1994

NIOSH

Resident Research Associateships
Postdoctoral and Senior Research Awards

tenable at the

National Institute for Occupational Safety and Health

Cincinnati, Ohio

Morgantown, West Virginia

administered by the
National Research Council
Washington, DC

N R C

Resident Research Associateships

Postdoctoral and Senior Research Awards

1994

OPPORTUNITIES FOR RESEARCH

at the

NATIONAL INSTITUTE FOR
OCCUPATIONAL SAFETY AND HEALTH

Cincinnati, Ohio
- Division of Biomedical and Behavioral Science
- Division of Physical Sciences and Engineering
- Division of Standards Development and Technology Transfer
- Division of Surveillance, Hazard Evaluations, and Field Studies

Morgantown, West Virginia
- Division of Respiratory Disease Studies
- Division of Safety Research

administered by the
NATIONAL RESEARCH COUNCIL
Washington, DC

The National Research Council serves as an independent advisor to the federal government on scientific and technical questions of national importance. Established under the congressional charter of the private, nonprofit National Academy of Sciences, the Research Council brings the resources of the entire scientific and technical community to bear on national problems through its volunteer advisory committees. Today the Research Council stands as the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering and is administered jointly by the two academies and the Institute of Medicine. The National Academy of Engineering and the Institute of Medicine were established in 1964 and 1970, respectively, under the charter of the National Academy of Sciences.

The National Research Council has nine major divisions. One of these, the Office of Scientific and Engineering Personnel, is charged with administering Research Associateships through its Associateship Programs office.

Foreword

The National Institute for Occupational Safety and Health (NIOSH) is the primary federal agency engaged in research to eliminate on-the-job hazards for America's working men and women. Originally established in the Department of Health, Education & Welfare (now Health & Human Services) by the Occupational Safety and Health Act of 1970, NIOSH was given additional responsibilities under the Mine Safety and Health Act of 1977. NIOSH headquarters is located in Atlanta, Georgia. It is one of the Centers for Disease Control and Prevention and is part of the United States Public Health Service.

NIOSH investigates occupational health and safety hazards, develops specific control methods, and recommends federal hazard-reduction standards. NIOSH also provides education and training to help alleviate the critical shortage of occupational health and safety manpower. The Mine Safety and Health Act gives the Institute responsibility for performing research on occupational diseases of miners, conducting epidemiological studies of the mining industry, and recommending exposure limits for miners.

The NIOSH philosophy is to formulate methodologies and to generate and test hypotheses that apply to specific problems in occupational health. This approach typically interweaves basic and applied research to gain fundamental knowledge while problems are being solved.

Associates will increase the productivity and efficiency of NIOSH's research by introducing ideas and backgrounds that will stimulate, critique, and challenge ongoing experimental approaches and results. As a consequence, meritorious ideas may be incorporated into current research, or additional avenues of research may be followed.

The NIOSH staff has expertise in biological and behavioral science, bioengineering, health, physics, statistics, and epidemiology. The expertise, knowledge, philosophy, ideas, and techniques available can contribute to the professional development of both Regular and Senior postdoctoral investigators. Completely equipped laboratories, adequate space, and in select instances, opportunities to do worksite studies give investigators flexibility in their approaches to problems. This research environment is intended to stimulate

investigators to continue working in the field of occupational health when they leave NIOSH to pursue independent research elsewhere.

Six NIOSH Divisions, with research laboratories located in Cincinnati, Ohio, and Morgantown, West Virginia, participate in the Research Associateship Programs.

Division of Biomedical and Behavioral Science
Cincinnati, Ohio

At the Institute laboratories in Cincinnati, studies in ergonomics, psychological stress, physical agents, and toxicological issues, as they relate to worker safety and health, are conducted by the branches of the Division of Biomedical and Behavioral Science (DBBS). The Applied Psychology and Ergonomics Branch investigates biomechanical strains, emotional and psychological disturbances, and behavioral dysfunctions as they may arise from adverse work environments, poor tool design, and undue job demands. Approaches include laboratory simulations of working conditions, and worksite studies and interventions. The Physical Agents Effects Branch undertakes animal and human research to characterize noise damage to hearing and ear structures and measures reactions to nonionizing radiation. Dedicated chambers are used to generate these exposures, and instrumentation aids in describing dose/response relationships in biophysical and electrophysiological terms. The Experimental Toxicology Branch and the Applied Biology Branch employ animal models and the latest bioassay and molecular biology techniques to depict the mechanisms underlying toxic reactions to workplace chemicals. Biomarkers are also established for exposure assessment and early indicators of disease. These efforts mainly address work-related cancer, reproductive disorders, and cardiac-toxicity problems.

Division of Standards Development and Technology Transfer
Cincinnati, Ohio

The Division of Standards Development and Technology Transfer (DSDTT) develops, by comprehensive analysis of existing scientific and technical information, documents containing (1) criteria for recommended occupational safety and health standards and (2) technical and scientific information that is relevant to a variety of occupational safety and health issues. DSDTT coordinates

NIOSH testimony at Department of Labor hearings on proposed standards to support scientific and technical considerations and prepares and annually reviews the legislatively mandated toxic substances list. DSDTT manages a clearinghouse for receiving, storing, retrieving, and disseminating technical information on occupational safety and health. To carry out its responsibilities, the DSDTT comprises an interdisciplinary group of 50 professionals and over 20 support staff. These personnel have expertise in epidemiology, occupational medicine, industrial hygiene, toxicology, geology, physiology, pharmacology, microbiology, physics, and information management.

DSDTT compiles and analyzes the results of laboratory research and field investigations pertaining to selected occupational safety and health hazards for the purpose of preparing recommended standards. These standards include environmental limits, requirements for medical surveillance of workers, labeling, personal protective equipment and clothing, employee notification of hazards, safe work practices, sanitation, environmental and medical monitoring, engineering controls, training, and record keeping. DSDTT also prepares current intelligence bulletins and special occupational hazard reviews on potential workplace hazards when new evidence of a particular hazard becomes known.

Personnel routinely collaborate with international experts in occupational safety and health. Bilateral agreements exist between DSDTT and the Swedish Criteria Group of the National Institute of Occupational Health and the Nordic Expert Group for Documentation of Occupational Exposure Limits to exchange information and expertise and to jointly develop documents that can be used as the basis for recommended standards. DSDTT also has an agreement with the International Programme on Chemical Safety of the World Health Organization to develop documents in occupational safety and health and to evaluate information that can be used for developing criteria for occupational standards. DSDTT personnel routinely interact to review and develop documents through the Organization's International Agency for Research on Cancer, and as a collaborating center with the Organization, the Division cooperates with experts from the Programme of Action on Worker's Health to develop occupational exposure limits.

DSDT also conducts risk assessments on selected occupational hazards to derives estimates of risk at various conditions of exposure. This risk assessment activity is currently staffed with five full-time and one part-time professionals located within the Office of the Director. Recent activities include developing quantitative risk assessments based on the results of both animal and

epidemiological studies. For example, quantitative risk assessments have been performed for radon, diesel exhaust, cadmium, and 1,3-butadiene for submission either to the Mine Safety and Health Administration or to the Occupational Safety and Health Administration. DSDTT is also conducting an assessment of risk of noise-induced hearing loss that is based on data gathered from workers occupationally exposed in different work settings.

DSDTT has developed a Memorandum of Understanding for collaborative research with the Division of Biometry and Risk Assessment at the National Institute of Environmental Sciences. Areas of collaboration under this agreement include investigating the nature of the exposure-response relationships of specific agents and developing risk-assessment methodologies. Future research efforts will include investigating risks for non-cancer endpoints such as the risk of respiratory disease to workers exposed to coal dust, modeling epidemiologic data, and improving interspecies extrapolation.

Division of Surveillance, Hazard Evaluations, and Field Studies
Cincinnati, Ohio

The Division of Surveillance, Hazard Evaluations, and Field Studies (DSHEFS) conducts a comprehensive program of field studies on all adverse occupational-health outcomes. The division comprises more than 200 individuals—medical officers, epidemiologists, industrial hygienists, biostatisticians, and administrative and support staff—who perform or execute the following:

— surveillance of the nation's work force and workplaces to assess the magnitude and extent of job-related illneses, exposures, and hazardous agents;

— legislatively mandated evaluations of health hazards requested by unions, employers, or employees;

— mandated industry-wide epidemiologic and industrial-hygiene research programs, including longitudinal record studies, clinical/environmental field studies, and industrial-hygiene surveys;

— technical assistance on occupational safety and health problems to other federal agencies, state and local agencies, and other technical groups; and

— energy health-related research authorized by NIOSH agreements with the Department of Energy (DOE) to manage and conduct all analytic epidemiology studies of employees at DOE facilities.

Surveillance systems are used for the early detection and continuous assessment of the type and frequency of occupational disease, disability, and deaths; they are designed to assess potential exposures to hazardous agents and to evaluate the effectiveness of intervention efforts. Existing data sources from federal, state, and local agencies and from labor, industry, physicians, and medical centers are adapted to these surveillance systems. Special emphasis has been given recently to agriculture and construction. DSHEF's activities also include assisting in facilitating and coordinating general occupational-health and safety surveillance within and outside NIOSH and developing a program of state-based surveillance, intervention, and prevention activities.

The industry-wide studies program functions as follows:

— identifies the occupational causes of disease in the working population and their offspring and determines the incidence and prevalance of acute and chronic effects of work-related exposures;

— conducts intervention studies to reduce occupational disease in working populations and their offspring and in work-related exposures;

— provides information on the extent of exposure to agents of interest in the workplace; and

— develops, disseminates, and evaluates risk communications for subjects of epidemiologic studies.

The Health-Hazard Evaluations and Technical Assistance (HETA) program responds to requests from employers, employees, employee representatives, other federal agencies, and state and local agencies. The typical HETA response to such a request is to evaluate whether chemical, physical, biological, or other agents are hazardous as used or found in the workplace and to recommend control procedures, improved work practices, and medical program to reduce exposure levels and prevent adverse health effects. The results of individual evaluations may trigger wider studies of similar exposures in other settings or may stimulate recommendations for implementing or modifying health standards.

Energy health-related research activities have been established to study DOE employees and other energy-related occupational-health research. The mission of this activity is outlined in a memorandum between the Department of Health and Human Services and DOE and includes investigating health effects of ionizing radiation, nonionizing radiation, solvents, and asbestos.

All programs within DSHEFS provide information that can be used for a variety of purposes including standards development for the control of occupational-health hazards.

Division of Physical Sciences and Engineering
Cincinnati, Ohio

The Division of Physical Sciences and Engineering (DPSE) conducts worksite and laboratory research to develop procedures and equipment to control and measure occupational safety and health hazards. Specifically, the DPSE conducts a control-technology assessment and research programs to prevent occupational disease and injury before they occur by assisting employers, especially smaller businesses, in the improved design and operation of the work place. This involves identifying and evaluating effective engineering controls used in various processes and industries. DPSE promotes the transfer and widespread application of these preventive-engineering control measures and also provides engineering expertise in formulating effective workplace standards. DPSE conducts research to establish performance requirements for direct reading, area, and personal instrumentation used to evaluate and prevent exposures to hazardous levels of chemical, biological, and physical agents; it also provides consultation for developing criteria and standards on monitoring strategies, instrumentation, and controls and conducts research to develop and improve methods for analyzing toxic substances found in the workplace.

DPSE provides support in analytical chemistry to NIOSH's laboratory research and field investigation programs including the routine measurement of samples by established methods, special measurement for complex samples, and short-term development of methods. This analytical research and support involves the use of advanced analytical instrumentation such as high-resolution gas chromatography, gas chromatography-mass spectrometry, high-performance liquid and ion chromatography, and Fourier-transfor infrared spectroscopy. DPSE conducts research to improve the quality of occupational exposure data through the Proficiency Analytical Testing (PAT) Program, a cooperative effort conducted by the American Industrial Hygiene Association (AIHA) and NIOSH. Finally, DPSE encourages and supports the development and promulgation of national guidelines for accreditation of industrial hygiene laboratory facilities, selects and develops standard reference materials to measure industrial hygiene, and provides for quality assurance in the analysis of NIOSH's laboratory and field programs and contract laboratories.

Division of Safety Research
Morgantown, West Virginia

The Division of Safety Research (DSR) serves as the focal point for NIOSH's occupational-injury research and prevention program. DSR collects and analyzes data to identify worker populations at high risk, develops prevention strategies, and conducts field trials and demonstration projects to test the strategies' efficacy. DSR also conducts research on respirators and other personal protective equipment. Its occupational-injury specialists provide engineering and ergonomic technical assistance in solving safety problems. Professional who may be interested in DSR's research opportunities include epidemiologists, statisticians, industrial hygienists, chemists, physicists, materials scientists, and engineers.

Division of Respiratory Disease Studies
Morgantown, West Virginia

The Division of Respiratory Disease Studies (DRDS) in Morgantown is the focal point for clinical, epidemiological, environmental, and laboratory research related to the prevention of occupational respiratory disease. Our specific program areas include mining, agriculture, asthma, fibers, and surveillance. The goal of the Laboratory, Clinical, and Epidemiological Investigations Branches is to utilize animal and statistical models of occupational respiratory disease to determine disease mechanism(s) and thus predict ways of detecting, reversing, or preventing occupational respiratory disease in America's workers. The approach is to investigate these disease models from the viewpoint of basic biological science, bioengineering, and epidemiology. Research efforts range from *in vivo* long-term studies to *in vitro* short-term studies.

Contents

Introduction

History and Objectives

The National Research Council conducts the Resident Research Associateship Programs in cooperation with sponsoring federal laboratories and research organizations approved for participation.

The Research Council, through its Associateship Programs office, conducts a national competition to recommend and make awards to outstanding scientists and engineers at recent postdoctoral and experienced senior levels for tenure as guest researchers at participating laboratories. These Programs have been conducted on behalf of a number of federal agencies since 1954.

The objectives of the Programs are (1) to provide postdoctoral scientists and engineers of unusual promise and ability opportunities for research on problems, largely of their own choice, that are compatible with the interests of the sponsoring laboratories and (2) to contribute thereby to the overall efforts of the federal laboratories.

For recent doctoral graduates, the Programs provide an opportunity for concentrated research in association with selected members of the permanent professional laboratory staff, often as a climax to formal career preparation.

For established scientists and engineers, the Programs afford an opportunity for research without the interruptions and distracting assignments of permanent career positions.

Participating laboratories receive a stimulus to their programs by the presence of bright, highly motivated, recent doctoral graduates and by senior investigators with established records of research productivity. New ideas, techniques, and approaches to problems contribute to the overall research climate of the laboratories. Indirectly, Associateships also make available to the broader scientific and engineering communities the excellent and often unique research facilities that exist in federal laboratories.

For the 1994 program year, an anticipated 1,000 applications will be received for the nearly 300 new awards to be made in the Associateship Programs.

Associates on Tenure

A Research Associate is a guest researcher, not an employee of the Research Council or of the laboratory. Associateships are analogous to fellowships or similar temporary programs at the postdoctoral level in universities and other organizations. They are not intended to be, or to compete with, permanent professional career positions.

No commitment on the part of an Associate, the sponsoring laboratory, or the Research Council with regard to later employment is implied or should be inferred by the offer or acceptance of an award.

Associates must devote their full-time effort to the research program proposed in their applications and must be in residence at the sponsoring laboratory during the entire period of the Associateship. No period of tenure may be spent in residence at another laboratory or institution. Associates have the status of visiting scientists or engineers but are subject to the general regulations of the laboratory.

No additional monetary aid or other remuneration may be accepted from another appointment, fellowship, or similar grant, except for sabbatical leave, during the period of the Associateship.

Regular or Senior Status and Length of Tenure

Regular Research Associateships are awarded to persons who have held the doctorate less than five years at the time an award is offered and are made initially for one year.

Senior Research Associateships are awarded only to applicants who have held the doctorate five years or more at the time an award is offered. Senior applicants should have research experience that has resulted in significant contributions and recognition as established investigators in their specialized fields. Although awards to Senior Associates are usually for one year, awards for periods of three months or longer may considered.

Under certain conditions, extensions may be granted to allow Associates to bring their research to a reasonable stage of completion. However, extensions are not automatically granted, and applicants are advised to plan their research programs to conform to the length of tenure stated above.

Consideration

Qualified applicants will receive consideration without regard to race, creed, color, age, sex, or national origin.

Citizenship

Opportunities at the National Institute for Occupational Safety and Health (NIOSH) are open to all citizens of the United States and on a limited basis to citizens of other countries who have full command of the English language and offer unique capabilities.

Visa Requirements

Non-US nationals who are offered awards must have valid visas throughout tenure. Only Exchange Visitor and Immigrant Visas are acceptable to the Research Council. If an awardee chooses to apply for an Exchange Visitor Visa, sponsorship must be by the National Research Council. If he or she chooses to apply for an Immigrant Visa, the Research Council will not be involved in the procedure.

Education and Experience

Awardees must hold the PhD, ScD, or other earned research doctoral degree recognized in US academic circles as equivalent to the PhD or must present acceptable evidence of having completed all the formal academic requirements for one of these degrees before tenure may begin. Applicants must have demonstrated superior ability for creative research.

An applicant's training and research experience may be in any appropriate discipline or combination of disciplines required for the proposed research.

Research Opportunities

This booklet contains abstracts, or research opportunities, that describe areas of research in which Associateships may be awarded at NIOSH.

NIOSH provides the funds for this program and furnishes all necessary support services, facilities, and equipment for the approved research program of each Associate.

While every effort has been made by NIOSH to provide opportunities of ample scope and relevance, the publication of any opportunity in this booklet does not guarantee that it will be available at the time awards are offered. Changes and/or deletions may occur following publication because of temporary lack of equipment, laboratory renovation, staffing already sufficient to meet research goals, or a lack of funding.

Research Adviser, Assistant Director for Science, and Laboratory Program Representative

Shown with each research opportunity are the names of one or more Research Advisers who conduct or direct the work described in the opportunity.

An Adviser is a scientist or engineer at NIOSH with whom a Regular Associate works most closely. An Adviser acts as a surrogate of the Research Council in monitoring an Associate, and all matters relating to an Associate's research program fall under his or her purview.

For a Senior Associate, an Adviser functions in a more collegial relationship and assists as needed in securing technical support and resources.

The overall coordination and administration of the Institute's Associateship program is conducted by the office of the NIOSH Assistant Director for Science, (ADS). This includes justification and acquisition of Institute funding for the Associateship program, budgetary projections and control, design and execution of the administrative procedures used for selecting those projects which ultimately receive Institute funding, and promulgation of executive decisions. In addition, the Laboratory Program Representative, a professional staff member who coordinates the Institute's Research Associateship Program, is a member of the Office of the ADS.

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Assistant Director for Science
and
Linda T Cockrill
Administrative Officer
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Telephone: (404) 639-3525

Research Proposal

Each applicant must submit a research proposal that relates to a specific research opportunity at NIOSH. A proposal must be the original work of an applicant and be approved by an Adviser listed with the opportunity.

Before writing a proposal, however, an applicant is advised to communicate directly with the Adviser, who can provide more specific information on current research and available technical facilities and offer scientific support of proposal development. Consult the section "Index of Research Advisers", later in this booklet, for a list of Adviser telephone numbers sorted by division.

Laboratory/Center Review

Each applicant's proposal must be approved by one of the Advisers listed in this booklet and endorsed by the Institute's specially convened Associateship Program Committee to be eligible for an award.

The Committee's endorsement affirms that the proposal is compatible with NIOSH's interests and that adequate programmatic support will be available if an award is offered.

NIOSH's action on the proposal, together with a copy of the Adviser's comments, will be provided directly to the applicant by the Laboratory Program Representative.

No applicant will be eligible for further consideration until the Associateship Programs office has been advised by NIOSH that his or her proposal has been approved by an Adviser and endorsed by the Program Committee. Otherwise, the Associateship Programs office will assume that the proposal is not of sufficient current interest to NIOSH or that support facilities cannot be made available.

Since the final review of applications is conducted by special panels appointed by the Research Council, all applicants should note that endorsement by an Adviser or laboratory, while essential to the application process, does not imply or guarantee an award by the Research Council.

The Panel Review

The Associateship Programs office receives all application materials and supporting documents and conducts the competitive evaluations of applications.

Evaluations for NIOSH Associateships are conducted in February, June, and October by special panels convened for this purpose. Panelists are chosen to review applications on the basis of their stature and experience in the fields of science and engineering, and their evaluations become the basis from which awards are made on behalf of NIOSH.

Applicants are recommended for awards only after this open, national competition in which the panels rank candidates on the basis of quality alone.

Final ranking in order of quality and the recommendation of applicants for awards are the exclusive prerogatives of the panels, and only notification by the Associateship Programs office of an applicant's status in the competition is authoritative.

Stipend

An Associate receives a stipend from the Research Council while carrying out his or her proposed research. The current annual stipend for a Regular Associate is $33,000. An appropriately higher stipend will be offered to Senior Associates.

This stipend is subject to adjustments from time to time in accordance with general national guidelines pertaining to scientists and engineers.

The Research Council is required by the US Tax Code to withhold an amount from the stipends of non-resident aliens who hold Exchange Visitor (J-1) Visas. Exchange Visitors are advised that approximately 30% per month will be

withheld from stipends and reported to the US Internal Revenue Service annually.

Applicants are cautioned against entering into any agreement or understanding with individual Advisers or other laboratory personnel for additional funding or other remuneration for work as an Associate.

Stipends for Associates are limited to the amounts and by the conditions set forth above, and any other arrangement, formal or informal, between an applicant and laboratory personnel for additional monies or other considerations is strictly prohibited by the Research Council.

Initiation of Tenure

Sufficient time must be allowed between the offer of an award and the beginning of tenure to enable the Associateship Programs office and NIOSH to complete all necessary administrative procedures.

The date on which tenure may begin is negotiated on an individual basis, normally within six months of the award. The starting date may be delayed by mutual agreement of NIOSH, the Associate, and the Associateship Programs office but cannot be later than 12 months from the date on which the award was originally offered.

If this condition cannot be met, a new application, including a newly approved research proposal, must be submitted to the Associateship Programs office and will be judged without prejudice in the next competition.

Prior Affiliation with the Laboratory

A primary objective of the Associateship Programs is to provide a mechanism for new ideas and sources of stimulation to be brought to the sponsoring laboratory. Thus persons with recent prior affiliation with a specific laboratory may not be eligible to apply for an Associateship there.

Prior affiliation includes direct employment relationships either with the laboratory or with a contractor whose work is performed there. A long-term consulting relationship usually makes an applicant ineligible.

Research contracts with universities that provide support for graduate students or faculty who perform research on campus are not ordinarily considered to be disqualifying.

Reapplication

Persons who have previously held an Associateship may apply for another award only if a period of at least two years will have elapsed between termination of the first award and the proposed tenure of a second.

Persons who have previously applied for an Associateship, but who were not recommended for an award by the panels, may reapply after one year.

Candidates who were recommended for an award by the panels, but who were not offered an award because of funding or other limitations, may reapply at any time without a mandatory waiting period.

Taxes and Insurance

As a guest investigator, an Associate is self-employed. All arrangements for payment of income taxes are the responsibility of the individual Associate, who is advised to become familiar with the relevant sections of the current tax codes.

The Research Council is required by the US Tax Code to withhold an amount from the stipends of non-resident aliens who hold Exchange Visitor (J-1) Visas. Exchange Visitors are advised that approximately 30% per month will be withheld from stipends and reported to the US Internal Revenue Service annually.

Job-related injury or death is covered by insurance (workmen's-compensation type). A group health-insurance program is required for Associates and is optional for dependents.

Relocation and Travel

A suitable relocation reimbursement will be determined for each awardee. Details will be provided at the time of the award.

Funds are also available for limited professional travel during tenure, provided such travel is approved in advance by the Associate's Adviser, the NIOSH Program Representative, and the Associateship Programs office.

Publication

Since an Associate's later scientific and technical career will be judged by others, publication in the accepted open technical literature is highly encouraged.

Publications should include a statement indicating that the research was conducted while the author held a National Research Council Resident Research Associateship. Manuscripts that result from work performed at NIOSH must be cleared by the agency to ensure compliance with its publications policies.

Application Procedure

Detailed information on procedures and all necessary application materials and supporting documents are available on request from the

Associateship Programs – TJ 2094
National Research Council
2101 Constitution Avenue NW
Washington, DC 20418

All deadlines for receipt of application materials are strictly observed by NIOSH and the Associateship Programs office. No allowances or exceptions are made for late submissions.

Application materials from previous competitions may not be used.

Panel Review Schedule

Although applications for NIOSH Research Associateships are accepted throughout the year, they are evaluated by the Panels only during February, June, and October.

February Review

To be eligible for review in February, completed application materials must be postmarked no later than January 15, 1994, and received by the Associateship Programs office no later than January 25, 1994. Supporting documents must be received by February 15, 1994.

June Review

To be eligible for review in June, completed application materials must be postmarked no later than April 15, 1994, and received by the Associateship Programs office no later than April 25, 1994. Supporting documents must be received by June 1, 1994.

October Review

To be eligible for review in October, completed application materials must be postmarked no later than August 15, 1994, and received by the Associateship Programs office no later than August 25, 1994. Supporting documents must be received by October 1, 1994.

Application Materials

Submit the following to the Associateship Programs office:

Signed Application
Questionnaire Sheet
Research Proposal (1 Copy)
Previous and Current Research

Supporting Documents

Have the following sent directly to the Associateship Programs office:

For Regular Applicants

Official transcripts of all graduate and undergraduate credits.

Four Reference Reports from the respondents listed on the Application. Only official Reference Reports may be used.

For Senior Applicants

Transcripts are not required of Senior applicants.

Letters of reference are accepted in lieu of Reference Reports. Senior applicants should endeavor to include some letters of reference from individuals who are not co-employees.

Laboratory/Center Documents

Submit the following directly to the Laboratory/Center Research Adviser:

Research Proposal (1 Copy)
Laboratory/Center Review (1 Set)

The Adviser will review the proposal and forward it to the Program Committee for review.

Notification of Awards

Awards are made only by the National Research Council. The endorsement of an application and research proposal by NIOSH, while essential to the application and review processes, does not constitute an agreement or obligation to confer an award.

A review board, drawn from members of the Research Council panels, determines a cutoff score. Applicants who score below this score cannot be considered further for an award and are so notified within two to four weeks.

Applicants who score above the cutoff score are recommended for awards by the board. These applicants are notified of the board's action as early as possible and are offered awards or alternate status to the extent of available facilities and funding by NIOSH.

Acceptances and declinations must be made directly to the Associateship Programs office of the National Research Council.

Program Administration

CENTERS FOR DISEASE CONTROL
ATLANTA, GEORGIA
Procurement and Grants Office

John L Williams, Director
Carolyn J Russell, Chief, Grants Management Branch
Henry S Cassell, Grants Management Officer

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
ATLANTA, GEORGIA

Office of the Director

(Vacant), Director
Richard A Lemen, PhD, Deputy Director
David D Bayse, PhD, Assistant Director for Science
Linda T Cockrill, Administrative Officer

Office of Administrative and Management Services

J Brian Dugan, Director

LOCATION OF RESEARCH FACILITIES

Division of Biomedical and Behavioral Science
National Institute for Occupational Safety and Health
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Division of Physical Sciences and Engineering
National Institute for Occupational Safety and Health
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Telephone: (513) 841-4262

Division of Respiratory Disease Studies
National Institute for Occupational Safety and Health
944 Chestnut Ridge Road
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Morgantown, West Virginia 26505
Telephone: (304) 291-4474

Division of Safety Research
National Institute for Occupational Safety and Health
944 Chestnut Ridge Road
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NATIONAL RESEARCH COUNCIL
Associateship Programs

Arnold E Schwartz, PhD, Director, Associateship Programs
Judith K Nyquist, PhD, Associateship Programs Administrator for NIOSH
Suzanne Polo, Program Coordinator for NIOSH
Marla J Allentuck, Editor

Opportunities for Research

Analytical Methods

Analytical Methods Development Using Laboratory Automation

ER Kennedy 53.03.19.01
Division of Physical Sciences and Engineering
Cincinnati, Ohio

One general procedure for sampling and analyzing volatile compounds in the workplace is to collect an air sample onto a sorbent, followed by solvent or thermal desorption of the compounds from the sorbent, and then using chromatography or other laboratory analysis techniques to determine the compounds. Developing an expert system to automate both the sampling and analytical method development, and to analyze the samples would involve (1) incorporatong the mechanical elements needed to handle sorbent tubes and perform analyses, and (2) determining the software elements necessary to optimize analytical conditions and desorption, perform analyses, and prepare reports of the analyses. The first area must address the design considerations of the robotic equipment, the analytical equipment, and the sampler for compatibility. The second area must address what information is critical to developing and evaluating a sampling and analytical method. Research proposals are sought which address using laboratory automation to develop sampling and analytical methods for air samples.

Study of Competitive Sorption to Improve Industrial Hygiene Sampling Methods for Trace Substances

RA Lunsford 53.03.19.02
Division of Physical Sciences and Engineering
Cincinnati, Ohio

Determining occupational exposures to toxic substances in the air often requires collection by a solid-sorbent sampler. If the targeted substance is carcinogenic

or toxic, necessitating trace-level determination, other environmental contaminants may be expected to competitively decrease the sorbent's ability to retain the targeted substance. Thus, selecting an appropriate sample volume is a trade off; the volume must be large enough to provide the needed sensitivity, yet small enough to prevent losses from breakthrough.

NIOSH would benefit from a comprehensive study of competitive sorption. Such a study might result in (1) the definition of a set of probe molecules to characterize the important physicochemical interactions that affect sorbent capacity; (2) the accumulation of characteristic retention data for the solid sorbents commonly used in air sampling; and (3) a rationale to recommend an appropriate sample volume for a target substance based on worst-case assumptions for atmospheric co-contaminants. Tracer pulse chromatography has been used to characterize the competition among various organic probe compounds and water for sorption on polyamide sorbents. Available equipment includes a Hewlett-Packard 5890 gas chromatograph, equipped with a 5971A mass selective detector.

Reference

Cooper SD, Pellizzari ED: Journal of Chromatography 498: 41, 1990

Study of Supercritical Fluid Extraction for Sample Recovery

RA Lunsford 53.03.19.03
Division of Physical Sciences and Engineering
Cincinnati, Ohio

We can determine if there are occupational exposures to toxic substances in the air by collecting such substances on solid sorbents and then analyzing the samples. This is usually accomplished by solvent extraction or thermal desorption. However, supercritical fluid extraction (SFE) is a promising technique that may offer significant advantages.

NIOSH would benefit from an investigation of SFE applied to the recovery of model compounds from the sorbents commonly used for industrial hygiene sampling. Suggested study areas include establishing the conditions required to optimize the recoveries for various compound-sorbent pairs, determining what extent sample volatility may limit recovery, and evaluating the potential for selective recovery (e.g., polycyclic aromatic hydrocarbons from an aliphatic hydrocarbon matrix). Completion of such a study would provide a basis for

selecting the most promising recovery technique to be evaluated during the development of new or improved sampling and analytical methods.

Reference
Houben RJ, et al: Journal of High Resolution Chromatography 13: 669, 1990

Bioengineering

Computerized Interpretation of Chest Radiographs

JL Hankinson 53.01.06.01
Division of Respiratory Disease Studies
Morgantown, West Virginia

In the NIOSH occupational surveillance program for working coal miners, chest radiographs are received by NIOSH and must be interpreted. To enhance this surveillance program, NIOSH is currently conducting research on using imaging processing on a digital computer to assist in the interpretation of chest radiographs. Related research areas include the use of statistical pattern recognition and digital signal processing in medical surveillance for possible early detection of occupational respiratory diseases and development of new pulmonary-function testing procedures and equipment. Research proposals are invited in these or closely related areas.

Biological Monitoring

Development of Analytical Methods for Biological Monitoring of Human Exposure to Industrial Chemicals

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Humans are exposed to toxic chemicals in their work environment through three routes: inhalation, ingestion, and absorption through the skin. Biological monitoring, a way to estimate the total uptake of chemicals resulting from these exposures, is frequently accomplished by analyzing timely samples of blood, breath, or urine for the toxicant or its metabolites. Of particular interest is the development and evaluation of analytical methods for use in biological

monitoring, the application of these methods in studies of the biotransformation and excretion of the toxicants, and in studies of the human dose response. Research proposals are welcomed to further improve biological monitoring. Instrumentation available includes gas, liquid, and supercritical fluid chromatography, and gas chromatography/mass spectrometry.

References

Tolos WP, et al: Applied Occupational and Environmental Hygiene 5: 303, 1990
Stettler LE, et al: Scandinavian Journal of Work, Environment, and Health 18(2): 78, 1992

Biomarkers of Occupational Musculoskeletal Disorders

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Cincinnati, Ohio

Currently, medical interventions for musculoskeletal (MS) disorders, including occupationally related MS disorders, are generally implemented after the condition has begun to show clinical manifestations. At this point, serious and sometimes irreversible damage may have developed. Thus, methods that could detect such damage at an early stage might allow intervention and prevention. Research is in progress to identify changes in serum proteins that are indicative of early damage to diarthrodal joints or of the inflammatory events associated with this damage (i.e., biomarkers of joint disease). The laboratory is equipped with liquid chromatography and electrophoresis instrumentation, including a new two-dimensional electrophoresis facility with computerized image analysis equipment; animal facilities; electron microscopy; immunochemistry; and statistical support. Research proposals are invited to expand the investigations of biomarkers of occupational joint disease and biomarkers of other occupational MS disorders

Reference

Mastin JP: Scandinavian Journal of Work, Environment, and Health 18(2): 85, 1992

Biomarkers of Exposure for Occupational Chemicals

RE Savage, Jr 53.02.12.03
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Cincinnati, Ohio

Environmental monitoring is not always an adequate method to evaluate worker exposure to toxic chemicals. Exposure can occur by routes other than inhalation; and factors such as environment, workload, or genetic differences in metabolism

may affect the uptake and activation of a chemical. The internal dose of a toxicant is defined as the amount of chemical absorbed; whereas, the biologically effective dose is considered to be the amount of toxicant reaching the target tissue. Biological monitoring is a relevant method for providing such exposure data. Thus, biomarkers of exposure (e.g., DNA or protein adducts) can be used to determine the internal or biologically effective dose for all routes of exposure. Sensitive analytical techniques can also be utilized to monitor long-term exposure, which is critical for the development of biologically based models or for risk assessment. Research proposals to expand these studies are welcome. Such efforts may include (1) developing biochemical indices suitable for quantitative assessment of the extent of worker exposure to toxic chemicals (e.g., measuring chemical DNA and protein adducts), (2) developing methods for qualitative and quantitative estimation of particular target organ damage that results from exposure to occupational chemicals (e.g., DNA damage and repair and enzyme induction/inhibition), and (3) evaluating the mechanism of toxicity of specific chemicals and/or classes of toxicants in experimental animal systems (e.g., metabolism and pharmacokinetic studies).

References

Cheever KL, et al: Fundamental and Applied Toxicology 14(2): 273, 1990
Cheever KL, et al: Fundamental and Applied Toxicology 18: 5, 1992

Cell Physiology and Biochemistry

Cellular Physiology and Biochemistry

V Castranova 53.01.01.01
Division of Respiratory Disease Studies
Morgantown, West Virginia

The laboratory conducts investigations in pulmonary function and occupational lung diseases, with emphasis on mechanisms involved in the development and progression of fibrosis, oxidant injury, byssinosis, and organic dust toxic syndrome. Studies involve measurement of various physiological parameters such as membrane potential, oxygen consumption, transport properties, secretory rates, and metabolic activities of several types of cells (alveolar macrophages, type-II cells, leukocytes, platelets, and fibroblasts). Of particular interest are the isolation and purification of lung cells, the steps involved in the phagocytotic process, cellular parameters involved in the excitation-secretion process, xenobiotic

metabolism by pulmonary cells, and the pulmonary toxicity of various occupational or environmental pollutants. Equipment is available in the laboratory for ultracentrifugation, cell counting, cell sizing, protein purification, cell separation, measurement of membrane potential, isotopic studies, metabolic studies, and morphological studies. In addition, the facilities of West Virginia University, located adjacent to the Appalachian Laboratory for Occupational Safety and Health facility, are also available.

References

Castranova V, et al: Journal of Leukocyte Biology 50: 412, 1991
Banks M, et al: Journal of Nutritional Biochemistry 2: 308, 1991

Cellular Biochemistry and Lung Physical Chemistry

JYC Ma 53.01.01.02
Division of Respiratory Disease Studies
Morgantown, West Virginia

Research focuses on the cellular mechanisms of dust-induced occupational lung disease. Of special interest are (1) the biochemical and physical chemical events in the lung that are related to the exposure to environmental pollutants, (2) the effects of respiratory substances on pulmonary surfactant biosynthesis and metabolism, (3) the effects of dust-induced lipidosis in relation to lipid metabolism in the lung, and (4) the use of potential antifibrotic agents to probe the underlying mechanisms of dust-induced pulmonary disease.

References

Ma JYC, et al: Experimental Lung Research 18: 829, 1992
Ma JKH, et al: Experimental Lung Research 17: 1061, 1991

Cellular and Subcellular Aspects of Pulmonary Physiology and Toxicology

PR Miles 53.01.01.03
Division of Respiratory Disease Studies
Morgantown, West Virginia

This program is designed to study the mechanisms by which inhaled substances affect various cellular and subcellular components of the respiratory system.

Examples of some of the pulmonary responses studied are (1) antibacterial activity and transmembrane potential changes in alveolar macrophages; (2) liquid peroxidation in lung microsomes, mitochondria, and cytosol; (3) drug metabolism (mixed-function oxidase activity) in lung microsomes and isolated type-II cells;

(4) membrane transport in isolated lung cells; and (5) surfactant synthesis, release, and metabolism in isolated alveolar type-II pneumocytes.

Research proposals are invited in these or closely related areas.

Reference

LaCagnin LB, Miles PR, et al: American Journal of Physiology, Lung, Cell, and Molecular Physiology 259: L57, 1990

Cellular Effects of Occupational Chemicals

HE Wey 53.02.01.01
Division of Biomedical and Behavioral Science
Cincinnati, Ohio

Workers are generally exposed to many diverse chemicals that may cause both subtle and overt cellular damage, which becomes part of a pathogenic process. This laboratory studies the cellular toxicity of industrial chemicals to develop sensitive methods for detecting cellular effects related to occupational disease. Current research focuses on developing human cell culture systems for the investigation of oxidant damage to lipids, proteins, and nucleic acids. Emphasis is placed on the effects of carcinogenic industrial chemicals. Experimental techniques include (1) utilization of microscopic image analysis of exogenous or endogenous fluorophores in living cells and (2) biochemical analysis of cellular damage resulting from reacting oxygen species and lipid peroxidation as a consequence of chemical exposure.

References

Wey HE, et al: Carcinogenesis 13: 1047, 1992
Floyd RA: FASEB Journal 4: 2587, 1990

Epidemiology and Surveillance

Epidemiology of Coal Related Diseases/Epidemiology Method/Statistical Method

MD Attfield 53.01.16.01
Division of Respiratory Disease Studies
Morgantown, West Virginia

The Epidemiology Branch of the Division of Respiratory Disease Studies is concerned with all aspects of epidemiologic research on occupational respiratory disease including design, planning, data collection, analysis, and reporting.

Occupational cohorts have included coal miners, metal and nonmetal miners, crushed stone workers, talc and clay workers, and welders, and have encompassed a wide range of exposures (e.g., diesel exhaust, silica, asbestos, and halite). Most of these studies are large cross-sectional or longitudinal surveys that take several years to complete, but the Branch also is involved in health hazard investigations which are usually small, short-term studies. In addition, disease surveillance and statistical activities form a substantial part of the Branch's activities. The statisticians are usually involved in each epidemiological study and investigation; however, statistical design and analysis support is also provided to the other branches of the Division. The incoming Associate can become involved in these continuing projects in a variety of ways. In addition, large data bases are available to explore various hypotheses on respiratory disease. There is also the possibility to explore methodological problems in the application of new epidemiological or statistical methods to biological data.

Reference

Attfield MD, et al: American Review of Respiratory Disease 145: 605, 1992

Epidemiologic Studies of Workers Exposed to Dioxin

MA Fingerhut MH Sweeney 53.05.16.01
Division of Surveillance, Hazard Evaluations, and Field Studies
Cincinnati, Ohio

The Industrywide Studies Program at NIOSH conducts occupational health research, the results of which are used to make recommendations regarding safe levels of exposure in the workplace. Epidemiologic field studies, cohort mortality and morbidity studies, case control studies, and cross-sectional medical studies are conducted to identify occupationally related causes of disease both in the working population and in their offspring. One area of specialization focuses on dioxin studies. A retrospective cohort mortality study was conducted on all workers in the US who were assigned to make dioxin-contaminated products at 14 chemical plants; additionally, a medical study was conducted on workers from 2 of the 14 plants. The products included 2,4,5-trichloropenol and 2,4,5-trichlorophenoxy acetic acid (which were contaminated by 2,3,7,8-tetrachlorodibenzo-p-dioxin) and pentachlorophenol (which was contaminated by other dioxins and furans). Exposure data include industrial hygiene measurements, and serum levels of dioxins and furans; while outcome data include causes of death, and medical tests on a wide variety of organ systems. Although some analyses of these data have been published, additional

analyses of mortality, medical outcomes, exposure data, and methodological questions are also possible. New studies may be designed to evaluate exposure or outcomes in these or other dioxin-exposed workers. Opportunities also exist for studies of other toxic substances with suspected effects on the health of workers.

References

Fingerhut MA, Halperin WE, Marlow DA, et al: New England Journal of Medicine 324: 212, 1991
Sweeney MH, Fingerhut MA, Patterson, DG Jr, et al: Chemosphere 20: 993, 1990

Occupational Health Hazard Evaluations

LJ Fine 53.05.16.02
Division of Surveillance, Hazard Evaluations, and Field Studies
Cincinnati, Ohio

NIOSH receives approximately 400 requests per year for on-site toxicity determinations in workplace settings. Several of these evaluations involve new hazards, new health effects, or innovative assessment techniques.

A candidate with expertise in the neurotoxicology field is needed to evaluate health hazard evaluations related to toxic effects of workplace hazards on the nervous system. Work would involve protocol development, identification of research tools, field data collection, and oversight of analysis. These hazard evaluations address important research questions, including the possible central nervous system effects of a previously unrecognized toxicant, and possible nervous system effects from exposure to a known neurotoxicant at levels below existing standards.

Although dermatologic conditions rank among the most common occupational disease, the NIOSH Health Hazard Evaluation Program conducts relatively few evaluations of such conditions. However, we would like to play a larger role in the prevention of occupationally related skin disorders. Work would involve developing protocols for hazard evaluations of worksites where dermatologic diseases are reported, and developing a plan to obtain more requests for hazard evaluations of worksites with a high risk of dermatologic disease in cooperation with unions, management groups, and state health and labor departments.

Occupational physicians are frequently in the position to detect and document occupational health complaints. Better communication with this group would enhance the opportunity to conduct evaluations of important occupational health problems. This work would involve developing an outreach program for

physicians who treat occupational diseases, to improve the awareness in the occupational medical community of the availability and expertise of the NIOSH Health Hazard Evaluation Program.

Twenty years of health hazard evaluation reports constitute a unique collection of occupational exposure information. Collation and review of this data would be of interest to both NIOSH and outside scientists. This work would involve developing a conceptual framework and implementation plan for an occupational exposure data base that uses industrial hygiene sample results from completed health hazard evaluations, reviews completed hazard evaluations for appropriateness of results to the data base, and selects and prepares appropriate software and programs for the data base.

References

Smith AB, et al: Chest 98(2): 398, 1990
Rinsky R: Environmental Health Perspectives 82: 189, 1989

Epidemiologic Studies of Occupational Diseases

WE Halperin PJ Seligman 53.05.16.03
Division of Surveillance, Hazard Evaluations, and Field Studies
Cincinnati, Ohio

Surveillance, the sensory apparatus of public health, includes the collection, analysis, and dissemination of health data to prevent occupational disease and injury; identify new problems; estimate the magnitude of such problems; track its trends; and target limited resources. A variety of data bases, from disease reports by physicians to national surveys, will be analyzed by Associates working with NIOSH staff. Field visits to industrial sites and state health departments are also encouraged.

Areas of interest include lead poisoning; cumulative trauma disorders; suicide; and preventable nonoccupational diseases such as breast cancer, dermatitis, tuberculosis, and many others.

References

Halperin W, Baher E (Eds.): in Public Health Surveillance. New York: Van Nostrand Reinhold, 1992
Seligman P, Halperin W: American Journal of Industrial Medicine 20: 381, 1991

Occupational Reproductive Epidemiology

TM Schnorr BA Grajewski 53.05.16.04
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Cincinnati, Ohio

The Industrywide Studies Branch focuses on epidemiologic studies of reproductive disorders among male and female workers. Our reproductive health research program conducts semen quality studies of men exposed to potential reproductive toxicants, and pregnancy outcome studies of women workers and the wives of men occupationally exposed.

Current studies utilize emerging laboratory techniques to detect potential reproductive toxicants. Such techniques include human chorionic gonadotrophin measurements to detect early pregnancy loss, urinary steroid metabolic measurements to detect ovulatory dysfunction, and genetic evaluation of the sperm cell. Projects include (1) analysis of existing data sets, (2) design and conduct of new studies, and (3) research on new analytic methodologies for reproductive field studies.

Reference

Schnorr TM, et al: New England Journal of Medicine 324(11): 727, 1991

Development and Implementation of Evaluation Methods for Public Health Interventions

PA Schulte 53.05.16.05
Division of Surveillance, Hazard Evaluations, and Field Studies
Cincinnati, Ohio

The application of epidemiologic and related methods to public health interventions is crucial to the assessment of effectiveness and impact. Opportunities exist for applications involving risk communications, cancer control programs for farmers, and industrial hygiene interventions.

Research is currently in progress to assess the short- and long-term impact of risk communications to workers at increased risk of bladder cancer from aromatic amine exposure. Other exposure-related communications that could be assessed include cadmium, sulfuric acid mist, uranium, and asbestos.

Projects are also under way to identify barriers farmers and their families face in obtaining cancer control information and services. Demonstration projects are being developed to overcome these barriers, with opportunities available to evaluate the effectiveness of such projects in various areas of the country.

Validation and Use of Biological Markers in Epidemiologic Research

PA Schulte 53.05.16.06
Division of Surveillance, Hazard Evaluations, and Field Studies
Cincinnati, Ohio

Biological markers of exposure, effect, and susceptibility have the potential to enhance epidemiologic research. To do this, we must show that potential markers are valid for use in population studies, which involves applying markers that are validated in the laboratory to small-scale human settings to determine how markers vary with occupational, demographical, or behavioral factors. These studies require the application of epidemiologic knowledge. Once validated in small population groups, biological markers may be used to address important public health questions. Current research involves DNA and protein adducts, cytogenetic markers, DNA repair, and metabolic phenotypes and genotypes. An Associate could collaborate with NIOSH laboratory researchers as well as with external sources.

Epidemiologic Methods Development

NK Steenland 53.05.16.07
Division of Surveillance, Hazard Evaluations, and Field Studies
Cincinnati, Ohio

NIOSH's Industrywide Studies Branch conducts large cohort studies, which are sometimes accompanied by estimates of exposure over time. These studies require analysis by methods appropriate for longitudinal data (i.e., person-year data), such as life table analysis and Poisson and Cox regression. In fact, regression analyses using a variety of models are increasingly replacing conventional life table analysis. Furthermore, nested case-control studies are frequently conducted within cohorts, raising further issues regarding sampling to select controls and appropriate analysis techniques. Large cross-sectional studies with multiple and repeated outcomes are also in progress. Research opportunities involve the development of appropriate methods to model epidemiologic data, including adjustment for potential errors in measuring exposure variables, appropriate model selection and goodness of fit assessment, use of survey data for regression analyses, assessment of potential impact of unmeasured confounders (e.g., smoking), and translation of known theoretical developments into practical applications. Multiple data are available, although some have not yet been analyzed.

Evaluations of Ergonomic Hazards in Industry

MH Sweeney LJ Fine S Baron 53.05.16.08
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Cincinnati, Ohio

Among the top ten disorders targeted for study by NIOSH are work-related disorders, including carpal tunnel syndrome and low-back disorders. In the Industrywide Studies Branch, epidemiological studies are being planned to measure the prevalence of such conditions in different workplace settings using a variety of study methodologies, and new and previously field tested data collection instruments. Physical and psychological factors that contribute to musculoskeletal disorders will also be assessed. Associates will have the opportunity to develop skills in epidemiology and ergonomics by being involved in the design, population selection, data collection, analytic phases, and publication of studies of interest. Opportunities may also include developing research topics on the epidemiology of work-related musculoskeletal disorders, measuring ergonomic risk factors, and collaborating with investigators on laboratory studies related to human factors and ergonomics. Areas of research include meatpacking, wholebody and segmental vibration, keyboard use, and the construction industry.

Aromatic Amine Carcinogenesis in Occupational Groups

EM Ward 53.05.16.09
Division of Surveillance, Hazard Evaluations, and Field Studies
Cincinnati, Ohio

Recent NIOSH studies have found a 6.5-fold increased risk of bladder cancer among workers exposed to o-toluidine and aniline, and elevated urinary excretion of o-toluidine and aniline among currently exposed workers. A number of studies can be designed to investigate the biological dose of these compounds as they relate to urinary levels and the issue of whether 4-aminobiphenyl (4-ABP) contamination presents a significant risk for workers exposed to o-toluidine and aniline currently or in the past. This research would be done in collaboration with industrial hygienists who are planning an exposure survey for o-toluidine, and laboratory scientists who have developed methods for measuring o-toluidine and aniline. Research issues include (1) a review of the literature on carcinogenicity, metabolism, and adduct formation to assess the relative biological potency of 4-ABP and o-toluidine; (2) identification of methods and laboratories able to measure 4-ABP in biological samples; (3) design of field studies to estimate the

pharmacokinetics of o-toluidine excretion; and (4) the design of studies to investigate the relationship between smoking and metabolic phenotypes (such as fast and slow acetylation), and the levels and ratio of acetylated parent compound in the urine. In addition, the Associate could collaborate on other toxicologic studies in the Branch.

Chemical Exposure Assessment Methodology

RW Hornung MA Waters 53.05.16.10
RF Herrick CS McCammon, Jr
Division of Surveillance, Hazard Evaluations, and Field Studies
Cincinnati, Ohio

This research focuses on the relationship between exposure to toxicants in the workplace and health effects in populations, including large-scale epidemiological studies, with emphasis placed on exposure assessment. Areas of interest include reconstruction of historical exposures for retrospective epidemiological studies, methods for classification of workers by exposure, design of statistically based prospective exposure assessment strategies, exposure misclassification in epidemiological studies, and examination of the various components of workers' exposures. A unique opportunity exists to blend occupational field studies with methodological research.

Reference

Hornung RW, Reed LD: Applied Occupational Environmental Hygiene 5(1): 46, 1990

Adjustment of Risk Estimates for Exposure Measurement Error

RW Hornung 53.05.16.11
Division of Surveillance, Health Evaluations, and Field Studies
Cincinnati, Ohio

In recent years, there has been considerable research on the effect of misclassification or errors in independent variables on estimated regression coefficients. However, relatively few studies have been done on the effect of errors in continuous measures of exposure on quantitative risk estimates. Most of what was done has been of a theoretical nature. Proposed NIOSH research involves the development or adaptation of existing theory to adjust risk estimates that are due to errors in exposure measurements. Furthermore, this theory should be applicable to the types of risk models generally used by NIOSH, which include the Cox proportional hazards model, Poisson regression, and the multistage model. In addition, the outcome of this research should include

development of software for use by NIOSH in producing such adjusted risk estimates.

Occupational Injuries

NA Stout 53.06.16.01
Division of Safety Research
Morgantown, West Virginia

Occupational injury is a primary cause of premature death and a major public health crisis in the US today. The NIOSH Division of Safety Research (DSR) is responsible for conducting surveillance and research to prevent such occupational injuries. Injuries are multifactorial events, requiring many different data sources and investigative techniques for adequate analysis and assessment. DSR maintains several fatal work injury surveillance systems, including the National Traumatic Occupational Fatality system, based on death certificate data; and the Fatality Assessment and Control Evaluation Program, based on field investigations of fatal work injuries. DSR also has access to other work injury data bases, and is working to improve occupational injury surveillance nationwide. Current research includes descriptive epidemiologic studies of fatal occupational injuries in the agricultural industry, injuries resulting from falls among construction workers, occupational homicides, work-related electrocution, race and gender differences in occupational fatality rates, and international comparisons of work-related death. Results are used to identify high-risk worker populations, characteristics, and work practices which can be targeted for further study and intervention. Research opportunities are available for descriptive epidemiologic studies of selected causes and/or worker populations to identify potential risk factors or correlates associated with specific occupational injuries.

References

Stout N, Bell C: American Journal of Public Health 81: 6, 1991
Bell C, et al: Journal of the American Medical Association 263: 22, 1990

Exposure/Response Relationships in Indoor Environmental Research

EM Ward 53.05.15.01

Division of Surveillance, Hazard Evaluations, and Field Studies

Cincinnati, Ohio

NIOSH has investigated over 600 reported occurrences of health problems attributed to indoor environmental exposures among office workers. Using conventional industrial hygiene techniques, these investigations have generally failed to identify responsible exposures or conditions. Therefore, the Industrywide Studies Branch has begun a multidisciplinary research effort to identify etiologic factors. Current research includes (1) a longitudinal study of seasonal variations in symptoms and environmental measurements among workers in a Federal office building, (2) a multi-building study of 12 California offices to explore demonstrated associations between symptom prevalence and various building features such as air-conditioning and carpets, and (3) a study of immune function among office workers potentially exposed to Penicillin mold. Research proposals are also invited in the following areas: (1) epidemiologic studies, such as cross-sectional, case-control, or controlled intervention studies; and (2) methods development work, to produce improved techniques for measuring health effects and indoor environmental exposures. Potential etiologic factors of interest include fungi and fungal products, volatile organic chemicals, temperature and humidity, and organizational and other job stresses. Of particular interest is multidisciplinary research in collaboration with microbiology, immunology, molecular biology, chemistry, ventilation engineering, or psychology.

Occupational Cancer Epidemiology

EM Ward AM Ruder 53.05.15.02

Division of Surveillance, Hazard Evaluations, and Field Studies

Cincinnati, Ohio

Over the past two decades, the Industrywide Studies Branch has conducted cohort mortality studies on many potential carcinogens of public health importance. In some of these studies, individual dose estimates were developed to allow application of the results to human risk assessment. We are continuing to update and initiate mortality studies of substances for which definitive answers have not been established.

Cohort mortality studies are valuable in detecting elevated cancer risks at sites with low survival; however, this methodology is not as valuable in detecting risks for less lethal cancers such as bladder and laryngeal cancer. NIOSH investigators have utilized two approaches to conduct cancer incidence studies: (1) mailing questionnaires to cohort members and (2) linkage with population-based tumor registries.

Current studies use classical techniques to determine cancer incidence or mortality, as well as emerging techniques that combine field studies with collections of biological specimens and laboratory analyses for markers of exposure and biological effect.

Medical Screening

RW Niemeier 53.04.15.01
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Cincinnati, Ohio

No consistent set of guidelines is available for medical screening of employees who are exposed to hazardous substances in the workplace. In response to this need, NIOSH has a project under way to develop recommendations for screening workers, based on the following components: (1) to identify and develop screening recommendations for health effects that result from hazardous occupational exposures and (2) to evaluate individual exposures for identifying associated screenable health effects.

These components differ from the traditional approach in which screening recommendations are specific to the substance. It is believed that this approach will lead to more consistent, standardized screening recommendations and facilitate future efforts to keep screening recommendations current. To date, specific guidelines for only 17 of approximately 600 chemicals have been developed. Research opportunities exist to further develop individual guidelines, to further define the decision logic, and to explore the ethical issues and feasibility of utilizing the guidelines in a work environment.

Evaluation of Communication Strategies

RW Niemeier 53.04.15.02
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Cincinnati, Ohio

Within NIOSH, the Technical Information Branch (TIB) serves as the centralized collection, indexing, and dissemination point for a variety of NIOSH-developed

materials, including NIOSH-numbered publications, Hazard Evaluation and Technical Assistance reports, grant reports, contract reports, and journal articles.

TIB has also developed (1) several manual and computerized systems for collecting and inventorying this material, which include manual reprint and publication storage files, Document Information Directory System, and NIOSHTIC; and (2) a variety of methods to disseminate its information to the occupational safety and health community, including general mailing lists (foreign and domestic), targeted mailing lists, exhibit programs, interaction with secondary disseminators (e.g., newsletters, trade association publications, and journals), 800-number inquiry service, and commercial availability of NIOSH data bases and publications.

Although TIB has been performing these activities for many years, there has never been a comprehensive evaluation of the effectiveness and usefulness of the information developed and disseminated by NIOSH. Therefore, NIOSH is interested in learning whether the information it provides was used to effect positive change in the workplace, whether it was packaged appropriately for the intended audience, and whether it reached the target audience.

Research opportunities exist for scientists to develop methods of assessing NIOSH's overall communication strategy, to quantify the effectiveness of its existing strategy, and to develop new or refined techniques for communicating its research findings to the scientific community. Evaluation studies would vary according to the type of information or intended audience. For example, it could consist of extensive contact with the target audience to assess the utility and availability of a NIOSH document, or an evaluation of reader response card surveys.

Risk Assessment Methodology

DA Dankovic 53.04.15.03
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Cincinnati, Ohio

Quantitative risk assessment, a relatively new scientific discipline, seeks to quantify the hazards from exposure to substances in the general work environment. The risk assessment process has generally been divided into the following elements: (1) hazard identification, (2) exposure, (3) dose-response modeling, and (4) risk characterization. Addressing these elements requires a multidisciplinary team of scientists, such as statisticians, epidemiologists, toxicologists, and industrial hygienists.

Quantitative risk estimates may be based on human (epidemiological) or animal data. In either case, questions may arise regarding the mechanism of carcinogenesis, and the appropriate treatment of dose in the risk assessment model. Physiologically based pharmacokinetic models have been proposed for dose estimation in quantitative risk estimates for both cancer and noncancer endpoints. Research opportunities exist to apply physiologically based pharmacokinetic models and biologically motivated mechanistic models to quantitative risk assessment, which could result in improvements in human risk assessment methodology. An Associate would also be able to collaborate with investigators from other NIOSH research divisions and from other institutions.

Modeling Occupational Exposure Limits

RW Mason 53.04.15.04
Division of Standards Development and Technology Transfer
Cincinnati, Ohio

A more concise and firmly based model is needed to extrapolate data from species-to-species and route-to-route for predicting effects on workers when determining occupational exposure limits. Acute and chronic effects to be considered range from eye irritation and surface effects (dermal and mucous membrane) to systematic toxicity. Data include physical and chemical characteristics of compounds, metabolism, excretion, partition coefficients, evaporation rates from the skin, and host factors such as metabolic rate, physical activity, and age. Opportunities are available to study various parts of the total model depending on the interests of the investigator, and to interact with scientists working on similar problems in other NIOSH Divisions, the University of Cincinnati, Wright-Patterson Air Force Base, and the Occupational Safety and Health Administration.

Reference

Mason RW, Johnson BL: Ergonomic Factors in Chemical Hazard Control, in Handbook of Human Factors/Ergonomics. Edited by Salvendy G. New York: John Wiley and Sons, 1987: 722

Management Factors in Reducing the Risk of Occupational Injuries/Policy

HW Ahlers 53.04.15.05
Division of Standards Development and Technology Transfer
Cincinnati, Ohio

Research focuses on assessing the impact of management attitudes and approaches to risk control to formulate appropriate models in order to predict

their effects on the rate of occupational injuries. We use occupational injuries as a focal point because more data on injury are available than that of chronic illness. Several industries have data sets on injury rates, which can be used to generate models for factors such as the degree of management emphasis on safety, extent of training, and the quality of safety programs. Specific research opportunities include relative injury rates among different employers in the same manufacturing area, trends in a given manufacturing facility following implementation of various safety programs, and the effect of Federal or state occupational safety regulations in a manufacturing area.

Immunology

Immunology in Lung Disease

DM Lewis 53.01.07.01
Division of Respiratory Disease Studies
Morgantown, West Virginia

Research activities focus on the immunologic aspects of occupational lung diseases associated with the inhalation of organic dusts. Ongoing studies include analysis of the direct effects of various organic dusts (e.g., grain dust and cotton dust) on the cellular elements of the immune system. The overall objective is to develop methods to characterize the inflammatory and/or immunogenic activity of such dusts and to identify the active substance(s) in them. Research interests also include allergic aspects of occupational lung diseases, with particular emphasis on development of methods for monitoring aero-allergen in the workplace and methods of evaluating occupational asthma.

References

Mamolen M, et al: American Journal of Industrial Medicine 23: 483, 1993
Lewis DM, Stasny A, Bledsoe TA: Scandinavian Journal of Work, Environment, and Health 18(2): 72, 1992

Occupational Hazards Related to Fungi and Their Metabolites

WG Sorenson 53.01.07.02
Division of Respiratory Disease Studies
Morgantown, West Virginia

This program is designed to study the potential hazard of fungi and their metabolites in airborne agricultural dusts. Research proposals are invited in any

of the following or closely related areas: (1) characterization of the microbial composition of agricultural workplace aerosols and silage; (2) analysis of agricultural dust samples for mycotoxins by existing methods and by analytical methods applicable to very small samples; (3) *in vivo* and *in vitro* studies on the immunomodulating effects of mycotoxins and other fungal products; and (4) *in vitro* toxicity studies with isolated lung cells, e.g., alveolar macrophages, mast cells, and natural killer cells.

References

Sorenson WG: Developments in Industrial Microbiology 31: 205, 1990
Sorenson WG, et al: International Biodeterioration 27: 373, 1991

Immunology of Occupational Respiratory Disease

SA Olenchock 53.01.07.03
Division of Respiratory Disease Studies
Morgantown, West Virginia

The immunology program is designed to study the mechanisms of immunologically mediated reactions to inhaled materials. All aspects of the immune response can be studied with relation to occupational exposures.

Research proposals are invited in the following or related areas: (1) interactions of complement with organic dusts, (2) inflammation, (3) immunochemistry of inhaled antigens, and (4) role of endotoxins in respiratory disease.

Laboratory and field-based research, as well as animal and human studies are in progress, and collaboration with extramural universities and research institutes complement our investigations.

References

Olenchock SA, et al: Biodeterioration and Biodegradation 8: 481, 1991
Olenchock SA, et al: Scandinavian Journal of Work, Environment, and Health 18: 58, 1992

Immunochemical Techniques in Biological Monitoring

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Division of Biomedical and Behavioral Science
Cincinnati, Ohio

Immunoassays which employ specific antibodies can be used to detect and quantify chemicals in the biological fluids of individuals following exposure to xenobiotics. Significant diagnostic use of immunoassays has already been made

in the areas of medicine and forensic chemistry to identify therapeutic drugs and other chemicals.

Research focuses on developing immunoassays to identify and quantitate exposure to specific occupational chemicals. The use of sensitive and specific field-type immunoassays could be extremely valuable for rapid assessment of exposure levels to xenobiotics in the workplace during health hazard evaluations or other epidemiologic studies. Our research approach is to develop assays which employ monoclonal or monospecific antibodies made from an immune reaction to an appropriate hapten for assessing chemicals of occupational concern. These specific immunologic biomarkers (antibodies) would be tested using animal models and human biological samples to determine chemical exposures. Subsequently, these immunoassays could be applied as powerful research tools for further toxicokinetic and dose-response characterization of antigenic chemical exposures found in the workplace. Research proposals are invited which address new development or unique application of immunoassays to evaluate biomarkers of occupational exposures or effects.

Reference

Biagini RE, et al: Life Sciences 47: 897, 1990

Microbiology and Mutagenesis

Occupationally Related Mutagenesis and Carcinogenesis

T Ong 53.01.03.01
Division of Respiratory Disease Studies
Morgantown, West Virginia

Workers in occupational settings are often exposed to chemical agents and/or complex mixtures. Many of these agents and mixtures may be genotoxic and may cause consequent changes of genetic materials in germ or somatic cells. To protect workers from any potential genotoxic and related health hazards, it is necessary to determine whether chemicals occurring at the workplace are genotoxic, whether these chemicals can cause or have caused DNA or chromosomal damage to the exposed population, and whether genotoxic endpoint can be used as an indicator of adverse health effects.

Research proposals are invited in the following or closely related areas: (1) performance of *in vivo* and/or *in vitro* genotoxicity studies of chemicals and

complex mixtures found in occupational settings, (2) development and/or validation of environmental or biological (genetic) monitoring systems, (3) development of mechanisms for risk assessment, (4) identification of agents that can eliminate or reduce the potential genotoxic hazards of chemicals to the exposed workers, and (5) determination of the role of proto-oncogen activation or genetic alteration in occupational carcinogenesis.

References

Ong T, Stewart J, Whong WZ: IARC 104: 101, 1990
Nath J, Ong T: Journal of Tissue Culture Methods 14: 125, 1992

Genotoxicity Monitoring of Workplace Environment

WZ Whong 53.01.03.02
Division of Respiratory Disease Studies
Morgantown, West Virginia

Development of methodologies for the detection and/or monitoring of airborne genotoxic agents and potential carcinogens in the workplace environment is our major research activity in the area of genetic toxicology. Efforts have also been made to develop *in vitro* and *in vivo* multiple genetic endpoint genotoxicity assay systems using mammalian lung cells. The genetic endpoints include gene mutations, sister chromatic exchanges, chromosomal aberrations, unscheduled DNA synthesis, and DNA adducts. Future researchers will employ molecular approaches for studying the genotoxic effect and oncogene activation potential of industrial chemicals. Research proposals in these or related areas are invited.

References

Whong WZ, et al: Mutation Research 283: 1, 1992
Whong WZ, et al: Mutation Research 262: 51, 1991

Noise

Audiometric and Morphologic Consequences of Acoustic Trauma

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Acoustic overexposure is prevalent in both occupational and social environments. Sensorineural hearing loss is the most common effect of noise exposure, but nonauditory effects have also been documented. Research proposals are invited

that address changes in auditory sensitivity and cochlear pathology that result from overexposure to sound alone or sound in combination with other stressors. Either field studies of exposed workers at the work site or laboratory studies of rodents can be performed. Measurement and instrumentation capabilities encompass the range from infrasound to low-frequency ultrasound. The laboratory is equipped for digital signal processing, contains reverberant and anechoic rooms, and has extensive acoustic calibration and measurement equipment. Facilities are available for morphologic and histologic evaluation of cochlear tissue and evaluation of auditory sensitivity in experimental animals. Animal housing and clinical laboratory facilities are available, and studies of human subjects can be made both in the laboratory and in the workplace.

References

Rydmarker S, et al: Scanning Microscopy 3(4): 1253, 1989

Dunn DE, et al: Journal of the Acoustical Society of America 90(4): 1975, 1991

Interactions of Hearing Protective Devices with Aural Structures

JR Franks 53.02.08.02

Division of Biomedical and Behavioral Science

Cincinnati, Ohio

Hearing protective devices such as earmuffs and earplugs are used in occupational settings to protect workers from acoustic overexposure. The amount of noise reduction a device provides a worker in the occupational rather than laboratory setting is not easily quantifiable. We invite proposals concerning methods of measuring the noise reduction provided by hearing protective devices or concerning the effects of hearing protective devices on speech communication. Such measurements should support development of models that permit the use of laboratory data to predict field results. Studies addressing the effects of one or all of the following are of particular interest: tympanic membrane and middle ear impedance, ear canal dimensions, pinna characteristics, geometry of the head, shape and size of the protective device, frequency and bandwidth of the test signals, and angle of signal incidence in a nondiffuse acoustic environment. Measurement and instrumentation capabilities available for such research encompass the range from infrasound to low-frequency ultrasound. The laboratory is equipped for digital signal processing, contains reverberant and anechoic rooms, and has extensive acoustic calibration and measurement

equipment. Clinical laboratory facilities are available, and studies of human subjects can be made both in the laboratory and in the workplace.

References
Franks JR: Ear and Hearing 10(2): 273, 1989
Franks JR: Ear and Hearing 13(1): 1, 1992

Chemical Protective Clothing Technology

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Division of Safety Research
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Skin disorders, including diseases and injuries such as chemical burns and various types of dermatitis are common, costly, and often severely disabling. Chemical protective clothing (CPC), viewed by many as the most economical way of protecting workers' skin from such insults, is widely used. If the CPC materials fail, the worker may be at an immediate risk of experiencing a harmful exposure. Consequently, CPC has been called the "last line of defense."

CPC is usually constructed from plastic and elastomeric materials. Selection is based on the chemical resistance and physical properties of the materials to act as a barrier. Chemical resistance testing evaluates the interaction between challenge chemicals and the CPC garment material. There are three types of interaction: (1) chemical degradation—a breakdown of the garment's physical structure resulting from garment-chemical incompatibility, (2) chemical penetration—the bulk chemical flow through garment imperfections or through discontinuities such as seams and closures, and (3) chemical permeation—the molecular flow of chemicals through garment materials.

The Protective Equipment Section (PES) has studied degradation test methods which use parameters such as visual inspection, weight change, and percent elongation. Research opportunities exist for chemists, physicists, material scientists, and industrial hygienists to develop degradation test methods.

In the past, chemical penetration testing has been investigated by the PES; however, current test methods rely on visual acuity to determine penetration. Thus, research opportunities exist for chemists, physicists, and industrial hygienists to develop second generation test methods that may be more definitive in determining penetration.

The PES has also conducted numerous chemical permeation studies. Challenge chemicals which have been used include neat liquids and binary mixtures that either were water soluble (> 0.5% w/w) or had significant vapor

pressure. Rapid analytical chemistry methods for chemical permeation testing are needed in order to analyze complex organic mixtures (e.g., pesticides, crude oil, weathered crude oil, and various hazardous wastes). Other research areas include the use of portable analytic equipment so that testing can be conducted "on-site", and the use of industrial hygiene analytical instruments such as the Miran 1a infrared analyzer.

Research is also necessary to develop a chemical permeation test method for poor water soluble chemicals with low volatility. Some viable methods could be Fourier-transform infrared spectroscopy using diffuse reflectance, or the modeling of chemical permeation using diffusion coefficients and solubility parameters. Opportunities are available to do computer modeling and to correlate such models to existing chemical permeation data.

PES research has shown that chemical permeation is significantly different for the same generic materials (i.e., nitrile rubber and neoprene rubber). These differences are believed to be related to variations in formulations. Thus, opportunities exist for chemists, physicists, and material scientists to explore the relationship between generic material composition and chemical resistance properties.

Reference

Berardinelli SP, Moyer ES, Hall RC: American Industrial Hygiene Association Journal 51(11): 595, 1990

Aerosol and Gas/Vapor Respirator Collection Mechanisms

ES Moyer 53.06.08.02
Division of Safety Research
Morgantown, West Virginia

Air-purifying respirators are used to remove contaminants from the air inhaled by the wearer. These contaminants can be particulate materials, gases, and/or vapors. Research in aerosol filtration and gas/vapor adsorption identifies testing criteria and maximizes capture mechanisms, thereby enhancing worker protection. Additional interests include aerosol generation methodology, aerosol characterization (e.g., aerosol size, size distribution, charge, density, and shape), aerosol filtration efficiency as a type of challenge aerosol (e.g., solid, liquid, or fiber), worker respiration (flow rate and breathing pattern), and environmental parameters (e.g., temperature and humidity). In the vapor/gas area, we are investigating new methods to evaluate sorbents, to enhance sorbent properties, to identify new specific contaminant adsorbents, and to develop chemical and

electronic life indicators. Ongoing research in sorbent modeling focuses on predicting sorbent breakthrough characteristics for all classes of chemical and environmental conditions from limited experimental laboratory reference data. Methodologies are also being investigated to characterize and model multicomponent mixed (aerosol and gas/vapor) environmental systems.

References

Wood GO, Moyer ES: American Industrial Hygiene Association Journal 50(8): 400, 1989
Moyer ES, Stevens GA: American Industrial Hygiene Association Journal 50(5): 265, 1989

Work-Related Injuries

HA Amandus 53.06.08.03
Division of Safety Research
Morgantown, West Virginia

The Analysis and Field Evaluations Branch conducts epidemiologic research on the causes of work-related injury and evaluates injury interventions. The Branch is currently studying injuries among power company linesmen and construction workers, stress and injury, seat belt use incentives, prevention of homicide and assaults in convenience store workers, and prevention of low back injury among nursing home assistants. Opportunities are available for analytical epidemiologic studies of selected causes and for evaluation of injury interventions.

Pathology

Pathogenesis and Carcinogenesis of Occupational Lung Disease

V Vallyathan 53.01.04.01
Division of Respiratory Disease Studies
Morgantown, West Virginia

This laboratory conducts studies leading to the elucidation of the biochemical, enzymic, and cytotoxic processes that lead to occupational lung disease. Of particular interest are secretions of cytokines, growth factors, and generation of oxygen radicals, which result in cell injury, death, fibrogenesis, and carcinogenesis. These changes are studied in *in vitro* cell systems, organ cultures, *in vivo* animal models, and human bronchoalveolar lavages biopsies and autopsy tissues using electron spin resonance, chemiluminescence, autoradiography, analytical electronmicroscopy, biochemistry, and immune histochemistry techniques. Role and interaction of neutrophils, macrophages, and lymphocytes in the induction of fibrosis is also an area of interest. Attempts in the

development and validation of short-term *in vivo* and *in vitro* bioassays as predictors of fibrogenicity and carcinogenicity are also pursued with great interest. Research proposals are invited in these closely related areas.

Reference

Vallyathan V, et al: American Journal of Respiratory Cell and Molecular Biology 6: 5, 1992

Pharmacology

Airway Smooth Muscle in Occupational Respiratory Disease

JS Fedan 53.01.02.01
Division of Respiratory Disease Studies
Morgantown, West Virginia

The neurological control, pharmacology, physiology, and biochemistry of airway smooth muscle in occupational respiratory disease, especially asthma, are being studied.

The following systems are being investigated in laboratory animal models: (1) occupational asthma, (2) purinergic neuroeffector mechanisms, and (3) the role of epithelium-derived modulatory substances in airway reactivity.

Proposals incorporating a multidisciplinary research approach are encouraged.

References

Fedan JS, Frazer DG: Journal of Pharmacology and Experimental Therapeutics 264: 210, 1993
Fedan JS, et al: Journal of Pharmacology and Therapeutics 264: 683, 1993

Physiology and Biophysics

Respiratory Bioengineering

DG Frazer, Jr 53.01.05.01
Division of Respiratory Disease Studies
Morgantown, West Virginia

The respiratory bioengineering program is currently involved in three research areas. The first involves the development of early detection methods of lung disease. This includes studying the mechanical properties of lungs, especially the mechanics of the alveoli and small airways, using pressure-volume and flow-

volume relationships of lungs. The second research area deals with the development of methods of exposing animals to test aerosols. Of particular interest are the design of aerosol generation systems, animal exposure chambers, and *in vivo* lung function tests. The third research area is concerned with the development of methods for examining the acoustical properties of lungs. These studies involve studying the sounds produced inside healthy and diseased lungs, as well as the acoustic transmission of externally produced sounds in the airways of lungs. Research proposals are invited in any of these or related areas.

Reference

Frazer DG Jr, et al: Journal of Biochemical Engineering 113: 104, 1991

Non-Ionizing Radiation

Dosimetric Evaluation of Workplace Exposure to Radio-Frequency Radiation

DL Conover 53.02.09.01
Division of Biomedical and Behavioral Science
Cincinnati, Ohio

Research opportunities include the measurement of radio-frequency (rf) fields and rf-induced currents in the workplace, and the determination of internal rf-induced power distributions in experimental animals and models of the worker. Internal power distributions may be obtained by phantom-modeling techniques and by measurement of internal temperature distribution in live and dead animals. Rf-induced currents will be measured using unique noninvasive current sensors. Unique calibrated monitors, designed by the National Institute for Standards and Technology (NIST), are available to measure electric and magnetic field strengths in the frequency range of 300 kHz–500 MHz. In addition, NIST has developed exposure/calibration facilities (300 kHz–500 MHz), rf (10–1,000 MHz) power absorption analyzers, and rf-insensitive temperature monitors that are available to support this research. This novel research is essential for improved understanding and usage of the rf-biological-effects scientific data base.

References

Schnerr TM, et al: New England Journal of Medicine 329(11): 727, 1991
Conover DL, et al: Bioelectromagnetics 13(2): 103, 1992

Biologically Effective Features of Electric and Magnetic Fields

JD Bowman 53.02.09.02
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Research focuses on whether extremely low frequency (30–300 Hz) electric or magnetic (EM) fields cause cancer and reproductive or neurobehavioral abnormalities, and which features (e.g., magnitudes, frequencies, direction, polarization, and wave shape) of these fields cause biological effects. The significant EM field features from laboratory studies are being fit to biophysical models to determine new EM field exposure measurements that should be used in occupational disease studies. Research opportunities include (1) developing biophysical models for EM field interactions with biological systems and testing them against data from laboratory studies; (2) exposing *in vitro* and/or animal systems to the EM field features suggested by such models; (3) estimating workers' biological responses to EM fields by applying such models to existing measurement data from occupational studies; and (4) developing new instruments, especially personal monitors, to measure worker exposure to the biologically effective EM field features.

Stress/Human Factors

Psychophysiological Monitoring in the Workplace

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Nearly 25% of all compensable injuries and illnesses are due to overexertion. For physical work, especially involving whole-body exertion, several studies have demonstrated that work standards based on traditional time study techniques are not consistent with the physiological needs of the workers. However, there is no satisfactory or practical method of measuring fatigue of workers engaged in manual jobs such as materials handling. Research is needed to develop new or refine existing techniques for assessing the source and extent of the physiological effort associated with manual, repetitive work. In this regard, research would be aimed at establishing appropriate work/rest cycles and man-machine trade-offs in easing problems of fatigue buildup and hazards of overexertion injuries at work. Both laboratory and worksite measurement-instruments are available to

conduct this research, such as computers, biomedical oscillographs, ergometers, work simulators, and environmental chambers.

Epidemiology of Occupational Stress-Related Disorders

LR Murphy 53.02.10.02
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Cincinnati, Ohio

Job stress studies over the past 20 years have identified a wide range of job factors associated with mental and physical health complaints. However, most of these studies used a subjective approach, relating *perceived* stressors to predict *perceived* health complaints, typically at single worksites. Thus, conceptual and methodological flaws inherent in self-report questionnaire studies have been noted. A supplementary approach involves identifying *objective* job stressors that are associated with health outcomes, measured across many different occupations. The results of this approach can be used to formulate job redesign and organizational strategies for reducing job stress. This research opportunity would involve ecological analyses of national health data bases to identify associations among occupations, job dimensions, and stress-related health outcomes. A microcomputer, access to national health and job analysis data bases, and appropriate statistical software will be made available for the research.

References

Murphy LR: Journal of Clinical Epidemiology 44: 155, 1990
Murphy LR, Brackbill R: Journal of Occupational Medicine 31: 358, 1989

Performance Effects Associated with Hours of Work

RR Rosa 53.02.10.03
Division of Biomedical and Behavioral Science
Cincinnati, Ohio

Past research has suggested that shift work may have health and safety implications for the individual worker because it disrupts the body's normal diurnal cycles. Current studies focus on assessing psychological and physiological fatigue that is associated with various shift regimens and extended work hours (e.g., mandatory overtime or 10- or 12-hour workdays). Additional work involves identifying and characterizing circadian performance rhythms that reflect individual cognitive and behavioral functions as they might affect the performance and safety of workers who are engaged in various tasks and shift

routines. Interventions aimed at alleviating some of the adverse effects of these work schedules are also being explored.

The National Institute for Occupational Safety and Health has a functioning human performance laboratory with work simulation equipment and all necessary computer support. Postdoctoral Associates who wish to investigate the chronobiological variation of human performance or interventions for alleviating the stress and fatigue of demanding work schedules are encouraged to apply.

References

Rosa RR: Work and Stress 5: 107, 1991

Rosa RR, et al: Work and Stress 3: 21, 1989

Testing Models of Occupational Stress

LR Murphy 53.02.10.04

Division of Biomedical and Behavioral Science

Cincinnati, Ohio

A variety of theoretical models can be found in the occupational stress literature which postulate relationships between stressful work conditions and illness. However, the factors proposed to affect or alter these relationships vary from model to model. Thus, theory testing and refinement, and more unifying conceptual frameworks are necessary.

Research would involve analysis of previously collected occupational stress data. This synthesis of earlier, isolated research efforts could be a considerable help in the search for a meaningful and explanatory model of the stress-illness relationship. A microcomputer, access to job stress data bases, and appropriate statistical software will be made available for the Associate.

Stress Assessment and Control in Computer-Mediated/Terminal-Based Work

SL Sauter 53.02.10.05

Division of Biomedical and Behavioral Science

Cincinnati, Ohio

It has been predicted that by 1990, 40–50% of all American workers will be making daily use of electronic terminal equipment with nearly 40 million terminal-based workstations of various kinds installed in offices, factories, and schools. Efforts to understand the potential stresses of this type of work are impeded by lack of appropriate and standardized psychometric instruments to characterize stressors (organizational, computer-system operational, and physical

ergonomic) of computer terminal work and of the office work environment. The paucity of empirical studies addressing job and workplace design solutions limits confidence in many of the suggested control measures. Opportunities and facilities exist for investigators to originate or improve on psychometric tools for assessing the stressful features of computer terminal work and of the office work environment. Controls involving both task and physical ergonomic design may be pursued and tested.

References

Sauter SL, Dainoff MJ, Smith MJ (eds.): in Promoting Health and Productivity in the Computerized Office: Models of Successful Ergonomic Interventions. London: Taylor and Francis, Ltd, 1991

Sauter SL, Schleifer LM, Knutson SJ: Human Factors 33(2): 151, 1991

Occupational Biomechanics

TR Waters 53.02.10.06

Division of Biomedical and Behavioral Science

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Single or repetitive exposures to heavy physical work activities are believed to account for a large percentage of occupationally related musculoskeletal injuries that occur in the US each year. These work activities result in large biomechanical forces and repetitive loading that may lead to severe, acute, or chronic injuries to musculoskeletal tissues comprising the upper and lower extremities, lower back, and trunk. Occupational biomechanics is useful for studying the adverse health effects of these forces on the musculoskeletal system and for developing control methodologies to reduce high forces or repetitive loading.

Laboratory and field studies are needed to quantify a worker's exposure to biomechanical stress and to develop scientifically based exposure limits. Video-based analysis and analog monitoring devices are available to measure the kinetic parameters of such work activity as the joint position, velocity, and acceleration. Then, computerized biochemical simulation models can be used to predict the kinetic parameters of the work activity, such as muscle, joint forces, and torques. Proposals are invited that address both laboratory and field methods to assess biomechanical risk factors and their impact on occupational health.

Occupational Reproductive Disorders of the Male

SM Schrader 53.02.14.01
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Cincinnati, Ohio

Disorders of reproduction and sexual dysfunction are increasingly recognized to affect large numbers of Americans. The extent to which occupational experiences contribute to the overall incidence of these disorders is not clear, but in some occupations there is evidence of male reproductive functions being affected by exposures to workplace chemicals. A NIOSH program is in place which involves interdisciplinary research (e.g., andrology, genetics, physiology, and toxicology) to address such risks. Projects include (1) evaluating the reproductive toxicity of industrial chemicals for various entry routes including inhalation, dermal, and oral; (2) assessing the reproductive potential of male workers through semen analyses, endocrine studies; (3) genetically evaluating the sperm cell; and (4) verifying extrapolations of reproductive hazard information from animals to man. Test facilities include a flow cytometer, computerized image, and motion analysis systems for sperm cell assessment. Candidates seeking basic or applied research opportunities in this subject area are encouraged to submit proposals.

References

Schrader SM: Occupational and Environmental Factors and Male Infertility, in Infertility and Reproductive Medicine Clinics of North America 3. Edited by Overstreet JW. Philadelphia: WB Saunder, Co, 1992: 319

Schrader SM, Turner TW, Simon SD: Journal of Andrology 12: 126, 1991

Developmental Neurotoxicology

BK Nelson 53.02.14.02
Division of Biomedical and Behavioral Science
Cincinnati, Ohio

Developmental neurotoxicology emphasizes investigations of morphological defects and neurobehavioral impairments in offspring following prenatal exposure to environmental agents that have known or suspect noxious properties. Research features animal studies in which the neurotoxic effects of workplace chemicals are determined, either individually or in combination with other chemical or physical agents. Ongoing research is determining whether the presence of radio-frequency radiation enhances the teratogenic effects of exposure to an industrial

solvent known to pose teratogenic hazards. Test facilities allow for various processes of administration and exposures to simulate occupational conditions, as well as laboratory instrumentation and procedures to assess the anatomical, neurological, and behavioral effects of the experimental exposures. Proposals are welcome to further knowledge of such effects and underlying mechanisms.

References

Nelson BK, et al: Neurotoxicology and Teratology 11: 273, 1989
Nelson BK, et al: Teratology 43: 621, 1991

Human Neurobehavior

RB Dick 53.02.14.03
Division of Biomedical and Behavioral Science
Cincinnati, Ohio

Occupational exposures to chemicals may act on the nervous system, producing toxic effects in the form of central or peripheral nervous system dysfunction. The detection and characterization of such effects has been through typical psychomotor, perceptual, and cognitive tests whose sensitivity and ease of measurement need re-examining in light of new automation and computer developments. Research proposals are invited which help us use these technologies to upgrade current test techniques and to establish their efficacy in depicting nervous system functions for use in neurotoxicity assessment. This laboratory is equipped with facilities for instrumentation development, with opportunities for human testing as part of worksite investigations.

References

Dick RB, et al: Neurotoxicology and Teratology 12: 1, 1990
Dick RB, et al: Fundamental and Applied Toxicology 19: 453, 1992

Polyamine Homeostasis and Cellular Toxicology

RE Savage, Jr 53.02.14.04
Division of Biomedical and Behavioral Science
Cincinnati, Ohio

Many of the diseases associated with exposure to chemicals in the workplace are the result of the interaction of these compounds with cellular biochemical or physiological control mechanisms. To more fully understand the mechanisms of chemical toxicity, the normal physiology and chemistry of the system examined must be clearly elucidated.

Of particular interest to this laboratory is the role of polyamines in cellular repair and toxicant response processes. Once thought to be a simplistic metabolic sequence with ornithine decarboxylase (ODC) as the rate limiting enzyme, polyamine homeostasis has become a complicated and sophisticated regulatory system with many potential areas for investigation. Our immediate goal is to explore more thoroughly some of these areas of molecular biology with special attention to how occupational insults, either chemical or physical, may affect them.

The components of this system with the highest priority to our lab are (1) significance of multiple forms of the ODC protein, (2) post-translational modification of ODC and the functional consequences of such an alteration, (3) regulatory proteins affecting the activity of the ODC enzyme, and (4) metabolism and function of polyamines.

Opportunities are available and encouraged for *in vitro* studies. The system for study is open, but it is highly desirable that it be related to occupational cancers of the bladder.

References

Savage RE, et al: Journal of Toxicology and Environmental Health 27(1): 57, 1989

Savage RE, et al: Cancer Letters 62(1): 63, 1992

Occupational Immunotoxicology

RE Biagini 53.02.14.05

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Cincinnati, Ohio

Immunotoxicology is the study of adverse effects on the immune system that result from excess exposures to occupational or other chemicals. Studies with laboratory animals have shown that the mammalian immune system is very sensitive to chemical injury. Growing evidence, mainly in the area of immunopharmacology, suggests that the human immune system may be at least equally as vulnerable to immune modulation by xenobiotics. Changes in immune function can produce decreased host-resistance to infectious disease and cancer, or increased immune responsiveness leading to autoimmunity or hypersensitivity.

The purpose of this research is to refine immunoassays for use with human biological samples in order to assess their potential as early indicators of exposure and preclinical disease. The desired approach for this study is to measure changes in major or critical components of the mammalian immune system following occupational exposures and to correlate the changes with either

disease resistance or immunopathology in a human population or a suitable animal model. It is anticipated that work in this area will also reveal possible mechanisms of immunotoxicity. The goal of this research is to achieve a better understanding of the biological significance of measured alterations in the immune system as related to disease outcomes. Proposals are invited that address both *in vitro* and *in vivo* methods to assess immunocompetence and its impact on occupational health.

References

Biagini RE, et al: Life Sciences 47(10): 897, 1990

Biagini RE, et al: Bulletin of Environmental Contamination and Toxicology 50: 266, 1993

Developing Procedures for Assessing Female Reproductive Potential in the Workplace

JS Kesner 53.02.14.06

Division of Biomedical and Behavioral Science

Cincinnati, Ohio

The work environment contains an array of chemicals, physical agents, and other forms of stressors, which may adversely affect the reproductive function of exposed workers. Reports indicate that a number of these toxicants promote spontaneous abortions and teratologic outcomes in women and laboratory animals. In addition to the studies of reproductive outcome, recent efforts have also focused on indices of reproductive potential or fertility. However, human studies have concentrated on the male function, even though women comprise a major and growing segment of the work force and frequently continue working well into the term of their pregnancies.

The purpose of this research program is to develop and validate procedures for evaluating the reproductive potential of women in the workplace and to utilize these procedures for early detection of workplace conditions that pose a risk to reproduction. Aspects of the female reproductive process to be emphasized include (1) ovulation and other ovarian and endocrine functions during the menstrual cycle, (2) frequency of conception, and (3) frequency of early fetal loss. Opportunities for research include (1) testing the applicability of available clinical methods for assessing reproductive function, (2) developing

new endpoints or techniques for assessing reproductive function, and (3) assessing the toxicity or action site of toxicants in animal models.

References

Kesner JS, et al: Reproductive Toxicology 6: 385, 1992
Kesner JS, et al: Scandinavian Journal of Work, Environment, and Health 18(2): 33, 1992

Fluorescent Microscopy for Assessment of Cellular Toxicity

MA Toraason 53.02.14.07
Division of Biomedical and Behavioral Science
Cincinnati, Ohio

We are developing fluorescent biological probes in order to assess cellular function. In addition, various fluorescent biomolecules can be used to measure gap junctional intercellular communication; free-radical generation; and intracellular calcium, sodium, or Ph. Such probes may be micro-injected or enzymatically trapped inside living cells for real-time assessment of cellular function. An important part of this research is to develop methods for obtaining and culturing primary cells from various organs such as the heart, liver, and skin. Analog and two-dimensional imaging techniques are also used to monitor the cellular response to toxicants with special emphasis placed on hazardous chemicals that induce an oxidative stress in cells. Proposals focusing on cellular mechanisms of cardiac toxicants are encouraged.

References

Toraason M, et al: Fundamental and Applied Toxicology 18: 59, 1992
Toraason M, et al: Toxicology *In Vitro* 4: 363, 1990

Respirable Particle Surface Interactions

WE Wallace 53.01.14.01
Division of Respiratory Disease Studies
Morgantown, West Virginia

Research concerns surface structure and bioactivities of respirable mineral and organic particles and fibers which affect pulmonary response to exposures and pulmonary disease induction. Spectroscopic methods are developed to analyze particle surfaces and their *in vitro* biological interactions with pulmonary surfactants. Bioassays are also developed and used to model the pulmonary bronchio-alveolar environment and to study cytotoxic and genotoxic potentials of respirable particles and aerosols under representative physiological conditions. Specific studies have included (1) effects of phospholipid surfactants on quartz

and silicate cytotoxicity, and the role of lysosomal enzymatic digestion of adsorbed surfactant on the initiation of toxic activity *in vitro*; (2) mutagenic and clastogenic *in vitro* activities of diesel soots and complex mineral-organic particles dispersed in components of pulmonary surfactant; (3) mathematical modeling and experimental testing of low-voltage scanning electron microscopy/ x-ray analysis of surface elemental inhomogeneities of respirable mineral particles; and (4) Fourier-transform infrared spectroscopy of mineral dust composition and of adsorbed surfactant.

References

Wallace WE, et al: Annals of Occupational Hygiene 34: 195, 1990

Wallace WE, et al: Journal of Toxicology and Environmental Health 37: 391, 1992

Index of Research Advisers and Administrative Personnel

Telephone inquiries concerning technical details of specific research opportunities may be made of the Advisers listed below.

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Hankinson, JL, 19	-4755
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Division of Safety Research
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Moyer, ES, 42	-4872
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Armed Forces Radiobiology Research Institute
Center for Devices and Radiological Health
Federal Highway Administration/Turner-Fairbank Highway Research Center
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NASA Ames Research Center
NASA Goddard Space Flight Center
NASA Jet Propulsion Laboratory
NASA Lyndon B Johnson Space Center
NASA John F Kennedy Space Center
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National Center for Infectious Diseases
National Institute for Occupational Safety and Health
National Institute of Standards and Technology
National Institutes of Health
National Oceanic and Atmospheric Administration
Naval Command, Control, Ocean Surveillance Center/Research, Development, Test, and Evaluation Division
Naval Medical Research and Development Command
Naval Postgraduate School
Naval Research Laboratory
The Aerospace Corporation
US Air Force Laboratories
US Army Armament Research, Development, and Engineering Center
US Army Edgewood Research, Development, and Engineering Center
US Army Medical Research and Development Command
US Army Missile Command
US Army Natick Research, Development, and Engineering Center
US Army Research Institute for the Behavioral and Social Sciences
US Army Research Laboratories
US Army Research Office
US Environmental Protection Agency
US Fish and Wildlife Service
US Geological Survey

Research opportunity booklets and application documents for all programs may be obtained by contacting the

Associateship Programs — TJ 2094
National Research Council
2101 Constitution Avenue
Washington, DC 20418
(202) 334-2760

National Research Council
1994 Research Associateship Programs
Alphabetical by Acronym

Organization	*Accepts the Following Applicants*			
	Regular	Senior	Foreign	Application Deadlines
AERO THE AEROSPACE CORPORATION	Yes	Yes	No	Jan 15/Apr 15/Aug 15
AFRRI ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE	Yes	Yes	Yes	Jan 15/Apr 15/Aug 15
AMRDC US ARMY MEDICAL RESEARCH AND DEVELOPMENT COMMAND	Yes	Yes	Yes	Jan 15/Apr 15/Aug 15
US Army Aeromedical Research Laboratory	Yes	Yes	No	
US Army Medical Research Institute of Chemical Defense	Yes	Yes	No	
ARDEC US ARMY ARMAMENT RESEARCH, DEVELOPMENT, AND ENGINEERING CENTER	Yes	Yes	No	Jan 15/Apr 15/Aug 15
ARI US ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES	Yes	Yes	In Basic Science Areas	Jan 15/Apr 15/Aug 15

Organization	*Accepts the Following Applicants*			
	Regular	Senior	Foreign	Application Deadlines
ARL US ARMY RESEARCH LABORATORIES	Yes	Yes	No	Jan 15/Apr 15/Aug 15
ARO US ARMY RESEARCH OFFICE	Yes	Yes	No	Jan 15/Apr 15/Aug 15
CDRH CENTER FOR DEVICES AND RADIOLOGICAL HEALTH	Yes	Yes	Yes	Jan 15/Apr 15/Aug 15
EPA US ENVIRONMENTAL PROTECTION AGENCY	Yes	Yes	Yes	Jan 15/Apr 15/Aug 15
ERDEC US ARMY EDGEWOOD RESEARCH, DEVELOPMENT, AND ENGINEERING CENTER	Yes	Yes	In Selected Areas	Jan 15/Apr 15/Aug 15
FHWA FEDERAL HIGHWAY ADMINISTRATION	Yes	Yes	Yes	Jan 15/Apr 15/Aug 15
FWS US FISH AND WILDLIFE SERVICE	Yes	Yes	No	Jan 15/Apr 15/Aug 15
METC MORGANTOWN ENERGY TECHNOLOGY CENTER	Yes	Yes	No	Jan 15/Apr 15/Aug 15
MICOM US ARMY MISSILE COMMAND	Yes	Yes	Legal Permanent Residents Only	Jan 15/Apr 15/Aug 15

Organization	*Accepts the Following Applicants*			
	Regular	Senior	Foreign	Application Deadlines
NASA — NATIONAL AERONAUTICS AND SPACE ADMINISTRATION				
ARC — AMES RESEARCH CENTER Dryden Flight Research Facility	Yes	Yes	In Selected Areas	Jan 15/Apr 15/Aug 15
GSFC — GODDARD SPACE FLIGHT CENTER Goddard Institute for Space Studies Wallops Flight Facility	Yes	Yes	In Basic Science Areas	Jan 15/Apr 15/Aug 15
JPL — JET PROPULSION LABORATORY	Yes	Yes	In Basic Science Areas	Jan 15/Apr 15/Aug 15
JSC — LYNDON B. JOHNSON SPACE CENTER	Yes	Yes	In Selected Areas	Jan 15/Apr 15/Aug 15
KSC — JOHN F. KENNEDY SPACE CENTER	Yes	Yes	In Basic Science Areas	Jan 15/Apr 15/Aug 15
LaRC — LANGLEY RESEARCH CENTER	Yes	Yes	In Selected Areas	Jan 15/Apr 15/Aug 15
LeRC — LEWIS RESEARCH CENTER	Yes	Yes	In Selected Areas	Jan 15/Apr 15/Aug 15
MSFC — GEORGE C. MARSHALL SPACE FLIGHT CENTER	Yes	Yes	In Selected Areas	Jan 15/Apr 15/Aug 15
SSC — JOHN C. STENNIS SPACE CENTER	Yes	Yes	In Selected Areas	Jan 15/Apr 15/Aug 15
NCID NATIONAL CENTER FOR INFECTIOUS DISEASES	Yes	Yes	Yes	Jan 15/Apr 15/Aug 15
NIH NATIONAL INSTITUTES OF HEALTH	Yes	Yes	Seniors only; Otherwise, Legal Permanent Residents	Jan 15/Apr 15/Aug 15

Organization	*Accepts the Following Applicants*			
	Regular	Senior	Foreign	Application Deadlines
NIOSH NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH	Yes	Yes (Limited Number)	Yes	Jan 15/Apr 15/Aug 15
NIST NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY	Yes	No	No	Jan 15
NMRDC NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND	Yes	Yes	Yes	Jan 15/Apr 15/Aug 15
NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	Yes	Yes	Yes	Jan 15
NPS NAVAL POSTGRADUATE SCHOOL	Yes	Yes	In Selected Areas	Jan 15/Aug 15
NRaD NAVAL COMMAND, CONTROL, AND OCEAN SURVEILLANCE CENTER; RESEARCH, DEVELOPMENT, TEST, AND EVALUATION DIVISION	Yes	Yes	No	Jan 15/Apr 15/Aug 15
NRDEC US ARMY NATICK RESEARCH, DEVELOPMENT, AND ENGINEERING CENTER	Yes	Yes	Yes	Jan 15/Apr 15/Aug 15
NRL NAVAL RESEARCH LABORATORY	Yes	No	No	Jan 15/Apr 15

Organization	*Accepts the Following Applicants*			
	Regular	Senior	Foreign	Application Deadlines
USAF				
US AIR FORCE LABORATORIES				
Armstrong Laboratory	Yes	Yes	Regular: No	Jan 15/Apr 15/Aug 15
Phillips Laboratory	Yes	Yes	(except in	Jan 15/Apr 15/Aug 15
Rome Laboratory	Yes	Yes	special cases)	Jan 15/Apr 15/Aug 15
Wright Laboratory	Yes	Yes	Senior: Yes	Jan 15/Apr 15/Aug 15
Seiler Laboratory	Yes	No		Jan 15/Apr 15/Aug 15
USGS	Yes	No	No	Jan 15
US GEOLOGICAL SURVEY				

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