

## **Overview:**

- **The Thai Fogarty ITREOH Center** will provide training and research opportunities in a partnership between Chulalongkorn University in Thailand and Rutgers-the State University of New Jersey and the University of Medicine and Dentistry of New Jersey (UMDNJ) in the United States.
- Other collaborating institutions include the New Jersey Department of Environmental Protection (NJDEP), the New Jersey Department of Health and Senior Services (NJDHSS), Wake Forest University School of Medicine, the Centers for Disease Control and Prevention (CDC), the National Institute of Environmental Health Sciences (NIEHS), the US Geological Survey (USGS) and the Thai-US Fulbright Foundation.
- The project International Advisory Committee consists of scientists from UC Berkeley, WHO, Wake Forest University, the editor of Public Health Reports, CDC, NIEHS, Chulalongkorn University, and the Executive Director of Thai-US Fulbright Foundation.
- The training and research objectives will be accomplished by in-country short- and long-term training opportunities as well as opportunities in the US for graduate degrees, visiting scholars, and short term training at Rutgers and UMDNJ as well as CDC, NIEHS, Wake Forest University, and two New Jersey State Agencies.
- Funding for the program will include the \$150,000 per year from the FIC as well as a real dollar match of \$15,000 per year from the New Jersey Agricultural Experiment Station (NJAES) at Rutgers, \$15,000 real dollar match from the UMDNJ-School of Public Health (SPH), Jubilee Scholarships from the Thai Government, and three short term ORISE fellowships (valued at \$27,000) from the CDC.
- We will have a pilot project program. The criteria include that the PI be a Thai scientist and that there is at least one US scientist on the project. During all five years, there will be a project from the NJAES and SPH matching funds. In Years 2, 4, and 5, there will also be pilot projects supported by the FIC funds (two in Years 2 and 4, and four in Year 5).
- The major theme of this proposed ITREOH program is the consequences of pesticide use and control technologies.

## **A. Background**

**A.1. Program Objective and Theme:** We propose to establish a **Thai Fogarty ITREOH Center**, through a partnership with Chulalongkorn University in Thailand and Rutgers-the State University of New Jersey and the University of Medicine and Dentistry of New Jersey (UMDNJ) in the United States as well as collaborators at the New Jersey Department of Environmental Protection (NJDEP), the New Jersey Department of Health and Senior Services (NJDHSS), Wake Forest University School of Medicine, the Centers for Disease Control and Prevention (CDC), the National Institute of Environmental Health Sciences (NIEHS), the US Geological Survey (USGS) and the Thai-US Fulbright Foundation. This program will provide (1) in-country (Thailand) short and long term training opportunities, (2) opportunities at Rutgers/UMDNJ for graduate degrees, visiting scholars, and (3) short term training at Rutgers/UMDNJ as well as CDC, NIEHS, Wake Forest University, and the two New Jersey State agencies. **The major theme of this proposed ITREOH program is the consequences of pesticide use and control technologies.**

**A.2. Program Need:** Agriculture is a significant part of the Thai economy, contributing approximately 11% to the gross domestic product (GDP). It employs approximately 64% of the total labor force. The major crops in Thailand are rice, cassava, rubber, coconut, cotton, sugar cane, and oil palm. Thailand is a major market for pesticides. In the decade of 1980 to 1990, the annual growth rate of the pesticide market was 8.8%. In 1994, sales of pesticides in Thailand amounted to \$247 million USD. Most of the pesticides used in Thailand are imported, including 52% of the pesticides used as herbicides, 38% as insecticides and 10% as fungicides. Of major importance is the fact that 73% of the imported pesticides are classified by WHO as Category 1a, extremely hazardous or Category 1b, highly hazardous, and 33% are WHO classified as moderately hazardous.

Pesticide poisoning incidents are seldom documented in Thailand. In 1998, a study concluded that only 2.4% of workers with poisoning incidents consulted a hospital. A study cited by GZT estimated that there could be as many as 39,600 pesticide poisoning cases per year in Thailand. Thus, the acute health burden of pesticide use in Thailand is substantial. Additionally, in Thailand, as in other countries, the chronic health burden of pesticide use may well exceed even the acute burden. Unfortunately, the chronic burden remains very poorly understood. For example, histories of pesticide use (including duration and types of pesticides use in the long term) have been characterized only sketchily, and only in a limited number of Thailand's many agricultural subpopulations. Furthermore, there has been essentially no effort to date to characterize the burden of illness and symptoms that continue after discontinuation of pesticide use (persistent health burden). Similarly interventions to reduce hazardous pesticide use and to reduce harmful health effects associated with pesticide use have not yet been devised or evaluated.

There is clearly an urgent need for environmental health research and education in Thailand. This need has been increasingly recognized in the recent years by the Thai Government and the Thai scientific community. The training program, funded by the National Research Center for Environmental and Hazardous Waste Management (NRC-EHWM) is an excellent example (this program is described below). Therefore, the time for establishing the ITREOH Center in Thailand is appropriate and the theme on pesticides is opportune.

**A.3. Program Rationale:** The proposed program is the result of a long history of collaboration between UMDNJ/Rutgers and Thai colleagues. Dr. Mark Robson, the PI and Program Director of the proposed Thai ITREOH Center, has been collaborating in Thailand with the former President of Prince of Songkla University (PSU), Dr. Prasert Chitapong since 1995. Dr. Chitapong recently stepped down as PSU President and was elected to the Thai Congress as a Senator from his region in southern Thailand. Dr. Robson has been teaching in the international post-graduate programs for environmental and hazardous waste management, a multidisciplinary program offered by the NRC-EHWM at Chulalongkorn University since 2001. He developed and has taught a course each year in Environmental Risk Assessment as well as mentored graduate students there as a thesis co-advisor (presently four PhD students and one MS student). To date, four papers have been published and several others are in press, all resulting from the collaborative research. These papers, with Thai and US authors, are provided in the Appendix of this proposal.

In 2003, Rutgers and UMDNJ sponsored a Research Symposium in Thailand to start the ground work for the development of this Fogarty Application. Faculty from Rutgers, UMDNJ, and Chulalongkorn were in attendance to explain and review the grant process, types of funding opportunities, and related issues. Since 2003, the research team has been working to develop ideas and linkages for the preparation of this proposal.

Drs. Robson and Buckley have hosted NRC-EHWM students at the UMDNJ-SPH and the Environmental and Occupational Health Sciences Institute (EOHSI) to learn laboratory techniques, expand research projects, and analyze data. EOHSI and SPH have sponsored, through the NIEHS Center Pilot Project Program, two pilot research studies in Thailand. The first project is on the effects of alternative water sources and the incidence of high levels of arsenic in drinking and bathing water. The second project assessed the effects of shipyards and the boat repair activities on the facility's workers and their children. Both of these studies are being completed and there are papers currently in press.

**A.4. Training Environment:** At Rutgers/UMDNJ, we have research and teaching programs covering the five key topic areas related to the theme of the proposed Thai ITREOH Center. These five key areas are (1) Pesticide Use, Pest Management and Ecology; (2) Exposure Science and Biomarkers; (3) Environmental Epidemiology and Risk Assessment; (4) Health Effects: Occupational Safety, Medicine and Toxicology; and (5) Health, Economic, and Policy Related Issues to Pesticide Use. Faculty members from the three universities (Rutgers, UMDNJ, and Chulalongkorn) have been identified and agreed to participate in the proposed program. These faculty members collectively have expertise covering all the five areas (See Table 1). Many of the faculty members have direct experience with pesticide research in the US and internationally, as demonstrated in the bio-sketches.

The training environment at Rutgers/UMDNJ for the proposed program houses three graduate or doctoral programs: the Joint Program in Toxicology, the Joint Program in Exposure Assessment, and the Joint Program in Public Health. This training environment also is home of the Office of Public Health Practice (OPHP), which provides training to 3,000 individuals on-site and 20,000 total off-site each year through 200 on-site courses and an additional 1,000 regional courses and workshops. OPHP has support of \$2,178,055 from NIEHS, \$120,000 from HRSA, \$200,000 from NIOSH, and \$1,000,000 from CDC. In addition, the following state or federal governmental agencies will provide support to the proposed training program: NJDEP and NJDHSS both in Trenton, New Jersey; the Pesticides Laboratory of U.S. CDC in Atlanta, Georgia; the Epidemiology Branch, and the NIEHS, Research Triangle Park, North Carolina. The enthusiastic and generous support from these agencies, as shown in their letters of support, will largely enhance and expand the scope of the proposed ITREOH program.

**Table 1: Faculty Collaborators**

<p style="text-align: center;"><u>Pesticide Use, Pest Management, and Ecology</u></p> <p>Burger<sup>2</sup> Cooper<sup>2</sup> Hamilton<sup>2</sup> Meyer<sup>5</sup> Murphy<sup>5</sup> Robson<sup>2</sup> Shearer<sup>2</sup> Tantiyaswadikul<sup>1</sup> Thirakhupt<sup>1</sup> Tongcmpou<sup>1</sup> Vowinkel<sup>7</sup></p>	<p style="text-align: center;"><u>Exposure Science and Biomarkers</u></p> <p>Barr<sup>4</sup> Buckley<sup>2</sup> Cory-Slechta<sup>3</sup> Kamolsiripichaiporn<sup>1</sup> Kukor<sup>2</sup> Lioy<sup>3</sup> Prueksasit<sup>1</sup> Rachakornkij<sup>1</sup> Richardson<sup>2</sup> Smith<sup>13</sup> Weschayanwivat<sup>1</sup> Zhang<sup>3</sup></p>	<p style="text-align: center;"><u>Environmental Epidemiology and Risk Assessment</u></p> <p>Caussy<sup>9</sup> Chapman<sup>1</sup> Demissie<sup>3</sup> Fagliano<sup>6</sup> Goun<sup>6</sup> Hoppin<sup>10</sup> Kuruchittham<sup>1</sup> Marshall<sup>3</sup> Rhoads<sup>3</sup> Rich<sup>3</sup> Rinsky<sup>11</sup> Sitthi-amorn<sup>1</sup> Stern<sup>5</sup> Wartenberg<sup>3</sup></p>
<p style="text-align: center;"><u>Health Effects: Occupational Injury, Medicine and Toxicology</u></p> <p>Blando<sup>6</sup> Gochfeld<sup>3</sup> Halperin<sup>3</sup> Kipen<sup>3</sup> Palanuvej<sup>1</sup> Passannante<sup>3</sup> Udasin<sup>3</sup></p>	<p style="text-align: center;"><u>Health, Economic, and Policy Related to Pesticide Use</u></p> <p>Guarnaccia<sup>2</sup> Hoffman<sup>2</sup> Pleasant<sup>2</sup> Pongpanich<sup>1</sup> Quandt<sup>8</sup> Somrongthong<sup>1</sup></p>	<p style="text-align: center;"><u>Project Advisor</u></p> <p>Gallo<sup>2</sup> Goodman<sup>2</sup> Gotsch<sup>3</sup> Kanjaniyot<sup>12</sup> Pongsapich<sup>1</sup> Rosen<sup>3</sup> Sharma<sup>2</sup></p>

<sup>1</sup> Chulalongkorn University<sup>2</sup> Rutgers, the State University<sup>3</sup> University of Medicine and Dentistry of New Jersey<sup>4</sup> Centers for Disease Control and Prevention<sup>5</sup> New Jersey Department of Environmental Protection<sup>6</sup> New Jersey Department of Health and Senior Services<sup>7</sup> US Geological Survey<sup>8</sup> Wake Forest University School of Medicine<sup>9</sup> World Health Organization<sup>10</sup> National Institute of Environmental Health Sciences<sup>11</sup> Public Health Reports<sup>12</sup> US Fulbright Foundation<sup>13</sup> UC Berkeley

Practical and Cultural Issues:

The Rutgers and UMDNJ faculty are very diverse and this diversity provides the trainees with exposure to a broad range of cultural factors for their study in the US. The same is true for the Thai faculty; most have trained outside of Thailand at prestigious universities in the US, Europe and elsewhere in Asia. They represent a rich diversity of ideas, beliefs, and experiences. For US faculty working in Thailand, there are a number of faculty who have, for a long time, worked in Thailand and can provide the necessary guidance and counsel regarding appropriate, culturally sensitive, and socially relevant information regarding interventions, treatments, training, and research design.

Housing Accommodations and Local Transportation: Rutgers University has large on-campus graduate housing facilities. These facilities are located within walking distance of the primary program faculty for the ITREOH at Rutgers and UMDNJ. The two University campuses are adjacent. Additionally, Rutgers University has a large campus bus system, second in size only to New Jersey Transit (NJT). Students can easily travel from campus to campus or into downtown New Brunswick on the free campus bus system. The Piscataway and New Brunswick campuses are just 20 minutes from Newark International Airport, 30 minutes from Penn Station in Manhattan (NYC) on NJT trains and less than three hours by train on Amtrak to Washington, DC.

Rutgers and UMDNJ have large urban/suburban campuses with a diverse and culturally rich group of faculty, staff and students. Included in this diverse community are a number of Thai faculty and students as well as local businesses owned and operated by Thai people.

**The UMDNJ–School of Public Health (SPH)** is sponsored by UMDNJ, Rutgers University and the New Jersey Institute of Technology (NJIT). The master's degree programs are designed to accommodate full-time students as well as working professionals as part-time students to focus on job-related areas of concentration. Most classes at all campuses are offered in the late afternoons/early evenings. The School is comprised of three campuses, each with its own unique history and departments.

The Piscataway/New Brunswick Campus was established in 1983 and accredited by the Council on Education for Public Health (CEPH) as a graduate public health program. Concentrations on this campus include: Biostatistics; Environmental and Occupational Health; Epidemiology; Health Education and Behavioral Science; and Health Systems and Policy. Currently the UMDNJ-SPH has over 100 faculty and over 400 Masters and doctoral students. The school has committed resources and facilities for the proposed project. Information about the SPH as well as EOHSI is contained on the resources page of the proposal.

**The New Jersey Agricultural Experiment Station (NJAES)** is mandated by the state and federal governments to conduct research and outreach to address the needs of New Jersey residents as they relate to agriculture, natural resources, and human and community development. Closely affiliated with Cook College, the Land Grant College of Rutgers-the State University of New Jersey, NJAES is a unit of Rutgers funded separately and directly by the State Legislature. Founded in 1880, it is the third oldest experiment station in the United States. The two functions of the NJAES are to conduct research and assist residents of the state to put this knowledge to work.

The research arm of NJAES represents a partnership between the United States Department of Agriculture (USDA) and the State of New Jersey. Among the Station's many important research accomplishments are the discovery of the antibiotic streptomycin which cured tuberculosis; pioneering work in mosquito control; safe pesticide use and pesticide management; artificial insemination techniques for dairy cattle; the development of highly successful plant varieties including the Rutgers tomato, asparagus, turf grasses and hybrid dogwoods, and the development of novel farmland and open space policies. NJAES supports approximately 150 Rutgers faculty in 13 discipline departments, 13 interdisciplinary centers on the Rutgers University campus, and 7 field stations located across the state. Dr. Robson is the new Director of NJAES.

**The Major Foreign Collaborator (MFC)** for the proposed ITREOH program is Chulalongkorn University, Thailand's most prestigious university. Chitr Sitthi-amorn, M.D., Ph.D. will serve as Co-PI with Drs. Robson and Zhang. Thai participating faculty will be mainly from the University's College of Public Health and the NRC-EHWM.

**The College of Public Health of Chulalongkorn University** was established in 1992 to address national and international public health issues. The College combines organized research with graduate education of health professionals. This combination constitutes a fundamental catalyst for a dynamic, integrated and comprehensive understanding, which strives to develop a multi-disciplinary, knowledge-based for decision making, improved education of public health human resources, dealing with changing environments, and efficient services to meet the needs of stakeholders, especially those who are less fortunate.

The College's academic programs focus on evolving knowledge and its application to solving problems affecting human as well as community health. The areas of primary focus are health problems, determinants and trends; human resource development; appropriate use of technology, health financing; and health development and change. To fulfill the Thai national and international mission, the College of Public Health first educates professionals and leaders for the private and public sectors of the health system, second prepares researchers and educators, third conducts research to improve public health, and finally contributes knowledge and expertise to health development in the community.

The College of Public Health provides three levels of postgraduate education: Diploma in Public Health, Master of Public Health, and Doctor of Philosophy in Public Health. In addition to the standard in-house program, the College of Public Health provides courses and workshops tailored to fit the specific public health-related needs of students and organizations.

Through its postgraduate courses, the College has trained public health professionals who have the ability to use a comprehensive interdisciplinary perspective to evaluate and solve health problems. In addition, the College seeks to create an understanding and ability to use innovative problem-solving processes, including the acquisition and critical appraisal of information. It builds the capacity to facilitate positive change in the orientation, planning, management and overall development of public health organizations. Since 1995, some 300 students have participated in the College's postgraduate program. They have represented many nations, including Bangladesh, Bhutan, Belgium, Cambodia, China, Indonesia, Fiji, Japan, DPR Korea, Lao PDR, Mongolia, Myanmar, Nepal, Pakistan, Papua New Guinea, Philippines, Singapore, USA and Vietnam.

**The National Research Center for Environmental and Hazardous Waste Management (NRC-EHWM)** is a consortium of five main universities in Thailand, led by Chulalongkorn University. The main research center at Chulalongkorn University in Bangkok works closely with the satellite centers at Chiang Mai University in the north, Khon Kaen University in the northeast, King Mongkut University of Technology Thonburi in Bangkok and Prince of Songkla University in the south, all equipped with sophisticated instruments for environmental research. NRC-EHWM's activities encompass two main elements: research and post-graduate programs, which are inter-related. The international postgraduate (master and doctoral) programs in environmental and hazardous substances management was established and operated by NRC-EHWM in collaboration with industries, government, and overseas universities. Each satellite center also serves as the hub of a regional network of relevant stakeholders to focus on regional environmental issues.

This network of environmental education focuses on technical and management research with emphasis on hazardous materials and waste. The collaboration with universities in the USA, Australia, and Europe provide excellent opportunities for students to have first-hand interaction and hands-on experience with foreign and Thai professors. After taking the core courses in the first year, students have the choice to undertake research projects of interest at any of the partner universities. Qualified students will spend some time conducting their research in foreign institutions.

In relation to the country's need, NRC-EHWM is actively and progressively pursuing research of hazardous substances with priority areas of treatment and disposal; ecological impact and risk management; bioremediation; industrial ecology and pollution prevention; and chemical information management.

**A.5. Request for Support:** We request support from the Fogarty International Center to support training of 11 visiting scholars, 5 graduate assistantships, 22 short term training experiences in the US, 21 workshops and short courses in Thailand, and at least 13 pilot research projects during the course of the 5-year program (5 from Rutgers/UMDNJ match and 8 from FIC funding). We will also leverage funds to include 3 CDC trainees and several Thai government-sponsored graduate assistantships under the Jubilee Scholarship Program marking the Sixtieth Anniversary His Royal Highness King Bhumibol Adulyadej's Accession to the throne. This high level of training capacity of a newly proposed ITREOH center is achieved by generous "matching" funding/support from the participating institutions. (See Table 2).

**Table 2: Budget Summary**

	Year 1	Year 2	Year 3	Year 4	Year 5
Thai Visiting Scholars ( \$26,500 per person)	2	2	2	2	1
Thai Graduate Students (\$38,502 per person)	1	1	1	1	1
Thai Short Term Trainees (\$4,500 per person)	4	5	4	5	4
Workshops in Thailand (\$3,200 per person)	3	4	3	4	4
Adv. Committee + Workshops (\$19,200 per workshop)		1		1	1
MFC travel to the U.S. (\$3,000)	1	1	1	1	1
Fogarty Supported Pilots (\$5,000 per project in yrs 2 and 4) (In Yr 5, 2 @ \$ 5,000/ project and 2 @ \$7,000/ project)		2		2	4
Supplies (varies from \$1,200 to \$2,500/yr)					

No salary support is requested for participating faculty and staff including the program directors (PIs). In addition to supporting the time/effort of all the faculty and staff, UMDNJ and Rutgers each will provide \$75,000 (total \$150,000) to the program (see letters of support from Drs. Goodman and Rhoads).

Travel Support for Meetings for US PIs and MFC:

There is \$3000 budgeted annually for this effort. Drs. Robson and Zhang can travel fairly inexpensively to Bethesda. There will be \$3000 in the annual budget to accommodate Dr. Chitr for travel to the US. Drs. Robson and Zhang will use discretionary funds for their travel to these required meetings when the expense that exceeds the allocated amount.

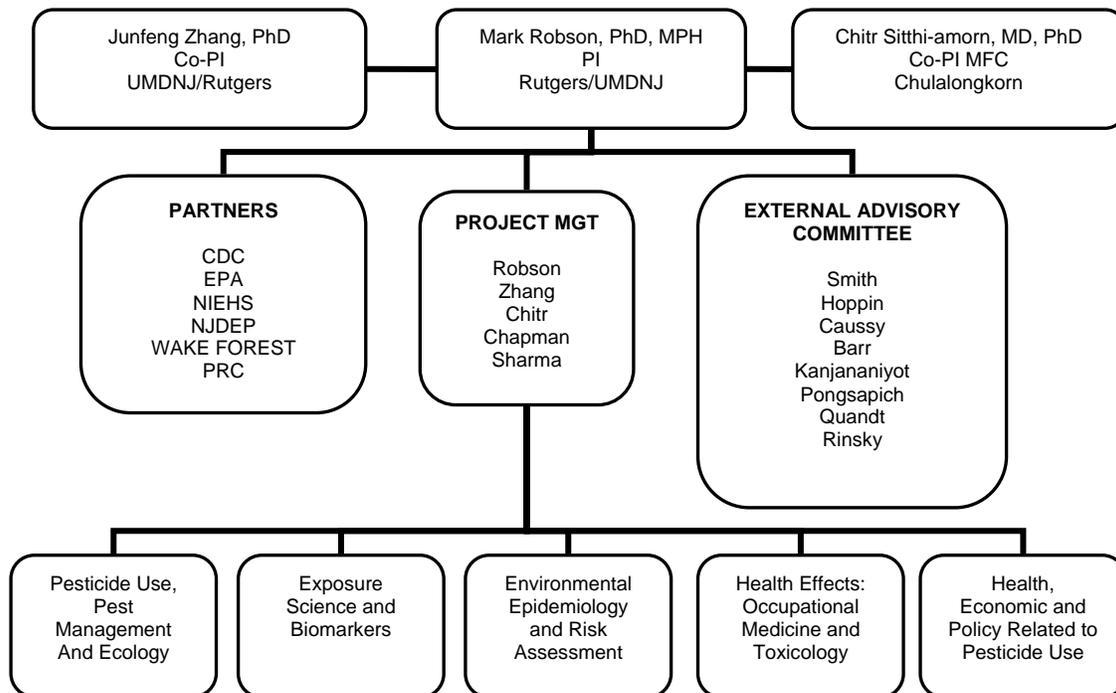
**A.6. Significance:** The theme of this proposed ITREOH center, specific environmental and occupational health research and training, has been identified as one of the priority areas listed in the RFA. Through this program, Rutgers and UMDNJ will increase their international reputation and international training expertise in exposure assessment, biomarker studies, environmental epidemiology, toxicology, and risk communications. This program will increase laboratory and field research expertise, especially related to pesticides research, of graduate students and postdoctoral researchers at Chulalongkorn University and other Thai institutions. This program will further strengthen and expand ongoing collaborative research and training in environmental and occupational health that UMDNJ/Rutgers faculty have already established in Thailand through other

mechanisms. Through research capacity building in Thailand to address such a common and widespread environmental and occupational hazard, the proposed Thai ITREOH program is expected to contribute beneficially to the society at large.

**B. Program Plan**

**B.1. Program Administration:** The proposed Thai ITREOH Center will be managed according to the administrative structure shown in Figure 1. The leadership consists of Program Directors (the PI, and two co-PIs, including the MFC) and two Associate Directors, the Rutgers/UMDNJ (Internal) Advisory Committee, and International (External) Advisory Committee.

**Figure 1: Organization chart of the Thai ITREOH Center and Divisions**



**Program Directors:** Directors will include the PI, Dr. Mark Robson and Co-PI, Dr. Junfeng Zhang, and the Thai Co-PI and MFC, Dr. Chitr Sitthi-amorn.

PI: Mark Robson, Ph.D., M.S., M.P.H., was recently appointed Director of the NJAES and Professor and Extension Specialist in Entomology at Rutgers University School of Environmental and Biological Sciences; he is also jointly appointed as Professor of Environmental and Occupational Health at the UMDNJ-SPH. Prior to September 1, 2006, he was the Chairman of the Department of Environmental and Occupational Health at the UMDNJ School of Public Health and previously the Executive Director of the EOHSI, a joint program of Rutgers University and UMDNJ-Robert Wood Johnson Medical School (RWJMS). Dr. Robson also served as the Extension Pesticide Specialist at Rutgers University. He is also active in the family fruit and vegetable farm operation in Burlington County, New Jersey.

Dr. Robson is also a Visiting Professor at Chulalongkorn University in Bangkok where he has taught Environmental Risk Assessment in the NRC-EHWM Program for the past six years as well as a Visiting Professor in the Faculty of Environmental Management at the PSU in Hat Yai in Southern Thailand. In 2005, Dr. Robson was a Fulbright Senior Specialist in Thailand working at PSU. Dr. Robson's international experience includes serving as a member of the Board of Science Advisors for World Information Transfer, a UN-recognized NGO; as a member of the International Advisory Board European Centre for Occupational Health, Safety, and the Environment at University of Glasgow, Scotland, UK; and Collaborator and

International Advisory Board Member for the Environmental Health Center Cluj-Napoca, Romania. He is also Associate Professor, at Babes-Bolyai University in Cluj, Romania. Dr. Robson has served as the Chairman of the EPA Peer Review for the Exposure Component of the National Agricultural Health Study (AHS) and was the Co-Chairman of the National Environmental Educational and Training Foundation (NEETF) Project on Pesticide Resources for Health Care Providers.

Co-PI and MFC: Chitr Sitthi-amorn, M.D., Ph.D., is the Dean of the College of Public Health, Director of the Institute of Health Research, and Professor of Epidemiology and Professor of Medicine at Chulalongkorn University in Bangkok. He is an internationally recognized epidemiologist and public health scientist.

Professor Chitr is the immediate past president of the International Epidemiological Association (IEA). The 17<sup>th</sup> IEA World Congress of Epidemiology (WCE) took place in Bangkok in 2005. Professor Chitr is the first Asian president of the IEA and last year's WCE was the first worldwide IEA meeting in Asia. Professor Chitr has extensive experience in clinical and epidemiological aspects of environmental health. His is also the principal investigator for Southeast Asia for INTERHEART studies, which are recognized as a classic in the area of cardiovascular disease epidemiology.

Co-PI: Junfeng (Jim) Zhang, Ph.D., is Professor and Acting Chairman of the Department of Environmental and Occupational Health at the UMDNJ-SPH. Dr. Zhang is also Visiting Professor at the prestigious Peking University in China. Dr. Zhang has several funded projects in Asia working in the area of environmental exposure and risk assessment. Dr. Zhang, in addition to his graduate studies in China and at Rutgers, also completed his postdoctoral fellowship at the East West Center in Hawaii. Dr. Zhang is on the graduate faculty in the Joint Graduate Program in Toxicology, in Public Health and in Environmental Science.

Over the last decade, Dr. Zhang has completed several funded research projects in Asia, ranging from characterization of urban and rural air pollution, validation of biomarkers of exposure, to epidemiologic investigation of health effects of outdoor and indoor air pollution. Particularly relevant to this proposal, Dr. Zhang, while under the mentorship of Dr. Kirk Smith (Chairman of the International Advisory Committee of this proposed ITREOH Center), worked at King Mongkut Institute of Technology in Bangkok in 1994 and 1995, where he establish a chromatography laboratory and trained Thai graduate students to analyze air pollutants emitted from the charcoal making process. He also set up emission sampling devices in rural sites near Bangkok and trained Thai graduate students to collect samples. In the late phase of this study, Drs. Smith and Zhang hosted Thai researchers at UC-Berkeley for several weeks to perform data analysis and for manuscript preparation. Similar to this collaborative effort with Thai scientists and graduate students, Dr. Zhang's projects in China and India have supported several doctoral research dissertations and produced more than 20 peer-reviewed papers co-authored with his Asian collaborators including graduate students.

**Associate Directors:** Dr. Robert Chapman at Chulalongkorn and Dr. Daniela Sharma at NJAES Rutgers will provide additional programmatic support for the project as well as contribute as investigators to the training and research efforts.

Robert Chapman, M.D., M.P.H., is a faculty member at Chulalongkorn University in the College of Public Health as well as Adjunct Professor of Environmental and Occupational Health at the UMDNJ-SPH. Dr. Chapman completed a distinguished career at the US EPA as an environmental epidemiologist prior to his moving to Thailand. Dr. Chapman has been a long time collaborator with Dr. Zhang in the study of air pollutants and the effects on respiratory health in Asia. Dr. Chapman is fluent in both Thai and Chinese. Dr. Chapman will play a key role as the primary academic administrator for the ITREOH program at Chulalongkorn as well as one of the Co-Investigators in the project.

Daniela Sharma, Ph.D., is the Assistant Director of the NJAES for Project Management and Reporting. Dr. Sharma is a direct report to Dr. Robson. Dr. Sharma's research interest and training is in the area of animal husbandry and endocrinology. Dr. Sharma will be the key project manger for the Rutgers/UMDNJ portion of the project and coordinate the various reporting and budgetary requirements for this project as well as assist

Drs. Robson and Zhang and their secretarial staff in coordinating the travel arrangements for Thai Visiting Scholars, short term trainees, graduate students, and visiting faculty to the Rutgers and UMDNJ.

**International External Advisors:** To provide effective consultation, guidance, and evaluation for our ITREOH Program, we have assembled a distinguished International Advisory Committee for the project. We will convene an advisory committee three (3) times in Thailand. We will take advantage of their presence in the country to also leverage these meetings into workshops and short courses (see In-Country Workshops). The advisory committee will meet as a group in Years 1, 3, and 5. Throughout the grant period, we will communicate through e-mail, conference calls, web casts, and other less costly exchanges to discuss and review the progress of the project, make critical suggestions for improvement, to monitor progress and to perform program assessments and evaluations.

Kirk Smith, Ph.D., is a Distinguished Professor of Environmental Health Sciences and Brian and Jennifer Maxwell Endowed Chair in Public Health at the School of Public Health at UC Berkeley and member of the National Academy of Sciences. Dr. Smith will chair the Advisory Committee. Dr. Smith has had experience with several other Fogarty projects. He is a highly regarded expert on a wide range of topics dealing with international environmental health.

Dana Barr, Ph.D., is the Director of the Pesticide Laboratory, National Center for Environmental Health at the CDC, Atlanta, Georgia. Dr. Barr is also the Editor in Chief of the *Journal of Exposure Science and Environmental Epidemiology*. Dr. Barr has worked in Thailand on previous assignments and has provided advice and counsel to several of Dr. Robson's ADB students in the Chulalongkorn graduate program as well as collaborated with faculty at Chiang Mai University. Dr. Barr, through CDC, will also provide three (3) Oak Ridge Institute Science Education Fellowships for Thai trainees.

Sara Quandt, Ph.D., is a Professor in the Department of Epidemiology, Division of Public Health Sciences at Wake Forest University School of Medicine in Winston-Salem, North Carolina. She is also Adjunct Professor of Anthropology at Wake Forest. She has published extensively on pesticide exposure assessment, prevention, and intervention. Dr. Quandt has also agreed to host pre- and post-doctoral students for short-term research training and data analysis. Drs. Quandt, Hoppin and Ms. Kanjananiyot will chair the evaluation portion of the project.

Jane Hoppin, Sc.D., is Staff Scientist-Epidemiologist at the NIEHS in Research Triangle, North Carolina. Dr. Hoppin is a Co-PI on the National AHS at NIEHS. The AHS is the largest agricultural cohort assembled to characterize agricultural practices and their health consequences in over 90,000 farmers and farm families in the United States. Drs. Quandt, Hoppin, and Ms. Kanjananiyot will chair the evaluation portion of the project.

Robert Rinsky, Ph.D., is Editor in Chief of *Public Health Reports*; he is a graduate trained environmental epidemiologist with a special interest in agricultural health issues. *Public Health Reports* (PHR) is a journal of the U.S. Public Health Service. Since 1999, PHR has been published by the Association of Schools of Public Health; PHR is a peer-reviewed, bi-monthly journal (six issues) offering articles in three main areas: public health practice, research, and viewpoints/commentaries.

Deoraj (Harry) Caussy, Ph.D., is Regional Epidemiologist in the Department of Communicable Diseases, at the World Health Organization, South East Asia Region, Indraprastha Estate, India. Dr. Caussy has worked with the PI through SCOMSEC and other venues regarding exposures and susceptible populations in this region. Dr. Caussy has responsibilities for the SE Asian Region and has also collaborated with faculty at Chulalongkorn and PSU.

Wasant Pongsapich, Ph.D., is the Executive Director of the NRC-EHWM, a consortium of the five major universities in Thailand established by a joint initiative between the Commission of Higher Education and the Asian Development Bank. His primary interests are environmental and geochemical research.

Porntip Kanjananiyot, M.Ed., M.A., is the Executive Director of the Thai-US Fulbright Foundation in Thailand. Ms. Kanjananiyot is located in Bangkok near the University. Ms. Kanjananiyot's previous experience included working in the US as well as the Thai government. She also played a key role in the establishment of the Asian Development Bank (ADB) Graduate Training Centers throughout Thailand. Ms. Kanjananiyot will assist the ITREOH Center in the identification and evaluation of Thai trainee applicants at all levels as well as to identify Fulbright opportunities that will compliment the Fogarty trainee opportunities for Thai students and faculty.

**Rutgers/UMDNJ Advisors:** The Rutgers/UMDNJ Internal Advisory Committee is assembled to assist in the operation and guidance of the program at Rutgers and UMDNJ, particularly in the review of the program, leveraging of funds, and provide project oversight.

Robert Goodman, Ph.D., is the Executive Dean of Rutgers School of Biological and Environmental Sciences and Executive Director of NJAES and Professor of Ecology, Evolution, and Natural Resources. Dr. Goodman will serve as Chair of this Committee.

Audrey Gotsch, Dr.P.H., C.H.E.S., is the Dean of the UMDNJ-SPH and Professor of Health Education and Behavioral Sciences.

Deborah Cory-Slechta, Ph.D., is the Director of EOHSI and the Director of the NIEHS Environmental Health Sciences Center of Excellence at UMDNJ/Rutgers and Professor and Chair of the Department of Environmental and Occupational Medicine at the UMDNJ-RWJMS.

**B.2. Program Faculty:** There has been a very strong response in the US and in Thailand by the host institutions for this ITREOH application, over 50 faculty have identified their interest in this project. While this number represents a rich and diverse set of interests, management of this many participants will take considerable time and energy. Many of the faculty listed in Table 1 will be resource faculty; the state and federal agency partners will provide practical hands-on field experiences, or access to databases or instrumentation.

Other faculty members will have a primary role as mentors for the Visiting Scholars, advisors for the trainees who are seeking a degree, masters or doctoral level or a certificate in the US. Another group of faculty have agreed to participate in the workshops and short courses in Thailand. Several faculty members have agreed to all three levels of participation. The faculty, both from Thailand and from the US, are described as having a primary interest in one of the five areas identified related to the major theme of this proposed ITREOH program: the consequences of pesticide use and control technologies. Participating faculty members are listed in Table 1 by the five key topic areas.

#### **Thai Faculty Collaborators from Chulalongkorn University:**

Co-PI and MFC: Chitr Sitthi-amorn, M.D., Ph.D., see above (Program Directors).

Robert Chapman, M.D., M.P.H., see above (Associate Directors).

Somporn Kamolsiripichaiporn, Ph.D., is Deputy Director of the NRC-EHWM. She has a particular interest in "green industries" in developing countries and its impact on the economy.

Porntip Kanjananiyot, Ed.M., M.A., see above (International External Advisors).

Vipat Kuruchittham, Ph.D. is a lecturer in the College of Public Health, particularly interested in computer aided models related to cancer epidemiology.

Chanida Palanuvej, M.S., is a researcher in The Institute of Health Research at Chulalongkorn University, with a research interest in infectious disease control.

Sathirakorn Pongsapich, Ph.D., is Director of PhD Studies and Associate Professor in the College of Public Health, particularly interested in health policies issues and health promotion and intervention.

Wasant Pongsapich, Ph.D., see above (International External Advisors).

Tassanee Prueksasit, Ph.D., is a Lecturer at Chulalongkorn University in the Faculty of Science. Her research interests include environmental risk assessment, specifically human exposures and PAHs in different urban environments.

Manaskorn Rachakornkij, Ph.D., is the Director of the Graduate Program at the Environmental Research Center at Chulalongkorn University, He is trained as an environmental engineer and is interested in the control of environmental contaminants through novel technology.

Ratana Somrongthong, Ph.D., is an assistant Dean in the College of Public Health. Her research interests are based around community public health programs, particularly for the underserved.

Palarp Tantiyaswasdikul, Ph.D., is Deputy Director for Research at the Institute for Health Research and Head of the Pesticide SADE Unit. Particular interests include safe pesticide use and pesticide regulation.

Kumthorn Thirakhupt, Ph.D., is the Chairman of Biological Sciences Department at Chulalongkorn University. He is a field ecologist with a particular interest in the long term effects of persistent pesticides on birds and fish in specialized habitats in Thailand.

Chantra Tongcmpou, Ph.D., is Deputy Director of the International Programs in Environmental Management at Chulalongkorn University. Her funded research includes work on ecological effects of heavy metals.

Punjaborn Weschayanwivat, Ph.D., is a Lecturer in the International Postgraduate Program in Environmental Management at Chulalongkorn University. Her research interest is the analysis of chemical contaminants in water.

#### **U.S. Faculty Collaborators from Rutgers and UMDNJ and University Partners:**

PI: Mark Robson, Ph.D., M.P.H., see above (Program Directors).

Co-PI: Junfeng (Jim) Zhang, Ph.D., see above (Program Directors).

Brian Buckley, Ph.D., is Director of the EOHSI Analytical Center and is an Adjunct faculty member in the UMDNJ-SPH. His research interests include analytical techniques for pesticides in human and environmental media.

Joanna Burger, Ph.D., is Distinguished Professor of Ecology at Rutgers Faculty of Arts and Sciences. Dr. Burger is a field ecologist with a particular interest in metals and other persistent toxins, including pesticides on survival and reproductive issues in indicator species, especially in birds.

Keith Cooper, Ph.D., is Deputy Director of the NIH Toxicology Training Grant at Rutgers and Professor of Toxicology. Dr. Cooper is a marine toxicologist with a particular interest in the effects of pesticide and other environmental toxicant on wildlife and habitat.

Deborah Cory-Slechta, Ph.D., see above (Rutgers/UMDNJ Advisors).

Kitaw Demissie, M.D., Ph.D., is Associate Professor of Epidemiology at the UMDNJ-SPH. His research interests include environmental exposures and cancer outcomes as well as reproductive health outcomes.

Michael Gallo, Jr., Ph.D., is the Director of the Air Pollution Training Center at NJAES and is involved in educational assessment and training programs for non-degree training and professional training.

Michael Gochfeld, M.D., Ph.D., is Professor of Environmental and Occupational Medicine at UMDNJ RJWMS and Professor of Public Health. His research interests include both occupational medicine as well as ecological effects of environmental toxicants.

Robert Goodman, Ph.D., see above (Rutgers/UMDNJ Advisors).

Audrey Gotsch, Dr.P.H., C.H.E.S., see above (Rutgers/UMDNJ Advisors).

Peter Guarnaccia, Ph.D., is Professor and Chair of the Department of Human Ecology. His research interests include pesticide exposures to rural populations and the social and economic outcomes of pesticide use in developing countries.

William Halperin, M.D., Dr.P.H., is Professor and Chair of the Department of Preventive Medicine at UMDNJ New Jersey Medical School and Professor of Public Health. Prior to coming to UMDNJ, Dr. Halperin was head of the occupational injuries section at NIOSH. He is particularly interested in injuries and occupational illness associated with agriculture.

George Hamilton, Ph.D., is Professor and Extension Specialist in Entomology and Professor of Public Health. Dr. Hamilton is nationally recognized in the area of safe pesticide use, pesticide applicator training and pesticide regulation. He is also the statewide program Director in NJ for the Rutgers Integrated Pest Management Program.

Daniel Hoffman, Ph.D., is an Assistant Professor in the Department of Nutrition at Rutgers School of Environmental and Biological Sciences. He is particularly interested in rural public health issues and nutritional epidemiology.

Howard Kipen, M.D., M.P.H., is Professor of Environmental and Occupational Medicine at UMDNJ-RWJMS and Professor of Public Health. He research interests include measurement and health outcomes and evaluation of exposures of farmers and other pesticide workers.

Jerome Kukor, Ph.D., is Associate Dean for Research and Graduate Programs at Rutgers School of Environmental and Biological Sciences and Associate Professor of Microbiology. His research interests include evaluation of remediation strategies for environmental contamination.

Paul Lioy, Ph.D., is Professor of Environmental and Occupational Medicine and Professor of Public Health. He is an internationally recognized exposure science researcher. He has studied pesticides, along with a variety of other environmental toxicants in indoor environments as well as the effects on human and ecological health.

Elizabeth Marshall, Ph.D., is Associate Professor of Epidemiology at UMDNJ-SPH. Her interests include agricultural exposures in particular exposures of children. She is also interested in occupational injuries in agriculture. While at the NYDOH she was a member of the SUNY-Albany Fogarty Center.

Marian Passannante, Ph.D., is an Associate Professor of Epidemiology and Head of the Injury Prevention Center at UMDNJ New Jersey Medical School and Associate Professor of Public Health. Her interests include injury reporting and prevention.

Andrew Pleasant, Ph.D., is an Assistant Professor in the Department of Human Ecology at Rutgers. His research interests include pesticide exposure and other health risks in communities in developing countries.

Sara Quandt, Ph.D., is Professor of Epidemiology and Prevention at the Wake Forest School of Medicine. Her research interests are primarily community participatory research concerning pesticides and other exposures.

George Rhoads, M.D., M.P.H., is Endowed Professor of Epidemiology at UMDNJ-SPH and also the Associate Dean for Academic Affairs. Dr. Rhoads has had a distinguished career as an epidemiologist and his particular interests include environmental exposures of contaminants and health outcomes in children, most notably lead.

David Rich, Sc.D., M.P.H., is an Assistant Professor of Epidemiology at UMDNJ-SPH. He is particularly interested in environmental exposures and adverse outcomes. He also has an interest in occupational epidemiology.

Robert Rinsky, Ph.D., is a former NIH Epidemiologist and is currently the Editor in Chief of *Public Health Reports*. He is particularly interested in the effects of occupational exposures, especially agricultural workers and workers exposed to solvents.

Mitchel Rosen, M.S., is the Director of the OPHP at the UMDNJ-SPH. He is responsible for the short courses and non-degree professional training programs. His reach interests are occupational health and safety training outcomes.

Daniela Sharma, Ph.D., see above (Associate Directors).

Peter Shearer, Ph.D., is Extension Specialist and Professor of Entomology. His particular expertise is in the safe and efficacious use of insecticides for the control of pests on fruit crops. He also conducts research on the use of beneficial insects and the reduction of pesticides through best management practices.

Kirk Smith, Ph.D., see above (International External Advisors)

Iris Udasin, M.D., is an Associate Professor of Environmental and Occupational Medicine at UMDNJ-RWJMS and Associate Professor of Public Health. Her research interests include stressors in the workplace and clinical evaluations of workers.

Daniel Wartenberg, Ph.D., is Professor of Epidemiology at UMDNJ-RWJMS and Professor of Public Health. He is particularly interested in the GIS applications and cancer outcomes, especially in regard to environmental exposures and in particular to pesticides.

#### **US State, Federal, and International Agency Collaborators:**

Dana Barr, Ph.D., see above (International External Advisors)

Deorja (Harry) Caussy, Ph.D., see above (International External Advisors)

Jerald Fagliano, Ph.D., M.P.H., is a Senior Administrator in the epidemiology branch at the NJDHSS. He is involved in database management and also in study of effects of environmental exposures.

Barbara Goun, Ph.D., M.P.H., is an Epidemiologist with the NJDHSS. She works on a number of state data bases involving cancer, worker injuries and deaths, and environmental impacts on populations.

Jane Hoppin, Sc.D., see above (International External Advisors)

Leroy Meyer, M.S., is the Section Chief of the NJDEP Pesticide Control Program's Technical Evaluation and Monitoring Section (TEAM). His expertise is in the measurement of pesticides in food and environmental media, including water and soil. He is also an adjunct faculty member in the UMDNJ SPH.

Eileen Murphy, Ph.D., is the Director of the NJDEP Division of Science, Research, and Technology. Her research interests are measurement of contaminants, including pesticides, and their health effects, in drinking water.

Alan Stern, Dr.P.H., D.A.B.T. , is Section Chief for the Bureau of Risk Assessment at the NJDEP Division of Research, Science, and Technology, and an adjunct faculty member at the UMDNJ SPH. His research interests include risk assessment and exposure assessment to environmental contaminants.

Eric Vowinkle, Ph.D., is a Hydrologist and Liaison for universities and federal agencies in Region II. His research interests include pesticides in both surface and ground water. He has collaborated on numerous studies with the PI for this project. He is also an adjunct faculty member in the UMDNJ-SPH.

**B.3. Proposed Training: The Thai Fogarty ITREOH Center** training and research objectives will be accomplished by a series of five program elements.

<b>Figure 2: Timeline for Thai Fogarty ITREOH Center</b>												
Activity	Months											
	-3	0	6	12	18	24	30	36	42	48	54	60
Notification of score	█											
Dr. Robson to BKK for initial meeting	█											
Call for visiting scholar applications	█											
<b>ITREOH Project Starts May 1, 2007</b>		█										
Call for visiting short term trainees		█										
First visiting scholars start		█										
Scholars (9 mos.)			█	█	█	█	█	█	█	█	█	█
Plan advisory meeting and first workshop	█											
First advisory meeting and workshop in BKK		█										
Advisory meetings at Chulalongkorn/ workshop						█					█	
Trainees to US			█	█	█	█	█	█	█	█	█	█
Workshops and training in Thailand			█	█	█	█	█	█	█	█	█	█
Solicitation for pilot projects		█		█		█		█		█		
Pilot project reports			█		█		█		█		█	
PIs and MFC to US for meetings			█		█		█		█		█	
Preparation for Renewal									█	█	█	█

I. Degree/Certificate Programs with a concentration in environmental and occupational health, environmental epidemiology, or environmental science in the US.

We will provide training in the United States at Rutgers and UMDNJ for students that will lead to an M.S. or M.P.H. degree (normally taking 18 months, on full-time basis) or a Ph.D. a Dr.P.H. degree (normally taking 48 months, on a full-time basis) with a concentration in environmental epidemiology, environmental and occupational health, exposure assessment, or toxicology. Some of the coursework and research can be completed in Thailand.

We will also offer a certificate in general public health, in epidemiology, or in environmental and occupational health (normally taking 12 months). All these degree programs and the certificate program are currently offered at Rutgers and UMDNJ.

Students will be selected and recommended by the ITREOH Selection Committee: Drs. Robson, Zhang, Sitthi-amorn, Chapman and Ms. Kanjananiyot. Applicants for degrees will be screened, evaluated based on undergraduate record, GRE scores, TOFEL scores, interview, and research interests. Details are listed under section B.5. There will be at least one Graduate Assistantship provided each year from the project for masters or doctoral study for a Thai student.

In addition, participating faculty will identify sources of support for the students after the first year of study on the ITREOH funds. Additionally, Dean Sitthi-amorn will commit Jubilee Scholarship funds for several (estimated to be 1 to 3) students per year for study under this program in the US. The Jubilee Scholarship funds are made available in honor of the Sixtieth Jubilee of His Royal Highness King Bhumibol Adulyadej (See Dean Sitthi-amorn's letter). Students will apply through the normal channels for international students in one of three programs at Rutgers and UMDNJ. All three of these programs are jointly sponsored programs of Rutgers and UMDNJ-SPH in epidemiology or environmental and occupational health, the Joint Graduate Program in Toxicology, or the Joint Exposure Science Program option within the Environmental Science Program. The US PIs, Drs. Robson and Zhang, are senior faculty in each of these graduate programs and will serve as the initial advisors for the Thai students coming to Rutgers and UMDNJ as part of the proposed project. They will serve as mentors throughout the program for these trainees. After the first year of the curriculum, students will work with Drs. Robson and Zhang to select a thesis area or practicum (field work) area in the case of the MPH degree, and will assemble a committee and begin to develop a research agenda. It is expected that the research portion of the project will take place jointly in the US as well as their native Thailand, looking specifically at a pesticide or related problem for their dissertation. Students can select to work with one of the faculty collaborators identified in this proposal from Rutgers and UMDNJ.

In 2005, the UMDNJ-SPH initiated a certificate program in General Public Health, a certificate in Epidemiology, and a certificate in Environmental and Occupational Health. These certificate programs usually take 12 months to complete. Students already having a B.S., M.S. or M.P.H. degree from a Thai institution may elect to come for one year training and receive a certificate in one of these three areas. Visiting Scholars may elect to also pursue a certificate upon approval by the Director and their mentor.

II. Visiting Scholars in environmental health, environmental epidemiology, exposure assessment or toxicology in the US.

There will be two Visiting Scholar positions to be provided per year for Years 1, 2, 3 and 4. In Year 5 there will be one Visiting Scholar position, all for Thai scientists.

We will offer training in the areas of environmental health, environmental epidemiology, exposure assessment or toxicology. This training will be laboratory based, field based, and/or clinically driven experiences. There are currently over 30 faculty members (See Table 1) at Rutgers and UMDNJ who have agreed to be investigators on the ITREOH Project. Their research interests range from basic laboratory research, to environmental epidemiology work, to clinical studies and evaluations, to community based research, to pest

management and pesticide exposure reduction. Visiting Scholars may elect to work with one of these investigators during a nine-month period here at Rutgers and UMDNJ.

III. In-country advanced research training in Thailand. Building on the successful model at Chulalongkorn funded under the NRC-EHWM Program, we will develop a series of courses and training experiences for students pursuing an M.S., M.P.H., or Ph.D. in Thailand. We will collaboratively develop courses at Chulalongkorn University. These courses will be taught jointly by the participating US and Thai faculty. For six years, Dr. Robson has been one of several international faculty at Chulalongkorn teaching in the NRC-EHWM graduate program that has been widely regarded as highly successful. This program has several graduate training centers in six focus areas. Dr. Robson teaches in the Environmental Research Center in the Faculty of Engineering at Chulalongkorn. In these programs, students take a series of accelerated courses, every day for four weeks which is the equivalent of one three (3) credit course. ITREOH faculty will work with the NRC-EHWM and the College of Public Health at Chulalongkorn to offer additional courses that will provide training for ITREOH students as well as students in related programs as an opportunity to broaden the number of students trained and leverage the funds in several programs at Chulalongkorn. Chulalongkorn serves as the primary institution for the program and all five major Thai public universities participate in this effort. A concern rose in previous reviews and consultation that there was a lack of programs and professors for human and environmental health courses. The ITREOH program will supply the needed faculty from Rutgers and UMDNJ to provide these courses in the program as well as access for other interested students. Presently Dr. Robson has four students where he serves as the major co-advisor for their dissertation research. The NRC-EHWM staff is a competent and well trained group and instrumental to the smooth and efficient operation of the program. The same staff will be accessible to the ITREOH students and provide additional support to the proposed ITREOH project. The NRC-EHWM program and the College of Public Health at Chulalongkorn will serve as the platform for the advanced training modules for the ITREOH.

IV. In-country short-term training in Thailand. Workshops and short courses will be held in Bangkok (Chulalongkorn-central Thailand) as well as regionally for specific training programs and workshops as identified by the partnership. These workshops will include students, graduate students, postdoctoral fellows, faculty, staff as well as public health and environmental health practitioners and government officials. The faculty at Chulalongkorn University have a very developed network of outreach for farmers, rural health officials, and government officials. We expect to deliver three workshops/short courses per year in Thailand. We will utilize the advisory committee meetings to leverage the international advisors who have agreed to deliver lectures and seminars.

#### Workshop Topics:

Based on our initial meetings to develop this proposal, we have identified three workshops that will be held in Thailand at Chulalongkorn University in Year 1 of the Project (see below). Workshop topics for subsequent years will be determined based on feedback from the Year 1 workshops, discussions among program directors and advisors, as well as input from the trainees and the faculty.

1- General Environmental Health Workshop including the areas of expertise represented on the Advisory Committee: A Workshop on the Assessment, Measurement and Evaluation of Environmental Exposures Related to Pesticide Use.

*By Advisory Committee members plus Drs. Robson and Zhang*

2- Utilizing Epidemiological Resources for Environmental Health Studies.

*By Drs. Chapman, Hoppin, and Rinsky*

Included in the second workshop will be the use of on-line resources. Dr. Rinsky has graciously and thoughtfully made available access to the journal *Public Health Reports* to the students and trainees participating in this project.

### 3-Pesticide Measurement, Exposure Reduction and Intervention in Rural Communities.

*By Drs. Barr, Hamilton, and Robson*

Strategies for reduction of pesticide exposure as well as measurement techniques in the field, sample preparation, management and analysis.

V. Short term training in the US. We will provide one to three month training opportunities for Thai students, visiting scholars, faculty, and research staff at Rutgers and UMDNJ; these include access to the specialized courses through UMDNJ's OPHP as well as our collaborators at NJDEP, NJDHSS, Wake Forest, CDC, USGS, and NIEHS. The training/research experiences will include field work, clinical work, and specialized laboratory work. The experience will be designed to fit the interest and background of the trainees, either highly technical (e.g. sophisticated instrumentation and analytical techniques) or fairly applied (e.g. community based participatory research programs).

The faculty collaborators on the project at Rutgers and UMDNJ as well as our partners at CDC, NIEHS, Wake Forest, NJDHSS, NJDEP, and USGS have agreed to provide laboratory, field or clinical research experiences for our trainees for one to three months. Of particular note is the commitment by Dr. Dana Barr, through the CDC, where they have agreed to provide three (3) Oak Ridge Institute Science Education Fellowships ORISE for Thai trainees during the course of the proposed project (see Dr. Barr's letter of support).

Also, students and faculty in the program will have the opportunity to visit and collaborate with NIEHS Epidemiology Branch scientists on projects relating to pesticide exposure and health effects. Dr. Hoppin is a co-principal investigator of the AHS, a prospective cohort study of over 90,000 farm residents. Participants in this Fogarty program will be welcome to work with Dr. Hoppin on analyses in this cohort or on other pesticide related analyses. NIEHS Epidemiology Branch has an active training program for pre and post-doctoral students as well as for faculty. Visiting fellows from foreign countries are welcome to collaborate and participate with NIEHS investigators (see Dr. Hoppin's letter of support).

Additionally, students and faculty may collaborate with Dr. Sara Quandt and her colleagues at Wake Forest University School of Medicine. Wake Forest has a number of ongoing epidemiologic field studies of pesticides and other occupational exposures, as well as data from other studies conducted over the past decade. This will provide an opportunity to observe field studies in the US among farmworkers and other populations, as well as to participate in on-going data analysis (see Dr. Quandt's letter of support)..

Short term training may also include some of the professional public health courses offered by Rutgers and UMDNJ including those from the OPHP at UMDNJ-SPH.

There will be four or five funded slots (opportunities) for Thai trainees to come to the US for short term training each year.

#### Pilot Research Projects:

In each of the five years, there will be one NJAES or SPH sponsored research pilot project for investigators. In each of Years 2, 4, and 5 there will also be FIC sponsored research pilot projects (two in Years 2 and 4 and four in Year 5).

For the selection of ITREOH pilot research projects, we will follow the model established by our EOHSI Environmental Health Sciences Center. Both Drs. Robson and Zhang and many other participating faculty are active members of the Center. This includes an open solicitation for proposals, a review by selected faculty members and the selection committee (Robson, Zhang, Chapman, Kamolsiripichaiporn, and Thirakhupt). Proposals will receive an NIH type score with comments and suggestions for improvement.

**Priorities:** Consequences of pesticide use and control technologies is a priority for the Thai people. Thailand is the world's largest exporter of rubber and is a major exporter of shrimp, rice, fruits and vegetables. Pesticide use continues to increase at an annual rate of over 8%. There are few control measures in place for the proper use of pesticide products on farms that consider both human and ecological health.

**B.4. Training Program Evaluation – Impact and Assessment:** The above described training will be delivered according to the following estimated timetable (see Figure 2).

Dr. Robson and Dr. Zhang along with other program administrative members will be responsible for the program evaluation activities. Dr. Hoppin, Dr. Quandt and Ms. Kanjananiyot will be responsible for chairing the external evaluation of the program.

The program evaluation metrics include the following:

- Numbers of MS, MPH, PhD and DrPH students trained.
- Number of visiting scholars (postdoctoral) trained.
- Number of short term US and short term in country (Thai) programs delivered.
- Number of publications from projects by ITREOH students and faculty.
- Number of successful ITREOH pilot projects awarded from the ITREOH program, from EOHSI, and possibly from elsewhere.
- Number of pilots that lead to larger and more comprehensive projects to be funded
- Comments by Thai, US, Fulbright, ADB or other international agencies.

For the short courses and workshops in Thailand we will use the well established evaluation process of the OPHP at the UMDNJ-SPH. The Director of the OPHP, Mr. Mitchel Rosen, is one of the investigators for this project. Mr. Rosen has agreed to provide this support from the OPHP for the ITREOH project. Examples of the evaluation instruments are located in the Appendices. Specific instruments will be developed for each program/workshop/short course, but there will be common elements for evaluation and program improvement.

All data become part of the OPHP's comprehensive computerized database. OPHP staff is experienced in statistics, computer programming, and study and instrument design. They also have experience in qualitative and quantitative data collection and analysis. The evaluation function is critical to quality and reporting and is structured around procedures of rigor related to quantitative and qualitative analyses.

For graduate students and postdoctoral fellows there will be a standardized questionnaire regarding general information for program evaluation. Each graduate student and postdoctoral fellow will also have an interview prior to the assignment, mid-point in the assignment and post assignment to provide assessment to his or her progress, the quality of the program, both the administrative and the intellectual components.

Each trainee will meet regularly with Drs. Robson and Zhang throughout his or her training experience regardless if it is short term or long term. Follow-up assessment and evaluation will also take place with trainees when possible.

**B.5. Trainee Candidates - Recruitment Plan:** Students will be selected and recommended by the ITREOH Selection Committee (Drs. Robson, Zhang, Sitthi-amorn, Chapman and Ms. Kanjananiyot). There will be at least one Graduate Assistantship provided each year from the project for masters or doctoral study for a Thai student. For graduate research assistantships and Jubilee Fellows, an initial solicitation from Thai faculty will take place, after the applicants are selected, a careful review of their academic record will take place.

Applicant names and portfolios will also be sent electronically to the International External Advisory Committee for review. Applicants for MS, MPH, DrPH and PhD degrees will be screened, evaluated based on their undergraduate record, GRE scores, TOFEL scores, interview, and research interests. Applicants must meet the requirements of Rutgers and UMDNJ for admission to the graduate programs in Public Health,

Environmental Science, or Toxicology. All applicants for visiting scholars will be solicited and screened by the same process, then carefully screened and reviewed by the mentor at Rutgers or UMDNJ. For short term training in the US, applicants must provide their academic credentials for review by the committee and a plan of work for their studies in the US for one or two months. All materials will be reviewed by the Selection Committee and, when necessary, be relevant faculty members as well. In addition, all required visa regulations as well as university regulations for international scholars must be followed.

For in-country short term workshops and short courses, there will be a standardized application form that will include work plan, goals and objectives, reasons for wanting to participate in their study programs, and expected outcomes from participation. For in-country study advanced study, students will follow the prescribed application for the Chulalongkorn programs to which they are applying. Their application must first meet the Chulalongkorn requirements and then it will be sent to the ITREOH committee for review and approval. A plan of work as well as a personal goals and an interest statement must be made at the time of application. In all circumstances students will undergo a regular review process throughout their time as an ITREOH supported trainee.

National support and Continued Collaboration: Funding through Chulalongkorn University will be sought to secure several (1 to 3) Jubilee Scholarships per year for trainees for study in the US. Additionally, Asian Development Bank funding and short and long term funding from the Fulbright International Foundation in Thailand will also be sought.

The area identified as the theme of the proposed training and research program is a primary area for the faculty at Chulalongkorn University as well as the two US PIs, many faculty at Rutgers and UMDNJ, in addition to collaborators at CDC, NIEHS, and other institutions. It is highly likely that the work already in place through Dr. Robson's participation in the NRC-EHWM program as well as the continued efforts of Rutgers and UMDNJ to expand their international projects will facilitate and foster long term and sustainable relationships with the Thai faculty and trainees from the ITREOH.

In the program budget there is one pilot project of \$5,000 in each year of the grant from NJAES and SPH funds. Additionally, there are eight pilot projects, two in Years 2 and 4 and four in Year 5 that are requested from the FIC program funds. Also, there is a commitment from the EOHSI and EHS Center Director, Dr. Cory Slechta, to consider funds from the EHS Center Pilot Project funding. In addition, there is a commitment from the Thai – US Fulbright Foundation to assist in a long term commitment through consideration of Fulbright Senior Specialist positions and Fulbright Fellow positions to assist in this effort. Criteria for the award of pilot funding include collaboration with at least one Thai investigator and one US investigator. The work must be done in Thailand with the PI for the project being Thai faculty member. There must be a sound evaluation plan as well as a plan for seeking additional funding for a larger project, with funds from Thai, US or other international funding agencies.

Additionally, we will seek funds from the EOHSI EHS Center of Excellence Pilot Fund project, providing the research proposal is found strong enough to be funded under the pilot project review process. (See Dr. Cory Slechta's letter of support).

Due to the modest budget and the major costs associated with travel, additional funds will be sought from each of the partners and other sources. Participating faculty members will be encouraged to leverage research funds, when possible, to support students, visiting scholars, and participating faculty. Project faculty will be encouraged to apply for other Fogarty funds for travel and study, in particular the FIRCA program.

Participating faculty members will be encouraged to apply for Fulbright Senior Specialists awards. These awards are for four to six weeks per year in the host country, in this case Thailand. Thai faculty are also encouraged to work through the Fulbright process as well as other opportunities with Thai sponsoring agencies, in particular the Asian Development Bank. Ms. Porntip Kanjananiyot of the Thai US Fulbright Foundation has agreed to serve on our International External Advisory Committee and will specifically provide consultation and direction regarding the Fulbright process.

Thai faculty will be encouraged to work with their students to seek support from various sources of scholarships and fellowships including the Jubilee Scholarships and Fellowships that are provided to celebrate HM the King's Jubilee. These opportunities will be for both long and short term study.

### **C. Minority Recruitment and Retention Plan**

The trainees from this program will be selected and recruited from the Chulalongkorn graduate programs from the students in public health and the students in environmental studies. Thailand is predominately a Buddhist country, approximately 95% of the population is Buddhist. There is a Moslem minority within the Thai population of less than 5%. The minority students are represented at the University at the level that is comparable with their representation in the general population. A strong effort will be made by the PI, Co-PIs and collaborating faculty to recruit minority students into the program. Existing programs in higher education are sensitive and actively pursue minority candidates for undergraduate and graduate training. Thailand is a very tolerant country with a commendable record regarding educational opportunity.

### **D. Plan for Instruction in the Responsible Conduct of Research**

Rutgers and UMDNJ through the graduate schools require and provide a course on responsible conduct. All ITREOH trainees, graduate students and postdoctoral fellows will be required to take the on-line NIH, Rutgers, and UMDNJ responsible conduct and ethics courses as well as the on-line courses in the protection of human subjects. If they are using animals in their research, they will be required to take the University course on animal welfare. The PI, Dr. Robson, will meet one on one with each of the trainees to be certain that they are completely aware of the requirements, that they fully understand these requirements, and finally that they have meet these requirements. All the mentors and faculty listed on this program are in compliance and understand the importance of this requirement. Chulalongkorn University has a similar program in place for Thai faculty and students.

### **F. Human Subjects**

Rutgers and UMDNJ have prescribed human subjects (IRB) protocols. Students who are studying in the US will be required to take all the necessary training and certifications for Rutgers and UMDNJ. For students who are participating only in their home institution through short courses or with a US advisor and their thesis work is conducted in Thailand must provide evidence of approvals from the Chulalongkorn human subjects review. These boards are in place in Thailand and students conducting human subjects research routinely apply for permission and are granted approvals for this type of work. The Graduate School at Chulalongkorn already has fairly rigorous requirements in place for trainees.

In many cases the trainee will be handling US data sets, either from the faculty at UMDNJ or Rutgers or the partners. In each case, if IRB is required, it will be sought directly by the PI and the trainee. In the case of working with NIEHS or CDC data sets, the agency IRB requirements must be followed and approvals granted.

All trainees supported by the ITREOH Center will be required to take the on-line courses for NIH, UMDNJ, and Rutgers. Dr. Robson will also provide one-on-one training for each of the applicants to insure that all the required human subjects and ethical standards are met. Students in the graduate programs will be required, as all of US students are required, to take the ethics course offered jointly by Rutgers and UMDNJ.

### **G. Vertebrate Animals**

Rutgers and UMDNJ have prescribed animal protection protocols. Students who are studying in the US will be required to take all the necessary training and certifications for Rutgers and UMDNJ. For students who are participating only in their home institution through short courses or with a US advisor and their thesis work is conducted in Thailand must provide evidence of approvals from the Chulalongkorn animal welfare review. These boards are in place in Thailand and students doing animal research routinely apply for permission and

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are granted approvals for this type of work. The Graduate School at Chulalongkorn already has fairly rigorous requirements in place for trainees.

All trainees supported by the ITREOH Center will be required to take the on-line courses for NIH, UMDNJ, and Rutgers. Dr. Robson will also provide one-on-one training for each of the applicants to insure that all the required animal welfare and ethical standards are met. Students in the graduate programs will be required, as all of US students are required, to take the ethics course offered jointly by Rutgers and UMDNJ.