

**The Johns Hopkins University  
Bloomberg School of Public Health  
Department of Environmental Health Sciences  
615 North Wolfe Street  
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**Final Progress Report**

**Occupational Health Education and Research Center**

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## **I. Abstract**

The Johns Hopkins University Education and Research Center (ERC) in Occupational Health and Safety completed its twenty-fifth year of effort in 2002. The Center supports professional degree programs in Industrial Hygiene, Occupational Health Nursing, Occupational Medicine, and Occupational Injury Epidemiology and Prevention. In addition, there is a very effective Continuing Professional Education Program which is aimed at practicing occupational health professionals. Finally, the Outreach Program has always been extremely active and during this grant period has increased its activities in Region III. The Industrial Hygiene and Occupational Medicine programs are fully accredited; this option does not exist for the Occupational Health Nursing or Injury Prevention programs at this time.

This report briefly traces the development of the ERC from its beginnings in 1977 to the current time. It is clear that NIOSH funds were fully responsible for the development of the outstanding interdisciplinary educational program that now exists at The Johns Hopkins Bloomberg School of Public Health. The ongoing challenge is securing sufficient funds to assist students in a time of high costs for graduate education. Significant features of each program and significant new developments during this grant period are described.

## **II. Significant Findings**

During the period 1997-2002, the Johns Hopkins Education and Research Center has provided training at the masters and doctoral levels in the core areas of industrial hygiene, occupational health nursing, occupational medicine, and occupational injury epidemiology. The Occupational Medicine Program has provided residency training that fulfills the academic and practicum year requirements for board eligibility in occupational medicine. Additionally, the Continuing Education Program has provided education, focusing on the needs of practicing professionals and the Outreach Program has addressed a wider, more diverse audience, with an increase in activities in Region III. A high level of interdisciplinary interaction has been reflected in all areas of education and outreach.

The following points, by program area, are presented as a summary of the major events and developments further described in this report.

### Industrial Hygiene

- The IH Program has been accredited by the Accreditation Board for Engineering and Technology since 1990.
- Alison Geyh, PhD recruited to the faculty.
- Faculty continued a high level of research productivity, reflected in a high rate of peer reviewed publications and book chapters.
- Faculty took primary responsibility for piloting and launching an on-line journal club.

### Occupational Health Nursing

- Increasing numbers of masters level students are pursuing the MSN/MPH joint degree option.
- Recruitment of Ms. Maureen Cadorette, RN, MPH to faculty.
- Increased number of Associate faculty from 2 to 8.
- Graduates hold significant leadership positions in occupational health education and occupational health nursing

### Occupational Medicine

- Dr. Jonathan Patz recruited to faculty.
- Dr. Clifford Mitchell became Director of Occupational Medicine Program (2001).
- Graduates have high rate of passing occupational medicine board certification examination.
- Instituted requirement that all trainees engage in a research project.

### Occupational Injury Epidemiology and Prevention

- One of few programs in U.S. with academic focus on epidemiology of occupational injury.
- Expanded field and research experiences available.
- Successfully competed for Supplemental funding in Occupational Injury Epidemiology Research Training
- Transition in leadership from Dr. Gordon Smith to Professor Susan Baker as Director (2001).

### Continuing Education and Outreach

- Transition in leadership from Ms. D. Zerbe to Ms. Mary Doyle as Director (2002).
- Conducted rotating continuing education needs assessments by discipline
- Began on-line journal club with IH Program faculty taking lead.
- IH and OM faculty members developed on-line training module for hazardous waste workers.
- Participated in outreach program to create more pathways for minority students to establish careers in health sciences
- Increasing emphasis on outreach in Region III.

### **III. Program Areas and Major Contributions**

#### **A. Background of the School and Center**

In 2002, the Johns Hopkins School of Hygiene and Public Health officially became the Johns Hopkins Bloomberg School of Public Health (BSPH). The school was Founded in 1916 with a grant from the Rockefeller Foundation and has grown exponentially to become an international resource in health research and education. The faculty comprises one-quarter of all faculty of U.S. schools of public health and awards one-fifth of all public health doctoral degrees. The BSPH teaches over 1,800 students a year from 100 different countries and has 450 full-time faculty working across 9 departments in alliances of research and action aimed at solving society's most pressing health problems.

To review the progress of the Johns Hopkins University Education and Research Center in Occupational Safety and Health (JHU ERC) one must consider the first years of the Center and the state of occupational health activities at the school immediately prior to center initiation in 1977. There has been continuity and growth in teaching, research, continuing education, and outreach activities since 1977.

#### Pre-Center (prior to 1977):

Dr. Anna Baetjer was the primary focus of the original occupational safety and health education training and research at the School of Hygiene and Public Health. Dr. Baetjer was a physiologist, toxicologist, and industrial hygienist and was a member of the Department of Environmental Medicine. Dr. Baetjer joined with Dr. Cornelius Krusé, a sanitary engineer and Chair of the Department of Environmental Health Engineering, to secure funding for an Air Pollution Training Grant beginning in 1970. This grant, along with Dr. Baetjer's experience with military medical training, formed the foundation of health and safety training at JHU. By 1970, there was already a long history of research in this area at JHU. In retrospect, prior to the advent of the ERC, the occupational safety and health program was underdeveloped, primarily due to limited staff commitment. Although training funds provided for both student support and partial faculty salaries, the key faculty did not devote their major efforts toward safety and health training.

In 1976, the Departments of Environmental Medicine, Environmental Health Engineering and Radiation Health were combined to form the Department of Environmental Health Sciences. Dr. Gareth Green assumed the Chair of this new department and, in 1977 after competitive application review and site visit, secured a NIOSH Educational Resource Center in Occupational Safety and Health for Johns Hopkins University. The new Center was a major funding resource to permit the school to expand into the field of occupational safety and health teaching and research. Because the school was at that time (and continues to be) leveraged such that approximately 80% of its budget is associated with grants and contracts, the desire to expand into this field was thwarted until the ERC was awarded. Major personnel recruitments occurred in the first five year award period in order to initiate educational programs in the core disciplinary areas.

#### 1977-1982 Initial Award Period:

Recruitment and program development characterized this period. All three program areas had to be built and space and facilities had to be developed. Major recruitments were:

Industrial Hygiene

Charles E. Billings, PhD.

Occupational Medicine	(Program Director, Industrial Hygiene Program) Edward A. Emmett, MD (Program Director, Occupational Medicine)
Occupational Health Nursing	Dianne Fogelman, PhD (Program Director, Occupational Health Nursing)
Industrial Hygiene	Morton Corn, PhD (Program Director, Industrial Hygiene & Director, ERC)
Continuing Education	Jacqueline K. Corn, Dr. Arts (Program Director, Continuing Education)

Courses in all program areas were established. The Occupational Medicine Residency was established and approved. The Occupational Health Nursing program was focused on doctoral level students, a controversial decision at the time, but one now viewed as innovative and highly relevant to graduating personnel capable of developing university faculty and the research base for the field of Occupational Health Nursing. Also, the Center for Occupational and Environmental Health was established to provide professional practice field experience for students and faculty. The Continuing Education Program and Outreach activities were started, a major innovation at the Johns Hopkins School of Hygiene and Public Health (JHSHPH) which did not engage in these activities prior to this initiative. Consistent with JHSHPH policies and funding, all newly recruited faculty either came with substantial funded research in progress, or initiated new research proposals, with subsequent funding. Thus, the research and teaching base for occupational health was laid primarily in this first five year period.

#### 1982-1987:

This period coincided with major reductions in not only ERC funding, but also in research and training funding in all areas in which the JHSHPH was active. The School incurred deficits in 1982 and 1983. The Advisory Committee to the ERC became an Advisory Committee to the Department and subsequently an advisory Committee to the School, with a Sub-Committee serving as the ERC Advisory Committee, as well as advisors to all occupational safety and health efforts. During this period the department targeted the private sector as a source of funds to alleviate stress caused by Federal funding reductions. By 1987, private sector funds would represent 25% of department funding, growing from 0% in 1982. Our target was then, and remains, 30% of the approximately \$15 million Department annual budget; we have leveled out at 25-27% in recent years. A substantial portion of private sector funds have been for research and student support in occupational safety and health.

Despite the adverse funding climate during this period, occupational safety and health faculty numbers expanded in these years, as did the accompanying research. Student numbers were reduced somewhat, the result of steadily increasing tuition and our inability to match this with increased student support. The reduced ERC funding substantially aggravated this situation. Of financial necessity, we reduced outreach activity and were quite active in professional practice; this strategy created modest surpluses to meet needs and to maintain expanded teaching and research activity.

The occupational medicine residency, industrial hygiene, nursing and continuing education programs matured and stabilized during these years. The nursing leadership changed, with Drs. Alice Gifford and Jacqueline Agnew assuming responsibilities, but the progress and stride were not broken.

The Occupational Safety and Health Seminar Series was institutionalized and a multitude of outstanding speakers offered seminars during this and subsequent periods. A major library in occupational safety and health was built using some annual ERC funds as well as other funds.

During this period Dr. Morton Corn, Center Director, served as the President, Association of University Programs in Occupational Health and Safety and as Chair, American Conference of Governmental Industrial Hygienists. Dr. Corn assumed the Center Directorship in 1981; Dr. Gareth Green was Director from 1977-80. The continuity of directorship since 1981 provided a unique opportunity to consolidate Center goals, activities and overall philosophy.

#### 1987 - 1992:

This was a period characterized by the blossoming of occupational safety and health activities throughout the school and, to a limited extent, elsewhere on the JHU campus. Perhaps the most important development was the linkage with the injury prevention effort in the Department of Health Policy and Management. Dr. Stephen Teret directed one of the first four funded Injury Prevention Centers under the Centers for Disease Control. Injury prevention, a new, exciting branch of safety science, formed the basis of the fourth ERC training core in safety science. Dr. Gordon Smith assumed the leadership role, which resulted in an application review, site visit and subsequent approval of this core program. The academic year 1990-91 was the first year this core was active as part of the ERC. It was funded on a two-year basis to coincide with the next grant renewal. A major teaching initiative stemming from this award was the introduction of the first ergonomics course, Introduction to Ergonomics, first offered in the 2nd Quarter, 1991-92, by Dr. Joanna Sznajder, Lecturer, who joined the faculty on a one-half time basis in September 1990. Dr. Sznajder's appointment was increased in 1993 to full-time.

A major recognition of the maturing of the industrial hygiene program in the period was the award of ABET accreditation to the program in 1990. The laboratory facilities of the IH Program were expanded. Links with industry and labor organizations were strengthened, bringing supplemental student funding and internship opportunities in the industrial hygiene and nursing programs and new rotations for occupational medicine residents at Baltimore Gas and Electric Company and International Association of Fire Fighters. Dr. Sheila Fitzgerald joined the faculty of the OHN Program as an Assistant Professor, and a closer relationship was developed with the relatively new School of Nursing. The Continuing Education Core started the Summer Institute in Environmental Health Sciences in 1987, permitting intensive study for professionals with the award of academic credit. Over this period, changes took place in school philosophy that eased the barriers to participation in degree programs - a part-time MPH option became available and course offerings at off-campus locations increased.

#### 1992-1997:

During this period a change in management philosophy literally swept through U.S. private and governmental organizations. It was characterized by downsizing and outsourcing of personnel and greater efficiency of operation. The impact on universities was major, as reflected by the following:

- reduction of Federal and private sector research funds making it difficult for universities to sustain the level of research activity built up over decades.

- increased competition among faculty to obtain research funding, making it difficult to attract and retain qualified faculty.
- increased numbers of applicants seeking improved credentials in a more competitive job market.
- a major increase in the availability and demand for consultation services in the occupational safety and health field, as contrasted to full-time staff professionals delivering these services as organization employees.
- increased emphasis on community and employee right-to-know in the presence of continuing regulatory reform and decreased emphasis on regulatory enforcement.

The net effect of these impacts was to stimulate a reassessment of activities at universities. At the School of Hygiene and Public Health a five year plan was developed that established goals in professional education, practice and research. The planning effort was initiated by a new Dean of the School, Dr. Alfred Sommer, who assumed the Deanship in 1991, and has been implemented and updated since its adoption in 1993. In 1993 Dr. John Groopman was appointed Chair, Department of Environmental Health Sciences, succeeding Dr. Gareth Green. Dr. Groopman has been a strong supporter of the NIOSH ERC and places a major departmental emphasis on occupational safety and health programs. The implementation of the five year plan resulted in increased emphasis on teaching, with satellite campuses in Montgomery County, Downtown Baltimore and Washington, D.C. in an effort to accommodate students interested in part-time professional education. The trend to part-time, as contrasted to full-time study, can be observed in the ERC programs in Industrial Hygiene and Safety Science, Occupational Health Nursing and Injury Epidemiology. In research, the implementation of the five-year plan has resulted in an increased emphasis on collaboration, "partnering" and sharing of resources to optimize the effectiveness of resources. Throughout this period the NIOSH ERC has maintained or expanded its efforts in all program areas. A change occurred in the leadership of the Continuing Education program, with a new Director, Diane Zerbe, MHS. In addition, the research output of the ERC programs thrived.

Additionally, the JHU ERC appointed an Advisory Board dedicated to the ERC, as contrasted to the previous practice of the ERC utilizing the services of selected members of the School of Hygiene and Public Health Advisory Board. The Board has continued to be a major resource for the ERC Director and Program Directors. Board members have developed a sense of involvement in the ERC and are thoroughly familiar with its activities.

In 1993 and in each subsequent year, an ERC faculty/student meeting of all students in programs, regardless of support has been held at the beginning of the academic year to fully familiarize students with ERC program history, the JHU ERC program faculty and students, activities, etc. This session has proven to convey information, and also to establish a foundation for continued student/faculty interaction early in the academic year. It also promotes a sense of shared values and interests among all those in the ERC.

Major personnel changes or changes in responsibilities of ERC faculty during the period 1992-97 were the following:

- Patrick Breyse, PhD became Director, Industrial Hygiene Program succeeding Dr. David Swift.

- Brian Schwartz, MD became Director, Occupational Health Division and Director of the Occupational Medicine and Residency Programs, succeeding Dr. J. Nethercott.
- Diane Zerbe, MHS became Director, Continuing Education program, succeeding Jacqueline K. Corn, DA
- Clifford Mitchell, MD, was appointed Assistant Professor, Occupational Medicine
- Virginia Weaver, MD was appointed Assistant Professor, Occupational Medicine.
- Timothy Buckley, PhD was recruited as Assistant Professor, Division of Environmental Health Engineering, and joined the ERC Industrial Hygiene faculty.

### 1997-2002:

This grant period began with a change in ERC leadership, precipitated by the planned phased retirement of the previous Director, Dr. Morton Corn as of July 1, 1997. Dr. Jacqueline Agnew, having served as Deputy Director to Dr. Corn for three years, and being familiar with all aspects of ERC activities and the role of the Director, assumed the Directorship. Dr. Peter Lees, a key member of the Industrial Hygiene faculty and thoroughly familiar with the ERC programs and faculty, became Deputy Director. Other leadership positions remained constant across the ERC programs until the final academic year, when Dr. Clifford Mitchell became director of the Occupational Medicine Program, Professor Susan Baker succeeded Dr. Gordon Smith as Director of the Occupational Injury Epidemiology Program, and Ms. Mary Doyle replaced Ms. Diane Zerbe as Director of the Continuing Education Program. These transitions took place quite seamlessly as all new directors were already thoroughly familiar with their respective programs and roles.

Other personnel changes during this grant period resulted in the gain of several junior faculty. These include the following:

- Alison Geyh, PhD was recruited as Assistant Scientist, Division of Environmental Health Engineering, and joined the ERC Industrial Hygiene faculty. She was recently appointed Assistant Professor.
- Andrew Lincoln, ScD joined the Occupational Injury Epidemiology faculty in 1998 as Assistant Research Professor. He has since left for another position but continues an affiliation with the program as Adjunct Assistant Professor.
- Maureen Cadorette, RN, MPH joined the Occupational Health Nursing faculty as a Research Associate.
- Jonathan Patz, MD, MPH is now an Assistant Professor on the Occupational Medicine faculty, bringing expertise in global climate change and other environmental issues.

Several faculty members were promoted during this period, received recognition through awards, or were elected to leadership positions in professional organizations.

Although many of the same external economic challenges remained unchanged during this period, the ERC Programs were characterized by stability. Additionally, the ERC saw significant growth due to the successful funding of two new programs - the Pilot Project Research Training Program (PPRT) and the Injury Epidemiology Research Training Supplement. The funding periods of these new programs do not make them eligible for discussion within this report, but it is important to appreciate their impact on the educational program of the center. The PPRT offers major advantages to each of the doctoral level training programs by providing resources that can be applied to student dissertation projects. This funding is having a significant impact on the ability of students to complete their programs in a timely manner and proceed with their professional careers. It also is strengthening the research programs of junior faculty, which in turn enhances the research training capacity of the center. Another benefit to the entire ERC has been the annual research presentation day that brings together all PPRT award recipients, including those from other institutions in Region III, and all ERC members, thus strengthening ties across programs within our region. The Occupational Injury Epidemiology Supplement has made it possible, after many years of reduced funding for the Occupational Injury program, to expand the number of students supported by the ERC and to prepare a greater number of critically needed injury research professionals.

JHBSPPH constantly monitors, evaluates and modifies curriculum design and course offerings to keep pace with current needs in public health education. This period was no exception. The Master of Public Health curriculum was enriched by the addition of an Integrating Experience, an opportunity to synthesize the competencies addressed over the course of the year long curriculum. There was also restructuring of the course offerings in satellite venues, with a decrease in off-campus classes and an increase in distance education opportunities. A large number of academic courses are now offered in web-based format and an Internet MPH curriculum is now available. Although ERC academic programs are not yet available as strictly distance education programs, a large number of the occupational health and safety courses are available on-line and may be taken by students in the programs. We will continue to be involved in the evolution of new technologies in teaching and to apply advances to benefit ERC trainees.

## **B. Industrial Hygiene**

### **1. Organization and Faculty**

The Industrial Hygiene Program (IHP) is located in the Department of Environmental Health Sciences, Division of Environmental Health Engineering and operates with four full-time core faculty, and a variety of affiliated faculty. Full-time faculty include Patrick N. Breyse (program director), Timothy Buckley, Peter S.J. Lees, and Alison Geyh. Dr. Alison Geyh, whose primary interest is particulate matter characterization and air pollution, was new to the core faculty during this report period and assists with teaching and student advising. The Director of the Environmental Health Engineering Division, the academic home of the IHP, is M. Gordon Wolman, a Professor and former Chair of the Department of Geography and Environmental Engineering in the Whiting School of Engineering.

The above faculty represent a diversity of highly specialized scientists who coordinate their scientific expertise and professional skills to solve problems in occupational safety and health. Faculty research focuses on the development of techniques for the systematic evaluation, quantification, and control of risk associated with exposure to agents in the workplace and the general environment. The research interests and areas of expertise for the full-time and affiliate faculty are summarized in Table 1. The full-time faculty commit essentially 100% effort to the Industrial Hygiene Program. Three of the core faculty are Certified Industrial Hygienists (CIH; certified in comprehensive practice).

Even though most areas of teaching are adequately covered by the IHP core faculty, there are a number of areas for which the development of courses by core faculty would be inefficient in the research-oriented atmosphere at the Johns Hopkins School of Public Health. For these purposes, affiliated faculty who are practicing professionals, provide a valuable resource for student education and training by teaching courses or giving lectures in their specific area of expertise. These affiliated faculty, also listed in Table 1, not only bring their expertise in the subject material, but also contribute their practical experience and insight in addressing short and long term needs in occupational health and safety.

In addition to the commitment and breadth of the IHP core and adjunct faculty, the overall depth of faculty expertise at the Bloomberg School of Public Health (BSPH) and in the University as a whole, particularly in areas of interest to our students, is a major programmatic strength. These subject areas include toxicology, physiology, radiation health sciences, epidemiology, biostatistics, health policy, biochemistry, and social and behavioral sciences. The Johns Hopkins University Bloomberg School of Public Health is the largest such institution in the U.S. and the world; its size, reputation, and breadth of interests give the IHP students a unique opportunity to experience an academic setting with a strong emphasis on training, research, and public service. The Department of Geography and Environmental Engineering in the School of Engineering offers additional expertise and courses in hazardous waste remediation and engineering. Interactions with the Department of Geography and Environmental Engineering are increasing with the addition of Dr. Wolman as the EHE Division Director.

The strength and reputation of the full-time core faculty is evidenced by their significant local, national, and international professional activity. The faculty have demonstrated a high level of research productivity, as evidenced by published papers, review articles, and book chapters, primarily in the field of occupational health and safety. These publications are augmented by numerous presentations at national and international conferences and participation and leadership roles on professional committees of the American Industrial Hygiene Association (AIHA) and American Conference of Governmental Industrial

Hygienists (ACGIH) and other national and international organizations, as well as extensive professional involvements.

Divisional faculty meet twice a month to discuss a variety of matters including academic matters relevant to the ERC - IHP. As the Program Director, Dr. Breyse is responsible for overall coordination, admissions, recruitment, and grant preparation. All core faculty share in student advising, teaching, and mentoring. The Program Director continually seeks input from other core faculty, faculty with the ERC and through professional contacts during the annual IHP Directors meeting and through the Academic Accreditation Committee of the American Academy of Industrial Hygiene. In addition, Dr. Breyse serves on the Department's and Chairs the School's Academic Standards Committees. In this capacity he is able to coordinate IHP-related academic matters within the Department and the School.

## **2. Masters Academic Program**

The IHP offers training at the masters (Masters of Health Sciences - MHS) and at the doctoral levels. The objectives of the masters training program are to: 1) provide high quality interdisciplinary professional education with a research/problem solving perspective for industrial hygiene students; 2) provide courses in industrial hygiene and related fields which are critical to the training of other ERC core students and students in other disciplines; and 3) be an industrial hygiene resource regionally, nationally and internationally. By providing faculty and student support, NIOSH funding continues to provide crucial resources to the IHP. The IHP is accredited by the Accreditation Board for Engineering Technology (ABET).

The MHS in Industrial Hygiene requires 1.5 years to complete as a full-time student. The typical program of study for masters level students is contained in Table 2. The first year consists of full-time course work followed by a summer internship. The IHP assists students in finding internships. During the internship each student is responsible for completing a preapproved project that provides the basis for their masters essay. The masters essay is reviewed and approved by at least two faculty members. The second year of study is dedicated to completing required courses and preparing the masters essay. A part-time MHS option exists but only one student is currently enrolled.

The IHP has graduated 29 masters graduates during this grant period (i.e. since 7/1/97) for an average of approximately 6 graduates per year. Four new masters students were enrolled for the 2000/2001 academic year, consistent with our target enrollment of 4-5 new full-time students per year. We currently have fellowships for approximately 2 new masters students per year. In order to reach our goal, this means that 2-3 students need to provide their own support (either self or from employer). With private school graduate tuition, this is an ongoing challenge for the IHP.

The IHP fills an important regional need. Many of our students come from within the region and most of our professional contacts and activities are also concentrated within the region. The BSPH is one of only three Schools of Public Health in the Region (the University of Pittsburgh and George Washington University being the others). In addition, the IHP is one of only three graduate IH programs in the Region (Temple and University of West Virginia have graduate industrial hygiene programs). The impact of the IHP on Region III can be documented in many ways including Continuing Education and Outreach. Many continuing education attendees come from Region III and some offerings such as the AIHA local section annual scientific meeting (which we help organize and present) are designed specifically for the Region III area. In addition, many outreach activities are concentrated in Region III. The IHP program provides an

important resource to Region III by providing masters students for summer internships. Interns provide a valuable support for local hygienists who in many cases cannot afford to hire additional full-time IH staff. By hiring an intern from our Program a hygienist also gains access to the faculty and IHP resources (in terms of sampling equipment and analytical capabilities). We routinely work closely with the industrial hygienists from sponsoring companies and provide sampling and analytical capabilities as needed. Finally the IHP faculty perform many field-based research and professional practice projects in Region III.

Examples include:

- Consultation on electric and magnetic field levels for the Department of Defense and the Federal Bureau of Investigation (Washington, DC);
- Investigation of suspected cancer cluster in Department of Education building (Washington, DC);
- Investigation of noise exposure in chicken processing plants and grain storage facilities (Eastern Shore of MD);
- Investigation of dust exposure in chicken processing plants and grain storage facilities (Eastern Shore of MD);
- Evaluation of home lead exposures to children and adults (Baltimore, MD);
- Evaluation of dust mite, cockroach, and animal dander allergen exposures in homes (Baltimore, MD);
- Consultation on health and safety program development for the US Coast Guard (Washington, DC); and
- Consultation with the Association of Flight Attendants on in-flight health concerns (Washington, DC).

### **3. Doctoral Program**

The objective of the doctoral training in the IHP is to graduate highly qualified doctoral students in occupational/environmental hygiene with an emphasis on exposure/dose assessment. Doctoral graduates are intended to enter research or advanced policy careers in universities, research institutes, governmental health agencies, international health organizations, or within private industry. Doctoral students at the BSPH can receive one of three degrees, PhD, ScD or DrPH. The PhD and the ScD are traditional research degrees with the main difference being that the ScD degree is administered by the BSPH rather than the University. In contrast, the DrPH degree has a more applied problem solving focus and is intended for students pursuing advanced careers in the public policy arena.

Faculty members in the BSPH are all expected to have a heavy involvement in research efforts, advising doctoral students and publishing scholarly works in books, peer reviewed journals, and technical reports. Promotion and tenure decisions at the School are heavily weighted toward research productivity and faculty are expected to raise 80% of their salary support from research grants and contracts. Thus the entire atmosphere of the school and department emphasizes research, and it is considered an important component of the academic mission of the ERC program in industrial hygiene.

Faculty research interests address many aspects of the environment-disease continuum with a focus on source characterization and exposure/dose assessment. In doing so, many of the research priority areas identified by NIOSH in the National Occupational Research Agenda (NORA) are addressed.

Completion of a doctoral degree requires 4-5 years. Students admitted to the IH doctoral program are expected to complete, or have completed, the equivalent of the MHS curriculum. Additional course work is based on the research area focus of the student and is designed on an individual basis by the student's

advisor with input from the Divisional faculty and the student's doctoral committee. In the four years since the last renewal, the IHP has graduated 8 doctoral students (6 PhD, 1 DrPH and 1 ScD). Three new doctoral students entered the IHP during the 2001/2002 academic year.

#### **4. Contributions to the Discipline**

The IHP research program exists in an environment with extensive interdisciplinary opportunities and ability to address the entire continuum of the "environment-disease" spectrum. These opportunities include inter-ERC, as well as school-wide collaborations. As mentioned earlier, the large size of the School and the strong emphasis on research makes the IHP an extraordinary environment for research and doctoral studies. The importance of collaboration and interdisciplinary research is well accepted in the Department and the School. As a result, the School's faculty are readily willing to assist students by serving as informal advisors, committee members, and by providing laboratory resources. For example, faculty members routinely share analytical resources and capabilities with other faculty members and students.

Of special note is the role of the IHP faculty and doctoral students in providing an exposure assessment resource to health effects studies. By providing detailed exposure assessment capabilities to other investigators at the School it is possible to provide a better understanding of what it means to be exposed relative to disease risk. Examples of recent large scale health effects studies in which IHP faculty have provided detailed exposure assessments include the following:

- Cohort study of inner-city childhood asthma;
- Retrospective study of chromate exposure and lung cancer risk;
- Childhood asthma intervention study;
- Investigation of olfactory effects of styrene exposed workers;
- Development of medical screening program for former DOE workers;
- Case-control study of brain cancer in petrochemical research facility; and
- Investigation of health complaints of flight attendants.

#### **5. Program Support**

The IHP research activities receive extensive support from other sources. We currently have 17 doctoral students in the program. Typically only one or two of these students receives support from the NIOSH ERC Training Grant. Other sources of support include the School, Department, employers, and sponsored projects. Examples of recent sources of funding for research activities include: the EPA, NIEHS, DOE, NASA, AMOCO, HUD, Mickey Leland Center for Air Toxics, Styrene Information and Research Center, and the American Forest and Paper Association.

#### **6. Program Evaluation**

Doctoral training in the EHE Division is evaluated at the Department level. Departmental review is accomplished by the Department's Education Committee which reviews all academic programs, including admissions requirements, individual applicants, student progress, and funding opportunities. Drs. Breyse serves on this committee. Each faculty member's individual research program is also reviewed at the Departmental and School level as a part of the promotion and budget allocation processes. Non-tenured faculty (JHU grants tenure only to full-professors) are reviewed annually with respect to their research program and doctoral student mentoring. In addition, the ERC Advisory Committee serves as an external

review of IHP research activities. Although ABET accreditation is for masters level training, the research capabilities of the IHP are also evaluated as a part of this review.

<b>Table 1 - Listing of IHP faculty, their appointments, and areas of research interest.</b>		
<b>Name</b>	<b>Appointments</b>	<b>Area of Expertise/Research Interest</b>
<b>Core Program Faculty</b>		
Patrick N. Breysse, PhD, CIH <sup>1</sup>	Professor, Industrial Hygiene Program Director	exposure assessment, fibers, non-ionizing radiation, and airborne allergens, childhood asthma
Timothy Buckley, PhD, CIH	Assistant Professor	total exposure, biomarkers, and air pollution
Peter S.J. Lees, PhD, CIH	Associate Professor, Deputy Director of ERC	exposure assessment for epidemiology, surface contamination, man-made vitreous fibers, and lead
Alison Geyh, PhD	Assistant Professor	particulate matter, air pollution, exposure assessment
<b>Affiliated Faculty</b>		
Ron Taylor, JD	Department Associate	occupational safety and health law
Jonathon Krasnoff, JD	Department Associate	occupational safety and health law
Stephen M. Bowes III, PhD, CIH	Adjunct Assistant Professor	general industrial hygiene, ventilation
Emory Knowles, CIH, CSP <sup>2</sup>	Department Associate	safety sciences, management
Linda Hanna, PhD	Adjunct Assistant Professor	risk assessment, hazardous waste
Mary Lopez, PhD	Department Associate	ergonomics
Anthony Connely	Department Associate	industrial ventilation
David Sliney, PhD	Department Associate	physical agents, lasers
Alice Koegel, MHS, CIH	Department Associate	general industrial hygiene, hazard communication
Joanna Sznajder, PhD, CPE <sup>3</sup>	Department Associate	ergonomics

1. CIH - Certified Industrial Hygienist; 2. CSP - Certified Safety Professional; 3. CPE - Certified Professional Ergonomist

**Table 2. Required courses for Industrial Hygiene Masters Program**

<b>Quarter</b>	<b>Course</b>	<b>Credits</b>
<b>1st Term</b>	Principles of Epidemiology (340.601)	5
	Statistical Methods in Public Health I (140.621)	4
	Fundamentals of Occupational Health in the US (188.680)	3
	Principles of Toxicology (187.610)	4
	EHE Seminar (182.840)	1
<b>2nd Term</b>	Fundamentals of Human Physiology (183.631)	4
	Statistical Methods in Public Health II (140.622)	4
	Principles of Industrial Hygiene (182.625)	4
	Introduction to Ergonomics (182.621)	4
	EHE Seminar (182.840)	1
<b>3rd Term</b>	Industrial Hygiene Laboratory (182.614)	5
	Airborne Particles (182.615)	3
	Occupational Safety & Health Management (182.623)	3
	Statistical Methods in Public Health III (140.623)	4
	EHE Seminar (182.840)	1
<b>4th Term</b>	Industrial Ventilation Controls (182.622)	4
	Occupational Health (188.681)	5
	Occupational Injury Prevention & Safety Practice (305.615)	2
	Electives	4-6
	EHE Seminar (182.840)	1
<i>Summer Internship</i>		
<b>5th Term</b>	Introduction to Radiation Health Sciences (186.601)	5
	Principles of Safety (182.631)	2
	Electives/Special Studies Research (182.840)	8
	EHE Seminar (182.840)	1
<b>6th Term</b>	Noise and Other Physical Agents in the Environment (182.637)	4
	Occupational Safety and Health Law (182.633)	3
	Introduction to Persuasive Communications (304.620)	4
	Electives/Special Studies Research (182.840)	4-6
	EHE Seminar (182.840)	1

## **C. Occupational Health Nursing**

### **1. Organization and Faculty**

The Occupational Health Nursing (OHN) Program is located in the Division of Occupational and Environmental Health, Department of Environmental Health Sciences. The disciplines represented in this Division include nursing, medicine, law, epidemiology, and laboratory science. The result is an interdisciplinary training climate that focuses on prevention, intervention, and research of occupational health problems. The OHN Program's location facilitates interaction with faculty and students of the Occupational Medicine Program within the division and with those in the Industrial Hygiene Program within the department. The ERC also provides a strong link with members of the Occupational Injury Epidemiology and Prevention Program which resides in the Department of Health Policy and Management.

New areas of interest specifically represented by the divisional faculty now span environmental law, global climate change, and public health policy. The result is a stronger interdisciplinary training climate. In addition, the area of occupational health research is receiving more emphasis due to the Pilot Project Research Training Program. that focuses on prevention, intervention, and research of occupational health problems.

The OHN Program is directed by Jacqueline Agnew, MPH, PhD, COHN-S, FAAN, a Professor of Environmental Health Sciences with a joint appointment in the School of Nursing, who also directs the ERC. Sheila Fitzgerald, CRNP, MSN, PhD is also an Associate Professor with a joint appointment in the School of Nursing. During this funding period the OHN faculty was joined by Mary Doyle, RN, MPH who was first a faculty consultant then moved to a full-time Research Associate faculty position as the Director of Continuing Education and Communications for the ERC. Additionally, Maureen Cadorette, RN, MPH was appointed to the division faculty in 2000 as a Research Associate, and is an OHN faculty member.

During this grant period, we increased from two to eight the number of Associate appointments granted to nurses who contribute to the OHN Program, and one faculty member in the School of Nursing was given a joint appointment. These nurses, listed in Table 3, serve as an additional resource for teaching, mentoring, and student precepting. This is a successful mechanism for augmenting the Program faculty.

In addition, we enjoy substantial interaction with faculty of the Johns Hopkins School of Nursing. Three faculty members involved in the Joint MSN/MPH Program, Drs. Jacquelyn Campbell, Sara Groves, and Joan Kub, work with OHN students in that program, and several other faculty work with OHN students based on their relevant areas of research. An example is joint advising that took place by Dr. Karen Huss and Dr. Fitzgerald with a student who is interested in occupational latex sensitivity. Dr. Huss is an expert in immunological effects of exposures and is also experienced in the topic of occupational asthma. The following summaries briefly present the core faculty's breadth of teaching and administrative activities related to academic training.

#### Jacqueline Agnew

As the Director of the OHN Program, Dr. Agnew directs and oversees all aspects of the Occupational Health Nursing Program. She recruits and advises master's and doctoral level students, directs course credit offerings in occupational health nursing, monitors student progress, and coordinates budgetary and administrative matters related to the program. Additionally, she directs the course titled "Advanced Topics

in Occupational Health Nursing." She represents the Division of Occupational and Environmental Health on the department Educational Programs Committee and is co-coordinator of the Certificate in Occupational Health. She also is an Associate Director of the Master of Public Health Program and serves on that program's Executive Board. In the division doctoral program, Dr. Agnew coordinates the application review process, advises students, and participates in policy decisions regarding program and curriculum requirements and monitoring of student progress. Dr. Agnew represented the School of Public Health in the development of the joint MSN/MPH Program and has chaired the Steering Committee of that degree program since 1992. She is also an Associate Director of the Johns Hopkins Center for Information Technology and Health Research.

#### Sheila Fitzgerald

Dr. Fitzgerald works with MPH and doctoral candidate OHN students while conducting research and performing administrative duties. She recruits students at both the masters and doctoral levels and advises them on their curriculum, supervises them in independent studies, organizes and directs the OHN Seminar series, and co-directs the course "Advanced Topics in Occupational Health Nursing." Dr. Fitzgerald was selected by the Dean to be the Principal Investigator of the Division of Nursing Training Grant for the School of Public Health. Dr. Fitzgerald is a nurse practitioner, credentialed to practice at the Johns Hopkins Hospital Occupational Health Service. She holds a joint appointment at the Johns Hopkins School of Nursing where she commits a percentage of her time to teaching and precepting undergraduate and graduate nursing students. She teaches physical assessment in a course titled "Dimensions of the Nursing Role" and "Health Assessment and Measurement" in the graduate advanced practice program. Dr. Fitzgerald has developed a course titled "Occupational and Environmental Health Nursing," which is jointly sponsored by the School of Nursing and the School of Public Health. This course is offered in the Spring to graduate students from both schools and to senior School of Nursing students. The content provides the grounding required for "Advanced Topics in Occupational Health Nursing" for students who have not taken the course curriculum in the Occupational Health Nursing Program. Dr. Fitzgerald also serves on the Affirmative Action Committee of the School.

#### Mary Doyle

During most of the period of this report, Ms. Doyle taught in classes and continuing education, coordinated communication with program graduates and prospective students, and facilitated interaction between programs of the ERC. She surveyed OHN program alumni to obtain data about employment of graduates in the area of occupational and environmental health and arranged annual Advisory Committee meetings. She assisted Dr. Fitzgerald in arranging the OHN seminar series and has been available to MPH students for assistance in identifying practicum experience sites. She developed print and electronic brochures for the OHN academic programs and responded to prospective student requests for information greatly improving communication with program graduates through e-mail, written correspondence and updates to our Internet site. In early 2002 Ms. Doyle was named Director of Continuing Education within the ERC. While the majority of her duties now focus directly on that program, she continues to perform some of her previous functions. However, the scope in many cases now addresses needs of the overall ERC. For example, she continues to lecture on various topics in the MPH and MHS programs (e.g., role of the OHN, noise and hearing conservation) and serves as course director and faculty in four ERC continuing education courses.

### Maureen Cadorette

Ms. Cadorette is completing her doctoral studies and adds expertise to our program in the areas of medical surveillance, risk communication, and use of Geographical Information Systems (GIS). She is currently working on a Department of Energy funded project that is conducting medical screening of former nuclear weapons complex workers. Ms. Cadorette is becoming increasingly involved with the OHN Program by participating in faculty meetings and policy discussions. She also serves as a resource for students who have an interest in respiratory exposures or GIS as a research methodology. We envision that her involvement in the Program will expand after she receives her degree.

### Supporting Faculty

The range of expertise represented by the OHN faculty makes it possible to offer high quality classroom, field, and research experiences for students enrolled in the program. Supporting faculty for the OHN Program include the remaining Division of Occupational and Environmental Health faculty, including the Occupational Medicine ERC faculty (described in the Occupational Medicine section of this report) and faculty with joint appointments in the division. Examples of subject areas thus represented are psychology, epidemiology, molecular biology, toxicology, international health, and environmental medicine, in addition to nursing and medicine. All division faculty are accessible to OHN students for individual consultation or independent advising for credit (termed "Special Studies"). Faculty interact with OHN students in ERC and division seminars, journal club, research seminars and grand rounds. They also serve on students' doctoral research committees. Other supporting faculty (e.g., toxicologists, physiologists, radiation health scientists) are available within the other divisions of the Department of Environmental Health Sciences. Additional faculty participation comes from the two remaining ERC programs - Industrial Hygiene and the Occupational Injury Epidemiology Program.

Faculty who hold joint appointments in the Division of Occupational Health make significant contributions to the OHN Program. For example, Dr. Barbara Curbow of the Department of Health Policy and Management brings expertise in behavioral sciences and often advises students on topics related to the health of workers. Dr. Curbow has also recently become affiliated with the ERC Pilot Projects Research Training Program. Faculty with joint appointments frequently serve on the doctoral research committees of OHN students and may represent the Department of Environmental Health Sciences in that capacity.

Faculty of the Johns Hopkins School of Nursing also work with the faculty and students of the OHN Program. School of Nursing faculty represent several areas of nursing expertise that are relevant to occupational health such as violence prevention, infection control, rehabilitation, health care management, immune responses and health promotion. OHN faculty collaborate with School of Nursing faculty on occupational health research topics of mutual interest.

Of the core and supporting faculty mentioned above, Dr. Agnew, Dr. Fitzgerald and Ms. Doyle receive ERC funding support from the OHN budget. Because long term faculty sustainment depends on establishing adequate external sources of support for all program faculty, we will continue to build individual research programs and seek other external sources of support.

The OHN faculty have demonstrated leadership in occupational health nursing through research, publications in peer reviewed literature, invited presentations, consultations, and membership in professional organizations and on national committees. They bring to this program strong backgrounds and reputations in occupational and environmental health nursing, public health, and several areas of

research. Table 3 summarizes the competency areas of the core and supporting faculty. Details about the expertise of supporting faculty may be found in the Occupational Medicine section of this report.

## **2. Masters Academic Program**

Training at the Master's level in the Occupational Health Nursing Program at Johns Hopkins centers on the Master of Public Health (MPH) degree program. Additionally, the development of the joint degree program as a venture with the Johns Hopkins School of Nursing now makes it possible to offer the MSN/MPH degree program as an expanded option.

### **Master of Public Health (MPH)**

The MPH Degree program requires completion of 80 credit units and as a full-time program spans 11 months (five terms). The program may be completed over a three year period if enrolled in part-time status. The part-time option has become a popular choice of nurses, who often must continue to work while pursuing graduate education. MPH and OHN core requirements appear in Table 4. To summarize, the specific OHN core course requirements include: Principles of Toxicology, Principles of Industrial Hygiene, Fundamentals of Occupational Health, Occupational and Environmental Medicine, Occupational Health, Advanced Topics in Occupational Health Nursing, one occupational safety or occupational injury prevention course, and the occupational health nursing weekly seminar series. The newly developed distance education format for the MPH degree program as well as two new MPH requirements that have been instituted during this report period, the Goals Analysis Course and the Integrating Experience, are described below.

Beginning in the 1999-2000 academic year, the School of Public Health has offered an Internet-based MPH degree program, thus providing an opportunity to obtain the degree through a combination of web-based courses and at least 20 credit units from on-site courses. The Internet-based MPH degree program is projected to eventually accommodate 100 new MPH students schoolwide per year. This has led to the rapid expansion of Internet offerings, with several of the occupational health and safety courses either already being taught in a web-based format or under development. Although not all of the required courses for the OHN program have been formatted for the distance learning option, it is possible to complete the program through a combination of Internet and on-site courses. One OHN student to date has enrolled in the Internet-based MPH option. Many others have taken Internet courses as part of their curriculum because they are available to all students.

All MPH students are now required to complete the core requirement course "MPH Educational & Professional Goals Analysis" (550.863) within two terms of matriculation. This course provides a structured process for MPH students to assess their educational needs in light of their current knowledge and skill levels and the requisite competencies for the MPH or MSN/MPH Program. In consultation with their advisor, students identify their educational and professional goals and develop a curriculum plan, including formal course work, special studies, extra-curricular activities, and the integrating experience project. This competency driven process is an excellent way to individualize each student's curriculum plan while ensuring that the comprehensive educational objectives will be met.

Beginning in the 1997-98 academic year, MPH students have been required to participate in an "Integrating Experience" that allows them to apply the competencies acquired in course work. A written paper and oral presentation comprise the products of these experiences which are tailored to students' goals.

While the majority of MPH students must define their own experiences and take part in a specific day of presentations at the end of fourth term, two acceptable alternative formats for the integrating experience have been approved for students in the OHN Program. The fourth term course, Occupational Health (188.681), requires an evaluation of an industry occupational health and safety program with oral and written reports. That requirement now also fulfills the Integrating Experience requirement. MSN/MPH students have a longer lead time until graduation and, in their second year, complete a required practicum experience involving program evaluation. That experience, with paper and presentation, has also been designated as satisfying the terms of the Integrating Experience for the MPH.

Although the MPH curriculum does not require completion of practicum or field experiences (with exception of the Integrating Experience described below), these are available to students and often are pursued. Experiences are tailored to students' goals. Options encompass a diverse range of settings in industry, local and federal government, and labor organizations. For example, students have access to the Johns Hopkins University occupational health settings such as the COEH and the Homewood campus employee health clinic. The availability of preceptors has increased over recent years, in part due to the fact that over half of the graduates of this program have taken positions in the region and the number of faculty Associate appointments has increased. Additionally, we have been successful in developing a mechanism whereby OHN program graduates may continue their student status post-graduation to participate in the OSHA Nurse Intern Program (which requires concurrent university affiliation). Because of the very concentrated curriculum, it had not previously been possible for full-time students to participate in the internship program. Coordination with several school officials recently helped overcome this barrier and made it possible for one OHN Program graduate to remain in Special Student status as an OSHA nurse intern. This mechanism is now in place.

Additionally, we utilize a weekly OHN Seminar series to stimulate interaction with practicing nurses and others in occupational health. The seminars build bridges with nurses in the community, place students in contact with future job opportunities, and demonstrate to students the many types of nursing roles experienced in this field. Included as speakers are nurses who are doing research relevant to occupational and environmental health.

### **Master of Science in Nursing / Master of Public Health (MSN/MPH)**

The joint degree program in Nursing and Public Health combines the Master of Public Health and Master of Science in Nursing into an 18 month program of full-time study for nurses who seek to integrate advanced nursing practice with a public health perspective. Part-time study is an option. Because the MSN/MPH curriculum is designed to accommodate a specific area of emphasis, the requirements of the joint program are compatible with those of the Occupational Health Nursing Program. The joint program curriculum includes all requirements for the MPH and MSN degrees plus four courses specifically designed for the joint program: Public Health Theory and Practice, Public Health Leadership and Management, and two respective practicum courses. For OHN students, practicum activities related to occupational and environmental health are available. As examples, students have spent time at OSHA, Maryland Department of the Environment, and the Center for Lead Safe Housing, and have worked on environmental research projects with Industrial Hygiene faculty. Table 5 shows a typical MSN/MPH Curriculum, including the OHN requirements. Dr. Agnew has been instrumentally involved in developing the joint program since its inception and serves as the Chair of the Steering Committee.

### **3. Doctoral Program**

The Research Training Program in Occupational Health Nursing was the first of its kind in the country and is designed to train occupational health nurses as researchers, administrators, educators, and policy-makers. The pre-doctoral training supported by this program leads to the degrees of Doctor of Philosophy (PhD), Doctor of Public Health (DrPH), or, less commonly selected, Doctor of Science (ScD). In general, the DrPH Program has a more problem solving focus and is intended for students pursuing advanced careers in the public policy arena. The doctoral program takes 4-5 years to complete.

The research component of the OHN Program is located primarily within the Division of Occupational and Environmental Health, Department of Environmental Health Sciences, where students follow the course of study in the divisional doctoral program. Students from other departments who have strong occupational health research interests may also be eligible for the program provided ERC faculty have input into the student's training and guidance. See Table 6 for a description of required courses in the DOEH doctoral program.

The research directions of the OHN doctoral program parallel those of the program faculty and also relate to the principal areas of research in the division which are discussed in the Occupational Medicine section, but can be summarized as: the validation and utilization of biomarkers of exposure, risk, and susceptibility; special populations at risk; and health services and outcomes research. The research focus of OHN faculty is particularly aimed at special populations at risk, notably workers who are aging, adolescent, disabled, or experiencing chronic diseases. The OHN faculty members have sound reputations as researchers and leaders in occupational health nursing, demonstrated by their peer reviewed publications, scientific presentations, and invited participation on peer review and national level advisory committees.

Faculty research interests address several priority areas that have been identified in the National Occupational Research Agenda (NORA). Examples of relevant NORA areas include: asthma and COPD, musculoskeletal disorders, fertility and pregnancy abnormalities, traumatic injuries, organization of work, and special populations at risk. In addition to overall divisional influences on the OHN research program, the program has an outstanding relationship with the other ERC Programs (Industrial Hygiene and Injury Epidemiology) and frequently interacts with those programs in research endeavors, thus providing rich experiences for doctoral students and excellent examples of interdisciplinary interaction..

We encourage doctoral students to participate in ongoing research of faculty advisors. This approach serves several purposes. The themes of student research will become more focused to capitalize on the combined expertise of faculty and other students in the program. Additionally, more opportunities are created for student and research support through grant funding mechanisms. For the first time, the OHN Program included a post doctoral fellow, bringing experience and seniority to the training environment.

The Pilot Projects Research Training Program has added a new and very strong dimension to the OHN doctoral program. This program offers a mechanism for supporting research needs such as expenses of data collection and analysis. Additionally, the program requires a poster presentation and brief oral presentation of the study so students gain valuable communication experience and skills needed for their career. The program promotes interdisciplinary research in the areas defined as important according to NORA. We will continue to encourage OHN doctoral students to compete and participate in this program.

Admission criteria for the doctoral program are designed to recruit applicants with strong research interests as well as academic and leadership potential. The goal is to recruit and admit highly qualified candidates at the rate of two per year. The number of inquiries and applicants to the doctoral program has increased steadily. The rate of acceptance depends on financial support, the pool of qualified applicants and the availability of faculty advisors with appropriate interests. We strongly encourage doctoral students to enroll in full-time status for the richest educational experience, exposure to non-credit activities, and ability to efficiently concentrate their research work. All students must spend at least one year in full-time status, but some have found it financially necessary to work while attending part-time. Fortunately, ERC funds have made full-time study a possibility for some. Recruitment of strong candidates continues to be a major plan. The second goal is to increase student funding. One helpful action in this regard has been the departmental supplementation of doctoral student stipends for two years, thus assisting students who otherwise would suffer financial hardships.

ERC funds are critically important for the support of newly admitted students. Our plan is to continue to pursue sources of external funding for all aspects of the program, including grant submissions which include support for student researchers.

#### **4. Contributions to the Discipline**

As the first program to prepare occupational health nurses with doctoral degrees, the Johns Hopkins ERC has produced many leaders in occupational health nursing education and research. Graduates of the doctoral program now direct and teach in other NIOSH supported programs, hold other university faculty appointments and hold post-doctoral fellowships. These and other program graduates not only actively conduct research, but influence the direction and recognition of OHN research through publications, presentations, and leadership positions in national organizations. The Program focuses on quality with respect to the preparation of nurses who become leaders in the field and advance the knowledge base of occupational health nursing. To date, the Program has graduated 18 nurses, of whom four hold full time academic positions and six have Adjunct or Associate faculty appointments.

#### **5. Program Support from Research Sources**

During this period, there were increased efforts to link student research projects with the funded research of faculty mentors. This has expedited the process of initiating doctoral research studies and, in many cases, has provided necessary support for research without long waiting periods for grant reviews and funding cycles. One student conducted his doctoral research as part of Dr. Agnew's studies that are funded by the Department of Defense. Thus, much of his research costs were supported, and he received stipend support in the final years of his doctoral program. He continued in the same research program as a post-doctoral fellow. Another student's doctoral study is linked to Dr. Fitzgerald's study of working adolescents, thus providing a means of supporting some of his research related expenses. As another example, a student's doctoral study was able to proceed because her dust samples were analyzed for allergen content without cost by the laboratories of a member of her research committee. A current doctoral student, has done her research on a subsample of patients who previously participated in a larger study by a School of Medicine faculty member who shared baseline data and facilitated the recruitment of subjects for her study of neurocognitive decline and work. Some students have independently sought and received support for their projects from private, government, and other sources.

We encourage submission of grant applications by doctoral candidates or their close involvement in the preparation of faculty grant applications because of the value in learning about the peer review process of grant review. Although all students must develop their doctoral proposal in the NIH format, there are many more components to an actual grant submission. We have received feedback from program graduates that they are much better prepared to function in the competitive research world as a result of their familiarity with the NIH grant system. Another mechanism that has greatly facilitated student research has been the Pilot Project Research Training Program, beginning with its forerunner, the Research Training Supplement supported by NIOSH in 1996. During 1996, 3 OHN students received support for their studies. In the two years of the Pilot Project Program, 4 OHN students and one faculty member have received support for essential expenses such as software, consultants, and interviewers. With the continuation of this program, OHNs will continue to compete and ongoing support is expected.

As mentioned, faculty have successfully obtained research support from external sources. Dr. Agnew has received three grants for her research program from the Department of Defense, providing significant stipend and research support for two doctoral students. Dr. Fitzgerald has been funded by NIOSH, enabling her to support a doctoral student's research. As the degree of external research funding for faculty of the program increases, more ERC funds are made available for student support. This is consistent with our objectives for the program.

## **6. Program Evaluation**

The primary form of evaluation of this program comes from ongoing contact with program graduates and surveys of their experiences. Graduates' contributions to occupational health, including publications and attainment of leadership positions, are a measure of the success of the program. Therefore, we are in regular contact with graduates to update our data base of contact information and career moves. Feedback of this type also assists in evaluating the need for curriculum changes.

External evaluation of the program is provided by both advisory bodies, the ERC Advisory Board and the OHN Program Advisory Board. While occupational health nursing is strongly represented on the ERC Advisory Board by a nurse, all members of that group contribute input regarding overarching concerns for all programs such as student recruitment, interdisciplinary research and training opportunities, and external funding sources. The OHN Advisory Board provides evaluation and advice regarding specific directions of the program. This combination has yielded some extremely valuable feedback with regard to the masters and doctoral programs.

Ongoing evaluation of doctoral student progress takes place at the division and departmental levels. Students present their research in progress at division seminars during the academic year. Additionally, each student who has completed the preliminary oral examination and has begun the research phase of the program must have their own research committee comprised of the advisor and two other thesis readers. The research committee meets with the student every six months to conduct a formal review of the student's progress; results are documented in a report submitted to the departmental Educational Programs Committee. Student admissions, progress and opportunities for enhanced educational experiences are also evaluated on a regular basis in divisional faculty meetings.

TABLE 3. Areas of Expertise and Research Interests of OHN Faculty

<b>CORE FACULTY:</b>	<b>AREAS OF EXPERTISE/ RESEARCH</b>
J. Agnew, RN, MPH, PhD	aging workers, musculoskeletal disorders, occupational stress
S. Fitzgerald, CRNP, MSN, PhD	health promotion, cardiovascular risk factors, occupational asthma, adolescent workers
M. Cadorette, RN, BSN, MPH	worker screening, risk communication, GIS as applied to occupational health
M. Doyle, RN, BSN, MPH	continuing education, worker training, hearing conservation
<b>SUPPORT FACULTY:</b>	
S. Bernard, JD, MPH	environmental health law
L. Goldman, MD	health care policy and regulation
C. Mitchell, MD, MPH, MS	medical surveillance, occupational and environmental health policy, repetitive-motion related disorders
J. Patz, MD	health effects of global climate change, environmental health policy
R. Rubin, PhD	occupational and environmental toxicology, risk assessment
B. Schwartz, MD, MS	occupational epidemiology, Lyme disease, neurotoxic effects of lead and solvents, exposure assessment
P. Strickland, PhD	molecular epidemiology, occupational cancer, molecular dosimetry of combustion product exposure, UV induced DNA damage in skin
V. Weaver, MD, MPH	occupational epidemiology, biomarkers, surveillance
<b>ASSOCIATE FACULTY:</b>	
W. Hayes, RN, MSN, PhD	occupational injury prevention, occupational health management
A. Schill, RN, MPH, PhD	musculoskeletal injuries, psychosocial work factors, occupational health policy
A. Alfriend, RN, MPH, COHN-S	OH management, OH services
J. Guidera, RN, BSN, COHN-S	workers' compensation, case management
F. Humphrey, CRNP, MSN, COHN-S	clinical OH, OH program management, health promotion
R. Moreland, RN, PhD, COHN-S	clinical OH, ergonomics, surveillance, program administration
E. Handleman, RN, M.Ed., COHN-S	regulatory process, occupational health policy
<b>JOINT FACULTY:</b>	
K. Huss, RN, PhD	asthma, latex allergy

**Table 4. Required Courses and Sample Curriculum - OHN MPH**

<b>Course Number</b>	<b>Course Title</b>	<b>Credits</b>
<b>Summer</b>		
PH140.609*	Statistical Computing in Public Health	2 Units
PH140.610*	Introduction to Public Health Statistics	2 Units
PH221.637*	Health Information Systems	4 Units
PH223.668	Social Behavioral Foundations	4 Units
PH550.605*	History of Public Health	2 Units
PH550608*	Problem Solving in Public Health	4 Units
PH550.863*	Special Topics: MPH Goals Analysis	1 Units
<b>1<sup>st</sup> Term</b>		
PH140.621*	Statistical Methods in Public Health I	4 Units
PH187.610**	Principles of Toxicology	4 Units
PH188.680**	Fundamentals of Occupational Health	3 Units
PH188.840**	Special Studies/Occupational & Environmental Health	1 Units
PH317.600	Intro to Risk Science & Policy	3 Units
PH340.601*	Principles of Epidemiology	5 Units
<b>2<sup>nd</sup> Term</b>		
PH140.622*	Statistical Methods in Public Health II	4 Units
PH182.625**	Principles of Industrial Hygiene	4 Units
PH340.602	Intermediate Epidemiology	6 Units
PH317.610	Risk Policy	3 Units
<b>3<sup>rd</sup> Term</b>		
PH140.623	Statistical Methods in Public Health III	4 Units
PH182.623**	Occupational Safety & Health Management	3 Units
PH188.684	Occupational and Environmental Medicine	4 Units
PH188.687	Occupational Health in Developing Countries	4 Units

PH188.840**	Special Studies/Occupational Health	1 Units
PH550.866*	Special Topics: MPH Integrating Experience	2 Units
PH340.612	Epidemiologic Basis for TB Control	2 Units
<b>4<sup>th</sup> Term</b>		
PH180.611	Global Environmental Health	4 Units
PH180.840	Special Studies/Environmental Health	2 Units
PH188.681**	Occupational Health	5 Units
PH188.840**	Special Studies/Occupational Health	1 Unit
PH340.618	Occupational Epidemiology	Audit
PH550.002	Internet Skills	Audit
PH188.694**	Advanced Topics in Occupational Health Nursing	3 Units

\* Required Courses: MPH Program

\*\*Required Courses: Occupational Health Nursing Program

**Table 5. Sample Curriculum- MSN/MPH Program**

<b>Course Title</b>	<b>Course Number</b>	<b>Credits</b>
<b>SUMMER</b>		
PH 550.605	History of Public Health	2 Units
PH 550.608	Problem Solving in Public Health	4 Units
PH 550.863	MPH Educational and Professional Goals Analysis	1 Unit
PH 140.610	Introduction to Public Health Statistics	2 Units
PH 140.609	Statistical Computing	3 Units
PH 221.637	Health Information Systems	3 Units
PH 302.690	Social and Behavioral Aspects of Public Health	4 Units
<b>FALL (1)</b>		
PH 340.601	Principles of Epidemiology	5 units
PH 180.610	Environmental Health	5 Units
NR 500.601	PHN: Theory and Practice	3 credits
PH 140.611-611	Statistical Reasoning in Public Health	6 Units
NR 100.515	Nursing Informatics	1 Credit
NR (Proposed Course)	Cultural Competency in the Community	2 Credits
<b>SPRING</b>		
NR 500.605	PHN: Leadership and Management	3 Credits
NR 100.500	Concepts and Theories in Nursing	3 Credits
NR 100.503	Research Design Methodology	3 Credits
PH 300.600	Introduction to Health Policy and Management	4 Units
PH 260.605	Biological Basis of Public Health	4 Units
	Elective	
<b>SUMMER (2)</b>		
NR 500.602	PHN: Theory and Practice Practicum	3 Credits
NR 100.561	Program Evaluation	2 Credits

NR 100.533	Ethics of Health Care	2 Credits
<b>FALL (2)</b>		
NR 500.6	PHN: Leadership, Management and Evaluation Practicum	3 Credits
NR 100.509	Scholarly Project	1 Credit
NR (Proposed Course)	Community Development in Urban Health	1 Credit
	Elective	

**Table 6. Required Courses and Sample Curriculum - OHN Doctoral Program**

<b>YEAR 1</b>		
<b>1<sup>st</sup> Term</b>		
PH140.621**	Statistical Methods in Public Health I	4
PH140.607	Introduction to Computing	2
PH221.637	Health Information Systems	2
PH187.610**	Principles of Toxicology	4
PH188.980**	Fundamentals of Occupational Health	3
PH188.840**	Special Studies/Occupational Health	1
PH340.601**	Principles of Epidemiology	5
<b>2<sup>nd</sup> Term</b>		
PH182.625**	Principles of Industrial Hygiene	4
PH140.622**	Statistical Methods in Public Health II	4
PH188.840**	Special Studies/Occupational Health	1
PH300.600	Introduction to Health Policy & Management	3
PH305.610**	Issues in Injury and Violence Prevention	2
PH340.601	Role of Government in Health Policy	2
PH182.621**	Introduction to Ergonomics	3
<b>3<sup>rd</sup> Term</b>		
PH188.684**	Clinical Occupational Medicine	4
PH188.840**	Special Studies/Occupational Health	1
PH182.623**	Occupational Safety & Health Management	3
PH188.687	Occupational Health in Developing Countries	4
<b>4<sup>th</sup> Term</b>		
PH188.681**	Occupational Health	5
PH188.840**	Special Studies/Occupational Health	1
PH302.690	Social and Behavioral Aspects of Public Health	3
PH188.694**	Advanced Topics in Occupational Health Nursing	3
<b>YEAR 2</b>		

<b>1<sup>st</sup> Term</b>		
PH188.840**	Special Studies/Research in Occupational Health	3
<b>2<sup>nd</sup> Term</b>		
PH180.601**	Environmental Health	5
PH 550.860**	Research Ethics	1
<b>3<sup>rd</sup> Term</b>		
PH140.623**	Statistical Methods III	4
<b>4<sup>th</sup> Term</b>		
PH140.624**	Statistical Methods IV	4
PH340.618	Occupational Epidemiology	4
<b>YEAR 3</b>		
<b>1<sup>st</sup> Term</b>		
PH188.840**	Special Studies/Research in Occupational Health	3
<b>2<sup>nd</sup> Term</b>		
PH340.602**	Intermediate Epidemiology	6
<b>3<sup>rd</sup> Term</b>		
PH180.640**	Molecular Biomarkers in Public Health	4
<b>4<sup>th</sup> Term</b>		
PH188.840**	Special Studies/Research in Occupational Health	3
Departmental Comprehensive Exam		
<b>YEAR 4</b>		
<b>1<sup>st</sup> Term</b>		
PH188.820	Thesis Research in Occupational Health	3
<b>2<sup>nd</sup> Term</b>		
PH188.820	Thesis Research in Occupational Health	3
<b>3<sup>rd</sup> Term</b>		
PH188.820	Thesis Research in Occupational Health	3
<b>**Required Courses - Doctoral Program Environmental Health Sciences</b>		
Continue Registering in: PH188.820 Thesis Research in Occupational Health 3 credits until Final Thesis Defense		

## **D. Occupational Medicine**

### **1. Organization and Faculty**

Dr. Clifford Mitchell is Director of the Occupational Medicine Residency program (OMR) and Director of the Occupational Medicine (OM) Program of the ERC. Dr. Mitchell is responsible for the operation and administration of the OMR, assisted by one staff person. Dr. Brian Schwartz, who previously directed the OMR, has coordinated the administration of non-resident graduate students in the OM program and continues his involvement with the OMR as Deputy Director. Dr. Mitchell became Director of the OMR in 1998, and assumed leadership of the ERC OM Program on 7/1/01.

The core faculty of the OMR (Table 7) includes: Dr. Mitchell (Director); Dr. Schwartz (Deputy Director); and Dr. Virginia Weaver. Dr. Clifford Mitchell has been the Director of the OMR since September 1998. Dr. Mitchell is board certified in internal medicine and occupational medicine. He is responsible for all aspects of the OMR, including: counseling trainees in both the academic and practicum phases with individualized educational plans; resident selection; competency development; evaluation and development of practicum rotations; resident supervision and evaluation at every phase of training; monitoring of resident progress; ensuring compliance with applicable rules and regulations established by the School's Graduate Medical Education Committee (GMEC), the Accreditation Council for Graduate Medical Education (ACGME), and other regulatory agencies; and all other aspects of OMR administration. Dr. Mitchell mentors resident research projects sponsored by NIOSH and the National Institute for Environmental Health Sciences (NIEHS) Center for Urban Environmental Health. In addition to the plant walk through course, Dr. Mitchell has also become the director of the Occupational Safety and Health Management course, previously directed by Morton Corn, PhD. Dr. Mitchell's research is in the areas of occupational health policy and program evaluation, particularly with respect to indoor air and work-related musculoskeletal disorders.

Dr. Brian Schwartz was Director of the Occupational Medicine Program in the previous grant period and remains the OMR Deputy Director and a core faculty member in the OMR. Dr. Schwartz was recently promoted to Professor of Environmental Health Sciences, and is the Director of the Division of Occupational and Environmental Health (DOEH). He is board certified in internal medicine and occupational medicine. His responsibilities in the OM program include: mentoring of trainees in the OMR; supervision and mentoring of non-resident graduate trainees in the doctoral program; and direction of the course entitled Fundamentals of Occupational Health (both in class and online). Dr. Schwartz has active research programs in lead, environmental health, and Lyme disease.

Dr. Virginia Weaver, MD, MPH is board certified in both internal and occupational medicine. Her responsibilities in the OMR include: resident selection (with other faculty), direction of the Clinical Occupational Medicine course and Journal Club, and clinical supervision of residents. Her research interests are in the use of biomarkers in occupational epidemiology and medical surveillance (e.g., lead, benzene).

The OM Program resides in the DOEH in the Department of Environmental Health Sciences (EHS) in the Johns Hopkins Bloomberg School of Public Health (JHSPH). The DOEH has eight other full-time faculty whose interests span a wide range of topics in occupational and environmental health. Jonathan Patz, MD, MPH is Director of the Program for the Health Effects of Global Climate Change. Paul Strickland, PhD is a leading researcher in biomarkers of exposure and disease. Susan Bernard, JD, MPH is an environmental lawyer who directs the course entitled, "Environmental Law and Policy and the Protection of Public Health." Dr. Jacqueline Agnew, Director of the Occupational Health Nursing Program and Director of the ERC,

organizes a component of the seminar program. Sheila Fitzgerald, RN, PhD (whose research involves adolescent workers and workers with disabilities) and Mary Doyle, RN, MPH, also work with individual residents. New DOEH faculty members also include Dr. Lynn Goldman, formerly with the Environmental Protection Agency, George Jakab, PhD, a toxicologist and expert in environmental health, and Maureen Cadorette, MPH, a nurse who is the project manager for the Former Los Alamos National Laboratory Medical Examination Program, funded by the Department of Energy.

Rotation preceptors also directly support the OMR. Anita Holloway, MD, Associate Director of the COEH, precepts the required COEH/JHH rotation and is active in the teaching programs. She is board-certified in physical medicine and rehabilitation. Dr. Michelle Smith-Jefferies, MD, MPH and Dr. Craig Thorne, MD, MPH are both board certified in occupational medicine and precept residents in the Washington Police and Fire Clinic.

The faculty has continued its commitment to teaching and advising. In addition to the courses mentioned above, the core faculty again presented a medical school course, "Unhealthy Jobs, Unhealthy Workplaces" (eighth year), and the fifteen-hour course, *Occupational Medicine Board Review*, in partnership with the American College of Occupational and Environmental Medicine. This course has been offered twice annually since 1997 and has enrolled 100 to 140 students each year. Dr. Mitchell also advises approximately 10 M.P.H. trainees per year, and he and Dr. Schwartz are members of the Professional Education and Practice and Graduate Medical Education Committees of the School.

The OMR faculty have contributed significantly in several areas of occupational medicine and public health research, teaching, and professional practice. These research and practice opportunities have provided occupational medicine trainees with unique opportunities to participate in and learn from faculty activities.

Dr. Mitchell's research and practice, in the areas of indoor air quality and program evaluation, have provided fertile opportunities for ERC trainees. He has conducted numerous indoor air quality evaluations of schools and office buildings, several of which have led to or been done in conjunction with research projects, including an evaluation of risk communication strategies and immunological markers in multiple chemical sensitivity. He has also published on tools and strategies for the evaluation of occupational health programs, based on public and private sector work in the region. In each of these activities, residents have had an opportunity to participate in public meetings, evaluation projects, and other aspects of the work. Dr. Mitchell and Dr. Timothy Buckley (industrial hygiene) collaborate in several areas, including indoor air in schools and development of internet-based hazardous waste training modules. Dr. Mitchell and Dr. Weaver also advise and teach in several union-based training programs for hazardous waste workers, operated by the International Chemical Workers Union and the George Meany Center for Labor Studies.

Dr. Schwartz is internationally recognized for his research on lead and occupational aspects of Lyme disease. In addition to his other ongoing research activities, he is involved in a large project funded by the Department of Energy (DOE), on the health of former DOE workers at the Los Alamos National Laboratory (LANL) in New Mexico.

Dr. Virginia Weaver's research includes development and validation of biomarkers of exposure and disease. She is currently working on validation and application of biomarkers used in assessing the health effects of lead and benzene, and has applied biomarkers to para-occupational exposures. She is on the Medical Advisory Committee of the International Association of Fire Fighters, and does a considerable amount of teaching of residents and workers in addition to her own clinical work.

The faculty also participate in numerous scientific and outreach activities, including CDC/NIOSH special emphasis panels, consultations with international unions and employers, and to local, county, and federal government agencies on environmental and occupational health issues. Faculty also served as expert witnesses and consultants and in professional societies. Faculty achievement is further documented in the Continuing Education report and in the publication record of the faculty.

Two factors have contributed significantly to the continued success of the Occupational Medicine Program. The first is the stability of the core faculty, which has remained constant since 1993. The second is the continued growth and evolution of the faculty within the School and particularly the Division of Occupational and Environmental Health. Several important recruitments have enhanced the strength of the faculty. Dr. Lynn Goldman, formerly a Deputy Administrator with the U.S. Environmental Protection Agency, is an expert in environmental health and risk assessment. Susan Bernard is an attorney with an extensive background in environmental law, particularly regarding hazardous waste sites, and strengthens the policy and law resources of the Division.

## **2. Occupational Medicine Residency**

The program includes the Occupational Medicine Residency (OMR), a two year training program leading to eligibility for the certifying examination of the American Board of Preventive Medicine. Successful candidates receive the Master of Public Health (MPH) degree. The OMR program is currently approved by the Accreditation Council for Graduate Medical Education (ACGME) for six first-year and six second-year residents. Generally, we have 3 to 4 residents in the first year and 4 to 6 in the second year, depending on funding and availability of qualified candidates. The ERC OM program also includes a research training program, available to physicians interested in a year of research. This is a non-degree program; candidates generally spend a year working with faculty on projects of mutual interest. The recruitment of physicians for the research year continues to be a priority of the ERC OM program.

Most OMR graduates go on to sit for and pass the Board examination. Over the past 20 years, the OMR program has graduated 96 residents. Of those 96 graduates, 82 (85.4%) have gone on to Board certification. The new program requirements of the ACGME call for a minimum of 50% of program graduates to have successfully passed the Board examination.

First Year (Academic Phase) The core curriculum in the first year (academic phase) of the program provides OMR trainees with the intellectual foundations of occupational and preventive medicine, with a focus on population health issues. Residents matriculate in the MPH program, taking courses in epidemiology, biostatistics, industrial hygiene, toxicology, management, international health, clinical preventive medicine, and environmental health. These are supplemented by the Occupational Medicine core, which consists of Fundamentals of Occupational Health (Dr. Schwartz), Occupational and Environmental Medicine (Dr. Weaver), Occupational Safety and Health Management (Dr. Mitchell), and the Occupational Health (plant walk-through) course (Dr. Mitchell, with Drs. Agnew and Lees). A sample curriculum for a resident in the MPH program is shown in Table 8. An essential aspect of this curriculum is the interaction between OMR trainees, industrial hygienists, nurses, and injury prevention professionals built into several core courses.

Second Year (Practicum Phase) The second year is designed to provide all residents with exposure to five important settings in occupational health: government, clinical, industrial plant, industrial corporate, and union. Residents are appointed as clinical fellows in the Division of Occupational Medicine (DOM), School of Medicine, during the practicum year (second year of the program) which provides them with access to all the

resources of the Department of Medicine and School of Medicine. The required rotations include: the International Association of Fire Fighters (IAFF), Maryland Occupational Safety and Health (MOSH); the Johns Hopkins Center for Occupational and Environmental Health/Johns Hopkins Hospital (COEH/JHH); and an employer-based rotation. Table 9 lists the current practicum rotations.

All told, residents in the practicum phase have an average of three months of electives and nine months of required rotations. Second year residents assemble at the School on Monday afternoons to discuss relevant issues and attend Divisional seminars (i.e., Grand Rounds, Journal Club, and the Divisional Seminar).

### **3. Research Training**

In response to previous reviews and development of competency-based training, the OMR instituted a requirement for trainees that they engage in a research project as part of their training. The general criterion adopted is the preparation of a publishable manuscript, either of original research, meta-analysis, case report, or critical review of the literature. Thus far, trainees have been actively pursuing a number of different projects, including: aviation safety; hospital ergonomics, management information systems in occupational medicine practices; the effectiveness of resident peer training for blood-borne pathogens; review of hair testing for toxicants and how results of such testing are being used to make decisions regarding chelation therapy; and the occupational epidemiology of Lyme disease and how this would guide the need for Lyme disease vaccination. The residents have used their research requirements to develop and demonstrate experience with hypothesis generation, study design, data collection and analysis, manuscript preparation, and risk communication.

In the third (research) year, trainees work essentially full time on a research project with either OMR faculty or other faculty on a project related to occupational health. They may also take courses to round out their training. One candidate has been recruited in the current grant period; another candidate has already been identified for the next grant period. We continue to actively encourage trainees and applicants to consider a research year. One of the purposes of requiring research projects during the two-year training program is to foster an interest in research a research year among trainees. However, it has been challenging to recruit physicians into a third research year over the past several years.

### **4. Contributions to the Discipline**

The Residency and Doctoral training programs of the Johns Hopkins ERC are among the largest and oldest training programs for occupational physicians in the country. Among the physicians who have passed through the OM program in its 20 year history, many have gone on to prominence in the field of occupational medicine, in research, teaching, residency training, clinical practice, and corporate achievement. The School of Public Health attracts candidates from across the country, but still serves an important local and regional need for training and occupational medicine resources. Two of the 3 current first year residents in the OMR program come from Maryland, and this is the only civilian occupational medicine training program in Maryland (there is also the U.S. military's program in Bethesda at the Uniformed Services University for the Health Sciences). Residents in the OMR fill regional occupational medicine needs at the Maryland Occupational Safety and Health agency (MOSH), where they are the occupational medicine resource for the agency, and at the IAFF, where they are similarly an invaluable resource for the union health and safety organization. In addition, faculty from the OM program are involved in many regional occupational health issues, and trainees are often able to use involvement in these issues as part of their training. Many OMR graduates go into practice,

government, or academic positions in the mid-Atlantic region. Many of these graduates have made and are making significant contributions in the public, private, and academic sectors in Region III.

#### **5. Program Support from Research Sources**

Divisional faculty have successfully competed for support from many different sources: NIEHS, NIOSH, EPA, the Department of Energy, NIA, NIAID, NCI, and other agencies. The faculty have also had support from a large number of private sources, including SmithKline Beecham, the E.I. Dupont de Nemours Corporation, AdvancePCS, Inc., and the Abbott Corporation. Faculty research has also been sponsored by local and state agencies such as the Baltimore City Occupational Medicine and Safety agency, Baltimore Health Department, and MOSH. Other funding sources include the IAFF.

#### **6. Program Evaluation**

The doctoral training program within the OM program must comply with standards set up by the School that govern all doctoral-degree programs. The JHSPH is accredited by the Council for Education in Public Health (CEPH).

**Table 7. Occupational Medicine Faculty and Preceptors**

<b>Faculty Member</b>	<b>Role in OMR, Appointment</b>	<b>Competence</b>
C. Mitchell, MS, MD, MPH	Director, OMR Associate Public Health Professor	Clinical occupational medicine, administration, legal/regulatory, disability management and work fitness, risk communication
B. Schwartz, MD, MS	Deputy Director, OMR Professor Director, Division of Occupational and Environmental Health	Clinical occupational medicine, surveillance, medical/legal, environmental health, biological markers of exposure/disease, occupational and environmental epidemiology
V. Weaver, MD, MPH	Core Faculty Assistant Professor	Clinical occupational medicine, surveillance, toxicology, biological markers of exposure/disease
J. Patz, MD, MPH	Supporting Faculty Assistant Professor	Environmental health, Health effects of global climate change
S. Bernard, JD, MPH	Supporting faculty Instructor	Legal issues in environmental health
P. Strickland, PhD	Supporting faculty Professor	Biological markers of exposure/disease, surveillance
L. Goldman, MD, MPH	Supporting faculty Associate Professor	Environmental health, pediatric environmental health
J. Agnew, RN, PhD	Supporting faculty Professor	Musculoskeletal disorders, stress and work organization, occupational health nursing
S. Fitzgerald, RN, PhD	Supporting faculty Associate Professor	Stress, disability and work fitness
M. Cadorette, RN, MPH	Supporting faculty Research Associate	Surveillance
G. Jakab, PhD	Supporting faculty Professor	Environmental health, toxicology
<b>Rotation Preceptors</b>		
A. Holloway, MD	Supporting faculty Preceptor, COEH	Musculoskeletal disorders, management and administration
E. Bernacki, MD, MPH	Supporting faculty Associate Professor Director, Johns Hopkins Div. of Occupational Medicine	Management and administration, workers' compensation, flight medicine
M. Smith-Jefferies, MD, MPH	Preceptor Director, Washington Police and Fire Clinic	Clinical occupational medicine, surveillance, behavioral health

<b>Faculty Member</b>	<b>Role in OMR, Appointment</b>	<b>Competence</b>
C. Thorne, MD, MPH	Preceptor Assistant Director, Washington Police and Fire Clinic	Clinical occupational medicine
M. Bleecker, MD	Preceptor Director, Center for Occupational and Environmental Neurology	Clinical and theoretical neurotoxicology
R. Duffy, MS	Preceptor, Director of Occupational Safety and Health, IAFF	Worker fitness, hazard evaluation and recognition, communication
W. Grabau	Preceptor	Legal/regulatory, hazard evaluation and recognition

**Table 8. Sample Curriculum for Occupational Medicine Residents in the MPH Program**

<i>Term and Course</i>	<i>Units</i>	<i>Instructor</i>	<i>Requirement for:</i>
<u>Summer Session 1 (July)</u>			
140.610 Introduction to Public Health Statistics	2		MPH
550.863 MPH Educational & Professional Goals Analysis	1		MPH
550.608 Problem Solving in Public Health	4		MPH
550.605 History of Public Health	2		MPH
188.840 Special Studies/Research Occ./Env. Health	1		OMR
<u>Summer Session 2 (August)</u>			
140.609 Statistical Computing	2		MPH
302.690 Social and Behavioral Aspects of Public Health	4		MPH
221.637 Health Information Systems	4		MPH
188.840 Special Studies/Research Occ./Env. Health	1		OMR
<u>1<sup>st</sup> Term</u>			
140.621 Statistical Methods in Public Health I	4		MPH
340.601 Principles of Epidemiology	5		MPH
187.610 Principles of Toxicology	4		OMR
188.680 Fundamentals of Occupational Health	3	Schwartz	OMR
260.601 Biological Basis of Public Health	4		MPH
182.631 Principles of Occupational Safety	2		Elective
188.840 Special Studies/Research Occ./Env. Health	1		OMR
<u>2<sup>nd</sup> Term</u>			
180.601 Environmental Health	5		MPH, OMR
182.625 Principles of Industrial Hygiene	4		OMR
140.622 Statistical Methods in Public Health II	4		MPH, OMR
182.621 Introduction to Ergonomics	4		Elective
340.602 Intermediate Epidemiology	6		Elective
182.633 Occupational Safety & Health Law	3		Elective
188.840 Special Studies/Research Occ./Env. Health	1		OMR
<u>3<sup>rd</sup> Term</u>			
140.623 Statistical Methods in Public Health III	4		MPH, OMR
180.629 Environmental Law & Policy and the Protection of Public Health	4	Bernard	Elective
182.623 Occupational Safety and Health Management	3	Mitchell	OMR
188.684 Occupational and Environmental Medicine	4	Weaver	OMR
305.623 Fundamentals of Clinical Preventive Medicine	3		OMR
188.687 Occupational Health in Developing Countries	4	Mendes	Elective
188.840 Special Studies/Research Occ./Env. Health	1		OMR
<u>4<sup>th</sup> Term</u>			
188.681 Occupational Health	5	Mitchell	OMR
188.611 The Global Environment and Public Health	4	Patz	Elective
340.618 Occupational Epidemiology	4		Elective
188.840 Special Studies/Research Occ./Env. Health	1		OMR

**Table 9. Occupational medicine practicum rotations and sample 2<sup>nd</sup> year resident schedule.**

<b>Rotation</b>	<b>Competencies</b>	<b>Required (R) or Elective (E)</b>	<b>Preceptor</b>
Johns Hopkins COEH/Johns Hopkins Hospital	Clinical, administrative, hazard recognition/evaluation, disability management, fitness for duty, medical/legal, surveillance	<b>R</b>	A. Holloway
Maryland Occupational Safety and Health	Legal/regulatory, surveillance, communication	<b>R</b>	W. Grabau
International Association of Fire Fighters	Administrative, communication	<b>R</b>	R. Duffy
Baltimore Occupational Medicine and Safety (new)	Clinical, hazard recognition/evaluation, disability management	<b>E</b>	J. Howard
General Motors	Clinical, fitness for duty, disability management	<b>E</b>	C. Patterson
GlaxoSmithKline	Administrative, disability management, clinical preventive services, surveillance	<b>E</b>	A. Kuhnen
Center for Occupational and Environmental Neurology	Clinical – neurology, medical/legal	<b>E</b>	M. Bleecker
Washington Police and Fire Clinic (currently part of IAFF)	Clinical, fitness for duty, psychological, communication, disability management	<b>R</b>	M. Smith- Jefferies, C. Thorne
<b>Sample rotation schedule for 2<sup>nd</sup> year resident</b>			
July – Aug. Sept. – Oct. Nov. – Dec. Jan. – Feb. March Apr May – June	COEH/JHH (including Center for Occupational and Environmental Neurology) IAFF Baltimore City Occupational Medicine and Safety MOSH Washington Police and Fire Clinic Clinical or research elective Electives <i>or</i> additional COEH, IAFF, MOSH		

## **E. Occupational Injury Epidemiology and Prevention**

### **1. Organization and Faculty**

The Occupational Injury Epidemiology and Prevention Program (OIEP) is located in the Department of Health Policy and Management, and is the only one of the ERC components that administratively resides outside of the Department of Environmental Health Sciences. Until the final academic year of this grant period, the OIEP was directed by Dr. Gordon Smith, and had three core faculty. At the end of 2001, Dr. Smith accepted a position as Director of the Center for Safety Research at Liberty Mutual Research Center for Safety and Health, although he has continued to hold an adjunct faculty position at Johns Hopkins and advises a doctoral student. In February of 2002 the OIEP Associate Director, Dr. Andrew Lincoln, left the OIEP to take a position as a research health scientist directing the education and research programs for the Department of Veterans Affairs War-Related Illness and Injury Study Center. Dr. Lincoln has maintained active ties with the program as an Adjunct Assistant Professor as described below. We have been very fortunate that Professor Susan Baker assumed the leadership of this program as Director, thus keeping the program in very experienced and capable hands. Professor Baker was the first Director of the program and has always been a member of the program faculty. Thus, the transition was seamless. Dr. Guohua Li, a School of Medicine Professor, assumed an increased role with the Occupational Injury Program as Associate Director. Additionally, Dr. Dennis Shanahan, who holds an Associate appointment in the Department of Health Policy and Management, began to work with the program as a consultant. All current faculty are listed in Table 10, and descriptions of core faculty activities follow.

**Susan P. Baker**, M.P.H., Sc.D. (hon.), is the current Program Director. An epidemiologist specializing in injury prevention, she is Professor of Health Policy and Management at the Johns Hopkins University Bloomberg School of Public Health with joint appointments in Environmental Health Sciences at this School and in Pediatrics and Emergency Medicine at the School of Medicine. Professor Baker chairs the admissions committee, supervises research projects, and participates actively in the teaching program. She actively directs the research training program, including supervising students on their doctoral research. Professor Baker is senior author of *The Injury Fact Book*, and author of four textbook chapters and more than 120 other publications. She chaired the 1991-92 NIOSH panel on occupational injuries that produced a long-term plan for preventing injuries in the workplace. She participated in the development of the original NIOSH Occupational Research Agenda (NORA). She served on the Advisory Committee for Injury Prevention and Control of the Centers for Disease Control and is a member of the Expert Advisory Panel on Accident Prevention for the World Health Organization. Her research related to occupational injuries includes a landmark study of all work fatalities in Maryland and research on truck drivers, pilots, municipal workers, and the military. Other published research includes motor vehicle occupant and pedestrian deaths; fatalities related to airplanes, motorcycles, and heavy trucks; carbon monoxide poisoning, drowning, burns, homicide, medical care of the injured, and injury severity scoring. Professor Baker has served as an informal consultant to the Teamster's Union, the UAW/GM Health and Safety Program, and Rohm and Haas. A participant in the Conference on Research in Work, Health, and Productivity, she is senior author of the chapter on "Injury Prevention in the Workplace." She also plays an active role in research on injuries in the military. Professor Baker has been honored by the American Public Health Association and the Dana Foundation as a pioneer whose efforts helped to achieve recognition of injuries as a major public health problem, meriting scientific attention such as that accorded to chronic and infectious diseases. Her research contributions often involve collaboration with faculty from other disciplines, notably surgery, law, pediatrics, and psychiatry. Her enthusiasm for teaching, which led to initial development of injury-related courses at the SPH and the

University of Minnesota Summer Epidemiology Program, has fostered continued contact and collaboration with former students. Concern for needed student support inspired her to raise endowment money to fund doctoral students (the William Haddon, Jr. Fellowship in Injury Prevention and the John Paul Stapp Injury Prevention Scholarship) and junior faculty (the Leon Robertson Career Development Chair).

**Guohua Li, MD, DrPH** became the Associate Program Director in 2002. A physician scientist specializing in injury epidemiology and research methodology, Dr. Li is Professor of Emergency Medicine at the Johns Hopkins University School of Medicine with a joint appointment at the Department of Health Policy and Management in the Bloomberg School of Public Health. Dr. Li has collaborated successfully with the program director (Prof. Susan Baker) on a number of projects, including several ongoing research and training grants sponsored by the National Institutes of Health. Much of Dr. Li's research has focused on commuter air carrier and air taxi pilots, and he currently has an NIA/NIH project that will determine factors such as aging and medical conditions on safety performance. He has also been developing a model system for burn injury prevention, treatment, and rehabilitation which includes a state-wide burn injury registry, series of epidemiologic studies of risk factors for occupational burn injuries, and clinical trials for mitigating adverse social and psychological outcomes of severe burns, such as disfigurement, depression, substance abuse, and barriers to employment. Dr. Li's other research interests include injuries associated with all modes of transportation, injuries to EMS workers, and occupational safety in developing countries. Dr. Li assists Professor Baker in developing and implementing the training program, supervises students in their course work and thesis research, and participates actively in classroom teaching, including directing the 4-credit course on "Alcohol and Health."

**Andrew E. Lincoln, ScD, MS**, is a graduate of the Occupational Injury Epidemiology and Prevention Research Training Program of the Hopkins Education and Research Center who, from 1998-2002, was OIEP Associate Director. He has a bachelor's degree in Engineering Science and Mechanics and a master's degree in Biomedical Engineering. Prior to joining the Center, he was Senior Clinical Rehabilitation Engineer at the National Rehabilitation Hospital, Washington D.C. Dr. Lincoln has a strong background in rehabilitation, biomedical engineering, musculoskeletal conditions, ergonomics, occupational injuries, epidemiology, and statistical analysis. His teaching activities included directing the "Graduate Seminar in Injury Research and Policy," co-teaching courses on "The Research and Proposal Writing Process," "Epidemiology of Injury," "Occupational Injury Prevention/Safety Practice," and advising master's students regarding integrating experiences and senior engineering students on injury-oriented design projects. In response to the training he received in the ERC and Injury programs, Dr. Lincoln collaborated with faculty from various disciplines including orthopaedics, rehabilitation and physical medicine, ophthalmology, preventive medicine, psychology, surgery, and law. These collaborations have provided opportunities to engage in a wide range of investigations including: low back injury and disability in the military; musculoskeletal disorders among auto workers; occupational eye injuries in military and private sectors; redesign of ambulance interiors to promote the safety of EMTs during transit; the impact of motor vehicle injuries on employers; return to work interventions for federal employees with compensable upper extremity disorders; sports injuries; pediatric motor vehicle injuries; and many other studies. Dr. Lincoln supervised students on their doctoral research and assisted in the administration of the program. Since his departure, Dr. Lincoln has maintained an Adjunct Assistant Professor appointment and his teaching activities include co-teaching the course "Occupational Injury Prevention/Safety Practice," lecturing in "Epidemiology of Injury," and teaching the Summer Institute course titled "Case Management of Workers with Disorders of the Upper Extremity."

**Gordon S. Smith, M.D., M.P.H.**, served as the Program Director until 2001 and is now Adjunct Associate Professor. He is a medical epidemiologist who received his medical training in New Zealand and specializes in injury epidemiology and surveillance systems. He has a long and distinguished career in teaching and injury research and, during his tenure at Johns Hopkins, held joint appointments in the Departments of Epidemiology, and Emergency Medicine at the Johns Hopkins School of Medicine. His commitment to student research training has produced many new investigators to study the epidemiological risk factors and consequences of occupational injuries. He developed new training opportunities for the program and coordinated several academic courses. Many of the program graduates whom Dr Smith has either formally or informally advised are now significant players in academic research positions (Hopkins, UPenn, University of Maryland, Arizona, North Carolina, USUHS), government policy positions (CDC, NIOSH, NCHS, HCFA, Norway Board of Health, Taiwan Institute of Public Health), non-governmental organizations (Center to Protect Workers' Rights, IIHS) and industry (Aviation Sciences International).

### **Supporting Faculty**

The supporting faculty members listed in Table 10 actively participate in the training program. Each faculty member has enthusiastically welcomed this opportunity to contribute to the training of students and to undertake collaborative research with trainees.

## **2. Masters Academic Program**

Our innovative training program builds on the strengths of the existing ERC core programs and our CDC funded Center for Injury Research and Policy (herein called the Injury Center). Although significant strides have been made with regard to the training of injury prevention professionals, there is a lack of training programs specifically addressing the unique problems and needs associated with occupational injuries. Most standards, regulations, and educational and other training programs continue to emphasize injuries in the manufacturing industry, where only 10% of all work-related deaths occur. The broader public health perspective and frameworks are necessary to recognize and address the entire distribution of occupational injuries to determine those most burdensome and worthy of intervention. The NIOSH-supported Occupational Injury Prevention Panel to develop a National Agenda for Injury Control in the 1990s, chaired by Professor Susan Baker, and the recent NORA Traumatic Occupational Injury Team Report on which Dr. Gordon Smith serves, have both recognized the need for programs such as ours, that emphasize epidemiological methods. The need for professionals trained in occupational injury prevention is increasingly recognized by many industries, unions, local and Federal Agencies, including health departments. We continue to receive many inquiries regarding our program from agencies that are interested in hiring our graduates. The Injury Control Program at the Centers for Disease Control rapidly grew to "Center" status over the last decade, indicating the priority at the federal level being given to the broader field of injury prevention. This proposed training program represents an opportunity to recruit the best and the brightest students into occupational injury prevention. The successful NIOSH Occupational Injury Research Symposium in Pittsburgh, at which our program was well represented, illustrates the increasing interest in the public health approach to workplace injury prevention. Universities and groups such as the NIOSH Division of Safety Research (DSR) in Morgantown continue to expand their injury epidemiology and prevention activities and there is an increasing need for trained staff in occupational injury prevention.

The unique contribution of this injury training program is its ability to integrate the public health/epidemiologic approach to injury prevention in the workplace with the strong traditions of ergonomics and other safety sciences. Our program emphasizes a strong background in research and the modern principles of injury

prevention in the workplace.

### **Specific Educational Objectives**

The educational objectives of our program combine the broader foundations of public health measurement sciences and health policy (e.g., survey methods, exposure assessment, research/experimental design, intervention evaluation) with the specific training in occupational injury epidemiology (e.g., injury surveillance, injury control, occupational safety, ergonomics).

### **Curriculum**

OIEP masters students are in the MPH Program which has its own required courses. The OIEP masters curriculum is shown in Table 11 (marked with \*). The educational objectives are achieved through course work, field experiences, and research integrated with seminars, special independent studies, conferences, and written reports.

There are eight courses required by the OIEP program as part of the MPH curriculum. Areas of study within the OIEP Program include: occupational injury; general injury prevention; occupational health; public policy and risk sciences; behavioral sciences; teaching and research skills; epidemiology; and biostatistics.

### **Integrating Experience**

One curriculum requirement of the MPH Program is completion of an Integrating Experience. The objective is to provide an opportunity to demonstrate the ability to integrate and apply the core MPH competencies within a personally and professionally relevant context. The Integrating Experience is a year-long process which begins with courses in Problem Solving and Goals Analysis. These provide the framework for organizing and sequencing the MPH curriculum. In the second term, the student identifies a general problem area, the basic format of the paper and faculty mentor. The process culminates in the 4th Term, in the Integrating Experience seminar and presentation of the project in May. Projects completed by students affiliated with the OIEP Program are typically research studies of limited size, allowing the student to complete the process of proposal preparation, data collection and analysis, and presentation of results within the year. Students often complete their Integrating Experience as a part of their faculty mentor's research program. This has served as a mechanism for introducing students to the many collaborative relationships enjoyed by those in the OIEP Program.

### **Collaborative Relationships and Interdisciplinary Interaction**

Interdisciplinary interaction is recognized as being central to injury prevention and is emphasized in our training program. Our occupational injury prevention training program includes opportunities for our faculty and students to interact with the various faculties throughout the Department of Health Policy and Management (Social and Behavioral Sciences, Health Services Research, Health & Public Policy) as well as other departments at the school, including all components of the ERC programs (Occupational Health Nursing, Occupational Medicine, and Industrial Hygiene). The core curriculum includes courses from four different departments of the school (Environmental Health Sciences, Health Policy & Management, Epidemiology, Biostatistics). Additionally, we have established links with faculty of the School of Medicine and the School of Nursing who have research interests in this area. The students who take the courses offered by the program

include physicians, nurses, engineers, safety specialists, industrial hygienists and a variety of students from other disciplines.

Students in the injury program have also organized field trips to other agencies. These included the General Motors Assembly Plant, Consumer Product Safety Commission, Beretta Manufacturing, Maryland Medical Examiner's Office and the Tunnel Construction Site for the metro rail extension (undertaken as a joint project with the local chapter of the American Society of Safety Engineers). These field trips provide valuable insight into problems in the workplace and are conducted in addition to those regularly offered.

During the past two years our faculty stepped up what had been a long-running informal association with military preventive medicine residents. Identification of similar research interests resulted in weekly meetings throughout the year to discuss the application of basic principles of epidemiology and research to investigations appropriate for the students' integrating experiences and continued research efforts during the students' second year of residency. Students pursued studies in a variety of areas including laser injuries, musculoskeletal disorders, eye injuries, work stress and suicide. Students have presented their studies before military and school officials in the First Annual Military Injury Mini-Symposium (MIMS) in May 2000, co-sponsored by the Johns Hopkins Center for Injury Research and Policy and the NIOSH ERC. Two additional doctoral students and a MPH student presented their military-oriented studies in this unique forum. Our faculty also advised an orthopaedic surgical resident who received an award for his military research looking at disability following anterior cruciate ligament (ACL) injury. The increased activity in military injury research is also evident in our work with a U.S. Army Aberdeen Proving Ground official/part-time doctoral student at JHSPH (M. Canham). Thus, faculty and student activities that focus on military injuries are reaching beyond those involved in our formal occupational injury prevention training program to benefit other students at the school.

In addition to the research training we provide to students from the military, the program faculty have well established collaborative relationships with military injury researchers and research agencies. For example, the U.S. Army Research Institute for Environmental Medicine, The Center for Health Promotion and Preventive Medicine, and the U.S. Army Safety Center at Fort Rucker are some of the U.S. Army agencies that routinely interact with the program. Faculty collaborate with faculty from the Uniformed Services University of Health Sciences, some of whom are our graduates. Additionally, we work with the U.S. Air Force Safety Center where the Chief of Research and Epidemiology is a recent graduate of our OIEP Program.

Numerous collaborative relationships are in place between program faculty and agencies that offer opportunities for research training. The following are some examples: Dr. Smith and Dr. Agnew have collaborated on a study of carpal tunnel syndrome at local garment manufacturers (e.g., London Fog, English American); three doctoral students completed studies at these sites; a back injury study involved industrial hygiene faculty, ergonomists, behavioral scientists, and biostatisticians. Dr. Smith's work includes collaboration with engineering faculty and students in the study of building collapse from natural disasters, and the resultant injuries. The Injury Center also sponsors a research project each year in which senior engineering students from the School of Engineering address an injury problem chosen by the Center faculty. These problems have included development of a system to protect EMS workers in ambulance crashes. These projects, in addition to producing products that can reduce the incidence of injuries, have served to interest young engineers in injury control and occupational safety.

The Program has links to the Liberty Mutual Research Center for occupational safety, where Program faculty has held the position of visiting professor and participated in a research fellowship co-sponsored by the

American Society of Safety Engineers. Several research projects have been completed under the auspices of Daimler-Chrysler/UAW Health & Safety Committee. Thus, we have ongoing opportunities to involve students in automotive manufacturing work studies. Additional research relationships exist with NIOSH Division of Safety Research (mentioned above), the World Bank, and other examples that are stated above in the description of faculty resources.

### **3. Doctoral Program**

Our doctoral students take similar course work to the master's program as indicated in Table 11. In addition to this, we enrich the research training. Required courses are shown in Table 11 (marked with #). A major focus of teaching activities in most of the Johns Hopkins programs is research training and experience. Traditionally, students have collaborated with faculty on ongoing research activities or initiated their own research under faculty guidance. The research training program on occupational injury epidemiology and prevention continues in this tradition, providing a variety of opportunities for students to acquire both practical skills in injury prevention and valuable research training experience. Several of the courses require students to develop small research projects. In addition, a requirement for all first year doctoral students in the Department of Health Policy and Management is that they be involved in at least two separate research projects for a total of 300 hours.

All program trainees are required to directly participate in one or more projects or research efforts as part of their training. This training will take the form of (i) work with faculty on existing projects, (ii) development of students' own projects culminating in dissertation research, (iii) work and research experience as part of collaborative arrangements with outside groups. Students will be encouraged to be involved in some or all of the many opportunities for research and practical training. Projects depend on the interest of students and suitable available research topics.

**Field Study or Research Placement:** The development of the numerous opportunities for funded research facilitates the requirement of a research experience for all our training programs. We have been successful in that students have been working on a variety of projects including injuries in the military, alcohol and occupational injuries, injury surveillance, our study of injuries to Chrysler workers, and collaborative projects with the Division of Safety Research in Morgantown. During the summer following completion of the first academic year, each student is required to participate in a field study placement or practical research experience of two to three months duration. This involves either research in an appropriate external setting approved by the program faculty, such as a government agency, industry or union, or participation in a research project with program faculty. For each placement, there is a supervisor from the faculty of the School of Public Health and a field supervisor at the field placement site. A set of objectives is agreed upon among the faculty advisors, field supervisor, and the student before the placement commences. At the end of the placement period, a written evaluation of the student's performance is provided by the field and faculty supervisors. The student prepares either a report based on the work performed during the field study or a manuscript for publication. An outline or plan for this report or research is submitted by the end of the summer session. Funding for these research placements is possible both through the grant stipends and also other support to be raised from participating agencies, and through ongoing research projects. This opportunity also provides for support to develop pilot projects that could later develop into fundable projects.

**Dissertation Research:** To satisfy program requirements, the dissertation topic must be related to occupational injury epidemiology and prevention, must be in the area of concentration of the student, and must focus on a contemporary issue in occupational injuries. The dissertation may incorporate research techniques from several disciplines, and indeed this is strongly encouraged as appropriate to the program. Determination of the adequacy of preparation is a joint responsibility of the student, the advisor, and the dissertation committee. A dissertation committee of at least 4 members, chaired by the student's advisor, will guide the student's progress. At least one member of the committee shall be a member of the program faculty from outside the student's primary department. The student will otherwise satisfy all the usual School requirements for the doctoral degrees. "Seed" money is sometimes available from the research training program for pilot projects and students also seek outside funding for their research. To date, we have been successful with this model; however, funding for thesis research is always difficult. We have also been successful in obtaining other support such as a recent NIH award to a student in the program to study safety culture, alcohol and injury risk.

**Military Injuries Research and Training Program:** Over the past few years an increasing number of military preventive medicine and aerospace residents have been coming to our school for their academic training (MPH). During this time most of the students take one or more of the courses in our injury program, with many taking the full series. A number have also worked with our faculty on research projects especially in the area of aviation safety. We have been awarded several grants to study injuries in the military, which involves collaborating with colleagues in each of the three services. It is planned to further develop this area of research and training, especially the opportunities for student involvement and training as part of the new training initiative. At present, several students are working on military injury projects, and one recently finished his PhD thesis using these data.

**Development of Research Databases:** The development of appropriate databases and opportunities for student research are central to our research training program. We are further developing three main databases that have been used for other studies and are capable of supporting occupational injury research. As part of this research training grant, we require the services of the research assistant/data coordinator to assist students with the analysis of the databases and to facilitate pilot projects using them. As demonstrated by the success in funding previous studies using data from the military data, the City Worker's Clinic and the medical examiners office, the small investment of time and resources is likely to provide for continued outside support for research activities. Examples of work injury databases follow:

**a. Maryland Medical Examiner Data:** While vital statistics data are valuable for identifying problems and defining priorities, they provide little specific data that can be used to develop prevention programs or to understand the problem in sufficient detail. The medical examiner (ME) records are the single most complete source of information on fatal injuries in many locales. They contain information on how the injury occurred, such as photographs and blood alcohol and drug test results. We are developing Maryland as a model state for the ongoing surveillance of fatal occupational injuries and collaborate with OSHA's efforts to improve reporting for occupational injury fatalities. In addition, the system will form the basis for more in-depth studies such as case-control studies of particular occupational injuries. We have worked with Maryland OSHA to link their data for construction fatalities (a student project) and plan to expand this for all injuries. Thus, the ME database can provide exciting opportunities for future student research on fatal occupational injuries.

**b. Baltimore City Worker's Clinic:** The Injury Prevention Center has worked closely with the City of Baltimore's Office of Occupational Medicine and Safety and is familiar with the large occupational group for which the office has responsibility. The City of Baltimore employs about 39,000 persons, or 10% of employed Baltimore residents. With certain exceptions, city employees who sustain occupational injury are treated at a single clinic operated by the Office of Occupational Medicine and Safety, which maintains a computerized risk information management system that is updated to include all new injuries incurred and new medical costs or periods of disability resulting from old injuries. Evidence of the Office of Occupational Medicine and Safety's willingness to participate in injury control research has been demonstrated by its enthusiastic collaboration with the investigators in five projects, to date. These are: (1) evaluation of low back injury claims, (2) a case-control study of occupational hand injury, (3) the epidemiology of motor vehicle related injuries occurring to City employees, (4) a case-control study of injuries to firefighters, and (5) a ongoing case-control study of back injuries. All projects have either been doctoral student projects or have had students work on the projects.

**c. Automobile Manufacturing Injuries Database:** As part of a collaborative research project with The United Automobile Workers/Chrysler Health and Safety Committee we have been working on injuries in their various manufacturing facilities. To date two doctoral students have worked on projects using this data and we see considerable opportunities to expand the value of the database for student research training.

### **Collaborative Relationships with External Institutions and Agencies Serving as Resources**

In addition to the organizations listed above we have developed formal ties with a variety of industries where students can do research projects. These include: General Motors/United Automobile Workers Union, The Boeing Aircraft Corporation, Dupont, and the Red Cross. Dr. Smith is also part of an international network of occupational injury researchers and his contacts and their respective institutions provide a valuable opportunity for collaborative research projects, many of which will involve students. These include the Swedish National Institute for Occupational Health and Safety, the World Health Organization, the Australian National Institute of Occupational Health and Safety, and the New Zealand Accident Compensation Corporation. One of our graduating students was awarded a Fulbright Fellowship to do a postdoctoral year in New Zealand studying occupational injuries.

Potential research projects for student research also include working with state and federal agencies. Two students have worked as summer interns at the NIOSH Division of Safety Research and numerous discussions have been held to strengthen our collaboration. Dr. George Conway in Alaska is also keen to involve students in their occupational studies. Other potential projects include the National Highway Traffic Safety Administration (NHTSA), Maryland State Health Department, and the Colorado State Health Department. The State Health Departments in Maryland and New Jersey are eager to have our students work with them and the proximity of these states in our region should make this a valuable opportunity.

### **Qualifications, Recruitment and Selection**

Successful doctoral applicants are required to possess high academic standing and achievement, interest in injury prevention and occupational health, and superior communication skills. We expect that most, if not all, successful applicants will already have had graduate-level education and/or experience in some aspect of occupational health, injury prevention, or other branches of public health. Occupational safety students interested in learning the public health approach to injury prevention are also encouraged to apply. In fact, our

graduates include an engineer from NIOSH, a rehabilitation engineer, and a corporate safety professional. All applicants should have completed at least an undergraduate degree with a strong biomedical, science, or engineering background. Applicants are recruited through a variety of forums, including several academic and professional websites (e.g., APHA Injury Control and Emergency Health Section, Occupational Health Section, Johns Hopkins School of Public Health, Departmental of Health Policy and Management, Department of Environmental Health Sciences, Center for Injury Research and Policy, and Education and Research Center for Occupational Health). Other recruitment mechanisms include newsletters, trade and scientific publications, and conferences and meetings (e.g., American Industrial Hygiene Conference and Exposition, NIOSH symposiums, American Occupational Health Conference, etc.). In addition to recruitments through the School prospectus and students from the Summer Institute: Principles and Practice of Injury Prevention, efforts will be made to obtain referrals from our graduates and faculty members at other institutions.

Admission to the program is based on academic achievement, results of the Graduate Record Examination, references, and interview (in person or telephone) by program faculty. We consider the overall balance of a candidate's qualifications but pay special attention to the importance of quantitative skills. Special consideration is given to minority applicants by for example, contacting them by telephone to encourage their acceptance if chosen for admission. Steering Committee members in each department will make sure that the admissions committees are aware of our traineeship and the availability of funds, so that prospective students can be informed of the potential availability of funds for pre-doctoral students interested in research training in occupational injury prevention. Students who may be appropriate for the traineeship but have not specifically mentioned the program in their application will be contacted by telephone or email to determine whether they would be interested. Though the program focus is for doctorally prepared graduates, we may offer limited financial support to promising masters student who are poised to make an important contribution to the field. The exact mix between masters and doctoral students will depend on the particular skills and qualifications of the applicant pool each year.

Over the past 3 years we have been able to support at least one new student each year, but have been restricted due to lack of full funding. While we do not have statistics on the number who submit informal inquiries, we estimate that we speak to approximately 3 people for every one who applies to the school and program. Based on the close guidance we provide to applicants, almost all who apply to the program are admitted and enter the program. Virtually all applicants visit the school prior to their application to determine whether funding is available and whether their research interests match those of the faculty. All students who end up applying to the OIEP program have been of very high quality. When we are contacted by a prospective student, one or more faculty hold discussions with that prospective student regarding program opportunities and requirements.

#### **4. Contributions to the Discipline**

The unique contribution of this research training is the diversity of research opportunities available to students. The emphasis on research skills training is the hallmark of the Hopkins educational experience. As the largest school of public health in the world, with 450 full time faculty who are supported primarily by research funds, the opportunities for student research training are almost unlimited, including opportunities in industry, unions, state, local and federal government, and a variety of international experiences. Our graduates have both a national and international reputation, holding many important positions in public health (see above). Our injury program graduates work in a variety of settings and are in demand. In fact, many of our graduates are hired to

work on their thesis topic even before they graduate. Our graduates are trained primarily in injury epidemiology and prevention with additional training in ergonomics, safety engineering and other safety sciences to work with other occupational safety and health professionals as part of a team approach to preventing occupational injuries.

Another contribution of this training program is its strong multi-disciplinary approach, which draws upon many disciplines to train the leaders of a major new thrust to prevent occupational injuries. The program includes research training aimed particularly at: the design and implementation of appropriate surveillance systems for occupational injuries; studies of risk factors for injury occurrence; development of prevention programs based on principles of ergonomics, occupational psychology, engineering and safety-related disciplines; and evaluation of injury/safety engineering interventions.

The Injury Center faculty has a long commitment to meeting the needs of industry and government in our region. Over the years, our faculty has served as consultants (often pro bono) to local industries and governments. For example, faculty and students have investigated injury problems across many local employers, including McCormick and Company in Baltimore; Rohm and Hass in Bristol, PA; London Fog factories in Maryland; and UAW/Chrysler and Dupont in Delaware. We have also consulted with a number of state and local health departments in the region on a wide variety of injury topics including back injuries to Baltimore City employees, State employees occupational injury claims in Maryland, firefighters injuries in Baltimore County, fatal occupational injuries in New Jersey, and musculoskeletal injuries in World Bank employees in Washington, DC. We have also worked on collaborative research projects with many regional companies and health departments such as the back injury and motor vehicle injury study with Baltimore City workers.

The development of a Distance Education Program here at the School provides new opportunities to expand our program to meet not only regional needs, but also global ones. One example of the use of distance education tools that has recently been piloted and which will receive more attention because of its success, is the ERC on-line journal club. This format functions as a chat room with a moderator who presents issues about a paper and receives comments from any number of participants, creating a lively discussion. We intend to include journal articles with an occupational injury focus in order to raise awareness of the developments and opportunities within occupational injury epidemiology among those in the broader occupational safety and health community. Dr. Smith also taught in the new internet injury course entitled "Measuring the Burden of Injuries."

## **5. Program Support from Research Sources**

Faculty at Johns Hopkins receive the majority of their support (over 75%) from outside funded research projects. This provides many opportunities for student involvement in projects. Students are encouraged to participate in any relevant faculty research projects. Current and past research projects that have outside support include the following: back injuries in the Army; back injuries in municipal workers; other back injury projects; alcohol, drugs, and fatal occupational injuries; evaluation of fatal occupational injury reporting by death certificates; occupational injury fatalities in Maryland; shiftwork and occupational injuries; injuries to firefighters; earthquake injury epidemiology and post-disaster search and rescue; truck driver mortality; mortality and morbidity of pilots; work stress and risk of occupational injury; injuries to firefighters;

occupational homicides; a health surveillance system in the paper industry; post doctoral training in occupational epidemiology including injuries (Dupont), a number of occupational epidemiology (which include injuries) studies in the Department of Epidemiology; injuries in automobile manufacturing; flight instructor crashes; injuries to EMS workers and helicopter crashes; injuries to women in the military; fatal injuries in construction; and non-fatal injury surveillance.

## **6. Program Evaluation**

An important component of the program is a continuous evaluation of the quality of the program and whether its objectives are being met as outlined in the program plan. The ultimate measure of success will be the quality of the graduates we produce, their progress through the program, their contributions to the field from both a teaching and research perspective, and the quality and number of research publications generated. These elements are tracked and tabulated through follow-up of graduates. Feedback will be actively solicited from preceptors of field placements as to the skills of our students and whether they are meeting the needs of the agencies receiving our students. Knowledge acquisition will be measured through an assessment of student's academic and research progress following each academic term. Student feedback will be obtained through annual surveys and regular discussions with students. All students will be required to produce written reports for all projects they work on in any substantive way. If possible these reports will take the form of first drafts of manuscripts. These must be completed within one month of completion of the research. A tracking system for all of these evaluation mechanisms will be established and maintained by the grant database manager with quarterly updates provided to core faculty. To monitor the quality of the training, the students also evaluate each course offered in the School. The results of these evaluations are published by the School and are used by incoming students for selection of appropriate courses. The course evaluations will be tracked and suggestions from students will be discussed among core faculty as well as presented to the advisory board for their ideas.

Table 10. Primary Areas of Competence for Faculty

CORE FACULTY	AREAS OF EXPERTISE/RESEARCH
S.P. Baker, MPH, ScD (hon); Professor	injury prevention; safety; epidemiology; aviation safety; health policy; aviation safety; automotive workers; mortality data; recreational injuries and helmet use
G. Li, MD, DrPH	commercial aviation injuries; aging and safety; burn prevention and rehabilitation; EMS workers; injury prevention in developing countries
A.E. Lincoln, MS, ScD; Assistant Research Professor (currently Adjunct Assistant Professor)	injury control; epidemiology; musculoskeletal injuries, occupational health policy; occupational biomechanics; ergonomics; work-related disability; rehabilitation engineering
SUPPORTING FACULTY	
J. Agnew, RN, MPH, PhD, Professor	aging workers, cumulative trauma disorders, occupational stress
M. Alexander, MD, MPH, Assistant Professor	clinical occupational medicine, continuing education for practicing healthcare professionals
J. Bowie, PhD, MPH, Assistant Professor	occupational health, cancer prevention; community or outreach programs; distance learning; quality of life program
B. Curbow, PhD, MA, Associate Professor	occupational stress; workplace policies, drug and alcohol attitudes and behaviors, work-family interface; risk communication; psychosocial issues surrounding chronic illness; changing health attitudes, beliefs, and behaviors
A. Gielen, ScD, MPH, Professor	psychosocial factors in injury prevention & control, injury - women & children living in poverty, domestic violence & HIV risk, community intervention
M. Lopez, PhD, CPE, OTR, Associate	occupational health, ergonomics, worksite evaluation, hazard prevention and control
E. MacKenzie, PhD, MSc, Professor	complex lower extremity fracture; disability following injury; hand injury; health survey; musculoskeletal injury; quality of care; residual impairment
C. Mitchell, MD, MPH, MS, Associate Public Health Professor	medical surveillance, occupational and environmental health policy, repetitive-motion related disorders
D. Salkever, PhD, Professor	work disability policy; health care economics; mental health economics; nonprofit organizations
B. Schwartz, MD, MS, Professor	occupational epidemiology, Lyme disease, neurotoxic effects of lead and solvents, exposure assessment
M. Segui-Gomez, ScD, MD, MPH, Assistant Professor	economic analysis of injury interventions; health care economics; injury; program evaluation (social sciences); technology assessment; trauma
E. Silbergeld, PhD, Professor	occupational and environmental health policy, environmental toxicology, molecular epidemiology, toxicity of lead, dioxins, mercury
D. Shanahan, MD; HIM Associate	aerospace medicine, injury epidemiology, bioengineering, transportation injuries
GS Smith, MB, ChB, MPH; Associate Professor (Currently Adjunct Associate Professor)	injury surveillance systems, epidemiology, occupational injury, alcohol & injury, international injury, injury policy, alcohol research, injury coding and classification, the cost of injuries
D. Webster, ScD, MPH, Associate Professor	alcohol; domestic violence; drug abuse; firearm policy; firearms; injury; trauma; suicide; violent behavior; youth violence
J. Weeks, ScD, CIH; HIM Associate	occupational injury prevention, mining safety, union involvement in injury prevention

**Table 11. Occupational Injury Epidemiology And Prevention Curriculum****Doctoral Required courses are noted with a #.****Master's Program courses are noted with an asterisk (\*).**

Other courses are suggested electives to be tailored to specific research interests.

**I. Occupational Injury Epidemiology and Prevention**

305.615	#*Occupational Injury Prevention and Safety Practice (4 <sup>th</sup> Term)	2 units
182.623	# Occupational Safety and Health Management (3rd Term)	3 units
182.631	#*Principles of Occupational Safety (1st Term)	2 units
188.681	#*Occupational Health (4th Term)	5 units
182.621	# Introduction to Ergonomics (2nd Term)	4 units
305.861	# Graduate Seminar in Injury Research and Policy (1 <sup>st</sup> - 4 <sup>th</sup> Terms)	1 unit
305.618	Aviation Safety (3rd Term.)	3 units

**II. Injury Prevention**

305.610	#* Issues in Injury and Violence Prevention (1st Term)	2 units
305.612	#* Epidemiology of Injuries (3rd Term)	3 units
305.613	# Design and Evaluation of Injury Interventions (4th Term)	2 units
309.630	Emergency Medical Services and Trauma Systems (4th Term)	3 units
301.627	Understanding and Preventing Violence (2 <sup>nd</sup> Term)	3 units
305.625	Biomechanical Epidemiology (4 <sup>th</sup> Term)	2 units
221.612	Injuries in Developing Countries: The Burden of Disease and Policy Perspectives (2 <sup>nd</sup> Term)	3 units

**III. Occupational Health/Industrial Hygiene**

188.680	#* Fundamentals of Occupational Health (1st Term)	3 units
182.633	Occupational Safety and Health Law (2nd Term)	3 units
301.620	Health, Work, and the Labor Movement (2 <sup>nd</sup> Term)	3 units
182.625	Principles of Industrial Hygiene (2nd Term)	2 units

**IV. Public Policy and Risk Sciences**

301.630	# Environmental and Occupational Health Policy (4 <sup>th</sup> Term)	3 units
317.600	Introduction to the Risk Sciences and Public Policy (1 <sup>st</sup> Term)	3 units
317.605	Methods in Quantitative Risk Assessment (3 <sup>rd</sup> Term)	4 units
317.610	Risk Policy (2 <sup>nd</sup> Term)	3 units
317.615	Topics in Risk Assessment (4 <sup>th</sup> Term)	2 units
300.600	Introduction to Health Policy and Management (1st Term)	4 units

**V. Behavioral Sciences**

305.720	Behavioral Science Research and Application in Injury Prevention	3 units
302.685	Psychosocial Factors in Health and Illness (3 <sup>rd</sup> Term)	4 units
302.690	Social and Behavioral Aspects of Public Health (Summer Term)	4 units
304.62 0	Introduction to Persuasive Communication (2 <sup>nd</sup> Term)	4 units

**VI. Teaching and Research Skills**

300.870-1	# The Research and Proposal Writing Process (1 <sup>st</sup> and 2 <sup>nd</sup> Terms)	4 units
300.750-1	# Teaching at the University Level (1 <sup>st</sup> & 2 <sup>nd</sup> Terms)	5 units
340.717	Health Survey Research Methods (1st Term)	6 units
301.840	Special Studies and Research, Health and Public Policy	≥ 2 units
182.810	Field Placement - Environmental Health Engineering	≥ 1 units
301.820	Thesis Research - Health and Public Policy	≥ 1 units
182.820	Thesis Research - Environmental Health Engineering	≥ 1 units

**VII. Epidemiology**

340.601	#* Principles of Epidemiology (1st Term)	5 units
340.602	# Epidemiologic Methods (2nd Term)	6 u n i t s
340.618	# Occupational Epidemiology (4th Term)	4 units
340.603	Cohort Studies: Design, Analysis & Applications (3rd Term) units	4
340.604	Design and Applications of Case-Control Studies (4th Term)	5 units
340.715	Problems in the Design of Epidemiologic Studies (4th Term)	6 units

**VIII. Biostatistics**

140.621	#* Statistical Methods in Public Health I (1st or Summer Term)	4 units
140.622	# Statistical Methods in Public Health II (1st or 2nd Term)	4 units
140.623	# Basic Biostatistics - Statistical Modeling (3rd Term)	4 units
140.624	Statistical Methods in Public Health IV (4 <sup>th</sup> Term) units	4
140.630	Introduction to Statistical Packages (2 <sup>nd</sup> or 4th Term)	4 units

## **F. Continuing Education and Outreach**

### **1. Organization and Faculty**

Until the end of this grant period, the Continuing Education Program was directed by Diane Zerbe, MHS, a graduate of our Industrial Hygiene program with expertise in health care management, occupational health, and industrial hygiene. Ms. Zerbe was a past president of the ERC Continuing Education Directors Group and has served on several planning committees for local and national meetings involving occupational health and safety professionals. She also instructs in the Hearing Conservation Course and the Preparation for the Occupational Health Nursing Certification Examination Course. During the Spring of 2001, the School undertook a new effort, "Public Health Scientists Working to Address Terrorism" and invited Ms. Zerbe to accept a faculty position with that new program. The new Continuing Education Program Director is Mary Doyle, RN, MPH, COHN-S, who was previously working part-time with the ERC OHN Program. (Please see OHN section of this report for details regarding Ms. Doyle's background.) Ms. Doyle, also a JHU ERC graduate, had been very involved in the teaching activities of the Continuing Education Program and was therefore immediately able to step into the role of Director. Ms. Zerbe continues to teach in our courses as mentioned above, as does Ms. Doyle. This has been a very fortunate outcome and entirely smooth transition for the program.

The Continuing Education Program offers short courses to prepare occupational safety and health and environmental professionals for the ever-changing climate in technical practices, regulations, compliance, health care delivery, and corporate culture. The continuing education plan for the core program areas of Industrial Hygiene, Occupational Health Nursing, Occupational Medicine and Occupational Injury Epidemiology and Prevention is structured to provide short courses and workshops for physicians, nurses, industrial hygienists, safety engineers and other occupational safety and health professionals working to promote occupational and environmental safety and health.

Students can receive continuing education units from the relevant professional boards or associations, such as those in medical education, industrial hygiene, occupational health nursing, and safety. The program offers approximately 30 courses per year which are primarily lecture-based, although some are augmented by laboratory practice components. Evaluation is an integral part of each course and is used to improve the quality of succeeding offerings and as a means of conducting an ongoing needs assessment. Additionally, a two-week Summer Institute is offered which incorporates a multi-disciplinary and multi-professional approach into the continuing education of health and safety professionals. For example, the Summer Institute for 2001 was comprised of three full courses, and four short courses on "hot topics" designed to compliment the three full courses. The short courses were each granted one academic credit of Special Studies. All courses provide the participant with continuing education credits.

Course instruction is provided by JHU faculty members, faculty from outside the university who are recognized experts in occupational health and safety and related areas, and Associate Faculty of each program area. To insure quality control for every course, a JHU faculty member serves as course director and must be involved in planning each course.

## **2. Continuing Education by Program Area**

### **a. Industrial Hygiene**

Continuing education courses in this program area are directed toward the recognition, evaluation, prevention, and control of factors in the workplace that may cause illness or injury. Courses presented in the last several years include topics such as air sampling techniques, certified industrial hygiene review, fetal and reproductive hazard management, occupational respiratory protection, assessment and measurement of waste anesthetic gases, biomedical waste, certified hazardous materials manager review and principles of industrial hygiene. Regional involvement with the Chesapeake Section of the American Industrial Hygiene Association over a several year period has resulted in the co-sponsorship of annual Professional Development Programs with significant involvement of ERC faculty. JHU ERC Program Directors and faculty, along with students, have served on planning committees, as faculty, and have presented poster sessions. These programs have been one means by which ERC faculty have stimulated interdisciplinary interaction in the region; the ERC CE Director has been responsible for incorporating into these professional meetings presentations by ERC faculty in occupational health nursing, occupational medicine, and ergonomics in addition to industrial hygiene. Thus, the regional annual conferences have done much to demonstrate and promote the collegial relationship of these disciplines.

A program to prevent health effects from ground level ozone was presented in collaboration with an area group "Clean Air Partners." The conference focused on the factors that contribute to ground level ozone and stressed awareness of how individuals contribute to air pollution while informing them about the adverse effects of ground level ozone. Dr. Buckley directed a new offering entitled "Airborne Particles: Exposure and Effects" offered in the Summer Institute and was well received. Additionally he prepared a distance education module to be used as a "Train the Trainer" education tool for hazardous waste workers. Dr. Lees directed a certification preparation course for hazardous materials managers. Additionally, Dr. Breyse began a new direction in distance learning and launched an On-Line Journal Club. This activity provides an opportunity for practicing professional to receive continuing education credit for participating in an on-line discussion of a scientific article recently published in a mainstream occupational safety and health journal.

### **b. Occupational Health Nursing**

Courses are geared toward the practicing occupational nurse who requires continuing education to meet the challenges of providing occupational health care as well as managing occupational health programs. Nurses are offered a variety of courses to enhance their understanding of toxicology, industrial hygiene, and safety and injury prevention as well as worker health care. One course that has been designed specifically to meet regional needs is the Preparation for the Occupational Health Nursing Certification Examination offered twice a year. A physical assessment course for occupational health nurses has been offered annually and has received high marks from the participants.

Dr. Fitzgerald continues as Director of Continuing Education for the Maryland Area Association of Occupational Health Nurses. She has brought an interdisciplinary perspective to planning and has included ERC faculty in programs. Presentations have covered such topics as an update on the OSHA Ergonomic Program Standard, a workshop for case managers, and an overview of mental

health disorders. The Seventh Annual Current Issues in Healthcare Regional conference was held on June 9, 2001. Regional involvement of the OHN faculty centers on providing leadership in planning programs for the Maryland Area, Seneca Valley, Metropolitan Washington Area, and the Northern Virginia Associations of Occupational Health Nursing.

### **c. Occupational Medicine**

Continuing education courses in this program area are designed to aid physicians who deliver occupational health care in industrial, governmental and clinical practice settings to acquire skills in both clinical and preventive occupational medicine. Dr. Schwartz directs the Occupational Medicine Board Review course given twice yearly and co-taught by Drs. Weaver and Mitchell. Dr. Mitchell directed a course entitled "Hazards in the Office Environment" in the Summer Institute which focused primarily on ergonomic and indoor air quality issues. He also participated in the development of the web-based module to train hazardous waste workers. The module gives facts and guidance on what hazardous waste workers should know about medical surveillance. Additionally, occupational medicine grand rounds are held on a regular basis throughout the year and continuing medical education credits are provided for these sessions.

The occupational medicine faculty demonstrates its commitment to interdisciplinary interaction by participating in courses such as the certified industrial hygiene review. Courses planned for the upcoming year include the above-mentioned courses and a course in conjunction with UAW-Ford that is aimed specifically at physicians, nurses, and physical therapists involved in the medical care of Ford Motor Company employees. The program focuses on prevention, management and rehabilitation of occupational musculoskeletal injuries.

### **d. Occupational Injury Epidemiology and Prevention Program**

Continuing education courses in this program area are designed to assist safety and health professionals acquire knowledge in workplace injury prevention, safety, and risk assessment. The course list has grown to include topics such as ergonomics, biomedical waste, and biohazards in the laboratory, advanced topics in musculoskeletal disorders, and a review course for Certified Hazardous Materials Managers. In order to offer traditional safety courses, the JHU faculty is augmented with experts in the field of safety from outside the University. Recently, a course was presented on injury epidemiology for the Indian Health Service Environmental Health Office. This course introduced the general principles of injury epidemiology and prevention with a strong emphasis on occupational injuries. This week-long course was presented at the University of Michigan Annual Graduate Summer Session in Epidemiology. Dr. Gordon Smith presented a course entitled "Occupational Injuries" in the Summer Institute that was aimed at providing a link between the public health approach to occupational injury prevention, the traditions of safety science and engineering, and their relationship with ergonomics and biomechanics.

## **3. Other Program Developments**

In order to better serve the regional needs of health and safety professionals and improve our course offerings, we are conducting continuing education needs assessments on an annual basis. Our plan is to take an innovative approach and focus in depth on a single professional group each year. Thus, the

assessment process will be ongoing, and each discipline will be re-evaluated every four years. This rotation of assessments will spread the use of resources over time.

During this five-year grant period, we have completed surveys of occupational health nurses (1997), industrial hygienists (1998), and occupational physicians in conjunction with Maryland ACOEM and Western Pennsylvania ACOEM (2000) from NIOSH Region III. We are currently surveying safety professionals in the Region with the National Safety Council. Needs assessments performed in conjunction with professional organizations save time and financial resources and have the advantage of facilitated access to the target population. In addition to this method of assessing the continuing education needs of our region, a brief needs assessment is included as a part of all of our course evaluations. Our JHU NIOSH ERC brochure also contains a needs assessment which is periodically mailed and distributed at conferences.

The Continuing Education Advisory Board has the mission of providing input, direction, and advice to the program. Members, represented by the relevant health and safety professions, assist in the development of needs assessments and contribute to ongoing evaluation of the overall program. The Board is comprised of a representative member from industrial hygiene, occupational health nursing, occupational medicine, and safety science. The members meet annually and conduct meetings by conference call to reduce time and travel burdens. In addition, the CE Director frequently consults board members on an individual basis and obtains input from the ERC and OHN advisory boards. The CE Program Director attends those meetings and presents on the progress of the CE program. Most recent discussions with the CE Advisory Board have centered on what new courses would address occupational health and safety needs and would be financially successful and well attended. Suggestions included; infection control, violence in the workplace, management of health and safety programs, workers' solutions to health and safety concerns, and driver safety. The Board is in the process of evaluating our web-site and On-Line Journal Club.

#### **4. Outreach Program**

##### **a. Introduction**

It is the goal of our outreach program to interact with and help other institutions and agencies located in Region III in matters of occupational safety and health. Our outreach program also has national and international components as a direct function of the school's reputation as a leader in public health and the demand for faculty in leadership roles around the world. Dr. Peter Lees is the director of the Outreach effort. During this five-year grant period ERC faculty routinely interacted with universities and schools, professional societies, labor organizations and corporations. Within our own institution, we have worked with faculty and students of the Schools of Arts & Sciences, Engineering, Medicine, and Nursing to increase curricular opportunities in occupational health and safety. Lectures and seminars and consultations have been conducted in Region III with professional as well as non-professional groups to raise awareness of health and safety issues.

Our ERC faculty and staff participate in an outreach program sponsored by the National Center for Research Resources (NCR) of NIH. The goals of this program are to provide structured science research experiences for both teachers and under-represented minority high school students and to establish and/or strengthen partnerships between biomedical research institutions and K-12 schools. The purpose is to develop mentoring ties and thus create more pathways for under-represented

minority students to establish careers in the health sciences. Two ERC programs, IH and OHN, have participated and have provided internships for one middle school teacher from Dunbar High School (Baltimore, MD) and four local high school students over a period of four summers. Students are invited to attend all CE activities that occur during their internship and attend seminars geared toward introducing them to occupational safety and health careers.

Monthly seminars provide one means by which the ERC facilitates contact between occupational health professionals in the region, JHU ERC program members, and nationally and internationally renowned experts in the field. The ERC sponsors speakers who present topics of contemporary interest in occupational health and which are of relevance to all ERC program areas. Invitations are sent to a wide mailing list of individuals and organizations in the region so the audience is more broad than the typical academic seminar. The themes of the seminars are frequently controversial and stimulate thoughtful discussions regarding policy issues in occupational health. The following describes selected outreach activities in each program area, highlighting educational development, presentations, lectures, seminars, and consultations.

#### **b. Industrial Hygiene**

The Industrial Hygiene Program faculty, which includes Drs. Patrick Breysse, Timothy Buckley, Alison Geyh, and Peter Lees, has shared their expertise in exposure assessment and control. Their outreach activities include specific areas of interest in electric and magnetic fields, man-made vitreous fibers, ergonomics, aerosol sampling, and risk assessment.

ERC faculty have participated in field trips and group discussions with the second year medical students from the University of Maryland Medical School. Faculty served on a steering committee for the U.S. Coast Guard Health and Safety Initiative/Partnership in Maritime Medicine, and worked with several government organizations. Dr. Breysse's activities include mentoring a science student from Dunbar High School, Baltimore, MD. He and Dr. Lees also assisted Sri Ramachandra Medical College & Research Institute, in Chennai India, in developing a graduate program in industrial hygiene. He served as Editorial Board member for Applied Occupational and Environmental Hygiene. He is a member of the Advisory Committee to the Power Plant Research Program in Maryland, Department of Natural Resources. Dr. Lees served as the Small Group Discussion Leader in Occupational and Environmental Health at the University of Maryland School of Medicine, Baltimore, MD. He is also on the Board of Studies, Masters of Industrial Hygiene and Safety Program at Sri Ramachandra Medical College and Research Institute, Chennai, India. Dr. Buckley served as co-instructor for the AIHA Professional Development Course, Biological Monitoring for the Detection and Quantification of Chemical Exposure in Orlando, Florida. Dr. Buckley gave a televised interview to Discoveries Breakthrough Inside Science regarding the topic "Highway Fumes Hit Home." He is an ad hoc reviewer for such journals as; American Journal of Epidemiology, Journal of Air and Waste Management, The Science of the Total Environment, and Environmental Health Perspectives.

A television network recruited the assistance of the Industrial Hygiene program when it sponsored a show that gave middle school teachers an understanding of environmental and occupational health. Consultation services provided by the Industrial Hygiene faculties have left an impact on corporations, labor organizations, and all levels of government agencies (federal, state, and local). Activities include

working with the Baltimore County Schools, Los Alamos National Laboratory Health and Safety Group, Association of Flight Attendants and the U.S. Coast Guard, as well as the media.

### **c. Occupational Health Nursing**

Occupational Health Nursing outreach activities have been broad in scope. Faculty interests, including occupational health nursing research, work-related musculoskeletal disorders, aging workers, disabled workers, occupational stress, and return to work issues, have formed the basis for many of the programs and faculty presentations and consultations. Faculty have worked with Georgetown University to arrange an industrial site visit program for 19 nurses from eastern Europe. They have provided consultation to the Pan American Health Organization and to the International Association of Fire Fighters.

The joint appointments of Drs. Agnew and Fitzgerald in the Johns Hopkins School of Nursing facilitate their involvement with undergraduate and graduate nursing students and has had a discernable impact on course and overall curriculum content in occupational health. Faculty have had an active role in the development of the joint MSN/MPH degree program at Johns Hopkins, with Dr. Agnew serving as the Chair of the Steering Committee. Joint programs between Schools of Public Health and Nursing are being promoted by the Division of Nursing and are being developed or explored by a number of universities in the nation. Dr. Agnew has provided advice nationally on joint program development, specifically addressing inclusion of occupational and environmental health content. Dr. Sheila Fitzgerald has made presentations on the following topics: Urinary incontinence in a manufacturing setting: Women's perceptions and responses; The prevalence and impact of urinary incontinence in working women: A study in a production facility; Job characteristics among working young adults: Predictors of anger; Social competence and interpersonal conflict during adolescence predicts later job stress; and Scientific Foundations of Occupational Health Nursing. Dr. Agnew lectures within the Johns Hopkins University School of Nursing on topics in Environmental and Occupational Health. Drs. Agnew and Fitzgerald serve on the course planning committee and lecture on the Environment and Health in a course jointly presented by Johns Hopkins School of Public Health/Sojourner Douglass College. Dr. Agnew's presentations include: Scientific Foundations of Occupational Health Nursing; Watching Your Workers Work: The relationship between gender, work place monitoring and work climate among communication workers; Toxic personalities at work: Who are they?; Women Workers: Age, and Musculoskeletal Symptoms. Additionally, Dr. Agnew has authored a chapter entitled, "Scientific Foundations of OHN Practice" in the 2<sup>nd</sup> edition of the AAOHN Core Curriculum for Occupational Health Nursing, serves on the Editorial Board of the AAOHN Journal, and is a reviewer for Intramural Research Programs for NIOSH.

### **d. Occupational Medicine**

The OM Program is known regionally, nationally, and internationally. The faculty are experts in lead intoxication, occupational pulmonary disease, medical surveillance, occupational health policy, occupational epidemiology, and musculoskeletal disorders. Requests are frequently received for faculty interviews by television, radio and newspaper journalists.

Dr. Schwartz serves as small group instructor in Occupational and Environmental Health at the University of Maryland. Dr. Schwartz presented "Beryllium and Your Health" to a group of former workers of Los Alamos National Laboratory. He has consulted on lead paint abatement in public

schools and for the railroad industry regarding lead exposure to workers and residents along lines from lead mines and smelters. Dr. Weaver lectures in the Occupational and Environmental Medicine Program at the University of Maryland and presented a toxicology lecture on hazardous material training for union railway workers at the George Meany Center. She consults with Former Los Alamos National Laboratory Workers Medical Screening Program. Dr. Weaver is a reviewer for Occupational and Environmental Medicine, Environmental Health Perspectives, and Environmental Research. Dr. Patz taught Global Environment and Public Health at the School of Public Health, and Global Change and Human Health at the School of Arts and Sciences at Johns Hopkins University. He has written articles for the NY Times, Environment News Network, MSNBC, and CNN.com and has spoken on radio stations; Deborah Ray Health Radio, Morning Edition, and National Public Radio. Dr. Clifford Mitchell and Dr. Weaver serve as Elective Directors of the Occupational and Environmental Medicine section in the Physicians and Society course for second year medical students in the Johns Hopkins University School of Medicine. Dr. Mitchell has given lectures to area public school systems and other groups on indoor air quality. Dr. Mitchell provides consulting services to Middle River Aircraft Systems, Maryland Occupational Safety and Health Agency, Baltimore City Occupational Medicine and Safety, and Environmental Research Association. Our faculty also serves on the Medical Advisory Board of the International Association of Fire Fighters.

#### **e. Occupational Injury Epidemiology and Prevention Program**

OIEP core faculty are known nationally and internationally for their expertise in injury prevention. Dr. Smith assisted in the development of an Injury Research Center at University of Queensland, Brisbane, Australia. He is a member of the Planning Committee, National Occupational Injury Research Symposium (NOIRS). At Auckland University Medical School, he co-supervised two student PhD thesis research projects on injuries. He has presented at the NIOSH National Occupational Injury Research Symposium on “Does occupational exposure account for excess injury risk: Serious eye injuries in the U.S. Army,” and at the American Public Health Association Annual Meeting on “Risk factors for disability discharge after anterior cruciate ligament injury in active-duty army personnel.” Dr. Smith’s consultations include serving as a member of the National Center for Health Statistics E Code Advisory Group to improve injury cause reporting in hospital discharge data. He also provided advice and consultation on design of the National Health Interview Survey including adding new questions on cause of injury and occupational injuries.

Professor Susan Baker has served as the Keynote Speaker at the Conference on Medical Misadventures, Milwaukee, Wisconsin where she presented a lecture entitled “Applying Injury Prevention Concepts to the Prevention of Medical Misadventures.” Professor Baker provided consultation services to NIOSH where she evaluated and reviewed Fatal Occupational Injuries to Civilians in the U.S., National and State Profiles, and to the Thrasher Research Foundation. Professor Baker served as Project Director, Transportation Safety Data, for the Bureau of Transportation Statistics. She has given radio, television, and newspaper interviews on “Gender Differences in Pilots in Aviation Crashes.” Dr. Lincoln was appointed to the Center for Ergonomics and Workplace Health in the Departments of Preventive Medicine & Biometrics and Medical and Clinical Psychology at the Uniformed Services University in Bethesda, MD. He served as Program Chair for the Injury Control and Emergency Health Services section of the American Public Health Association’s 129<sup>th</sup> Annual Meeting. His presentations include a summary of interventions for the primary prevention of work-related carpal tunnel syndrome at the Annual International Occupational Ergonomics & Safety Conference. Dr Lincoln has served as a consultant to the Joint

NIOSH/NHTSA project to create a survey to assess the effect of motor vehicle crashes on the workforce. At Georgetown University, he initiated "Integrated Case Management for Work Related Upper Extremity Disorders," sponsored by the Robert Wood Johnson Foundation.

## **G. Conclusions**

The Johns Hopkins Education and Research Center in Occupational Health and Safety continues to prepare leaders in industrial hygiene, occupational health nursing, and occupational medicine as well as occupational injury epidemiology. The Continuing Education and Outreach Programs serve practicing professionals and organizations, with a focus on those located in Region III. Students benefit from the core program disciplinary strengths, interdisciplinary coursework and field opportunities, and the associated strengths of other school programs. The core programs have grown and evolved in response to contemporary needs in the field. In all program areas, student numbers have remained steady or increased, while program applicants have generally increased. The programs in Occupational Medicine, Occupational Injury Epidemiology and Prevention, and Continuing Education experienced changes in leadership near the end of this grant period, but new leadership was quickly positioned without any disruption in program functions. In all, the Johns Hopkins Education and Research Center has demonstrated a high level of success in carrying out its mission during this grant period.

## **H. Publications Resulting from the Grant**

### **1. Industrial Hygiene Program**

**Bold** - IHP Faculty

**Bold/Italics**- Trainees

M - IHP Masters Student

D - IHP Doctoral Student

M/D - IHP Masters and Doctoral Student

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(Trainees & Faculty listed in bold)

M- Masters Student

D- Doctoral Student

M/D- Masters and Doctoral Student

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