

**Title Page**

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Institution to which the award was made:  
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Project Title: Occupational and Environmental Factors in Neurological Disease  
Grant Number: R13 OH010279  
Project Period: 03/01/2012 – 02/28/2013

Completion date of final report: May 6, 2013

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## **List of Terms and Abbreviations**

NIOSH: National Institute for Occupational Safety and Health

ATSDR: Agency for toxic Substances Disease Registry

CDC: Centers for Disease Control and Prevention

UCSF: University of California San Francisco

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## **Abstract**

Occupational and environmental causes of neurological disease subsume chemical, biologic, and physical factors. Emerging risk factors are regularly recognized. Moreover, issues related to hearing, the special senses, sympathetic neuropathy, and vibration effects have been under-appreciated, in particular through multiple exposure interrelationships. Health professionals need to be well-informed about emerging or re-emerging risk factors; be cognizant of evolving pathophysiological concepts; keep abreast of current practice in the diagnosis and treatment of these conditions; and be attuned to key regulatory issues in this field. We wished to address this through a scientific-clinical conference uniquely focusing on these issues. Specific aims of this endeavor were to have presentations by recognized experts on a full range of topics in the field; to employ an integrated approach to shared structure-activity relationships and toxicant mechanisms; and to underscore prevention strategies for work-related and environmentally-caused neurological illness and injury. The conference that resulted, "Occupational and Environmental Factors in Neurological Disease," advanced the field of occupational and environmental health by focusing on neurological conditions in relation to the workplace and the broader environment. It brought together a cross-disciplinary group of health care practitioners and researchers including physicians, nurses, industrial hygienists, and public health professionals. The conference used formal presentations and less structured collegial interactions to meet these goals, including an abstract poster discussion session and three pre-conference practicum workshops (nerve conduction; neuropsychiatric testing; and neurological examination) and an evening poster session that emphasized clinical case reports and outbreak investigation. The main conference day included 10 themed presentations (addressing key central and peripheral nervous system topics) as well as an introductory presentation and a concluding panel. Specifically the content included: "Neurologic Disease and Environmental Exposures – Evidence and Opportunity from Applied Research"; "Chemical Triggers of Peripheral Neuropathy"; "Metal Neurotoxins" "Occupational and Environmentally-related Central Nervous System Degenerative Disease"; "Hearing Loss: Exposure Cofactors in Noise-induced Loss" "Occupational Exposures and the Special Senses: Sight, Smell, and Taste"; "Red Tide Toxin as a Paradigm for Biological Neurotoxins- Implications for Work-related and Environmental Exposures"; "Sympathetic Nervous System as a Target Organ" "Cerebellar Manifestations of Occupational and Environmental Toxicant Exposure"; "Overuse Neuropathy: Evolving Concepts" "Emerging Neurotoxins"; and "Setting the Future Agenda" (the concluding panel discussion). In total, 125 professionals, including faculty, participated in the course. The majority of participants were MDs but also the group also included PhD, RN, and MPH-level trained scientists and clinicians. Evaluative data systematically elicited from the participants demonstrated a strong degree level of satisfaction with the educational experience and a high likelihood of impact on practice parameters. The conference addressed knowledge gaps relating to occupationally-related and environmentally-caused neurological disease. This conference met all of its central stated aims. It was a highly successful educational event that is likely to lead to beneficial clinical and research outcomes for the participants and, because of their academic roles, those that they teach and precept.

## **Final Progress Report (2-page limit)**

### **Section 1**

#### **Significant (Key) Findings**

This Conference, "Occupational and Environmental factors in Neurological Disease," advanced the field of occupational and environmental health by focusing on neurological disease. It brought together a cross-disciplinary group of health care practitioners and researchers including physicians, nurses, industrial hygienists, and public health professionals. The conference used formal presentations and less structured collegial interactions to meet these goals, including an abstract poster discussion session and pre-conference practicum workshops. In total, 125, including faculty, participated in the course. The Conference addressed knowledge gaps relating to occupationally-related and environmentally-caused neurological disease. This is an area of considerable importance in clinical practice, epidemiological and experimental research, and public policy. Indeed, this group of problems has been recognized as comprising a major class of occupational conditions ever since the original NIOSH formulation of the "Ten Leading Causes of Occupational Illness and Injury" several decades ago. Further, this topic cuts across multiple sectors within the current NIOSH strategic plan, given that morbidity clusters of neurological disease span more than one industry.

Specifically, the conference provided a series of thematic presentations by recognized experts on a full range of topics covering the subject of occupational and environmental factors in neurological disease. We integrated disparate topics into an overarching framework in which to approach occupationally and environmentally-associated neurological insults, including shared structure-activity relationships and mechanism for toxicants and common issues in clinical and epidemiological assessment. This approach highlighted key priorities for primary, secondary, and tertiary prevention of work-related and environmentally-caused neurological illness and injury, including regulatory aspects of such prevention.

We offered non-didactic educational experiences to further promote these goals, including three hands-on workshop opportunities (nerve conduction; neuropsychiatric testing; and neurological examination) and an evening poster session that emphasized clinical case reports and outbreak investigations. We evaluated attendees' educational experiences through structured assessment forms that showed through systematic analysis a high level of participant satisfaction and perceived educational improvement.

#### **Translation of Findings**

This Course is highly likely to translate its content through disseminated knowledge among its participants, many of who represent leaders in the field. This is not only likely to lead to improved occupational medicine clinical practice (e.g., in terms of diagnostic activities) but also potential research initiatives.

#### **Outcomes/ Impact**

There was clear interest in sharing selected specific quantitative techniques as a Conference outcome. For example, in follow-up to the Conference, Dr. Bruce Bernard from NIOSH has approached Dr. Donald Fox to explore applications related to ophthalmological toxicity assessment. As another example, Dr. Sainio's Finnish experience in solvent-related encephalopathy also spurred interest in potential applications in the U.S. context. When participants were surveyed on the likelihood that they would make changes in their practice setting as a result of this conference (applicable only to active clinicians), the majority responded that this was "highly likely" or "definitely" the case. Specific response included: "More awareness of possible importance of auditory damage"; "Better diagnostic ability - toxic neuro effects"; "Consider injecting carpal tunnel more frequently"; "Consider additional discussion with worker with elevated lead level"; "Change my neuro exam in pt's exposed to mercury" "Counsel my fire fighters better on hearing loss and CO exposure" "Discuss with other colleagues re MeM (metal on metal) hip replacements"; "Aware of solvent use/effects more and discuss with pt"; "Special attention to workers exposed to noise and solvents" "Awareness about HAVS and other peripheral autonomic neuropathy"; "Try to take an occ history on all my patients, especially those who are retired."

## Section 2 of the Final Progress Report

### Scientific Report

**Background for the project.** Occupational and environmental causes of neurological disease subsume chemical, biologic, and physical factors. Emerging risk factors are regularly recognized. Moreover, issues related to hearing, the special senses, sympathetic neuropathy, and vibration effects have been under-appreciated, in particular in relation to multiple exposure interrelationships. Health professionals need to be well-informed about emerging or re-emerging risk factors; be cognizant of evolving pathophysiological concepts; keep abreast of current practice in the diagnosis and treatment of these conditions; and be attuned to key regulatory issues in this field.

**Specific aims.** “Occupational and Environmental Factors in Neurological Disease” Conference providing:

- Presentations by recognized experts on a full range of topics in the field
- An integrated approach to shared structure-activity relationships and toxicant mechanism
- Prevention strategies for work-related and environmentally-caused neurological illness and injury
- Hands-on workshops (nerve conduction; neuropsychiatric testing; and neurological examination).

### Methodology

<i>Conference Day One October 31, 2012; (4:00- 5:30 pm) Hands-On Workshops</i>
1. Electrophysiological Testing Anne Poncelet, MD Professor of Clinical Neurology; Endowed Chair for Teaching in Neurology UCSF; 2. Neuropsychiatric Testing Joel Kramer, PsyD Professor of Neuropsychology in Neurology UCSF; 3. Neurological Examination Jonathan S. Rutchik, MD, MPH Environmental and Occupational Medicine Associates
Scientific Poster Session (6:30-8:00 pm)
<i>Conference Day Two - November 1, 2012 (8AM- 6:15 PM)</i>
Introductory Keynote. Neurologic Disease and Environmental Exposures – Evidence and Opportunity from Applied Research: Tom Sinks, PhD Deputy Director, National Center for Environmental Health and ATSDR (CDC)
Chemical Triggers of Peripheral Neuropathy: Peter Spencer, PhD Professor of Neurology; Senior Scientist, Center for Research on Occupational & Environmental Toxicology; Oregon Health & Science University
Metal Neurotoxicants: Brian Schwartz, MD, MS Professor of Environmental Health Sciences, Epidemiology, and Medicine, Johns Hopkins Bloomberg School of Public Health
Occupational and Environmentally-related Central Nervous System Degenerative Disease: Caroline M. Tanner, MD, PhD Director, Clinical Research Parkinson's Institute, Sunnyvale, CA
Hearing Loss: Exposure Cofactors in Noise-induced Loss: Laurence Fechter, PhD Associate Director for Research, Loma Linda Veterans Association for Research and Education (delivered by Paul Blanc)
Occupational Exposures and the Special Senses: Sight, Smell, and Taste: Donald A. Fox, PhD Professor, University of Houston School of Optometry
Red Tide Toxin as a Paradigm for Biological Neurotoxins- Implications for Work-related and Environmental Exposures: Lora Fleming, MD, MPH, PhD Co-Director, NSF- NIEHS University of Miami Oceans and Human Health Center
Sympathetic Nervous System as a Target Organ: Howard Kipen, MD Environmental and Occupational Health Sciences Institute, University of Medicine and Dentistry of New Jersey, Robert Wood Johnson Medical Center
Cerebellar Manifestations of Occupational and Environmental Toxicant Exposure: Roberto Lucchini, MD Professor and Director of Occupational and Environmental Medicine, Department of Preventive Medicine, Mount Sinai School of Med
Overuse Neuropathy: Evolving Concepts Edward Diao, MD Professor Emeritus of Orthopaedic Surgery UCSF
Emerging Neurotoxins: Jordan Firestone, MD, PhD, MPH Neurologist and Director of Occupational Health, Stanford U.
Concluding Panel Session: Setting the Future Agenda: Markku Sainio, MD, PhD, Adjunct Professor in Neurology, Finnish Institute of Occupational; Bruce Bernard, MD, MPH Chief Medical Officer, Health Hazard Evaluations and Technical Assistant Branch, NIOSH; Debra Gold, CIH Deputy Chief, CAL-OSHA)

**Results and Discussion.** There were 125 participants, the majority of whom were MDs but also including PhD, RN, and MPH trained scientists and clinicians. In evaluations of the specific activities noted above (on a 5-point scale), the median value was >4.0, which is impressive in terms of our normative data.

**Conclusions.** This conference met all of its central stated aims. It was a highly successful educational event that is likely to lead to beneficial clinical and research outcomes for its participants. Moreover, because of their academic roles, it is also likely to impact those that they teach and precept.

**Inclusion Enrollment Table** NA. This was a conference, not a study with subject enrollment.

**Publications.** None

**Inclusion of gender and minority study subjects** NA. This was a conference, not a study with subject enrollment.

**Inclusion of Children** NA. This was a conference, not a study with subject enrollment.

**Materials available for other investigators.** None