Do the Effects of Exercise on Breast Cancer Prevention Vary with Environment?

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Columbia, SC 29208

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Fort Detrick, Maryland 21702-5012

Abstract:

Does walking outdoors have the same breast cancer protective effect as walking on a treadmill indoors, away from natural light, in a typical gym atmosphere? Is the ambient exposure to sunlight important in stress and breast cancer risk reduction? Our basic premise is that the breast cancer protective mechanisms of exercise depend on context of exercise, not just on the number of repetitive muscular contractions completed over a specific period of time, and that a more pleasant and peaceful environment will decrease perceived stress and enhance immunity, theoretically leading to more positive mood and more effective cancer surveillance. A more relaxed walking atmosphere may decrease physiological consequences of stress, such as high cortisol, melatonin, and norepinephrine (as measured by alpha amylase). Revisions to the original endpoints include adding a questionnaire to assess mood changes, and replacing blood samples with salivary hormone measurements of cortisol, alpha amylase, and melatonin.

Subject Terms:

exercise, stress hormones, breast cancer prevention
# Table of Contents

Cover........................................................................................................... ...1

SF 298.............................................................................................................. 2

Introduction .................................................................................................... 4

Body................................................................................................................. 5

Key Research Accomplishments................................................................. 7

Reportable Outcomes..................................................................................... 8

Conclusions.....................................................................................................9

References.....................................................................................................10

Appendices....................................................................................................12
Introduction

Do the Effects of Exercise on Breast Cancer Prevention Vary With Environment?

Does walking outdoors have the same breast cancer protective effect as walking on a treadmill indoors, away from natural light, in a typical gym atmosphere? Is the ambient exposure to sunlight important in stress and breast cancer risk reduction? Our basic premise is that the breast cancer protective mechanisms of exercise depend on context of exercise, not just on the number of repetitive muscular contractions completed over a specific period of time, and that a more pleasant and peaceful environment will decrease perceived stress and enhance immunity, theoretically leading to more positive mood and more effective cancer surveillance. A more relaxed walking atmosphere may decrease physiological consequences of stress, such as high cortisol, melatonin, and norepinephrine (as measured by alpha amylase). Revisions to the original endpoints include adding a questionnaire to assess mood changes, and replacing blood samples with salivary hormone measurements of cortisol, alpha amylase, and melatonin.
Body of Report

Task 1. Develop Plan for Study Computer Database, Months 1-3
   a. Normal study values will be entered for each outcome variable, so out-of-range values will immediately alert investigators to potential problems. Completed
   b. Access database will be developed to monitor each volunteer and to record data from laboratory analyses and medical histories.

Tracking system was in place. However, due to the resignation of the project coordinator only two days before the study began, after recruiting only 5 women, the study was then expanded to healthy postmenopausal women who normally exercised 3.5 hours/week. It was not possible to recruit 13 healthy postmenopausal women who had been treated for early breast cancer who normally exercised at least 3.5 hours/week. Our constraint was the South Carolina summer, which is hot and muggy, and the scheduled study day for the outside exercise was May 25th. Our additional constraint was the necessity of completing the study before October 17th, ruling out the possibility of postponing the study until the weather became cooler in the fall.

Task 2. Obtain IRB approval from local institutions (Palmetto Health Alliance and the University of South Carolina).
   a. Done

Task 3. Obtain IRB approval from the U.S. Army
   a. The re-designed endpoints were submitted to the Human Subjects Protection Specialist, and the changes were approved February 14, 2005 by my local IRB (University of South Carolina),

Task 4. Subject Recruitment and Study, Months 5-7
   a. Subjects were recruited primarily by the PI during the 2 days prior to the commencement of the study. This was the result of the unexpected resignation of the project manager, Wendy MacKenzie, 2 days before the commencement of the study.

Recruitment of healthy volunteers and selection of eligible subjects is estimated to take 3 months.
   a. A total of 26 healthy postmenopausal women were recruited. However, due to heavy rains on the afternoon of the first exercise session, 5 women did not come to the first session, and 2 others were determined to be premenopausal, rather than postmenopausal, and therefore were ineligible. A total of 19 healthy postmenopausal women participated in the study. There were no dropouts.

Task 5. Data Analysis of Results from Healthy Volunteers, Months 8-12
a. Meetings with oncologists and member of the Exercise Sciences Department at the University of South Carolina to present preliminary data.
   1. Meetings have taken place, but due to difficulties in the lab analysis of the saliva samples for melatonin, the final data were only available October 15, 2005. Meetings are ongoing and we hope to have the final manuscript submitted by the end of October, 2005.

b. Final meeting with volunteers to explain study results and to answer any questions.
   1. Meeting was scheduled for September, 2005, but we will wait until all analyses have been completed.

c. Final report to USARMC
   1. This is the Final report to USARMC.
Key Research Accomplishments

1. Completed the study.
2. Presented poster at the South Carolina Public Health Association Annual Meeting, May 25, 2005 at Springmaid Beach Conference Center, Myrtle Beach, SC.
3. Poster accepted for the American Association of Cancer Researchers Frontiers in Cancer Prevention Research October 30 – November 2, 2005 in Baltimore, MD.
4. Submission of abstract to the American Society of Preventive Oncology Annual meeting February 26-28, 2006 in Bethesda, MD.
5. Final analyses and manuscript preparation continues.
6. Degrees obtained that were supported by this training grant:
   - Senthil Raghavan was supported by this grant for two years, and completed his Masters degree in Public Health.
   - Santosh Ghumare was partially supported by this grant during his classwork towards his Masters degree in Public Health.
7. Grant applications based on these results are in process.
Reportable Outcomes

1. Presented poster at the South Carolina Public Health Association Annual Meeting, May 25, 2005 at Springmaid Beach Conference Center, Myrtle Beach, SC.

2. Poster accepted for the American Association of Cancer Researchers Frontiers in Cancer Prevention Research October 30 – November 2, 2005 in Baltimore, MD.

Conclusions

1. Although there was no change in acute stress (salivary alpha amylase) for women walking outdoors, there was a 36% increase for the women when they walked on treadmills (p=0.033) (comparison of pre versus post exercise indoors).

2. Chronic stress (cortisol) levels were also 25% higher for women after an hour of treadmill walking indoors than after an hour of walking outdoors (p<0.027) (post indoors vs post outdoors).

3. Treadmill walking was also associated with a 67% increase in anger assessment, compared to a 50% decrease in angry feelings after an hour of outdoor walking, as a result, the indoor anger post measurements were significantly higher (p=0.037) than the post measurements of anger outdoors (post indoors versus post outdoors). Both frustration and worry were also higher indoors (p <0.02).

4. Positive emotions of feeling pleased, happy, delighted, and joyful were all higher after an hour of walking outdoors (p<0.05).

Our original hypothesis that the exercise environment is an important modulator of stress and mood responses is supported by our data. More research is needed in assessing what makes exercise pleasurable, as a pleasant experience would contribute to greater adherence to an exercise regime and to more favorable reduction in stress hormones.
References

1. Manuscript preparation is in progress.
List of Personnel

P.I.
    Jane Teas, Ph.D.
Co-P.I.
    Gregory Hand, Ph.D.
Project Director
    Wendy MacKenzie
Medical Monitors
    Gladys Gaillard-McBride, APRN
    Renee I. L'Ecuyer, MSN, APRN, CFNP
Statistician
    Daniela K. Nitcheva, Ph.D.
Appendices

1. Abstract for poster at the South Carolina Public Health Association Annual Meeting, May 25, 2005 at Springmaid Beach Conference Center, Myrtle Beach, SC
3. Abstract submitted to the American Society of Preventive Oncology Annual meeting February 26-28, 2006 in Bethesda, MD.
4. CV for Jane Teas, Ph.D.
Studies of breast cancer risk and exercise have generally reported lower risk with regular exercise. The mechanisms of action are not well understood, and we propose that the specific environment in which exercise is done plays an important role in its anticarcinogenic effects. This could either be via a direct physiological response modification in stress hormones such as cortisol and norepinephrine and the anti-stress/antioxidant hormone melatonin, or indirectly via mood in which a pleasant exercise experience would lead to pleasure-associated improvements in immunity and greater adherence to an exercise regime. Little is known about the effects of exercise on healthy postmenopausal women. Most studies have focused on college students and elite athletes. In this study we examine the effects of exercise done either indoors in a university gym on a treadmill or outdoors, walking along a college campus. Twenty four postmenopausal women were recruited to walk for 1 hour at approximately 3 miles/hour rate first indoors and then outdoors. Half of the women had a history of having been treated for breast cancer. All women received brief physical exams before beginning exercise. Saliva samples and three brief qualitative stress questionnaires were used to estimate stress levels. Noise and light exposures in the two kinds of exercise environments were also measured as possible confounding variables. As the study is ongoing, results have not yet been analyzed, but will be available by the conference date. By describing exercise in different environments and its effects on different physiological systems, we will be able to make more precise on breast cancer risk reduction strategies.
Do the Effects of Exercise Vary with Environment?

Jane Teas, Mindy Holland, Santosh Ghumare, Daniela Nitcheva, Wesley Dudgeon, Kisito Ogoussan, Gregory Hand.

Most of the 57 epidemiologic reports comparing exercise with the risk of breast cancer have found that exercise reduces risk, with median risk reduction averaging about 20-30% for postmenopausal women. Of the 12 studies that did not show a reduction in risk, two found an increase, and 10 found no association. Recent evidence from breast cancer survivors in the Nurses Health Study indicates that exercise for 1 – 3 hours per week can decrease breast cancer recurrence by up to 50%. Several mechanisms have been proposed, including modulation of hormones, improved weight control, and possible changes in immunity. Methodological issues of concern have been accurate measurement of intensity, dose response, and amount of exercise. However, exercise is more than the repetitive contraction and relaxation of muscles. Most exercise physiology studies have focused on college students and elite athletes, and little is known about the effects of exercise on healthy postmenopausal women. We investigated the possibility that the environment in which the exercise takes place can impact physiological and psychological responses to exercise, and could be an important cofactor in explaining variation in the protective effects of exercise against breast cancer. Methods: 19 healthy postmenopausal women who normally exercised at least 3 hours/week were recruited for the study. We compared the effects of an hour of walking exercise done at a comfortable self-determined pace either indoors in a university gym on a treadmill, or outdoors, walking on the university campus. To simulate a normal gym atmosphere, we played similar heavy metal music at the same loudness in our gym lab as played in two other workout rooms in the same PE center. Mood changes were assessed by pre and post exercise questionnaires (Visual Analogue Scale-Anxiety, Visual Analogue Scale-Happiness, Positive Affect Scale and the Negative Affect Scale), blood pressure and pulse rate variations, and salivary hormone changes in chronic stress (salivary cortisol) and acute stress (norepinephrine, as indirectly measured by changes in salivary alpha amylase). Results: Although there was no change in acute stress (salivary alpha amylase) for women walking outdoors, there was a 36% increase for the women when they walked on treadmills (p=0.03). Chronic stress (cortisol) levels were also 25% higher for women after an hour of treadmill walking indoors than after an hour of walking outdoors (p=0.03). Treadmill walking was also associated with a 66% increase in anger assessment, compared to a 50% decrease in angry feelings after an hour of outdoor walking. The differences in post exercise anger was significantly different (p=0.01). Eighteen of the women preferred walking outdoors along the wooded paths over walking on treadmills in a gym setting. Conclusions: The exercise environment can be a significant factor in the stress response to exercise. More research is needed in assessing what makes exercise pleasurable, as a pleasant experience would contribute to greater adherence to an exercise regime and to more favorable reduction in stress hormones.
Stress hormones, mood, and exercise

Teas J, Holland M, Nitcheva D, Ghumare S, Ogoussan K, Dudgeon W, Hand G.

Exercise physiology studies have focused primarily on individuals under the age of 50 years, and little is known about the effects of exercise on healthy postmenopausal women. In this study we compared the effects on both stress hormones and mood changes associated with walking for an hour outdoors and indoors.

**Methods:** 19 healthy postmenopausal women who normally exercised at least 3 hours/week were recruited for the study. We compared the effects of an hour of walking exercise done at a comfortable self-determined pace either indoors in a university gym on a treadmill, or outdoors, walking on the university campus. To simulate a normal gym atmosphere, we played similar heavy metal music at the same loudness as music played in two public workout rooms in the same exercise facility.

Mood changes were assessed by questionnaires and salivary hormone changes in chronic stress (salivary cortisol) and acute stress (norepinephrine, as indirectly measured by changes in salivary alpha amylase).

**Results:** Subjects reported improved mood (pleased, delighted, happy, and joyful) after walking in both environments. However treadmill walking for an hour was associated with a 67% increase in self-reported anger, compared to a 50% decrease in angry feelings after an hour of outdoor walking (p=0.037). Stress hormone responses varied with environment. Alpha amylase was unchanged for women walking outdoors, but 42% higher for the women after walking on a treadmill (p=0.057). Cortisol levels were also 25% higher for women after an hour of treadmill walking indoors compared to outdoor walking (p<0.027).

**Conclusions:** The exercise environment can be a significant factor in mood and stress hormone responses to exercise and these changes may contribute to understanding how exercise reduces cancer risk.

Funded by the Department of Defense Concept Award A100751
CURRICULUM VITAE OF JANE TEAS

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Health Promotion Education and Behavior
South Carolina Cancer Center
2221 Devine St. Room 230
Columbia, South Carolina 29203

Home Address
6049 Robinwood Rd
Columbia, SC 29206

TEL: (803) 734-4429
FAX: (803) 734-5505
TEL: (803) 738-3129

Academic Training

Postdoctoral Research Fellow
Harvard School of Public Health
Boston, MA
1978-1983

Department: Interdisciplinary Programs in Health. Special Projects in Breast Cancer Epidemiology, Animal Models of Carcinogenesis (Seaweed), AIDS, and Anthropological Research in Medical Decision Making.

Ph.D.
Johns Hopkins University
School of Hygiene and Public Health
Baltimore, MD
1978

Dissertation title: Behavioral Ecology of Rhesus Monkeys in Kathmandu, Nepal

B.A.
University of California
Berkeley, CA
1973

Major Fields: Anthropology and Geography

Academic Positions:

Research Assistant Professor
University of South Carolina, Department of Environmental Health Sciences
1999-present

And the South Carolina Cancer Center
Continue to research health effects of brown seaweed against both cancer (breast, colon, and prostate), and HIV.

Studied macrobiotics and cancer and faith and healing for a CDC funded grant on Complementary and Alternative Medicine with Curative Intent

**Member:** South Carolina Cancer Center, South Carolina Cancer Alliance; University of South Carolina

**Member:** Women's Studies Affiliate Board 1999-2003

**Member:** African Studies Working Group 2004

**Member:** American Anthropology Association

**Member:** American Association for Cancer Research

**Research Assistant Professor** 1990-1999

University of Massachusetts Medical School, Department of Medicine, Division of Preventive and Behavioral Medicine, Worcester, MA

Wrote numerous grants, three of which have been funded to study brown seaweeds and breast cancer prevention. Taught graduate course in Medical Anthropology

**Lecturer** 1990-1991

University of Massachusetts, Department of Anthropology, Boston, MA

Taught two-semester undergraduate course in primate behavior.

**Research Associate** 1984-1985

Harvard University, Department of Anthropology, Cambridge, MA

Infant Care Project. Analyzed data collected on breastfeeding and non-breastfeeding mothers living in the Boston area, co-authored papers, and supervised two research assistants.

**Grants Awarded:**

**University of South Carolina Education Foundation and personal E-Funds at the Department of Health Promotion, Education and Behavior** 2/03-open

Algae and AIDS

**Purpose:** To explore the possibility that dietary algae could prolong symptom-free survival and reduce HIV viral load for HIV positive patients

**Role:** PI

**University of South Carolina Office of Research** 7/04-7/06
Part of the Center for Cancer Complementary and Alternative Medicine (CCCAM) at the University of South Carolina

Dietary algae in poor prognosis breast cancer

Purpose: To explore the consequences of dietary algae on cell-cell adhesion.

Role: PI

Department of Defense / Phase VI Medical University of South Carolina and University of South Carolina 2/04 – 1/06

Dietary Algae as a Modulator of Breast Cancer Metastases.

Purpose: To explore validate methods for detecting metastatic breast cancer cells in peripheral blood and to evaluate whether dietary seaweed has an effect on breast cancer cell numbers and CXCR4/SDF-1 binding

Role: PI

Department of Defense BC996167/DAMD-17-00-1-0659 10/17/05

Do the Effects of Exercise on Breast Cancer Prevention Vary with Environment?

Purpose: To investigate whether the effects of exercise vary with the specific environment (indoors versus outdoors).

Role: PI

Centers for Disease Control SIP6 U48/CCU409664 10/1/2000-9/30/2004

Complementary and Alternative Medicine with Curative Intent

Purpose: To investigate the use and efficacy of faith healing and macrobiotics as complementary and alternative medicine as it is currently being used in the Columbia, South Carolina area.

Role: PI


Dietary Seaweed and Soy and Early Breast Cancer: A Randomized Trial

Purpose: The major goal of this study is to compare the effects of dietary seaweed and soy to placebo. We are collecting data on biomarkers of breast cancer risk.

Role: PI

The South Carolina Cancer Center July 1, 2000 - June 30, 2001

Ratio of Two Urinary Estrogen Metabolites and Risk of Prostate Cancer

Purpose: To determine if estrogen metabolism is correlated with PSA levels and prostate cancer in men.

Role: PI

Centers for Disease Control October, 2000 - September, 2004

Complementary and Alternative Medicine with Curative Intent
Purpose: To investigate faith healing practices in Columbia, SC, and to document the use of macrobiotics in the treatment of cancer.
Role: PI

Palmetto Health Foundation
October 2000 - September 2003
Pilot Study of HBO Treatment to Reduce Breast Cancer Treatment Related Lymphedema
Purpose: To evaluate the effectiveness of hyperbaric oxygen therapy on breast cancer treatment related lymphedema.
Role: PI

Susan G. Komen Foundation
1998-2000
Brown Seaweed as a Breast Cancer Preventive
Purpose: Evaluate the health effects of chronic seaweed ingestion in healthy postmenopausal women.
Role: PI

Earthwatch
1984
Rhesus Maternal Care and Demography. Kathmandu, Nepal
Purpose: Collect primate behavioral data.
Role: PI

Wallace Genetic Foundation
1982
Seaweed and Breast Cancer
Purpose: Pilot study to explore the effects of dietary seaweed in a rat Dimethylbenzanthracene (DMBA) mammary carcinogen model
Role: PI

Earthwatch
1978
Male Behavior of Rhesus Kathmandu, Nepal
Purpose: Collect primate behavioral data on non-troop males and their social behavior.
Role: PI

Earthwatch
1977
Rhesus Troop Home Range Behavior
Purpose: Collect information on the home range behavior of two troops of monkeys living in temples in Kathmandu, Nepal.
Role: PI

National Geographic Society
1974-1978
Temple Monkeys of Kathmandu Nepal
Purpose: Collect information on monkeys living in two temples in Kathmandu Nepal
Role: Project Leader

Publications


Publications in Press


Book Chapters


Teas J. Dietary Brown Seaweeds and Human Health Effects
Seaweed Resources Ed: Critchley, Alan T, Masao Ohno and Danilo Largo

Book Submitted:


Papers Submitted:

Teas J, Braverman LE, Kurzer MS, Pino S, Hurley TG, Hebert JR. Seaweed and Soy: Companion Foods in Asian Cuisine and Their Effects on Thyroid Function in American Women

Heiney SP, McWayne J, Teas J. Being Real on Holy Ground: The Lived Experience of Hospital Chaplains

Papers Presented


Teas J. “Healing among the faithful” University of South Carolina Medical Humanities Lunch Seminar, October 30, 2002.


Posters Presented

Teas J. Dietary Algae and Breast Cancer. Hollings Cancer Center MUSC 5th Annual Research Retreat Citadel's Holliday Alumni Center, November 18, 2005


Teas J, Ph.D., Fitton HJ, Ph.D., Irihime M, M.S., Ghumare S, BOMB³, Talwani R, M.D.⁴, Phillips KD, Ph.D.⁵, Hand G, Ph.D.³, Dudgeon W, M.S.³, Daniels D, M.D., Randolph LJ, M.D., Belay A, Ph.D. Dietary Algae as Modulator of CD4 Cell Counts in
People with HIV. 3rd Annual SC Nutrition Research Summit on Friday, November 4, 2005 Columbia Conference Center, Columbia SC.

**Teas, J.**, Holland, M., Ghumare, S. Do the Effects of Exercise on Breast Cancer Prevention Vary with Environment? **South Carolina Public Health Association** May 25, 2005 Myrtle Beach, SC.

Ghumare, S., **Teas, J.** AIDS Epidemic in India - Exploring New Alternatives **SCPHA** May 25, 2005 Myrtle Beach, SC.


AL Cousins, S Heiney, P Verma, JE Cunningham, G Khushf, J Teas. Data in search of analysis: How can we understand patient narratives that attribute healing to faith? **Alpha Xi Chapter of the Sigma Theta Tau International Honor Society of Nursing.** Columbia, SC February 2001.


**Teas, J., Cunningham, J.E. and Braverman, .Dietary Seaweed and Soy and Early Breast Cancer: A Randomized Trial. Era of Hope Department of Defense Conference Proceedings, June 8-11, 2000**

**Reviewer for:**

Journal of Nutrition
International Immunopharmacology
Journal of Pharmacy and Pharmacology.
Molecular and Cellular Biochemistry
Clinical and Experimental Pharmacology and Physiology

**Review Committees**

1996-1999 University of Massachusetts IRB
1998 University of Massachusetts Internal Grant Review
2004 University of South Carolina Research Centers of Economic Excellence Review

Conferences Organized


Other Activities

Expert testimony given to FTC in support of SeaVegg
South Carolina Science Fair Judge 2000-present
Breast cancer telephone support group invited guest speaker

Government Testimony


http://nccam.nih.gov/about/advisory/capcam/minutes/2002feb.htm#6

Patent Application

University of South Carolina Patent Office
USCRF No. 380.01b-PPA (Teas)
Algae and AIDS (PPA)
Provisional Patent Application
May 4, 2005

Work Experience

Principal Investigator
Seaweed Studies (Komen and Army):
Collected 22 samples of edible seaweed for iodine determination, identified seaweed harvesters, visited harvest sites, chose site and harvester, identified encapsulator, visited site, directed patient recruitment, organized sample container identification system, labeled containers, performed basic laboratory sample preparation of urine and blood specimens,
**Supervised** Project Director who coordinated volunteer enrollment and participation, identified new research questions and arranged for additional analyses.

**Processed** blood and urine samples, developed labeling and storage systems; developed collaborative relationships with investigators in 7 labs;

**Data analysis and interpretation; Writing articles on results.**

**Department of Defense Studies (breast cancer and seaweed; exercise)**

Wrote IRB applications and have worked with the Army IRB to try to achieve permission to conduct the studies

Conducted preliminary flow cytometry studies, interpreted data, wrote follow-up grants

**Complementary and Alternative Medicine Studies**

Wrote IRB applications

Supervised project coordinator, 4 students, worked with colleagues, hired professionals,

Conducted fieldwork on faith institutions

Conducted interviews

Writing and data interpretation

Directed project

Copy-edited 2,780 pages of transcripts that were then given to the Smithsonian Museum of American History permanent research collection December 28, 2004

**Earthwatch and National Geographic**

Designed and directed various primate research projects, trained 60 volunteers in behavioral methodologies, coordinated the on-site data collection and analysis in Kathmandu, Nepal, worked with primatology colleagues, analyzed data, interpreted data, wrote papers

**Principal**

U.S. Department of Defense 1998-present

**Investigator**

**IDEA Award**

Principal investigator for a project involving dose-response relationship of brown seaweeds and breast cancer prevention. Identified seaweeds to be used, visited harvesters. Recruitment will begin during the summer of 1999.

**Member**

Multicultural Committee 1993-99

Touchstone Community School

Grafton, MA

Active member of Multicultural Committee that seeks to provide diversity to the students at Touchstone Community School. Classroom speaker on primate behavior and culture and people of Nepal.

**Member**

Human Subjects Committee 1992-1995

University of Massachusetts Medical School
Worcester, MA

Member of the internal review board that reviews all scientific proposals for issues that relate to safety of human volunteers.

Chairperson
Ways and Means, Welcome Wagon 1992
Shrewsbury, MA

Organized fundraising activities for charitable organization of women in Shrewsbury. Responsible for raising the most money in the organization’s history.

President
Tobin Hill, Inc 1987-1991

Co-created a company to produce and sell seaweed-based moisturizer. Co-designed product, identified chemist and seaweed ingredients, co-designed label, wrote bylaws, filed incorporation paperwork, co-wrote advertising, co-designed business plan, co-designed packaging, identified packaging company, did order fulfillment, oversaw mail order advertising, kept accounts, and filed taxes and filed un-incorporation paperwork.

President
Dorchester, MA

Organized and moderated one-day workshops for New England Interstate Water Pollution control commission on Pesticides and Drinking Water. Edited newsletter on “Potatoes, Pesticides, and Problems” workshop, wrote newsletter on “Lawncare”; organized and provided logistical support for two day workshop on Contaminated fish and Shellfish; wrote final summary of workshop for EPA Region I.

Organized and conducted field research on possible animal vectors of AIDS. Identified hogs living in the Belle Glade, Florida AIDS epicenter, coordinated collection of hog blood and delivery of the blood to Pirbright Labs in England. Collected ticks from houses and nearby areas to the Belle Glade epicenter. Arranged for the ticks to be tested for AIDS transmission.

Consultant
UNICEF 1987

Kampala, Uganda

Designed and wrote a grant to the World Health Organization for $20,000,000 for the UNICEF AIDS public health program in Uganda.

Toxics Coordinator
New England Interstate Water Pollution Control Commission 1985-1986
And
Northeast States for Coordinated
Air Use Management
Boston, MA

Coordinated interstate workgroups on aquatic toxicity, pesticides, drinking water, and health, and air toxics for the six New England states, New York, and New Jersey. Edited regional air toxics risk assessments for tetrachloroethylene and trichloroethylene.

**Principal Investigator**
Earthwatch/Center for Field Research
Belmont, MA

**Medical Writer**
“New York Native”
1984-1991

Summarized information on AIDS for a general audience. The “New York Native” was a gay newspaper in New York City. My particular focus was on African Swine Fever Virus and AIDS.

**Principal Investigator**
Wallace Genetic Foundation
1982

Designed and conducted an animal study to test the protective effects of dietary seaweed against chemically induced mammary carcinogenesis; coordinated the efforts of a veterinarian and a biostatistician and provided animal care during the project.

**Consultant**
John Snow Inc
210 Lincoln St.
1981, 1982 and 1983

**Boston, MA 02111**

Provided an annotated bibliography of available research relating to traditional medical practices and health attitudes of people in Nepal, and the status of women in Nepal; designed two goiter intervention programs for a health project in Nepal.

**Collaborator**
Legal Medicine
Harvard School of Public Health
665 Huntington Ave
Boston, MA 02115

Interviewed doctors, nurses, data managers, and hospital administrators about perceived problems with informed consent procedures for cancer patients.