Bicher, Ed., Adv. in Exptl. Med. & Biol. Series, Vol. 37B, Plenum Press, 1974.

Fleischman, M., and B. H. Chang, "Oxygen Absorption by Intact Red Blood Cells," Annual FASEB Meeting, Atlantic City, N. J., April 1974 (Fed. Proc., Part I, March 1974).

Chang, B. H., Fleischman, M. "Oxygen Absorption by Intact Red Blood Cells," AIChE 77th National Meeting, Pittsburgh, Pa., June 1974 (submitted to Canadian J. Chem. Eng.)

Fleischman, M., "Reuse of Wastewater Effluent as Cooling Tower Makeup Water" Conf. on Complete Waste Reuse, May 1975, Chicago, Ill. (will be published in conference proceedings)

Richards, D. L., Fleischman, M. "Ozone Transfer to Aqueous Systems in a Static Mixer", 2nd Inter. Conf. on Ozone Technology, Montreal, May 1975

IN-HOUSE REPORTS

"Gas Pipeline Roughness Factor Improvement," Esso Engineering November, 1969.

"Recovery of Gasoline Vapors in Truck Loading Terminals," Esso Engineering, November, 1969.

"Flow Simulation Study of Resid Deasphalting in a Shed Row Tower," Esso Engineering, June, 1969.

"Fluid Flow and Heat Transfer in Polypropylene Slurries," Esso Engineering, February, 1969.

Several Radiological Health papers for U. S. Public Health Service Training Manuals covering radiochemistry and radioactive waste treatment, 1961-1963.