Overview and Theme of NEUROTOX 27  www.neurotoxicology.com

Environmentally Triggered Neurodevelopmental Disorders: Focus on Endocrine Disruption and Sex Differences in Autism, ADHD, and Schizophrenia

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OVERVIEW

The twenty-seventh meeting in this International Neurotoxicology Conference Series (NEUROTOX 27) took place October 30 – November 2, 2011 at the Sheraton Imperial Hotel and Conference Center in Research Triangle Park, North Carolina. It featured the theme, Environmentally Triggered Neurodevelopmental Disorders: Focus on Endocrine Disruption and Sex Differences in Autism, ADHD, and Schizophrenia. Scientists from around the world presented new findings and innovative research in a variety of venues including Plenary Sessions, Symposia, Roundtable Discussion, Platform Sessions, Workshops, Poster Sessions with Pre-doctoral Student and Post-doctoral Trainee Research and Travel Award Competitions, and focused Panel Discussions.

Background on the Conference Series:
The International Neurotoxicology Conference is an annual event that provides an opportunity for presenting new data encompassed by the broad disciplines encompassed by neurotoxicology. Special emphasis is placed on promoting, nurturing and mentoring students and young investigators in the field; networking with experts is facilitated and encouraged. The Neurotoxicology Conference has convened in either Little Rock or Hot Springs, Arkansas, on most occasions. Other cities in which the conference has convened include Chicago (x2), Colorado Springs (x2), Honolulu, Research Triangle Park (x2), San Antonio and Rochester, NY. Each year the conference focuses on a timely theme that is identified by leaders in the field of neurotoxicology.

SIGNIFICANCE OF THE THEME

Theme of NEUROTOX 27 and Innovative Focus: Each conference in the series is devoted to a current, emerging theme that significantly impacts environmental health and for which there is evidence that the science relevant to the theme will be advanced by scientific scrutiny and debate in this established, multidisciplinary format. To ensure cutting-edge science, the conference chair partners with internationally-recognized scientific experts on the chosen theme to co-organize the meeting. This year the meeting focused on two endpoints: (1) endocrine disruption and (2) sex differences in three complex neurodevelopmental disorders: (1) autism, (2) ADHD and (3) schizophrenia. The plenary sessions were structured to present the latest clinical and basic research in a format that facilitated discussion, addressed specific questions (published in the Program) and stimulated transdisciplinary discussions on common factors across all three neurodevelopmental disorders. A wider series of discussions took place on the last day of the conference, when the breadth of the scientific evidence could be viewed holistically.

Significance 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 and physical stimuli, shifts in nutritional status, social deprivation, and medical interventions. The prevalence of autism has increased dramatically, along with 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 at levels of concern in maternal, gestational, and neonatal tissues, breast milk and urine. Our knowledge of how endocrine signals influence neurodevelopment has advanced significantly over the last five years, and presentations on the current state of the science served as a framework for the conference. The consequences of endocrine disruption during critical periods of neurodevelopment have far-reaching implications and were made the focus of the conference. The sessions presented the latest evidence and controversies linking endocrine disruption and altered neurodevelopment, particularly in the context of 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 conference was designed to present attendees with the latest state of the science about the role of the endocrine system in environmentally triggered disorders.

**Theo Colborn Award:**
The Theo Colborn Award, presented by Linda Birnbaum, Ph.D., D.A.B.T., A.T.S., Director of the National Institute for Environmental Health Sciences/NIH, was given to Dr. Theo Colborn during the annual awards banquet on Tuesday, November 1, 2011. Dr. Colborn was recognized “In gratitude, for legions of children not yet born, but because of you, shielded from harm” by the Neurotoxicology scientific community. Dr. Bernard Weiss hosted “Conversation with Theo” in which they discussed the progression of Neurotoxicology over the years and the hope for the future.

**SPECIFIC AIMS**
The specific aims of NEUROTOX 27 were to:

**Aim 1.** Convene international experts and other established and new researchers to present, discuss and evaluate the most recent research data and information related to “Environmentally Triggered Neurodevelopmental Disorders” with the focus on Endocrine Interactions and Sex Differences as Common Factors in Autism, ADHD and Schizophrenia

**Aim 2.** Encourage and enhance communication, understanding and collaboration between basic scientists, practicing clinicians, clinical researchers, epidemiologists, stakeholders, special interest groups, risk assessors and others working to further our understanding of all aspects of environmentally triggered neurodevelopmental disorders, with the focus on autism, ADHD, and schizophrenia.

**Aim 3.** Organize the conference participants, tutorials, invited and free presentations, discussions, debates, demonstrations and interactions to document major new research advances, facilitate identification of specific research gaps, formulate hypotheses and potential experimental designs to answer questions listed in the program.

**Aim 4.** Facilitate interdisciplinary collaboration of practitioners and scientist/investigators to help foster or initiate new multidisciplinary research approaches necessary to advance the science related to the theme.

**Aim 5.** Include promising young scientists and investigators from other fields as invited speakers in order to promote and foster new researchers in the field. To provide opportunity for late breaking research to be presented by holding open platform time for speakers to be chosen from submitted abstracts.

**Aim 6.** Organize a special student session devoted to – and co-organized by – students, post-docs and young investigators and provide opportunities for young or new investigators to network with more senior or established scientists and leaders in the field. To provide an informal more casual, conversational venue during the poster session, noon Brown Bag Lunch Conversation, and special student session to facilitate this goal.

**Aim 7.** Rapidly peer-review and disseminate findings to the scientific community. All presenters were invited to submit original research papers of new data presented at the conference as well as Commentaries, Reviews or Mini-Reviews of recent findings related to specific topics discussed at the conference. Papers are peer-reviewed and once accepted papers are published in less than one year in a special issue of Neurotoxicology, an international scientific journal that is widely disseminated, indexed, abstracted and available online. The Guest Editors of the special issue of Neurotoxicology devoted to NEUROTOX 27 will be the Conference Organizers (Drs. Pessah, Lein, Zoeller, Schantz, Seegal and Cranmer). This Specific Aim has
been accomplished for each of the previous 26 conferences in this series (see Appendix 6 “List of Publications Resulting from the International Neurotoxicology Conference Series (1982 - 2011).

ACKNOWLEDGMENT OF SPONSORS

A full page Sponsor Listing and a full-page Logo Display of the Sponsors is included in this Special Issue. The generous support of those who made this international conference possible is gratefully acknowledged:

**Sponsors - Diamond Level:**
- National Institute of Environmental Health Sciences/NIH (1R13 ES021146-01)
- NIH Office of the Director/NIH CounterACT Program
- NIH/NIMH/Office of Autism Research Coordination
- Autism Research Institute
- Environmental and Occupational Health Sciences Institute/UMDNJ & Rutgers University
- EPA/ORD/National Center for Environmental Assessment (EP-11-H-001667)
- CDC/Agency for Toxic Substances and Disease Registry
- Elsevier – Publisher of NeuroToxicology
- Environmental Health Perspectives

**Sponsors - Platinum Level:**
- Superfund Research Program/UC Davis (3 P42 ES004699-24S2)
- Autism Society
- March of Dimes (4-FY11-547)
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- Autism Speaks
- Arkansas Children’s Hospital

**Sponsors - Gold Level:**
- Charles River DDS – Argus Division
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- NIH/National Institute of Child Health and Human Development
- Morris and Joan Cranmer

**Sponsors - Silver Level:**
- Society of Toxicology
- INND/Toxipedia

**Educational Partner:**
- University of Arkansas for Medical Sciences

27TH INTERNATIONAL NEUROTOXICOLOGY CONFERENCE

ACKNOWLEDGMENT OF SESSION CHAIRS AND STAFF

We, the Conference Co-Chairs, especially would like to recognize the Session Co-Chairs for serving as stimulating session chairs and discussion leaders, delivering an exemplary research presentation and formulating topics for discussion.

**Session Chairs and Planners:** Tomas Guilarte, David Jett, Susan Makris, Susan Schantz, Richard Seegal, J. Thomas Zoeller.

**Session Leaders and Advisors:** Aaron Bowman, Will Boyes, Susan Daniels, Randi Hagerman, Alycia Halladay, G. Jean Harry, Martha Herbert, Jill James, Anumantha Kanthasamy, Prasada Kodavanti, Cindy Lawler, Elise Miller, Jason Richardson, Tim Shafer, Edwin van Wijngaarden, Bernard Weiss, Mary Ann Wilson.

**Conference Staff and Editorial Assistant:** On behalf of all Conference participants we extend our heartfelt thanks and appreciation to the talented individuals who worked diligently before, during and after this meeting to insure that everything ran smoothly and all details were attended to. These dedicated and hard-working individuals are Leslie Lang (Conference Administrator), Jackie Jagers (Associate Director of Continuing Medical Education, Arkansas Children’s Hospital), and Alycia Buford-Penn (Vanderbilt University).

**STUDENT AWARDS**

Special emphasis was placed on nurturing, recognizing and rewarding pre- and post-doctoral students and young investigators. Twenty-nine poster abstracts were entered in the Student Award Competition. Abstracts were divided into two groups by category with sixteen posters in the Post-Doctoral group and thirteen in the Pre-Doctoral group. Each group was judged separately. First, second & third place winners were selected from the Post-Doctoral group and there was a tie for first place winners chosen from the Pre-Doctoral group. A total of 5 students received awards as follows: 1st Place Winners received an engraved award plaque, $500.00, a 1-year subscription to NeuroToxicology provided by Elsevier, and the peer-reviewed Special Issue from the 26th International Neurotoxicology Conference entitled: *Unifying Mechanisms of Neurological Disorders: Scientific, Translational, and Clinical Implications*. The 2nd Place Winner Received: a certificate, $300.00, a 1-year subscription to NeuroToxicology provided by Elsevier, and the Special Issue from the 26th International Neurotoxicology Conference.
Neurotoxicology Conference entitled: Unifying Mechanisms of Neurological Disorders: Scientific, Translational, and Clinical Implications. The 3rd Place Winner: Received a certificate, $200.00, a 1-year subscription to NeuroToxicology provided by Elsevier, and the Special Issue from the 26th International Neurotoxicology Conference entitled: Unifying Mechanisms of Neurological Disorders: Scientific, Translational, and Clinical Implications. All participants were enriched by the close networking and collegial atmosphere among students, judges, poster presenters and conference attendees.

Judges for Postdoctoral and Predoctoral Awards. Drs. Anumantha Kanthasamy and Will Boyes did an outstanding job as the overall organizers and co-chairs of the Student Award competition. There were two sets of specialty judges for the two different categories so competition was even for all students. The judges for the two groups were as follows: the Post-doctoral Award Committee was broken into two sub-groups: (A) Drs. Anumantha Kanthasamy (chair), Jamie DeWitt, and Christine Curran. (B) Drs. Judy Van de Water (chair), Ed Levin and Janice Juraska. The Pre-Doctoral Award Committee was broken into two sub-groups: (A) Drs. Will Boyes (chair), Sarah Blossom, and Brenda Eskanazi. (B) Drs. David Jett (chair), Aaron Bowman and Rebecca Knickmeyer. Thanks to the judges for their expert efforts on behalf of the students!

Post-Doctoral Poster Award Competition Winners

Post-Doctoral 1st Place Award Winner: Sarah Short, PhD – Title: “Prenatal Influenza Infection Impacts Offspring Brain Development: Diffusion Tensor Imaging of White Matter in the Rhesus Monkey.” Mentor: John H. Gilmore, PhD, Department of Psychiatry, School of Medicine, University of North Carolina, Chapel Hill, NC.

Post-Doctoral 2nd Place Award Winner: Mamta Behl, PhD – Title: “Effects of Developmental Exposure to 3, 3’, 4, 4’-Tetrachloroazobenzene and T4 Deficits on Neurobehavior and Hippocampal Morphology in Sprague-Dawley Rats.” Mentors: Jean Harry & Michelle Hooth, National Institute of Environmental Health Sciences, Research Triangle Park, NC

Post-Doctoral 3rd Place Award Winner: Adam Dziorny, PhD – Title: “Auditory Processing in Offspring of Mothers who Consumed a Pregnancy Diet High in Fish.” Mentor: Philip Davidson, PhD, Department of Environmental Medicine, University of Rochester School of Medicine, Rochester, NY, USA

Pre-Doctoral Competition Poster Award Winners

Pre-Doctoral Award 1st Place Winner: Megan Culbreth - Title: “Comparison of Chemical-Induced Changes in Proliferation and Apoptosis in Human and Mouse Neuroprogenitor Cells.” Mentor: Tim Shafer, PhD, NHEERL, US EPA, RTP, NC.

Pre-Doctoral Award 2nd Place Winner: Marjannie Eloi - Title: “Differential Immune Responses to the Environmental Toxicant, BDE-49 in Children with Autism Spectrum Disorders.” Mentor: Judy Van de Water, PhD, University of California, Davis

Pre-Doctoral Award 3rd Place Winner: Christopher McPherson - Title: “Potential Contribution of Resident Microglia During Chemical Injury-Induced Neurogenesis.” Mentor: Jean Harry, PhD, Neurotoxicology Group, NIEHS/NIH, RTP, NC, USA.

Trainee Travel Award: Travel Awards to attend the 27th International Neurotoxicology Conference (NEUROTOX 27) were provided to the selected pre-doctoral students or post-doctoral trainees who presented their own research in a poster presentation at the meeting. Recipients were selected by the NEUROTOX 27 Travel Awards Committee. Criteria: The applicant has submitted an abstract for NEUROTOX 27 and checked the box indicating that it is for the Pre-Doctoral Student or Post-Doctoral Trainee Travel Award Competition. The abstract was judged for its quality and relevance to neurotoxicology; The applicant was currently a pre-doctoral student or a post-doctoral trainee; The applicant submitted a 1-page personal statement indicating his or her Rationale for attending NEUROTOX 27, Relevance of his or her work to neurotoxicology, Need for funding, and How attendance at the meeting will contribute to his or her long-term career goals; An applicant may receive travel award funding only once; An applicant may receive both a Travel Award and Poster Award for the same conference. Judges for Trainee Travel Awards: Drs. G. Jean Harry (chair), Aaron Bowman, Anumantha Kanthasamy, & Jason Richardson.

Trainee Travel Award Winners

Post-Doctoral

Asad A. Aboud, MD - Title: “Neuroprogenitors Differentiated From Park2 Mutant Stem Cells Exhibit Altered Sensitivity to Neurotoxic Metals.” Mentor: Aaron Bowman, PhD, Vanderbilt University Medical Center, Dept. of Neurology, Nashville TN

Pre-Doctoral

Marjannie Eloi - Title: “Differential Immune Responses to the Environmental Toxicant, BDE-49 in Children with Autism Spectrum Disorders.” Mentor: Judy Van de Water, PhD, ¹School of Medicine, University of California, Davis

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Congratulations to all the winners!

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PHOTOS FROM 27TH NEUROTOXICOLOGY CONFERENCE AWARDS BANQUET HONORING THEO COLBORN, PH.D.

Clockwise from Left: Joan M. Cranmer, Ph.D., Theo Colborn, Ph.D., and Bernard Weiss, Ph.D. Top: Linda Birnbaum, Ph.D., and Theo Colborn, Ph.D. Bottom: Theo Colborn, Ph.D. and Bernard Weiss, Ph.D. during “Conversations with Theo.”