

# Environmentally Triggered Neurodevelopmental Disorders

*Focus on Endocrine Disruption and Sex Differences in Autism, ADHD, and Schizophrenia*

Oct 30 - Nov 2, 2011

Sheraton Imperial Hotel

Research Triangle Park, NC

Sunday Afternoon 30 Oct 2011 2:00 PM – 2:30 PM

**2:00 PM Sunday: Opening of NEUROTOX 27**

## **SESSION I: OPENING SESSION**

2:00 PM – 2:30 PM

### **Opening, Welcome and Acknowledgements**

Conference Chair: **Joan Cranmer**, *University of Arkansas for Medical Sciences*

### **Overview of Theme of the Conference**

Conference Co-Chairs: **Isaac Pessah**, *University of California, Davis*  
**Pamela Lein**, *University of California, Davis*

Sunday Afternoon 30 Oct 2011 2:30 PM – 5:30 PM

### *State of the Science on the Theme*

## **SESSION II: TUTORIALS ON ENDOCRINE DISRUPTION, IMMUNOLOGICAL INFLUENCE AND SEX DIFFERENCES IN NEURODEVELOPMENTAL DISORDERS**

Session Chair: **Pamela Lein**, *University of California, Davis*

**Theme and Rationale:** The focus of this workshop is on endocrine interactions, sex differences and inflammation as common mechanisms by which environmental factors confer susceptibility to complex neurodevelopmental disorders and synaptic plasticity as a common target in neurodevelopmental disorders. The goal of this session is to provide background and context for the remaining sessions. Speakers will present an overview of what is currently known about the role of the endocrine and immune systems in neurodevelopment and mechanisms of endocrine disruption.

### **Topics and Speakers:**

2:30 PM – 2:50 PM

### **Sexual Dimorphism in Neurological Disorders: From Development to Neurodegeneration**

*Richard Seegal, Wadsworth Center, New York State Department of Health*

2:50 PM – 3:25 PM

### **Role of the Gonadal Hormones in Neurodevelopment**

*Janice Juraska, University of Illinois at Urbana-Champaign*

3:25 PM – 3:40 PM *Break*

3:40 PM – 4:20 PM

### **Influence of the Immune System on Neurodevelopment**

*Judy Van de Water, University of California, Davis*  
*Pamela Lein, University of California, Davis*

4:20 PM – 4:55 PM

### **Mechanisms of Endocrine Disruption**

*Tom Zoeller, University of Massachusetts*

4:55 PM – 5:30 PM

### **Tutorial: Synaptic Plasticity as a Common Target in Neurodevelopmental Disorders.**

*Serena Dudek, NIH/National Institute of Environmental Health Sciences*

5:30 PM – 6:30 PM *Break*

Sunday Evening 30 Oct 2011 6:30 PM – 8:45 PM

**6:30 PM – 8:45 PM**

*Welcoming Reception and Hosted Dinner Buffet*

Monday Morning 31 Oct 2011 8:30 AM – 8:45 AM

*Opening of Plenary Sessions***OVERVIEW AND RATIONALE FOR THE THEME**

Clinical disorders of the central nervous system arise from complex interactions among multiple risk factors. Genetic mutations, polymorphisms, and copy number variations confer heritable susceptibility to environmental stressors including exposures to xenobiotic chemicals, shifts in nutritional status, and medical interventions. The prevalence of autism has increased dramatically and there is emerging evidence that suggests increases in the diagnosis of ADHD and schizophrenia. Although some of these trends can be explained by increased awareness, diagnostic drift and changes in diagnostic criteria, environmental factors are likely contributors. An increasing number of persistent organic pollutants (POPs) and metals have been shown to alter endocrine signaling mediated by thyroid, estrogen and androgen hormones. Many of these chemicals are detected in maternal and gestational tissues, breast milk, and neonates at levels of concern. Our knowledge of how endocrine signals shape neurodevelopment has advanced significantly over the last five years, and presentations on the current state of the science will serve as a framework for the conference. The consequences of endocrine disruption during critical periods of neurodevelopment have far-reaching implications and will be the focus of the symposium. The sessions will present the latest evidence and controversies linking endocrine disruption and neurodevelopmental disorders, with a focus on autism, ADHD, and schizophrenia. These disorders share several clinical features including strong gender bias, immune impairments, and an association with seizure disorders. Yet these disorders differ in onset of clinical symptoms that may provide clues to critical windows of susceptibility to specific endocrine disruptors and their underlying mechanisms. The symposium is designed to present attendees with the latest state of the science about the role of the endocrine system in environmentally triggered disorders.

*Conference Co-Chair:* Isaac Pessah, *University of California, Davis*

8:30 AM – 8:45 AM

**Theme and Rationale: Environmentally Triggered Neurodevelopmental Disorders. Focus on Endocrine Interactions and Sex Differences as Common Factors in Autism, ADHD and Schizophrenia**

*Isaac Pessah, University of California, Davis*

Monday Morning 31 Oct 2011 8:45 AM – 12:00 PM

*Plenary Session***SESSION III: ENDOCRINE DISRUPTION IN AUTISM SPECTRUM DISORDERS**

*Session Chairs:* R. Thomas Zoeller, *University of Massachusetts*  
Isaac Pessah, *University of California, Davis*

**Theme and Rationale:** Endocrine systems play important roles in sculpting the human brain in development. Specific hormones such as estrogen, androgen, progesterone, thyroid hormone and cortisol are known to engage signaling pathways important for stem cell proliferation or differentiation, migration, synaptogenesis and apoptosis. These hormones account for sex differences in specific brain structures and condition cellular responses to contact-dependent or other signaling pathways. Environmental chemicals that interfere with hormone signaling during development can have profound effects on brain architecture by direct impacts on endocrine signaling, and on the ability of hormones to guide cellular response to developmentally important signals. Major classes of chemicals are known to simultaneously interact with more than one endocrine system and in different ways. Some POPs directly interact with receptors for estrogen, androgen and thyroid, as does bisphenol-A. Heavy metals including mercury and lead are known to influence specific endocrine systems. Inflammatory signaling pathways interact with hormone signaling pathways during normal brain development, and overlying inflammatory processes or pharmaceutical therapies may interfere with this. Lifetime consequences of endocrine dysregulation during development may be avoided by recognizing and preventing these disruptive interactions.

**Topics and Speakers:**

8:45 AM – 9:15 AM

**State of the Science on Endocrine Regulated Developmental Milestones and Their Disruption by Environmental Exposures (PoPs, Pesticides, and Personal Care Products)**

*R. Thomas Zoeller, University of Massachusetts*

will give an overview of the current science of how thyroid, estrogen and androgen signaling systems influence critical prenatal and neonatal neurodevelopmental milestones and outcomes later in life (example - during puberty). He will present the state of the science of how endocrine signals are impaired by exposures to chemicals of concern to environmental health and their impairment of developmental milestones will be discussed.

9:15 AM – 9:45 AM

**What is Known Regarding Endocrine Dysfunction in Autism?**

Isaac Pessah, *University of California, Davis*

will give a review of the current literature about what is known about endocrine dysfunction as a contributor to autism susceptibility. Studies of several species will be presented that indicate substantial cross-talk between neuropeptide and endocrine signaling pathways that have significant influence on the development of social cognition that can be highly gender dependent.

9:45 AM – 10:15 AM

**The Maternal Infection Risk Factor for Schizophrenia and Autism**

Paul H. Patterson, *California Institute of Technology*

will present his recent research findings showing that activation of the maternal immune system in rodent models sets in motion a cascade of molecular pathways that ultimately result in autism- and schizophrenia-related behaviors in offspring.

10:15 AM – 10:30 AM      **Break**

10:30 AM – 11:00 AM

**Sex Hormones in Autism: Androgens and Estrogens Differentially and Reciprocally Regulate RORA, a Novel Candidate Gene for Autism**

Valerie W. Hu, *George Washington University Medical Center*

will present data from her lab showing that male and female hormones differentially regulate the expression of a novel autism candidate gene, retinoic acid-related orphan receptor-alpha (RORA) in a neuronal cell line, SH-SY5Y. Her results suggest a mechanism for introducing sex bias in autism.

11:00 AM – 11:30 AM

**Sex-Specific Changes in Prairie Vole Social Behavior After Chronic Metals Exposure: An Animal Model of Autism?**

J. Thomas Curtis, *Oklahoma State University Center for Health Sciences*

will present his recently published results testing if metals capable of altering central dopamine systems can produce the social withdrawal characteristic of autism. Results suggest that metals exposure may contribute to loss of social cognition, possibly by interacting with central dopamine function, and support the use of prairie voles as a model organism in which to study autism.

11:30 AM – 12:00 Noon

**Discussion**

12:00 Noon – 1:30 PM      *Break for Lunch on Your Own*

**Monday Afternoon      31 Oct 2011      1:30 PM – 4:30 PM**

*Workshop and Panel Discussion*

**SESSION IV: CLINICAL CLUES OF ENDOCRINE DISRUPTION IN AUTISM SPECTRUM DISORDERS**

*Session Chairs:* **Martha Herbert**, *Harvard Medical School*

**Isaac Pessah**, *University of California, Davis*

**Randi Hagerman**, *UC Davis MIND Institute*

**Theme and Rationale:** Today, one in 110 children (and one in 70 boys) born in the U.S. is diagnosed with autism, and the numbers have been rising 10% to 17% a year. Autism has a range of features that suggest the possibility of endocrine-related alterations, including a much higher prevalence in males. Additional clues of endocrine dysfunction may contribute to autism severity include atypical growth patterns, abnormal patterns of autonomic arousal (both hypo- and hyper-arousal), marked changes at puberty (e.g. sometimes seen are increase in aggression, severe premenstrual syndrome), sleep disturbances, hypothyroid, and seizures. These clinical manifestations invite investigation of potential toxicological and endocrine disruptive contributors and will be the focus of the session presentation and discussion.

**Topics and Speakers:**

1:30 PM – 1:55 PM

**Patterns of Susceptibility in FMR1 Related Disorders: Clues from Gender Specific Differences**

Randi Hagerman, *UC Davis MIND Institute*

will report on the clinical manifestations of psychiatric illness in FMR1 related disorders including premutation carriers, FXTAS and FXS. Cognitive, mood, anxiety, and autistic disorders appear to have gender biases. Fragile X premutation-associated conditions are part of the clinical differential diagnosis of several psychiatric syndromes, particularly in pedigrees with known fragile X syndrome cases. She will discuss how FMR1-associated psychiatric manifestations serve as a useful model for a molecular genesis of neuropsychiatric illness.

1:55 PM – 2:20 PM

**Why Are Autism Spectrum Conditions More Common in Males?**

Rebecca Knickmeyer, *University of North Carolina Chapel Hill*

will present an overview of the state of the science addressing biological contributions to the gender bias observed with autism. She will discuss how relating typical sex differences in brain structure may be relevant to autism, highlighting possible biological mechanisms mediated by endocrine hormones to account for the male bias. Alternative biological theories will be considered, the X and Y chromosome theories, and the reduced autosomal penetrance theory. She will present her latest research findings and will discuss critical research needs.

2:20 PM – 2:35 PM *Break*

2:35 PM – 3:00 PM

**Prenatal Exposure to Endocrine Disrupting Chemicals and Childhood Behavioral Development**

Stephanie A. Engel, *University of North Carolina at Chapel Hill*

will present how prenatal exposure to endocrine disruptors has the potential to impact early brain development in children. This study investigated prenatal exposure to the phthalate esters and bisphenol A (BPA), and social behavior in a sample of adolescent inner-city children. Prenatal phthalate exposure was associated with childhood social impairment in a multiethnic urban population.

3:00 PM – 3:25 PM

**Endocrine System in Autism and Related Disorders: What are the Clinical Clues?**

Martha Herbert, *Harvard Medical School*

will present case reports that focus on clinical clues of endocrine dysfunction in autism. Outcomes discussed will include atypical growth patterns, abnormal patterns of autonomic arousal (both hypo- and hyper-arousal), marked changes at puberty (e.g. sometimes seen are increase in aggression, severe premenstrual syndrome), sleep disturbances, hypothyroid, and seizures.

3:25 PM – 4:30 PM

**FACILITATED ROUNDTABLE PANEL DISCUSSION**

*Questions:* Selected questions that address key issues are published in the program to facilitate discussion. Additional questions from participants are welcome!

**Discussion Leaders:** Martha Herbert, *Harvard Medical School*  
R. Thomas Zoeller, *University of Massachusetts*

**Panelists:**

**Speakers in Sessions III and IV:**

- Isaac Pessah, *University of California, Davis*
- Paul H. Patterson, *California Institute of Technology*
- Valerie W. Hu, *George Washington University Medical Center*
- J. Thomas Curtis, *Oklahoma State University Center for Health Sciences*
- Randi Hagerman, *University of California, Davis*
- Rebecca Knickmeyer, *University of North Carolina at Chapel Hill*
- Stephanie A. Engel, *University of North Carolina at Chapel Hill*

**Representatives from governmental agencies with missions related to the theme of NEUROTOX 27:**

- NIEHS – Cindy Lawler
- NIMH/OARC – Susan Daniels
- NIH CounterACT Program – David Jett
- EPA/ORD/NCEA – Susan Makris
- ATSDR – Casandra Smith

**Autism Advocacy Groups:**

- Autism Research Institute – Jill James
- Autism Society – Donna Ferullo
- Autism Speaks – Alycia Halladay
- Safe Minds – Sallie Bernard

**Questions:**

1. Because autism is defined by behavioral measures, how can rodent (or other) model systems be employed to study the etiology of autism spectrum of disorders?
2. Hormones control many different aspects of development, and sex differences in the brain are clearly related to hormone action during development. How do you imagine that hormones may interact that, when disrupted, may produce an element of autism spectrum?
3. Thyroid hormone controls oligodendrocyte differentiation. Is it possible that thyroid disruption could be responsible for altering myelination in a sex-specific manner such that elements of autistic spectrum could be triggered?
4. If endocrine disruption is important in the measured increase in the incidence of autistic spectrum disorders, how can it be identified in the human population?
5. Most animal work in the field of environmental impacts on brain development employs a model whereby a single chemical is tested for its ability to interfere with development by an endocrine or other mechanism. These studies can be enhanced by molecular and biochemical studies that clarify specific pathways of interaction. However, when this insight is applied to the human population, to what degree is it possible to "prove" a causal relationship between chemical exposure (in a mixture) and adverse outcome? Do you believe that regulatory agencies are cognizant of the limits to which science can prove these relationships?

4:30 PM – 6:30 PM *Break for Dinner on Your Own*

6:30 PM: Return for Keynotes, Poster Session, Student Competition and Dessert! (*No-Host Bar*)

Monday Evening 31 Oct 2011 6:30 PM – 9:00 PM

**Keynotes and Poster Session****SESSION V: KEYNOTES ON STEM CELLS, GENERAL POSTER SESSION & STUDENT AWARD COMPETITION****Keynotes**

6:30 PM – 7:15 PM

**“STEM CELLS . . . SUPER HEROES OR SUPER VILLAINS OF NEUROTOXICOLOGY?”****Patient-Derived Stem cells as a Translational Model of Neurological Risk**

Aaron Bowman, *Vanderbilt University Medical Center*

**Progress and Pitfalls in the Use of Stem Cell Derived Neurons as Testing Models for Neurotoxicology**

Tim Shafer, *US Environmental Protection Agency*

7:15 PM – 9:00 PM

**POSTER SESSION**

Poster Session Co-Chairs and Networking Mentors:

**Nikolay Filipov**  
**Mary Gilbert**  
**Jean Harry**  
**Prasada Kodavanti**

**Susan Schantz**  
**Rich Seegal**  
**Edwin van Wijngaarden**  
**Dongren Yang**

Poster abstracts are numbered from P-64 to P-108 and are listed on pages 15 – 21 of this Program

The Poster Session is a highlight of this conference series. It has proven to be an effective venue for informal, in-depth discussion and collaboration building -- as well as an important networking opportunity for all participants. Papers on any aspect of neuroscience, toxicology, children’s environmental health, public health & policy are welcome! Posters may be put up as early as 9:00 AM on Sunday and should remain up for the conference duration for maximum exposure.

7:15 PM – 8:30 PM

**STUDENT AWARD COMPETITION**

*Competition Co-Chairs:* **Will Boyes**  
**Anumantha Kanthasamy**

The Student Award Competition is divided into two groups: one for post-doctoral and one for pre-doctoral competition. Awards will consist of a cash prize, plaque or certificate, plus a one year subscription to the international journal *NeuroToxicology*. A winner(s) will be chosen from each group. Competing students are asked to give an overview of their work in 2-3 minutes to the judges followed by a brief set of questions and answers. Originality, significance, hypothesis, presentation material and style, as well as knowledge of the subject, will be considered in selecting the winners. All papers in competition for the Student Awards must be presented from poster. Judging will be done during this time.

Judging will be done between 7:15 PM and 8:30 PM. Students please stand by your poster during this time.

**GROUP I: POST-DOCTORAL COMPETITION**

*Chair:* **Anumantha Kanthasamy**

*Post-Doctoral Award Committees**Sub-Group A*

**Anumantha Kanthasamy, Chair**  
**Jamie DeWitt**  
**Christine Curran**

*Sub-Group B*

**Judy Van de Water, Chair**  
**Ed Levin**  
**Janice Juraska**

*Post-Doctoral Trainees*

- |                   |  |                      |  |
|-------------------|--|----------------------|--|
| 1. Bagrat Abazyan | <i>Mentors:</i> Mikhail Pletnikov & Tomás Guilarte | 9. Allison McAfee    | <i>Mentor:</i> Sean Strain                 |
| 2. Asad A. Aboud  | <i>Mentor:</i> Aaron B. Bowman                     | 10. Amir Miodovnik   | <i>Mentor:</i> Shanna H. Swan              |
| 3. Mamta Behl     | <i>Mentors:</i> Jean Harry & Michelle Hooth        | 11. Maria Mulhern    | <i>Mentor:</i> Sean Strain                 |
| 4. Celia Dodd     | <i>Mentor:</i> Nikolay M. Filipov                  | 12. Christina Powers | <i>Mentor:</i> J. Michael Davis            |
| 5. Adam Dziorny   | <i>Mentor:</i> Philip Davidson                     | 13. Sarah Short      | <i>Mentor:</i> John H. Gilmore             |
| 6. Paul Eubig     | <i>Mentor:</i> Susan Schantz                       | 14. David Szabo      | <i>Mentors:</i> Bob Sonawane & Kate Guyton |
| 7. Kate Hoffman   | <i>Mentor:</i> Julie Daniels                       | 15. Steven Szabo     | <i>Mentor:</i> Jean Harry                  |
| 8. Fang Liu       | <i>Mentor:</i> Cheng Wang                          | 16. Sukrat Sinha     | <i>Mentor:</i> TBA                         |

**GROUP II: PRE-DOCTORAL COMPETITION**

*Chair:* **Will Boyes**

*Pre-Doctoral Student Award Committees**Sub-Group A*

**Will Boyes, Chair**  
**Sarah Blossom**  
**Brenda Eskenazi**

*Sub-Group B*

**Stephanie Engel, Chair**  
**Aaron Bowman**  
**David Jett**

*Pre-Doctoral Students*

- |                      |                                       |                           |                                   |
|----------------------|---------------------------------------|---------------------------|-----------------------------------|
| 1. Jordan Bailey     | <i>Mentor:</i> M. Christopher Newland | 8. Elizabeth Hawkey       | <i>Mentor:</i> Joel T. Nigg       |
| 2. Ian Bryan         | <i>Mentor:</i> Jamie DeWitt           | 9. Saritha Krishna        | <i>Mentor:</i> Nikolay M. Filipov |
| 3. Nioka Chisolm     | <i>Mentor:</i> Janice Juraska         | 10. Wang Luan             | <i>Mentor:</i> Douglas Ruden      |
| 4. Megan Culbreth    | <i>Mentor:</i> Timothy Shafer         | 11. Christopher McPherson | <i>Mentor:</i> Jean Harry         |
| 5. Marjannie Eloi    | <i>Mentor:</i> Judy Van de Water      | 12. Abby Meyer            | <i>Mentor:</i> Helen Sable        |
| 6. Jocelyn Fowler    | <i>Mentor:</i> Christine Curran       | 13. Renee Sadowski        | <i>Mentor:</i> Janice Juraska     |
| 7. Jason N. Franklin | <i>Mentor:</i> Jamie DeWitt           |                           |                                   |

**SESSION VI-A: ADHD – THE ROLES OF GENETICS, ENVIRONMENTAL CONTAMINANTS AND SEX**

*Session Co- Chairs:* **Susan Schantz**, *University of Illinois – Champaign-Urbana*  
**Richard Seegal**, *Wadsworth Center, New York State Department of Health*

**Theme and Rationale:** Attention deficit disorder with hyperactivity (ADHD) is the most common neurodevelopmental disorder and encompasses several core symptoms including inattention, hyperactivity and impulsivity. ADHD is more common in boys than girls although the sexual dimorphism is not as profound as that seen in autism. This session will focus on environmental contaminants as putative etiologic agents in ADHD, as well as presenting findings related to the pathobiology, genomics and neuroendocrine factors that play a role in this disorder and which may aid in explaining the aforementioned sexual dimorphism.

**Topics and Speakers:****8:30 AM – 9:00 AM****ADHD: Gene x Environment Interactions, Etiology, Pathobiology, Neuropsychology, and Sex Differences***Joel Nigg, Oregon Health & Science University*

will discuss the neuropsychological, endocrine and gene x environment interactions that influence the prevalence of ADHD; the greater incidence in boys and the effects of lead exposure in the etiology of ADHD.

**9:00 AM – 9:30 AM****Pesticides and Other Environmental Risk Factors for ADHD***Brenda Eskenazi, UC Berkeley*

will discuss her ongoing epidemiological research showing an association between exposure to organophosphate pesticides and ADHD.

**9:30 AM – 10:00 AM****Developmental Exposure to Diverse Environmental Compounds: Common Pathways Leading to Neurobehavioral Dysfunction Associated with ADHD***Jason Richardson, Rutgers University*

will discuss his laboratory studies describing the role of developmental exposure to pesticides in altering neurochemical and behavioral processes impaired in ADHD.

**10:00 AM – 10:20 AM** *Break***10:20 AM – 10:50 AM****Developmental Exposures to PCBs and Lead: Parallels with ADHD***Paul Eubig, University of Illinois, Urbana-Champaign*

will discuss the behavioral consequences of developmental exposure to polychlorinated biphenyls (PCBs) and lead and the parallels with the behavioral deficits observed in ADHD children.

**10:50 AM – 11:20 AM****Sex-Specific Developmental White-Matter Effects of PCBs***Veronica Miller, Wadsworth Center, New York State Dept. of Health*

will discuss the consequences of developmental exposure to PCBs on cerebellar morphology, inflammatory cytokines and innate sexually dimorphic differences in neuronal and glial markers of development related to ADHD.

**11:20 AM – 11:45 AM****Panel Discussion***Discussion Leaders: Susan Schantz and Rich Seegal***11:45 AM – 1:15 PM** *Break for Lunch on Your Own*

**Tuesday Morning 1 Nov 2011 8:30 AM – 11:45 Noon***Concurrent Session - Platform***SESSION VI-B: NEUROPROTECTION, NEURODEGENERATION, NEUROEPIDEMIOLOGY, NEUROBEHAVIOR, AND SOLVENTS**

*Session Co- Chairs:* **Anumantha G Kanthasamy**  
**Mary Ann Wilson**

**Topics and Speakers:****8:30 AM – 8:45 AM****Mercury's Effects on Brain Selenoenzyme Activities***Nicholas Ralston, Energy & Environmental Research Center, University of North Dakota***8:45 AM – 9:00 AM****Protective Effects of Selenomethionine Against Methylmercury-Induced Neuronal Degeneration in Developing Rat Brain***Mineshi Sakamoto, National Institute for Minamata Disease, Japan***9:00 AM – 9:15 AM****Epigenetic Regulation of a Pro-Apoptotic Kinase PKC $\delta$  Gene Expression in Neurotoxicity Models: Implications for Gene-Environment Interactions in Neurodegeneration***Anumantha G Kanthasamy, Iowa State University***9:15 AM – 9:30 AM****The Occupational JP8 Exposure Neuroepidemiology Study (OJENES).***Susan Proctor, US Army Research Institute of Environmental Medicine***9:30 AM – 9:45 AM****Differential Expression of Neuroimmune Mediators Following Postnatal Exposure to Trichloroethylene***Sarah Blossom, University of Arkansas for Medical Sciences***9:45 AM – 10:00 AM****Sub-Chronically Exposure Benzo[a]pyrene Inhibiting the Long-Term Potentiation in Rat Hippocampal CA1 Area***Jinping Zheng, School of Public Health, Shanxi Medical University, China***10:00 AM – 10:15 AM****Fibromyalgia, Mood Disorders, and Intense Creative Energy: A1AT Polymorphisms Are Not Always Silent***Donald E. Schmechel, Duke University Medical Center***10:15 AM – 10:30 AM** *Break***10:30 AM – 10:45 AM***Post-Doctoral Competition***Effects of Developmental Exposure to 3, 3', 4, 4'-Tetrachloroazobenzene and T4 deficits on Neurobehavior and Hippocampal Morphology in Sprague-Dawley Rats.***Mamta Behl, NIH/National Institute of Environmental Health Sciences***10:45 AM – 11:00 AM****Lead Exposure Alters Dendritic Spine Maturation in Rodent Somatosensory Cortex***Mary Ann Wilson, Hugo W. Moser Research Institute at Kennedy Krieger and The Johns Hopkins Univ. School of Medicine***11:00 AM – 11:15 AM***Post-Doctoral Competition***Developmental Lead (PB<sup>2+</sup>) Exposure in Schizophrenia Mouse Model Creates New Behavioral Phenotype***Bagrat Abazyan, Johns Hopkins Hospital***11:15 AM – 11:30 AM***Post-Doctoral Competition***Interactive Effects of Lithium and Trimethyltin on Depression Associated Behavior: Possible Relevance to Mood Disorders***Steven Szabo, NIH/National Institute of Environmental Health Sciences*

11:30 AM – 11:45 AM

Discussion

11:45 AM – 1:15 PM *Break for Lunch on Your Own*

**Tuesday Early Afternoon 1 Nov 2011 1:15 PM – 3:15 PM**

*Concurrent Session - Plenary*

**SESSION VII-A: SCHIZOPHRENIA**

*Session Chair: Tomás Guilarte, Columbia University*

**Theme and Rationale:** Schizophrenia is a neurodevelopmental disorder with a later life onset that like autism and ADHD exhibits a strong gender bias. There is growing evidence that susceptibility and/or severity of schizophrenia is determined by gene-environment interactions, and one common factor linked to schizophrenia is inflammation. This session will provide evidence to support a role for early life infections and the possible role of environmental contaminants in the etiology and/or progression of schizophrenia.

**Topics and Speakers:**

1:15 PM – 1:40 PM

**Brain Development and Risk for Schizophrenia: Overall Overview from an Infection Perspective**

*John Gilmore, University of North Carolina*

will present his research focused on brain development and risk for schizophrenia and other neurodevelopmental disorders. He is Director of the UNC Schizophrenia Research Center, an NIMH-sponsored Conte Center for the Neuroscience of Mental Disorders.

1:40 PM – 2:05 PM

**Neuroimmune Dysfunction in Schizophrenia: DISC1 Model**

*Mikhail Pletnikov, Johns Hopkins University*

will present his research on molecular and cellular mechanisms of abnormal brain development with relevance to neurodevelopmental psychiatric disorders such as schizophrenia and autism

2:05 PM – 2:30 PM

**Prenatal Lead Exposure and Schizophrenia: The Connection**

*Mark Opler, NYU Medical Center*

will present research focused on the etiology, lifecourse, and treatment of schizophrenia and other psychiatric disorders especially as related to prenatal lead exposure. His past research focused on the impact of prenatal chemical exposures on the risk of psychotic disorders, resulting in a replicated finding using prospectively collected biological samples from US-based birth cohorts.

2:30 PM – 2:55 PM

**Early Life Lead Exposure and Schizophrenia: Neurobiological Connections and Testable Hypothesis**

*Tomás Guilarte, Columbia University*

will present a novel hypothesis using a gene x environment interaction model of early life lead exposure in disrupted-in-schizophrenia 1 (DISC 1) mutant mice. DISC1 is a gene that has been strongly implicated as a risk factor for schizophrenia and allied mental disorders.

2:55 PM – 3:15 PM

Discussion

3:15 PM – 3:30 PM *Break*

**Tuesday Afternoon 1 Nov 2011 1:15 PM – 2:45 PM**

*Concurrent Session – Mini Symposium*

**SESSION VII-B: MERCURY AND NUTRIENTS**

*Session Chair: Edwin van Wijngaarden, University of Rochester Medical Center*

**Theme and Rationale:** Fish are an important source of protein and contain a variety of essential nutrients. These include the n-3 long chain polyunsaturated fatty acids (LCPUFA), selenium, iodine, vitamin B<sub>12</sub> and certain other vitamins. Fish also contain small amounts of methylmercury (MeHg), a known neurotoxicant. Another important source of human exposure to mercury (Hg) occurs from dental amalgams which emit Hg vapor (Hg<sup>0</sup>). Whether child neurodevelopment is adversely affected from prenatal MeHg exposure from maternal fish consumption and/or Hg<sup>0</sup> exposure from maternal dental amalgams is presently unclear. The Seychelles

Child Development Study (SCDS) in a series of investigations has examined whether any risks are associated with MeHg exposure that would result from daily ocean fish consumption during pregnancy. More recently, we have also investigated whether there is a dynamic interplay between and among nutrients in fish, MeHg, and Hg<sup>0</sup> that will ultimately determine the influence they exert on child development. This session will provide new information regarding the nutritional status of mothers and children in the SCDS, and the association of exposure to toxicants and nutrients with developmental endpoints.

**Topics and Speakers:****1:15PM - 1:30 PM****Prenatal Hg Vapor, MeHg, and LCPUFAs and Developmental Outcomes at 9 and 30 Months in the Seychelles Child Development Nutrition Study***Gene Watson, University of Rochester Medical Center***1:30 PM - 1:45 PM****Developmental Outcomes at Five Years of Age in the Seychelles Child Development Nutrition Study: Evidence of Associations with Dietary PUFA***Philip W. Davidson, University of Rochester Medical Center***1:45 PM - 2:00 PM***Post-Doctoral Competition***Dietary Determinants of LCPUFA and Mercury Status in Pregnant Women and Their Children Aged 5 Years in the Seychelles Child Development Nutrition Study***Maria Mulhern, University of Ulster, UK***2:00 PM - 2:15 PM****Maternal Selenium Status in Relation to Child Development in the Seychelles Child Development Nutrition Study***Edwin van Wijngaarden, University of Rochester Medical Center***2:15 PM - 2:30 PM****Discussion of Posters****Prenatal Methyl Mercury Exposure in Relation to Psychological and Behavioral Endpoints at 19 Years from the Seychelles Child Development Study Main Cohort***Edwin van Wijngaarden, University of Rochester Medical Center**Post-Doctoral Competition***Auditory Processing in Offspring of Mothers Who Consumed a Pregnancy Diet High in Fish***Adam Dziorny, University of Rochester Medical Center***2:30 PM – 2:45 PM****Discussion****2:45 PM – 3:00 PM****Break****Tuesday Late Afternoon 1 Nov 2011 3:30 PM – 5:00 PM***Concurrent Session - Plenary***SESSION VIII-A: CHEMICALLY-INDUCED SEIZURE AND THE ROLE OF INFLAMMATION****Session Chair:** *David Jett, NIH CounterACT, NINDS*

**Theme and Rationale:** There is great interest in epilepsy amongst researchers studying neurodevelopmental disorders because epilepsy is a common co-morbidity in autism and a high percentage of children with seizure disorders have ADHD. This session will focus on environmentally-triggered seizures, the relationship of environmental exposures to epilepsy and the role of inflammation in both seizures and epilepsy. It is hoped this will stimulate discussion of a potential link between inflammation and chemically-induced seizure disorders. .

**Topics and Speakers:****3:30 PM – 3:45 PM****Introduction – Environmentally-Induced Seizures***David A. Jett, NIH CounterACT, NINDS*

will provide an overview of how acute exposures to chemical agents cause epileptiform activity in the brain, and the short and long-term neurologic sequelae of these effects.

3:45 PM – 4:15 PM

**Diazepam and Diazepam/Valproic Acid Treatments are Neuroprotective, Antiepileptogenic and Correlated with Increased Neurogenesis in the Dentate Gyrus of Rats Exposed to Soman**

Debra L. Yourick, *Walter Reed Army Institute of Research*

will describe the occurrence of spontaneously recurring seizures after exposure to the nerve gas soman.

4:15 PM – 4:45 PM

**Inflammation, Seizures and Epilepsy**

Tallie Z. Baram, *Danette Shepard Professor of Neurological Sciences, University of California Irvine*

will describe inflammatory mediators-released by brain cells and peripheral immune cells-in both the origin of individual seizures and the epileptogenic process.

4:45 PM – 5:00 PM

**Discussion**

*Discussion Leaders: David Jett and Pam Lein*

6:30 PM: Return for Reception and Hosted Awards Banquet Honoring Theo Colborn

**Tuesday Late Afternoon 1 Nov 2011 3:00 PM – 5:00 PM**

*Concurrent Session - Platform*

**SESSION VIII-B: DEVELOPMENTAL NEUROTOXICOLOGY, MECHANISMS**

*Session Co-Chairs: Aaron Bowman, Vanderbilt University Medical Center*

*Jean Harry, National Institute of Environmental Health Sciences/NIH*

**Topics and Speakers:**

3:00 - 3:15 PM

*Post-Doctoral Competition*

**Changes in Gene Expression after Phencyclidine Administration in Developing Rats: A Potential Animal Model for Schizophrenia**

Fang Liu, *National Center for Toxicological Research/U.S. Food & Drug Administration*

3:15 PM – 3:30 PM

**Angiogenesis Disruption: A Potential Contributing Mechanism in Developmental Neurotoxicity**

Hassan El-Fawal, *Albany College of Pharmacy and Health Sciences*

3:30 PM – 3:45 PM

*Pre-Doctoral Competition*

**Comparison of Chemical-Induced Changes in Proliferation and Apoptosis in Human and Mouse Neuroprogenitor Cells**

Megan Culbreth, *ISTD, NHEERL, US Environmental Protection Agency*

3:45 PM – 4:00 PM

*Pre-Doctoral Competition*

**Potential Contribution of Resident Microglia During Chemical Injury-Induced Neurogenesis**

Christopher McPherson, *National Institute of Environmental Health Sciences/NIH*

4:00 PM – 4:15 PM

**Ahr<sup>d</sup>Cyp1a2(-/-) Mice Show Increased Susceptibility to PCB-Induced Developmental Neurotoxicity**

Christine Curran, *Northern Kentucky University*

4:15 PM – 4:30 PM

*Pre-Doctoral Competition*

**Omega-3 Fatty Acid Supplementation and Blood Level Associations with ADHD Symptoms: A Meta Analytic Review of Current Research**

Elizabeth Hawkey, *Oregon Health & Science University School of Medicine*

4:30 PM – 4:45 PM

**Obesity, Environmental Obesogens, and the View from Neurotoxicology**

Bernard Weiss, *University of Rochester School of Medicine and Dentistry*

4:45 PM – 5:00 PM

**Discussion**

6:30 PM: Return for Reception and Hosted Awards Banquet Honoring Theo Colborn

**Tuesday Evening 1 Nov 2011 6:30 PM – 9:30 PM**

*Tuesday Evening, November 1<sup>st</sup>*

6:30 PM – 7:00 PM

**Reception**

*(No-Host Bar)*

7:00 PM – 9:30 PM

**Hosted Awards Banquet Honoring  
Theo Colborn**

**Recognition of Neurotoxicology Conference Sponsors**

**Presentation of Student Poster and Trainee Travel Awards**

**Recognition of Theo Colborn**

*“In gratitude, for legions of children not yet born,  
but because of you, shielded from harm.”*

**“Conversation with Theo”**

**Wednesday Early Morning 2 Nov 2011 8:00 AM – 9:20 AM**

*Platform Session*

**SESSION IX: OXIDATIVE STRESS, IMMUNOPATHOGENESIS, AUTISM, SEX DIFFERENCES**

*Session Co-Chairs: Jill James, University of Arkansas for Medical Sciences*

*Elizabeth Sajdel-Sulkowska, Brigham and Women's Hospital/Harvard Medical School*

**Topics and Speakers:**

8:00 AM - 8:20 AM

**Evidence of Oxidative Damage and Inflammation Associated with Low Glutathione Redox Status in the Autism Brain**

*Jill James, University of Arkansas for Medical Sciences*

8:20 AM - 8:40 AM

**Environmentally-Induced Oxidative Stress and Disruption of Local Brain Thyroid Hormone Homeostasis**

*Elizabeth M. Sajdel-Sulkowska, Brigham and Women's Hospital/Harvard Medical School*

8:40 AM - 9:00 AM

**Immunopathogenesis in Autism: Regulatory T Cells and Markers of Autoimmunity in Mice Developmentally Exposed to Perfluorooctanoic Acid (PFOA)**

*Jamie DeWitt, Brody School of Medicine, East Carolina University*

9:00 AM - 9:20 AM

**Sex Differences in the Persisting Neurobehavioral Impacts of Low-Level Neonatal Pesticide Exposure in Rats**

*Ed Levin, Duke University Medical Center*

Wednesday Mid Morning 2 Nov 2011 9:20 AM – 11:00 AM

Workshop

**SESSION X: RISK ASSESSMENT OF NEUROTOXIC AGENTS**

Session Chair: Susan Makris, US EPA/ORD/NCEA

**Theme and Rationale:** A number of environmental toxicants have been linked with adverse neurotoxicological consequences in adults and children. This symposium will discuss approaches to the risk assessment of neurotoxic agents, as implemented by the US EPA. Speaker presentations will highlight some of the issues and challenges faced by environmental risk assessors, and provide a forum to discuss advances and research needs in this area.

**Topics and Speakers:**

9:20 AM - 9:45 AM

**Neurotoxicology Risk Assessment at the U.S.EPA – Successes, Issues, and Challenges**

Susan Makris, U.S. EPA, National Center for Environmental Assessment

9:45 AM - 10:00 AM

**Use of Mechanistic Data in Risk Assessment of Neurotoxicants**

Ambuja Bale, U.S. EPA, National Center for Environmental Assessment

10:00 AM - 10:15 AM

**Challenges to Using High-Throughput Assays for Evaluating Developmental Neurotoxicity: A Thyroid Disrupting Chemical Case Study**

Deborah Segal, U.S. EPA, National Center for Environmental Assessment

10:15 AM - 10:30 AM

*Break*

10:30 AM - 10:45 AM

**Consideration of Neuroglia in Chemical Assessments**

Andrew Kraft, U.S. EPA, National Center for Environmental Assessment

10:45 AM - 11:00 AM

**-Omics and Mixtures in Developmental Neurotoxicity Risk Assessment**

David Szabo, U.S. EPA, National Center for Environmental Assessment

Wednesday Late Morning 2 Nov 2011 11:00 AM – 12:00 NOON

Panel Discussion

**SESSION XI: PANEL DISCUSSION ON COMMON FACTORS IN AUTISM, ADHD AND SCHIZOPHRENIA**

**Theme and Rationale:** Following up the individual sessions on ASD, ADHD and Schizophrenia, this session will be devoted to a "cross-cutting" panel discussion on *common factors* relating Autism, ADHD and Schizophrenia. A set of questions have been included to facilitate discussion; all conference attendees are invited to participate.

**Session Chairs:** Isaac Pessah, University of California, Davis  
Pamela Lein, University of California, Davis

**Panelists:** Tomas Guilarte, Columbia University  
Martha Herbert, Harvard University  
Jill James, University of Arkansas for Medical Sciences  
David Jett, NIH CounterACT, NINDS  
Ed Levin, Duke University Medical Center  
Susan Makris, U.S. EPA, National Center for Environmental Assessment  
Elizabeth M. Sajdel-Sulkowska, Brigham and Women's Hospital/Harvard Medical School  
Susan Schantz, University of Illinois, Champaign-Urbana  
Richard Seegal, Wadsworth Center, New York State Department of Health  
Tom Zoeller, University of Massachusetts

Discussion is invited from all conference participants

## Questions to be Addressed:

1. Given the growing evidence of convergent mechanisms underlying neurodevelopmental disorders with distinct clinical outcomes, what factors determine specificity?
2. What strategies can be employed to identify/confirm environmental risk factors for neurodevelopmental disorders?
3. What factors are key to the development of useful animal models for neurodevelopmental disorders including ADHD, autism or schizophrenia?
4. Given the associations between hypothyroxinemia and resistance to thyroid hormones (RTH) and ADHD, what are the biochemical and structural changes that mediate ADHD-like behaviors?

## Open Q&A Session

Wednesday Noon 2 Nov 2011 12:00 Noon CLOSING OF NEUROTOX 27

**Formal closing of the Twenty-Seventh International Neurotoxicology Conference!!!**

**Conference Chair & Co-Chairs:** Joan Cranmer, *University of Arkansas for Medical Sciences*  
Pamela Lein, *University of California, Davis*  
Isaac Pessah, *University of California, Davis*

The Wednesday Afternoon Workshop is organized and co-sponsored by Collaborative on Health and the Environment's (CHE) Learning and Developmental Disabilities Initiative (LDDI) and the Autism Society (AS)

All registrants for NEUROTOX 27 and are encouraged to join the informal discussion with Theo Colborn and attend this afternoon workshop

Wednesday Noon 2 Nov 2011 12:00 Noon – 1:00 PM

Complimentary Box Lunches for Registrants **Courtesy of AS and LDDI**

Informal Discussion with Theo Colborn

Wednesday Afternoon 2 Nov 2011 1:00 PM – 4:00 PM

**LEARNING AND DEVELOPMENTAL DISABILITIES INITIATIVE / AUTISM SOCIETY WORKSHOP:**

***“Environmental Influences on Neurodevelopment:  
Translating the Emerging Science into Public Health Policy”***

**Workshop Co-Chairs:** Donna Ferullo, *Director of Program Research, The Autism Society*  
Elise Miller, *Director, Collaborative on Health and the Environment (CHE)*

1:00 PM – 1:45 PM

**Summary Science: Children, Environment and Brain Development**

Martha Herbert, *Harvard Medical School/Massachusetts General Hospital*  
Susan Schantz, *University of Illinois at Urbana-Champaign*

1:45 PM – 2:30 PM

**Policy Approaches to Protecting Neurodevelopment**

Richard Denison, *Environmental Defense Fund and Campaign for Safer Chemicals, Healthy Families*  
Tom Zoeller, *University of Massachusetts at Amherst*

2:30 PM – 3:00 PM

**Legislative Action for Children's Health in the Community**

Kay Hagan, *U.S.Senator from North Carolina*

3:00 PM – 4:00 PM

**How NGOs Use Science to Move Policy with Expert Q and A**

Donna Ferullo, Director, Environmental Health Initiative, *The Autism Society*

John Willson, President, North Carolina Chapter, *Learning Disabilities of America*

Beth Mettersmith, Director, North Carolina Campaign, *MomsRising*

Billie Karel, Program Director, *ToxicFree North Carolina*

All Previous Speakers

4:00 PM

**Formal closing of the LDDI/AS Workshop**

Workshop Co-Chairs: **Donna Ferullo**, *The Autism Society*

**Elise Miller**, *Collaborative on Health and the Environment (CHE)*

**NOTE: All NEUROTOX 27 papers being presented from Poster in Monday Evening Poster Session V are grouped by category and listed below. The numbers correspond with the numbers in the Abstract Book and on the Poster Boards.**

**NEUROTOX 27  
SESSION V: POSTER SESSION  
Monday Evening, October 31, 2011  
7:15 PM – 9:30 PM**

**STUDENT POSTER AWARD COMPETITION**

- Judging will be done between 7:15 PM – 8:30 PM
- Students please stand by your poster during this time

**PAPERS PRESENTED FROM POSTER**

**ENVIRONMENTAL RISK FACTORS FOR NEURODEVELOPMENTAL DISORDERS**

**P-64**

**PRENATAL MERCURY EXPOSURE AND ADHD-RELATED BEHAVIOR IN CHILDREN.** SK Sagiv<sup>1,2</sup>, SW Thurston<sup>3</sup>, DC Bellinger<sup>4,5</sup>, C Amarasiriwardena<sup>2,5</sup>, SA Korrick<sup>2,5</sup>. <sup>1</sup>*Boston University School of Public Health, Boston, MA;* <sup>2</sup>*Harvard Medical School, Boston, MA;* <sup>3</sup>*University of Rochester School of Medicine and Dentistry, Rochester, NY;* <sup>4</sup>*Children's Hospital, Boston MA;* <sup>5</sup>*Harvard School of Public Health, Boston, MA.*

**Keywords:** Methylmercury, Neurodevelopment, Attention Deficit Hyperactivity

**P-65**

*Post-Doctoral Poster Award Competition*

**PRENATAL EXPOSURE TO PHTHALATES AND ATTENTION-DEFICIT HYPERACTIVITY DISORDER IN CHILDREN.** A Miodovnik and SH Swan. *Department of Preventive Medicine, Mount Sinai School of Medicine, New York, NY, USA*

**Keywords:** Prenatal Exposure, Phthalates, Attention-Deficit Hyperactivity Disorder

**Mentor:** Shanna H. Swan

**P-66**

*Post-Doctoral Poster Award Competition*

**EFFECTS OF FLUPENTHIXOL AND AMPHETAMINE ON DELAY DISCOUNTING IN THE LONG EVANS RAT.** PA Eubig, TE Noe, and SL Schantz. *Department of Comparative Biosciences, College of Veterinary Medicine, University of Illinois at Urbana-Champaign, Urbana, Illinois, U.S.A.*

**Keywords:** Impulsivity, Delay Discounting Task, ADHD

**P-67**

*Post-Doctoral Poster Award Competition*

**POLYBROMINATED DIPHENYL ETHERS AND SOCIAL AND EMOTIONAL DEVELOPMENT IN TODDLERS.** K Hoffman<sup>1</sup>, JL Daniels<sup>1</sup>, M Adgent<sup>2</sup>, B Davis Goldman<sup>1</sup> and A Sjödin<sup>3</sup>. <sup>1</sup>*University of North Carolina, Chapel Hill North Carolina USA.* <sup>2</sup>*National Institute of Environmental Health Sciences, Research Triangle Park, North Carolina USA.* <sup>3</sup>*Centers for Disease Control and Prevention, Atlanta GA USA*

**Keywords:** PBDE Exposure, Social and Behavioral, Breastmilk

**Mentor:** Julie Daniels

**P-68**

*Pre-Doctoral Poster Award Competition*

**THE IMPACT OF BISPHENOL-A (BPA) EXPOSURE ON NEURO-DEVELOPMENT AND SUBSEQUENT VISUOSPACIAL LEARNING AND MEMORY.** JN Franklin, and JC DeWitt. *Department of Pharmacology and Toxicology, Brody School of Medicine, East Carolina University, Greenville, NC, USA.*

**Keywords:** Bisphenol-A, Neurodevelopmental, Barnes Maze

**Mentor:** Jamie DeWitt

**P-69**

**EFFECT OF SODIUM (META) ARSENITE ON RAT FETAL BRAIN.** M Kuwagata, M Senuma, T Ogawa and S Shioda. *Department of Anatomy, Showa University School of Medicine, Shinagawa, Tokyo, Japan*

**Keywords:** Developmental Neurotoxicity, Arsenite, Rat Fetal Brain

**P-70** (Also presented from Poster & Discussed in Session VII-B #43)

**PRENATAL METHYL MERCURY EXPOSURE IN RELATION TO PSYCHOLOGICAL AND BEHAVIORAL ENDPOINTS AT 19 YEARS FROM THE SEYCHELLES CHILD DEVELOPMENT STUDY MAIN COHORT.** E van Wijngaarden, SW Thurston, GJ Myers, JJ Strain, B Weiss, T Zarccone, G Watson, G Zareba, E McSorley, J Wallace, M Mulhern, A McAfee, CF Shamlaye, PW Davidson. *University of Rochester School of Medicine and Dentistry.*

**Keywords:** Methylmercury, Nutrition, Child Development

**P-71** (Also presented from Poster & Discussed in Session VII-B #44)

*Post-Doctoral Poster Award Competition*

**AUDITORY PROCESSING IN OFFSPRING OF MOTHERS WHO CONSUMED A PREGNANCY DIET HIGH IN FISH.** AC Dziorny, MS Orlando, T Love, D Harrington, GJ Myers, PW Davidson. *Department of Environmental Medicine, University of Rochester School of Medicine, Rochester, NY, USA*

**Keywords:** Methylmercury, Polyunsaturated Fatty Acids, Auditory Processing

**Mentor:** Philip Davidson

## **ENVIRONMENTAL RISK FACTORS FOR PERIPHERAL NEUROTOXICITY AND NEURODEGENERATIVE DISEASES**

**P-72**

**ANALYSIS OF ASSOCIATIONS OF LONG-TERM AVERAGE OZONE AND PM2.5 CONCENTRATIONS WITH PARKINSON'S DISEASE AMONG FARMERS AND SPOUSES ENROLLED IN THE AGRICULTURAL HEALTH STUDY.** E. Kirrane<sup>1</sup>, J.A. Davis<sup>1</sup>, T. Luben<sup>1</sup>, C. Bowman<sup>1</sup>, J.A. Hoppin<sup>2</sup>, A. Blair<sup>3</sup>, H. Chen<sup>2</sup>, M. Patel<sup>1</sup>, D.P. Sandler<sup>2</sup>, C. Tanner<sup>4</sup>, L. Vinikoor-Imler<sup>1</sup>, M. Ward<sup>3</sup>, F. Kamel<sup>2</sup>. <sup>1</sup>*US Environmental Protection Agency, Research Triangle Park, NC, USA.* <sup>2</sup>*NIH/National Institute for Environmental Health Sciences, Research Triangle Park, NC, USA.* <sup>3</sup>*National Cancer Institute, Washington, DC, USA.* <sup>4</sup>*The Parkinson's Institute, Sunnyvale, CA, USA.*

**Keywords:** Ozone, Air Pollution, Parkinson's Disease

**P-73**

**NEUROTOXICITY EVALUATION OF N-BUTYLBENZENESULFONAMIDE (NBBS).** C Rider<sup>1</sup>, M Behl<sup>1</sup>, K Janardhan<sup>2</sup> CA McPherson<sup>3</sup>, and GJ Harry<sup>3</sup>. <sup>1</sup>*Toxicology Operations Branch, NTP, NIEHS,* <sup>2</sup>*Cellular/Molecular Pathology Branch, NIEHS and Integrated Laboratory Systems,* <sup>3</sup>*NTP Lab, NIEHS, RTP, NC*

**Keywords:** Sciatic nerve, screening neurotoxicity, plasticizer

**P-74**

*Pre-Doctoral Poster Award Competition*

**BRAIN ACCUMULATION AND TOXICITY OF MANGANESE IN MICE: AN MRI STUDY.** Krishna, Saritha; Dodd, Celia A; Hekmatyar, Shahryar K; and Filipov, Nikolay M. *Department of Physiology and Pharmacology, University of Georgia, Athens, GA, United States.*

**Keywords:** manganese, MRI, Mice

**Mentor:** Nikolay M. Filipov

**GENE-ENVIRONMENT INTERACTIONS THAT INFLUENCE NERVOUS SYSTEM DEVELOPMENT AND FUNCTION**

**P-75**

**MUTATIONS IN RYANODINE RECEPTOR INCREASE NON-COPLANAR PCB 95 MEDIATED CALCIUM OSCILLATIONS IN PRIMARY CORTICAL NEURONS.** DD Bose, H Chen, SC Maxwell, PJ Lein and IN Pessah. *Department of Veterinary Molecular Biosciences, University of California, Davis, CA, USA.*

**Keywords:** PCB 95, Ryanodine Receptors, Calcium Signaling

**P-76**

*Pre-Doctoral Poster Award Competition*

**ASSESSING MOTOR FUNCTION IN THREE GENOTYPES OF MICE EXPOSED TO POLYCHLORINATED BIPHENYLS DURING GESTATION AND LACTATION.** JP Fowler, AA Ashworth, MA McKay, CJ Strohmaier, and CP Curran. *Department of Biological Sciences, Northern Kentucky University, Highland Heights, KY, USA.*

**Keywords:** Polychlorinated Biphenyls, Genetic Susceptibility, Motor Function

**Mentor:** Christine Curran

**P-77**

**SEARCHING GENE CANDIDATES RESPONSIBLE FOR MENTAL DISORDERS IN THE FETAL MOUSE UNDERNUTRITION MODEL.** T Ogawa, R Rakwal, J Shibato, C Sawa, T Saito, A Murayama, H Kageyama, M Kuwagata and S Shioda. *Department of Anatomy, Showa University School of Medicine, Shinagawa, Tokyo, Japan*

**Keywords:** Prenatal Undernutrition, Mental Disorder, Immune System

**P-78** (Also presented from Platform in Session VI-B #33)

*Post-Doctoral Poster Award Competition*

**DEVELOPMENTAL LEAD (PB<sup>2+</sup>) EXPOSURE IN SCHIZOPHRENIA MOUSE MODEL CREATES NEW BEHAVIORAL PHENOTYPE.** \*B. Abazyan<sup>1</sup>, C. Yang<sup>2</sup>, J. Dziedzic<sup>5</sup>, S. Mori<sup>3</sup>, M. Pletnikov<sup>4</sup>, T. R. Guilarte<sup>5</sup>. <sup>2</sup>Psychiatry, <sup>3</sup>SOM Rad MR Res., <sup>4</sup>Psychiatry, Neurosci., <sup>1</sup>Johns Hopkins Hosp, BALTIMORE, MD; <sup>5</sup>Dept. of Envrn. Hlth. Sci., Mailman Sch. of Publ. Hlth. Columbia Univ., New York, NY

**Keywords:** Gene-Environment, DISC1, Lead

**Mentor:** Mikhail Pletnikov & Tomás Guilarte

**P-79** (Also presented from Platform in Session VIII-B #48)

*Post-Doctoral Poster Award Competition*

**CHANGES IN GENE EXPRESSION AFTER PHENCYCLIDINE ADMINISTRATION IN DEVELOPING RATS: A POTENTIAL ANIMAL MODEL FOR SCHIZOPHRENIA.** Fang Liu, Cheng Wang. *Division of Neurotoxicology, National Center for Toxicological Research/U.S. Food & Drug Administration, Jefferson, AR, United States*

**Keywords:** Neuronal Development, DNA Microarray, Gene Expression, Phencyclidine (PCP), Schizophrenia, Apoptosis

**Mentor:** Cheng Wang

**P-80**

*Post-Doctoral Poster Award Competition*

**NEUROPROGENITORS DIFFERENTIATED FROM PARK2 MUTANT STEM CELLS EXHIBIT ALTERED SENSITIVITY TO NEUROTOXIC METALS.** Asad A. Aboud<sup>1\*</sup>, Andrew M. Tidball<sup>1\*</sup>, M. Diana Neely<sup>1</sup>, Michael Litt<sup>1</sup>, Peter Hedera<sup>1</sup>, Charles C. Hong<sup>2</sup>, Kevin C. Ess<sup>1</sup>, and Aaron B. Bowman<sup>1</sup>. <sup>1</sup>Vanderbilt University Medical Center, Dept. of Neurology, <sup>2</sup>Research Medicine, Veterans Administration TVHS, Cardiovascular Medicine Division, Nashville TN 37232-8552

**Keywords:** Induced Pluripotent Stem Cells, Metal Neurotoxicants, Parkinson's

**Mentor:** Aaron Bowman

ENDOCRINE DISRUPTION AND SEX DIFFERENCES IN NEURODEVELOPMENTAL DISORDERS

**P-81**  
**DEVELOPMENTAL EXPOSURE TO THE ORGANOPHOSPHATE CHLORPYRIFOS DIFFERENTLY AFFECTS SOCIAL BEHAVIOR AND RELATED BRAIN NEUROENDOCRINE MARKERS IN FEMALE AND MALE MICE.** A. Venerosi<sup>1</sup>, L. Ricceri<sup>1</sup>, S. Tait<sup>2</sup>, A. De Felice<sup>1</sup>, A. Mantovani<sup>2</sup> and G. Calamandrei<sup>1</sup>. <sup>1</sup>Dept. Cell Biology and Neurosciences, <sup>2</sup>Dept. Food Safety and Veterinary Public Health, Istituto Superiore di Sanità Rome, Italy  
**Keywords:** Mouse Social Behavior, Developmental Exposure to Organophosphates, Chlorpyrifos as Endocrine Disruptor

**P-82**  
**SEX DIFFERENCES IN THE EFFECT OF PRENATAL ORGANOCHLORINE EXPOSURE ON ATTENTION AND IMPULSE CONTROL AT AGE 8 YEARS** SK Sagiv<sup>1,2</sup>, SW Thurston<sup>3</sup>, DC Bellinger<sup>4,5</sup>, LM Altshul<sup>5</sup>, SA Korrick<sup>2,5</sup>. <sup>1</sup>Boston University School of Public Health, Boston, MA; <sup>2</sup>Harvard Medical School, Boston, MA; <sup>3</sup>University of Rochester School of Medicine and Dentistry, Rochester, NY; <sup>4</sup>Children's Hospital, Boston MA; <sup>5</sup>Harvard School of Public Health, Boston, MA.  
**Keywords:** Organochlorines, Neurodevelopment, Sex Differences

**P-83**  
*Pre-Doctoral Poster Award Competition*  
**EFFECTS OF LOW DOSE BISPHENOL A DURING GESTATION AND EARLY DEVELOPMENT ON MATERNAL BEHAVIOR IN LONG EVANS HOODED RATS.** Chisholm NC<sup>a</sup>, Sadowski RN<sup>b</sup>, Park PY<sup>a</sup>, Neese SL<sup>bc</sup>, Schantz SL<sup>bc</sup>, Juraska JM<sup>ab</sup>. <sup>a</sup>Department of Psychology, <sup>b</sup>Neuroscience Program and <sup>c</sup>Comparative Biosciences, University of Illinois at Urbana –Champaign, Champaign, Illinois 61820  
**Keywords:** Development, Maternal Behavior, Bisphenol A  
**Mentor:** Janice Juraska

**P-84**  
*Pre-Doctoral Poster Award Competition*  
**EFFECTS OF LOW DOSE BISPHENOL A ADMINISTERED TO MALES AND FEMALES DURING GESTATION AND EARLY POSTNATAL DEVELOPMENT ON ADULT BEHAVIOR IN THE RADIAL ARM MAZE.** RN Sadowski<sup>1</sup>, PY Park<sup>2</sup>, SL Neese<sup>1,3</sup>, SL Schantz<sup>1,3</sup>, JM Juraska<sup>1,2</sup>. <sup>1</sup>Neuroscience Program, <sup>2</sup>Psychology, <sup>3</sup>Comp Biosciences, University of Illinois, Champaign IL  
**Keywords:** BPA, Radial Arm Maze, Body Weight  
**Mentor:** Janice Juraska

**P-85** (Also presented from Platform in Session VI-B #31)  
*Post-Doctoral Poster Award Competition*  
**EFFECTS OF DEVELOPMENTAL EXPOSURE TO 3, 3', 4, 4'-TETRACHLOROAZOBENZENE AND T4 DEFICITS ON NEUROBEHAVIOR AND HIPPOCAMPAL MORPHOLOGY IN SPRAGUE-DAWLEY RATS.** Mamta Behl<sup>1</sup>, Michelle J. Hooth<sup>1</sup> and G. Jean Harry<sup>1,2</sup>. <sup>1</sup>Division of the National Toxicology Program and <sup>2</sup>Laboratory of Toxicology and Pharmacology, National Institute of Environmental Health Sciences, Research Triangle Park, NC, 27709  
**Keywords:** Developmental, Neurotoxicology, tetrachloroazobenzene  
**Mentors:** Jean Harry & Michelle Hooth

**P-86**  
**DIFFERENCES IN ACTIVITY IN MALE AND FEMALE B6C3F1 MICE USING THE OPEN FIELD AND VOLUNTARY RUNNING WHEEL.** DR Goulding<sup>1</sup>, GJ Harry<sup>2</sup>, GE Kissling<sup>3</sup>, TL Blankenship-Paris<sup>1</sup> and DB Forsythe<sup>1</sup>. <sup>1</sup>Comparative Medicine Branch<sup>1</sup>, <sup>2</sup>Neurotoxicology Group<sup>2</sup>, <sup>3</sup>Biostatistics Branch<sup>3</sup>, National Institute of Environmental Health Sciences, NIH, DHHS, Research Triangle Park, NC, USA  
**Keywords:** Locomotor Activity, Sex Differences In Mice, Voluntary Running Wheel

IMMUNE SYSTEM INFLUENCES ON NEUROTOXICOLOGIC RESPONSES

**P-87** (Also presented from Platform in Session VIII-B #51)  
*Pre-Doctoral Poster Award Competition*  
**POTENTIAL CONTRIBUTION OF RESIDENT MICROGLIA DURING CHEMICAL INJURY-INDUCED NEUROGENESIS.** CA McPherson and GJ Harry. *Neurotoxicology Group, NIEHS/NIH, RTP, NC, USA.*  
**Keywords:** Brain Injury, Neurogenesis, Microglia  
**Mentor:** Jean Harry

**P-88**

**A MODEL TO EXPLORE THE SPECTRUM OF DIVERSE MICROGLIAL FUNCTIONS WITH INJURY.** S Das<sup>1,2</sup>, CA McPherson<sup>1</sup>, and GJ Harry<sup>1</sup>.  
<sup>1</sup>Neurotoxicology Group, NIEHS, RTP, NC. <sup>2</sup> East Chapel Hill High School, Chapel Hill, NC, USA

**Keywords:** Model, Microbial Function, Injury

**P-89**

*Post-Doctoral Poster Award Competition*

**PRENATAL INFLUENZA INFECTION IMPACTS OFFSPRING BRAIN DEVELOPMENT: DIFFUSION TENSOR IMAGING OF WHITE MATTER PATHWAYS IN THE RHESUS MONKEY.** SJ Short and JH Gilmore. *Department of Psychiatry, School of Medicine, University of North Carolina, Chapel Hill, NC, USA.*

**Keywords:** Pregnancy, Influenza, Brain Development

**Mentor:** John H. Gilmore

**P-90**

*Pre-Doctoral Poster Award Competition*

**DIFFERENTIAL IMMUNE RESPONSES TO THE ENVIRONMENTAL TOXICANT, BDE-49 IN CHILDREN WITH AUTISM SPECTRUM DISORDERS.** Marijannie D. Elói,<sup>1</sup> Robert Boyce,<sup>1</sup> Isaac N. Pessah,<sup>2,3,4</sup> Paul Ashwood<sup>2,4,5</sup>, and Judy Van de Water<sup>1,2,4</sup>. <sup>1</sup>School of Medicine, Division of Rheumatology, Allergy and Clinical Immunology, University of California, Davis <sup>2</sup>The M.I.N.D. Institute, University of California, Davis <sup>3</sup>Department of Veterinary Molecular Biosciences, University of California, Davis <sup>4</sup>NIEHS Center for Children's Environmental Health, University of California, Davis <sup>5</sup>Department of Medical Microbiology, University of California, Davis.

**Keywords:** Autism, Cytokines And Chemokines, Environmental Toxicants

**Mentors Name:** Judy Van de Water

**P-91**

*Pre-Doctoral Poster Award Competition*

**IMMUNOPATHOGENESIS IN AUTISM: REGULATORY T CELLS AND THE EFFECTS OF DEVELOPMENTAL EXPOSURE TO PERFLUOROOCTANESULFONIC ACID (PFOS) AND PERFLUOROOCTANIC ACID (PFOA) ON THE CEREBELLUM IN C57BL/6 MICE.** IL Bryan and JC DeWitt. *Department of Pharmacology and Toxicology, Brody School of Medicine, East Carolina University, Greenville, NC, USA.*

**Keywords:** Autism, Perfluorooctanesulfonic Acid, Perfluorooctanoic Acid

**Mentor:** Jamie DeWitt

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*Post-Doctoral Poster Award Competition*

**BEHAVIORAL AND NEUROCHEMICAL ANALYSIS FOLLOWING SUBCHRONIC MANGANESE EXPOSURE IN MICE: MODULATION BY ACUTE LIPOPOLYSACCHARIDE ADMINISTRATION.** CA Dodd, S Krishna, and NM Filipov. *Department of Physiology and Pharmacology, University of Georgia, Athens, Georgia*

**Keywords:** Manganese, Lipopolysaccharide, Drinking Water

**Mentor:** Nikolay M. Filipov

## **MODIFYING FACTORS AND INTERACTIONS THAT INFLUENCE NEUROTOXICITY**

**P-93**

**TOXIC EFFECTS OF WATER TREATMENT WITH FLUOSILICIC ACID.** Myron J. Coplan<sup>1</sup>, Roger D. Masters<sup>2</sup>. <sup>1</sup>Intelleguity Consulting, 430 Center St., Newton, MA. 02456, <sup>2</sup>Dept. of Government, Dartmouth College, Hanover, NH 03755.

**Keywords:**

**P-94**

*Pre-Doctoral Poster Award Competition*

**INHIBITORY CONTROL PERFORMANCE IN RATS DEVELOPMENTALLY EXPOSED TO PCBS FOLLOWING MICROINJECTION OF BUPROPION INTO THE MEDIAL PREFRONTAL CORTEX.** AE Meyer, MM Miller, JL Nelms, MA Ward, and HJK Sable. *Department of Psychology, University of Memphis, Memphis, TN, USA.*

**Keywords:** Polychlorinated Biphenyls, Medial Prefrontal Cortex, Bupropion

**Mentor:** Helen Sable

**P-95** (Also presented from Platform in Session VI-B #34)

*Post-Doctoral Poster Award Competition*

**INTERACTIVE EFFECTS OF LITHIUM AND TRIMETHYL TIN ON DEPRESSION ASSOCIATED BEHAVIOR: POSSIBLE RELEVANCE TO MOOD DISORDERS.** Szabo ST<sup>1,2</sup>, Harry GJ<sup>1</sup>. <sup>1</sup>Neurotoxicology Group, NTP Labs, NIEHS, RTP, NC, USA. <sup>2</sup>Duke University, Psychiatry and Behavioral Sciences, Durham, NC, USA

**Keywords:** Organotin, Neurotoxin, Neuropsychiatry

**Mentor:** Jean Harry

**P-96** (Also presented from Platform in Session VII-B #41)

*Post-Doctoral Poster Award Competition*

**DIETARY DETERMINANTS OF LCPUFA AND MERCURY STATUS IN PREGNANT WOMEN AND THEIR CHILDREN AGED 5 YEARS IN THE SEYCHELLES CHILD DEVELOPMENT NUTRITION STUDY.** MS Mulhern<sup>1</sup>, AJ McAfee<sup>1</sup>, T Love<sup>2</sup>, MP Bonham<sup>3</sup>, EM McSorley<sup>1</sup>, JMW Wallace<sup>1</sup>, CF Shamlaye<sup>3</sup>, SW Thurston<sup>2</sup>, GJ Myers<sup>2</sup>, PW Davidson<sup>2</sup> and JJ Strain<sup>1</sup>. <sup>1</sup>Northern Ireland Centre for Food and Health, University of Ulster, Coleraine, BT52 1SA, <sup>2</sup>University of Rochester, School of Medicine and Dentistry, US <sup>3</sup>Monash University, Melbourne and <sup>4</sup>Ministry of Health, Seychelles.

**Keywords:** Mercury, Long Chain Polyunsaturated Fatty Acids, Child Development

**Mentor:** Sean (JJ) Strain

**P-97**

*Post-Doctoral Poster Award Competition*

**ESTIMATED DAILY METHYLMERCURY INTAKES FROM FISH BY PREGNANT WOMEN AND THEIR CHILDREN: SEYCHELLES CHILD DEVELOPMENT AND NUTRITION STUDY.** AJ McAfee<sup>1</sup>, MS Mulhern<sup>1</sup>, EM McSorley<sup>1</sup>, MP Bonham<sup>2</sup>, JMW Wallace<sup>1</sup>, CF Shamlaye<sup>3</sup>, GE Watson<sup>4</sup>, GS Myers<sup>4</sup>, PW Davidson<sup>4</sup> and JJ Strain<sup>1</sup>. <sup>1</sup>Northern Ireland Centre for Food and Health, University of Ulster, Coleraine, UK, <sup>2</sup>Department of Nutrition and Dietetics, Monash University, Melbourne, Australia, <sup>3</sup>Ministry of Health, Victoria, Mahé, Republic of Seychelles and <sup>4</sup>University of Rochester, School of Medicine and Dentistry, NY, USA

**Keywords:** Methylmercury, Fish Consumption, Child Development

**Mentor:** Sean (JJ) Strain

## **MECHANISMS OF NEUROPROTECTION**

**P-98**

**GLUTATHIONE INDUCTION BY 3H-1,2-DITHIOLE-3-THIONE AS A DIRECT MECHANISM OF PROTECTION AGAINST ACROLEIN-INDUCED HUMAN NEUROBLASTOMA (SH-SY5Y) CELLS INJURY.** Zhenquan Jia<sup>ab</sup>, Hong Zhu<sup>b</sup>, Bhaba R. Misra<sup>b</sup>, Hara Misra<sup>b</sup>, Yunbo Li<sup>b</sup>. <sup>a</sup>Department of Biology, University of North Carolina at Greensboro, Greensboro, North Carolina, USA. <sup>b</sup>Division of Biomedical Sciences, Edward Via College of Osteopathic Medicine, Virginia Tech Corporate Research Center, Blacksburg, Virginia, USA.

**Keywords:** Acrolein, Cytotoxicity, Neuroprotection

**P-99** (Also presented from Platform in Session VIII-B #53)

*Pre-Doctoral Poster Award Competition*

**OMEGA-3 FATTY ACID SUPPLEMENTATION AND BLOOD LEVEL ASSOCIATIONS WITH ADHD SYMPTOMS: A META ANALYTIC REVIEW OF CURRENT RESEARCH.** Elizabeth Hawkey B.A. and Joel T. Nigg, Ph.D. Department of Psychiatry, OHSU School of Medicine, Oregon Health & Science University, Portland, OR, USA.

**Keywords:** ADHD, Omega-3, Meta-Analysis

**Mentor:** Joel T. Nigg

**P-100**

*Pre-Doctoral Poster Competition*

**NIMODIPINE IS NEUROPROTECTIVE AGAINST ADULT-ONSET MEHG NEUROTOXICITY.** JM Bailey and MC Newland. Psychology Department, Auburn University, Auburn, AL, USA

**Keywords:** Methylmercury, Nimodipine, Behavior

**Mentor:** M. Christopher Newland

**P-101**

*Post-Doctoral Poster Award Competition*

**AGE-ASSOCIATED ALTERATIONS OF MONOAMINE OXIDASE, MEMBRANE FLUIDITY, NEUROLIPOFUSCIN AND GLUCOSE TRANSPORTER IN MALE RAT BRAIN: NEUROPROTECTIVE ROLE OF DEHYDROEPIANDROSTERONE.** Pardeep Kumar, R.K. Kale and N.

Z. Baquer. *School of Life Sciences, Jawaharlal Nehru University, New Delhi-110067, India*

**Keywords:** Brain Aging, Dehydroepiandrosterone, Neuroprotection

**Mentors:** Prof. N. Z. Baquer & Prof. R.K. Kale

## **EVOLVING METHODS, MODELS AND RESEARCH NEEDS IN NEUROTOXICITY TESTING**

**P-102**

**IN VITRO SCREENING OF DEVELOPMENTAL NEUROTOXICANTS IN RAT PRIMARY CORTICAL NEURONS USING HIGH CONTENT IMAGE ANALYSIS.** JA Harrill<sup>1</sup>, BR Robinette<sup>2</sup>, TM Freudenrich<sup>2</sup> and WR Mundy<sup>2</sup>. <sup>1</sup>*Institute for Chemical Safety Sciences, the Hamner Institutes for Health Sciences, RTP, NC*, <sup>2</sup>*Integrated Systems Toxicology Division, U.S.EPA, RTP, NC.*

**Keywords:** Development, In Vitro, High Content Screening

**P-103** (Also presented from Platform in Session VIII-B #50)

*Pre-Doctoral Poster Award Competition*

**COMPARISON OF CHEMICAL-INDUCED CHANGES IN PROLIFERATION AND APOPTOSIS IN HUMAN AND MOUSE NEUROPROGENITOR CELLS.** ME Culbreth<sup>1</sup>, WR Mundy<sup>2</sup>, TJ Shafer<sup>2</sup>. <sup>1</sup>*Student Services Contractor to ISTD, NHEERL, US EPA, RTP, NC;* <sup>2</sup>*ISTD, NHEERL, US EPA, RTP, NC.*

**Keywords:** Neuroprogenitor, High-Throughput, Proliferation/Apoptosis

**Mentor:** Tim Shafer

**P-104**

*Post-Doctoral Poster Award Competition*

**MODULATION OF NA-K ATPASE ACTIVITY OF RAT BRAIN SYNAPTOSOME BY NOREPINEPHRINE AND SEROTONIN.** Sukrat Sinha. *Center for Biotechnology, University of Allahabad, Allahabad-211002*

**Keywords:** REM Sleep, Na-K ATPase, Norepinephrine, Serotonin

**Mentor:**

**P-105**

*Pre-Doctoral Poster Award Competition*

**A DROSOPHILA MODEL FOR FRIEDREICH'S ATAXIA.** Luan Wang and Douglas Ruden. *Institute of Environmental Health Sciences, Wayne State University, Detroit, MI, USA*

**Keywords:** Friedreich's Ataxia, Frataxin, Heart

**Mentor:** Douglas Ruden

**P-106** (Also presented from Platform in Session X #63)

*Post-Doctoral Poster Award Competition*

**'OMICS AND MIXTURES IN DEVELOPMENTAL NEUROTOXICOLOGY RISK ASSESSMENT.** David Szabo, Ruchir Shah and Linda Birnbaum. *Oak Ridge Institute for Science and Education, National Center for Environmental Assessment, Office of Research and Development, U.S. Environmental Protection Agency, Washington DC; SRA International; and National Cancer Institute/National Institute of Environmental Health Sciences, Research Triangle Park, NC.*

**Keywords:** Risk Assessment, Toxicogenomics, Mixtures

**Mentor:** Bob Sonawane & Kate Guyton

**P-107**

**THE BLUEPRINT FOR NEUROSCIENCE RESEARCH.** Annette Kirshner PhD and Cindy Lawler PhD, *Division of Extramural Research and Training, National Institute of Environmental Health Sciences, Research Triangle Park, NC*

**Keywords:** Neuroscience Blueprint, History, Resources

**P-108**

*Post-Doctoral Poster Award Competition*

**NEUROTOXICITY OF NANOMATERIALS: RESEARCH NEEDS TO SUPPORT RISK ASSESSMENT.** Powers, CM and Gillespie, PG\*. *Office of Research and Development, National Center for Environmental Assessment, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711 USA; \* Office of Research and Development, National Center for Environmental Assessment, Hazardous Pollutants Assessment Group, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711 USA*

**Keywords:** Nanomaterials, Neurotoxicology, Risk Assessment

**Mentor:** J. Michael Davis