53rd Annual Meeting and ToxExpo™
Phoenix, Arizona
March 23–27, 2014
Dear Colleagues:

It is my pleasure to invite you to attend SOT’s 53rd Annual Meeting, March 23–27, 2014, at the Phoenix Convention Center in Phoenix, Arizona. The Annual Meeting provides opportunities to learn from your colleagues about their latest scientific achievements in the field of toxicology and related disciplines as well as from Nobel laureates and other distinguished leaders who will expand your scientific horizons. In addition, the SOT Annual Meeting provides a venue for you to share your year’s work. For the science of toxicology, this is the premier meeting that shouldn’t be missed.

Ample networking time allows Annual Meeting attendees to meet potential collaborators and mentors, and with increasing attendance from scientists around the world, those interactions can take on a global scope. The Annual Meeting also offers a chance to pause to pay tribute to those scientists who have distinguished themselves in their field of expertise as the recipients of the Society’s most prestigious awards. I’m sure that all attendees also look forward to enjoying the company of friends and colleagues.

Finally, SOT attendees can take advantage of the ToxExpo, which is the world’s largest exposition of its kind. Hundreds of exhibits offer a comprehensive marketplace for product information and cutting-edge technology.

The SOT Annual Meeting is the premier event that the Society hosts every year to meet the needs of the entire toxicology community. Please join me in Phoenix for this meeting and help us to make the SOT 53rd Annual Meeting an event to remember.

Sincerely,

Lois D. Lehman-McKeeman, PhD, ATS
2013–2014 SOT President
Contents

Direct Connection—SOT QR Codes.........................................................2
Preliminary Program Content Reference..............................................5
Scientific Program Overview................................................................6
Thematic Approach Index.....................................................................10
SOT Affiliates .......................................................................................12
Your Invitation to Attend ....................................................................13
ToxExpo ...............................................................................................14
An Invitation to International Attendees.............................................14
SOT Headquarters Staff Contacts ......................................................15

General Information
Accessibility for Persons with Disabilities........................................15
Attire .................................................................................................15
Badge ...............................................................................................15
Child Care Services ...........................................................................15
Green in Phoenix ..............................................................................16
Guest/Spouse Hospitality Room ......................................................16
Housing Information .........................................................................17
Hotel Reservation Information .........................................................17
Room-Share Program .......................................................................17
Hotel Accommodations ...................................................................18
Hotel Map ........................................................................................20
Hotel Services ..................................................................................21
Golf and Spa Post-Meeting Trip ......................................................17
Internet Access at the Convention Center .......................................22
Media Support Services ....................................................................22
Meeting Requests: Hospitality Suites and Ancillary Meetings .......22
Networking Time ..............................................................................22
Phoenix Convention Center ............................................................22
Phoenix General Information ..........................................................22
Poster Displays ................................................................................24
Satellite Meetings .............................................................................27
SOT Pavilion .....................................................................................27
Supporting Opportunities ..................................................................27
Tours ...............................................................................................28
The Toxicologist and Annual Meeting Program .............................26
Transportation ..................................................................................28
Weather ...........................................................................................30

Registration
Online Registration ...........................................................................32
Mail or Fax Registration ...................................................................32
Registration Materials ........................................................................32
Registration Guidelines .....................................................................32
Registration Form ............................................................................33, 35

Preliminary Program
53rd Annual Meeting and ToxExpo
March 23–27, 2014

Career Resource and Development Services
Career Resource and Development Services .................................39

Special Events
Awards Ceremony (2014 Award Recipients)....................................40
Recognition and Special Events .....................................................43
Student and Postdoctoral Scholar Events .....................................45
Education Outreach Activities and Events .....................................47
RC, SIG, and SS Receptions ............................................................50

Continuing Education
Continuing Education Courses .......................................................55

Scientific Sessions
Plenary Opening Lecture .................................................................65
Featured Sessions ............................................................................65
Symposia .........................................................................................70
Workshops .......................................................................................84
Roundtables ....................................................................................102
Historical Highlight .........................................................................104
Informational Sessions ....................................................................106
Education-Career Development Sessions ....................................109
Regional Interest Session ...............................................................112

ToxExpo Exhibitors
2014 ToxExpo Exhibitor Listing ......................................................116
Exhibitor-Hosted Sessions ..............................................................118

Support
2014 Annual Meeting Supporters .................................................128, Inside Back Cover
Support Opportunities .....................................................................128

Important Program Changes This Year!
In an effort to conserve resources, the printed Program will be mailed
ONLY by request and may include a shipping fee. Use the new and
enhanced 2014 mobile event app or the online event website to plan your
schedule to make the most of your time at the Annual Meeting (available

Registration Express
Register by January 31, 2014, with full payment and you’ll receive
your name badge and tickets in the mail before the meeting.
Scan these QR (Quick Response) codes with your smartphone or mobile device to access the information or services directly. The codes can be decoded by most camera-equipped smartphones or devices with a free downloadable application or reader, thereby offering a direct link to the latest and greatest SOT Annual Meeting information and services on the Internet. Access the latest meeting information at www.toxicology.org/2014.

**SOT Website**
The SOT website is the portal to all SOT information and services.
This year we are happy to announce that we are again providing you, our guests, with a new and enhanced mobile event app. This app offers you multiplatform mobile solutions for the SOT Annual Meeting and ToxExpo, provided free of charge to attendees and exhibitors. The mobile event app will be available late January via the SOT website and app marketplaces. Attendees also can access the website version of the app to access meeting resources and plan their schedule.

**SOT 2014 Annual Meeting**
The SOT 2014 Annual Meeting website contains all the essentials for your Annual Meeting experience, including a wide range of general information and tips for those attending, registration and housing specifics, scientific programs, special events, abstract submission guidelines, awards and fellowship information, and career services. Almost any question concerning the meeting has an answer here!

**Phoenix Travel Website**
Your one-stop website for complete Phoenix area information including where to eat, what to do, and where to shop. Use the website to find transportation information, to purchase tickets to local attractions, and to make restaurant reservations.

**SOT Housing Reservation**
Access the easy-to-use Online Housing Reservation System and receive discounted rates negotiated by SOT at various Phoenix hotels—known as the SOT hotel room block. Your patronage of these official meeting hotels makes it possible for SOT to secure the space necessary for this event at a greatly reduced cost.

**SOT Online Registration**
SOT members and nonmembers are invited to register for the SOT 2014 Annual Meeting using SOT’s Online Registration System. The system is designed for those who would like a simple and speedy method for paying their registration fee by credit card.

**Job Bank**
The SOT Annual Meeting, with over 6,500 attendees including top toxicologists, early career scientists, and toxicology-related employers, is the best place to make your connection. Whether you are looking for a position or searching for the right candidate, the SOT online Job Bank prepares you to take full advantage of the on-site Job Bank Center in Phoenix.

**Mentor Match**
The Society of Toxicology recognizes the importance of mentoring in the scientific and professional development of its members. The SOT Annual Meeting provides a great opportunity for the mentor and mentee to meet in person. We strongly encourage members of the Society to visit the Mentor Match site and register online as mentors and/or mentees.

**ToXchange**
Communicate, connect, and collaborate with colleagues via ToXchange, the professional, secure SOT member network. Access the mobile option with your iPad, tablet, or smartphone.
Dear Colleagues,

On behalf of the Scientific Program Committee and the Society of Toxicology, I would like to invite you to join us at our 53rd Annual Meeting, to be held March 23–27, 2014, at the Phoenix Convention Center in Phoenix, Arizona.

As always, it is our goal to construct a program that reflects the best science as well as the breadth of interests across the SOT membership. We believe that the 2014 symposia, roundtables, workshops, and other special sessions are timely and highly informative and span a broad spectrum of topics to meet the diversity of our membership.

We are very pleased to confirm the participation of Sir John B. Gurdon as the Plenary Opening Lecturer. Dr. Gurdon, currently a Distinguished Group Leader in the Wellcome Trust/CRUK Gurdon Institute in Cambridge, United Kingdom, was one of the recipients of the 2012 Nobel Prize in Physiology or Medicine. He has been recognized for his important discovery that mature cells can be reprogrammed to become pluripotent. His research on pluripotent cells is most timely and relevant to the mechanisms of toxicity and disease etiology, and we look forward to a stimulating scientific Plenary Lecture to open the meeting.

In addition to the diverse scientific sessions, the meeting will feature lectures from the recipients of distinguished Society Awards. These include the Merit and Distinguished Toxicology Scholar Awards reflecting sustained contributions in toxicology, along with the Translational Impact and Leading Edge in Basic Science Awards, which will highlight significant contributions that impact toxicology and contribute to enhancing human health. Also featured will be the Frontiers for Toxicology Symposium on "Noncoding RNAs in Human Health, Therapeutics, and Environmental Disease." Although a busy scientific program, this year's meeting has been organized to dedicate some time for networking with colleagues, an important adjunct to the outstanding scientific content.

We are very excited about our first meeting held in Phoenix, located in what has been termed the “Valley of the Sun.” Phoenix is a city filled with culturally significant art, history, museums, and many resorts for those who may wish to extend their trip beyond our Annual Meeting. The convention center is conveniently located in downtown Phoenix.

In addition to the 2,300+ abstracts currently scheduled to be presented during the Annual Meeting, interested participants are welcome to submit abstracts for a second and final submission period, December 2, 2013, through January 6, 2014. Due to the extenuating circumstances surrounding the first abstract submission deadline, for this year only, abstracts accepted during this final submission period will be integrated into the regular program sessions, Monday, March 24 through Thursday, March 27, 2014. These abstracts will be included in the printed copy of The Toxicologist. Abstracts submitted during the second and final submission period should be uploaded online at www.toxicology.org. We look forward to welcoming you to Phoenix, Arizona.

Warmest regards,

Norbert E. Kaminski, PhD
SOT Vice President and
Scientific Program Committee Chairperson, 2013–2014
2014 Past Presidents’ 5k Fun Run/Walk
“People who get together to sweat together, stay together!”
– Jay Goodman, SOT Past President

Tuesday, March 25, 2014
6:30 AM
Steele Indian School Park
Please see page 44 for more details.

Some Phoenix photos are courtesy of Greater Phoenix Convention & Visitors Bureau unless otherwise noted. Some photos by Jill Richards.
Preliminary Program Content Reference

Maximize the value of your Annual Meeting attendance by familiarizing yourself with this reference guide for the Preliminary Program.

**Preliminary Program Overview**

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Program Overview</td>
<td>This reference lists the Annual Meeting sessions and their scheduled dates and times, including Symposia, Workshops, and Roundtables, special lectures, and Platform and Poster Presentations. Please note that detailed information for many of these sessions will not be available until the final Program is published.</td>
</tr>
<tr>
<td>Thematic Session Index</td>
<td>Each of the Annual Meeting sessions highlighted within the five themes are listed. Throughout the Preliminary Program, each of the scientific sessions tracked within a theme is identified by a symbol, including Continuing Education (CE) courses. For the 53rd Annual Meeting the Society will highlight 93 Thematic Sessions and CE courses.</td>
</tr>
<tr>
<td>Special Events</td>
<td>The Award pages announce your colleagues who have been awarded a prestigious SOT award in recognition of their accomplishments in the field of toxicology. The 53rd Annual Meeting Recognition and Social Events details are provided. The Regional Chapter, Special Interest Group, and Specialty Section reception schedules are included in this section. The Student Events listing, including the Student/Postdoc Scholar Mixer and In Vitro Toxicology Lecture and Luncheon, are listed. This section also highlights several scientific and career development sessions of particular interest to the SOT Student and Postdoctoral membership. A special highlight in this section includes the Educational Outreach initiatives undertaken each year at the Annual Meeting, including the Undergraduate Education Program.</td>
</tr>
<tr>
<td>Continuing Education Courses</td>
<td>These pages list the 2014 CE course descriptions and presenter information. These courses have separate registration fees. Each participant in a CE course will receive a copy of the course booklet. These are available for sale to noncourse registrants on-site at the meeting, while supplies last.</td>
</tr>
<tr>
<td>Featured Sessions</td>
<td>This section lists the keynote and other special lectures and sessions for the 2014 Annual Meeting. Detailed information for these sessions will be available in the final Program.</td>
</tr>
<tr>
<td>Scientific Courses</td>
<td>The Preliminary Program layout is similar to that of the final Program. Specifically, this section lists the scientific sessions in date, time, and alphabetical order for Symposia, Workshops, Roundtables, Historical Highlight, Informational, Education-Career Development, and finally the Regional Interest sessions.</td>
</tr>
<tr>
<td>Exhibits</td>
<td>ToxExpo is the profession’s largest trade show and best resource for the latest information in technology, equipment, and services. This section contains the current list of exhibiting companies and Exhibitor-Hosted sessions.</td>
</tr>
</tbody>
</table>

**Session Types**

- **Education-Career Development Sessions (80 minutes)**—Sessions that provide tools and resources to toxicologists that will enhance their professional and scientific development (page 109).
- **Exhibitor-Hosted Sessions (60 minutes)**—Informative sessions developed by an exhibiting company (page 118).
- **Featured Sessions (50–165 minutes)**—Keynote and other special lectures (page 65).
- **Historical Highlight Sessions (80 minutes)**—Sessions that provide a review of a historical body of science that has impacted toxicology (page 104).
- **Informational Sessions (80 minutes)**—These present the latest science in toxicology or other learning opportunities that address the professional interests and needs of toxicologists in the areas of career development, general information, and planned scientific activities and are not based on the outcome of scientific research (page 106).
- **Platform Sessions (165 minutes)**—Oral presentations that cover new areas, concepts, or data (see details in the final Program).
- **Poster Sessions (180–210 minutes)**—Topic-specific presentations that cover new areas, concepts, or data (see details in the final Program).
- **Regional Interest Sessions (165 minutes)**—Central topics of relevance that describe public health and/or ecological problems related to the region (page 112).
- **Roundtable Sessions (80 minutes)**—These provide an overview of controversial subjects, followed by questions and discussion (page 102).
- **Symposium Sessions (165 minutes)**—Cutting-edge science, emphasizing new areas, concepts, and data (page 70).
- **Thematic Sessions (45–225 minutes)**—Timely topics of relevance to toxicology (check the specific session type).
- **Workshop Sessions (165 minutes)**—Generally accepted, state-of-the-art knowledge in toxicology in informal interactive presentations with ample time for discussion (page 84).

*Poster sessions that occur on Monday morning will be programmed for 180 minutes. The remaining poster sessions, including those on Monday afternoon, will be programmed for 210 minutes.*

Use the new and enhanced 2014 mobile event app or the online event website to plan your schedule to make the most of your time at the Annual Meeting (available in January). See page 37 for details.
Monday, March 24

8:00 AM to 9:00 AM

PLENARY OPENING LECTURE

The Origins and Future of Pluripotency and Cellular Reprogramming

Lecturer: John B. Gurdon, University of Cambridge

9:15 AM to 12:00 Noon

SYMPOSIUM SESSIONS

- Air Pollution and Cardiovascular Effects: Mechanisms and Role of Lipid Peroxidation
- Carbon Nanotubes Are Toxic in Experimental Models: What’s Next, Who’s Being Exposed, and Should We Be Concerned?
- Computational Approaches to Predict Repeat-Dose Toxicity: Lessons Learned from Cosmetic Ingredients
- Induced Human Pluripotent Stem Cells and Their Differentiated Progeny Cells: Implementation in Toxicity Testing
- Methylmercury’s Modes of Action: New Approaches to Understanding an Old Problem
- To Bug or Not to Bug the Immune System: Benefits and Consequences of Altering the Microbiome

WORKSHOP SESSIONS

- Developmental Programming of Hepatic Metabolism: Assessing the Impact of Perinatal Exposure to Xenobiotics
- New Concerns and New Science Addressing Environmental Asbestos Exposures

PLATFORM SESSION

- Enhancing Strategies for Pesticide Risk Assessment

9:30 AM to 12:30 PM

POSTER SESSIONS

- Alternatives to Mammalian Models I
- Autoimmunity/Hypersensitivity
- Biological Modeling
- Biomarkers I
- Carcinogenesis I
- Cell Death/Apoptosis
- Developmental Toxicology: Mammalian Models
- Developmental Toxicology: Nonmammalian Models
- Epidemiology
- Food Toxicology/Nutrition
- Neurotoxicity: General
- Safety Assessment: Drug Development I

12:10 PM to 1:30 PM

ROUNDTABLE SESSION

- Environmental Factors in Dysregulation of Puberty Timing and Progression

INFORMATIONAL SESSION

- Nonrodents Can Be Monitored, Too... Characterization of Novel Biomarkers of Drug-Induced Kidney Injury (DIKI) in Rats, Canines, Nonhuman Primates, and Humans

EDUCATION–CAREER DEVELOPMENT SESSION

- The Role of Consultants in the Science and Practice of Safety Assessment

12:30 PM to 1:20 PM

MERIT AWARD LECTURE

Lecturer: Jay I. Goodman, Michigan State University
1:00 PM to 4:30 PM
POSTER SESSIONS
- Biotransformation/Cytochrome P450
- Cardiovascular Toxicity and Hemodynamics
- Chemical and Biological Weapons
- Computational Toxicology and Data Integration I
- Ecotoxicology
- Genetic Toxicity Testing
- Inflammation: Methods and Mechanisms
- Nanotoxicology: General and Carbon-Based
- Pesticide Exposure, Toxicology, and Risk Assessment
- Pharmacogenomics and Genetic Polymorphisms
- Regulation and Policy
- Risk Assessment I
- Systems Biology and Toxicology

1:30 PM to 2:30 PM
FEATURED SESSION
A Conversation with the Director of NIEHS: Dr. Linda S. Birnbaum

2:00 PM to 4:45 PM
SYMPOSIUM SESSIONS
- Adverse Outcome Pathways As an Integrative Framework for Predictive Toxicology: Combining Top-Down and Bottom-Up Thinking
- Is Neuroimmune Crosstalk Important to Neurotoxicology? Critical Insight from Animal and Human Studies
- Perinatal Exposures and Children’s Health Outcomes
- The Emerging Role of Mitochondrial Turnover, Biogenesis, and Dynamics in Tissue Injury
- Use of Stem Cells in Toxicity Testing—From Basic Research to Personalized Toxicology

WORKSHOP SESSION
- Skeptically Re-Examining the Limits of Toxicology Evidence in the Courtroom

EDUCATION-CAREER DEVELOPMENT SESSION
- Scientific Ethics in Research and Publications

4:45 PM to 6:00 PM
SOT/EUROTOX DEBATE
- Are Nonmonotonic Dose-Responses at Low Dose Levels Toxicologically Relevant?

Tuesday, March 25
8:00 AM to 8:50 AM
LEADING EDGE IN BASIC SCIENCE AWARD LECTURE
Lecturer: Vishal S. Vaidya, Harvard Medical School

9:00 AM to 11:45 AM
SPECIAL SYMPOSIUM
Frontiers for Toxicology Session: Noncoding RNAs in Human Health, Therapeutics, and Environmental Disease
1. John Mattick
2. Muller Fabbri
3. Caroline Lee
4. Joshua Mendell

SYMPHOSUM SESSIONS
- Does This Chemical Make My Liver Look Fat? (Environmental Exposures and Steatosis)
- Ocular Immunotoxicology: A Privileged View

WORKSHOP SESSIONS
- Application of the Adverse Outcome Pathway (AOP) Concept to Neurotoxicology: A Challenging Approach
- Idiosyncrasies of Cells in Culture: Lessons from Genetic Toxicology
- Photosafety Evaluation of Pharmaceuticals without Testing in Animals
- Stem Cell-Derived Cardiomyocytes: An Alternative Cardiac Toxicity Model for Assessing Drug Safety and Chemical Health Risk
- The Doorway between Exposure and Response: How Biologically-Based Inhalation Dosimetry Models Enhance Human Health Risk Assessment

9:30 AM to 4:30 PM
RESEARCH FUNDING SESSION
Research Funding Information Room

1:00 PM to 4:30 PM
POSTER SESSIONS
- Alternatives to Mammalian Models II
- Children’s Health and Juvenile Toxicity
- Clinical and Translational Toxicology
- Endocrine Toxicology
- Epigenetics
- Gene Regulation and Signal Transduction I
- Inflammation in Disease
- Medical Devices
- Nanotoxicology: Metals, Environmental, and In Silico
- Natural Products: In Vitro
- Natural Products: In Vivo
- New Science on Neurodegenerative Disease
- Pharmacokinetics and Disposition
- Toxicity of Chemical Mixtures

12:00 Noon to 1:30 PM
RESEARCH FUNDING SESSION
Brown Bag Luncheon

NETWORKING TIME
1:00 PM to 4:30 PM
POSTER SESSIONS
- Arsenic
- Carcinogenesis II
- Cardiovascular Toxicity and Hemodynamics: An In Vitro Approach
- Developmental Neurotoxicity I: Mechanisms, Metals, and Industrial Chemicals
- Inhalants and Cardiopulmonary: Agents and Methods
- Inhalants and Cardiopulmonary: PM, Ozone, and Diesel Exhaust
- Liver
- Metal Neurotoxicity I: Mn
- Metal Neurotoxicity II: MeHg and Other Metals
- Metals I: Zn, Cd, Hg
- Metals II
- Receptors

(continued on next page)
1:30 PM to 4:15 PM

WORKSHOP SESSIONS

- Addressing Uncertainties of the Toxicology of Nanomaterials in Food and Food Contact Products
- Challenges Facing the Next Generation of Risk Assessment
- Contribution of Nonimmune Cells to Adverse Immune Responses: Implications for Toxicology
- Developmental Toxicity from Chemical Mixtures: Research to Application in Susceptible Populations
- Somatic Cell Therapy—Paradigms for Investigational New Drug (IND)-Enabling Programs, Scientific and Regulatory Considerations, and Clinical Translation
- The Promise of Translational Imaging in Nonclinical Safety Assessment
- The Role of Toxicology in Undergraduate STEM Education Reform

4:30 PM to 6:00 PM

SOT ANNUAL BUSINESS MEETING

Wednesday, March 26

8:00 AM to 9:00 AM

KEYNOTE MEDICAL RESEARCH COUNCIL (MRC) LECTURE

Guiding Signals through Anchored Enzyme Complexes: Implications for Disease

Lecturer: John D. Scott, Howard Hughes Medical Institute, Department of Pharmacology, University of Washington

9:00 AM to 11:45 AM

SYMPOSIUM SESSION

- In Vitro Microphysiological Systems: Advancing Regulatory Science through Innovation.
- Mechanisms of Metal-Induced Disruption of DNA Repair
- Molecular Mechanisms Involved in Neuro/Glial Toxicity: From Oxidative Stress to Redox Signal Transduction
- The Role of the AHR in Stem Cell Development and Lineage Specification
- Three Dimensions of Nanomaterial Pulmonary Toxicity: Innate Immunity, TLRs, and Inflammasomes

9:00 AM to 12:30 PM

POSTER SESSIONS

- Biomarkers II
- Carcinogenesis III
- Developmental Basis of Adult Disease
- Developmental Neurotoxicity II: New Methods, Persistent Chemicals, and Flame Retardants
- Developmental Neurotoxicity III: Pesticides, Food, and Drugs
- Education, Ethical, Legal, and Social Issues
- Exposure Assessment and Biomonitoring
- Gene Regulation and Signal Transduction II
- Nonpharmaceuticals: Safety Evaluation
- Reproductive Toxicology: Male
- Safety Assessment: Drug Development II
- Safety Assessment: Pharmaceutical Drug Discovery

9:30 AM to 4:30 PM

RESEARCH FUNDING SESSION

Research Funding Information Room

12:00 Noon to 1:20 PM

ROUNDTABLE SESSION

- Hydraulic Fracturing: Are There Worker Health Issues?

INFORMATIONAL SESSION

- Understanding the Implications of Breastfed Infant Exposures to POPs: How Can We Do Better?

EDUCATION-CAREER DEVELOPMENT SESSION

- Training and Continuing Education for the “Total Toxicologist”: How Do We Optimize Training and Educational Opportunities for Different Job Sectors?

12:30 PM to 1:20 PM

DISTINGUISHED TOXICOLOGY SCHOLAR AWARD LECTURE

Lecturer: Richard E. Peterson, University of Wisconsin Madison

View featured speaker bios, connect with other attendees, and create your own schedule using the new and enhanced 2014 event mobile app or the event website—available from the SOT website in January.
1:00 PM to 4:30 PM
POSTER SESSIONS
- Genotoxicity Mechanisms
- Immunotoxicity
- Kidney
- Liver and Models
- Nanotoxicology: In Vitro
- Nanotoxicology: In Vivo
- Neurotoxicity: Pesticides
- Oxidative Injury and Redox Biology
- Risk Assessment II
- Stem Cell Biology and Toxicology

1:30 PM to 4:15 PM
SYMPOSIUM SESSION
- Exploring the Interface between Air Pollution and Metabolic Syndrome: The Bittersweet Dilemma

WORKSHOP SESSIONS
- Advances in the Application of Imaging Technologies to Developmental Toxicology
- Beyond hERG: Novel Cardiovascular De-Risking Strategies and Their Regulatory Acceptance
- Communication and Engagement with the Public about Toxicology in a World That Misunderstands Science and Scientists: How Do You Make Your Message Relevant and “Sticky”
- Databases Facilitating Systems Biology Approaches to Toxicology?
- Genomics in Toxics Regulation and Litigation in the Era of Whole Genome Sequencing
- Is Manganese-Induced Parkinsonism Mediated via Dopamine Neuron Degeneration or Dysfunction
- Science-Based Preclinical Safety Assessment: Decision Making to Enhance Regulatory Success?

4:30 PM to 5:50 PM
HISTORICAL HIGHLIGHT SESSION
- A History of the 3Rs in Toxicity Testing: From Russell and Burch to 21st Century Toxicology

INFORMATIONAL SESSIONS
- Leadership in Science: Skills and Styles
- Recent Challenges Beyond the Usual Toxicological and Public Health Challenges in Africa

Thursday, March 27
8:30 AM to 12:00 Noon
POSTER SESSIONS
- Animal Models of Disease
- Animal Models: Measurements and Validation
- Animal Models: Methods Development
- Computational Toxicology and Data Integration II
- Metals in the Environment
- Persistent Organic Pollutants
- Reproductive Toxicology: Female
- Risk Assessment III
- Skin

4:30 PM to 5:20 PM
TRANSLATIONAL IMPACT AWARD LECTURE
Lecturer: Timothy D. Phillips, Texas A&M University

9:00 AM to 11:45 AM
SYMPOSIUM SESSIONS
- Clinical Evaluation of Emerging Biomarkers of Drug-Induced Liver Injury
- Neurobehavioral Impacts of Early-Life Manganese Exposure: Linking Human and Animal Model Studies

WORKSHOP SESSIONS
- Are Biofuels More or Less Toxic Than Conventional Fuels and What Are the Implications for Human Exposure and Risk?
- Role of Circulating Factors in Mediating Systemic Toxicity of Inhaled Substances
- The Use of Dogs and Minipigs As an Alternative to the Nonhuman Primate in Nonclinical Safety Assessment of Biopharmaceuticals

REGIONAL INTEREST SESSION
- When the Dust Settles: Exposure Assessment and Health Effects from Dust Exposures in the Arid Southwest

PLATFORM SESSIONS
- Autoimmunity/Hypersensitivity to Environmental Contaminants
- Ozone: Multiple Tissue Endpoints
The Scientific Program Committee has developed a slate of timely and highly informative Symposium Sessions, Workshop Sessions, Roundtable Sessions, and other special sessions that span the spectrum of topics of interest to our diverse membership.

The 2014 scientific themes listed here illustrate the core contributions toxicology makes to these areas, and the sessions that will be highlighted within these themes are indicated.

### Advancing Clinical and Translational Toxicology and Application of Biomarkers
- Biomarkers I—Poster Session
- Biomarkers II—Poster Session
- Clinical Evaluation of Emerging Biomarkers of Drug-Induced Liver Injury—Symposium Session
- Computational and Experimental Aspects of microRNAs in Toxicology—Continuing Education (AM02)
- Clinical and Translational Toxicology—Poster Session
- Developmental Programming of Hepatic Metabolism: Assessing the Impact of Perinatal Exposure to Xenobiotics—Workshop Session
- Developmental Toxicity from Chemical Mixtures: Research to Application in Susceptible Populations—Workshop Session
- Environmental Factors in Dysregulation of Puberty Timing and Progression—Roundtable Session
- Improving the Safety of Dietary Supplements and Natural Health Products by Assessing Effects in Humans—Workshop Session
- Inflammation in Disease—Poster Session

### Enhancing Strategies for Risk Assessment
- Adverse Outcome Pathways As an Integrative Framework for Predictive Toxicology: Combining Top-Down and Bottom-Up Thinking—Symposium Session
- Application of the Adverse Outcome Pathway (AOP) Concept to Neurotoxicology: A Challenging Approach—Workshop Session
- Challenges Facing the Next Generation of Risk Assessment—Workshop Session
- Children’s Health and Juvenile Toxicity—Poster Session
- Computational Approaches to Predict Repeat-Dose Toxicity: Lessons Learned from Cosmetic Ingredients—Symposium Session
- Enhancing Strategies for Pesticide Risk Assessment—Platform Session
- Genomics in Toxics Regulation and Litigation in the Era of Whole Genome Sequencing—Workshop Session
- Methodologies in Human Health Risk Assessment—Continuing Education Course (AM06)
- Risk Assessment I—Poster Session
- Risk Assessment II—Poster Session
- Risk Assessment III—Poster Session
- Risk Assessment of Metals—Platform Session
- The Doorway between Exposure and Response: How Biologically-Based Inhalation Dosimetry Models Enhance Human Health Risk Assessment—Workshop Session
- Understanding Weight of Evidence: Exploring Different Approaches to Integrating Evidence from Diverse Data Streams—Workshop Session

Use the new and enhanced 2014 event mobile app or the event website to plan your schedule using the thematic track option. Navigating sessions for each theme is easy and convenient within this mobile planning tool.
New Science and Perspectives Surrounding Environmental and Occupational Exposures

- Air Pollution and Cardiovascular Effects: Mechanisms and Role of Lipid Peroxidation—Symposium Session
- Are Biofuels More or Less Toxic Than Conventional Fuels and What Are the Implications for Human Exposure and Risk?—Workshop Session
- Carbon Nanotubes Are Toxic in Experimental Models: What’s Next, Who’s Being Exposed, and Should We Be Concerned?—Symposium Session
- Does This Chemical Make My Liver Look Fat? (Environmental Exposures and Steatosis)—Symposium Session
- Epidemiology—Poster Session
- Epidemiology for Toxicologists: What the Numbers Really Mean—Continuing Education Course (PM09)
- Exploring the Interface between Air Pollution and Metabolic Syndrome: The Bittersweet Dilemma—Symposium Session
- Exposure Assessment and Biomonitoring—Poster Session
- Hydraulic Fracturing: Are There Worker Health Issues?—Roundtable Session
- Inhalation Studies: Challenges and Complexities—Continuing Education Course (AM05)

Safety Assessment: Mechanisms and Novel Methods

- Addressing Uncertainties of the Toxicology of Nanomaterials in Food and Food Contact Products—Workshop Session
- Advances in the Application of Imaging Technologies to Developmental Toxicology—Workshop Session
- Beyond hERG: Novel Cardiovascular De-Risking Strategies and Their Regulatory Acceptance—Workshop Session
- Chemical and Biological Weapons—Poster Session
- Combination Products: Toxicology and Regulatory Challenges—Continuing Education Course (SR01)
- Contribution of Nonimmune Cells to Adverse Immune Responses: Implications for Toxicology—Workshop Session
- Current Trends in Genetic Toxicology Testing—Continuing Education Course (AM03)
- Databases Facilitating Systems Biology Approaches to Toxicology—Workshop Session
- Developmental Neurotoxicity I: Mechanisms, Metals, and Industrial Chemicals—Poster Session
- Developmental Neurotoxicity II: New Methods, Persistent Chemicals, and Flame Retardants—Poster Session
- Developmental Neurotoxicity III: Pesticides, Food, and Drugs—Poster Session
- Elucidating Adverse Outcome Pathways (AOPs) for Developmental Toxicity Workshop Session—Continuing Education Course (AM04)
- Idiosyncrasies of Cells in Culture: Lessons from Genetic Toxicology—Workshop Session
- Inflammation: Methods and Mechanisms—Poster Session
- In Vitro Microphysiological Systems: Advancing Regulatory Science through Innovation—Symposium Session
- Kidney—Poster Session
- Mechanisms of Metal-Induced Disruption of DNA Repair—Symposium Session
- Molecular Mechanisms Involved in Neuro/Glial Toxicity: From Oxidative Stress to Redox Signal Transduction—Symposium Session
- Neurotoxicity: Pesticides—Poster Session
- Nonclinical Pediatric Drug Development: Considerations, Study Designs, and Strategies—Continuing Education Course (PM11)
- Ocular Immunotoxicology: A Privileged View—Symposium Session
- Photosafety Evaluation of Pharmaceuticals without Testing in Animals—Workshop Session
- Role of Circulating Factors in Mediating Systemic Toxicity of Inhaled Substances—Workshop Session
- Safety Assessment: Pharmaceutical Drug Discovery—Poster Session
- Science-Based Preclinical Safety Assessment: Decision-Making to Enhance Regulatory Success—Workshop Session
- The Emerging Role of Mitochondrial Turnover, Biogenesis, and Dynamics in Tissue Injury—Symposium Session
- The Promise of Translational Imaging in Nonclinical Safety Assessment—Workshop Session
- The Use of Dogs and Minipigs As an Alternative to the Nonhuman Primate in Nonclinical Safety Assessment of Biopharmaceuticals—Workshop Session

Stem Cell Models for Integrated Biology

- Cardiovascular Toxicity and Hemodynamics: An In Vitro Approach—Poster Session
- Induced Human Pluripotent Stem Cells and Their Differentiated Progeny Cells: Implementation in Toxicity Testing—Symposium Session
- Stem Cell Biology and Toxicology—Poster Session
- Stem Cell-Derived Cardiomyocytes: An Alternative Cardiac Toxicity Model for Assessing Drug Safety and Chemical Health Risk—Workshop Session
- Stem Cells in Toxicology—Continuing Education Course (PM12)
- The Role of the AHR in Stem Cell Development and Lineage Specification—Symposium Session
- Use of Stem Cells in Toxicity Testing—From Basic Research to Personalized Toxicology—Symposium Session

up-to-date information at www.toxicology.org
AbbVie
Abbott Park, Illinois

American Chemistry Council
Washington, DC

American Petroleum Institute
Washington, DC

AstraZeneca R&D
Södertälje, Sweden

Boehringer Ingelheim Pharmaceuticals, Inc.
Ridgefield, Connecticut

Bristol-Myers Squibb Company
Princeton, New Jersey

CANTOX
Mississauga, Ontario, Canada

Celgene Corporation
Summit, New Jersey

Celsis In Vitro Technologies, Inc.
Baltimore, Maryland

Charles River
Wilmington, Massachusetts

Chevron Corporation
San Ramon, California

Colgate-Palmolive Company
Piscataway, New Jersey

Covance
Madison, Wisconsin

Dow Chemical Company
Midland, Michigan

Dow Corning Corporation
Midland, Michigan

The DuPont Haskell Global Centers for Health and Environmental Sciences
Newark, Delaware

Eli Lilly and Company
Indianapolis, Indiana

ExxonMobil Biomedical Sciences, Inc.
Annandale, New Jersey

Genentech, Inc.
South San Francisco, California

Gilead Sciences, Inc.
Foster City, California

GlaxoSmithKline
King of Prussia, Pennsylvania

The Hamner Institutes for Health Sciences
Research Triangle Park, North Carolina

Honeywell International, Inc.
Morristown, New Jersey

Janssen Pharmaceutical Companies of Johnson & Johnson
Raritan, New Jersey

Metabolon, Inc.
Durham, North Carolina

Millennium: The Takeda Oncology Company
Cambridge, Massachusetts

MPI Research
Mattawan, Michigan

Organovo, Inc.
San Diego, California

Pfizer, Inc.
Groton, Connecticut

Procter & Gamble Company
Cincinnati, Ohio

Regeneron Pharmaceuticals, Inc.
Tarrytown, New York

RTC Research Toxicology Centre S.p.A.
Pomezia, Italy

Sanofi
Bridgewater, New Jersey

Sequani, Ltd.
Ledbury, Herefordshire, United Kingdom

SNBL USA, Ltd.
Everett, Washington

Syngenta Crop Protection, Inc.
Greensboro, North Carolina

Toxicology Excellence for Risk Assessment (TERA)
Cincinnati, Ohio

WIL Research Laboratories, LLC
Ashland, Ohio

WuXi AppTec
Saint Paul, Minnesota

If your organization is interested in participating in the SOT Affiliate program, please contact Marcia Lawson at marcia@toxicology.org.
Your Invitation to Attend

You are cordially invited to attend the Society of Toxicology’s (SOT) 53rd Annual Meeting and ToxExpo, March 23–27, 2014, at the Phoenix Convention Center in Phoenix, Arizona. The SOT Annual Meeting is the largest meeting of its kind. This annual event features a broad range of scientific sessions and a thematic program that provides participants with a unique opportunity to deepen their knowledge in topical areas and interact with leaders in their respective disciplines.

The scientific program includes a plenary session, the MRC Lecture, symposia, workshops, roundtable discussions, informational sessions, regional sessions, as well as platform and poster sessions. The Society anticipates that more than 6,500 toxicologists from more than 50 countries will attend. The SOT Annual Meeting also features the ToxExpo, which is the largest exhibition dedicated to toxicology and the biomedical sciences.

The exhibition features 350 exhibitors, exhibitor-hosted sessions, and the opportunity to debut cutting-edge products, services, and technologies.

You will want to attend because…

Innovative Perspectives: The SOT Annual Meeting provides the most complete and in-depth coverage of toxicology. The Scientific Program Committee’s (SPC) mission is to devise a scientific program that covers the diverse areas of science that toxicology encompasses. The meeting is the venue for toxicologists to learn about the scientific advances that have taken place over the past 12 months. The Scientific Program Committee reviews more than 2,500 abstracts to deliver the most comprehensive and up-to-date program imaginable.

In-Depth Analysis: The Scientific Program Committee has devised a thematic approach that encompasses five themes of topical interest:

- Advancing Clinical and Translational Toxicology and Application of Biomarkers
- Enhancing Strategies for Risk Assessment
- New Science and Perspectives Surrounding Environmental and Occupational Exposures
- Safety Assessment: Mechanisms and Novel Methods
- Stem Cell Models for Integrated Biology

Countless Networking Opportunities: With more than 6,500 toxicologists from more than 50 countries in attendance, this five-day event allows everyone the opportunity to network with colleagues and leading scientists from around the world.

ToxExpo Attendees Are Engaged in One or More of the Following Areas of Research

- Biological Modeling
- Biotechnology
- Carcinogenesis
- Cardiovascular Toxicology
- Clinical and Translational Toxicology
- Comparative and Veterinary
- Dermal Toxicology
- Drug Discovery Toxicology
- Epidemiology
- Ethical, Legal, and Social Issues
- Food Safety
- Immunotoxicology
- In Vitro and Alternative Methods
- Inhalation and Respiratory
- Mechanisms
- Medical Device
- Metals
- Mixture
- Molecular Biology
- Nanotoxicology
- Neurodegenerative Disease
- Neurotoxicology
- Occupational and Public Health
- Ocular Toxicology
- Pathology
- Pharmacokinetics
- Pharmacology
- Regulatory and Safety Evaluation
- Reproductive and Developmental Toxicology
- Risk Assessment
- Stem Cells

For more information on exhibiting at the largest toxicology trade show in the world, please visit ToxExpo.com, or contact Ray Luca at 703.438.3115; email at ray@toxicology.org.
A Global Audience: More than 20 percent of the attendees come from outside North America, including countries as far away as Australia, Egypt, China, Latin America, and Africa. Toxicologists can explore lessons learned, share scientific findings, and novel approaches with other toxicologists at this annual event, which is designed to showcase the year’s latest in research.

Value: The SOT Annual Meeting is one of the most cost-effective meetings you can attend. For example, you pay $300 for early-bird registration, compared to an average cost of $461 for similar toxicology society meetings. Also, SOT has arranged air carrier discounts and has reserved SOT Annual Meeting attendee discounted rates rooms at various hotels in the Phoenix area through the SOT hotel room block. If you need to provide your employer with additional justification for attending the SOT Annual Meeting, to the SOT Annual Meeting website to find more information about the importance of this annual five-day event and why it should be the one meeting you attend.

ToxExpo
ToxExpo is the toxicology profession’s largest trade show, bringing together attendees and exhibitors from around the world to exchange information on the latest products and services. Exhibitors display innovative products and ToxExpo offers attendees the opportunity to interact with 350+ exhibitors. The benefits of ToxExpo extend far beyond the three-day event building and sustaining partnerships.

Use the new and enhanced 2014 mobile event app or the event website to create a list of exhibitors with which you want to connect at ToxExpo. You can search the exhibitor listing to view detailed exhibitor information and pinpoint their location on the interactive ToxExpo map.

The following are the 2014 ToxExpo hours:

- Monday ..........................9:00 AM–4:30 PM
- Tuesday ..........................8:30 AM–4:30 PM
- Wednesday ......................8:30 AM–4:30 PM

Here are some sources of information to help you obtain a visa:

- [http://travel.state.govvisa](http://travel.state.govvisa)
  A website designed with you in mind about current visa policies and procedures.

- [http://www.nationalacademies.org/visas](http://www.nationalacademies.org/visas)
  For additional visa information, contact the International Visitors Office (IVO) of the National Academies of the Sciences at the above website. A survey is available that can be used to assist future travelers with the visa process.

- **Make an Appointment**
  Before visiting the United States Embassy or Consulate, make sure you ask if there are any fees required. Most fees must be paid before your appointment. Wait times for appointments may be longer than in the past. Schedule the appointment as soon as possible. Information on visa wait times can be found at the US Department of State website at [http://travel.his.com/visa/temp/wait/wait_4638.html](http://travel.his.com/visa/temp/wait/wait_4638.html).

- **Get Your Documents Ready**
  Organize your passport, applications, documents to support the application with employment details (reason for travel along with financial status), and proof of payment of fees.

- **Submit Your Application**
  Send your application and passport along with supporting documents to the United States Embassy or Consulate.

- **Start Early**
  Additional reviews may be required. This could add an additional four to six weeks to the processing time.
Accessibility for Persons with Disabilities

The Phoenix Convention Center and most of the SOT hotels are accessible to persons with disabilities. If you require special services, please mark the appropriate box on the Annual Meeting Registration Form.

LSA Interpretation Services
800.305.9673
www.lsaweb.com

Language Services Associates (LSA) is a nationwide full-service firm providing translators and interpreters in 180 languages.

Scoot Around
888.441.7575
www.scootaround.com

If you require more handicapped information about accessibility, please contact Heidi Prange at SOT Headquarters: 703.438.3115 ext. 1424.

Attire

The official attire for the Annual Meeting is business casual. No coat or tie is required! We encourage you to bring comfortable clothing and shoes. Because meeting rooms may seem cold, please bring a sweater or jacket and/or dress in layers.

Badge

Annual Meeting attendees who register by January 31, 2014, will receive badges and registration materials in the mail. Attendees who already have their 2014 Annual Meeting badges do not need to stand in the registration line. If you have registered by the meeting date and have NOT received your badge by mail, or need a replacement badge, go to the “BADGE PICK UP” registration counter to pick up your badge. You will be asked to show a photo ID.

If you have not registered for the meeting before you arrive in Phoenix, please complete the on-site registration form found at the kiosks in the registration area and proceed to the appropriate registration line. All attendees should stop by the registration area to pick up their registration materials (page 32).

Child Care Services

Child care services will not be provided during the Annual Meeting. Arrangements may be made by contacting the concierge desk at your hotel. To ensure safety, children are not permitted in session rooms, the Exhibit Hall, or the poster area.
Green in Phoenix

PHOENIX IS GREEN! The Phoenix Convention Center says sustainability is one of their core values and missions. Their West Building is certified by the US Green Building Council with a Leadership in Energy and Environmental Design (LEED) Silver Rating. They provide clients with energy-efficient facilities and venues. The convention center also has a long-standing recycling program that includes not only paper, but the collection of plastic, cardboard, and glass materials. Last year the convention center recycled more than 500 tons of material.

In conjunction with the City of Phoenix Environmentally Preferable Purchasing (EPP) program, the Phoenix Convention Center strives to purchase products or services that have a reduced effect on the environment. The convention center’s green purchases include 31,000 KI Daylight chairs made from recycled car battery casings and seatbelts, tablecloths made from recycled plastic bottles, and fresh produce purchased from local farms. There are also rooftop solar panels and a water-harvesting garden that converts condensation from the building’s heating and cooling system into water for landscaping.

Outside of the Phoenix Convention Center, the City of Phoenix is also doing its part in being green. The Metro Light Rail serves the greater Phoenix area and has a stop assigned to the Phoenix Convention Center and Symphony Hall. Hybrid cabs are also available throughout downtown Phoenix, and the city’s bus lines operate exclusively with low-emissions natural gas.

Guest/Spouse Hospitality Room

The SOT Guest/Spouse Hospitality Room provides guest participants (non-scientists) with a place to meet and socialize with other guests. To visit the Hospitality Room, guests must register for the Annual Meeting with the person they are accompanying. Guests will not have access to the scientific sessions or the Exhibit Hall. Please remember to wear your badge to all SOT events such as the Welcoming Reception. The Guest/Spouse Hospitality Room will be located in the Sheraton Phoenix Downtown Hotel.

Use our QR (Quick Response) codes and go green!

QR codes are the fast, easy way to save paper while getting the most out of your SOT Annual Meeting experience. Simply scan the desired code with any tablet or smart phone QR code reader and find a wealth of information regarding the 53rd SOT Annual Meeting, ToxExpo, and the surrounding city of Phoenix. See more details on page 2.
Housing Information

The Society of Toxicology has reserved and arranged for discounted room rates at various Phoenix hotels—known as the SOT hotel room block. Booking a room in the room block is an important way to support the Society and keep overall meeting costs as low as possible. Your patronage of these official meeting hotels makes it possible for SOT to secure the space necessary for this event at a greatly reduced cost. The hotels not only offer discounted rates and the best networking opportunities, but staying in the group blocks helps the Society meet its obligation to the hotel, avoid penalties, and keeps meeting registration prices down. Please assist the Society by making your hotel reservation through the online housing reservation system.

Hotel Reservation Information

All reservations for housing must be made through the SOT Housing Bureau and not with the hotels directly. The deadline date for new housing reservations is February 20, 2014. Please choose only one option to make your reservation:

- Mail Housing Form to:
  SOT Housing Bureau/
  Connections Housing
  950 Scales Road, Building 200,
  Suite 201
  Suwanee, GA 30024
  United States
- Fax: 404.601.7441
  (Domestic and International)
- Tel: 800.262.9974 (USA) or
  404.842.0000
  (Domestic and International)
- Hours of Operation:
  9:00 AM–7:00 PM (EST) Monday–Friday

Hotel Acknowledgement

A reservation acknowledgment will be emailed, faxed, or mailed via the SOT Housing Bureau to you once your reservation has been booked. (You will not receive a confirmation from your hotel.) If you do not receive an acknowledgment within three (3) business days, please call Connections Housing.

Changes and Cancellations

The deadline date for new reservations is Thursday, February 20, 2014. You can make changes and/or cancellations online or by contacting Connections Housing at 404.842.0000 or 800.262.9974. All cancellations made within 72 hours prior to the day of arrival and no shows will be charged the first night’s room and tax by the hotel. Early departures are subject to penalty fees set by the hotel. For best availability and immediate confirmation, make your hotel reservation via Internet or by telephone. Faxed and mailed housing requests will take longer to process and your hotel selections may not be available.

Room-Share Program

The Society is pleased to provide a room-share program to those registered for the Annual Meeting. It is available to each meeting registrant who voluntarily enrolls in the program and accepts the terms of the legal disclaimer. This program allows SOT Annual Meeting registrants to identify others with whom a room might be shared. Access this option from the Annual Meeting section of the SOT website.

Golf and Spa Post-Meeting Trip

Once the SOT Annual Meeting is over, it will be time to treat yourself to a weekend getaway at the Hilton Squaw Peak Resort. Enjoy the resort’s Tocasierra Spa & Salon, 18 hole golf club, putting course, the River Ranch Water Park, and much more for just $199 per night (plus tax and an $18 Resort Fee). The SOT Resort Weekend Package includes: 20% off one treatment at Tocasierra Spa & Salon, driving range access for two guests at nearby Lookout Mountain Golf Club, one round of 18-hole executive miniature golf for up to four guests, tennis court time for two guests, complimentary fitness center access, complimentary admittance into the River Ranch for four guests, and complimentary internet. Make your reservations today on the Hilton SOT Resort Weekend reservation website. Please stop by the SOT Housing Desk located in the SOT Registration Area to discuss transportation options. It’s spring baseball season, so book early to secure your time to relax and enjoy the scenic beauty of the desert and all that the Phoenix valley has to offer.
# General Information

## Hotel Accommodations

<table>
<thead>
<tr>
<th>Hotel Name</th>
<th>Rate</th>
<th>Address</th>
<th>Club</th>
<th>Check-in/Check-out</th>
<th>Distance from Convention Center</th>
<th>Distance to Light Rail</th>
<th>Parking</th>
<th>Internet Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Aloft Phoenix Airport</td>
<td>$189</td>
<td>4450 E. Washington Street, Phoenix, AZ 85034</td>
<td>Starwood Preferred Guests</td>
<td>3:00 PM/12:00 Noon</td>
<td>5 Miles</td>
<td>0.5 Block</td>
<td>Complimentary self-parking</td>
<td>Complimentary wireless Internet in guest rooms</td>
</tr>
<tr>
<td>2) DoubleTree Guest Suites Phoenix</td>
<td>$199</td>
<td>320 N. 44th Street, Phoenix, AZ 85008</td>
<td>Hilton Honors</td>
<td>3:00 PM/12:00 Noon</td>
<td>5 Miles</td>
<td>1 Block</td>
<td>Complimentary self-parking</td>
<td>Complimentary wireless Internet in guest rooms</td>
</tr>
<tr>
<td>3) Fairfield Inn and Suites Phoenix Midtown</td>
<td>$179</td>
<td>2520 N. Central Avenue, Phoenix, AZ 85004</td>
<td>Marriott Rewards</td>
<td>3:00 PM/12:00 Noon</td>
<td>2 Miles</td>
<td>1 Block</td>
<td>Complimentary self-parking</td>
<td>Complimentary wireless Internet in guest rooms</td>
</tr>
<tr>
<td>4) Hilton Garden Inn Phoenix Airport North</td>
<td>$179</td>
<td>3838 E. Van Buren Street, Phoenix, AZ 85008</td>
<td>Hilton Honors</td>
<td>3:00 PM/12:00 Noon</td>
<td>4 Miles</td>
<td>3 Blocks</td>
<td>Complimentary self-parking</td>
<td>Complimentary wireless Internet in guest rooms</td>
</tr>
<tr>
<td>5) Hilton Garden Inn Phoenix Midtown</td>
<td>$199</td>
<td>4000 N. Central Avenue, Phoenix, AZ 85012</td>
<td>Hilton Honors</td>
<td>3:00 PM/12:00 Noon</td>
<td>3 Miles</td>
<td>3 Blocks</td>
<td>Complimentary self-parking</td>
<td>Complimentary wireless Internet in guest rooms</td>
</tr>
<tr>
<td>6) Holiday Inn Express and Suites Phoenix Downtown</td>
<td>$209</td>
<td>620 N. 6th Street, Phoenix, AZ 85004</td>
<td>Priority Club Rewards</td>
<td>3:00 PM/11:00 AM</td>
<td>7 Blocks</td>
<td>7 Blocks</td>
<td>Complimentary self-parking</td>
<td>Complimentary wireless Internet in guest rooms</td>
</tr>
<tr>
<td>7) Holiday Inn Phoenix Downtown North</td>
<td>$199</td>
<td>212 W. Osborn Road, Phoenix, AZ 85031</td>
<td>Priority Club Rewards</td>
<td>3:00 PM/12:00 Noon</td>
<td>3 Miles</td>
<td>2 Blocks</td>
<td>Complimentary self-parking</td>
<td>Complimentary wireless Internet in guest rooms</td>
</tr>
<tr>
<td>8) Hotel Palomar Phoenix CityScape</td>
<td>$239</td>
<td>2 E. Jefferson Street, Phoenix, AZ 85004</td>
<td>Kimpton InTouch Loyalty Program</td>
<td>3:00 PM/12:00 Noon</td>
<td>4 Blocks</td>
<td>1 Block</td>
<td>$27/night valet parking, $20/night self-parking</td>
<td>Complimentary wireless Internet in guest rooms with InTouch Rewards</td>
</tr>
<tr>
<td>9) Hotel San Carlos</td>
<td>$149</td>
<td>202 N. Central Avenue, Phoenix, AZ 85004</td>
<td>N/A</td>
<td>3:00 PM/12:00 Noon</td>
<td>1 Block</td>
<td>1 Block</td>
<td>$20/night valet parking, $15/night self-parking</td>
<td>Complimentary wireless Internet in guest rooms</td>
</tr>
</tbody>
</table>

All hotel accommodations, rates, Internet access, and parking pricing are subject to change. Early departures are subject to penalty fees set by the hotels. Although we understand that making your reservations outside of the SOT hotel block can sometimes be more economical, it decreases the money available to the Society to carry out its strategic goals and may cause the Society to have to pay attrition fees for unutilized hotel rooms. In addition, the Society is unable to assist you if you have any difficulties with your room reservation, such as the hotel over-booking or misplacing your reservation.

SOT depends on the Annual Meeting revenue (hotel room commissions and rebates) to fund other programs throughout the year and to keep future registration fees low. Please assist the Society by making your hotel room reservation through SOT Housing Bureau.
General Information

10) Hyatt Regency Phoenix

$220 single/double
122 N. 2nd Street, Phoenix, AZ 85004

Club: Gold Passport
Check-in: 3:00 PM/Check-out: 12:00 Noon
1 Block from convention center
1 Block to light rail
$28/day valet parking, $12/night self-parking
($19/day—in/out self-parking)
Wireless Internet in guest rooms is $9.95/day

11) Phoenix Airport Marriott

$184 single/double
1101 N. 44th Street, Phoenix, AZ 85008

Club: Marriott Rewards
Check-in: 3:00 PM/Check-out: 12:00 Noon
6 Miles from convention center
8 Blocks to light rail
Complimentary self-parking
Complimentary wireless Internet in guest rooms

12) Phoenix Airport Plaza Hotel

$169 single/double
4300 E. Washington Street, Phoenix, AZ 85034

Club: Coast Rewards
Check-in: 3:00 PM/Check-out: 12:00 Noon
5 Miles from convention center
.5 Block to light rail
Complimentary valet parking for overnight guests
Complimentary wireless Internet in guest rooms

13) Phoenix Place Hotel and Suites

$129 single/double
3600 N. 2nd Avenue, Phoenix, AZ 85013

Club: N/A
Check-in: 3:00 PM/Check-out: 11:00 AM
3 Miles from convention center
2 Blocks to Light Rail
Complimentary self-parking
Complimentary wireless Internet in guest rooms

14) Renaissance Phoenix Downtown

(Formerly Wyndham)

$220 single/double
50 E. Adams Street, Phoenix, AZ 85004

Club: Marriott Rewards
Check-in: 4:00 PM/Check-out: 12:00 Noon
2 Blocks from convention center
.5 Block to light rail
$27/day valet parking
Wireless Internet in guest rooms is $12.95/day

15) Sheraton Phoenix Downtown Hotel

*SOT Headquarters Hotel

$229 single/double
340 N. 3rd Street, Phoenix, AZ 85004

Club: Starwood Preferred Guests
Check-in: 3:00 PM/Check-out: 12:00 Noon
4 Blocks from convention center
3 Blocks to light rail
$27/day valet parking, $17/day self-parking
Wireless Internet in guest rooms is $14.95/day

16) SpringHill Suites Phoenix Downtown

$201 single/double
802 E. Van Buren Street, Phoenix, AZ 85006

Club: Marriott Rewards
Check-in: 3:00 PM/Check-out: 12:00 Noon
4 Blocks from convention center
8 Blocks to light rail
Complimentary self-parking
Complimentary wireless Internet in guest rooms

17) Westin Phoenix Downtown

$235 single/double
333 N. Central Avenue, Phoenix, AZ 85004

Club: Starwood Preferred Guests
Check-in: 3:00 PM/Check-out: 12:00 Noon
4 Blocks from convention center
.5 Block to light rail
$28/day valet parking
Wireless Internet in guest rooms is $10/day

Legend:

- Valet Parking
- Self-Parking
- Fitness Center
- Swimming Pool
- Business Center
- In-Room Wireless Internet
- In-Room Safe
- Gift Shop
- Complimentary Breakfast
- Restaurant
- Rating

All hotels have Internet access. Hotel sales tax is currently 12.27%
Use the new and enhanced 2014 event mobile app or the event website to access a complete Phoenix city guide including, hotels, restaurants, attractions, nightlife, and shopping. The event website and app will be available in January via the SOT website and app marketplaces.
## General Information

### Hotel Services

<table>
<thead>
<tr>
<th>Hotel</th>
<th>Rewards Program</th>
<th>Blocks to Convention Center</th>
<th>Blocks to Light Rail/LRT Station</th>
<th>Single/Double Rate</th>
<th>Restaurant</th>
<th>Complimentary Breakfast</th>
<th>Fitness Center</th>
<th>Swimming Pool</th>
<th>Business Center</th>
<th>In-Room Wireless Internet</th>
<th>Gift Shop</th>
<th>Room Service</th>
<th>Overnight Self-Parking</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Aloft Phoenix Airport</td>
<td>Starwood Preferred Guests</td>
<td>5 Miles</td>
<td>.5 Block to LR</td>
<td>$189</td>
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<td>3 Stars</td>
</tr>
<tr>
<td>2) DoubleTree Guest Suites Phoenix</td>
<td>Hilton Honors</td>
<td>5 Miles</td>
<td>1 Block to LR</td>
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<td>3 Stars</td>
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<td>Hilton Honors</td>
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<td>3 Blocks to LR</td>
<td>$179</td>
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<tr>
<td>5) Hilton Garden Inn Phoenix Midtown</td>
<td>Hilton Honors</td>
<td>3 Miles</td>
<td>3 Blocks to LR</td>
<td>$199</td>
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<td>3 Stars</td>
</tr>
<tr>
<td>6) Holiday Inn Express and Suites Phoenix Downtown</td>
<td>Priority Club Rewards</td>
<td>7 Blocks</td>
<td>7 Blocks to LR</td>
<td>$209</td>
<td></td>
<td></td>
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<td>3 Stars</td>
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<tr>
<td>7) Holiday Inn Phoenix Downtown North</td>
<td>Priority Club Rewards</td>
<td>3 Mile</td>
<td>2 Blocks to LR</td>
<td>$199</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td>3 Stars</td>
</tr>
<tr>
<td>8) Hotel Palomar Phoenix CityScape</td>
<td>Kempton InTouch Loyalty Program</td>
<td>4 Blocks</td>
<td>1 Block to LR</td>
<td>$239</td>
<td></td>
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<td>4 Stars</td>
</tr>
<tr>
<td>9) Hotel San Carlos</td>
<td>N/A</td>
<td>3 Blocks</td>
<td>1 Block to LR</td>
<td>$149</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 Stars</td>
</tr>
<tr>
<td>10) Hyatt Regency Phoenix</td>
<td>Gold Passport</td>
<td>1 Block</td>
<td>1 Block to LR</td>
<td>$220</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td>3 Stars</td>
</tr>
<tr>
<td>11) Phoenix Airport Marriott</td>
<td>Marriott Rewards</td>
<td>6 Miles</td>
<td>8 Blocks to LR</td>
<td>$184</td>
<td></td>
<td></td>
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<td></td>
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<td>3 Stars</td>
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<tr>
<td>12) Phoenix Airport Plaza Hotel</td>
<td>Coast Rewards</td>
<td>5 Miles</td>
<td>.5 Block to LR</td>
<td>$169</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td>3 Stars</td>
</tr>
<tr>
<td>13) Phoenix Place Hotel and Suites</td>
<td>N/A</td>
<td>3 Miles</td>
<td>2 Blocks to LR</td>
<td>$129</td>
<td></td>
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<td>3 Stars</td>
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<tr>
<td>14) Renaissance Phoenix Downtown (formerly Wyndham)</td>
<td>Marriott Rewards</td>
<td>2 Blocks</td>
<td>.5 Block to LR</td>
<td>$220</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>3 Stars</td>
</tr>
<tr>
<td>15) Sheraton Phoenix Downtown Hotel + SOF Headquarters Hotel</td>
<td>Starwood Preferred Guests</td>
<td>2 Blocks</td>
<td>3 Blocks to LR</td>
<td>$229</td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td>4 Stars</td>
</tr>
<tr>
<td>16) SpringHill Suites Phoenix Downtown</td>
<td>Marriott Rewards</td>
<td>4 Blocks</td>
<td>8 Blocks to LR</td>
<td>$201</td>
<td></td>
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<td></td>
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<td></td>
<td>3 Stars</td>
</tr>
<tr>
<td>17) Westin Phoenix Downtown</td>
<td>Starwood Preferred Guests</td>
<td>4 Blocks</td>
<td>.5 Block to LR</td>
<td>$235</td>
<td></td>
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<td>4 Stars</td>
</tr>
</tbody>
</table>

1Rates shown are for single and double occupancy; additional fees may apply for additional guests.

All hotels currently have a business center, offer complimentary fitness center access, and have a tax rate of 12.27%.

Please note: services offered, taxes, and fees associated with hotel services are subject to change and availability.

Information listed is complete and accurate as of November 30, 2013.

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up-to-date information at [www.toxicology.org](http://www.toxicology.org)
Internet Access at the Convention Center

SOT understands the importance of being connected to your daily activities while attending the Annual Meeting and provides several ways for you to access the Internet while at the Phoenix Convention Center.

@SOT Center—Internet Access and Technology Training Center

SOT will provide computers you can use to access the Internet. These computers are available to attendees in the @SOT Center, located outside the ToxExpo entrance.

Free Wireless Internet Access

As a service to Annual Meeting registrants, SOT will be providing free wireless internet access throughout the Phoenix Convention Center in all locations where SOT events are being held. Information on how to gain access to the wireless internet, will be made available in the Final Program.

Meeting Requests: Hospitality Suites and Ancillary Meetings

All requests for hospitality suites and ancillary meetings must be approved by SOT Headquarters. To reserve a meeting room, go to www.toxicology.org/ai/meet/am2014/meetingreq.asp. Ancillary functions may be hosted only by SOT affiliates, exhibitors, sponsors, or organizations otherwise associated with SOT. All ancillary functions are held outside of the convention center in nearby hotels. Hospitality suites and ancillary meeting spaces book quickly—submit your request now! Only meeting requests made by December 13, 2013, will be listed in the Annual Meeting Calendar and the Program.

Networking Time

The Scientific Program Committee has created a time on Tuesday, March 25, especially for attendee networking. We encourage you to connect and engage with your colleagues at the Annual Meeting from 12:00 noon to 1:30 pm on Tuesday between sessions. Only networking events and Exhibit Hall activities are scheduled during this time, so meet your colleagues in ToxExpo, grab a bite to eat, and grow your network!

Phoenix General Information

Phoenix is America’s fifth-largest city with over 1.5 million residents. It is located in the heart of the Sonoran Desert and is known as the gateway to the Grand Canyon. Arizona itself is known as the Grand Canyon State. Its elevation is 1,117 ft. For more information on things to do, where to eat, special events, etc., please visit www.visitphoenix.com/about-phoenix/downtown-phx-sot/index.aspx.

Science in Phoenix

Arizona Science Center
600 E. Washington Street
Tel: 602.716.2000
www.azscience.org

Located in the heart of downtown Phoenix, the Arizona Science Center offers hands-on, eye-opening fun with more than 300 interactive exhibits, a state-of-the-art planetarium, five-story giant screen theatre, live demonstrations, and traveling exhibitions.

Heritage Square and Science Park
115 N. 6th Street
Tel: 602.262.5071
www.phoenix.gov/parks/parks/heritagepk.html

Home to James Beard Award-winning restaurants, the world-class Arizona Science Center, the historic 1895 Rosson House.
Museum, and its collection of carefully restored historic homes and buildings, Heritage and Science Park is a crucial piece of the cultural landscape in downtown Phoenix. The tree-lined park also is a popular home for major festivals and special events that bring thousands to the area each year.

### Pueblo Grande Museum and Archaeological Park
4619 E. Washington Street  
Tel: 602.495.0901  
www.phoenix.gov/recreation/arts/museums/pueblo/index.html

Experience an interesting juxtaposition of centuries and cultures as cars whoosh by on nearby freeways and jets thunder above this prehistoric 1,500 year-old Hohokam village ruin in the center of the city.

### Rosson House Museum
113 N. 6th Street  
Tel: 602.262.5070  
www.rossonhousemuseum.org

Restored to its Victorian grandeur, the Rosson House brings Phoenix’s past to life. The 1895 historic house museum is open for public tours, special events, and school tours. Located at Historic Heritage Square inside Heritage and Science Park. Hours: Wednesday–Saturday, 10:00 am–4:00 pm; Sunday, 12:00 noon–4:00 pm; Tuesday, 10:00 am–4:00 pm.

### Phoenix Area Activities

#### For Things to Do in Greater Phoenix, Go to www.visitphoenix.com.

#### Camelback Mountain
E. McDonald Drive at Tatum Boulevard  
Tel: 602.261.8318  
www.phoenix.gov/parks/trails/locations/camelback

Climb the city’s most famous landmark, the mountain resembling a crouching dromedary, for superb valley views, or visit the Echo Canyon recreation area, where sheer red cliffs and hiking paths attract outdoor enthusiasts.

#### Children’s Museum of Phoenix
215 N. 7th Street  
Tel: 602.253.0501  
www.childrensmuseumofphoenix.org

Hands-on interactive exhibits are designed to engage the minds, muscles, and imagination of children up to age ten.

#### Desert Botanical Garden
1201 N. Galvin Parkway  
Tel: 480.941.1225  
www.dbg.org

The world’s largest collection of desert plants has more than 50,000 plants on display throughout five thematic trails. In addition to the natural botanical art and opportunities for beautiful photographs, the garden offers specialized tours, concerts, special events, seasonal exhibits, an outdoor café, gift shop, and much more.

#### Heard Museum
2101 N. Central Avenue  
Tel: 602.252.8848  
www.heard.org

If you’re interested in ancient cultures of the Southwest, visit this world-renowned museum. You’ll find a staggering collection of Native American art and artifacts, including the largest kachina doll collection of any museum in the country.

#### Musical Instrument Museum (MIM)
4725 E. Mayo Boulevard  
Tel: 480.478.6000  
www.mim.org

The MIM features more than 10,000 instruments and artifacts from every country in the world and an ongoing program of exciting live performances.

#### Phoenix Art Museum
1625 N. Central Avenue  
Tel: 602.257.1222  
www.phxart.org

The Phoenix Art Museum showcases more than 18,000 works of American, Asian, European, Latin American, Western American, modern and contemporary paintings, photography, and fashion design.

#### Phoenix Heritage Square
115 N. 6th Street  
Tel: 602.262.5071  
www.phoenix.gov/parks/parks/heritagepk.html

Stroll through a city block of museums, gift shops, and restaurants in buildings that date to the late 1800s, anchored by the Rossen House.

#### Phoenix Zoo
455 N. Galvin Parkway  
www.phoenixzoo.org

The Phoenix Zoo is the nation’s largest privately owned, nonprofit zooological park. This zoo is home to more than 1,300 animals, including 200 endangered or threatened birds, mammals, and reptiles from around the world.

#### St. Mary’s Basilica
3rd and Monroe Streets  
Tel: 602.354.2100  
www.saintmarysbasilica.org

Erected in 1881, the oldest standing church in Phoenix adds historic flavor to the downtown area.

#### Taliesin West
12621 N. Frank Lloyd Wright Boulevard  
Tel: 480.860.2700  
www.franklloydwright.org

Tour the winter home of the famed Frank Lloyd Wright, which now serves as a school of architecture.

#### Phoenix Golf Courses
Greater Phoenix is home to more than 200 golf courses. Below are just a few of the closet courses to the convention center.

#### Papago Golf Course
5595 E. Moreland Street  
(nine miles from the convention center)  
Tel: 602.275.8428  
www.papagolfcourse.net

Papago Golf Course, owned by the City of Phoenix, was long considered the finest public golf course in the state. It was designed by well known and esteemed golf course architect William Francis (Billy) Bell, who
learned his craft from his father, William Park Bell. They collaborated on many highly rated California courses. Perhaps best known among the nearly one hundred courses to Billy’s credit is Torrey Pines in San Diego.

**Encanto Park Golf Course**

2775 N. 15th Avenue  
(ten minutes from the convention center)  
Tel: 602.253.3963  
www.phoenix.gov/recreation/rec/facilities/golf/golfcourses/encanto

Built in 1935, located in the core of the Encanto Historic District, Encanto is the third-oldest golf course in Arizona. It sports a relaxed atmosphere enhanced by the course’s abundance of mature palm and salt cedar trees, plus some truly spectacular views of downtown Phoenix. William P. Bell designed both the traditional 18-hole championship course and the executive 9-hole course, which is just a block away. Encanto is ideally suited for the average golfer. Its level fairways are wide, and it has a limited number of hazards. Amenities include driving range and practice green.

**Raven Golf Club—Phoenix**  
(Formerly the Phoenix Raven at South Mountain Golf Course)  
3636 E. Baseline Road  
(ten minutes from the convention center)  
Tel: 602.243.3636  
www.ravenphx.com/home

Raven Golf Club—Phoenix provides a unique golf experience in the desert. From the Georgia pine tree-lined fairways to the multilitered greens, this Gary Panks and David Graham golf course design is a “must-play” in the Phoenix area. Raven Golf Club—Phoenix is proud to have received a 4.5-star rating from *Golf Digest* and has been recognized as having the best guest service in North America.

**Arizona Grand Golf Course**  
8000 S. Arizona Grand Parkway  
(ten minutes from the convention center)  
Tel: 602.438.9000  
www.arizonagrandresort.com/arizona-golf-courses.php

For over two decades, Arizona Grand Golf Course has supported the rich tradition of the game with its unique links course, featuring panoramic views of the surrounding desert landscape. Dramatic elevation changes and breathtaking mountain vistas highlight the diverse and challenging par 71 layout. The course complements the grandeur of the spectacular Sonoran Desert with stunning conditions and a service staff committed to creating exceptional experiences for players of all ability levels.

**Phoenix Fun Facts**

1. Phoenix is the sixth-largest US city.
2. Greater Phoenix has a population of approximately 2.97 million and covers 2,000 square miles.
3. Maricopa County—where Greater Phoenix is located—covers 9,222 square miles.
4. Phoenix’s elevation is 1,117 feet.
5. According to legend, Phoenix gets its name from Cambridge-educated pioneer Darrell Duppa, who saw the ruins and prehistoric canals of the Hohokam and believed another civilization would rise from the ashes.
6. Greater Phoenix is located in the Sonoran Desert, which is one of the wettest and greenest deserts in North America, thanks to 3–15 inches of annual rainfall.
7. Phoenix basks in more than 300 days of sunshine per year, more than any other major metropolitan area in the US.
8. Phoenix has an average annual temperature of 72.6°F and an average annual high temperature of 85°F. Phoenix has an average annual rainfall of 7.7 inches. The average high temperature in winter is 67°F.
9. Arizona is home to 23 reservations representing 21 different Native American tribes.
10. Phoenix is one of only 13 US cities with franchises in all four major professional sports leagues: Phoenix Suns (NBA), Arizona Diamondbacks (MLB), Arizona Cardinals (NFL), and Phoenix Coyotes (NHL). Phoenix will host Super Bowl XLIX in 2015.
12. Greater Phoenix consistently ranks among the nation’s top cities in the number of four- and five-diamond and four- and five-star resorts.
13. More than 15 million people visit Phoenix each year.
14. Greater Phoenix is home to more than 200 golf courses.
15. Phoenix is home to the largest municipal park in North America. South Mountain Park and Preserve covers more than 20,000 acres and has more than 50 miles of hiking, biking, and equestrian trails.

**Poster Displays**

**Global Gallery of Toxicology**

Toxicology societies from around the world are invited to participate in the Global Gallery of Toxicology. Now in its fourth year, posters of these sister societies will be prominently displayed during the meeting, showcasing their formation, key accomplishments, strategic initiatives, and activities. The 2014 Global Gallery poster session will be listed in the scientific program with a “Representative Attended” poster time from
11:45 am to 12:15 pm on Monday, March 24. The goal of SOT and of all these societies is to increase the reliance of international decision-makers on the science of toxicology and to advance human health and disease prevention. For more information about participating in the Global Gallery, please contact Susan Simmons at 703.438.3115 by January 6, 2014.

RC, SIG, and SS Posters
SOT will have dedicated poster space available for the Regional Chapters, Special Interest Groups, and Specialty Sections at the 2014 SOT Annual Meeting. The poster area will be located adjacent to the SOT Pavilion in the ToxExpo Exhibit Hall and will be attended on Monday between 11:45 am and 12:15 pm.

Scientific ePosters
SOT is pleased to offer our poster presenters the opportunity to share their research electronically as well as in their assigned poster sessions. Poster presenters will be able to upload their ePosters beginning in late February. ePosters will be available to meeting attendees at kiosks located in the Exhibit Hall during ToxExpo. Attendees will also be able to access ePosters though the meeting event app anytime during the meeting.

Scientific Poster Printing Services
SOT is pleased to offer our poster presenters a convenient service through Shepard Exposition Services, the official general service contractor for the Annual Meeting. No need to worry about traveling with your poster or having your poster lost in shipping. Simply fill out the online form, email, or upload your poster using the link provided, review and approve the final layout of your poster, and then pick up your poster on-site. Shepard will produce the materials for a reasonable price, which will include production, transportation, and storage for the show.

To get more information you can contact Michael Graham with Shepard Exposition Services at 703.352.4900 or mgraham@shepardes.com. The order form can also be found online on the SOT Annual Meeting website at: www.toxicology.org/ai/meet/am2014/forms.asp.

Global Gallery of Toxicology

Celebrate Toxicology Globally

Toxicology-related scientific societies are invited to display a poster showcasing their information, key accomplishments, strategic initiatives, activities, and more.

Posters will be displayed prominently in the ToxExpo Exhibit Hall.
The *Toxicologist* and Annual Meeting Program

**The Toxicologist:** The Official Record of the 2014 Annual Meeting Abstracts

*The Toxicologist* is an important scientific resource, as it is the official compilation of all accepted abstracts for the 53rd Annual Meeting of the Society of Toxicology. With over 2,300 abstracts for the meeting, this supplementary issue of *Toxicological Sciences* is a critical publication to access the latest findings in toxicology.

- A copy of the printed version of *The Toxicologist* may be preordered via the registration form or purchased on-site while supplies last for $25.
- *The Toxicologist* PDF is available for download via the SOT website.
- Full abstracts can be accessed via the event mobile App or event website available on the SOT website and App market places in late January.

For the 2014 Annual Meeting only, abstracts accepted from the second abstract submission period will be incorporated into the regular scientific program so as to be presented with relevant thematic content. These abstracts will be searchable by the Annual Meeting mobile app, and will appear in the printed *Program* and in *The Toxicologist*.

*(Please see complete details on page 69.)*

**The Program:** The Official Guide to the SOT 2014 Annual Meeting and ToxExpo

The *Program* is the official guide to all the activities of the 2014 Annual Meeting and ToxExpo. The *Program* includes detailed information on the scientific sessions including an overview for these sessions, with the exception of the poster and platform sessions. The *Program* includes the poster session schedule, and a map of the poster sessions, as well as an abstract overview of all the Continuing Education course offerings. The *Program* details the schedule of events by name and a listing of all the special events including 2013 award recipients, 2013 Honorary members, SOT Endowment Fund 2013 award recipients, recognition and special events; and Regional Chapter, Special Interest Group, and Specialty Section meetings and receptions. In addition, the *Program* includes a general section that highlights tour, travel, hotel, registration, parking, and safety and security information. The complete listing of the ToxExpo exhibitors is provided along with the floor plan for the ToxExpo and a complete listing of exhibitor-hosted sessions.

- The *Program* PDF is available for download via the SOT website.
- Full abstracts can be accessed via the event mobile App or event website available on the SOT website and App market places in late January.

- The *Program* PDF is available for download via the SOT website (late January).
- Copies of the *Program* can be picked up on-site. In an effort to better use resources, the printed *Program* will be mailed ONLY by request (within the US and Canada only). If you wish to receive your printed *Program* before the meeting (request made by February 28), please select the “I want to receive the printed *Program* before the meeting by mail” checkbox on the registration form, and the *Program* will be mailed in late February (in the US and Canada only).
**Satellite Meetings**

Each year, SOT endorses several satellite meetings that are held in conjunction with the Annual Meeting. Satellite meetings are organized around scientific topics related to toxicology and are scheduled at the end of the Society’s program. The 2014 satellite meetings will be held in and around the Phoenix area. Proposals for a satellite meeting should be sent by email to heidi@toxicology.org to the attention of Norbert E. Kaminski, SOT Vice President and Scientific Program Committee Chair. Requests approved by December 20, 2013, will be published in the Program. All requests must be received by January 18, 2014.

**SOT Pavilion**

Do you know all the resources available through SOT and where to find them? Stop by the SOT Pavilion to learn about SOT activities, membership benefits, strategic initiatives, and the Endowment Fund. Learn about materials to support the discipline of toxicology and information on K–12 and public outreach. It is a one-stop shop for all your questions and member needs. The Pavilion is located inside the ToxExpo Exhibit Hall. It is open the following hours:

- **Monday** ................. 9:00 AM–4:30 PM
- **Tuesday** .................. 8:30 AM–4:30 PM
- **Wednesday** ............ 8:30 AM–4:30 PM

**Supporting Opportunities**

Annual Meeting support serves as visible evidence of an organization’s commitment to the Society’s mission of “creating a safer and healthier world by advancing the science of toxicology.” Moreover, support provides an opportunity for private, public, and not-for-profit organizations to increase overall awareness of their services and programs to SOT members and Annual Meeting attendees. Supporters are listed in publications related to the Annual Meeting, including the Preliminary Program, the Program, pre- and postmeeting newsletters, and the ToxExpo Directory.

In addition, Annual Meeting supporters are listed on the SOT Annual Meeting website, an essential source of information for all registrants. During the Annual Meeting, acknowledgment signs, which group supporters by level of contribution, are displayed prominently at many of the SOT functions, as well as in the SOT presentations in all session rooms. In appreciation for their support of the Society, supporters at the Silver Level and above are invited to the SOT President’s Reception. Five levels of support are available:

- **Diamond** ($10,000 or more)
- **Platinum** ($5,000–$9,999)
- **Gold** ($2,500–$4,999)
- **Silver** ($2,000–$2,499)
- **Contributor** ($1,000–$1,999)

Please see [www.toxicology.org](http://www.toxicology.org) for more details.
Tours

SOT is proud to offer all attendees and their guests a wide range of activities to make your visit to Phoenix, Arizona more enjoyable. A tour desk will be located in the SOT registration area of the Phoenix Convention Center.

Tour Registration

To register for these tours, please either fax, mail, or email your Tour Registration Form to Avalon Meetings & Entertainment, Inc (AME). To view the Tour Registration Form, please go to www.toxicology.org/AI/MEET/AM2014/touring.asp. If you have any questions please call AME at 480.860.2423.

Register now to ensure your reservation for tours. On-site registration will be limited and will be accommodated on a space-available basis only.

- Deadline to submit form is February 21, 2014 (NEW DEADLINE).
- AME reserves the right to cancel tours if minimums are not met.
- Full payment to AME must accompany your registration form. Tours are nonrefundable, unless minimums are not met.

Tour Schedule

Valley Discovery City Tour
Sunday, March 23, 2014
1:00 PM–4:00 PM (Three Hours)
Price: $25 per Guest
Based on a Minimum of 30

What are the Superstition Mountains? Where is Pinnacle Peak? Did Geronimo really live in Arizona? Which cactus yields water? These are just some of the many questions that visitors to Phoenix have. Our expert guide will answer as many questions as possible while providing fun facts and stories of Phoenix and its surrounding cities.

Winding through the streets, your group will view the surrounding desert and unique architecture that come together to form the “Valley of the Sun.” Lunch will not be provided on this tour.

Includes:
- Deluxe ground trip transportation
- Guided tour of downtown Phoenix
- Iced water en route

Desert Botanical Garden & Heard Museum Tour
Monday, March 24, 2014
10:00 AM–2:00 PM (Four Hours)
Price: $67 per Guest
Based on a Minimum of 30

The Desert Botanical Garden displays more than 50,000 desert plants throughout five thematic trails and is one of the finest collections of desert plants in the world. Plants and people of the Sonoran Desert demonstrate how desert dwellers have used native plants for thousands of years for food, construction, and medicines. In addition to the natural botanical art and opportunities for beautiful photography, the garden offers specialized tours, concerts, special events, seasonal exhibits, an outdoor café, and more.

If you’re interested in ancient cultures of the Southwest, you need to visit the world-renowned Heard Museum. The museum houses a staggering collection of Native American art and artifacts, including the largest kachina doll collection of any museum in the country. Lunch will be from 11:15 am–12:00 noon at the garden. Cost of lunch is not included in this price.

Includes:
- Deluxe Ground Trip Transportation
- Guided Tour of the Arabian Horse Ranch
- Self-Guided Tour of Desert Botanical Garden
- Complimentary Soft Drink or Water Upon Arrival

Arabian Horse Ranch Tour
Tuesday, March 25, 2014
10:00 AM–2:00 PM (Four Hours)
Price: $50 per Guest
Based on a Minimum of 30

Scottsdale, Arizona is the Arabian Horse Capital of the World and has been home to some of the industry’s most important Arabian horse breeders for over 30 years. This interactive tour features famous Arabian Champions and historical legends. See world-class facilities, experience riding demonstrations, and enjoy a spectacular view of the horses. Guests will hear about state-of-the-art breeding and veterinary techniques, learn about health and daily care of the horses, and see mares and their babies in the pastures.

A stop for lunch will be made after the tour at the Mexican restaurant, Los Olivos. Cost of lunch is not included in this price.

Includes:
- Deluxe ground trip transportation
- Desert Botanical Garden Admission & Heard Museum Admission
- Self-Guided Tour of Desert Botanical Garden
- Iced water en route

Transportation

Air Transportation

Special Airfare Discounts

SOT has established discounted rates through Southwest and United Airlines originating in the United States and Canada. Be sure to use the reference numbers when making your reservations. You may purchase your ticket online, call the airline directly using the toll free numbers, or provide your travel agent with the reference/discount numbers listed below to receive the discount.
Southwest Airlines
Tel: 800.435.9792
www.swabiz.com
SOT Discount Code: 99150833
Southwest Airlines is offering a 10% discount off the Business Select or Anytime fare classes and 5% off Wanna Get Away fares for attendees traveling to Phoenix for the SOT Annual Meeting. The discount is valid for travel dates of March 18–31, 2014. Discounts are not applicable for bookings made within two weeks of the travel date. You may book your ticket at www.southwest.com (no service fee applies); in the promotion code box, type 99150833 to receive the discount.

United Airlines
Tel: 800.426.1122
www.united.com
SOT Discount Code: ZR5G796287
United Airlines is offering up to a 10% discount on fares for attendees traveling to Phoenix for the SOT Annual Meeting. The discount is valid March 20 – 30, 2014. You may book your ticket at www.united.com (no service fee applies); in the offer code box, type ZR5G796287 to receive the discount.

SOT Travel Agent—Carlson Wagonlit
Carlson Wagonlit is the official travel management firm for SOT’s 53rd Annual Meeting. To take advantage of their services and savings, call toll-free 800.669.6024 Monday through Friday, 9:00 am–5:30 pm (Eastern standard time) and ask to speak to anyone on our SOT-dedicated team, or email arlington.us@contactcwt.com. To obtain the maximum discounted fares, call at least 60 days prior to departure. Discounted fares are still obtainable up to 14 days in advance.

Please note that Carlson Wagonlit charges a $42 service fee per ticket.

Before calling Carlson Wagonlit, please gather the following information:
- Your name as it appears on your ID, and your date of birth
- The desired dates of arrival to and departure from Phoenix
- Your home city or originating airport
- Your approximate time of departure from the originating airport
- The number of persons traveling (adults/children)
- Your method of payment, either credit card or check
- Your airline frequent flyer number(s)

Phoenix Sky Harbor International Airport (PHX)
Phoenix Sky Harbor International Airport (PHX) is a joint civil-military public airport located three miles southeast of the central business district of the city of Phoenix, in Maricopa County, Arizona. Phoenix Sky Harbor International Airport is one of the ten busiest in the nation for passenger traffic serving over 40 million passengers per year. Sky Harbor services more than 80 domestic and approximately 21 international cities with daily flights, most of them nonstop. For more information, go to www.skyharbor.com.

Ground Transportation—From the Airport
Ground transportation is located curbside in each of the four terminals at Phoenix Sky Harbor International Airport (PHX).

Car Rental
Hertz
US and Canada: 800.654.2240
Local: 405.749.4434
SOT Discount Code: CV#04X50001
Hertz is the official car rental company for the 53rd SOT Annual Meeting. SOT discounted rates begin at $47 per day. These special group rates are good one week before and after the SOT Annual Meeting. To reserve your car on line go to www.toxicology.org/AI/MEET/AM2014/hertz.asp. You may also call Hertz directly at the numbers listed above. Be sure to mention the SOT Hertz discount number CV#04X50001.

Taxi Cabs
Apache Taxi: 480.804.1000
AAA/Yellow Cab: 480.888.8888
Mayflower Cab: 602.955.1355
Taxi fares to Phoenix downtown areas are $5 for the first mile; each additional mile is $2.30. Each hour of a traffic delay is $23. The minimum fare is $15. The following taxis are contracted to pick up passengers at Phoenix Sky Harbor, and the rate remains the same regardless of the company, number of passengers, and number of bags.

Shuttle Service
SuperShuttle
Tel: 602.244.9000
www.supershuttle.com/?gc=2UNM9&port=PHX&aType=M
SOT Discount Code: 2UNM9 only online
SuperShuttle and Execucar provide the easiest and most cost-effective ground transportation service between the Phoenix Sky Harbor International Airport and all other major hotels in the downtown area. Shuttles depart from 9:00 AM–9:00 PM daily to downtown hotels every 15 minutes. Passengers may purchase tickets at the airport baggage claim area. Ticket fares are $18 per person.
General Information

to downtown hotels or $34 for a roundtrip ticket. Book online and receive an additional discount. Online rates are $11 one way and $22 roundtrip per person. The SOT discount is valid March 20–31, 2014 and available only online.

PHX Sky Train and METRO Rail
The PHX Sky Train™ is an automated train that transports travelers from 44th Street/ Washington Valley Metro Light Rail to the East Economy parking area and Terminal 4. The PHX Sky Train™ is free to the public and runs 24 hours a day, arriving at stations about every three minutes during peak periods.

Once at the 44th Street and Washington Metro Light Rail station, board a westbound train taking you into downtown Phoenix, past the Phoenix Convention Center, and to the convention hotels in the area.

Approximate cost is $2, and transfer time is 15 minutes. For more information, visit www.valleymetro.org or call 602.253.5000.

Public Transportation—Getting around Town

Metro Light Rail
Tel: 602.253.5000
www.valleymetro.org

The Metro Light Rail is a convenient, cost effective, and the easiest way to get around downtown Phoenix. Vending machines are located at each light rail station and have on-screen instructions for purchasing tickets, which makes your transaction simple and fast. A one-ride pass is $1.75, or for an all-day pass, $3.50. Trains arrive at stations every 10 minutes between 6:00 am–7:00 pm on weekdays and every 15 minutes on Saturdays. All other times are every 20 minutes. Trains operate seven days a week, 20+ hours a day, 365 days a year.

Arizona Pedal Cab Company
Tel: 602.252.1152
www.azpedicab.com

The Arizona Pedal Cab Company is the oldest established pedicab company in the state. It is a human-powered, radio-dispatch cycle shuttle between hotels, bars, eateries, and Phoenix Convention Center. Downtown tours available.

Phoenix Convention Center Parking (PCC)
The Phoenix Convention Center operates and manages approximately 8,000 parking spaces in the downtown area. Getting to the convention center is relatively simple. The center is within walking distance of two light rail stations, and they offer four convenient parking garages to choose from. Event parking fees in covered garages average $12. Metered parking is also available for $1.50 an hour until 5:00 pm Monday–Friday, and is free after 5:00 pm weeknights and all day Saturday and Sunday.

East Parking Garage
602 E. Washington Street
Phoenix, AZ 85004
Capacity: 2,876 Spaces, 7 levels
Venues Serviced: PCC North Building, PCC South Building, Chase Field, and US Airways Center
Entry Locations:
Jefferson Street between 5th Street and 7th Street
Washington Street between 5th Street and 7th Street
5th Street between Washington Street and Jefferson Street (buses and trucks only)

West Parking Garage
185 N. 2nd Street
Phoenix, AZ 85003
Capacity: 194 Spaces, 2 levels
Venues Serviced: PCC West Building, Symphony Hall, and Herberger Theatre Center
Entry Location:
Corner of 2nd Street and Monroe Street

North Parking Garage
475 E. Monroe Street
Phoenix, AZ 85004
Capacity: 325 Spaces, 2 levels
Venues Serviced: PCC North Building, Arizona Science Center, and St. Mary’s Basilica
Entry Location:
Monroe Street between 3rd Street and 5th Street

Regency Parking Garage
40 N. 2nd Street
Phoenix, AZ 85004
Capacity: 513 Spaces, 5 levels
Venues Serviced: PCC West Building, Symphony Hall, and the Hyatt Regency
Entry Location:
Corner of 2nd Street and Adams Street

Overnight Parking
Due to city zoning restrictions, overnight parking is not permitted in Phoenix Convention Center parking garages.

Please check the SOT Hotel Accommodations and Services on pages 18–21 for valet and self-parking rates for your hotel.

SOT Ride Share
SOT is offering a ride-share program in conjunction with the Annual Meeting. For those who live close enough to the Phoenix area or those who do not wish to fly, you may want to consider the ride-share program. Avoid airport hassles by driving and make it easier for other scientists to attend by sharing ideas. Students especially appreciate ways to make the meeting even more economical.

Once you have registered for the Annual Meeting, you can access the ride-share program. You can indicate whether you want to drive or be a passenger, and then see a list of others who have signed up. It will be up to you to match your plans with someone else who is registered, and then to remove your name when you have travel plans in place.

Weather
Phoenix has a subtropical desert climate, typical of the Sonoran Desert in which it lies. Although Phoenix has extremely hot summers and warm winters, the average temperature for March is a pleasant 62.2°F. For an up-to-date, detailed weather forecast, visit the National Weather Service Forecast Office at www.wrh.noaa.gov/psr.
Enhance Your Annual Meeting Experience

Participate in your Regional Chapter, Special Interest Group, and Specialty Section Meetings and Receptions.

Your component group meetings and receptions offer an excellent opportunity to network at the SOT Annual Meeting. Be sure to attend your Regional Chapter, Special Interest Group, or Specialty Section meeting/reception to connect and engage with your colleagues. It’s a great time to catch up with new and old friends and colleagues!

Interested in joining a Regional Chapter, Special Interest Group, or Specialty Section?

Attend a component group networking meeting/reception at the Annual Meeting. It’s a great way to meet, network and decide on joining a component group. You’ll be glad you did!

Component group meetings/receptions may be found on the SOT mobile event app or event website and in the 53rd Annual Meeting Program.
Registration for the Annual Meeting is available now. Register by January 31 to get the Early-Bird rate to avoid on-site registration lines and ensure that you receive your registration materials before the meeting. Registration is available online, via fax, or mail to SOT Headquarters.

Online Registration
SOT members and nonmembers are invited to register for the 2014 SOT Annual Meeting using the SOT Online Registration System. The system is designed for those who will be paying their registration fee by credit card.

Registration information can be accessed via the SOT website at www.toxicology.org/register. After registering, you will receive an electronic confirmation. If you do not, please send an email to jim@toxicology.org.

Mail or Fax Registration
Registrants may fax or mail their registration payments using the registration form located on pages 33 and 35. Please type or print clearly. No phone registrations will be accepted.

Please send registration forms to:

SOT Registration
PO Box 91895
Washington, DC 20090-1895

or

SOT Headquarters
(Faxes require credit card payment)
Fax: 703.438.3113

Express packages must be mailed to:

SOT Headquarters Registration Dept.
1821 Michael Faraday Drive, Suite 300
Reston, VA 20190

Forms will be date-stamped as they arrive. This is your date of registration. Fax registrations will be accepted by SOT Headquarters only if a credit card number is clearly listed in the appropriate area.

SOT needs only one copy for processing. All mailed and faxed registration forms will be processed online by SOT staff.

Registration Materials
In an effort to increase resources, the printed Program will be mailed ONLY by request (in the US and Canada only). If you wish to receive your printed Program before the meeting, please mark the checkbox on the registration form by February 28, and it will be mailed to you in late February (in the US and Canada only). The Program will also be available for download via the SOT website in January and for pick up on-site. See pages 26 and 35 for more details about the Program and The Toxicologist.

Badges and event tickets will be mailed in advance if you register by January 31, 2014. When you arrive at the Phoenix Convention Center, please go to the registration area located on the Lower Level, North Building to pick up your registration materials that were not mailed (i.e., Program, the ToxExpo Directory, and other supplementary materials). You must present your 2014 Annual Meeting badge to obtain these items. The materials will be available in bins near the registration area.

If you have not already registered or have not received your badge when you arrive at the meeting, please go to the registration counters. NOTE: If you are registered and have your badge, you do not need to stand in the registration line.

Registration Guidelines

Payment
Registration forms must be accompanied by one of the following methods of payment:

• Check (company or personal), United States currency only. Please list all registrants on check memo or check stub.
• Government Purchase Order (Check must be drawn from the US Department of Treasury.)
• Money Order
• Visa, MasterCard, Discover, Diner’s Club, or American Express

Registration Deadlines

- Early-Bird Registration: January 31, 2014
- Standard Registration: February 28, 2014
- Final Registration after: February 28, 2014

DO NOT mail your registration form to SOT if it will arrive after March 20, 2014. SOT will accept Annual Meeting registrations until March 20. After March 20, registrations not processed online will only be accepted on-site at the Annual Meeting. The online registration system will be open throughout the meeting, and if you register online after March 20, 2014, you can easily pick up your badge at the “BADGE PICK UP” registration counter.

Registration Discount to Nonmembers
JOIN SOT AND SAVE!

Special offer to nonmember 2014 Annual Meeting attendees: apply for membership by May 1, 2014, and when accepted, SOT will waive your 2014 dues. See page 34 for membership information.

Guest/Spouse Registration
The SOT Guest/Spouse Hospitality Room provides guest participants (nonscientists) with a place to meet and socialize with other guests. The room will be open Sunday through Thursday, and information on local attractions, rental cars, and tours will be available there. Guests and spouses must be registered for the Annual Meeting to access the Hospitality Room. Guests should register with the person they are accompanying. Reminder: Guest/Spouse registrants and children under the age of 15 are not permitted in the Exhibit Hall) unless the session chair has provided consent.

If the person the guest is accompanying is already registered, he or she must use the Guest Registration Form and send it to SOT Headquarters along with a copy of the regular registrant’s confirmation.

(join on page 36)
Registration Form
SOT 53rd Annual Meeting • March 23–27, 2014

(REQUIRED: Please check the appropriate box)

PLEASE PRINT CLEARLY OR TYPE

☐ SOT Member  ☐ Nonmember  Badge Name: ____________________________
First Name/Middle Initial: ____________________________  Professional Degree(s): ____________________________
Organizational Name: ____________________________
(Is this a new employer and/or new address?  _____ Yes  _____ No)
Company (second line): ____________________________
Department: ____________________________
Street Address: ____________________________
City/Region: ____________________________  State/Prov: ____________________________  Postal Code: _____________
Country: ____________________________
Area Code/Telephone Number: ____________________________  Fax Number: ____________________________
Email Address: ____________________________
Advisor’s Name: ____________________________
Institution: ____________________________
Advisor’s Telephone Number: ____________________________  Advisor’s Email: ____________________________

REGISTRATION FEES:

<table>
<thead>
<tr>
<th>Registration Fee(s)</th>
<th>Early Bird Registration (Received by Jan. 31)</th>
<th>Standard Registration (Feb 1 to Feb. 28)</th>
<th>Final Registration (After Feb. 28*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOT Member</td>
<td>$300</td>
<td>$360</td>
<td>$420</td>
</tr>
<tr>
<td>Nonmember**</td>
<td>$640</td>
<td>$700</td>
<td>$760</td>
</tr>
<tr>
<td>SOT Retired/Emeritus Member</td>
<td>$70</td>
<td>$120</td>
<td>$170</td>
</tr>
<tr>
<td>Postdoctoral SOT Member</td>
<td>$85</td>
<td>$135</td>
<td>$185</td>
</tr>
<tr>
<td>Postdoctoral Nonmember**</td>
<td>$170</td>
<td>$220</td>
<td>$270</td>
</tr>
<tr>
<td>Graduate Student Member</td>
<td>$65</td>
<td>$115</td>
<td>$165</td>
</tr>
<tr>
<td>Graduate Student Nonmember**</td>
<td>$130</td>
<td>$180</td>
<td>$230</td>
</tr>
<tr>
<td>Undergraduate Student (Copy of Student ID Required)</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>SOT Affiliate</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Press</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Guest/Spouse (Nonscientist)</td>
<td>$70</td>
<td>$85</td>
<td>$100</td>
</tr>
</tbody>
</table>

Guest/Spouse Name: ____________________________

☐ CME Only (Wednesday and Thursday) ____________________________
☐ CME Only (Wednesday) ____________________________
☐ CME Only (Thursday) ____________________________

METHOD OF PAYMENT:

All registrations submitted by hard copy or fax will be processed online by SOT staff.

☐ Check or Money Order # ____________________________

Government Purchase Order # ____________________________

(US GOVERNMENT PO FORM MUST BE ATTACHED)

☐ American Express  ☐ Diner’s Club  ☐ Discover  ☐ MasterCard  ☐ Visa

Credit Card #: ____________________________  Expiration Date: ____________________________
Signature: ____________________________  Cardholder’s Printed Name: ____________________________

By registering for the SOT Annual Meeting you agree to the terms and conditions outlined in the registration policies on page 36.

REGISTRATION FEES: $ ____________________

Print Materials $ ____________________

Student and Postdoc Functions $ ____________________

Continuing Education Courses $ ____________________

TOTAL DUE $ ____________________

* After February 28, Final Registration rates apply. SOT will accept faxed registration forms until March 20. Online registration will be open until March 27. On-Site registration forms will be available at the Annual Meeting Registration Desk.

** Special offer to Novmember 2014 Annual Meeting attendees: Apply for membership by May 1, 2014, and when accepted, SOT will waive your 2014 dues.

RETURN THIS TWO-PAGE FORM WITH PAYMENT TO:
Society of Toxicology • PO Box 91895 • Washington, DC 20090-1895
Faxed forms are accepted only if using a credit card. Fax form to: 703.438.3113.

US GOVERNMENT PURCHASE ORDERS MUST BE FAXED OR MAILED WITH THE REGISTRATION FORM.
Express packages may be mailed to:
SOT Headquarters Registration Dept., 1821 Michael Faraday Drive, Suite 300, Reston, VA 20190-5332
Questions? Contact SOT • Tel: 703.438.3115 • Email: sothq@toxicology.org

up-to-date information at www.toxicology.org
**JOIN as a new member or upgrade to the level of membership that’s right for you**

Founded in 1961, the Society of Toxicology (SOT) includes more than 7,400 members from nearly 60 countries worldwide. SOT members are drawn from academic institutions, industry, and government service, among others, and are active in myriad related fields and professions. All members partner with SOT in advancing science to enhance human, animal, and environmental health. You may apply to join the SOT at the following membership levels:

- **Student**—enrolled in a graduate degree program related to toxicology
- **Postdoctoral**—hold a PhD or other doctoral degree (e.g., MD, DVM) with an interest in toxicology and be under the direction of a research mentor
- **Associate**—engaged in continuing professional scientific activities in toxicology
- **Full**—demonstrate a continuing professional interest in toxicology and have conducted and published original research and/or are generally recognized as expert in some area of toxicology

Apply for or upgrade to the level of membership that’s right for you! Please see the “Join SOT” section of the SOT website at [www.toxicology.org/ms/join.asp](http://www.toxicology.org/ms/join.asp) for further information.

Undergraduate students may become SOT Undergraduate Student Affiliates.

**As an SOT member you can…**

- Communicate, connect, and collaborate with colleagues via ToXchange, the professional, secure SOT member network, and keep current at [www.toxicology.org](http://www.toxicology.org) with member-only information.
- Qualify for reduced SOT member rates for the SOT Annual Meeting, Continuing Education Courses, and Contemporary Concepts in Toxicology topical meetings.
- Receive SOT publications, including the official journal of the SOT, *Toxicological Sciences; The Toxicologist;* the SOT newsletter, *Communiqué,* and the SOT Membership Directory.
- Utilize Career Resources such as the SOT Job Bank and register for Mentor Match as a mentor or mentee.
- Qualify for exclusive SOT member awards—from Graduate Student Travel Support and Research Training to Postdoctoral Fellowships, Traveling Lectureships, SOT Awards, and more!
- **Plus…** Choose to join one or more of 27 Specialty Sections, 18 Regional Chapters, or 6 Special Interest Groups that provide a variety of networks for exchanging information and collaborating with peers. **Note:** Graduate Student and Postdoctoral members may join one Specialty Section and one Special Interest Group at no additional cost.

**Membership Fees:**

<table>
<thead>
<tr>
<th>Membership Level</th>
<th>Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Membership</td>
<td>$138</td>
</tr>
<tr>
<td>Associate Membership</td>
<td>$138</td>
</tr>
<tr>
<td>Postdoctoral Membership</td>
<td>$35</td>
</tr>
<tr>
<td>Student Membership</td>
<td>$20</td>
</tr>
</tbody>
</table>

**Membership Fees for Members from Developing Countries**

<table>
<thead>
<tr>
<th>Membership Level</th>
<th>Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Membership</td>
<td>$50</td>
</tr>
<tr>
<td>Associate Membership</td>
<td>$50</td>
</tr>
<tr>
<td>Postdoctoral Membership</td>
<td>$10</td>
</tr>
<tr>
<td>Student Membership</td>
<td>$10</td>
</tr>
</tbody>
</table>

Join or upgrade your membership using the easy online membership application at [www.toxicology.org](http://www.toxicology.org).

**Membership**

[www.toxicology.org](http://www.toxicology.org)

*For complete information about membership in the Society of Toxicology, visit the SOT website at [www.toxicology.org](http://www.toxicology.org) and select Member Information.*
### CONTINUING EDUCATION COURSES:

- **Yes, I would like to attend the following CE courses. (Only meeting registrants may enroll in a CE course.)**
  
<table>
<thead>
<tr>
<th>AM #</th>
<th>PM #</th>
<th># of Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOT Member/Affiliate</td>
<td>$150 each</td>
<td>$185 each</td>
</tr>
<tr>
<td>SOT Retired/Emeritus Member</td>
<td>$110 each</td>
<td>$145 each</td>
</tr>
<tr>
<td>Nonmember</td>
<td>$300 each</td>
<td>$335 each</td>
</tr>
<tr>
<td>Postdoctoral (SOT Member/Nonmember)</td>
<td>$90 each</td>
<td>$125 each</td>
</tr>
<tr>
<td>Graduate or Undergraduate Student (SOT Member/Nonmember)</td>
<td>$45 each</td>
<td>$80 each</td>
</tr>
<tr>
<td>Press</td>
<td>$0 each</td>
<td>$0 each</td>
</tr>
</tbody>
</table>

- **Yes, I would like to attend the Sunrise CE Mini-Course (includes continental breakfast)**
  
<table>
<thead>
<tr>
<th>AM #</th>
<th>PM #</th>
<th># of Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOT Member/Affiliate</td>
<td>$55 each</td>
<td>$90 each</td>
</tr>
<tr>
<td>SOT Retired/Emeritus Member</td>
<td>$55 each</td>
<td>$90 each</td>
</tr>
<tr>
<td>Nonmember</td>
<td>$75 each</td>
<td>$110 each</td>
</tr>
<tr>
<td>Postdoctoral (SOT Member/Nonmember)</td>
<td>$55 each</td>
<td>$90 each</td>
</tr>
<tr>
<td>Graduate or Undergraduate Student (SOT Member/Nonmember)</td>
<td>$25 each</td>
<td>$60 each</td>
</tr>
<tr>
<td>Press</td>
<td>$0 each</td>
<td>$0 each</td>
</tr>
</tbody>
</table>

### STUDENT AND POSTDOCTORAL FUNCTIONS:

- **Yes, I am an undergraduate student and would like to attend the Sunday Undergraduate Education Program. (Limited seating and ticket required)**
  
  - Cost: $125 each
  - AM # 5
  - PM # 5

- **Yes, I am a student or postdoc registrant and would like to attend the complimentary Student/Postdoctoral Mixer on Sunday, 7:30 pm–9:00 pm. (Ticket required)**
  
  - Cost: $55 each
  - AM # 5
  - PM # 5

- **Yes, I am a graduate student or postdoc member registrant and would like to attend the complimentary Trainee Discussion Lecture**
  
  - AM # 5

- **Yes, I would like to attend the Sunrise CE Mini-Course (includes continental breakfast)**
  
  - Cost: $125 each
  - AM # 5

### PRINT MATERIALS:

In an effort to increase resources, the printed Program will be mailed ONLY by request (in the US and Canada only). If you wish to receive your printed Program before the meeting, please mark this checkbox and it will be mailed to you in late March (in the US and Canada only). The Program will also be available for download via the SOT website in January and for pick up on-site.

- **Yes, I want to receive the printed Program in the mail (option not available after February 28, 2014).**
  
  - Cost: $25 each

### REGISTRANT—CIRCLE ALL THAT APPLY: (YOU MUST MAKE ONE SELECTION/CATEGORY)

#### A. Type of Organization:

- 1. Academia
- 2. Consultant
- 3. Contract Research
- 4. Government
- 5. Military
- 6. Private Industry
- 7. Other

#### B. Job Function:

- 8. Analytical
- 10. Computer/Statistics
- 11. Health and Safety
- 12. Mgmt. Corporate
- 13. Mgmt. Facilities
- 14. Mgmt. Personnel
- 15. Marketing/Sales
- 16. Quality Assurance
- 17. Regulatory
- 19. R&D Operations
- 20. R&D Technical
- 21. Teaching
- 22. Other

#### C. Field of Work:

- 23. Biological Modeling
- 24. Biotechnology
- 25. Carcinogenesis
- 26. Cardiovascular
- 29. Dermal Tox.
- 31. Epidemiology
- 32. Ethical, Legal, and Social Issues
- 33. Food Safety
- 34. General Tox.
- 35. Genetic Tox.
- 36. Immunotoxicology
- 37. Infusion Tox.
- 38. Inhalation Tox.
- 40. Mechanisms
- 41. Medical Devices
- 42. Metals
- 43. Methods
- 44. Mixture
- 45. Molecular Biology
- 46. Mutagenicity
- 47. Nanotoxicology
- 48. Neurotoxicology
- 49. Occup. and Public Health
- 50. Ocular Tox.
- 51. Pathology
- 52. Pharmacokinetics
- 53. Pharmacology
- 54. Risk Assessment
- 55. Reg. and Safety Eval.
- 56. Repro. and Develop. Tox.
- 57. Stem Cells
- 58. Other

#### D. Product Interest:

- 59. Publications
- 60. Contract Services:
  - a. Analytical
  - b. Aquatic Tox.
  - c. Clinical Tox.
  - d. Computer
  - e. In Vitro Tox.
  - f. Metabolic Profile
  - g. Pathology
  - h. Predilutional Tox.
  - i. Quality Assurance
  - j. Wildlife Tox.
  - 61. Supplies/Equipment
    - a. Analytical
    - b. Clinical Chem.
    - c. Hardware
    - d. Software
    - e. In Vitro
    - f. In Vivo
    - g. Lab Animal
    - h. Neurotoxicology
    - i. Pathology
    - j. Radiative Isotope
    - 62. Other

#### E. Purchasing Responsibilities:

- 63. I make purchasing decisions
- 64. I influence purchasing decisions
- 65. I do not participate in purchasing decisions

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There will be no refunds for cancellations received at SOT Headquarters after February 28, 2014.

SOT will accept faxed registration forms until March 20. Online registration will be open until March 27. On-Site registration forms will be available at the Annual Meeting Registration Desk. There will be no refunds after February 28, 2014.
Registration

(continued from page 32)

Guests are welcome to attend the Welcome Reception, but will not have access to the scientific sessions or the Exhibit Hall. Please remember to wear your badge to all SOT events. The Guest/Spouse Hospitality Room will be located in the Sheraton Phoenix Downtown Hotel.

**CME Registration**

New this year, Continuing Medical Education (CME) only registration is available at reduced cost. There are 1) Wednesday and Thursday, 2) Wednesday Only, or 3) Thursday Only CME course registration options. Please see the registration form for details.

**Tickets**

Tickets are required for Continuing Education courses and some other events. If you have these events on your registration form, your tickets will be issued with your meeting badge.

Annual Meeting registration is required to participate in CE or special events.

**Confirmation**

Online registrants will receive an electronic confirmation following registration. All registrants will be mailed a registration confirmation, name badge, and Continuing Education and/or event ticket(s) before the meeting if your registration form is received by January 31, 2014. If your registration is received after January 31, you can pick up your badge and tickets at the “BADGE PICK UP” registration counters on-site. You do not need to enter the regular registration line.

**Cancellation Refund Policy**

All requests for cancellations and/or refunds must be received in writing at SOT Headquarters by February 28, 2014. These refunds will be processed, less a $50 cancellation fee, following the Annual Meeting. *Refund requests received after February 28, 2014, will not be processed.*

**Exhibitors**

To register exhibitor booth staff, please visit [www.ToxExpo.com](http://www.ToxExpo.com) and log into the Exhibitor Service Center using your password, which was provided in your booth confirmation email. For more information, please email sot_exhibits@toxicology.org.

**Americans with Disabilities Act (ADA)**

The Phoenix Convention Center is accessible to persons with special needs. If you have special needs, please check the special accessibility requirement box or contact Heidi Prange at SOT Headquarters: 703.438.3115 ext. 1424 or email: heidi@toxicology.org.

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### 2014 SOT Annual Meeting Policies

By registering for the 2014 SOT Annual Meeting, you are agreeing to the following terms and conditions:

For individuals who are not members of SOT, participation in SOT’s Annual Meeting and ToxExpo is available only to bona fide individuals who are engaged in or promote the field of toxicology or biotechnology research and support the growth and development of the toxicology field. For organizations, participation in the SOT’s Annual Meeting and ToxExpo is available only to bona fide organizations with public policy positions and business practices that are generally consistent with SOT’s mission, goals, reputation, and its policies and principles as determined by SOT. SOT reserves the right to review applications for participation at SOT’s Annual Meeting and ToxExpo to confirm that the applicant meets these criteria and may, at SOT’s sole discretion, reject a registration by any individual or organization or withdraw registration privileges at any time if any individual or organization is found to be inconsistent with SOT’s principles and interests.

**Unless written notification by the registrant, stating otherwise, is submitted to SOT Headquarters prior to the Annual Meeting or while registering on-site, SOT Annual Meeting registrants grant SOT permission:**

- To reproduce, copy, and publish image, voice, and any or all media taken at the Annual Meeting.
- To share registrant contact information with organizations that we believe might have a product or service of interest to you. Limited data provided to third parties include name, affiliation, and business address. Your telephone and fax numbers, and email will not be disclosed to third parties.
- To share registrant name and affiliation with SOT exhibiting companies.
- To be included in the attendee listing accessible to meeting registrants using the mobile event app or event website—registrant name and affiliation shared.

The policies adopted above will be enforced by the Society. Those individuals who do not comply will be asked to leave the session or ToxExpo floor. If you have any questions regarding these policies, please contact the SOT Headquarters Office.
The SOT 2014 Annual Meeting Mobile Event App

This year we are happy to announce we are providing you, our guests, with a new and improved mobile event app and event website. These tools offer multiplatform mobile solutions for the SOT Annual Meeting and ToxExpo, provided free of charge to attendees and exhibitors. The mobile event app and event website will be available late January via the SOT website and app marketplaces. These mobile tools enable you, the attendee, to engage with organizers, exhibitors, and each other, and to manage your time and maximize your experience while at the Annual Meeting.

The mobile event app and website will allow you to:

- Connect with fellow attendees
- Enhanced for 2014—Build your own schedule and synchronize from the mobile event website to your iPad, tablet, and smartphone simply by logging in
  - Add individual presentations or entire sessions to your schedule
  - Add a specific session abstract to your schedule
  - Add your own items to your schedule
- Enhanced for 2014—View presentation details, abstracts, and ePosters
- Enhanced for 2014—Search for items based on session title, abstract title, abstract keywords, thematic track, author name or affiliation
- View and interact with speakers
- Enhanced for 2014—Build your own Briefcase and synchronize from mobile event website to your iPad, tablet, and smartphone by logging in
- View the Phoenix Convention Center map and Phoenix city maps
- Request meetings with attendees and exhibitors
- Navigate the real-time ToxExpo floor plan and search for products, specials, and exhibitors
- Contact exhibitors
- Integrate with ToXchange, Twitter, and Facebook
- Scan QR codes quickly and easily within the app

Download the app late January from your favorite app marketplace, or access the mobile event website via the SOT website.
YOUR EMPLOYMENT AND RECRUITMENT RESOURCE

Job Seekers—Jobs Await You in the SOT Job Bank!
Employers Are Looking for Candidates through This Service

- Every SOT member can utilize the SOT Job Bank as a job seeker free of charge.
- SOT Members can log in to instantly browse posted positions.
- Post your resume and activate your profile to be seen by potential employers.
- Review the positions posted by many different corporations, academic institutions, government agencies, and private research organizations; positions range from junior to senior level.
- Search by geographic location, employer name, salary, and other criteria.
- Find potential matches to your skills and training at any stage of your career.
- Contact employers.
- Gain access to information that will help you plan your near-term and long-term goals and objectives.
- See which sectors are hiring.
- Stay abreast of new and emerging fields.

Employers—Recruit Highly Qualified Candidates through the SOT Job Bank!
The SOT Job Bank is the Ideal Place to Streamline Your Recruitment Process

- Join the many employers who rely on this cost-effective and efficient database to assist with their employment needs.
- Find the right candidate from among scientists trained in toxicology and the biological sciences with the expertise and work experience you are looking for.
- Schedule interviews to be held during the SOT Annual Meeting at the on-site Job Bank Center.
- Reserve interview rooms in advance or on-site.
- SOT Corporate Affiliates receive a reduced registration rate in appreciation for supporting the Society in achieving its objectives.

The Online SOT Job Bank is available any time at www.toxicology.org/jobbank

SOT | Society of Toxicology
Streamline Your Job Search: Use SOT Job Bank Services

Free Job Search for SOT Members!
The SOT Annual Meeting, with over 6,500 attendees, including top toxicologists, early-career scientists, and toxicology-related employers, is the best place to make your connection. Whether you are looking for a position or searching for the right candidate the SOT online Job Bank prepares you to take full advantage of the on-site Job Bank Center in Phoenix.

Job Bank
Access Available Any Time, Anywhere
The SOT online Job Bank includes positions available at corporations, academic institutions, government agencies, and private research organizations. Last year over 100 positions were posted at the time of the Annual Meeting. Employers rely on this service to provide them with a robust database of candidates available for career opportunities ranging from junior -to senior- level positions. As a member benefit, SOT members can search Job Bank listings at no cost. SOT Corporate Affiliates may use this system at a reduced rate in appreciation of their commitment to helping further the objectives of the Society. Candidates and employers alike can access this year-round service any time at www.toxicology.org/jobbank.

The SOT online Job Bank allows you to:
- Register as a candidate or employer
- Post employment positions or resumes
- Search the Job Bank database
- Contact active employers or candidates

Candidates may search the listing of available jobs, and employers may browse candidate profiles. Both employers and candidates have the option of making a confidential posting, in which no identifying information is displayed. Communication with a desired employer or candidate can even be made via email messages created within the system to protect confidentiality. Candidates will want to update their CVs and contact information due to the increased traffic to the Job Bank at the time of the Annual Meeting.

Annual Meeting Job Bank Center
Located in the Phoenix Convention Center in 130 (Office) and 131 B-C (Interview Rooms), the on-site Job Bank Center provides access to the SOT Job Bank as well as assistance in facilitating interviews at the SOT Annual Meeting. We offer personalized assistance if you are new to the Job Bank or have questions. For your convenience, printers will be available for producing hard copies of candidate profiles and position descriptions. All candidates and positions must be sought online.

The center is available during the following hours of operation:

- Sunday ..................1:00 PM–5:00 PM
- Monday .................9:00 AM–5:00 PM
- Tuesday ..................8:30 AM–5:00 PM
- Wednesday...............8:30 AM–5:00 PM

Employers recognize and appreciate that the Annual Meeting Job Bank Center provides a cost-effective and efficient way to interview a distinguished pool of candidates. For your convenience, we provide eight interview rooms on-site during the hours listed above. Employers may reserve interview rooms ahead of time or at the meeting on a first-come, first-served basis.

Mentor Match
Online Mentoring Program
The Society of Toxicology recognizes the importance of mentoring in the scientific and professional development of its members. The objective of the Mentor Match online mentoring program is to provide a service that matches mentees with potential mentors from the SOT membership to provide advice on career path selection, professional development, and life/work balance issues. SOT members are encouraged to share their professional knowledge and experience by serving as mentors for colleagues and for the next generation of toxicologists. The SOT Annual Meeting provides a great opportunity for the mentor and mentee to meet in person. We strongly encourage members of the Society to visit the Mentor Match site and register online as mentors and/or mentees. The Mentor Match program is accessible to all active SOT members by visiting www.toxicology.org/ai/newcrad/mentormatch.asp.
SOT 53rd Annual Meeting

AWARDS CEREMONY • Sunday, March 23, 2014 • 5:15 PM to 6:30 PM • Phoenix Convention Center

Honorary Membership

John B. Gurdon, Kt, DPhil, DSc, FRS
Wellcome Trust/Cancer Research UK, Institute of Cancer and Developmental Biology, University of Cambridge, Cambridge, United Kingdom.

Donald E. Ingber, MD, PhD
Founding Director of the Wyss Institute for Biologically Inspired Engineering at Harvard University; Judah Folkman Professor of Vascular Biology at Boston Children’s Hospital and Harvard Medical School; and Professor of Bioengineering at the Harvard School of Engineering and Applied Sciences.

Board of Publications

Board of Publications for the Best Paper in Toxicological Sciences Award

The Threshold Length for Fiber-Induced Acute Pleural Inflammation: Shedding Light on the Early Events in Asbestos-Induced Mesothelioma

Anja Schinwald, Fiona A. Murphy, Adriele Prina-Mello, Craig A. Poland, Fiona Byrne, Dania Movia, James R. Glass, Janet C. Dickerson, David A. Schultz, Chris E. Jeffree, William MacNee, and Ken Donaldson

SOT Awards

Achievement Award
Matthew J. Campen, PhD, MSPH
University of New Mexico, Albuquerque, NM

Arnold J. Lehman Award
B. Bhaskar Gollapudi, PhD
Exponent, Inc., Midland, MI

Distinguished Toxicology Scholar Award
Richard E. Peterson, PhD
University of Wisconsin Madison, Madison, WI

Distinguished Toxicology Scholar Award Lecture—
Wednesday, March 26, 12:30 PM to 1:20 PM

Education Award
Herman N. Autrup, PhD, ATS
University of Aarhus, Aarhus, Denmark

Founders Award
John A. Thomas, PhD, ATS
Indiana University School of Medicine–Fishers, IN

Leading Edge in Basic Science Award
Vishal S. Vaidya, PhD
Harvard Medical School, Boston, MA

Leading Edge in Basic Science Award Lecture—
Tuesday, March 25, 8:00 AM to 8:50 AM

Merit Award
Jay I. Goodman, PhD, ATS
Michigan State University, East Lansing, MI

Merit Award Lecture–Monday,
Monday, March 24, 12:30 PM to 1:20 PM

Public Communications Award
David L. Eaton, PhD, ATS
University of Washington, Mukilteo, WA

Translational Impact Award
Timothy D. Phillips, PhD, ATS
Texas A&M University, College Station, TX

Translational Impact Award Lecture—
Wednesday, March 26, 4:30 PM to 5:20 PM

Undergraduate Educator Award
William D. Atchison, PhD
Michigan State University, East Lansing, MI

Undergraduate Educator Award

ENDOWMENT
Investing in the Future ...
## Sponsored Grants, Fellowships, and Awards

### Global Senior Scholar Exchange Program

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gonzalo J. Diaz, DVM, PhD</td>
<td>National University of Colombia, Bogotá, Colombia</td>
</tr>
<tr>
<td>Host:</td>
<td>James E. Klaunig, PhD, ATS, IATP</td>
</tr>
<tr>
<td></td>
<td>Indiana University, Bloomington, IN</td>
</tr>
<tr>
<td>Ebenezer O. Farombi, PhD, FRSC</td>
<td>University of Ibadan, Ibadan, Nigeria</td>
</tr>
<tr>
<td>Host:</td>
<td>Wilson Kiiza Rumbeiha, DVM, PhD, DABT, DABVT</td>
</tr>
<tr>
<td></td>
<td>Iowa State University, College of Veterinary Medicine, Ames, IA</td>
</tr>
</tbody>
</table>

### Best Postdoctoral Publication Awards

**Presented at the Postdoctoral Assembly Luncheon on Tuesday**

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
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</thead>
<tbody>
<tr>
<td>Annie Lumen, PhD</td>
<td>National Center for Toxicological Research/US FDA, Jefferson, AK</td>
</tr>
<tr>
<td>Gul Mehnaz Mustafa, PhD</td>
<td>University of Texas Medical Branch, Galveston, TX</td>
</tr>
<tr>
<td>Phoebe A. Stapleton, PhD</td>
<td>West Virginia University, Morgantown, WV</td>
</tr>
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</table>

### Colgate-Palmolive Grants for Alternative Research

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
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</thead>
<tbody>
<tr>
<td>Patricia E. Ganey, PhD</td>
<td>Michigan State University, East Lansing, MI</td>
</tr>
<tr>
<td>Matthew Troese, PhD</td>
<td>MB Research Laboratories, Spinnerstown, PA</td>
</tr>
</tbody>
</table>

### Colgate-Palmolive Postdoctoral Fellowship Award in In Vitro Toxicology

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
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</thead>
<tbody>
<tr>
<td>Jonathan H. Shannahan, PhD</td>
<td>University of Colorado, Aurora, CO</td>
</tr>
</tbody>
</table>

### Syngenta Fellowship Award in Human Health Applications of New Technologies

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
</tr>
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<tbody>
<tr>
<td>Dilshan S. Harischandra, BS</td>
<td>Iowa State University, Ames, IA</td>
</tr>
</tbody>
</table>

### Colgate-Palmolive Award for Student Research Training in Alternative Methods

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laura E. Armstrong, BS</td>
<td>University of Rhode Island, Kingston, RI</td>
</tr>
<tr>
<td>Christin M. Grabinski, MS</td>
<td>US Air Force Research Laboratory, Dayton, OH</td>
</tr>
</tbody>
</table>
SOT Developing Country Travel Awards
The SOT/AstraZeneca/SOT Endowment Fund/IUTOX Travel Awards for several individuals from developing countries selected in December 2013 will be honored at the Awards Ceremony.

Outstanding Graduate Student Leadership Committee Award
The Outstanding Graduate Student Leadership Committee (GSLC) Award recognizes a student representative who has contributed to the Society in a significant manner (i.e., above and beyond the normal expected basic service as a representative). Academic achievements are not considered for the award. Representative nominations and support letters should be submitted by February 1. The recipients will be honored at the Graduate Student/Postdoc Mixer on Sunday, March 23.

Regional Chapter, Special Interest Group, and Specialty Section Awards
Regional Chapters, Special Interest Groups, and Specialty Sections offer awards throughout the year. Check the website for full details at www.toxicology.org/awards.

Most of the SOT Endowment named funds provide travel support for students and postdoctoral to participate in the Annual Meeting. To learn more visit: www.toxicology.org/endowment.
Special Events

Recognition and Special Events

All activities will be held at the Phoenix Convention Center in Phoenix, Arizona, unless otherwise noted.

Full details on the Special Events will be available in the Program, on the website, and via the mobile event app.

Committee on Diversity Initiatives Reunion

Saturday, March 22, 7:00 PM to 9:00 PM

Sponsor(s):
Committee for Diversity Initiatives (CDI)

This year, the CDI Reunion, hosted by the Committee on Diversity Initiatives, will celebrate the 25th anniversary of the Undergraduate Education Program. This event will provide a great opportunity for former students, mentors, speakers, and, most especially, the organizers of the program to gather and celebrate its accomplishments—accomplishments made possible through the commitment and dedication of its volunteers. As always, 2014 program participants will be on hand for you to meet and greet, and the Gehring Diversity Student Travel Award will be presented. Dessert, coffee, and tea will be served. Start the 53rd Annual Meeting with this special 25th anniversary celebration of your contributions to the Undergraduate Education Program.

Awards Ceremony Music

Sunday, March 23, 4:45 PM to 5:15 PM

Performed by
Nicole Pesce

Nicole Pesce will perform for SOT Annual Meeting attendees prior to the SOT Award Ceremony. Nicole is currently nominated by Arizona Foothills Magazine’s “Best of 2014 Award” for “Best Local Band/Musician.” She has been recognized as one of the “top ten musicians to hear in Phoenix” by the Arizona Republic and plays everything from Chopin to Lady Gaga.

Nicole appeared on the Jerry Lewis MDA Telethon, which aired to over 60 million viewers. Through the years, Nicole has had the privilege of performing for Muhammad Ali, George Bush, Sr., Shaquille O’Neal, Jimmy Carter, Chris Rock, Steve Nash, and more. Find additional event details on the SOT 2014 Annual Meeting website at www.toxicology.org/ai/meet/am2014/socialevents.asp.

Awards Presentation

Sunday, March 23, 5:15 PM to 6:30 PM

SOT will recognize our prestigious award recipients at the SOT Awards Ceremony (pages 40–42). Please refer to the Awards and Fellowships section of the SOT website for complete details.

Welcome Reception

Sunday, March 23, 6:30 PM to 7:30 PM

Continue the celebration by attending the Welcome Reception following the Awards Ceremony. The Welcome Reception is a great opportunity to renew old friendships and to make new acquaintances. Please join the Society in this kick-off of the Annual Meeting.

25-Year (Or More) Member Reception

Sunday, March 23, 7:00 PM to 8:00 PM

If you have been a member of the Society of Toxicology for 25 years or more, please join your colleagues to celebrate and recognize the scientists who established the Society. Be sure to wear your 25-year, 35-year, 45-year, or 50-year member pin.

SOT Mentoring Breakfast

Monday, March 24, 6:15 AM to 7:45 AM (Reservation Required)

Sponsor(s):
Career Resource and Development (CRAD) Committee
Postdoctoral Assembly (PDA)
Graduate Student Leadership Committee (GSLC)

The Society of Toxicology recognizes the importance of mentoring in the scientific and professional development of its members. As such, the Career Resource and Development Committee, in conjunction with the Postdoctoral Assembly and Graduate Student Leadership Committee, is pleased to announce the 3rd Annual Mentoring Breakfast.

The Mentoring Breakfast is for SOT members at any career stage—from graduate students and postdoctoral fellows to senior scientists—who are seeking a mentor. Brief presentations will be followed by small group discussions led by trained facilitators. Facilitators will work to match participants with compatible mentors. Note that mentor information will be provided after the Annual Meeting, and only mentees should attend the breakfast.
A limit of 60 participants will be accepted on a first-come, first-served basis for this event at a cost of $10/person, which includes a continental breakfast.

Global Collaboration Coffee

Monday, March 24, 9:30 AM to 11:30 AM

The SOT Council invites all Global Gallery participants and representatives of societies from around the world to the Global Collaboration Coffee. Invitees also include SOT Special Interest Group leaders, IUTOX Executive Committee members, SOT Councilors, 2014 Global Senior Scholars and their hosts, and the 2014 recipients of the SOT/AstraZeneca/SOT Endowment Fund/IUTOX Travel Awards (senior scientists from developing countries.) This event offers an opportunity for scientific leaders to meet and make plans for future collaborations. Following the coffee, attendees will adjourn together to the Global Gallery, where presenters will share their posters in a “Representative Attended” poster time from 11:45 am to 12:15 pm on Monday, March 24. See page 24 for more information about the Global Gallery of Toxicology.

In Vitro Toxicology Lecture and Luncheon for Students

Monday, March 24, 12:00 Noon to 1:20 PM
(Ticket Required)

Chairperson(s): Teresa L. Leavens, Education Committee Chair, Cary, NC, and Emily G. Notch, Dartmouth Medical School, Hanover, NH.

Searching for Reliable Replacement Models in Topical Toxicology—Focus on Skin and Eye Toxicity

Lecturer: Helena Kandarova, MatTek Corp. & MatTek In Vitro Life Science Laboratories, Bratislava, Slovakia.

Supported by an educational grant from the Colgate-Palmolive Company

Host: Education Committee

The goal of the In Vitro Toxicology Lecture series is to feature important research using in vitro and alternative techniques to study basic mechanisms and to illustrate how these test methods benefit animal welfare by refining, reducing, and replacing animal use whenever it is feasible. Graduate students, undergraduates, postdoctoral scholars, and recipients of Colgate-Palmolive awards are among the guests at the In Vitro Toxicology Lecture and Luncheon. Students and postdoctoral scholars register for $10 (nonrefundable) via the Annual Meeting registration. Dr. Kandarova will present an introduction to the topic, and then participants will discuss related questions and report responses. More information can be found on page 46.

Postdoctoral Assembly Luncheon

Tuesday, March 25, 12:00 Noon to 1:15 PM
(Ticket Required)

Chairperson(s): Ebany Martinez Finley, The MIND Research Network, Albuquerque, NM.

Sponsor(s):

Postdoctoral Assembly

Amidst the hubbub of Annual Meeting events, the Postdoctoral Assembly (PDA) Luncheon is time for postdocs to relax, celebrate achievements, and have fun! All postdocs are invited to this casual luncheon organized by the PDA Executive Board. The Best Postdoctoral Publication Award will be given to three postdoctoral scholars, and postdoc award recipients from SOT Regional Chapters, Special Interest Groups, and Specialty Sections will be recognized. The PDA Board will review the year’s accomplishments and share their vision for the future. Newly elected Executive Board members for 2014-2015 will be introduced. Door prizes are always a big hit and add to the fun of the event. Postdocs should reserve a ticket for $10 when they register for the Annual Meeting.
Undergraduate Educator Network Meeting

**Wednesday, March 26, 2:15 PM to 3:30 PM**

**Chairperson(s):** Mindy F. Reynolds, Washington College, Chestertown, MD.

**Sponsor(s):**
- Education Committee
- Undergraduate Education Subcommittee

The Education Committee and the Undergraduate Education Subcommittee are hosting the Undergraduate Educator Network Meeting for all faculty involved in the teaching of toxicology to undergraduates, or for those interested in including toxicology at the undergraduate level. Hear an update on initiatives for undergraduate faculty, provide your input, and network.

Student and Postdoctoral Scholar Events

**Chat with an Expert**

**Monday, March 24 to Thursday, March 27**

**Time Varies by Group**

*(Meet at the Chat with an Expert Bulletin Board in registration area)*

**Sponsor(s):**
- Graduate Student Leadership Committee

The purpose of Chat with an Expert is to provide students and postdoctoral scholars the opportunity to network informally with well-established toxicologists while obtaining career advice and meeting new colleagues. Small groups are composed by matching research interests of students and postdocs with those of an expert. The expert for each group identifies a time and a place for an informal meeting (such as a coffee house or inexpensive restaurant), and the group meets at the Chat with an Expert Bulletin Board before proceeding to the meeting location. This program also includes opportunities for postdocs to host informal meetings with graduate students. Sign up via the Graduate Student section of the SOT website. Details for each group meeting will be sent to participants in advance of the meeting.

**Student/Postdoctoral Scholar Mixer**

**Sunday, March 23, 7:30 PM to 9:00 PM**

*(Ticket Required)*

**Sponsor(s):**
- Graduate Student Leadership Committee

The Graduate Student Leadership Committee hosts this opportunity for students and postdoctoral scholars to gather, meet new colleagues, and reestablish relationships in an informal atmosphere at the beginning of the meeting. Tickets are obtained at no cost by registering for this event on the Annual Meeting Registration Form. Ticket and meeting badge are required. Complimentary refreshments and a cash bar will be available.

**Poster Tours for Trainees**

**Monday, March 24 to Wednesday, March 26**

**Time Varies by Group**

*(Meet at the Poster Tour sign at the SOT Pavilion)*

**Sponsor(s):**
- Postdoctoral Assembly

Gradstudents and postdoctoral scientists will once again have the opportunity to participate in a one-hour guided poster tour with an expert toxicologist. Poster Tours for Trainees allows trainees to take part in critical evaluation of cutting-edge toxicology methods and research findings. It also provides the opportunity to network with an expert and build a mentoring relationship with a senior toxicologist. Notices will go out to grad students and postdocs once guide sign-ups are completed. Options to sign up for specific times and topics will also be provided on the Annual Meeting website.
Trainee Discussion with Plenary Lecturer: Dr. Gurdon

Monday, March 24, 10:00 AM to 11:00 AM  
(Ticket Required; SOT Student and Postdoctoral members only, limited seating)

Chairperson(s): Ebany Martinez-Finlay, The MIND Research Network, Albuquerque, NM.

Lecturer: John B. Gurdon, Wellcome Trust/Cancer Research UK, Institute of Cancer and Developmental Biology, University of Cambridge, Cambridge, United Kingdom.

Dr. Gurdon will meet informally for discussion with graduate students and postdoctoral scholars after his plenary opening lecture (see page 65). Room size is limited, and participants register for a ticket with their Annual Meeting registration.

In Vitro Toxicology Lecture and Luncheon for Students

Monday, March 24, 12:00 Noon to 1:20 PM  
(Ticket Required)

Chairperson(s): Teresa L. Leavens, Education Committee Chair, Cary, NC, and Emily G. Notch, Dartmouth Medical School, Hanover, NH.

Searching for Reliable Replacement Models in Topical Toxicology—Focus on Skin and Eye Toxicity

Lecturer: Helena Kandarova, MatTek Corp. & MatTek In Vitro Life Science Laboratories, Bratislava, Slovakia.

Supported by an educational grant from the Colgate-Palmolive Company

Host: Education Committee

The goal of the In Vitro Toxicology Lecture series is to feature important research using in vitro and alternative techniques to study basic mechanisms and to illustrate how these test methods benefit animal welfare by refining, reducing, and replacing animal use whenever it is feasible. Undergraduate students, graduate students, postdoctoral scholars, and recipients of Colgate-Palmolive awards are among the guests at the In Vitro Toxicology Lecture and Luncheon. Students and postdoctoral scholars register for $10 (nonrefundable) via the Annual Meeting registration. Dr. Kandarova will present an introduction to the topic, challenge participants to discuss specific questions at their tables, and then participants will report responses.

Lord Kelvin is reputed to have said, “If you can't make a model of it, you do not understand it.” This maxim can be applied perfectly to searching for replacement models (i.e., models where animals are not required) in toxicology. Major progress in development and broad acceptance of replacement models have been achieved in the area of topical toxicity. Since 2004, the Organization for Economic Cooperation and Development (OECD) Test Guidelines Program adopted three methods for skin irritation and four methods for skin corrosion testing that are based on the use of in vitro reconstructed human skin models. Reconstructed cornea models are being validated for general prediction of eye irritation, and they now are accepted by the US Environmental Protection Agency (EPA) for antimicrobial pesticides toxicity testing. This success was achieved because these in vitro systems are able to mimic with great fidelity many responses of native human tissues to toxic stimuli. However, one key problem in establishing reliable and relevant replacement models and methods is linked to the in vivo animal models used currently in regulatory toxicology. There are questions of their prediction accuracy for human responses despite acceptance of the animal models as the “gold standard” for human skin and eye toxicity. Animal models correctly predict only 40–70% of human responses depending on the toxicity endpoint. Therefore, in vitro assays calibrated against over-predictive or under-predictive in vivo animal assays may be challenged for their prediction accuracy. Ongoing scientific dialogue between the developers and users of these systems and involvement of the regulators at early stages of the validation processes makes the scientific, as well as regulatory, acceptance significantly easier.

Dr. Kandarova will present an introduction, challenge participants to discuss specific questions at their tables, and then participants will report responses.

Postdoctoral Assembly Luncheon

Tuesday, March 25, 12:00 Noon to 1:15 PM  
(Ticket Required)

Chairperson(s): Ebany Martinez Finley, The MIND Research Network, Albuquerque, NM.

Sponsor(s):
Postdoctoral Assembly

Amidst scrambling to attend all of the events at the meeting, this will be time for postdocs to kick back and relax! All postdoctoral scholars are invited to a casual luncheon organized by the Postdoctoral Assembly (PDA). The Best Postdoctoral Publication Awards will be given to three postdoctoral scholars, and postdoc award recipients from SOT and Regional Chapters, Specialty Groups and Specialty Sections will be recognized. The PDA Board members will present an overview of accomplishments and future directions for the PDA, and will introduce the new board members for 2014–2015. There will be a drawing for prizes. Postdocs can reserve a ticket for $10 when they register for the Annual Meeting.
Trainee Discussion with Medical Research Council (MRC) Lecturer: Dr. Scott

Wednesday, March 26, 10:00 AM to 11:00 AM
(Ticket Required; SOT Student and Postdoctoral members only, limited seating)

Chairperson(s): Colleen E. McLoughlin, CDC-NIOSH, Morgantown, WV.
Lecturer: John D. Scott, Howard Hughes Medical Institute, Department of Pharmacology, University of Washington, Seattle, WA.

Dr. Scott will meet informally for discussion with graduate students and postdoctoral scholars after his Keynote MRC Lecture (see page 65). Room size is limited, and participants register for a ticket with their Annual Meeting registration.

Undergraduate Student Meeting

Wednesday, March 26, 4:00 PM to 5:00 PM

Chairperson(s): Mindy F. Reynolds, Washington College, Chestertown, MD.
Sponsor(s):
  Education Committee
  Undergraduate Education Subcommittee

Undergraduate students attending the meeting are encouraged to participate in an informal meeting to talk about shared interests related to career paths in toxicology, discuss undergraduate tox-related activities, clubs, and majors on their campuses, and to provide feedback to the Undergraduate Education Subcommittee.

Education Outreach Activities and Events

High School Poster Exposition

Tuesday, March 25

Chairperson(s): Daniel E. Arrieta, Chevron Phillips Chemical Company LP, The Woodlands, TX.
Sponsor(s):
  Education Committee
  K–12 Subcommittee

High school students are invited to submit research posters for consideration for presentation in a special area in the SOT Pavilion. Deadline to submit is February 12, 2014. This display recognizes student effort and provides the high school students who have engaged in research with scientific meeting experience. Meeting attendees are invited to drop by to visit with these outstanding potential future toxicologists. More information is available on the SOT Annual Meeting website.

High School Student and Teacher Workshop

Saturday, March 22, 8:30 AM to 4:15 PM
Health Science Education Building, University of Arizona, Phoenix Biomedical Campus

Lotions are not Potions: Toxicology and Product Safety

Chairperson(s): Angie Slitt, University of Rhode Island, Providence, RI, K–12 Subcommittee Chair, Todd Camenisch, University of Arizona, Tucson, AZ, and Virunya Bhat, NSF International, San Diego, CA.

Sponsor(s):
  Education Committee
  K–12 Subcommittee
  Mountain West Regional Chapter

The Society of Toxicology will host Arizona area high school students and teachers at an all-day workshop at the Phoenix Biomedical Campus to convey the theme that toxicologists help ensure safer homes and healthy living. Authentic learning activities will include featured presentations by SOT members and a consumer products safety activity that includes making lotion and exploration of safety evaluation data. Students and teachers will meet informally at lunch with toxicologists to learn about the exciting and diverse options for careers in toxicology. For more information please visit the Special Events section of the Annual Meeting website.

Undergraduate Education Program

Saturday, March 22 to Monday, March 24
Convention Center

Chairperson(s): Ofelia A. Olivo, National Institutes of Health–National Cancer Center, Bethesda, MD.
Sponsor(s):
  Committee for Diversity Initiatives (CDI)

For schedule details go to www.toxicology.org/ai/meet/am2014/edout.asp or contact CDI Staff Liaison Susan D. Simmons at susan@toxicology.org.

Saturday, March 22
Open to CDI Travel Awardees in the Undergraduate Education Program.

• Registration for Undergraduate Students
• Opening Program
• 7:00 PM–9:00 PM—CDI Reunion, Celebrating the 25th Anniversary of the Minority Undergraduate Program
Open to anyone previously involved with CDI programs.
• Recognition of the 2014 Perry J. Gehring Diversity Student Travel Award Recipient

(continued on page 48)
Special Events

(continued from page 47)

Sunday, March 23
Open to CDI Travel Awardees in the Undergraduate Education Program, and undergraduates who register through Annual Meeting registration.

- Welcome from SOT President Lois D. Lehman-McKeeman
- Toxicology Lectures
- Interactive Presentation
- Breakout Sessions
  For Students: What Is Graduate School and What Can I Expect: How to Get into Graduate School
  For Advisors: Tips for Advising Prospective Graduate Students
- Open Time with Academic Toxicology Program Directors and Internship Sponsors
  Featuring representatives from academic programs across the country looking for talented students interested in advanced studies in the biomedical sciences.
- Student/Postdoc Mixer

Monday, March 24
Open to CDI Travel Awardees in the Undergraduate Education Program.

- Plenary Lecture
- Students Attend Planned Annual Meeting Sessions with Their SOT Mentors and Small Groups
- In Vitro Lecture and Luncheon for Students
- Career Session—Small group sessions where students will meet with scientists from academia, government, and industry to learn and ask questions about the variety of career paths available in toxicology.
- Program Recognitions and Wrap-Up

3rd Annual

Tox ShowDown
Tuesday evening, March 25, 7:30 PM–9:00 PM, Sheraton Hotel

Calling All Meeting Attendees: Contestants Still Needed!

Tox ShowDown is a quiz game pitting three teams of toxicologists—The Endocrine Disruptors, The Free Radicals, and The Toxic Metabolites—against each other to see who really knows the most when it comes to toxicological fact and fancy. No ticket is required.

Join the Graduate Student Leadership Committee and your peers for an evening of fun!

If you’d like to be a contestant, contact the GSLC Secretary Alessandro Venosa or Phil Wexler.

Sponsored by: SOT Graduate Student Leadership Committee (GSLC)

www.toxicology.org/al/meet/am2014/socialevents.asp
The Official Journal of the Society of Toxicology

Toxicological Sciences

- A top original research journal in Toxicology
- Ranked 8 out of 85 in this category
- Advance Access—quick online publication, weeks ahead of print
- Optional open access for authors

VISIT OUR BOOTH AT TOXEXPO 2014
OR VISIT US ONLINE AT
www.toxsci.oxfordjournals.org

* 2012 Journal Citation Reports (Thomson Reuters, 2013)
**RC, SIG, and SS Receptions**

### Regional Chapter Meetings/Luncheons or Receptions

**Monday, March 24, through Wednesday, March 26, Various Times** *(Refer to the Annual Meeting Program and mobile event app or event website for more details.)*

Many of the SOT Regional Chapters meet during the SOT Annual Meeting. A list of Regional Chapter receptions will be listed in the *Program* Event Calendar.

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lone Star and South Central Regional Chapters Mixer</td>
<td>Tuesday March 25</td>
<td>5:30 PM to 7:30 PM</td>
</tr>
<tr>
<td>Michigan and Allegheny Erie Regional Chapters Joint Reception</td>
<td>Monday, March 24</td>
<td>5:00 PM to 6:30 PM</td>
</tr>
<tr>
<td>Mid-Atlantic Regional Chapter Luncheon</td>
<td>Monday, March 24</td>
<td>12:00 Noon to 2:00 PM</td>
</tr>
<tr>
<td>Northern California Regional Chapter/Reception</td>
<td>Tuesday, March 25</td>
<td>6:30 PM to 9:00 PM</td>
</tr>
<tr>
<td>Northeast Regional Chapter Student Luncheon</td>
<td>Tuesday, March 25</td>
<td>12:00 Noon to 1:30 PM</td>
</tr>
<tr>
<td>PANWAT Reception</td>
<td>Monday, March 24</td>
<td>5:30 PM to 7:30 PM</td>
</tr>
</tbody>
</table>

### Special Interest Group Meetings/Luncheons or Receptions

**Monday, March 24, through Wednesday, March 26, Various Times** *(Refer to the Annual Meeting Program and mobile event app or event website for more details.)*

Each of the six Special Interest Groups will hold a meeting/reception during the 2014 SOT Annual Meeting at various local locations. All current and prospective SOT Special Interest Group members are encouraged to attend. The Event Calendar in the *Program* will have an updated listing of locations and event times.

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Association of Chinese in Toxicology Special Interest Group</td>
<td>Monday, March 24</td>
<td>5:00 PM to 6:00 PM</td>
</tr>
<tr>
<td>Distinguished Chinese Toxicologist Lectureship Award Seminar</td>
<td></td>
<td>TBA</td>
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<tr>
<td>American Association of Chinese in Toxicology Special Interest Group</td>
<td>Monday, March 24</td>
<td>TBA</td>
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<tr>
<td>Meeting/Reception</td>
<td></td>
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<tr>
<td>Association of Scientists of Indian Origin Special Interest Group Lunch and Learn</td>
<td>Tuesday, March 25</td>
<td>12:00 Noon to 1:30 PM</td>
</tr>
<tr>
<td>Association of Scientists of Indian Origin Special Interest Group Reception</td>
<td>Monday, March 24</td>
<td>7:00 PM to 9:00 PM</td>
</tr>
<tr>
<td>Hispanic Organization of Toxicologists Special Interest Group Reception and Awards Ceremony</td>
<td>Tuesday, March 25</td>
<td>6:30 PM to 9:30 PM</td>
</tr>
<tr>
<td>Special Interest Group Collaboration Group: Global Seminar</td>
<td>Monday, March 24</td>
<td>5:00 PM to 6:30 PM</td>
</tr>
<tr>
<td>Toxicologists of African Origin Special Interest Group Reception</td>
<td>Monday, March 24</td>
<td>6:30 PM to 8:00 PM</td>
</tr>
<tr>
<td>Women in Toxicology Special Interest Group Reception</td>
<td>Tuesday, March 25</td>
<td>4:30 PM to 6:30 PM</td>
</tr>
</tbody>
</table>
### Specialty Section Meetings/Luncheons or Receptions

Each of the 27 SOT Specialty Sections will hold either a luncheon or early evening meeting/reception during the 2014 SOT Annual Meeting. All current and prospective SOT Specialty Section members are encouraged to attend. The Event Calendar in the Program will have an updated listing of locations and event times.

<table>
<thead>
<tr>
<th>Event</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Biological Modeling Meeting/Reception</td>
<td>Tuesday, March 25</td>
<td>6:00 PM to 7:30 PM</td>
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<tr>
<td>Biotechnology Meeting/Reception</td>
<td>Tuesday, March 25</td>
<td>6:00 PM to 7:30 PM</td>
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<tr>
<td>Carcinogenesis Meeting/Reception</td>
<td>Monday, March 24</td>
<td>6:00 PM to 7:30 PM</td>
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<tr>
<td>Cardiovascular Toxicology Meeting/Reception</td>
<td>Tuesday, March 25</td>
<td>6:00 PM to 7:30 PM</td>
</tr>
<tr>
<td>Clinical and Translational Toxicology Meeting/Reception</td>
<td>Tuesday, March 25</td>
<td>6:00 PM to 7:30 PM</td>
</tr>
<tr>
<td>Comparative and Veterinary Luncheon</td>
<td>Wednesday, March 26</td>
<td>12:00 Noon to 1:30 PM</td>
</tr>
<tr>
<td>Dermal Toxicology Meeting/Reception</td>
<td>Tuesday, March 25</td>
<td>6:00 PM to 7:30 PM</td>
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<tr>
<td>Drug Discovery Toxicology Meeting/Reception</td>
<td>Wednesday, March 26</td>
<td>6:00 PM to 7:30 PM</td>
</tr>
<tr>
<td>Ethical, Legal, and Social Issues Luncheon</td>
<td>Tuesday, March 25</td>
<td>12:00 Noon to 1:30 PM</td>
</tr>
<tr>
<td>Food Safety Meeting/Reception</td>
<td>Monday, March 24</td>
<td>6:00 PM to 7:30 PM</td>
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<tr>
<td>Immunotoxicology Meeting/Reception</td>
<td>Wednesday, March 26</td>
<td>6:00 PM to 7:30 PM</td>
</tr>
<tr>
<td>In Vitro and Alternative Methods Luncheon</td>
<td>Wednesday, March 26</td>
<td>12:00 Noon to 1:30 PM</td>
</tr>
<tr>
<td>Inhalation and Respiratory Meeting/Reception</td>
<td>Monday, March 24</td>
<td>6:00 PM to 7:30 PM</td>
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<tr>
<td>Mechanism Meeting/Reception</td>
<td>Wednesday, March 26</td>
<td>6:00 PM to 7:30 PM</td>
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<tr>
<td>Medical Device Meeting/Reception</td>
<td>Monday, March 24</td>
<td>6:00 PM to 7:30 PM</td>
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<tr>
<td>Metals Meeting/Reception</td>
<td>Monday, March 24</td>
<td>6:00 PM to 7:30 PM</td>
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<tr>
<td>Mixtures Meeting/Reception</td>
<td>Wednesday, March 26</td>
<td>6:00 PM to 7:30 PM</td>
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<tr>
<td>Molecular and Systems Biology Meeting/Reception</td>
<td>Monday, March 24</td>
<td>6:00 PM to 7:30 PM</td>
</tr>
<tr>
<td>Nanotoxicology Meeting/Reception</td>
<td>Monday, March 24</td>
<td>6:00 PM to 7:30 PM</td>
</tr>
<tr>
<td>Neurotoxicology Meeting/Reception</td>
<td>Wednesday, March 26</td>
<td>6:00 PM to 7:30 PM</td>
</tr>
<tr>
<td>Occupational and Public Health Luncheon</td>
<td>Monday, March 24</td>
<td>12:00 Noon to 1:30 PM</td>
</tr>
<tr>
<td>Ocular Toxicology Meeting/Reception</td>
<td>Tuesday, March 25</td>
<td>6:00 PM to 7:30 PM</td>
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</tbody>
</table>

(continued on next page)
### Specialty Section Meetings/Luncheons or Receptions (continued)

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulatory and Safety Evaluation Meeting/Reception</td>
<td>Wednesday, March 26</td>
<td>6:00 PM to 7:30 PM</td>
</tr>
<tr>
<td>Reproductive and Developmental Toxicology Meeting/Reception</td>
<td>Tuesday, March 25</td>
<td>6:00 PM to 7:30 PM</td>
</tr>
<tr>
<td>Risk Assessment Meeting/Reception</td>
<td>Wednesday, March 26</td>
<td>6:00 PM to 7:30 PM</td>
</tr>
<tr>
<td>Stem Cells Meeting/Reception</td>
<td>Tuesday, March 25</td>
<td>6:00 PM to 7:30 PM</td>
</tr>
<tr>
<td>Toxicologic and Exploratory Pathology Luncheon</td>
<td>Monday, March 24</td>
<td>12:00 Noon to 1:30 PM</td>
</tr>
</tbody>
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**2014 Past Presidents’ 5k Fun Run/Walk**

“People who get together to sweat together, stay together!”

– Jay Goodman, SOT Past President

**Tuesday, March 25, 2014**

**6:30 AM**

**Steele Indian School Park**

Please see page 44 for more details.
Thank You

Council

Lois D. Lehman-McKeeman ........................................... President
Norbert E. Kaminski .......................................... Vice President
Peter L. Goering ........................................... Vice President-Elect
Denise Robinson Gravatt .................................... Treasurer
Judith T. Zelikoff ................................................... Secretary
Leigh Ann Burns Naas .......................................... Secretary-Elect
William Slikker Jr. ................................................ Past President
Lorrence Buckley .................................................. Councilor
Myrtle A. Davis .................................................. Councilor
Dori R. Germolec ........................................... Councilor
John C. Lipscomb ........................................... Councilor
Ivan Rusyn .................................................. Councilor
John A. Wisler ................................................ Councilor

Continuing Education Committee

Mark E. Hurtt ................................................... Chair
Qiyu Jay Zhao .................................................. Co-Chair
Gayathri Chadalapaka ......................................... Member
Saber M. Hussain .............................................. Member
William B. Mattes .............................................. Member
Monicah A. Otieno .............................................. Member
Gary O. Rankin ................................................ Member
Vishal S. Vaidya ................................................ Member
Tao Wang .................................................. Member
Sachin Bhusari ............................................... Postdoctoral Representative
Sanket Gadhia ........................................ Student Representative

Scientific Program Committee

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Peter L. Goering ........................................... Co-Chair
Jeanine L. Bussiere ........................................... Member
Michael J. Carvan III ........................................... Member
Mary Beth Genter ........................................... Member
B. Bhaskar Gollapudi ........................................... Member
Paul C. Howard .............................................. Member
Abby A. Li .................................................. Member
Donald R. Mattison ........................................... Member
Barry S. McIntyre ........................................... Member
David Ross ................................................ Member
James L. Stevens ........................................... Member
Lisa M. Sweeney ........................................... Member
Peter K. Working ........................................... Member

up-to-date information at www.toxicology.org
Continuing Education Courses Online

CEd-Tox offers a great, low-cost way to expand your professional development or stay current in the field of toxicology, all year long. A diversity of CE courses from SOT Annual Meetings are now available, including slide presentations and audio; English language transcriptions are available for select courses. SOT Graduate Student and Postdoctoral members receive complimentary access to all courses!

Whether to update your knowledge or to explore a new area, we invite you to register for CEd-Tox.

For more information or to register, visit the SOT website: www.toxicology.org/cedtox.asp.
Continuing Education

Continuing Education Courses

The Continuing Education Program offers a wide range of courses that cover established knowledge in toxicology, as well as new developments in toxicology and related disciplines. Courses can be applied toward certifying and licensing board requirements and may also be used for recertification with the American Board of Toxicology (ABT). Both basic and advanced course topics are offered. The basic course is intended to provide a broad overview of an area or to assist individuals in learning new techniques or approaches. The advanced course is intended to be of interest to individuals with previous knowledge of the subject or already working in the field.

All courses will be held on Sunday, March 23, 2014, at the Phoenix Convention Center. Please check the signage in the registration area and at the CE booth for room assignments. Note: Your course materials will be available in the room immediately prior to the course (they will not be available at the registration area). If you have your course ticket, go directly to the assigned room. If you have not received your course ticket or have not registered, please go to the registration area on Saturday afternoon/evening or on Sunday morning. If you have misplaced your ticket, please go to a Continuing Education booth at the convention center on Sunday. The booths will be open from 6:30 am–5:30 pm.

Please Note: Each Continuing Education Course is offered in one of three time blocks:

SR—Sunrise (7:00 AM–7:45 AM)
AM—Morning (8:15 AM–12:00 Noon)
PM—Afternoon (1:15 PM–5:00 PM)

Registration for the Annual Meeting and a separate CE course ticket are required.

2014 Continuing Education Courses

Combination Products: Toxicology and Regulatory Challenges

SR01  CE BASIC

Chairperson(s): Jon Cammack, AstraZeneca Biologics, Gaithersburg, MD, and Chandramallika (Molly) Ghosh, US FDA, Silver Spring, MD.

Sponsor(s):
Career Resource and Development Committee
Drug Discovery Toxicology Specialty Section
Medical Device Specialty Section

Therapeutic and diagnostic products that combine drugs, devices, and/or biological elements are termed and regulated by US Food and Drug Administration (US FDA) as combination products. Technological advances continue to merge product types and blur the historical lines of separation among traditional drugs, biologics, and medical devices. Concomitantly, US FDA’s medical product centers, the Center for Biologics Evaluation and Research (CBER), the Center for Drug Evaluation and Research (CDER), and the Center for Devices and Radiological Health (CDRH) are employing ever-evolving collaborative efforts to address the regulatory complexities of combination products. Because combination products involve components that would normally be developed and regulated under different types of processes and policies (and frequently submitted to different US FDA centers), these products raise challenging development, regulatory, and review-management questions. Differences in these pathways for each combination product type can impact the processes for all aspects of product development and management (especially preclinical testing), but also clinical investigation, marketing applications, manufacturing and quality control, adverse event reporting, promotion and advertising, and post-approval modifications. Trends and strategies for addressing the impact of overlapping technologies and evolving regulatory processes in developing a successful preclinical evaluation program will be highlighted. A regulatory overview of definitions and combination product examples, as well as a high-level review of US FDA’s final rule (effective July 22, 2013), will be included. A primary focus of the course is discussion of approaches in optimizing a preclinical program for a hypothetical drug-device combination product (e.g., a monoclonal antibody packaged in a prefilled syringe). Additionally, regulatory overview of the preclinical evaluation program will be provided. Future trends in combination product therapies will also be highlighted.

- Overview of Combination Products. Thinh Nguyen, US FDA Office of Combination Products, Silver Spring, MD.
- Overview of a Development Program for a Hypothetical Combination Product. Jon Cammack, AstraZeneca Biologics, Gaithersburg, MD.
Computational and Experimental Aspects of microRNAs in Toxicology

MicroRNAs (miRNAs) are small noncoding RNAs that function as post-transcriptional regulators of gene expression. miRNAs are increasingly recognized for their importance in regulating mechanisms of disease and exposure, including those associated with nervous system development, cardiac function, metabolism and cancer. miRNAs and their transcriptional targets are highly conserved across species. They are also stable in plasma and urine as biomarkers of tissue-specific damage or response. Furthermore, miRNAs are unique in that not only can they be experimentally measured along with their inhibitory effects on transcript and protein levels, but their post-transcriptional regulation can also be computationally predicted based on sequence specificity and conservation across species. Given the overall importance of miRNAs in toxicology, it is necessary to understand both computational and experimental aspects of miRNAs for accurate miRNA quantification and discovery of the functional consequences of their disruption by chemical or drug exposure. The goal of the course is to provide toxicologists with a better understanding of miRNA biology (biogenesis, sequence, structure, function, and species similarities), the experimental and computational resources available for identification and target prediction, and how these resources can be leveraged to identify mechanisms and biomarkers of toxicity.

- Background on miRNA Biology and Relationship to Toxicology. Igor Pogribny, US FDA-NCTR, Jefferson, AR.
- Computational Resources for miRNA Identification, Target Prediction, and Integration of Co-Expressed miRNAs and mRNAs. Susan C. Tilton, Pacific Northwest National Laboratory, Richland, WA.
- Network and Pathway Analysis of miRNA Data. Richard J. Brennan, Sanofi, Waltham, MA.
- Strategies for Developing miRNA Biomarkers of Toxicity. Karol L. Thompson, US FDA-CDER, Silver Spring, MD.
Elucidating Adverse Outcome Pathways (AOPs) for Developmental Toxicity

Safety Assessment: Mechanisms and Novel Methods

AM04	CE BASIC


Sponsor(s):
- Regulatory and Safety Evaluation Specialty Section
- Reproductive and Developmental Toxicology Specialty Section
- Scientific Liaison Coalition

An Adverse Outcome Pathway (AOP) is a theoretical construct that integrates the biological plausibility and weight of evidence supporting a linkage between a Molecular Initiating Event (MIE) to adverse response at the individual or population level. Conceptually, an AOP spans multiple levels of biological organization and organizes the stepwise propagation of chemical disruption from MIE to toxicological outcome via a series of key events. Qualitatively, the concept of an AOP is basic to establishing plausible hypotheses and weight of evidence for chemical mode of action. This has practical use in the integration of high-dimensional data with knowledge of a complex biological system and focusing research planning on critical data needs identified as gaps in the AOP, thereby enhancing current risk assessment practices. Alternatively, development of more quantitative AOP constructs requires a framework to delineate causal relationships across a temporal series of events, and will support more realistic quantitative risk assessment. As AOPs are initially governed by signaling networks and metabolic processes, SNPs in key genes relevant to the AOP could point toward susceptible populations. The course will delve into the science of AOP elucidation from a systems biology perspective, focusing on developmental processes and toxicities for early-life-stage susceptibilities. The presenters will each focus on making extensive use of current knowledge, informatics, and data-mining tools to advance predictive toxicology.

- Approaches to Genetic Toxicology Testing in the Era of Genomics. Matthew J. LeBaron, The Dow Chemical Company, Midland, MI.
- Quantitative Assessment of Dose-Response in Genetic Toxicology Studies. B. Bhaskar Gollapudi, Exponent, Midland, MI.
- AOPs for Endocrine Signaling and Reproductive Development. George P. Daston, Procter & Gamble Company, Mason, OH.
- AOPs for Developmental Neurotoxicity: Principles and Experimental Approaches. Alexey Terskikh, Sanford-Burnham Medical Research Institute, La Jolla, CA.

Inhalation Studies: Challenges and Complexities

New Science and Perspectives Surrounding Environmental and Occupational Exposures

AM05	CE BASIC

Chairperson(s): Gregory L. Baker, Battelle, West Jefferson, OH, and Willie J. McKinney, Altria Client Services, Richmond, VA.

Sponsor(s):
- Inhalation and Respiratory Specialty Section

The successful execution of animal inhalation studies (e.g., acute, subchronic, and chronic) present many challenges and complexities not encountered with other routes of exposure. Five inhalation study challenges will be addressed: 1) comparison of methods of exposure and potential impact on inhalation studies; 2) using various test materials, generating simple atmospheres (e.g., exposures to gases, nanoaerosols, bioaerosols, micron-sized aerosols) and mixtures (e.g., semivolatile compounds and particles, tobacco smoke); 3) selection of the appropriate animal species (e.g., species-specific dosimetry); 4) incorporating standard and novel toxicological endpoints; 5) deciding which regulatory guidance document or specifications (e.g., US EPA, US FDA, OECD, and NTP) to follow. The diversity of presenters’ backgrounds (government, contract research organization, industry, and academic) and depth of experience will provide a broad and rich resource for the participants.

- Introduction. Willie J. McKinney, Altria Client Services, Richmond, VA.
- Inhalation Studies—Test Subjects and Dose Predictions. Michael J. Oldham, Altria Client Services, Inc., Richmond, VA.
- Toxicological Endpoints in Inhalation Studies. Jack R. Harkema, Michigan State University, East Lansing, MI.
Methodologies in Human Health Risk Assessment

**Enhancing Strategies for Risk Assessment**

**AM06**  
**CE BASIC**

**Chairperson(s):** Qiyu (Jay) Zhao, US EPA, Cincinnati, OH, and M.E. (Bette) Meek, University of Ottawa, Ottawa, ON, Canada.

**Sponsor(s):**  
- Biological Modeling Specialty Section  
- Regulatory and Safety Evaluation Specialty Section  
- Risk Assessment Specialty Section

This course provides an overview of more advanced aspects of chemical risk assessment, following up from a successful CE course on basic principles offered at the Annual Meeting in 2013. This new course will focus on methodologies, which incorporate increased use of biological-and chemical-specific data as a basis to providing-more accurate estimates of risk. In addition, it will address evolving areas, such as problem formulation, as a basis to better target toxicity testing and tailor assessments to the needs of risk management.

The course will feature presentations and discussions focusing on the value of mode-of-action analysis for characterization of hazard, the fundamental tenets of physiologically-based pharmacokinetic (PBPK) model development and implementation, use of benchmark dose (BMD) models to identify points of departure, and use of chemical-specific adjustment factors to address inter- and intraspecies uncertainty and variability. The principles and key components of these methodologies will be illustrated with applied case examples from the regulatory risk assessment arena.

- **An Overview of Advanced Aspects of Risk Assessment.**  
  M.E. (Bette) Meek, University of Ottawa, Ottawa, ON, Canada.

- **Mode-of-Action Analysis.**  
  M.E. (Bette) Meek, University of Ottawa, Ottawa, ON, Canada.

- **Benchmark Dose Modeling.**  
  Qiyu (Jay) Zhao, US EPA, Cincinnati, OH.

- **Physiologically-Based Pharmacokinetic and Pharmacodynamic Modeling.**  
  Hugh A. Barton, Pfizer, Inc., Groton, CT.

- **Nondefault Uncertainty Factor Values.**  
  John C. Lipscomb, US EPA, Cincinnati, OH.

Nonclinical Animal Models Enabling Biopharmaceutical Advances in Translational Medicine

**Advancing Clinical and Translational Toxicology and Application of Biomarkers**

**AM07**  
**CE BASIC**

**Chairperson(s):** Thomas M. Monticello, Amgen Inc., Thousand Oaks, CA, and Vivek Kadambi, Millennium, Cambridge, MA.

**Sponsor(s):**  
- Clinical and Translational Toxicology Specialty Section  
- Comparative and Veterinary Specialty Section  
- Toxicologic and Exploratory Pathology Specialty Section

A fundamental theme in drug discovery and nonclinical development is the utilization of appropriate animal models that are predictive for efficacy or adverse events in humans administered a novel biopharmaceutical. The accurate prediction of human adverse effects using nonclinical animal toxicity studies remains a major goal in drug development and relies on appropriate animal models. Essential attributes for an appropriate animal model include similar target distribution, target pharmacology, systemic pharmacokinetics, metabolism, and distribution to those of humans. Utilization of the most appropriate animal model aligns with the 2011 US FDA Strategic Plan to advance regulatory science and modernize toxicology in order to enhance safety and develop better models of human adverse responses. The Preclinical Safety Leadership Group (PSLG) of the International Consortium for Innovation and Quality in Pharmaceutical Development (IQ) is creating a contemporary industry-wide database to determine the accuracy with which the interpretation of nonclinical safety assessments in animal models correctly predicts human risk. The course will present considerations for the selection of an appropriate animal model for nonclinical safety, the use of animal models of disease in safety testing, emerging use of the minipig in safety testing, data from an industry-wide nonclinical to clinical translational database, and the use of animal safety data in the design and conduct of clinical trials. Output from the course will help identify advances and remaining gaps in the utilization of animal models in biopharmaceutical development.

- **Introduction.**  

- **What Constitutes a Relative Animal Model in Translational Medicine?**  
  Rakesh Dixit, MedImmune Inc., Gaithersburg, MD.

- **Use of Animal Models of Human Disease for Nonclinical Safety Assessment of Pharmaceuticals.**  
  Sherry J. Morgan, Abbvie, North Chicago, IL.

- **The Minipig As a Nonrodent Species in Nonclinical Safety Testing and Where Are We Now?**  
Nanotoxicology: Past Achievements, Future Challenges, and Potential Solutions

Nanomaterials (NM) possess tremendous promise to advance consumer, military, and medical applications due to their unique physicochemical properties, such as enhanced surface area, tunable size, modifiable surface chemistry, and particle reactivity. However, these same properties have made NMs a potential health hazard, thus giving rise to the field of nanotoxicology (NT), which has become a prominent player in toxicological advancement and research over the past decade. Initial NT studies were limited by a lack of both available materials and characterization tools. Through advances in material science, enhanced capabilities have been developed that allow for the synthesis of distinctive NMs and the ability to accurately evaluate their characteristics. Taking advantage of these developments, NT has made remarkable progress in evaluating the hazards of NMs and correlating specific properties, such as size, shape, coating, and composition, to observe cytotoxicity. However, even with these numerous advances, there are still a number of constraints plaguing the field of NT. One principal area of concern is the development of procedures that account for new NT facets, including NM behavior in a physiological environment, varied aggregate structure, role of ionic dissolution, and realistic modes of exposure. Another limitation is the need for new and more powerful characterization tools. Recently, the question of dosimetry has become a forefront topic and whether universal, conceptual standard should be adopted, such as mass, surface area, or particle number. Arriving at a consensus on this issue is critical for the establishment of NM exposure limits and risk assessment metrics, which are significantly lacking. To accomplish accurate risk assessment and regulatory evaluations, NT will have to develop a means to improve the correlation of in vitro data to in vivo predictions, via enhanced cell models, relevant dosages (low vs. high), and realistic exposure scenarios. This CE course will evaluate where NT stands, by highlighting key research successes, identifying challenges facing the field today, and exploring solutions to overcome current limitations.

Epidemiology for Toxicologists: What the Numbers Really Mean

Twenty-first-century risk assessment relies on data from multiple lines of evidence. High-quality human epidemiology data are generally preferred for regulatory decision-making, but the body of evidence often includes animal toxicity, in vitro, in silico, animal dosimetry, and human exposure data. The quality of individual epidemiology studies can be highly variable and dependent on study design as well as other critical factors that sometimes cannot be controlled for. For risk assessors to fully understand the implications of epidemiology evidence, they must understand how the overall integration of toxicity and mechanistic data with human epidemiology findings facilitates science-informed decision-making. A sufficient understanding of the epidemiology data is a necessary starting point for appropriately integrating all the available information. The course is geared towards the toxicologist who is trying to determine how to appropriately evaluate, use, and integrate epidemiology data in a weight-of-evidence evaluation or risk assessment. Attendees first will be given a basic overview of epidemiology, with a focus on different epidemiology study designs and their strengths and weaknesses.
Attendees will also gain an understanding of exposure assessment and biomonitoring, and how this information is used and evaluated in epidemiology studies. Additional learning objectives of the course: how to determine when an association may be supportive of a causal relationship and what confidence intervals mean; how to use trend information; how to evaluate and understand adjustments that are made for potential confounding factors; and how to evaluate several epidemiology studies on the same topic, particularly in light of available toxicity and mechanistic data. Finally, attendees will learn to integrate all types of data streams with a real example. Attendees will leave the course with a stronger understanding of how to interpret and use epidemiology data in their weight-of-evidence analyses and risk assessments, and how epidemiology can help inform regulatory decision-making.

- **Setting the Stage.** Nancy B. Beck, American Chemistry Council, Washington, DC.

- **Overview of Epidemiologic Studies.** Michael Goodman, Emory University, Atlanta, GA.

- **Exposure Assessment and Biomonitoring in Epidemiologic Studies.** Sorina Eftim, George Washington University School of Public Health and Health Services and ICF International, Fairfax, VA.

- **When an Association Indicates Causation.** Julie E. Goodman, Harvard School of Public Health and Gradient, Cambridge, MA.

- **A Case Study Showing How Toxicology Complements Epidemiology for Informing Human Risk.** James S. Bus, Exponent, Midland, MI.

### Innovations in Methodologies for Inhalation Exposure and Interpretations of In Vivo Toxicity

- **New Science and Perspectives Surrounding Environmental and Occupational Exposures**

  **PM10 CE ADVANCED**

  **Chairperson(s):** Urmila Kodavanti, US EPA, Research Triangle Park, NC, and Juergen Pauluhn, Bayer HealthCare, Wuppertal, Germany.

  **Sponsor(s):** Inhalation and Respiratory Specialty Section

  Regulatory and Safety Evaluation Specialty Section

  The respiratory system presents most diverse structural and cellular heterogeneity suited to handling is complicated aspects of air-liquid interface, such as the direct exposure of the delicate cellular and capillary surfaces to the atmosphere and the encounter of lung epithelial cells to complex mixtures of particles and gases. Not only the respiratory depositions of inhaled substances vary regionally but also the regional responses generated by the respiratory tract. Recently the field of inhalation technology and respiratory toxicology has seen revolutionary growth because of the emergence of the use of nanomaterials and renewable energy sources creating new environmental challenges. Moreover, the paradigm shift of toxicology testing to high-throughput screening has led to the development of novel inhalational approaches for cells. The course will cover the recent advances in inhalation methodologies for various types of emerging inhalants and focus on generation of atmospheres for *in vivo* and *in vitro* toxicity assessment. These aerosols will include gas and particulate emissions from vehicles using old and new energy sources, forest fires, coal combustion, manufactured nanomaterials and mixtures formed from atmospheric aging. The dynamic of physicochemical composition of such mixed aerosols will be discussed to allow for identification of causative constituents and lung site-specific injuries. Structural differences in the respiratory tract of rodents and large mammals, including humans, impacting dosimetry will be discussed. Respiratory system heterogeneity between humans and animals, and their differential neurohumoral mechanisms, will be discussed to aid in interpretation of inhalational hazard for humans. This course will be useful for those involved in air pollution toxicology, nanotoxicology, novel drug delivery systems, pulmonary toxicology, and risk assessment.

- **Inhalation Exposure Methodologies of Rodents and Nonrodents.** Juergen Pauluhn, Bayer HealthCare, Wuppertal, Germany.

- **Aspects of Inhalation Studies with Complex Mixtures—Aerosol Generations, Chemistry, and Exposure.** Jacob D. McDonald, Lovelace Respiratory Research Institute, Albuquerque, NM.

- **Inhalation Exposure Methodologies for Manufactured Nanomaterials.** Bean T. Chen, NIOSH, Morgantown, WV.

- **The Use of Environmental Irradiation Chambers to Test Health Effects of Controlled Air Atmospheres.** Kenneth G. Sexton, University of North Carolina at Chapel Hill, Chapel Hill, NC.

- **Methodologies to Conduct In Vitro Exposures to Aerosols and Vapors.** Mark A. Higuchi, US EPA, Research Triangle Park, NC.

### Nonclinical Pediatric Drug Development: Considerations, Study Designs, and Strategies

- **Safety Assessment: Mechanisms and Novel Methods**

  **PM11 CE BASIC**

  **Chairperson(s):** Kary E. Thompson, Bristol-Myers Squibb Company, New Brunswick, NJ, and Elise M. Lewis, Charles River Laboratories, Horsham, PA.

  **Sponsor(s):** Reproductive and Developmental Toxicology Specialty Section

  Although nonclinical and clinical testing needs for drugs for pediatric populations have been discussed for more than 40 years, there is no default approach to evaluating safety in this age group. Over the last decade there has been a heightened awareness of the differences between the pediatric and adult patient, and these differences are being addressed by the pharmaceutical and healthcare industries,
as well as the governmental and regulatory bodies that sanction the
development and testing of drugs for children. As regulatory demands evolve for nonclinical safety assessments in juvenile animals, industry leaders are developing innovative ways to meet the regulatory expectations and to overcome the challenges associated with pediatric drug development. Many practical issues regarding nonclinical testing in immature animals have been surmounted, using novel and/or adapted approaches. There are considerations related to the differences in regional guidelines (US FDA, EU, and Japan); therefore, development of appropriate information for submission to worldwide agencies is critical. History and experience provide the best scientific arguments as to why juvenile animals can be useful. There are numerous examples of drugs that have identified findings in various species, including information regarding kinetic and toxicity differences that highlight considerations regarding nonclinical testing models. Additionally, there are unique challenges associated with nonclinical juvenile toxicity testing for biopharmaceuticals, including selection of appropriate animal models, immunogenicity, dose selection (toxicity vs. pharmacology), and relevant endpoints. Developing a juvenile animal program requires an appreciation of the complexity of the nonclinical strategies to enable pediatric trials and an overview of the historical perspective and the current approaches to evaluating safety during this unique period of life.

- **Introduction.** Elise M. Lewis, Charles River Laboratories, Horsham, PA.
- **US FDA Regulatory Perspective on Pediatric Product Development.** Karen Davis-Bruno, US FDA, Silver Spring, MD.
- **Nonclinical Strategies to Support Pediatric Trials.** Kary E. Thompson, Bristol-Myers Squibb Company, New Brunswick NJ.
- **Juvenile Toxicity Studies: What Can We Do?** Susan B. Laffan, GlaxoSmithKline, King of Prussia, PA.
- **Biologics Juvenile Toxicity Testing: Exploring Options to Address the Challenges.** Gary J. Chellman, Charles River Laboratories, Reno, NV.

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**Stem Cells in Toxicology**

**Biomarkers for Exposure Assessment, Safety Evaluation, and Translational Medicine**

**PM12**

**CE BASIC**

**Chairperson(s):** Erik J. Tokar, NIEHS, Research Triangle Park, NC, and Michael P. Waalkes, NIEHS, Research Triangle Park, NC.

**Sponsor(s):**
- **Stem Cells Specialty Section**

Stem cells are revolutionizing toxicological research and remain an area with tremendous potential. Recently, research on stem cells has generated tremendous public and professional interest. However, some areas of toxicological research have lagged behind in the integration of stem cells as a concept in toxicant-induced disease etiology. We will describe the utility and suitability of the assorted types of stem cell models (i.e. embryonic, fetal, progenitor, induced pluripotent, immortalized stem cell lines, etc.) for various research purposes, including disease modeling, drug discovery and toxicity testing in order to describe the potential applications of stem cells in toxicological research. This important overview of stem cells will highlight their nomenclature, properties, and their roles in the genesis of various diseases.

- **Introduction.** Erik J. Tokar, NIEHS, Research Triangle Park, NC.
- **The Concepts and Methods for Stem Cells.** Erik J. Tokar, NIEHS, Research Triangle Park, NC.
- **Stem Cells in Carcinogenesis.** Michael P. Waalkes, NIEHS, Research Triangle Park, NC.
- **Stem Cells and Regenerative Medicine.** Robert Deans, Athersys, Inc., Cleveland, OH.
- **Stem Cells in Safety Testing.** Kyle L. Kolaja, Cellular Dynamics International, Montclair, NJ.

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**Translational Biomarkers in the Assessment of Health and Disease**

**Advancing Clinical and Translational Toxicology and Application of Biomarkers**

**PM13**

**CE ADVANCED**

**Chairperson(s):** Vishal S. Vaidya, Harvard Medical School, Boston, MA, and Donna L. Mendrick, US FDA, Silver Spring, MD.

**Sponsor(s):**
- **Association of Scientists of Indian Origin Special Interest Group**

Biomarkers serve as quantitative measures of chemical exposures and biologically effective doses, early warning signals of biologic effect, they predict outcome in a patient with disease, and identify who will respond to an intervention and whether the intervention is working. The current era of scientific discovery has brought seem-
ingly limitless opportunities for improvements in medical care. Translational biomarkers that can be measured in blood or urine in both experimental animals and man are of particular interest. Given the importance to the clinical, pharmaceutical, and regulatory communities motivated by more specific and timely diagnoses, early intervention and safer therapies, clinically useful biomarkers have evolved over time, reflecting the scientific and technologic progress made over the centuries. An increasing number of clinically relevant tests and procedures are available to estimate organ injury and guide treatment. The use of molecular signals in the assessment of health and disease is not new; however, the concept of what constitutes a useful biomarker has evolved considerably in the past two to three decades given the advanced enabling technologies, deeper molecular understanding of disease, and the advent of a regulatory framework for biomarker qualification. Our panel experts will highlight the potential of these biomarkers over a wide variety of applications spanning preclinical-clinical safety in liver and kidney to disease monitoring in cancer. The panel will also demonstrate the application of translational biomarkers in clinical trial design. Coordinated efforts at biomarker discovery and validation as well as technologies for biomarker measurement will help ensure that the ultimate goal of safer drugs, a cleaner environment, and improved patient outcomes are realized.

- **Introduction.** Donna L. Mendrick, US FDA, Silver Spring, MD.

- **Discovering Cancer Biomarkers: From Diagnosis and Prognosis Through Therapy.** Marsha A. Moses, Children’s Hospital Boston, Harvard Medical School, Boston, MA.

- **Kidney Safety Biomarkers: From Proteins to MicroRNAs.** Vishal S. Vaidya, Harvard Medical School, Boston, MA.

- **Liver Safety Biomarkers: A Comprehensive Evaluation in Human Subjects.** Jiri Aubrecht, Pfizer, Inc., Groton, CT.

- **Application of Biomarkers in Clinical Trial Design.** Chris Leptak, US FDA, Silver Spring, MD.
Consider Organizing a Contemporary Concepts in Toxicology Meeting

Contemporary Concepts in Toxicology (CCT) Meetings expand the opportunities and forums for members to engage in the exchange of ideas and information relevant to toxicology. CCT Meetings are one- to two-day focused, open registration, scientific meetings in contemporary and rapidly progressing areas of toxicological sciences. CCT Meetings also can be held as webinars.

If you think that your research area could be enhanced by thought leader collaboration or that public health and safety could be improved by disseminating your research findings more broadly, please consider organizing an SOT CCT Meeting. The CCT Conferences Committee and the SOT Headquarters staff are prepared to help move your meeting forward.

The Society will underwrite all the liabilities of the CCT Meeting (up to the $25,000 in seed money) with the expectation that the meeting at least break even financially. Profit sharing for SOT component groups is available. For more information about CCT Meetings, please visit the SOT website at www.toxicology.org/cct.

CCT Meetings focus on a wide range of topics and future CCTs address the following:

- **FutureTox II: In Vitro Data and In Silico Models for Predictive Toxicology**
  January 16–17, 2014, Chapel Hill, North Carolina

- **Toxicity of Biodiesel and Other Biofuels: Implication for Global Use**
  September 4-5, 2014, Edinburgh, Scotland

In order to sustain the quality standards of the Society, only meetings in which SOT maintains scientific and administrative control will be considered. Meetings developed and administered by other organizations may be eligible for sponsorship and/or endorsement by the Society of Toxicology.

www.toxicology.org
Contributors to the SOT Endowment Fund are helping to build for the future of toxicology through long-term financial support that generates critical resources that enable the Society to fulfill its mission, now and in the years to come.

Since its inception in 2006, contributors to the Endowment have:

- Underwritten more than 140 Student Travel Awards to the SOT Annual Meeting.
- Recognized colleagues who have made enormous contributions to improving human health and the environment.
- Created funds that acknowledge the contributions of educators in toxicology to undergraduate students in toxicology and toxicology-related areas.
- Strengthened global participation by providing financial support to scientists from developing countries to attend the SOT Annual Meeting.

Make a difference by becoming a contributor to the SOT Endowment Fund—the Society of Toxicology will match your contribution to an established fund dollar for dollar.

The 1 to 1 ratio dollar match is effective from July 1, 2013 until June 30, 2016 or until the $400,000 of matching funds has been expended.

Discover the Benefits of Giving Wisely.

Please help SOT continue to make a difference by becoming a contributor to the SOT Endowment Fund. For more information, go to www.toxicology.org/endowment.
Plenary Lectures

Plenary Opening Lecture

The Origins and Future of Pluripotency and Cellular Reprogramming

Monday, March 24, 8:00 AM to 9:00 AM

Lecturer: John B. Gurdon, Wellcome Trust/Cancer Research UK, Institute of Cancer and Developmental Biology, University of Cambridge, Cambridge, United Kingdom.

The different cell types that compose our bodies are remarkably stable. Hardly ever do we find skin cells in the brain or liver cells in the heart. In those very special cases where some regeneration can take place in vertebrates, there is little if any evidence for a switch in cell type. Nevertheless, nuclear transfer, cell fusion, and induced pluripotency can result in pluripotent embryo cells being derived from specialized adult cells. The mechanisms by which nuclear reprogramming can occur in these cases is beginning to be understood. It may become possible for new, regenerated cell types to be derived from adult cells and given back to a patient so that they receive new cells of their own genetic constitution, thereby avoiding the need for immunosuppression. The history of work in this area, and the prospects for cell replacement in the future, will be discussed.

Dr. Gurdon was a zoology undergraduate at Oxford University and returned, after a postdoc year at CalTech, as Lecturer in Embryology. In 1971, he joined the MRC molecular biology lab in Cambridge to continue his work on amphibian developmental biology. In 1983, as John Humphrey Plummer Professor of Cell Biology at the University of Cambridge, he co-founded a research institute of developmental and cancer biology (now named the Gurdon Institute) with Professor Laskey, acting as Chairman until 2002. His career has concentrated on nuclear transplantation in the frog and experiments to discover the value of mRNA microinjection, mechanisms of response to morphogen gradients, and recently, mechanisms of nuclear reprogramming by Xenopus oocytes and eggs. Master of Magdalene College Cambridge from 1995–2002, he has received various recognitions, including the 2009 Lasker Award for Basic Medical Science and the Nobel Prize for Physiology or Medicine in 2012.

Keynote Medical Research Council (MRC) Lecture

Guiding Signals through Anchored Enzyme Complexes: Implications for Disease

Wednesday, March 26, 8:00 AM to 9:00 AM

Lecturer: John D. Scott, Howard Hughes Medical Institute, Department of Pharmacology, University of Washington, Seattle, WA.

Intracellular signal transduction events are precisely regulated in space and time. This is achieved in part by A-Kinase Anchoring Proteins (AKAPs) that tether signaling enzymes such as protein kinases and phosphatases in proximity to selected substrates. AKAP targeting provides an efficient means to reversibly control the phosphorylation status of key substrates and contributes to the dynamic regulation of sophisticated cellular events. Using a variety of genetic, electrophysiological, and live-cell imaging techniques, we show that AKAPs, which enhance the precision of signaling events, are up-regulated under certain pathophysiological states. This leads to aberrant regulation of certain physiological processes and disorders such as diabetes and heart disease. In this talk Dr. Scott will present some recent data on the role of anchored signaling complexes that modulate various extra-pancreatic complications of diabetes, including hypertension and cataract formation.

Dr. Scott is the Edwin G. Krebs–Hilma Speights Professor in the Department of Pharmacology at the University of Washington School of Medicine, Seattle. He received his BSc (Hons) degree in biochemistry from Herriot-Watt University, Edinburgh, and his PhD degree from the University of Aberdeen. He did postdoctoral research on protein kinase inhibitors in the laboratory of Edwin Krebs at the University of Washington and then joined the faculty of the University of California, Irvine. Dr. Scott continued his research at the Vollum Institute at the Oregon Health & Sciences University, Portland, until 2008, when he moved to the University of Washington, Seattle. Dr. Scott is a fellow of the Royal Society, London, and the Royal Society of Edinburgh.
The Thematic Track information can be found on pages 10–11.

## Special Symposium Sessions

### Frontiers for Toxicology Session

**Noncoding RNAs in Human Health, Therapeutics, and Environmental Disease**

**Tuesday, March 25, 9:00 AM to 11:45 AM**

**Chairperson(s):** Michael J. Carvan III, University of Wisconsin-Milwaukee, Milwaukee, WI, and James L. Stevens, Eli Lilly and Company, Indianapolis, IN.

**Sponsor(s):** Scientific Program Committee

A little over a decade ago, the regulatory role of small non-protein-coding RNAs was first uncovered through experiments involving the deliberate introduction of short double-stranded RNAs (dsRNA) into plant and eukaryotic cells. These exogenous dsRNAs were found to induce post-transcriptional gene silencing, a process termed RNA interference. This seminal observation led to the discovery of novel and complex biological processes of gene regulation involving endogenous noncoding RNAs of which several varieties have been identified, including microRNA, PIWI-interacting RNA, and long noncoding RNA. During the past 10 years, significant advances have been made in gaining an understanding of the role of noncoding RNAs spanning the period from organismal development and continuing throughout all stages of life. Although the biological role of noncoding RNA has yet to be fully understood, it is important to emphasize that only a small fraction of the mammalian genome codes for mRNAs, and yet the majority of the remaining genome is transcribed into noncoding RNAs. It is tempting to speculate that a large proportion of these noncoding RNAs are transcribed for the distinct purpose of carrying out critical regulatory functions. Indeed, there is a growing literature identifying specific processes under the control of noncoding RNAs and, likewise, the pathology that can ensue when noncoding RNA regulatory processes are disrupted. Relatively little is known concerning the influence environmental factors exert on noncoding RNAs at the level of their expression, function, or contribution to the etiology of disease processes; therefore, this represents an important frontier for toxicological investigation. In light of the importance of this relatively new area of biology and its potential impact on human health, the goal of this session is to feature eminent scientists who have made important contributions and advances to our current knowledge of noncoding RNAs. The broad areas to be addressed include general concepts surrounding the biology of noncoding RNAs, their role in development and in specific disease processes, and their potential role in novel therapeutic approaches.

- **Introduction.** Norbert E. Kaminski, Michigan State University, East Lansing, MI.

- **RNA at the Epicenter of Human Development.** John Mattick, Garvan Institute of Medical Research, Darlinghurst, NSW, Australia.

- **Role of microRNA Signaling in the Cancer Microenvironment Communication.** Muller Fabbri, University of Southern California, Los Angeles, CA.

- **MicroRNAs in Hepatocellular Carcinoma.** Caroline Lee, Duke University-National University of Singapore, Singapore.

- **MicroRNA Reprogramming in Cancer: Mechanisms and Therapeutic Opportunities.** Joshua Mendell, University of Texas Southwestern Medical Center, Dallas, TX.

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### A Conversation with the Director of NIEHS: Dr. Linda S. Birnbaum

**Monday, March 24, 1:30 PM to 2:30 PM**

**Chairperson(s):** Norbert E. Kaminski, Michigan State University, East Lansing, MI.

This important session will provide an informal venue for meeting attendees to have a candid and open discussion with Dr. Linda Birnbaum concerning the direction, funding opportunities, and scientific priorities for the National Institute for Environmental Health Sciences. The entire session will be devoted to a question and answer period featuring Dr. Birnbaum. Dr. Birnbaum has served as the Director of the National Institute for Environmental Health Sciences and the National Toxicology Program since 2009.

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### Award Lectures

#### Merit Award Lecture

**Monday, March 24, 12:30 PM to 1:20 PM**

**Lecturer:** Jay I. Goodman, Michigan State University, East Lansing, MI.
The Thematic Track information can be found on pages 10–11

**Leading Edge in Basic Science Award Lecture**

**Tuesday, March 25, 8:00 AM to 8:50 AM**

**Lecturer:** Vishal S. Vaidya, Harvard Medical School, Boston, MA.

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**Distinguished Toxicology Scholar Award Lecture**

**Wednesday, March 26, 12:30 PM to 1:20 PM**

**Lecturer:** Richard E. Peterson, University of Wisconsin Madison, Madison, WI.

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**Translational Impact Award Lecture**

**Wednesday, March 26, 4:30 PM to 5:20 PM**

**Lecturer:** Timothy D. Phillips, Texas A&M University, College Station, TX.

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**SOT/EUROTOX Debate**

**Are Nonmonotonic Dose-Responses at Low Dose Levels Toxicologically Relevant?**

**Monday, March 24, 4:45 PM to 6:00PM**

**Chairperson(s):** Peter L. Goering, US FDA, Silver Spring, MD, and Arisitidis Tsatsakis, University of Crete, Heraklion, Greece.

**SOT Debater:** James C. Lamb IV, Exponent, Alexandria, VA.

**EUROTOX Debater:** Dieter Schrenk, Technische Universität Kaiserslautern, Kaiserslautern, Germany.

**Endorsed by:**
- Society of Toxicology (SOT)
- European Societies of Toxicology (EUROTOX)

Each year the SOT Annual Meeting includes a debate that continues a tradition that originated in the early 1990s, in which leading toxicologists advocate opposing sides of an issue of significant toxicological importance. This year, our debaters will address the proposition: Are Nonmonotonic Dose-Responses at Low Dose Levels Toxicologically Relevant?

Dose-response curves are often drawn and considered in the context of the “dose makes the poison.” This is described simplistically as increasing dose levels result in increasing adverse effects. This can be the result of a monotonic increase or decrease in a response that is associated with an adverse effect. Nonmonotonic dose-responses (NMDRs) are biological effects with dose-response curves deviating from the usual shape of a continuous increase in effect with dose eventually reaching a saturation level at high doses and showing no measurable response at very low doses. NMDRs are characterized by a change in the slope of the curve at one or more points within the dose range examined. Several controversial claims are associated with NMDRs: 1) that in the low dose range, the curve may run through a minimum but may show significant effects at very low doses; 2) that some of these effects may be adverse, in particular, those which affect or disturb highly sensitive signaling pathways in the organism, such as those triggered by steroid hormones or thyroid hormones; 3) that such effects may be of particular relevance in the developing organism; and 4) that our current testing strategies in toxicology do not or insufficiently detect such effects. The debaters will address the relevance of these reported NMDRs and claims to toxicology and risk assessment.

Regardless of framework differences and personal convictions, each scientific debate delegate will present relevant evidence and compelling scientific arguments to persuade and appeal to the response of the audience in order to obtain the approval or refusal of the motion. In addition to being a featured session at the SOT Annual Meeting in Phoenix, Arizona, this debate will again take place (with the debaters taking the reverse positions) in Edinburgh, Scotland during the 50th...
Congress of the European Societies of Toxicology (2014 Eurotox Annual Congress), September 7–10.

**Featured Sessions**

**Research Funding Sessions**

**Research Funding Information Room**

**Tuesday, March 25 and Wednesday, March 26, 9:30 AM to 4:30 PM**

**Chairperson(s):** David Dorman, North Carolina State University, Raleigh, NC.

**Sponsor(s):**

Research Funding Committee

Representatives from federal agencies funding research, including NIH program and review staff of the Center for Scientific Review and NIEHS, will be available in the Research Funding Room for individual conversations. Make an appointment with your program officer in advance or at their exhibit booth, or check the posted schedule, to meet with the staff member who can discuss with you aspects of scientific review or specific grant opportunities. New investigators are especially encouraged to meet with program staff. Handouts will be available.

**Brown Bag Luncheon**

**Tuesday, March 25, 12:00 Noon to 1:30 PM**

**Chairperson(s):** David Dorman, North Carolina State University, Raleigh, NC.

**Sponsor(s):**

Research Funding Committee

Investigators from various federal agencies will be on hand for this luncheon meeting to talk about the art of preparing successful grant packages. Panelists will talk about the grant submission process and offer advice about how to submit a potentially successful grant and offer tips about how to make their submission stand out.
Submit Your Recent Scientific Research during a Second Abstract Submission Phase

The Society is poised to have another successful Annual Meeting with currently more than 2,300 presentations scheduled to be presented in Phoenix, March 23–27, 2014.

We invite you to submit an abstract during a second abstract submission phase which will occur from December 2, 2013, through January 6, 2014. All abstracts will be submitted online. The cost to submit an abstract is $50.

In light of events of the fall, particularly those resulting from the shutdown of the US government, SOT has made changes to the 2014 Annual Meeting program in an effort to enable full participation from our broad membership and contribute to a successful scientific and professional experience for all attendees.

For the 2014 Annual Meeting only, abstracts accepted from this submission period will be incorporated into the regular scientific program so as to be presented with relevant thematic content. These abstracts will be searchable by the Annual Meeting mobile app, and will appear in the printed Program and in The Toxicologist.

Additional qualifications for submitting an abstract during this final submission phase include:

- Scientists who had to wait until after the original October deadline to submit due to funding issues are encouraged to submit an abstract for consideration.

- All abstracts will be reviewed by the Scientific Program Committee and held to the same standards used to evaluate abstracts submitted for the original deadline.

- Not more than one abstract will be accepted by the same presenting author.

- Your abstract should not be a revision of a previously-submitted one that was not accepted unless you received specific communication from the Scientific Program Committee suggesting that resubmission during the second abstract period may be appropriate.

We look forward to welcoming you to the Society’s Annual Meeting in Phoenix, Arizona.
MONDAY

Air Pollution and Cardiovascular Effects: Mechanisms and Role of Lipid Peroxidation

Monday, March 24, 9:15 AM to 12:00 Noon

Chairperson(s): Daniel J. Conklin, University of Louisville, Louisville, KY, and Jesus Araujo, University of California Los Angeles, Los Angeles, CA.

Sponsor(s):
- Cardiovascular Toxicology Specialty Section
- New Science and Perspectives Surrounding Environmental and Occupational Exposures

The mechanisms by which air pollution, including particulate matter (PM) and volatile gases, affect human cardiovascular health are incompletely known. Yet many animal studies performed to probe these mechanisms have observed changes in the levels of lipids and/or lipid peroxidation products regardless of the specific form of air pollution, e.g., diesel engine exhaust, concentrated ambient particulate matter, or volatile gases, used in the exposure that associates with severity of injury. These studies suggest a potential common pathway of injury that is dependent on oxidative stress and an increased production of lipid mediators. The role of lipids and lipid peroxidation as final common mediators of air pollution-induced injury in the cardiovascular system is the focus of this symposium. Speakers will address how exposures to diverse types of air pollutants, including complex mixtures, traffic emissions, volatile acrolein, and concentrated ambient particulate matter, result in alterations in circulating lipid levels, lipids structure and function, and lipid peroxidation products in target organs including lungs, blood, and the vasculature. Collectively, these presentations will shed light on the specific role of lipids and lipid peroxidation in air pollution-induced cardiovascular injury.

- Air Pollution, Lipid Oxidation, and Cardiovascular Effects in Humans and Animals Models. A. Bhatnagar, University of Louisville, Louisville, KY.
- Vascular Lipid Peroxidation Induced by Complex Emissions Indicates Gas-Particle Interactions in Driving Systemic Toxicity. Matthew Campen, University of New Mexico, Albuquerque, NM.
- Effects of Acrolein or Concentrated Ambient Particulate Matter Exposure on Plasma Lipids and Vascular Targets. Daniel J. Conklin, University of Louisville, Louisville, KY.
- Vehicle Emissions-Exposure Results in Increased Cerebrovascular Lipid Peroxidation Associated with Altered Blood Brain Barrier Permeability. Amie K. Lund, University of North Texas, Arlington, TX.
- Air Pollution, Lipid Peroxidation, and Alterations in HDL Functionality. Jesus Araujo, University of California Los Angeles, Los Angeles, CA.

Carbon Nanotubes Are Toxic in Experimental Models: What’s Next, Who’s Being Exposed, and Should We Be Concerned?

Monday, March 24, 9:15 AM to 12:00 Noon

Chairperson(s): Aaron Erdely, CDC-NIOSH, Morgantown, WV, and James M. Antonini, CDC-NIOSH, Morgantown, WV.

Sponsor(s):
- Inhalation and Respiratory Specialty Section
- Nanotoxicology Specialty Section
- Occupational and Public Health Specialty Section

Engineered nanomaterials have vast potential with applications in medicine, electronics, and composites. Carbon nanotubes (CNT) represent one such material with broad applications, but this material also has the propensity for significant toxicity. Toxicities include pulmonary and systemic inflammation, fibrosis, immunosuppression, and cardiovascular dysfunction, and evidence is growing that CNT may have properties that influence carcinogenicity. Over the past decade there has been a significant investment in research to examine the in vivo and in vitro toxicity of CNT. Conversely, very little is known about the exposure level and chemical and physical properties of airborne CNT that humans are exposed to, especially in the workplace. These deficiencies make the interpretation of the vast number of experimental studies to human relevance difficult. Initial findings from epidemiological studies of workers handling engineered nanomaterials, recent advancements in detailed facility exposure assessment, pertinent in vivo toxicity studies with dosimetry-based human health implications, regulatory aspects, and risk assessment based on results from animal inhalation studies will be included. The outcome of this session is to provide the most recent human exposure assessment and epidemiological findings and to gather perspective on in vivo toxicity studies involving risk estimates and potential carcinogenicity. This data should have direct influence on the course of newly designed studies and add perspective on previous studies of CNT-induced toxicity.

- Epidemiological Study of Workers Handling Carbon Nanotube and Engineered Nanomaterials. Saou-Hsiong Liou, National Health and Environmental Risk to Carbon Nanotubes. Linda M. Sargent, CDC-NIOSH, Morgantown, WV.
- Carbon Nanotube Exposure Assessment: An Evaluation of Workplace Exposures in the US. Matthew Dahm, CDC-NIOSH, Cincinnati, OH.
- Relationship between In Vivo Carcinogenicity and Human Risk to Carbon Nanotubes. Linda M. Sargent, CDC-NIOSH, Morgantown, WV.
Computational Approaches to Predict Repeat-Dose Toxicity: Lessons Learned from Cosmetic Ingredients

**Enhancing Strategies for Risk Assessment**

**Monday, March 24, 9:15 AM to 12:00 Noon**

**Chairperson(s):** Chihae Yang, Altamira LLC, Columbus, OH, and Mark T. Cronin, Liverpool John Moores University, Liverpool, United Kingdom.

**Sponsor(s):**
- Biological Modeling Specialty Section
- Regulatory and Safety Evaluation Specialty Section
- Risk Assessment Specialty Section

Assessing the toxicity of cosmetic ingredients presents numerous challenges, the solution of which will contribute to the general understanding of chemically-induced toxicity. The goal is to predict the effects to humans of long-term repeated low-dose exposure to chemicals used in cosmetics. For risk assessment, the results of *in vivo* assays are often distilled in terms of NOAELs and LOAELs. However, alternatives are required for cases where animal test data are lacking or cannot be obtained due to cost, time, or legislation. The past decade has seen an immense growth in attempts to predict toxicity computationally, but even with these advances traditional approaches (e.g., quantitative structure-activity relationships (QSARs)) are limited due to the lack of understanding of xenobiotic targets and small molecular interactions associated with observed phenotypic effects. QSAR is also not appropriate for making reliable estimates of NOAELs; thus, a new paradigm is being sought. Despite these drawbacks, the key premise is that structure-based computational analysis of a chemical of interest and close structural analogues for which experimental data are available will lead to improved predictively due to greater association with mechanisms of toxicity. Exposure is often dermal, but inhalation or oral routes are also possible. Penetration and metabolism within the dermis, possibly followed by target organ toxicity, must all be considered and accounted for when necessary. The combined factors of relatively low-dose, dermal ADME properties and toxicity to specific organs are amongst the greatest challenges facing computational toxicology for the prediction of the effects of exposure to cosmetics. This session will address these issues and review the current state of the art of computational modeling at the organ level to support risk assessment as it is being developed in a unique European Union Project called COSMOS. The funding of the COSMOS Project is from the European Commission and Cosmetics Europe.

**Databases, Tools, and TTC Approach Applied to Chemicals in Cosmetics Products.** Chihae Yang, Altamira LLC, Columbus, OH.

**Role of Bioavailability in Risk Assessment of Cosmetic Ingredients: Kinetics, Permeation, and Metabolism.** Elena Fioravanzo, S-IN Soluzioni Informatiche, Vicenza, Italy.

**Adverse Outcome Pathways (AOPs) for Target Organ Effects: The Role of Structural Alerts and Chemotypes for Liver Toxicity to Group Compounds and Apply Read-Across.** Mark T. Cronin, Liverpool John Moores University, Liverpool, United Kingdom.

**Applying Databases and Tools from COSMOS to the Scientific Needs of US FDA’s CERES Project.** Kirk Arvidson, US FDA, College Park, MD.

**US EPA’s ToxCast, Tox21, and COSMOS Projects: Cheminformatics Approaches to Creating Data Linkages and Synergies.** Ann M. Richard, US EPA, Research Triangle Park, NC.

**Induced Human Pluripotent Stem Cells and Their Differentiated Progeny Cells: Implementation in Toxicity Testing**

**Stem Cell Models for Integrated Biology**

**Monday, March 24, 9:15 AM to 12:00 Noon**

**Chairperson(s):** Kyle L. Kolaja, Cellular Dynamics International, Montclair, NJ, and Blake D. Anson, Cellular Dynamics International, Madison, WI.

**Sponsor(s):**
- Stem Cells Specialty Section

Over the past two decades stem cell technology has progressed from isolating murine and nonhuman primate embryonic stem cells (ESCs) to reprogramming fully differentiated human samples into induced pluripotent stem cells (iPSCs). Concurrent advances have been made in the differentiation of stem cells into progeny tissue cells and the ability of those cells to increasingly recapitulate native behavior. Together, these advances have driven the translation of this technology from small-scale basic biological investigations into large-scale use within the pharmaceutical industry and potential clinical applications. This symposium will focus on several examples of iPSC-derived tissue cell use in understanding and translating preclinical cardiotoxicity to the clinic; hepatocyte function, toxicity, and idiosyncratic drug-induced liver injury; and developmental neuronal toxicity. Particular emphasis will be placed on practical implementations in toxicity testing as well as the ever-expanding functional incorporation of samples from clinic populations.

**Engineering the Microscale Environment around iPSC-Derived Human Hepatocytes In Vitro.** Salman R. Khetani, Colorado State University, Fort Collins, CO.

**iPSC-Derived Liver Cultures to Study Mechanisms Underlying Idiosyncratic Hepatotoxicity.** Paul Watkins, The Hamner Institutes For Health Sciences, Research Triangle Park, NC.

**Databases, Tools, and TTC Approach Applied to Chemicals in Cosmetics Products.** Chihae Yang, Altamira LLC, Columbus, OH.
• Induced Pluripotent Stem Cell-Derived Neurons As a Human Model for Testing Environmentally-Induced Developmental Neurotoxicity, Ingrid L. Druwe, US EPA, Research Triangle Park, NC.

• Improved Translation from Preclinical to Clinical Outcomes Using Human iPSC-Derived Cardiomyocytes. Hong Shi, Bristol-Myers Squibb Company, Pennington, NJ.

Methylmercury’s Modes of Action: New Approaches to Understanding an Old Problem

New Science and Perspectives Surrounding Environmental and Occupational Exposures

Monday, March 24, 9:15 AM to 12:00 Noon

Chairperson(s): Nicholas V. Ralston, University of North Dakota, Grand Forks, ND, and Michael Aschner, Vanderbilt University Medical Center, Nashville, TN.

Sponsor(s):
- Mechanisms Specialty Section
- Metals Specialty Section
- Neurotoxicology Specialty Section

Recent advances in understanding of methylmercury (MeHg) chemistry and ecogenetics provide important insights into its molecular mechanisms of toxicity and modes of action in cells of various tissues. These new perspectives clarify MeHg’s pathophysiological effects at the organism level and indicate that the findings of epidemiological studies that were thought to be in conflict are actually highly consistent with expectations. Biochemical associations between MeHg and various biomolecules influence its bioavailability, tissue distributions, dose-effect relationships, and its characteristic signs and symptoms of toxicity. Sensitivity to MeHg exposure is also notably dependent upon other physiological factors, some which have been recognized for decades, but are only now becoming well understood, as well as emerging concepts such as epigenetics and gene-environment interactions. Like other soft electrophiles, MeHg’s notable toxicity occurs as a direct result of binding with biological ligands from the chalcogen series (group 16 in the periodic table), which include sulfur (S) and selenium (Se). Speakers will provide the latest information and evidence regarding the molecular targets, genetic/epigenetic underpinnings, and physiological pathways that are modulated by MeHg and how these aspects correlate with disease outcomes. Participation in this symposium acquaints the audience with the latest developments and scientific breakthroughs regarding molecular targets of Hg, its modes of action, neurodevelopmental effects, and outcomes of epidemiology studies. This will inform toxicologists, neurobiologists, and biochemists, and will be of interest to anyone who wants to understand MeHg’s roles in human and environmental health.

• What Can Be Learned from the Nematode (C. elegans) about Molecular Targets Associated with MeHg Toxicity? Michael Aschner, Vanderbilt University Medical Center, Nashville, TN.

• Inhibition of the Human Thioredoxin System As a Mechanism of Mercury Toxicity, Cristina M. L. Carvalho, Universidade de Lisboa, Lisbon, Portugal.

• Inherited Effects of Low Levels of Methylmercury in Neural Stem Cells. Sandra Ceccatelli, Karolinska Institutet, Stockholm, Sweden.

• Can Genetic Polymorphisms and Epigenetics Advance Mercury Risk Assessment? Evidence from Humans and Animals. Nil Basu, University of Michigan School of Public Health, Ann Arbor, MI.

• The “SOS” Molecular Mechanisms of Mercury Toxicity. Nicholas V. Ralston, University of North Dakota, Grand Forks, ND.

To Bug or Not to Bug the Immune System: Benefits and Consequences of Altering the Microbiome

Advancing Clinical and Translational Toxicology and Application of Biomarkers

Monday, March 24, 9:15 AM to 12:00 Noon

Chairperson(s): Victor J. Johnson, BRT-Barleson Research Technologies, Morrisville, NC, and Berran Yucesoy, CDC-NIOSH, Morgantown, WV.

Sponsor(s):
- Immuno-toxicology Specialty Section
- Metals Specialty Section
- Reproductive and Developmental Toxicology Specialty Section

The Human Microbiome Project, a NIH initiative to understand the complexity, constitution, and diversity of microbes living on and in the human body, was recently completed in 2012. The term “Super-Organism” was coined to describe humans as a result of characterization of the breadth and diversity of microbes that live on the external surface as well as in the blood, tissues, and cells of the human body. What role do commensal organisms play in health and disease? What role do pathogenic microbes play in health and disease? For decades, a major emphasis in the field of immunotoxicology has been to understand the impact of environmental/occupational/therapeutic exposures on host defense against invading and opportunistic pathogens. Mounting evidence suggests that equal effort should be provided to understanding the relationship between the human microbiome and how alterations thereof can have profound implications for the development of complex immune and inflammatory diseases. Individuality of the microbiome contributes to immune-diversity, “metagenetic” diversity, and interindividual differences in susceptibility to many complex diseases including allergic disease, autoimmune diseases, cancer, and others. Evidence suggests that development of an individual’s microbiome begins before birth, and the nature of this colonization can influence susceptibility to disease later in life. In addition, homeostasis of the microbiome is under continual attack due to exposures encountered in daily life. Recent research shows that exposure to toxic chemicals can shift the domi-
nant characteristics of the microbiome, thereby providing a strong contribution to disease susceptibility. Therefore, it is important to consider this research in the context of human health risk assessment. The purpose of this symposium is to provide evidence of beneficial and detrimental contributions of the microbiome to the development of immune and inflammatory diseases and provide insight into the how microbiome research integrates into human health risk assessment.

- **Toxic Exposures and the Microbiome: Their Input Counts Too.** Ellen Silbergeld, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.
- **The Human Microbiome and Autoimmunity.** Amy Proal, Autoimmunity Research Foundation, Thousand Oaks, CA.
- **The Microbiome in Human Health Risk Assessment: Where Do We Go from Here?** Kerry L. Dearfield, US Department of Agriculture, Washington, DC.

### Adverse Outcome Pathways As an Integrative Framework for Predictive Toxicology: Combining Top-Down and Bottom-Up Thinking

**Enhancing Strategies for Risk Assessment**

**Monday, March 24, 2:00 PM to 4:45 PM**

**Chairperson(s):** Chris Corton, US EPA, Durham, NC, and Imran Shah, US EPA, Durham, NC.

**Sponsor(s):**
- Mechanisms Specialty Section
- Molecular Biology Specialty Section

A number of regulatory agencies have ongoing efforts to identify, describe, and categorize AOPs. Developing libraries of AOPs that can effectively address the practical needs of chemical risk assessment is a major undertaking. There is increasing consensus on the AOP concept and structure: chemical exposure triggers a molecular initiating event that leads to a series of biochemical/cellular alterations culminating in tissue effects including frank toxicity. There is recognition that a reductionist approach may not capture sufficient biological complexity of chemical-induced effects for effectively implementing the AOP framework in risk assessment. In the era of large-scale/high-throughput biology, top-down (hypothesis-driven) and bottom-up (data-driven/systems biology) thinking are both vital for building and using AOPs. This symposium will bring together cutting-edge ideas on AOPs as an integrative framework for predictive toxicology and will focus on 1) building the structure of libraries of AOPs, 2) populating the key events with chemical-induced effects from both a top-down and bottom-up (systems biology) approach, and 3) applying the AOP framework to quantitative risk assessment. The first speaker will give an overview of international efforts to build libraries of AOPs and highlight the requirements for their utility in a regulatory context. The second speaker will discuss some of the techniques and hurdles in combining top-down thinking using large-scale molecular data to characterize molecular and cellular events involved in adverse outcomes in the liver. The third speaker will present a large-scale semantic approach for linking data in relation to AOPs. The fourth speaker will present a computational framework that uses data-driven and knowledge-driven analysis to reconstruct AOPs. The last speaker will present some of the opportunities and challenges in using AOPs for qualitative and quantitative extrapolation from *in vitro* to *in vivo*. This symposium will be of wide interest to SOT members including scientists working in the regulatory arena as well as those interested in the application of molecular and systems biology to risk assessment.

- **An International Program for the Development of Adverse Outcome Pathways to Support Chemical Risk Assessment.** Maurice P. Whelan, The Joint Research Center of the European Commission, Ispra, Italy.
- **Integrating Genomics into the AOP Framework.** Chris Corton, US EPA, Durham, NC.
- **Opportunities in Toxicology for Large-Scale Semantic-Linked Data and Prediction.** David J. Wild, Indiana University, Bloomington, IN.
- **Interactive Computational AOP Reconstruction from Data.** Imran Shah, US EPA, Durham, NC.
- **From AOPs to Quantitative *In Vitro to In Vivo* Extrapolation.** Melvin E. Andersen, The Hamner Institutes for Health Sciences, Research Triangle Park, NC.

### Is Neuroimmune Crosstalk Important to Neurotoxicology? Critical Insight from Animal and Human Studies

**Advancing Clinical and Translational Toxicology and Application of Biomarkers**

**Monday, March 24, 2:00 PM to 4:45 PM**

**Chairperson(s):** Traci Brown, University of Montana, Missoula, MT, and Colleen E. McLoughlin, CDC-NIOSH, Morgantown, WV.

**Sponsor(s):**
- Graduate Student Leadership Committee
- Neurotoxicology Specialty Section
- Postdoctoral Assembly

Convincing evidence of bidirectional communication between the immune system and the nervous system has led to a paradigm shift in our understanding of neuroimmune interactions. Emerging evidence establishes a role for immune signaling in key neurodevelopmental events. Additional evidence suggests immune system contribution...
to neuronal responses in the form of neuroprotection and repair of tissue injury, as well as in the pathogenesis of neurodevelopmental and neurodegenerative disease. Simultaneously, neurons may actively participate in immune responses in the nervous system by signaling to resident and infiltrating immune cells. The net result of the neuroimmune crosstalk depends on the balance between protective and destructive signaling pathways. There is increasing consensus that exposure to neurotoxicants may tip this balance toward a more disruptive outcome and augment the risk and/or severity of disease. How the immune system can act as a mediator/modulator of neurotoxicity remains elusive. Understanding gained by investigation into neuroimmune interactions will guide improvement of disease diagnosis, prevention, and treatment. This session will present evidence of neuroimmune perturbations in human studies and animal models of neurotoxicant exposure. Evidence from human studies will focus on immune alterations following developmental neurotoxicant exposure in children with documented neurological deficits and in a pediatric population with autism spectrum disorders. Supporting data from animal models will focus on peripheral immune alterations and neuroinflammation following developmental or adult nervous system insult.

- Neuroimmune Interactions in CNS Development, Repair, and Damage: An Overview. Marianna Stamou, University of California Davis, Davis, CA.
- Effect of Polybrominated Diphenyl Ethers (PBDEs) on Immune Function and Cellular Signaling in Children with Autism. Marjannie Eloi Atkintunde, University of California Davis, Davis, CA.
- The Immune and Neurological Impacts of Developmental BPA Exposure. Jason N. Franklin, East Carolina University, Greenville, NC.
- Exploring the Relationship between Neuroinflammation and Neurotoxicity. Kimberly A. Kelly, CDC-NIOSH, Morgantown, WV.
- Neuroautoantibodies: Biomarkers and Potential Pathogenicity. Lana A. Shaiba, University of British Columbia, Vancouver, BC, Canada

### Perinatal Exposures and Children’s Health Outcomes

**Advancing Clinical and Translational Toxicology and Application of Biomarkers**

**Monday, March 24, 2:00 PM to 4:45 PM**

**Chairperson(s):** Miriam C. Poirier, National Cancer Institute, Bethesda, MD, and Nina Holland, University of California Berkeley, Berkeley, CA.

**Sponsor(s):** Biotechnology Specialty Section, Reproductive and Developmental Toxicology Specialty Section

The developing fetus is more susceptible to xenobiotic toxicant exposures than are individuals in adulthood. This may be largely due to the rapid growth rate, the inability of the placenta to protect completely, and the undeveloped/immature fetal immune and metabolic systems. In utero and perinatal xenobiotic exposures may contribute to chronic diseases of adolescence and adulthood, including cancer, asthma, and obesity. Molecular epidemiology of children’s environmental health, which attempts to link exposure and disease, is a fast-growing area of research, both nationally and internationally. Clinical end points examined include growth parameters, metabolism, and cognitive capacity. Biomarker studies have concentrated on revealing genotoxic and epigenetic events, as well as mitochondrial toxicity, alterations in DNA repair, estrogenic effects, prediabetic metabolic syndromes, and other changes. Epigenetic effects related to prenatal exposures are considered to play a role in the fetal origin of adult human diseases, but the importance of this area for public health is only beginning to be understood. The relevant exposures may range from metals, polycyclic aromatic hydrocarbons associated with air pollution, and pesticides, to hormone disruptors and widely-used chemotherapeutic drugs. Fetal adverse outcome may appear early (mitochondrial toxicity, metabolic syndrome, asthma, cognitive disorder), or years later (leukemia, obesity, and diabetes). This symposium is designed to highlight the significance of adverse health outcomes induced in infants and young children by a broad range of xenobiotic exposures occurring in utero and/or shortly after birth. If we can elucidate underlying genetic and epigenetic mechanisms, it may be possible to devise strategies that will better protect the health of all infants and children.

- Perinatal Exposures to Environmental Pollutants and Children’s Health. Jerrold J. Heindel, NIEHS, Research Triangle Park, NC.
- Early-Life Metal Exposure and Epigenetics. Robert O. Wright, Mount Sinai School of Medicine, New York, NY.
- Fetal Consequences of In Utero Antiretroviral (ARV) Nucleoside Reverse Transcriptase Inhibitor (NRTI) Exposures in Primates. Miriam C. Poirier, National Cancer Institute, Bethesda, MD.
The Emerging Role of Mitochondrial Turnover, Biogenesis, and Dynamics in Tissue Injury

Monday, March 24, 2:00 PM to 4:45 PM

Chairperson(s): Jae-Sung Kim, University of Florida, Gainesville, FL, and John J. Lemasters, Medical University of South Carolina, Charleston, SC.

Sponsor(s):
- Korean Toxicologists Association in America Special Interest Group Mechanisms Specialty Section
- Toxicologic and Exploratory Pathology Specialty Section

The mitochondria, the cell’s powerhouses, provide cells with adenosine triphosphate (ATP) to drive diverse energy-requiring reactions. Besides energy generation, the mitochondria are also involved in a myriad of essential functions and signaling events in cells. Consequently, disturbances affecting mitochondrial integrity diminish the quality and function of mitochondria, ultimately leading to tissue injury and death. Indeed, mitochondrial dysfunction is a key mechanism underlying ischemia/reperfusion, aging, and drug-induced toxicity in the liver, kidney, and other organs. To maintain normal cell function and survival under the conditions of a variety of stresses, cells possess a powerful surveillance system that selectively eliminates injured or dysfunctional mitochondria in a timely manner, a process called mitophagy. Impaired or insufficient mitophagy is causatively linked to pathology of ischemia/reperfusion, aging, and alcohol- and acetaminophen-mediated hepatotoxicity.

The mitochondria are newly formed, and constantly divide and fuse, and continuously change their size and morphology during times of cellular stresses or in response to environmental stimuli. The biogenesis of mitochondria is tightly regulated, and inhibition of mitochondrial biogenesis has been associated with the development of age-related degenerative diseases. Furthermore, mitochondrial dynamics not only determines mitochondrial size, but also regulates mitophagy. Growing evidence is accumulating that mitochondrial biogenesis and dynamics are neatly interconnected with mitophagy. This symposium will emphasize the emerging role of mitochondrial turnover, biogenesis, and dynamics in tissue injury.

- Variants of Mitochondrial Autophagy: Types 1 and 2 Mitophagy. John J. Lemasters, Medical University of South Carolina, Charleston, SC.

- Mitochondrial Autophagy in Ischemia-Reperfusion Injury and Age-Mediated Hepatotoxicity. Jae-Sung Kim, University of Florida, Gainesville, FL.

- Mitochondrial Dynamics and Oxidative Tissue in Diabetes. Yisang Yoon, Georgia Regents University, Augusta, GA.

- Mitochondria Dynamics in Acetaminophen-Induced Liver Injury. Hartmut Jaeschke, University of Kansas Medical Center, Kansas City, KS.

Use of Stem Cells in Toxicity Testing—From Basic Research to Personalized Toxicology

Monday, March 24, 2:00 PM to 4:45 PM

Chairperson(s): Stephane H. Dhalluin, UCB Pharma SA, Brussels, Belgium, and Yvonne Will, Pfizer, Inc., Groton, CT.

Sponsor(s):
- Drug Discovery Toxicology Specialty Section
- Mechanisms Specialty Section
- Stem Cells Specialty Section

Drug-induced toxicity remains a major problem for all pharmaceutical companies, and most have deployed in silico and in vitro testing paradigms throughout the drug discovery process to select safer drugs to be tested in animal models and advance to patients. Despite many advances in understanding mechanisms of toxicity, the majority of in vitro assays predict human risks by less than 50%, and it was shown that measuring simple mechanistic toxicity endpoints in organ-relevant cell lines does not predict organ toxicity (Lin and Will, 2012, Lu and Will, SOT 2013). This may be due to the fact that certain basic toxicity mechanisms such as apoptosis or mitochondrial dysfunction can contribute to a variety of organ toxicities and that many cell lines lack features of organ physiology, such as proper metabolism, relevant ion channel pharmacology, genetic diversity or disease background, to name a few. To build a predictive multicell model, it is necessary to begin with improved functional cell models from the relevant tissue, e.g., hepatocytes, cardiomyocytes, etc. Therefore, efforts to generate physiologically-, pharmacologically-, and toxicologically-relevant cells from ES and iPS cells are important. Progress has been made in the production of human/patient-derived pluripotent stem cells, which can be continuously expanded in the undifferentiated state and differentiated to form most cell types, potentially allowing recapitulation of genetic variation such as association with known gene variants (e.g., HLA susceptibility alleles). This symposium will contribute to our understanding of the current and future state of stem cell usage in toxicology by: 1) providing an overview of stem cells, their characteristics in comparison to native organs, their ability to represent patient

up-to-date information at www.toxicology.org
genetics and disease, 2) describing the current state of application to detect liver, heart, and kidney toxicity, 3) discussing how good patient genetic and disease background give rise to personalized toxicity assessment.

- **Human Pluripotent Stem Cells As Tools for Safety Toxicology.** James Thomson, Morgridge Institute for Research, Madison, WI.

- **The Application of Stem Cell-Derived Hepatocytes in Mechanism-Based Drug Safety Assessment.** Chris Goldring, University of Liverpool, Liverpool, United Kingdom.

- **iPSCs for Cardiac Drug Testing.** Joseph Wu, Stanford University, Stanford, CA.

- **In Vitro Models for the Prediction of Nephrotoxicity in Humans.** Daniele Zink, Agency for Science, Technology and Research, Singapore.

**TUESDAY**

**Does This Chemical Make My Liver Look Fat? (Environmental Exposures and Steatosis)**

*New Science and Perspectives Surrounding Environmental and Occupational Exposures*

**Tuesday, March 25, 9:00 AM to 11:45 AM**

**Chairperson(s):** Charlene A. McQueen, US EPA, Research Triangle Park, NC, and Nathan J. Cherrington, University of Arizona, Tucson, AZ.

**Sponsor(s):**

- Drug Discovery Toxicology Specialty Section
- Mechanisms Specialty Section
- Molecular Biology Specialty Section

Headlines have proclaimed the exponential increase in obesity, type 2 diabetes, and metabolic syndrome in the US and other developed countries. Fatty liver is associated with all of these conditions that adversely affect human health. Initially, fatty liver disease (FLD) is benign, but, unfortunately, the disease may develop into the more serious condition steatohepatitis, characterized by lipid accumulation, inflammation, and fibrosis. Further progression can result in cirrhosis and even cancer. Much research has focused on the cellular and molecular changes in order to develop better diagnostic and treatment options. In contrast, there is only limited knowledge of the causes of fatty liver disease (FLD). Upon diagnosis, FLD is classified as alcoholic fatty liver disease (AFLD), with excessive alcohol consumption identified as the cause, or the broader category of nonalcoholic fatty liver disease (NAFLD). Known causes of NAFLD include a high-fat diet and some drugs, but these only account for a fraction of the estimated 30–40 million cases in the US. A better understanding of the environmental and chemical causes of NAFLD can aid in both prevention and treatment of the disease. This symposium focuses on the role of environmental chemicals in the etiology of NAFLD. The presentations will provide a better understanding of how environmental agents, from disinfection byproducts to pesticides, result in steatosis, as well as the multigenerational persistence of the effects of these exposures. Importantly, new insights will be gained on environmental agents that may contribute to the increasing incidence of NAFLD. (This is an abstract or a proposed presentation and does not necessarily reflect US EPA policy.)

- **Exposure to Disinfection Byproducts of Drinking Water in Obesity: From Adipokine Imbalance to Epigenetic Alterations leading to Metabolic Syndrome, NASH, and End-Stage Liver Disease.** Saurabh Chatterjee, University of South Carolina, Columbia, SC.

- **AhR in Fatty Liver Disease, The Expected and Unexpected.** Wen Xie, University of Pittsburgh, Pittsburgh, PA.

- **Chronic Low-Dose Perfluorooctanesulfonic Acid (PFOS) Induces Hepatic Lipid Accumulation and Dampens Caloric Restriction-Induced Lipid Loss in Mice.** Angela L. Slitt, University of Rhode Island, Kingston, RI.

- **Prenatal Obesogen Exposure Causes Transgenerational Inheritance of Increased Fat Mass, Stem Cell Programming, and Hepatic Steatosis.** Bruce Blumberg, University of California Irvine, Irvine, CA.

**Ocular Immunotoxicology: A Privileged View**

*Safety Assessment: Mechanisms and Novel Methods*

**Tuesday, March 25, 9:00 AM to 11:45 AM**

**Chairperson(s):** Brian Christian, Covance Inc., Madison, WI, and JoAnn C.L. Schuh, JCL Schuh, PLLC, Bainbridge Island, WA.

**Sponsor(s):**

- Immunotoxicology Specialty Section
- Ocular Toxicology Specialty Section

Vision is achieved through highly specialized ocular tissue structures and processes which refract and transmit light to the photosensitive cells of the retina. Optimal visual function depends on maintaining the integrity and transparency of cornea, aqueous, lens, and vitreous, which can be compromised by unchecked immune reactions. The eye is considered to be an “immune-privileged” organ because of its capacity to moderate intraocular inflammatory responses and protect tissues of the visual axis through anatomic barriers, as well as through local and systemic immunoregulatory mechanisms, particularly immunosuppression. Breakdown or dysregulation of ocular immune privilege can lead to inflammatory disorders such as uveitis, and progression of intraocular neoplasms, and has been implicated in age-related macular degeneration and glaucoma. In addition, ocular inflammation is a commonly encountered response to intentional breach of immune privilege via intraocular administration of therapeutics. This session will highlight the unique aspects of the immunology of the eye and the associated implications for
ocular toxicology and the development of ocular therapeutics. The audience will gain current understanding of structural barriers and active mechanisms of ocular immune privilege. Examples of innate and acquired immune responses to ocular insult, including allergens, microorganisms, and ocular administration of small molecule drugs, biotherapeutics, and viral vector-based gene therapies will be presented. Routine and specialized techniques for evaluating ocular immune responses will also be described. The session will include a presentation describing a current immunomodulatory approach to treat ocular disease involving the complement pathway and possible mechanisms for toxicities in preclinical studies. The final presentation will provide clinical examples and mechanisms of drug-induced immunotoxicity.

- **Ocular Oversight: Immune Privilege, and Immune Regulation and Dysregulation.** JoAnn C.L. Schuh, JCL Schuh, PLLC, Bainbridge Island, WA.
- **Innate and Adaptive Immune Responses to Ocular Insult.** Brian Gilzer, North Carolina State University, Raleigh, NC.
- **Complement As a Target for Ocular Disease.** Damon Demady, Novartis Institute for Biomedical Research, Cambridge, MA.
- **Innate and Acquired Immune Responses to Ocular Viral Gene Delivery Vectors in Primate Eyes.** Curtis R. Brandt, University of Wisconsin School of Medicine and Public Health, Madison, WI.
- **Clinical Implications of Ocular Immunotoxicology.** Frederick W. Fraunfelder, Oregon Health and Science University, Portland, OR.

**WEDNESDAY**

**In Vitro Microphysiological Systems: Advancing Regulatory Science through Innovation**

Safety Assessment: Mechanisms and Novel Methods

Wednesday, March 26, 9:00 AM to 11:45 AM

Chairperson(s): Suzanne C. Fitzpatrick, US FDA, College Park, MD, and Anthony Bahinski, Wyss Institute for Biologically Inspired Engineering at Harvard University, Boston, MA.

Sponsor(s):
- Cardiovascular Toxicology Specialty Section
- In Vitro and Alternative Methods Specialty Section
- Regulatory and Safety Evaluation Specialty Section

Development of safe and effective drugs is currently hampered by the poor predictive power of existing preclinical animal models that often lead to failure of drug compounds late in their development. Given the tremendous cost of drug development and the long timelines involved, major pharmaceutical companies and government funding agencies are now beginning to recognize a crucial need for new technologies that can quickly and reliably predict drug safety and efficacy in humans in preclinical studies. Advances in bioengineering, material sciences, microfabrication, and microfluidics technologies have enabled the development of microphysiological systems that mimic the functional units of an organ. These advances have made it possible to initiate the engineering of cellular microenvironments and/or functional units of lung, heart, blood vessels, muscles, bones, liver, nervous system (including eye), gut, and kidney. In general, these microphysiological systems, or human “organs-on-chips,” use microscale engineering technologies combined with cultured living human cells to create microfluidic devices that recapitulate the physiological and mechanical microenvironment of whole living organs. The next challenge is to develop an integrated microsystem platform that can incorporate several different modular organs on a chip. These integrated microsystems would mirror the complex physiology and biology of the human body. An integrated microphysiological platform could further our understanding of disease etiology and fill the critical need for improved model systems to predict efficacy, safety, bioavailability, and toxicology outcomes for candidate compounds. This symposium will examine the building blocks needed to bring this new innovative technology into the regulatory arena, including the need for adequate stem cells, the development of representative organ systems, challenges to building a “human on a chip”, and the pathway to qualification for regulatory use.

- **The Importance of Partnerships for Innovation in Regulatory Science—The NCATS/US FDA/DARPA Partnership for Developing Microphysiological Systems.** Danilo A. Tagle, National Center for Advancing Translational Sciences (NCATS), NIH, Bethesda, MD.
- **Good Cell Culture Practices and Their Application to iPSC for Neurotoxicity.** Thomas Hartung, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.
- **Successes and Challenges in Integrating Organ Chips: The Heart-Lung Micromachine.** Donald E. Ingber, Wyss Institute for Biologically Inspired Engineering at Harvard University, Boston, MA.
- **Challenges of Developing an Integrated “Human on a Chip” System.** John P. Wikswo, Vanderbilt University, Nashville, TN.
- **Moving Innovation into Regulatory Reality.** David Jacobson Kram, US FDA, Silver Spring, MD.
Mechanisms of Metal-Induced Disruption of DNA Repair

Wednesday, March 26, 9:00 AM to 11:45 AM

Chairperson(s): Hong Xie, University of Southern Maine, Portland, ME, and Ke Jian Liu, University of New Mexico, Albuquerque, NM.

Sponsor(s):
- Carcinogenesis Specialty Section
- Mechanisms Specialty Section
- Metals Specialty Section

Metal compounds are found throughout the environment from natural sources and human activities. Industrial applications contribute significantly to human metal exposure. Some metals, including arsenic, cadmium, chromium, lead, and nickel have been classified as or considered to be human carcinogens. DNA molecules are continuously damaged by endogenous factors and environmental agents (e.g., UV, chemical toxicants, and biological toxins). Thus, the efficient repair of these lesions is crucial to maintaining DNA integrity. In recent years, mounting evidence has suggested that DNA repair processes are susceptible to carcinogenic metals. Chronic exposure to Cr(VI) was shown to inhibit the error-free DNA double-strand break repair pathway, homologous recombination. Cd(II) interferes with DNA mismatch repair by binding to specific sites on Msh2-Msh6 to block its DNA binding and ATPase activities. Ni(II) was found to compromise activity of xeroderma pigmentosum group A complementing protein (XPA) in nucleotide excision repair (NER) pathway by interfering with zinc finger structure of XPA. As(III), Co(II), Cd(II), Hg(II), and Pb(II) have been found to decrease the incision step or the polymerization step in NER system. Studies reported that low concentrations of As(III) inhibit poly(ADP-ribose) polymerase (PARP)-1, leading to interference with DNA repair process triggered by UV radiation. It has been proposed that interference with DNA repair systems is one of the common modes of action for metal-induced carcinogenicity. It is of great interest and importance to understand the steps affected by metals in the repair pathway and the mechanism of the repair inhibition. The presentations in this symposium will highlight the latest findings on the molecular mechanisms of metal-induced inhibition of DNA repair.

- Impact of Cadmium and Copper on the Cellular Response to DNA Damage: Interference with Redox-Regulation. Andrea Hartwig, Karlsruhe Institute of Technology, Karlsruhe, Germany.
- Inhibition of DNA Repair As a Mechanism of Arsenic Carcinogenesis. Ke Jian Liu, University of New Mexico, Albuquerque, NM.
- Prolonged Exposure to Particulate Chromate Induces a Switch from Homologous Recombination Repair to Nonhomologous End Joining Repair in Human Lung Cells. John P. Wise Sr., University of Southern Maine, Portland, ME.

Molecular Mechanisms Involved in Neuro/Glial Toxicity: From Oxidative Stress to Redox Signal Transduction

Wednesday, March 26, 9:00 AM to 11:45 AM

Chairperson(s): Rodrigo Franco, University of Nebraska-Lincoln, Lincoln, NE, and Michelle L. Block, Virginia Commonwealth University, Richmond, VA.

Sponsor(s):
- Mechanisms Specialty Section
- Molecular Biology Specialty Section
- Neurotoxicology Specialty Section

Oxidative stress, defined as the imbalance between the production of reactive oxygen (ROS) or nitrogen (RNS) species and the ability of cells to scavenge these reactive species and repair oxidative damage, has been largely reported to participate in environmental toxicity. Biomarkers of oxidative damage in proteins, lipids, and nucleic acids are inherent to neuronal toxicity associated with pesticides, metals, and particulate matter. Electron-transfer processes called “redox signaling” play key messenger roles in biological systems. Initially, ROS/RNS formation was thought to lead to nonspecific cellular damage. However, recent in vitro and in vivo findings demonstrate that, in response to environmentally relevant doses toxicants, a specific set of redox signaling events play a major role activating specific signaling transduction cascades, regulating gene expression, enzyme activity, cellular metabolism, and cell fate outcome of neuronal and glial cells. In this session we will examine recent findings on the molecular mechanisms by which redox signaling regulates environmental neuro/glial toxicity. More specifically, the speakers will highlight the novel mechanisms by which mitochondrial redox homeostasis, iron-sulfur cluster oxidation, electrophile-adduct formation, thiols, transcription factor regulation, oxidative post-translational modifications, and oxidative DNA-damage regulate the toxicity of particulate matter, aldehydes, pesticides, and metals. This topic should be of great importance to biochemists, risk assessors, graduate students, postdoctoral trainees, and academics within distinct Specialty Sections.

- Mitochondrial Redox Mechanisms of Neurotoxicants Implicated in Parkinson's Disease. Manisha N. Patel, University of Colorado, Aurora, CO.

The Electrophile-Responsive Proteome As a Target for Environmental Neurotoxicants. Richard M. LoPachin, Montefiore Medical Center, Bronx, NY.
- Redox Regulation of NF-κB p50 and M1 Polarization in Neurotoxic Microglia. Michelle L. Block, Virginia Commonwealth University, Richmond, VA.
- Redox Signaling and Methylmercury Toxicity. Michael Aschner, Vanderbilt University Medical Center, Nashville, TN.
- Repair of Mammalian Genome Damage Induced by Oxidative Stress and Their Linkage to Neurodegenerative Diseases. Sankar Mitra, The Methodist Hospital Research Institute, Houston, TX.

The Role of the AHR in Stem Cell Development and Lineage Specification

Stem Cell Models for Integrated Biology

Wednesday, March 26, 9:00 AM to 11:45 AM

Chairperson(s): David H. Sherr, Boston University, Boston, MA, and Alvaro Puga, University of Cincinnati, Cincinnati, OH.

Sponsor(s):
- Carcinogenesis Specialty Section
- Molecular Biology Specialty Section
- Stem Cells Specialty Section

For decades the aryl hydrocarbon receptor (AHR) has been studied for its mediation of the toxic and carcinogenic effects of ubiquitous environmental chemicals including dioxins, planar PCBs, and PAHs. A subtext to this work has always been the nature of the "normal" physiological function of this evolutionarily conserved protein. In the last five years, several breakthrough studies have begun to reveal the significance of the AHR in normal biological processes. Similarly, technological advances developed in the last five years have allowed investigators, for the first time, to map out some of the most basic tenets of pluripotent and multipotent stem cell differentiation. The significance of this work cannot be overstated since control of stem cell differentiation is a key to both organ generation/regeneration and cancer stem cell immortality. Here, we focus on the intersection of AHR and stem cell biology to highlight the importance of the AHR to the regulation of stem cell differentiation and to emphasize the potential for environmental AHR ligands to disrupt essential cell specification programs. We will discuss AHR control of: 1) pluripotent (embryonic stem cell and induced pluripotent stem cell) development into cardiomyocytes, erythroid lineage cells and megakaryocytes, 2) multipotent hematopoietic stem cell senescence and differentiation into lymphocytes, and 3) cancer stem cell development. In so doing, we will identify themes common to multiple developmental systems (e.g., common AHR signaling pathways, the role of the AHR in maintaining "stem-ness," and predicted outcomes after environmental chemical exposure). Symposium speakers will address the significant implications of their work for stem cell and AHR biology under normal physiological conditions and when impacted by exposure to environmental AHR ligands.

- The AHR Regulates the Production and Specification of Bipotential Hematopoietic Progenitor Cells. George Murphy, Boston University School of Medicine, Boston, MA.
- The AHR Controls Breast Cancer Stem Cell Development and Function. David H. Sherr, Boston University School of Public Health, Boston, MA.
- The AHR Modulates Cardiomyogenesis in Embryonic Stem Cells. Alvaro Puga, University of Cincinnati, Cincinnati, OH.
- The AHR Is a Key Factor in the Regulation of Hematopoietic Stem Cells and Their Protection from Premature Exhaustion, Stress, and Hematopoietic Disease. Thomas A. Gasiewicz, University of Rochester, Rochester, NY.
- A Role for the Aryl Hydrocarbon Receptor (AHR) on Platelet Function. Eleftherios Papoutsakis, University of Delaware, Newark, DE.
**Exploring the Interface between Air Pollution and Metabolic Syndrome: The Bittersweet Dilemma**

**New Science and Perspectives Surrounding Environmental and Occupational Exposures**

**Wednesday, March 26, 1:30 PM to 4:15 PM**

**Chairperson(s):** Urmila P. Kodavanti, US EPA, Research Triangle Park, NC, and James G. Wagner, Michigan State University, East Lansing, MI.

**Sponsor(s):**
- Cardiovascular Toxicology Specialty Section
- Inhalation and Respiratory Specialty Section
- Mechanisms Specialty Section

The metabolic syndrome (MetS) affects approximately 32% of the US population and is expected to grow to 34% by 2020. The conventional risk factors, such as diet and sedentary lifestyle, do not fully explain this rising epidemic. Multiple lines of epidemiological evidence show associations of high ambient air pollution with the incidence of metabolic disease, such as diabetes, and risk factors that comprise the metabolic syndrome. Coincident with uncontrolled air pollution in developing countries is improved lifestyle (less physical activity) and calorie-rich diets. These imply that there is likely an interaction between diet, metabolic processes, and injuries induced by inhaled pollutants. While new research on the contribution of air pollution to cardiometabolic derangements is emerging, the mechanisms by which airborne materials can affect multiple cardiovascular and metabolic pathways are unknown. The goal of this session is to present new data from both animal and human studies to shed light on the interaction of air pollutant exposure with both the incidence and exacerbation of diabetes, obesity, and cardiovascular disease. Some key issues to be addressed by presentations in this session include: What behavioral, dietary, and environmental factors contribute to the development of MetS and, subsequently, to type 2 diabetes and cardiovascular disease? How do obesity and other metabolic abnormalities interact to promote cardiovascular disease? How do air pollutants alter cardiometabolic outcomes during controlled versus natural exposures in humans? How does diet-induced metabolic syndrome alter cardiovascular responses to single and multipollutant exposures? How does obesity predispose for exaggerated airway responses to pollutants? Lastly, how do air pollutants alter stress pathways and energy expenditure? Together, the presentations begin to answer these critical questions and provide some seminal examples of the toxic interface between diet, metabolic homeostasis, and air pollutant exposure.

**Thursday, March 27, 9:00 AM to 11:45 AM**

**Clinical Evaluation of Emerging Biomarkers of Drug-Induced Liver Injury**

**Advancing Clinical and Translational Toxicology and Application of Biomarkers**

**Thursday, March 27, 9:00 AM to 11:45 AM**

**Chairperson(s):** Jiri Aubrecht, Pfizer Inc., Groton, CT, and Alison H. Harrill, University of Arkansas for Medical Sciences, Little Rock, AR.

**Sponsor(s):**
- Clinical and Translational Toxicology Specialty Section
- Drug Discovery Toxicology Specialty Section
- Risk Assessment Specialty Section

Drug-induced liver injury (DILI) remains the primary cause of drug failures during clinical development and post-marketing. It is estimated that up to 40% of potentially hepatotoxic compounds in humans go undetected in preclinical studies that utilize conventional biomarkers. Serum alanine aminotransferase (ALT) activity is a widely used clinical biomarker to assess the risk of liver injury during drug development and approvals by regulatory agencies. Since ALT increases may be transient, thus less clinically relevant, the development of alternative biomarker strategies capable of differ-
entiating transient ALT increases from those that progress to severe DILI is essential. Several biomarkers identified by evidence from peer-reviewed literature and datasets at various institutions are being evaluated as potential DILI biomarkers by individual scientists and international research consortia such as Innovative Medicines Initiative and Critical Path Institute’s Predictive Safety Testing Consortium. In this symposium we will discuss gaps and opportunities for clinical evaluation of DILI biomarkers and their application in DILI biomarkers strategies. Special attention will be given to the evaluation of protein- and miRNA-based biomarkers for detection of DILI in the clinic including their potential to facilitate the understanding of underlying toxic mechanisms. Furthermore, we will introduce the application of NextGen Sequencing in DILI biomarker research in human subjects.

- Clinical Evaluation of Emerging Biomarkers of Drug-Induced Liver Injury: Gaps and Opportunities. Jiri Aubrecht, Pfizer Inc., Groton, CT.
- Evaluation of Emerging Biomarkers of DILI in Human Populations. Shelli J. Schomaker, Pfizer Inc., Groton, CT.
- Mechanistic Biomarkers of Mitochondrial Dysfunction during Drug-Induced Liver Injury in Humans. Hartmut Jaeschke, University of Kansas Medical Center, Kansas City, KS.
- Novel Liver Biomarkers Provide Insight into Benign Drug-Induced ALT Elevations in the Clinic. Alison H. Harrill, University of Arkansas for Medical Sciences, Little Rock, AR.
- Application of NextGen Sequencing for Discovery of Novel miRNA-Based Candidate Biomarkers of DILI in Human Subjects. Joost H.M. van Delft, Maastricht University, Maastricht, Netherlands.


Enhancing Strategies for Risk Assessment

Thursday, March 27, 9:00 AM to 11:45 AM


Sponsor(s):
- Comparative and Veterinary Specialty Section
- Molecular Biology Specialty Section
- Regulatory and Safety Evaluation Specialty Section

Training in evolutionary thinking can help biomedical researchers, clinicians, and toxicologists ask useful questions that they might not otherwise pose. Emerging high-throughput technologies, predictive toxicology, and bioinformatics, as well as alternative toxicity models such as bacteria, yeast, C. elegans, zebrafish, and stem cells, provide new information across the phylogenetic tree at a molecular scale to support human health risk assessments. These novel approaches also create an opportunity to consider what role evolution plays in toxicity testing, particularly in cross-species toxicity extrapolation of pollutants and manufactured chemicals. This symposium aims to generate discussion on evolution and three specific aspects of toxicity testing:
1. how can the phylogeny of species-xenobiotics interaction influence the design and interpretation of high-throughput screens with microbes and alternative animal models; (2) how can the molecular evolution of naturally-occurring toxins and species interaction in the natural world inform the hazard characterization of pollutants and manufactured chemicals; and (3) how can comparative physiology in both vertebrates and invertebrates influence the development of adverse outcome pathways for human health risk assessments.

- Molecular Evolution of Transcription Factors in Zebrafish and Killifish: Implications for Biomedical and Environmental Toxicology. Alicia R. Timme-Laragy, University of Massachusetts, Amherst, MA.
- The Comparative Toxicogenomics Database (CTD): Leveraging Species Diversity to Understand Mechanisms of Toxicity. Carolyn J. Mattingly, North Carolina State University, Raleigh, NC.

Neurobehavioral Impacts of Early-Life Manganese Exposure: Linking Human and Animal Model Studies

Advancing Clinical and Translational Toxicology and Application of Biomarkers

Thursday, March 27, 9:00 AM to 11:45 AM

Chairperson(s): Donald Smith, University of California Santa Cruz, Santa Cruz, CA, and Roberto Lucchini, Icahn School of Medicine at Mount Sinai, New York, NY.

Sponsor(s):
- Clinical and Translational Toxicology Specialty Section
- Metals Specialty Section
- Neurotoxicology Specialty Section

This symposium will highlight advances in our understanding of the complex causal relationships between early-life environmental manganese (Mn) exposure and lasting neurobehavioral impairment,
gained through the coordinated integration of epidemiological and animal model studies. Behavior and cognitive function are among the most important public health outcomes, since the potential loss of neurological functioning early in life due to toxic exposures may result in diminished academic and economic productivity that can persist over the life span. Motor abnormalities are likewise relevant in relation to neurodegenerative disorders, leading to Parkinsonian disturbances in the aged. Multidisciplinary investigations that synthesize advances in developmental testing, animal toxicology, exposure assessment, statistical modeling, and epidemiology are necessary to gain insights into the impacts of early-life Mn exposure—impacts that have direct implications for public health. This symposium will address this research need through presentation of coordinated human and animal research that focuses on comparable neurophenotypes across species and age ranges, and that incorporates novel exposure-assessment tools, such as Mn levels in shed deciduous teeth, to assess the impacts of early-life and lifelong Mn exposure over distinct developmental windows/life stages.

- Animal-Human Correlates of Early-Life Mn Exposure and Executive Functioning. Robert O. Wright, Icahn School of Medicine at Mount Sinai, New York, NY.
- Neurodevelopmental Effects of Ambient Exposure to Manganese in Appalachian Children Residing near a Ferromanganese Refinery. Erin Haynes, University of Cincinnati, Cincinnati, OH.
- Manganese Exposure across Different Life Stages Produces Comparable Deficits in Neuromotor Function and Olfactory Discrimination. Roberto Lucchini, Icahn School of Medicine at Mount Sinai, New York, NY.
- Validation of Novel Exposure Biomarkers in Manganese-Exposed Rats and in a Cohort of Children at Risk of Environmental Manganese Exposure. Manish Arora, Icahn School of Medicine at Mount Sinai, New York, NY.
- Fine Neuromotor Deficits Following Early and Lifelong Manganese Exposure, and the Efficacy of Oral Methylphenidate Treatment to Alleviate Motor-Function Deficits. Donald Smith, University of California Santa Cruz, Santa Cruz, CA.
- Attentional Deficits in Early-Life and Lifelong Manganese-Exposed Rats and Their Reversal with Oral Methylphenidate Treatment. Stephane A. Beaudin, University of California Santa Cruz, Santa Cruz, CA.
MONDAY

Developmental Programming of Hepatic Metabolism: Assessing the Impact of Perinatal Exposure to Xenobiotics

Monday, March 24, 9:15 AM to 12:00 Noon

Chairperson(s): Lauren M. Aleksunes, Rutgers, The State University of New Jersey, Piscataway, NJ, and Angela L. Slitt, University of Rhode Island, Kingston, RI.

Sponsor(s):
Mechanisms Specialty Section
Molecular Biology Specialty Section
Reproductive and Developmental Toxicology Specialty Section

It is becoming increasingly evident that epigenetics is important in the ontogeny of hepatic metabolism and transport pathways. This workshop highlights the most recent knowledge of the developmental regulation of hepatic metabolism through transcriptional and epigenetic mechanisms in rodents and humans. Interestingly, emerging research from a number of laboratories demonstrates that maternal exposure to environmental chemicals during the perinatal period alters the expression and function of metabolic and transport proteins in progeny later in life. Up- or down-regulation of key hepatic metabolic processes, including cytochrome (Cyp) P450 and carboxylesterase (Ces) enzymes, as well as excretory transporters, may have a significant impact on the pharmacological and toxicological responses to xenobiotics during puberty and adulthood and, additionally, impact systemic hormone levels. The purpose of this workshop is to bring together experts in the field of toxicology to highlight the regulatory mechanisms underlying the developmental programming of hepatic metabolism and transport, and to discuss the potential impact of early exposure to xenobiotics on the ability of the liver to metabolize and excrete chemicals later in life. Experimental design and cutting-edge technologies will also be discussed. The workshop contains presentations and a roundtable discussion that will address four questions: What is the role of nuclear receptors and transcription factors in the ontogenic regulation of hepatic metabolism? What epigenetic mechanisms are involved in the hepatic programming of the liver? Do environmentally-relevant concentrations of chemicals alter the developmental programming of xenobiotic metabolism pathways? What are the potential long-term consequences resulting from altered hepatic programming of metabolic enzymes, including the toxicity of pollutants and the efficacy of pharmaceuticals?

- Hepatic Ontogeny of Drug Processing Genes in Mouse Liver.
  Xiaobo Zhong, University of Connecticut, Storrs, CT.

- Xenobiotic Receptor CAR and Epigenetic Misprogramming.
  Wendong Huang, City of Hope National Medical Center, Duarte, CA.

- Pharmacokinetic and Pharmacodynamic Consequences of Long-Term Increases in Carboxylesterase Expression following Developmental Pesticide Exposure. Jason R. Richardson, Robert Wood Johnson Medical School, Rutgers University, Piscataway, NJ.

- Developmental Bisphenol A Exposure Alters Hepatic Phase II Metabolism and Transport via Histone Deacetylase. Angela L. Slitt, University of Rhode Island, Kingston, RI.

New Concerns and New Science Addressing Environmental Asbestos Exposures

Monday, March 24, 9:15 AM to 12:00 Noon


Sponsor(s):
Carcinogenesis Specialty Section
Inhalation and Respiratory Specialty Section
Mechanisms Specialty Section

Although extensive research has been conducted on asbestos health effects for specific fiber types, there are still many unresolved issues and controversies, particularly related to environmental asbestos exposures. Further, the health effects of mixtures of elongate mineral fibers have not previously been studied in detail. Approximately 120,000 asbestos-related deaths occur in the US and worldwide every year, and it has been well known for the past 30–40 years that occupational exposure to asbestos causes mesothelioma, asbestosis, and lung cancer. Moreover, environmental asbestos exposures have led to a declared public health emergency in Libby, Montana, an area known to have a higher incidence of asbestos-related diseases than the rest of the US. Other areas, such as El Dorado Hills, California, and Nooksack and Sumas, Washington, are also currently being evaluated for asbestos-contaminated soils and potential exposure to populations living in these areas. Although occupational asbestos exposures have been limited, there is increased concern related to exposures to environmental asbestos. For both environmental and occupational exposures, there are a number of critical issues, including: (1) How can complex mixtures of different forms of asbestos and nonasbestos contaminants be evaluated? (2) What are the cellular and systemic mechanisms resulting in fibrosis and/or tumor development? (3) What is the relative toxicity of different forms of asbestos? (4) What is the proper dose-metric to consider (e.g., mass, fiber number, or surface area of fibers) when interpreting asbestos toxicity? (5) What are the effects of asbestos exposure on susceptible populations (e.g., children and adolescents)?; and (6) How do we implement toxicological findings into risk assessment and clean-up efforts? This workshop has been designed to present the latest epidemiological and basic research findings in an attempt to address some of these questions,
and to highlight the efforts of all stakeholders in determining the role of asbestos in various disease endpoints.

- **Human Health and Environmental Exposure to Libby Amphibole Asbestos.** Ted Larson, ATSDR, Atlanta, GA.
- **Autoimmune Responses following Asbestos Exposure.** Jean C. Pfau, Idaho State University, Pocatello, ID.
- **Determinants of Toxicity of Environmental Asbestos Fibers.** S. H. Gavett, US EPA, Research Triangle Park, NC.
- **Role of Inflammasomes in Malignant Mesotheliomas.** Arti Shukla, University of Vermont, Burlington, VT.
- **Challenges and Recommendations for Future Asbestos Research.** Aubrey Miller, NIEHS, Bethesda, MD.

**Skeptically Re-Examining the Limits of Toxicology Evidence in the Courtroom**

**Monday, March 24, 2:00 PM to 4:45 PM**

**Chairperson(s):** George B. Corcoran, Wayne State University, Detroit, MI, and Sol M. Bobst, Nexeo Solutions, LLC, The Woodlands, TX.

**Sponsor(s):**
- Communications Committee
- Ethical, Legal, and Social Issues Specialty Section
- Regulatory and Safety Evaluation Specialty Section

This session examines the legal applications and boundaries of toxicology and closes with a panel discussion and audience question and answer. Law and science exist in a time-frame dichotomy. The law needs a just jury verdict today, yet the modus operandi of science works over years toward more accurate theories. The adversary system and its use of experts to support a partisan position is explored. Differing models of legal and scientific interaction dictate that goals of science or of the law may suffer while the other is upheld. Toxicology stands front and center in how the law approaches scientific evidence and professional expert testimony. Galileo’s Revenge did much to expound junk science in expert testimony. The Supreme Court selected cases rooted in toxicology to re-tool the federal approach to scientific expertise in Daubert v. Merrill Dow and Joiner v. General Electric. The courts followed with the Federal Reference Manual on Scientific Evidence guiding the role of science in complex litigation. Questions about how toxic substances cause injury and how to trace and attribute responsibility remain among the most common in the courtroom. This workshop examines neurological damage and the roles of genetics and genomics. The limits of expertise to explain and predict the causes and effects are central to such cases. Experts are offered from many disciplines, some never seen before depositions. Lawyers and judges are urged by Daubert to view science as scientists do, through the scientific method. Following this skeptical evaluation of toxicology evidence in the courtroom, attendees will be better prepared to assist the higher ends of both toxicology and the law.

- **Trial Factfinders and Expert Evidence.** Michael J. Saks, Arizona State University, Tempe, AZ.
- **Presentation Approach: The 5-Question Approach to Specific Causation, and Beyond.** Sol M. Bobst, Nexeo Solutions, LLC, The Woodlands, TX.
- **Evidentiary Challenges with Genomic Data in Toxic Tort Litigation.** Gary E. Marchant, Arizona State University, Tempe, AZ.
- **Evidentiary Standards for Neuroactive and Neurotoxic Drug Testing.** Ted Simon, Ted Simon LLC, Winston, GA.
- **Challenging Toxicologists to Advance the Science of Forensics.** Roderick T. Kennedy, New Mexico Court of Appeals, Albuquerque, NM.

**TUESDAY**

**Application of the Adverse Outcome Pathway (AOP) Concept to Neurotoxicology: A Challenging Approach**

**Tuesday, March 25, 9:00 AM to 11:45 AM**

**Chairperson(s):** Ellen Fritsche, IUF-Leibniz Research Institute for Environmental Medicine, Duesseldorf, Germany, and Anna K. Price, The Joint Research Center of the European Commission, Ispra, Italy.

**Sponsor(s):**
- Neurotoxicology Specialty Section

An adverse outcome pathway (AOP) describes a sequence of key measurable events, starting by a molecular initiating event in which a chemical interacts with a biological target, followed by a sequential series of key cellular events, leading to anatomical and functional changes in biological processes and ultimately resulting in an adverse outcome relevant to the human organism and the human population. Thereby, AOP characterization could provide information on the development of structure-activity relationships, i.e., using effect information from one chemical to predict effects for other structurally similar chemicals. Finally, AOPs provide evidence important for qualitative and quantitative predictive models of the adverse outcome that result from triggering molecular initiating or other key events for which high-throughput testing methods can be developed. There are a large number of cellular and molecular processes known to be critical to proper function of the central (CNS) and peripheral nervous systems (PNS). However, comprehensive understanding of pathways leading from chemical exposure to an adverse outcome in the CNS or PNS is sparse. In this session, five AOPs with relevance for human neurotoxicity will be presented, and common key events across these AOPs will be determined, increasing the possibility to identify potential neurotoxicants, even if toxicity is mediated by various pathways.
Moreover, vulnerable windows of susceptibility to chemical exposure during brain development and aging will be discussed.

- **Organophosphate-Induced Neurotoxicity.** Alan Hargreaves, Nottingham Trent University, Nottingham, United Kingdom.
- **N-Methyl-D-Aspartate Receptor (NMDA-R) Over activation As a Pathway for Neurotoxicity.** Cristina Suñol, IIBB-CSIC-IDIBAPS, Barcelona, Spain.
- **SH-Group Binding-Induced (Developmental) Neurotoxicity.** Christoph van Thriel, IfADo-Leibniz Research Center for Working Environment and Human Factors, Dortmund, Germany.
- **Adverse Outcome Pathway (AOP) for Neuroinflammation.** Florianne Tschudi-Monnet, University of Lausanne and Swiss Center for Applied Human Toxicology (SCAHT), Lausanne, Switzerland.
- **Oxidative Attack of the Neural Progenitor Cell Niche As an AOP for Neurotoxicity of the Elderly.** Ellen Fritsche, IUF-Leibniz Research Institute for Environmental Medicine, Duesseldorf, Germany.

### Idiosyncrasies of Cells in Culture: Lessons from Genetic Toxicology

**Sponsor(s):**
- Regulatory and Safety Evaluation Specialty Section
- Women in Toxicology Special Interest Group

Because of a desire to reduce laboratory animal use and a goal to provide information using human cells in culture, rather than rodents, there is an international focus on developing *in vitro* predictive toxicity assays for chemical hazard assessment. These factors, coupled with the new molecular 'omics technologies, have provided the major impetus behind the Tox21, ToxCast, and other efforts to move toward an all *in vitro* hazard test battery. The genetic toxicology community began developing *in vitro* assays to predict both cancer and human heritable genetic disease in the early 1970s. Ultimately, a regulatory test battery was established and is used by the majority of international regulatory agencies. Over the decades there has been substantial knowledge gained concerning the strengths and weaknesses, as well as the important issues involved in using *in vitro* assays for hazard assessment. In addition, major improvements to the genetic toxicology assays and the interpretation of data have been accomplished over this time period. Currently, there is a multi-sector international effort with a focus on better understanding the issues around cell stewardship, cell line characteristics, and the appropriate strategies for providing/assuring the required metabolic activation for *in vitro* systems. This effort, coupled with other genetic toxicology community experience, including the use of 2D vs. 3D cell cultures, and the selection of endpoints and correlations with apical health outcomes, provide extensive information that should inform the current efforts to establish all *in vitro* approaches for chemical hazard assessment.

- **Overview and Perspective Based on Lessons Learned from the Evolution of *In Vitro* Genetic Toxicology.** Martha M. Moore, ENVIRON International Corporation, Little Rock, AZ.
- **Know Your Cells: Importance of Cell Line Stewardship in Toxicity Testing.** Matthew J. LeBaron, The Dow Chemical Company, Midland, MI.
- **Impact of Cell Type on Toxicity Testing—Implications for Assay Interpretation.** Julie Clements, Covance Laboratories, Harrogate, North Yorkshire.
- **In Vitro Simulation of Endogenous Mammalian Metabolism: Lessons From Genetic Toxicology.** Paul White, Health Canada, Ottawa, ON, Canada.
- **Utility of Three-Dimensional Tissue Constructs for Toxicity Testing.** Stefan Pfuhler, Procter & Gamble, Cincinnati, OH.

### Photosafety Evaluation of Pharmaceuticals without Testing in Animals

**Sponsor(s):**
- Dermal Toxicology Specialty Section
- In Vitro and Alternative Methods Specialty Section
- Regulatory and Safety Evaluation Specialty Section

Advances in understanding of photochemistry, photoreactivity, and phototoxicty of pharmaceuticals offer for the first time the opportunity to appropriately evaluate the potential for photosafety risk in humans while minimizing or eliminating testing in animals. Generally, compounds that absorb light in the visible and UV ranges and generate reactive oxygen species (ROS) pose a potential risk for phototoxicity. Photoactivity tests to detect generation of ROS and *in vitro* bioassays to detect phototoxicity (3T3-NRU and 3D-skin assays) offer high sensitivity (e.g., few false negatives) but lower selectivity (higher numbers of false positives) with which to predict phototoxic potential in humans. To support an integrated assessment strategy, it is most important these assays show high sensitivity, because negative assay results are usually conclusive and do not warrant further photosafety evaluation. Thus, it is not essential that positive assay results always predict a clinically relevant phototoxic response, and the fact that these assays measure entirely different...
endpoints lowers the probability of multiple “false-positive” findings, such that one negative finding with other positives is generally sufficient to indicate negligible photosafety risk. Finally, compounds that absorb in the relevant spectrum and test positive in chemical and/or in vitro assays can be evaluated for photosafety in clinical trials with proper precautions, without intermediate in vitro or animal testing if the sponsor chooses (ICH M3(R2) 2010). The session will be of broad interest to academic, industry, regulatory, and consultant toxicologists concerned about the current status of photosafety testing and/or advances in nonclinical safety assessment that reduce or replace animal testing (e.g., 3Rs).

- **Chemical Methods for Detection of Photoreactive Pharmaceuticals.** Satomi Onoue, University of Shizuoka, Shizuoka, Japan.
- **How In Vitro Phototoxicity Data May Inform Selection and Later Risk Assessment of Investigational Drugs.** Daniel Bauer, Novartis Institutes for Biomedical Research, Basel, Switzerland.
- **In Vitro 3-Dimensional Skin Models for Testing Phototoxic Potential of Dermal Formulations.** Helena Kandarova, MatTek In Vitro Life Science Laboratories, Bratislava, Slovakia.
- **Evaluation of Phototoxicity of Pharmaceuticals in Clinical Trials.** Hon-Sum Ko, US FDA, Silver Spring, MD.

**Stem Cell-Derived Cardiomyocytes: An Alternative Cardiac Toxicity Model for Assessing Drug Safety and Chemical Health Risk**

**Stem Cell Models for Integrated Biology**

**Tuesday, March 25, 9:00 AM to 11:45 AM**

**Chairperson(s):** Syril D. Pettit, ILSI, Health and Environmental Sciences Institute, Washington, DC, and Kevin Dreher, US EPA, Research Triangle Park, NC.

**Sponsor(s):**
- Cardiovascular Toxicology Specialty Section
- In Vitro and Alternative Methods Specialty Section
- Stem Cells Specialty Section

Cardiac safety is a major cause of attrition, withdrawal, and adverse reactions in drug development. It is estimated that adverse cardiac and/or vascular reactions account for greater than 20% of drug attrition over the preclinical, clinical trials, and post-market phases. Effective chemical safety evaluations are also critical for protecting public health. Significant adverse cardiac effects following exposure to a variety of chemicals present in the environment have been reported by the World Health Organization and other researchers. Cardiac safety associated with pharmaceutical drugs and chemical exposures are a mutual focus of keen interest for clinical and public health researchers, academic scientists, government regulators, and industrial scientists worldwide. The development of alternative testing methods predictive of drug and/or chemical toxicity could impact drug discovery and safety evaluations as well as chemical health risk assessment. This workshop brings together a trans-sector and multidisciplinary group of experts to present and discuss the use of stem cell-derived cardiomyocytes as an alternative model to determine alterations in cardiac electrophysiology, contractility and, structural and developmental toxicity following drug or chemical exposure. Presenters and discussions will address the sensitivity, reproducibility, and biological relevance or “fit for purpose” of stem cell-derived cardiomyocytes and how these factors relate to the use of such data in a screening, risk, or safety evaluation for drugs and chemicals.

- **Transitioning Cardiac Stem Cells from Research Platforms to Predictive Tools.** Syril D. Pettit, ILSI, Health and Environmental Sciences Institute, Washington, DC.
- **Stem Cell-Derived “Cardiomyocytes” and Their Application to Cardiac Safety Assessment: Ready for Primetime?** Hugo M. Vargas, Amgen Inc., Thousand Oaks, CA.
- **Stem Cell-Derived Cardiac Cells in High-Throughput Screens for Modulators of Contractility.** Mark Mercola, University of California San Diego, San Diego, CA.
- **High Content Screening of Bioenergetic Modulation of Kinase Inhibitor Mitochondrial Toxicity in Human Stem Cell-Derived Cardiomyocytes.** Nick Thomas, GE Healthcare, Waltham, MA.
- **Evaluating Chemical Safety, Molecular Targets, and Toxicity Pathways in Mouse Embryonic Stem Cell Differentiation to Cardiomyocytes.** Edward S. Hunter, US EPA, Research Triangle Park, NC.

**The Doorway between Exposure and Response: How Biologically-Based Inhalation Dosimetry Models Enhance Human Health Risk Assessment**

**Enhancing Strategies for Risk Assessment**

**Tuesday, March 25, 9:00 AM to 11:45 AM**

**Chairperson(s):** J. A. Hatchkiss, The Dow Chemical Company, Midland, MI, and John B. Morris, University of Connecticut, Storrs, CT.

**Sponsor(s):**
- Biological Modeling Specialty Section
- Inhalation and Respiratory Specialty Section
- Risk Assessment Specialty Section

The respiratory tract is the portal of entry for inhaled gasses, vapors, and particles, providing a route of entry for systemic exposure and a potential target for toxic agents. The inhaled dose is dependent on the physical state, solubility, reactivity, and concentration of the material, the structural and functional characteristics of the respiratory tract,
and the types and metabolic capability of the surface epithelial cells. It is also contextual and dependent on the dose metric used, whether it is the systemic blood or tissue concentration or the regional dose to specific anatomic sites or target cell populations in the respiratory tract. Human risk assessments are often based on inhalation toxicity studies in rodents yet a number of vapors, including hydrogen fluoride and diacetyl, have been shown to produce nasal and large airway injury in rodents, but small bronchiolar airway injury in humans. Computational modeling has confirmed significant differences in regional vapor absorption patterns between rats and humans that provide a rational framework to explain the observed differences in site-specific injury between species. Multiscale computational models of the respiratory system that incorporate species-specific anatomic details and data derived from in vitro measurement of particle deposition/clearance and vapor absorption have been developed to improve estimates of material transport and regional dosimetry. Model accuracy is greatly improved by incorporating regional morphologic characteristics of the mucosa and exposure-response data to validate model predictions of species- and species-specific dosimetry. The goal of this workshop is to provide participants with a working knowledge of the state-of-the-art computational tools available to predict regional deposition, absorption, and dose of inhaled materials in laboratory rodents, the essential data needed to validate these predictions, and the use of biologically-based computational modeling in human health risk assessment applications and related research.

- Site-Specific Airway Pathology and Dosimetry of Inhaled Toxicants. Jack Harkema, Michigan State University, Okemos, MI.
- The Role of Inhalation Dosimetry Models in Multiscale Support to a Range of Risk Assessment Applications. Annie M. Jarabek, US EPA, Research Triangle Park, NC.

### Addressing Uncertainties of the Toxicology of Nanomaterials in Food and Food Contact Products

**Safety Assessment: Mechanisms and Novel Methods**

**Tuesday, March 25, 1:30 PM to 4:15 PM**

**Chairperson(s):** Annette Santamaria, Exponent, Houston, TX, and Christie M. Sayes, RTI International, Research Triangle Park, NC.

**Sponsor(s):**
- Food Safety Specialty Section
- Nanotoxicology Specialty Section
- Regulatory and Safety Evaluation Specialty Section

Nanotechnology has the potential to revolutionize the food industry by improving the delivery of nutrients, providing brighter colors and enhanced flavors, increasing food longevity, imparting antibacterial or biosensor properties, and providing product traceability in food and food contact products. The food industry is incorporating nanoparticles such as nanoparticles, silver, titanium dioxide, amorphous silica, clay, and carbon nanotubes into a growing number of food and food contact products, so consumers are likely being exposed to a variety of nanoparticles through ingestion. At this point, there is little information available on the toxicokinetics (absorption, distribution, metabolism, and excretion) and/or toxicological effects of engineered nanoparticles following ingestion. In addition, few studies have been conducted to evaluate tissue localization of the nanoparticles and/or effects on gut flora (e.g., due to their antimicrobial properties). There is also a need to develop standard methods for evaluating the levels of nanoparticles in foods and/or the migration of nanomaterials from food packaging or products (e.g., cutting boards) into food items. Regulatory agencies such as the US FDA, USDA, US Environmental Protection Agency (EPA), and risk assessment agencies such as the EFSA may request that a company provide extraction and/or toxicological studies to address some of these uncertainties, particularly for novel nanomaterials that may be used in foods and as food contact substances. This SOT session aims to address what is known about the potential exposure levels for nanomaterials in foods and food contact products, toxicokinetics and/or toxicological effects following ingestion, and laboratory methods for measuring tissue localization or effects of nanoparticles on the gastrointestinal tract. An overview of what food and food additive companies may need to do to address current or future regulations and/or guidelines will be presented. The findings and recommendations from the collaborative research projects will also be discussed by the speakers of this symposium who have participated in those projects.

- NanoRelease Food Additive Project—Developing Methods to Measure Characteristics Relevant to Nanomaterial Uptake from Food. Richard Canady, ILSI Research Foundation, Washington, DC.
Adverse Outcome Pathways: A Conceptual Framework for 21st-Century Risk Assessment

Enhancing Strategies for Risk Assessment

Tuesday, March 25, 1:30 PM to 4:15 PM

Chairperson(s): J. Craig Rowlands, The Dow Chemical Company, Midland, MI, and Kevin Crofton, US EPA, Research Triangle Park, NC.

Sponsor(s):
- Mechanisms Specialty Section
- Molecular Biology Specialty Section
- Risk Assessment Specialty Section

An Adverse Outcome Pathway (AOP) represents existing knowledge concerning the linkage between a molecular initiating event and an adverse outcome at the individual or population levels (Ankley, Bennett, et al. 2009). As such, it is a conceptual framework that describes known linkages between a chemical-induced initial molecular event that alters biochemical cellular processes that cascade via a series of key events observed as cellular, tissue, and anatomical changes, that ultimately culminates in an adverse outcome of relevance to human or ecological health. This workshop will provide a regulatory rationale for using AOPs, along with the types and amounts of data needed to construct an AOP. Further, the level of confidence in an AOP will be explored for usage in regulatory decision-making, whether priority setting for chemical toxicity testing or hazard prediction. The practical utility of AOPs for risk assessment of chemicals will be illustrated using three case study examples.

- Creations and Use of AOPs: Progress and Prospects. Alan R. Boobis, Imperial College London, London, United Kingdom.
- Adverse Outcome Pathway (AOP) for Skin Sensitization. Grace Patlewicz, DuPont, Newark, DE.
- Thyroid Hormone Adverse Outcome Pathway-Based Screening Assays for Thyroid-Disrupting Chemicals. Kevin Crofton, US EPA, Research Triangle Park, NC.
- Reproductive Adverse Outcome Pathways for Chemical Inhibitors of Steroid Synthesis in Fish. Gerald T. Ankley, US EPA, Duluth, MN.
- The Adverse Outcome Pathway for Hepatic Toxicity and Tumorigenesis in Rodents Initiated by Activation of the Aryl Hydrocarbon Receptor by Dioxin-Like Chemicals. J. Craig Rowlands, The Dow Chemical Company, Midland, MI.

Challenges Facing the Next Generation of Risk Assessment

Enhancing Strategies for Risk Assessment

Tuesday, March 25, 1:30 PM to 4:15 PM

Chairperson(s): Robinan Gentry, ENVIRON International Corporation, West Monroe, LA, and Betty J. Locey, ARCADIS, Ann Arbor, MI.

Sponsor(s):
- Risk Assessment Specialty Section

Risk assessors continue to be faced with significant challenges due to the increase in technology and complexity of endpoints and datasets to be considered in understanding the potential for chemical exposure to result in adverse impacts on humans or the environment. This workshop will bring scientists from multiple disciplines together to discuss these challenges for both human and ecological risk assessment and the potential for innovative solutions. The goal of this workshop is to present the latest thinking on issues significant to the practice of risk assessment today in a forum that allows for expanded thinking and an exchange of ideas. New concepts and older concepts that are being revisited to address new challenges will be presented. Topics will include the critical need for interoperability of data and models for risk assessment, consideration of variability and uncertainty in risk assessment, weight-of-evidence approaches, challenges in dose-response modeling, and the current and future guidance from the National Research Council on risk assessment issues as we move forward in the 21st century. This workshop will be the second collaboration between members of the SOT Risk Assessment Specialty Section and the SETAC Human Health Risk Assessment Advisory Group and builds on the concepts presented in a workshop developed by these two specialty sections in 2012. The 2012 workshop was titled “Concepts Critical to the Next Generation of Human Health and Ecological Risk Assessment” and highlighted some of the challenges facing the next generation of risk assessors. The goal of that workshop was to provide information on new programs and approaches within regulatory agencies, as well as in the private sector, that rely on the integration of human, animal, or ecological data.


- Uptake and Distribution of Ingested Nanomaterials. Stephen M. Roberts, University of Florida, Gainesville, FL.
Workshops

- **Weight-of-Evidence: Data Requirements and Approaches for Use in Regulatory Decision-Making.** Christopher J. Borgert, Applied Pharmacology and Toxicology, Inc., Gainesville, FL.

- **Challenges to Risk Assessment in the 21st Century: Characterizing Variability and Reducing Uncertainty in Risk Assessments.** Paul S. Price, The Dow Chemical Company, Midland, MI.

- **Multiscale Modeling: Data Integration and Interoperability.** Annie M. Jarabek, US EPA, Research Triangle Park, NC.

**Contribution of Nonimmune Cells to Adverse Immune Responses: Implications for Toxicology**

**Tuesday, March 25, 1:30 PM to 4:15 PM**

**Chairperson(s):** Peer W.F. Karmaus, St. Jude Children's Research Hospital, Memphis, TN, and Barbara L.F. Kaplan, Mississippi State University, Mississippi State, MS.

**Sponsor(s):**
- Immunotoxicology Specialty Section
- Metals Specialty Section

The potential for direct adverse effects of xenobiotics on the immune system is widely recognized. These intrinsic effects are often due to expression of target receptors for xenobiotics on immune cells or alteration of intracellular processes. However, novel evidence supports that cellular changes induced by xenobiotics in nonimmune cells can alter the competence of the immune system. Organs outside of the immune system are increasingly recognized for their ability to initiate and shape an immune response. These organs include, but are not limited to, the central nervous system, the mucosal areas such as the lung and the gut, the liver, and the cardiovascular system. The role of toxicants and their ability to modulate organ systems, thereby initiating or altering an immune response resulting in immunotoxicity, is poorly understood. Research highlighting how toxicant-induced changes in tissue physiology can result in perturbations of the immune system will be discussed. The focus of presentations will address the considerations for modeling and for assessing toxic responses and explore putative mechanisms.

- **Cannabinoid-Induced Suppression of beta2AR+ B Cell Function.** Barbara L.F. Kaplan, Mississippi State University, Mississippi State, MS.

- **Amiodaqueine-Induced Liver Injury: A New Animal Model of Immune-Mediated Toxicity.** Robert Li, Bristol-Myers Squibb Company, New Brunswick, NJ.

- **Adverse Effects of Systemic Inflammation and Acute Phase Responses Induced by Toxicants.** Stephen B. Pruett, Mississippi State University, Mississippi State, MS.

- **The Role of Epithelial Cell-Derived Hypoxia Signaling in Establishing the Inflammatory Response to Allergens.** John J. LaPres, Michigan State University, East Lansing, MI.

- **Indirect Xenobiotic Immune Modulation: Risk Assessment.** Laine P. Myers, US FDA, Silver Spring, MD.

**Developmental Toxicity from Chemical Mixtures: Research to Application in Susceptible Populations**

**Tuesday, March 25, 1:30 PM to 4:15 PM**

**Chairperson(s):** Danielle J. Carlin, NIEHS, Research Triangle Park, NC, and Moiz Mumtaz, ATSDR, Atlanta, GA.

**Sponsor(s):**
- Mixtures Specialty Section
- Reproductive and Developmental Toxicology Specialty Section
- Risk Assessment Specialty Section

The study of environmental chemical mixtures is highly complex and requires sophisticated approaches to determine which mixture component(s) contribute to health effects. Consideration of sensitive subpopulations such as pregnant mothers, the developing fetus, infants, and children, significantly increases the complexity due to chemicals exhibiting different effects depending on the timing of exposure. For example, it is well known that exposure to mixtures of inorganic metals (e.g., lead, cadmium, mercury, arsenic) and pesticides leads to neurological and other organ-specific health effects in adults, but the suite of health effects associated with these mixtures in the developing fetus and infant could differ from that of adults and is less understood. This workshop will focus on the health effects of chemical mixtures with particular attention to exposure to pregnant mothers, the developing fetus, and children, and will include discussion of toxicological studies, statistical and modeling approaches, and application to human health risk assessment in these susceptible populations. There is an impending need to understand interactions among components of mixture exposures in order to improve human health risk assessments in these susceptible populations.

- **Chemical Mixtures, Developmental Windows, and Neurodevelopment.** Robert O. Wright, Mount Sinai School of Medicine, New York, NY.

- **En Route to More Relevant Animal Models: Interactions of Chemical and Nonchemical Stressors in Developmental Neurotoxicology.** Deborah A. Cory-Slechta, University of Rochester School of Medicine, Rochester, NY.

- **Toward the Rational Use of Exposure Information in Mixtures Toxicology.** Rogelio Tornero-Velez, US EPA, Research Triangle Park, NC.
Somatic Cell Therapy—Paradigms for Investigational New Drug (IND)-Enabling Programs, Scientific and Regulatory Considerations, and Clinical Translation

Tuesday, March 25, 1:30 PM to 4:15 PM

Chairperson(s): Charles Lindamood III, CLIII Consulting, LLC, Hoboken, NJ, and Jason Hamilton, Athersys, Inc., Cleveland, OH.

Sponsor(s):
- Biotechnology Specialty Section
- Clinical and Translational Toxicology Specialty Section
- Stem Cells Specialty Section

There is significant interest in somatic cell therapies and their therapeutic potential to stimulate repair in diseased or injured tissue. Development of these therapies has been hindered by lack of knowledge of appropriate methods for assuring patient safety in clinical trials. Standard pharmacological and toxicological methods may not apply in safety evaluation of somatic cell therapies. Animal model selection, and safety concerns to be assessed, varies greatly depending upon clinical indication, source and type of cell therapy, and method of cell therapy delivery. The aim of this workshop is to provide insight into successful paradigms for IND-enabling studies supporting clinical evaluation of somatic cell therapies. Speakers with both regulatory and academic/industry development expertise in somatic cell therapy will provide presentations of program experience. The overall goal is to aid current investigators in the somatic cell therapy field, and to facilitate and expedite the development of somatic cell therapies in clinical medicine by sharing lessons learned from previous experiences.

- Intravenous Administration of Human Bone Marrow-Derived MultiStem® Cells after Ischemic Stroke: Preclinical Safety, Efficacy, and Mechanism of Action Studies to Support IND Submission and Clinical Trial Design. Jason Hamilton, Athersys, Inc., Cleveland, OH.
- Considerations in Dose Extrapolation of Stem Cell-Based Therapies: Optimizing First in Human Trial Design. Joy Cavagnaro, Access BIO, Boyce, VA.
- Nonclinical Development of Human Umbilical Tissue-Derived Cells (hUTC) for Degenerative Retinal Diseases. Clifford Sachs, Janssen Research and Development, LLC, Spring House, PA.

The Promise of Translational Imaging in Nonclinical Safety Assessment

Tuesday, March 25, 1:30 PM to 4:15 PM


Sponsor(s):
- Cardiovascular Toxicology Specialty Section
- Neurotoxicology Specialty Section
- Toxicologic and Exploratory Pathology Specialty Section

This workshop is designed to explore how several clinical to preclinical translational imaging modalities can be efficiently and effectively integrated into contemporary drug development and chemical hazard assessment. Standard clinical imagers, such as Magnetic Resonance Imaging (MRI), Magnetic Resonance Spectroscopy (MRS), Echocardiography (Echo) and Positron Emission Tomography (PET) have demonstrated strong utility in the nonclinical setting by allowing for the ability to perform real-time, non-invasive, longitudinal animal studies that can provide morphological, functional, and molecular data. Additionally, these modalities greatly minimize the need for assumptions in data interpretation and reduce uncertainty due to product development or risk assessment; therefore, the preclinical application of these imaging strategies and the integration of these capabilities into modern drug safety assessment and environmental hazard identification is a promising development with the potential to greatly impact the field. This workshop will provide an overview of the challenges facing clinical trials and opportunities for translational imaging to address these gaps. Imaging approaches that address major contributors to pharmacological attrition, including cardiovascular safety, drug-induced liver injury, and neurotoxicity, will be presented. Additionally, the panel discussion will explore the hurdles of validating the use of imaging modalities as a biomarker in the field and by regulators. Ultimately, this workshop aims to facilitate dialogue across disciplines for broader acceptance and implementation of
translational imaging in improving preclinical safety assessment and basic toxicity studies.

- **Translational Imaging Advances in Preclinical Assessment and Challenges for Regulatory Acceptance.** Brian R. Berridge, GlaxoSmithKline, Research Triangle Park, NC.

- **In Vivo Imaging of Hepatobiliary Transporter Function.** Paul Hockings, AstraZeneca, Mölndal, Sweden.

- **Characterization of Drug-Induced Changes in the Cardiovascular System.** Jonathan Heyen, Pfizer, San Diego, CA.

- **Magnetic Resonance Histology—Applications in Toxicology.** Allan G. Johnson, Duke University, Durham, NC.

- **Preclinical Development of Neurotoxicity Biomarkers Using In Vivo MRI.** Serguei Liachenko, NCTR, Jefferson, AR.

**The Role of Toxicology in Undergraduate STEM Education Reform**

**Tuesday, March 25, 1:30 PM to 4:15 PM**

**Chairperson(s):** Richard S. Pollenz, University of South Florida, Tampa, FL, and Marie M. Bourgeois, University of South Florida, Tampa, FL.

**Sponsor(s):**
Career Resource and Development Committee
Postdoctoral Assembly

The attrition of undergraduates who enter STEM degree programs but do not earn a STEM undergraduate degree is an area of national concern. “Vision and Change in Undergraduate Biology Education,” the 2011 report from AAAS/NSF, and “Engage to Excel,” the 2012 report from the President’s Council of Advisors on Science and Technology (PCAST), are two national calls to action on this issue and advocate for significant reform in the way undergraduate STEM education is delivered. A strategic goal of SOT is a commitment to education in toxicology and the recruitment of students and new members into the profession. Although the number of undergraduate toxicology degree programs is limited, toxicology is a STEM discipline and many SOT members currently engaged in teaching undergraduates incorporate toxicology into traditional STEM undergraduate degree programs such as biology, biomedical sciences, chemistry, public health, and nursing. The learning objectives of this interactive workshop are to, 1) provide context to the national call to action on undergraduate STEM education reform, 2) present four case studies of inquiry-based approaches in undergraduate STEM education that inspire students about the multidisciplinary science of toxicology, and 3) engage attendees to develop an “action plan” that incorporates toxicology and inquiry into a current STEM undergraduate degree program. During the workshop attendees will have the opportunity to network with practitioners who can help inform their practice. This session should have widespread benefit to anyone engaged in teaching “toxicology” at any level of academia or industry who has an interest in innovations that help to engage trainees to “work the problem.”

- **The Changing National Landscape of STEM Education: Building Partnerships with Scientists and Educators.** Jay Labov, National Research Council, Washington, DC.

- **Case Study 1: Creating Research Experiences and Activities for Public Health Undergraduates through Teaching Enhancement (CREATTE).** Marie M. Bourgeois, University of South Florida, Tampa, FL.

- **Case Study 2: Integrating Toxicology into the Undergraduate Curriculum.** Teresa Dodd-Butera, California State University, San Bernardino, San Bernardino, CA.

- **Case Study 3: Integrating Toxicology into the Undergraduate Laboratory Curriculum.** Bryan W. Brooks, Baylor University, Waco, TX.

- **Case Study 4: Problem-Based Instruction of Pharmacokinetics.** Teresa L. Leavens, Pharmacokinetic Consultant, Cary, NC.

- **Break-Out Session and Development of Individual Action Plan: Incorporating Inquiry into the Undergraduate Curriculum.** Sue M. Ford, St. John’s University, Jamaica, NY, and Jean C. Piau, Idaho State University, Pocatello, ID.

- **Report Outs/Discussion.** Richard S. Pollenz, University of South Florida, Tampa, FL.

**WEDNESDAY**

**Improving the Safety of Dietary Supplements and Natural Health Products by Assessing Effects in Humans**

**Wednesday, March 26, 9:00 AM to 11:45 AM**

**Chairperson(s):** James C. Griffis, Council for Responsible Nutrition, Washington, DC, and Scott A. Jordan, Health Canada, Ottawa, ON, Canada.

**Sponsor(s):**
Clinical and Translational Toxicology Specialty Section
Food Safety Specialty Section
Regulatory and Safety Evaluation Specialty Section

The use of dietary supplements and other natural health products is widespread internationally. Despite large-scale use, the lack of premarket approval in some countries and a general lack of information on the safety of these products is a recognized problem. Animal studies and other translational methods can be used to assess the safety of dietary supplements, but direct premarket information on humans is seldom available. This necessitates the use of postmarket human surveillance data to evaluate the long-term safety of dietary...
supplements. Sources of such information range from poison control
data, adverse event data reported to regulatory authorities, consumer
AER complaints to the product manufacturer, and controlled trials in
volunteers. The assessment of adverse events reported to regulatory
authorities can be challenging due to under-reporting, although the
reporting of serious adverse events and recordkeeping requirements
for dietary supplement manufacturers became law in the US in 2007.
Challenges in assessing adverse event reports are greater than for
pharmaceutical drugs because of the complexity of dietary supple-
ment products and the lack of standardized terminology. Other novel
sources of information include poison control centers, which have
been studied as potentially valuable sources of adverse reactions to
dietary supplements. Although much less studied, controlled studies
in humans have provided direct information that can be used to assess
the safety of dietary supplements. This symposium brings together
expertise ranging from clinicians to company-responsible care units
to discuss, inform, and provide examples of how this information
is finding use in regulatory environments, labeling, formulation/
re-formulation decisions, and new directions in basic research.

- **Introduction: The Use of Human Data in Assessing Dietary
  Supplement Safety.** Scott A. Jordan, Health Canada, Ottawa, ON,
  Canada.

- **A Clinician's Perspective on Accurate Adverse Event Knowledge
  in the Emergency Setting.** Lewis Nelson, NYU Emergency
  Medicine Associates, New York City, NY.

- **Natural Product Postmarket Surveillance: A Safety Net
  Designed to Detect Signals, Generate Hypotheses for Research,
  and Confirm Safety.** Rick Kingston, University of Minnesota,
  Bloomington, MN.

- **Clinical Utility of Dietary Supplement Case Reports and Adverse
  Event Reports: A Pharmaceutical Scientist's Perspective.** Bill
  Gurley, University of Arkansas for Medical Sciences, Little Rock,
  AR.

- **Systematic Analyses of Kava's Hepatotoxic Risk—What We Know
  and What We Do Not Know.** Chris Xing, University of Minnesota,
  Bloomington, MN.

- **Collection, Interpretation, and Utilization of Adverse Event Data
  within a Global Dietary Supplement Company.** Vasilios Frankos,
  Herbalife, Torrance, CA.
Workshops

- Using Gene Signatures to Predict Molecular Initiating Events in Liver Adverse Outcome Pathways. Chris Corton, US EPA, Durham, NC.
- Genetically Diverse Mouse Populations Facilitate Toxicogenetic Analysis of Drug-Induced Hepatotoxicity. Alison H. Harrill, The Hamner Institutes for Health Sciences, Research Triangle Park, NC.
- Overcoming Obstacles to Study Drug-Induced Liver Injury with Toxicogenomics towards a Regulatory Application. Weida Tong, NCTR, US FDA, Jefferson, AR.

Understanding Weight of Evidence: Exploring Different Approaches to Integrating Evidence from Diverse Data Streams

Wednesday, March 26, 9:00 AM to 11:45 AM

Chairperson(s): Nancy B. Beck, American Chemistry Council, Washington, DC, and Julie E. Goodman, Gradient, Harvard School of Public Health, Cambridge, MA.

Sponsor(s):
  - Mechanisms Specialty Section
  - Occupational and Public Health Specialty Section
  - Risk Assessment Specialty Section

While it can be straightforward to evaluate a single study, or a single evidence stream, evaluating an entire body of literature for hazard assessment or risk assessment, where one needs to integrate data that comes from multiple evidence streams (e.g., human data, toxicological data, and mechanistic information), can be more complicated. The integration of all this information is becoming increasingly complex and is particularly driven by the explosion in biological sciences and technologies that are dramatically reshaping both the volume and utility of mechanistic information. Mechanistic information, when coupled with classical endpoint-oriented toxicity data, offers a growing opportunity to more closely examine the toxicologic plausibility of observational associations obtained from epidemiologic studies. Different organizations have taken different approaches to the integration of evidence from diverse data streams, and no clear consensus approach currently exists. This workshop will explore and discuss some current approaches to integrating evidence from several organizations that develop assessments. This is timely and important, as in 2009 the National Academies (NAS) specifically called upon the US EPA to, among other things, improve the way in which evidence is synthesized within the Integrated Risk Information System (IRIS) assessments. The NAS panel acknowledged that there are existing approaches, currently used by other government programs and elsewhere, for each of these steps and encouraged the US EPA to select from and adapt them. The session will describe, using specific examples, current frameworks that use different approaches to integrate epidemiologic, toxicological, mechanistic, and other data. In addition, seen through the lens of a state user, this perspective will describe what elements are necessary in order to apply and use an integrated evaluation. Time will be provided for a robust discussion and questions.

- Understanding Hypothesis-Based Weight of Evidence. Lorenz R. Rhomberg, Gradient, Cambridge, MA.
- The Office of Health Assessment and Translation Approach to Evidence Integration for Assessment of Noncancer Health Effects. Andrew A. Rooney, NIEHS, Research Triangle Park, NC.

Advances in the Application of Imaging Technologies to Developmental Toxicology

Wednesday, March 26, 1:30 PM to 4:15 PM

Chairperson(s): Susan L. Makris, US EPA, Washington, DC, and Vicki Sutherland, Bristol-Myers Squibb Company, New Brunswick, NJ.

Sponsor(s):
  - Neurotoxicology Specialty Section
  - Regulatory and Safety Evaluation Specialty Section
  - Reproductive and Developmental Toxicology Specialty Section

The multiple imaging modalities utilized in developmental science have allowed for the ability to visualize everything from gene activation in a zebrafish embryo to developmental stages in a growing conceptus to malformations in scores of rodent fetuses in a high-throughput manner. This workshop is designed to showcase the advantages of the various imaging systems utilized in developmental studies and their benefits to basic researchers, preclinical experimenters, and clinicians alike. Presentations include examples of the diverse imaging tools (confocal episcopic fluorescence, 2-photon microscopy, ultrasound, micro-MRI, PET, and micro-CT) currently being utilized for developmental (including neurodevelopmental) toxicity studies and how these techniques are being applied to help understand the normal versus a diseased state. The potential for expanded application of developmental imaging data in a regulatory context for pharmaceuticals and environmental chemicals is widely recognized. However, there are challenges in implementing this conceptual shift in the methods traditionally used for hazard charac-
terization and in applying the results in decision-making. Technical and methodological standards need to be developed; validation studies will be necessary to demonstrate the sensitivity, specificity, and reliability of the methods to support utilizing them in a regulatory context; and laboratories will need to weigh the cost of implementing an imaging protocol against the potential gains in technical efficiency and increased study sensitivity.

- **Visualizing the Role of Specific Proteins during Embryogenesis Using a Two-Photon Microscope and the Developing Zebrafish.** Vicki Sutherland, Bristol-Myers Squibb Company, New Brunswick, NJ.
- **High-Throughput Phenotyping Pipeline Using Multiple Imaging Modalities for the Diagnosis of Structural Birth Defects in Fetal/ Newborn Mice.** Cecilia W. Lo, University of Pittsburgh, Pittsburgh, PA.
- **PET/CT Approaches to Imaging Aspects of Neurotoxicity in the Developing Animal.** Merle G. Paule, NCTR, US FDA, Jefferson, AR.
- **Recent Applications of Micro-CT Imaging in Preclinical Developmental Toxicology.** Christopher Winkelmann, Merck Research Laboratories, West Point, PA.

### Beyond hERG: Novel Cardiovascular De-Risking Strategies and Their Regulatory Acceptance

#### Safety Assessment: Mechanisms and Novel Methods

**Wednesday, March 26, 1:30 PM to 4:15 PM**

**Chairperson(s):** John Davis, Pfizer, Inc., Andover, MA, and Tiffini K. Brabham, Pfizer, Inc., Cambridge, MA.

**Sponsor(s):**
- Cardiovascular Toxicology Specialty Section
- Drug Discovery Toxicology Specialty Section

Whether drug development is prosecuting small molecule or biologic programs, cardiovascular safety is still one of the leading causes of compound attrition. The rationale for attrition has gone far beyond the traditional drug-induced long QT syndrome associated with inhibition of the human Ether-a-go-go Related Gene (hERG). Pharmaceutical companies have built-in greater controls for eliminating that hurdle by using sensitive high-throughput in vitro screens around this and other important cardiac ion channels that have significantly reduced arrhythmogenic risks. Despite these advances, adverse effects on the cardiovascular system remain a multifactorial risk, difficult to discern, especially during early drug discovery stages. Recent comprehensive preclinical attrition data has demonstrated that hemodynamic alterations, vasculitis, and left ventricular cardiac hypertrophy are increasing in incidence in short- and long-term animal studies. Unlike the well-established mechanistic link between hERG and QT prolongation, these unique pathologies either lack suitable investigative tools and models, or have a lack of confidence in the underlying mechanisms preclinically. This challenge is compounded by the advancement of molecules that act as novel targets for which limited safety data are available. However, in the past couple of years promising advances have been made in in vitro and ex vivo assay development, which have the potential to impact industry cardiovascular safety de-risking standards much as hERG screening did. Investigators are exploring more integrative tactics, by effectively employing predictive ex vivo tissue baths as well as stem cell-derived human cardiomyocytes to rank-order and/or advance suitable drug candidates. While developing innovative tools is important, it’s also clear, as the diversity of pharmaceutical drug products evolve into a more challenging target space (i.e., kinase inhibition), these inherent risks need to be evaluated on par with regulatory expectations.

- **Study of Cardiovascular Safety of Small Molecules and Biologics: The State of Science, Challenges, and Gaps.** Alan S. Bass, Merck & Co., Kenilworth, NJ.
- **Regulatory Expectations for Submission of Novel In Vitro Assays Addressing Cardiovascular Risk.** Thomas Papoian, US FDA, Silver Spring, MD.
- **Translation of Models for Assessment of Hemodynamic Endpoints.** Jonathan Heyen, Pfizer, San Diego, CA.
- **Applications of Stem Cell-Derived Cardiomyocytes—From Basic Research to Arrhythmia Prediction to Potential Regulatory Implications.** Kyle L. Kolaja, Cellular Dynamics International, Montclair, NJ.
- **Cardiovascular Risk Assessment for Biopharmaceuticals.** Hugo M. Vargas, Amgen, Inc, Thousand Oaks, CA.
Workshops

Communication and Engagement with the Public about Toxicology in a World That Misunderstands Science and Scientists: How Do You Make Your Message Relevant and “Sticky”?

Wednesday, March 26, 1:30 PM to 4:15 PM

Chairperson(s): Barbara L.F. Kaplan, Mississippi State University, Mississippi State, MS, and Steven J. Hermansky, ConAgra Foods, Omaha, NE.

Sponsor(s):
Communications Committee
Education Committee
Food Safety Specialty Section

Dissemination of scientific results drives innovation and productivity in all fields, including toxicology. It is critical to effectively communicate findings to colleagues, peers, and trainees in written and oral forms, and most of us are comfortable in this arena. However, it is more difficult to communicate results and translate risk to the lay public that listens to messages through an emotional lens—especially in the world of social media that defines “experts” based upon frequency and volume of communication rather than demonstrated expertise. Certainly, the public faces a barrage of environmental health issues associated with alleged hazards due to contamination of food, water, air, and soils. To make appropriate decisions, the public, media, and legislators need information in a readily understandable format presented in a way that resonates with them. In general, communicating and engaging with the lay public is not addressed as part of graduate training, and, therefore, even accomplished toxicologists who are effective scientific communicators find themselves underprepared. Communication directed “at” lay audiences, even that which uses appropriate terminology, is often ignored and does not “stick” with the target audience. Moreover, it is now clear that effective public communication must exceed simple dissemination of results; all stakeholders, including affected communities and populations, should be engaged by toxicologists in bidirectional discussions that facilitate learning by both scientists and the public on an emotional and transparent level. Four actors from four different vantage points will present on the role scientists should play in communication and engagement with the public about toxicology. A discussion panel will follow.

- To Speak or Not to Speak...That Is the Question...And the Challenge. Michael P. Holsapple, Battelle, Columbus, OH.
- The New Universe of “Knowledge.” Steven J. Hermansky, ConAgra Foods, Omaha, NE.
- Values, Trust, and Science. Charlie Arnot, Center for Food Integrity, Gladstone, MO.
- The Boundary-Work of Superfund Science. Wynne Wright, Michigan State University, East Lansing, MI.

Databases Facilitating Systems Biology Approaches to Toxicology

Wednesday, March 26, 1:30 PM to 4:15 PM

Chairperson(s): Susan M. Bello, The Jackson Laboratory, Bar Harbor, ME, and Mary Shimoyama, Medical College of Wisconsin, Milwaukee, WI.

Sponsor(s):
Mechanisms Specialty Section
Molecular Biology Specialty Section

The application of systems biology approaches to toxicology promises discovery of new molecular and genetic connections, the ability to draw novel inferences about mechanisms and modes of actions, and the ability to build better predictive models. However, a systems biology approach first requires identifying appropriate data from a vast array of possible data types and resources. By using multiple high-quality databases, researchers can pull together the required gene, pathway, chemical relationship, and other information needed to build their predictive model. To best use these resources, one first needs to know what resources exist, what the strengths and limitations of the resources are, and how to efficiently retrieve data from them. This session will provide an introduction to several types of resources, including model organism (Mouse Genome Informatics, Rat Genome Database), pathway (Reactome), and toxicology (Comparative Toxicogenomics Database, EPA Dashboard) databases. The goal of this session is to familiarize participants with the power and limitations of publicly available databases that may be used to build and refine models of biological systems that can be applied to toxicology research. Talks will present content overviews for each database and demonstrate data retrieval and analysis capabilities. Speakers also will be available for interactive demonstration sessions during the meeting (see the US EPA booth for dates and times).

- Mouse Genome Informatics: Using Data Integration to Facilitate Discovery of Relationships Among Genes. Susan M. Bello, The Jackson Laboratory, Bar Harbor, ME.
- Chemical Connections at the Rat Genome Database. Mary Shimoyama, Medical College of Wisconsin, Milwaukee, WI.
- The Reactome Knowledgebase: Using Open-Source Data Analysis Tools to Reveal Biological Pathways in Toxicological Data Sets. Marc E. Gillespie, St. John’s University, Queens, NY.
- The Comparative Toxicogenomics Database (CTD): Facilitating Mechanistic Understanding of Chemical Effects. Carolyn J. Mattingly, North Carolina State University, Raleigh, NC.
- Interactive Web Application (Chemical Safety for Sustainability Dashboard) for Computational Toxicology Data Exploration. Matthew T. Martin, US EPA, Research Triangle Park, NC.
Genomics in Toxics Regulation and Litigation in the Era of Whole Genome Sequencing

Wednesday, March 26, 1:30 PM to 4:15 PM

Chairperson(s): Gary E. Marchant, Arizona State University, Tempe, AZ, and Anthony R. Schatz, Merck & Co, Summit, NJ.

Sponsor(s):
Ethical, Legal, and Social Issues Specialty Section

Genomic and other ‘omic data are increasingly being used in both toxic tort litigation and environmental standard-setting. For example, defendants are beginning to request genetic testing of toxic tort plaintiffs to demonstrate alternative causation, while plaintiffs are using genomic biomarkers in appropriate cases to buttress their proof of specific causation. On the regulatory side, the US Environmental Protection Agency is increasingly using genetic susceptibility data to identify susceptible subgroups in setting ambient air quality standards, while using toxicogenomic data to evaluate and characterize the toxicology of pesticides and chemicals. These initial applications of genomic data are setting the precedents and creating the pathways for much broader use of genomic data in both the toxic tort litigation and environmental regulation contexts as we rapidly move into the era of whole genome sequencing. This year, tens of thousands of people will have their genome sequenced. That number is expected to rapidly climb to the millions and perhaps even hundreds of millions over the next few years. This session will discuss current applications of genomic data, and how whole genome sequencing will greatly increase the availability and use of genomic data, in both the litigation and regulatory domains. It will also discuss the complex ethical, legal, and social issues the increased use of genomic data will present in these contexts, including informed consent, disclosure and access issues, the “right not to know,” privacy and confidentiality issues, and the rights and responsibilities of those that produce and are harmed by toxic substances with differential genetic susceptibility.

- Incorporating Genomic Data into the Risk Analysis Paradigm. Harvey J. Clewell, The Hamner Institutes For Health Sciences, Research Triangle Park, NC.
- Regulatory Applications and Implications of Whole Genome Sequencing. Mark A. Rothstein, University of Louisville School of Medicine, Louisville, KY.
- Genome Sequence Data and Toxic Torts. Angela J. Harris, ENVIRON International Corporation, Little Rock, AR.
- Next Generation Sequencing and Genetic Liability. Gary E. Marchant, Arizona State University, Tempe, AZ.

Is Manganese-Induced Parkinsonism Mediated via Dopamine Neuron Degeneration or Dysfunction?

Wednesday, March 26, 1:30 PM to 4:15 PM

Chairperson(s): Wei Zheng, Purdue University, West Lafayette, IN, and Tomas R. Guilarte, Columbia University Mailman School of Public Health, New York, NY.

Sponsor(s):
Mechanisms Specialty Section
Metals Specialty Section
Neurotoxicology Specialty Section

Degeneration of dopamine (DA)-containing neurons in Substantia Nigra Pars Compacta (SNpc) is responsible for clinical manifestation of idiopathic Parkinson’s disease (IPD). Manganese (Mn) intoxication is known to cause a clinical syndrome that partially overlaps with those typically seen in IPD. Cumulative data from clinical observations, animal experiments, and imaging approaches have come to the point of inciting a discussion on whether the neurotoxicity mediated by Mn on the DAergic system is one of dysfunction, degeneration, or both. This workshop brings together internationally recognized experts in the field with their diverse experimental observations on Mn-DA research to address this issue. The session starts with a brief introduction of the nigrostriatal pathway in movement disorders, followed by a description of the topic in question. The first speaker presents neuropathological features of human brains collected from autopsy workers chronically exposed to Mn. The second speaker shows clinical data from subjects exposed to the eliciting drug and discusses the integrity of DA terminals. The third speaker discusses the observations from nonhuman primate studies suggesting that Mn-induced movement abnormalities are associated with an impaired DAergic function. The fourth speaker reports the data from a rat model on Mn accumulation in SNpc and neurochemical changes in brain by synchrotron X-ray fluorescent and neurochemical/pathological analyses. The last speaker demonstrates the temporal relationship of injury vis-à-vis the affected neurotransmitter systems in a C. elegans model. The topic on DA dysfunction, degeneration, and related entwining processes will further the current understanding of the contribution of dysfunction vs. degeneration in environmental etiology of neuronal diseases. The session will be of interest to a broader audience and, in particular, to those engaged in toxicological research related to Mn toxicity, IPD and neurodegenerative diseases, neuroscience, neurotoxicology, and systems biology.

- Pre- and Post-Synaptic Dopaminergic Dysfunction in Mn-Exposed Workers. Brad A. Racette, Washington University School of Medicine, St. Louis, MO.
- Manganese-Induced Parkinsonism in Methcathinone Abusers. Katrin Sikk, North Estonia Central Hospital, Tallinn, Estonia.
Workshops


- Accumulation of Manganese in Substantia Nigra and Alterations in Brain Neurochemistry following Subchronic Manganese Exposure in Rats. Wei Zheng, Purdue University, West Lafayette, IN.

- Manganese (Mn) Interaction with Dopaminergic Neurons: Evidence from C. elegans. Michael Aschner, Vanderbilt University Medical Center, Nashville, TN.

Science-Based Preclinical Safety Assessment: Decision-Making to Enhance Regulatory Success

Are Biofuels More or Less Toxic Than Conventional Fuels and What Are the Implications for Human Exposure and Risk?

THURSDAY

Thursday, March 27, 9:00 AM to 11:45 AM

Chairperson(s): Annette M. van Erp, Health Effects Institute, Boston, MA, and Michael C. Madden, US EPA, Chapel Hill, NC.

Sponsor(s):
Cardiovascular Toxicology Specialty Section
Inhalation and Respiratory Specialty Section
Occupational and Public Health Specialty Section

During the past decade, the use of biofuels such as biodiesel and bioethanol has been steadily increasing as a viable alternative to the use of petroleum-based fuels. Although there are clear advantages in terms of energy security and climate change, there are several unknowns about the long-term effects of the use of biofuels on the environment and on human health. Because there are many different biofuels and biofuel blends that originate from different feedstocks, evaluating their effects on the environment and human health over their entire lifecycle becomes rather complex. Although there may be reductions in emissions of certain compounds, there may also be unintended consequences. For example, adding bioethanol to gasoline reduces emissions of benzene and other hydrocarbons, but increases the levels of toxic aldehydes in the engine exhaust, and also leads to increased evaporative emissions. While first-generation biofuels such as ethanol derived from corn are now widespread, next-generation fuels such as those produced by microorganisms are under development. The workshop will start with an overview of the types of biofuels that are currently available and recent results of comparative...
emissions-testing programs in the US. We will then present the latest results from several research programs to evaluate the emissions and comparative toxicity of biofuels, including in vitro testing for genotoxicity, in vivo evaluation of pulmonary and cardiovascular effects, and the toxicity of fatty acid methyl esters (FAME) that are found in biodiesel. In addition to new results regarding emissions testing, the workshop will discuss different approaches and harmonization of toxicity testing in vitro and in vivo. Finally, we will conclude with approaches to assess human exposure and health impacts. [This may not represent official US EPA policy.]

- Biofuel Usage, Composition, and Engine Emissions. Kent Hoekman, Desert Research Institute, Reno, NV.

- In Vitro Toxicological Evaluations of Emissions from Heavy-Duty Vehicles Using Biofuel Blends. Norman Kado, University of California Davis, Davis, CA.

- Comparative Toxicity and Mutagenicity of Biodiesel Exhaust. Ian Gilmour, US EPA, Durham, NC.


**Role of Circulating Factors in Mediating Systemic Toxicity of Inhaled Substances**

**Safety Assessment: Mechanisms and Novel Methods**

**Thursday, March 27, 9:00 AM to 11:45 AM**

Chairperson(s): Matthew Campen, University of New Mexico, Albuquerque, NM, and Lung Chi Chen, New York University School of Medicine, Tuxedo, NY.

Sponsor(s):

Cardiovascular Toxicology Specialty Section
Inhalation and Respiratory Specialty Section
Occupational and Public Health Specialty Section

Air pollution has been long known to cause chronic and acute systemic health effects, including cardiovascular and possibly neurodegenerative diseases, but the pathway by which inhaled substances drive effects beyond the lung is unclear. The lung provides an effective barrier against most gaseous and particulate components of air pollution, and those that are taken up systemically are often in remarkably low concentrations. Moreover, several studies fail to see the same effects at relevant concentrations when particulates are delivered by gavage, intravenously, or in cell culture studies, implying that there is a species-specific reaction that occurs to drive the systemic effects. Recent studies have revealed that inhalation exposures to a variety of pollutants can lead to the generation of circulating bioactive factors that drive endothelial cell activation and may also be responsible for neuroinflammation. Circulatory changes include generation of adducted proteins, altered metabolites and lipids, and altered function of lipoproteins. The identity of the causal component(s) in the circulation remains unclear, but ongoing lipidomic and metabolomic research is providing important insights. This workshop will highlight a number of advances in this area related to exposures to particulate matter, metals, ozone, combustion mixtures, and nanomaterials.

- Influence of PM$_{2.5}$ Exposure on the Receptor for Advanced Glycation End Products: Insight into an Emerging Risk for Diabetes. Joshua M. Vaughan, New York University, Tuxedo, NY.

- Carbon-Based Engineered Nanomaterial Exposure Alters Circulating Factors that Induce Endothelial Activation and Impairment of Nitric Oxide Synthesis. Aaron Erdely, CDC-NIOSH, Morgantown, WV.

- Endothelial Cell Pattern Recognition Receptors, CD36 and LOX-1, Contribute to Responses to Pollution-Induced Circulating Factors. Matthew Campen, University of New Mexico, Albuquerque, NM.

- Ambient PM and Diesel Exhaust Alter Functionality of HDL. Jesus Araujo, University of California Los Angeles, Los Angeles, CA.

- Systemic Effects of Inhalation Exposure Mediated by ‘Omic Perturbation in Serum. Andrew K. Ottens, Virginia Commonwealth University, Richmond, VA.

**The Use of Dogs and Minipigs As an Alternative to the Nonhuman Primate in Nonclinical Safety Assessment of Biopharmaceuticals**

**Safety Assessment: Mechanisms and Novel Methods**

**Thursday, March 27, 9:00 AM to 11:45 AM**

Chairperson(s): Joerg Bluemel, MedImmune LLC, Gaithersburg, MD, and John A. Wisler, Amgen, Inc, Thousand Oaks, CA.

Sponsor(s):

Biotechnology Specialty Section
Drug Discovery Toxicology Specialty Section
Regulatory and Safety Evaluation Specialty Section

Appropriate species selection is paramount for the nonclinical safety evaluation of biopharmaceuticals. Regulatory guidance requires the use of a pharmacological responder species, in particular for biopharmaceuticals. Most often the nonhuman primate (NHP) is considered as the only pharmacologically relevant species, and especially the cynomologus monkey is frequently used for nonclinical safety studies. In recent years, ethical concerns, increased public scrutiny, and issues of availability and transportation of NHPs have put considerable pressure on researchers worldwide to improve study designs and to intensify the search for alternative species. Besides recent activities to improve study designs to reduce the number of animals used, there is a sense of urgency to intensify the search for
alternative species and consider nontraditional approaches beyond the use of "standard" toxicology species. Species like the dog and minipig are meanwhile widely used in toxicity studies for chemical-derived pharmaceuticals but rarely considered for nonclinical safety evaluation of biopharmaceuticals. The limited availability of scientific background data, e.g., pharmacogenomic or physiology comparisons, and limited regulatory experiences are considered as major obstacles for a wider use of dogs and minipigs for biopharmaceutical safety testing. A better understanding of factors like sequence homology, target/ligand expression, downstream signaling, effector functions, and antibody kinetics, as well as the availability of tools like species-specific background databases, in vitro assays, or reagents, would greatly facilitate the use of dogs and minipigs. Increased use of dogs and minipigs for nonclinical safety assessment of biopharmaceuticals would in turn increase the regulatory confidence and experience. The objective of this workshop is to review and discuss recent progression and challenges in the scientific characterization of dogs and minipigs and discuss their utility and limitations for regulatory safety testing of biopharmaceuticals.

- The Dog and Minipig As Pharmacology Models to Evaluate Biopharmaceuticals. Noel Dybdal, Genentech, South San Francisco, CA.
- Animal Model Genomic Data Aids Species Selection in Pharmaceutical Discovery and Development. Jessica J. Vamathevan, GlaxoSmithKline, Stevenage, United Kingdom.
**MONDAY**

**Environmental Factors in Dysregulation of Puberty Timing and Progression**

*Advancing Clinical and Translational Toxicology and Application of Biomarkers*

Monday, March 24, 12:10 PM to 1:30 PM

*Chairperson(s):* Wilma D. Kempinas, State University of São Paulo, Botucatu, Brazil, and Xiaoqin Ye, University of Georgia, Athens, GA.

*Sponsor(s):* Reproductive and Developmental Toxicology Specialty Section

Puberty is a time of dramatic developmental changes, characterized by the transition from childhood to adulthood. The initiation of puberty is triggered by re-activation of a pulsatile pattern of hypothalamic gonadotropin-releasing hormone (GnRH) secretion, which in turn drives the pituitary-gonadal axis. Pubertal timing greatly varies among individuals, and recent studies have demonstrated a progressive decrease in age of onset of puberty in children around the world. This is generally accepted to be due to a complex interaction between genetic, neuroendocrine, and environmental factors, acting in concert with one another in each individual, determining pubertal timing. It has been demonstrated in animal and human studies that a highly heterogeneous group of exogenous substances interfering with the endocrine and neuroendocrine systems, imitating or antagonizing the action of endogenous hormones, have effects on the onset of puberty. Moreover, links between dietary factors, obesity, and dysregulation in puberty onset have been reported. The aim of this roundtable is to present the state of this important issue and discuss future directions of research, prioritizing a multidisciplinary approach.

- **Child’s Environment and Pubertal Timing.** Erica Eugster, Indiana University, Indianapolis, IN.
- **Timing and Progression of Puberty: Fundamental Neuroendocrine Mechanisms.** Tony Plant, University of Pittsburgh, Pittsburgh, PA.
- **Pubertal Timing Dysregulation: Animal Studies.** Wilma D. Kempinas, State University of São Paulo, Botucatu, Brazil.

**WEDNESDAY**

**Hydraulic Fracturing: Are There Worker Health Issues?**

*New Science and Perspectives Surrounding Environmental and Occupational Exposures*

Wednesday, March 26, 12:00 Noon to 1:20 PM

*Chairperson(s):* Debra A. Kaden, ENVIRON International Corporation, Boston, MA, and Ziad S. Naufal, Chevron, Houston, TX.

*Sponsor(s):* Inhalation and Respiratory Specialty Section

Occupational and Public Health Specialty Section

Use of horizontal drilling and hydraulic fracturing in the US oil and gas (O&G) industry has expanded, with >500,000 workers in this industry in 2013. As with any industry, the workforce has the greatest potential for exposure to contaminants. Furthermore, due to the rapid expansion and need to work at multiple locations, many workers remain transient and work at different sites, often owned by different operators, which can lead to additional complexities when assessing exposures. O&G exploration using hydraulic fracturing has constantly evolved to increase efficiency in recovering oil and gas, which have market value, and further minimize any environmental and health hazards to workers and nearby residents. The highly sophisticated process holds potential hazards as high pressures are used transferring large volumes of water, sand (silica), and small quantities of specific chemicals from the surface to specific geologic structures. Extensive use is made of diesel-powered equipment. Current practices seek to recover and reuse injected fluids to minimize water consumption and the disposal of hazardous waste, including trace elements and naturally-occurring radioactive material. Toxicology and epidemiology have been used to guide improvements in technology (e.g., advanced diesel engines, fuels, and exhaust after-treatment to reduce diesel emissions of PM and NOx) and replace proppants/additives with more environmentally-friendly alternatives. Concern for occupational hazards, including minimizing exposure to noxious agents that may have immediate or long-term impact, is key to planning hydraulic fracturing operations.

- **NIOSH Exposure Assessment of Upstream Oil and Gas Production.** John E. Snawder, CDC-NIOSH, Williamstown, KY.
- **Collaborative Industry Initiatives to Evaluate and Mitigate Exposures in Hydraulic Fracturing Operations.** Robert A. Nocco, Chevron, San Ramon, CA.
- **Hydraulic Fracturing: Continually Changing to Reduce Hazards and Increase Efficiency.** Roger O. McClellan, Toxicology & Human Health Risk Analysis, Albuquerque, NM.
A History of the 3Rs in Toxicity Testing: From Russell and Burch to 21st-Century Toxicology

Wednesday, March 26, 4:30 PM to 5:50 PM

Chairperson(s): Ian Kimber, University of Manchester, Manchester, United Kingdom, and Martin L. Stephens, Johns Hopkins University, Baltimore, MD.

Sponsor(s): In Vitro and Alternative Methods Specialty Section

The 3Rs—replace, reduce, and refine—have become the internationally established framework guiding the development of alternatives to animal experimentation in toxicology. Yet this framework languished for two decades after it was first proposed in 1959 by British scientists William Russell and Rex Burch. Then, as the animal experimentation controversy intensified in the 1980s, the concept of alternatives became politically charged, with some arguing that in vivo experiments could be replaced readily and others arguing that they were irreplaceable. A generation or so later, following the 2007 publication of a US National Research Council (NRC) report Toxicity Testing in the 21st Century, a Vision and Strategy, prominent scientists began predicting the near elimination of animal use in toxicity testing through the development of “21st-Century Toxicology.” How have we gotten from Russell and Burch to the beginnings of 21st Century Toxicology? In this session, we will present results from comprehensive citation and literature searches that track the influence of Russell and Burch’s 3Rs framework and the prevalence of 3Rs-related research in toxicology over time. We will also draw on timelines of various 3Rs activities, including the founding of 3Rs organizations, centers, journals and websites, funding sources, the organization of workshops and conferences, the enactment of animal welfare/alternatives laws, and other milestones, to inform our historical analysis. We will present a historical narrative framed around four phases of activity: incubation (1959–1979), increasing acceptance and spread (1980–early 1990s), maturation (early 1990s–2007), and paradigm shift (2007–present). The impact of more than 50 years of 3Rs activity will be measured in part by focusing on the validation and regulatory acceptance status of alternative methods and trends in animal-use statistics, concluding with a discussion of remaining challenges to the development, validation, regulatory acceptance, and implementation of 3Rs methods.

• **Historical Patterns in 3Rs-Related Activity in Toxicology: Literature Searches, Citation Analysis, and Timelines.** Nina Mak, Alternatives Research and Development Foundation, Jenkintown, PA.

• **A History of the 3Rs Activity in Toxicology: Phases and Impacts.** Martin L. Stephens, Johns Hopkins University, Baltimore, MD.
**MONDAY**

**Nonrodents Can Be Monitored, Too…**

**Characterization of Novel Biomarkers of Drug-Induced Kidney Injury (DIKI) in Rats, Canines, Nonhuman Primates, and Humans**

Monday, March 24, 12:10 PM to 1:30 PM

*Chairperson(s):* James E. McDuffie, Janssen Research & Development, LLC, San Diego, CA, and Scott Adler, AstraZeneca, Wilmington, DE.

*Sponsor(s):*
- Regulatory and Safety Evaluation Specialty Section

The purpose of this informational session is to broaden the dialogue around the necessities for translatable DIKI biomarkers for use in drug discovery and development, as well as highlight ongoing research relative to the discovery and qualification of DIKI biomarkers across species. Traditional parameters used to detect DIKI include serum creatinine (sCr) and blood urea nitrogen (BUN). In all species, sCr and BUN lack sensitivity and/or specificity in detecting early stages of renal tissue injury identified by routine histopathology. The Critical Path Institute’s Predictive Safety Testing Consortium, the Foundation for the National Institutes of Health, the International Life Sciences Institute-Health and Environmental Sciences Institute (ILSI-HESI), and the European Union Innovative Medicines Initiative (IMI) Safer and Faster Evidence-Based Translation program are in the process of identifying and qualifying novel biomarkers of kidney injury and dysfunction. Eight novel urinary protein kidney biomarkers have already been qualified for specific “context of use” in rat preclinical safety studies. Ongoing qualification of additional biomarkers in rats will be discussed. The potential utilities for the qualified rat renal biomarkers in canine and nonhuman primate preclinical toxicology studies will be reviewed. Paramount is the need for qualified renal biomarkers that allow for the monitoring of DIKI in the clinical setting. Efforts have been focused on bridging the gap between biomarkers being qualified in rats to nonrodent species and humans. During this workshop, selected data and other relevant information will be presented that underpins our overall translational strategy for the validation of biomarkers in rodents leading to the qualification of safety biomarkers for use in the clinical trials.

- **Next Generation Regulatory Qualification of Nonclinical and Clinical Nephrotoxicity Biomarkers**, Jonathan A. Phillips, Boehringer Ingelheim Pharmaceuticals LLC, Ridgefield, CT.
- **Translational Renal Biomarkers: Case Examples in Drug Development**, Deborah Burt, Pfizer Inc., Groton, CT.

**WEDNESDAY**

**Understanding the Implications of Breastfed Infant Exposures to POPs: How Can We Do Better?**

Wednesday, March 26, 12:00 Noon to 1:20 PM

*Chairperson(s):* Geniece M. Lehmann, US EPA, Research Triangle Park, NC, and David G. Farrer, Oregon Health Authority, Portland, OR.

*Sponsor(s):*
- Biological Modeling Specialty Section
- Occupational and Public Health Specialty Section
- Reproductive and Developmental Toxicology Specialty Section

Persistent organic pollutants (POPs), such as polychlorinated biphenyls (PCBs), may accumulate within a woman’s adipose tissue over many years prior to pregnancy and may subsequently partition into human milk upon breastfeeding. As a result, infant POP intake from breastfeeding may be much greater than average daily maternal POP doses. The developmental period is critical because it sets the stage for lifelong health. Humans continue to develop postpartum, and effects of POP exposure during this period may persist into childhood, or even adulthood. Thus, it is important to be able to accurately assess early-life exposures to these chemicals. In many cases, current environmental exposure assessment methods do not account for differences between maternal and infant POP exposures. In order to fully consider the breastfeeding pathway when assessing risk from POP exposure, it is useful to have methods to estimate a breastfed infant dose based on an average daily maternal dose. In this session, PCBs will be considered as an example of POPs to which human mothers and their infants are commonly exposed. Models developed to estimate breast milk PCB concentrations based on lifetime maternal exposure will be presented, as will the potential application of these models for identifying health effects associated with PCB exposure during infancy. Furthermore, potential policy implications of addressing the difference between average daily maternal PCB dose and breastfeeding infant dose will be discussed. Although PCBs were chosen as an example to use for these discussions, lessons learned can be applied to many POPs, including emerging chemicals of concern. This session will be of interest to risk assessors and regulators who seek to include the breastfeeding exposure pathway in the consider-
Leadership in Science: Skills and Styles

Wednesday, March 26, 4:30 PM to 5:50 PM

Chairperson(s): Brinda Mahadevan, Abbott Laboratories, Columbus, OH, and Prathibha Rao, Bristol-Myers Squibb Company, Princeton, NJ.

Sponsor(s):
- Career Resource and Development Committee
- Postdoctoral Assembly
- Women in Toxicology Special Interest Group

In the 21st century, more than any other time in history, science is a team sport and requires cross-disciplinary/cross-functional interaction to meet the objectives and gain results. These interactions across multiple disciplines often require careful management and skillful leadership. Often times we fall prey to the belief that “a leader is always born.” However, all of us “lead” in everyday life subconsciously, or rather unconsciously. A question that begs to be asked is, “Why should anyone be led by me?” The answer can be elusive and requires the recognition that not all leaders are born. Good leaders can be developed. This, of course, leads to question, “How?” That again has to be addressed directly in terms of tangible competencies and behaviors. Is this due to the perception that the scientific ladder and management ladder are parallel and one cannot support the other? The 21st century demands that each of us “own” our careers as well as the contributions towards society in a variety of ways. The time has arrived to spurt the enthusiasm to “lead” in all fronts—the classroom to the boardroom and beyond. This informational session will include presentations by key leaders from academia, industry, government, and consulting. The speakers will introduce the concept of leadership as it relates to the current and emerging work environment, followed by a testimonial of core skills and styles required to be an effective leader. The testimonials will be individual but will provide set of tangible core qualities that are key to succeed and lead—at all levels. The session is designed for presentation and includes time for questions and discussion.

- Leadership—Doing the Right Things. Linda S. Birnbaum, NIEHS, Research Triangle Park, NC.
- Developing a Leadership Style That Works for You. Hollie Swanson, University of Kentucky, Lexington, KY.
- Leadership Skills and Styles to Be Effective across Different Organizations. Marilyn Aardema, Marilyn Aardema Consulting LLC, Fairfield, OH.

Recent Challenges Beyond the Usual Toxicological and Public Health Challenges in Africa

New Science and Perspectives Surrounding Environmental and Occupational Exposures

Wednesday, March 26, 4:30 PM to 5:50 PM

Chairperson(s): Abdul M. Kadry, US EPA, Washington, DC, and Steven Myers, University of Louisville, Louisville, KY.

Sponsor(s):
- Food Safety Specialty Section
- Risk Assessment Specialty Section
- Toxicologists of African Origin Special Interest Group

Africa has shown strong levels of economic growth over the last ten years, with African countries among the fastest movers on the United Nations Development Program’s (UNDP) Human Development Index. However, there are still a large number of toxicological problems and environmental challenges that face the continent. While considerable work has been done to recognize the hazards of air pollution and minimize its extent in many of the world’s cities, the major metropolitan areas of several African cities still suffer from excessive air pollution. Air pollution can come from a variety of sources, including vehicle exhaust, uncontrolled industrial production, resource extraction, as well as various industrial emissions. Disposal of scrap tires is also a serious challenge facing several African countries. The unregulated widespread practice of using scraps of tires as a source of energy in several African countries may raise concerns for food, public health, and environmental safety. Tires are a very rich source of energy; however, tires are made of a complex mixture of ingredients that release toxic chemicals upon burning. The appropriate storage, labeling and the judicial use of pesticides also pose a challenge. There are large numbers of pesticide stockpiles scattered over the continent, often stored haphazardly. In many African countries, empty pesticide containers are used to store fuel, food, and water. There are 50,000 metric tons of obsolete and banned pesticides still in use in many African countries. This informational session should enhance our understanding of the opportunities for increased

up-to-date information at www.toxicology.org
Informational Sessions

Informational Sessions

The Thematic Track information can be found on pages 10–11

NOTES

Scientific

global research initiatives focusing on solving the new emerging toxicological challenges facing Africa.

- **Toxicology of Air Pollution and Particulate Matter in Some African Cities.** Steven Myers, University of Louisville, Louisville, KY.

- **Toxicological and Public Health Implications of the Use of Scrap Rubber Tires for Smoking Meat in Africa.** Evans Afriyie-Gyawu, Georgia Southern University, Statesboro, GA.

- **Pesticide Usage in Africa: The Risk and Benefit with Special Focus on Obsolete Pesticides.** Salah Soliman, Alexandria University, Alexandria, Egypt.

- **Pesticides in Egypt: An Overview.** Mohamed T. Ahmed, Suez Canal University, Ismailia, Egypt.
MONDAY

The Role of Consultants in the Science and Practice of Safety Assessment

Monday, March 24, 12:10 PM to 1:30 PM

Chairperson(s): Mark S. Miller, Wake Forest School of Medicine, Winston-Salem, NC, and William B. Mattes, PharmPoint Consulting, Poolesville, MD.

Sponsor(s):
  - Regulatory and Safety Evaluation Specialty Section
  - Women in Toxicology Special Interest Group

During the past decade, a significant number of industrial and academic scientists have pursued full or part-time careers in toxicology consulting. Resources describing the nuts and bolts of how to set up a consulting business are often very general and do not address specific issues related to toxicology. The best safety assessment and product development efforts take a village, namely a team with a wide variety of detailed scientific knowledge, regulatory skills, and practical experience in product development, occupational toxicology, genetic toxicology and carcinogenesis, public health, etc. In many cases such knowledge, skill, and experience lie outside the internal resources of a firm. Toxicology consultants are a diverse external resource with varied specialties who can quickly and effectively address serious issues in safety assessment and/or product development. They can also perform more standard tasks when firms are constrained by the availability of internal toxicologists. In addition, toxicology consultants play a critical role in the interface between the scientific and lay communities when legal issues arise. This career development session will provide practical advice for those considering entering the field of toxicology consulting on a part-time or full-time basis, provide a comprehensive discussion of how toxicology consultants can satisfy critical needs of various types of clients, and provide guidance on leveraging their expertise in advancing the science and practice of toxicology. The talks will cover the full spectrum of consulting environments, including independent consultants, consulting in an academic environment, and consulting as part of a large firm, as well as examples of the client-consultant relationship.

- **Toxicology Consulting Demystified: How One Starts and Survives.** Reid Patterson, Reid Patterson Consulting Inc., Bonita Springs, FL.
- **Consulting in an Academic Environment.** Mark S. Miller, Wake Forest School of Medicine, Winston-Salem, NC.
- **The Consulting Toxicologist—Helping Industry Comply with Regulations and Evaluate Their Environmental Policies.** Lisa J.N. Bradley, AECOM Environment, Westford, MA.
- **Transitioning from Industry to Consulting: How to Best Leverage Your Toxicology Expertise.** Roger G. Ulrich, RUC Pharmaceutical Development Specialists, Sammamish, WA.
- **Case Study: How Consultants Help Impact the Science of Nanomaterial Safety Assessment.** David W. Hobson, LoneStar PharmTox LLC, Boerne, TX.

Scientific Ethics in Research and Publications

Monday, March 24, 2:00 PM to 4:45 PM

Chairperson(s): William J. Brock, Brock Scientific Consulting, Montgomery Village, MD, and Mary Beth Genter, University of Cincinnati, Cincinnati, OH.

Sponsor(s):
  - Career Resource and Development Committee
  - Education Committee
  - Ethical, Legal, and Social Issues Specialty Section

For many involved in toxicological research and publishing, it may seem strange or uncomfortable to engage in a discussion of the practicality of ethics. However, with the daily pressures of career advancements and salary increases as well as notoriety and professional recognition, engaging in this discussion will permit continued awareness of the pitfalls of poor ethical behavior that can lead to catastrophic career outcomes. The scientific community has been rocked by unfortunate media reports over the years that call into question the results of studies and fallibility of science. Although these reports may represent a small percentage of individuals, the impact is far-reaching throughout the scientific community. There have been several reports in the past few years that suggest that the number of retracted papers in scientific literature has increased 10-fold over the previous decade, and that a majority of the retracted papers was due to scientific misconduct that included fraud, plagiarism, and outright data falsification. In spite of the increase in retractions, many of those retracted papers continue to be cited in subsequent publications and grant submissions. Plagiarism by far represents the more common concern in scientific writing. Whether this occurs from the originating author or the wording is “stolen” by others to improve or even exaggerate a conclusion has led to a change in peer-review processes, development of plagiarism software, and mandatory training in certain academic circles. In addition, “ghost” and “in absentia” authors have raised significant data credibility concerns in a regulatory environment. In this session, the background of the problem is presented with real-world examples from literature and reports, and the impact of this problem on a career. Can the peer-review process reduce the likelihood of scientific misconduct? Discussion will occur on the peer-review process and how that process affects the publishing of duplicative or plagiarized data.

- **Introduction to Scientific Misconduct: The Problem, the Results, and the Potential Impact of Advancing a Career Path.** William J. Brock, Brock Scientific Consulting, Montgomery Village, MD.
- **Responsible Research: What Is It and Can It Be Done?** Holly Bante, University of Cincinnati, Cincinnati, OH.
Education-Career Development Sessions

- **Authorship and Scientific Misconduct.** William B. Mattes, PharmPoint Consulting, Poolesville, MD.

- **Seeking, Identifying, and Preventing Plagiarism: Manuscript Submissions and Peer Review.** Mary Beth Genter, University of Cincinnati, Cincinnati, OH.

**WEDNESDAY**

**Training and Continuing Education for the “Total Toxicologist”: How Do We Optimize Training and Educational Opportunities for Different Job Sectors?**

Wednesday, March 26, 12:00 Noon to 1:20 PM

*Chairperson(s):* Courtney E. W. Sulentic, Wright State University, Dayton, OH, and Donald A. Fox, University of Houston, Houston, TX.

*Sponsor(s):*
- Career Resource and Development Committee
- Education Committee
- Graduate Student Leadership Committee

The training and continuing education of toxicologists is a priority for the SOT membership as demonstrated by the SOT Professional Needs Assessment Task Force (PNATF) and Education Summit. But what defines a well-trained toxicologist or the “Total Toxicologist”? Does the definition vary depending on the employment sector? Do current graduate programs and continuing education programs provide the necessary and sufficient training for toxicologists? To initiate a discussion regarding these questions, SOT and the National Institute of Environmental Health Sciences sponsored the 2011 Toxicology Educational Summit, which brought participants from academia, industry, and government together to better define the necessary skill sets for the Total Toxicologist (Tox Sci 127:331, 2012). Conclusions from the Summit underscored a deficiency in critical thinking, communication skills, and practical application of laboratory data to drug development and risk assessment as well as a need for improved educational opportunities for mid-career toxicologists. Sustaining a career in the current and future global environment, with the ever-changing and rapid advances in technology, requires partnerships between academia, industry, and government to train and re-train the Total Toxicologist. The goal of this session is to offer multi-faceted perspectives on the skill sets (both hard and soft) required for a successful career as a Total Toxicologist and will include talks from early-, mid-, or late-career toxicologists currently employed in academia, industry (pharmaceutical and agricultural/chemical), or government. The session will also provide a brief summary of the results from the PNATF survey to offer a perspective from the SOT membership regarding their perceived training needs. This session should be of interest to students, post-docs, and early- and mid-career toxicologists and is consistent with SOT’s goals to continue educational awareness and advancements for all toxicologists.

- **Planning from Day 1: Timely Completion of Your Training, and Specialized Training for the Job That You Want.** Mary Beth Genter, University of Cincinnati, Cincinnati, OH.

- **Creating Futures for New Toxicologists: Challenges in Academic Toxicology Training for 21st-Century Jobs.** David L. Eaton, University of Washington, Seattle, WA.

- **Skill and Career Growth for the Toxicologist in the Pharmaceutical Industry.** Matthew S. Bogdanoff, Boehringer Ingelheim Pharmaceuticals Inc., Ridgefield, CT.

- **What Do I Need in My Toolbox? Defining the Core Skill Set for a 21st-Century Toxicologist in the Chemical Industry.** Darrell R. Boverhof, The Dow Chemical Company, Midland, MI.

- **From Research to Regulatory Science: Toxicology Careers in Government.** Dori R. Germolec, NIEHS, Research Triangle Park, NC.
Regional Interest Session

THURSDAY

When the Dust Settles: Exposure Assessment and Health Effects from Dust Exposures in the Arid Southwest

Thursday, March 27, 9:00 AM to 11:45 AM

Chairperson(s): R. Clark Lantz, University of Arizona, Tucson, AZ, and Jacob D. McDonald, Lovelace Respiratory Research Institute, Albuquerque, NM.

Sponsor(s):
Mountain West Regional Chapter

Airborne pollutants have long been implicated as potential etiological agents in the development of asthma and other diseases. In addition, exposure to airborne particulates exacerbates the pulmonary responses in already sensitized individuals. Further complicating these responses is the fact that ingestion of high levels of arsenic in drinking water is occurring simultaneously in the southwestern US. This session will focus on these important regional issues. Talks will present data on exposure assessment and characterization of dusts from roads and legacy mines. Potential adverse health outcomes from these exposures will be presented. The impact of these exposures on native populations will also be discussed. Data from both population and laboratory-based research will provide excellent examples and information related to the effects of exposure to dusts and metal containing dusts. This will be of interest to those involved in metal-toxicology, pulmonary toxicology, developmental toxicology, public health, risk assessment, and regulatory management.

- **Influence of Collection Region and Site Type on the Composition of Paved Road Dust: It's Not Just Dirt!!!** Jacob D. McDonald, Lovelace Respiratory Research Institute, Albuquerque, NM.

- **Multimedia Exposure to Metals near a Mine Tailings Site.** Miranda Loh, University of Arizona, Tucson, AZ.

- **Effects of In Utero and Early Postnatal Exposures to Metal Containing Dusts.** R. Clark Lantz, University of Arizona, Tucson, AZ.

- **Metals, the West, and Translational Science.** Johnnye L. Lewis, University of New Mexico, Albuquerque, NM.
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116
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Challenging Contemporary Status on Drug Safety Evaluation: A Case for the Implementation of Ototoxicity Screening into Toxicology Programs

Monday, March 24, 9:15 AM to 10:15 AM
Presented by:
MPI Research

Of the primary senses assessed, hearing is not commensurately evaluated in spite of cases of post-market, drug-induced hearing loss. Past challenges associated with evaluating hearing have impeded progress toward integration into toxicology programs. Advances in assessing audition and histopathological processing now enable an efficient means for ototoxicity screening.

Is There Such Thing As a “Normal” Biopharmaceutical Anymore?

Monday, March 24, 9:15 AM to 10:15 AM
Presented by:
Huntingdon Life Sciences

Increasingly, drug developers are finding ever more novel ways to combine the activities of different biological and chemical drugs to produce new products. This can range from enhancing binding and effector functions of monoclonal antibodies to conjugating cytotoxic drugs to biological molecules to increase drug effectiveness.

Novel ChanTest Assays for Assessing Cardiotox, Contractility and ECG-Like Aberrations in Stem Cell-Derived Cardiomyocytes

Monday, March 24, 9:15 AM to 10:15 AM
Presented by:
ChanTest Corp.

This session will cover, in detail, the assay services provided by ChanTest for assessing cardiotox, contractility and ECG-like aberrations in stem cell-derived cardiomyocytes. Results from studies with human iPSC-derived cardiomyocytes from different sources will be presented. Higher-throughput assay tools used by ChanTest help to minimize costs for compound providers.

The Use of a Next Generation Telemetry System in Animal Research

Monday, March 24, 9:15 AM to 10:15 AM
Presented by:
TSE Systems, Inc.

The Stellar product line is a next-generation telemetry system (ECG, blood pressure, temperature etc.), in which longer battery life is combined with the ability of running sophisticated experimental protocols while allowing unparalleled freedom of activity, social interaction, and freedom to work and exercise (swim, run) by the animal (and investigator).

Dietary Ingredient Safety Determinations—Third-Party Organization and Regulatory Perspectives

Monday, March 24, 10:30 AM to 11:30 AM
Presented by:
NSF International Applied Research Center

Determining safety of dietary ingredients depends on fundamental toxicology principles. Still, the “no objection” letter from US FDA concluding that the ingredient is reasonably expected to be safe can be elusive. This seminar introduces the NDI notification process and illustrates how appropriate analytical characterization and toxicology data review facilitate a successful submission.

The National Toxicology Program Nonneoplastic Lesion Atlas

Monday, March 24, 10:30 AM to 11:30 AM
Presented by:
National Toxicology Program

The National Toxicology Program’s Nonneoplastic Lesion Atlas is a searchable, online pathology tool for use by anyone doing in vivo rodent studies. It provides guidelines for diagnosing background and treatment related, nonneoplastic lesions in rodents and includes thousands of high quality images.
The Use of Integrated *In Silico* Solutions under the Proposed ICH M7 Guidelines

**Monday, March 24, 10:30 AM to 11:30 AM**

**Presented by:**
Lhasa Limited

Lhasa Limited, the world leader for knowledge and data sharing in chemistry and the life sciences, will present their views on the benefits of utilizing an integrated *in silico* solution to comply with the proposed ICH M7 guidelines.

Recent Research for Airborne Materials on Biological Systems at KIT

**Monday, March 24, 10:30 AM to 11:30 AM**

**Presented by:**
Korea Institute of Toxicology

KIT, the future global leader in inhalation toxicology, has performed the “creative research” that integrates various research fields. Dr. Kyuhong Lee and colleagues will present their recent studies with keywords of inhalation, pulmonary, neuro, nano, metal ion, etc. The session also includes recently developed technologies, such as *in vitro* exposure, mouse video instillator, etc., being used in inhalation toxicology study.

Databases—A Powerful Tool in Regulatory Toxicology

**Monday, March 24, 11:45 AM to 12:45 PM**

**Presented by:**
Fraunhofer ITEM

The session will focus on different databases targeting tumor data (RITA: Registry of Industrial Toxicology Animal data), data from repeated-dose toxicity (FeDTex: database on reproductive and developmental toxicity, RepDose: database on repeated-dose toxicity studies, PaFtox: particle and fiber toxicity database), as well as teratology studies (DevTox).

*In Silico* Assessment of Genotoxic Impurities According to the ICH M7 Guideline: Recommendations and Case Studies

**Monday, March 24, 11:45 AM to 12:45 PM**

**Presented by:**
MultiCASE Inc

Use of *in silico* tools is one of the central points of the ICH M7 guideline. However, computational assessment of genotoxic impurities in real life is still challenging. Discussion will include the scientific background of MultiCASE’s CASE Ultra platform, the proper usage techniques and ICH M7-relevant case studies.

In Vivo Small-Animal Imaging: Latest Developments in Cardiovascular and Cancer Research

**Monday, March 24, 11:45 AM to 12:45 PM**

**Presented by:**
VisualSonics

In the past decade, high-frequency ultrasound and photoacoustic imaging have emerged as key imaging technologies for small-animal in vivo research. These techniques are proven to address the key scientific needs that researchers are looking to quantify today in translational research.

Validation of Novel Multispecies Primary Hepatic Tissue Constructs for Use in Extended DMPK/Tox Studies

**Monday, March 24, 1:00 PM to 2:00 PM**

**Presented by:**
Hurel Corporation

Accurately predicting pharmacokinetic and toxicological properties of drugs earlier in the development process can reduce the number of clinical failures, and the cost of developing a drug. Data from novel primary hepatocyte cell-based *in vitro* systems that exhibit longer metabolic capacities in multiple species will be reviewed.
Advancing Environmental Health Data Sharing and Analysis

Monday, March 24, 2:15 PM to 3:15 PM

Presented by:
National Institute of Environmental Health Sciences

Environmental health science has undergone a dramatic transformation in recent years, becoming data-intensive, interdisciplinary, computational, and collaborative. Coordinated efforts, with input from the community, are needed to better address data opportunities, and improve data interoperability and data access to advance understanding about chemical effects on human health and the environment.

Microsampling in Adult and Juvenile Rodents: A Little May Go a Long Way!

Monday, March 24, 2:15 PM to 3:15 PM

Presented by:
Charles River

Microsampling has allowed scientists to assess toxicology endpoints using lower blood volumes than ever before. By reducing blood volumes and adapting existing bioanalytical techniques, toxicologists can assay more endpoints in individual animals, gain further insights into “main study” animals and reduce the need for extra animals in satellite groups.

Phenotypic and Functional Evaluation of Drug-Induced Platelet Alterations in Nonclinical Laboratory Studies

Monday, March 24, 2:15 PM to 3:15 PM

Presented by:
SNBL USA, Ltd.

The prevalence of drug-induced thrombocytopenia warrants platelet evaluation during drug development. This presentation highlights numerous phenotypic and functional assays that are suitable for assessing platelets in nonhuman primate (NHP) samples, and reviews data on the reproducibility of flow cytometric analysis for platelet activation, aggregation and development.

Regulated Bioanalysis of Oligonucleotide Therapeutics and Biomarkers

Monday, March 24, 2:15 PM to 3:15 PM

Presented by:
Tandem Labs

Oligonucleotide therapeutics and biomarkers are a growing segment of the global drug development and clinical diagnostic business. In addition to traditional hybridization-ELISA, HPLC, or capillary gel electrophoresis-UV/fluorescence methods, more sensitive and/or more specific quantitative PCR, LC-MS/MS, LC-high resolution accurate mass and hybridization-based LC-fluorescence assays are being used.

Evaluation of Species Differences in Adverse Drug Properties with Plateable Cryopreserved Hepatocytes from Human, Monkey, Dog, Rat, and Mouse

Monday, March 24, 3:30 PM to 4:30 PM

Presented by:
In Vitro ADMET Laboratories LLC

Novel advances in the application of cultured cryopreserved hepatocytes from human and nonhuman animals for species-comparison of xenobiotic toxicity will be discussed, with emphasis on the selection of the most appropriate nonhuman animal species for the prediction of human drug toxicity.

TUESDAY

Use of Chemical Analyses and Toxicological Risk Assessments to Support the Biological Evaluation of Medical Devices

Tuesday, March 25, 8:30 AM to 9:30 AM

Presented by:
WuXi AppTec, Inc.

Biological evaluation of medical devices should be conducted within a risk management process. This includes chemical characterization and risk assessments. Quantitation of leachable chemicals from finished devices is recommended to conduct meaningful risk assessments, and biocompatibility testing completes the biological evaluation.
Validating Cell-Based Assays for 3D Culture Models

**Tuesday, March 25, 8:30 AM to 9:30 AM**

**Presented by:**
Promega Corporation

Complex 3D cell culture models provide a challenge for assay chemistries originally designed for measuring classical cytotoxicity endpoints from monolayers of cells. We will present factors to consider and guidelines for designing and validating performance of cell-based assays measuring viability, apoptosis, and cell stress events leading to cytotoxicity.

Beyond the Basics: Specialized Ocular Evaluations in Systemic Toxicology Studies

**Tuesday, March 25, 9:45 AM to 10:45 AM**

**Presented by:**
Charles River

Many of the pathways targeted in novel therapeutics development also exist in the eye. Inhibiting these pathways may induce unwanted ocular side effects. This session highlights compound classes of concern, specialized techniques and endpoints to assess ocular structure and function in preclinical studies, translatability to the clinic and case examples.

Dried Blood Spots (DBS) in Toxicology: Can Science Overcome the Regulatory Challenge?

**Tuesday, March 25, 9:45 AM to 10:45 AM**

**Presented by:**
Algorithme Pharma

This session will focus on methods to overcome limitations of dried blood spot analysis and highlight the precut technique for use in analyzing new molecular entities and biomarkers. It will include the recent IQ recommendations on refining DBS to meet regulatory requirements.

Nanomaterial Characterization Techniques in Regard to Current EU Regulations

**Tuesday, March 25, 9:45 AM to 10:45 AM**

**Presented by:**
NanoSight

Nanomaterials legislation increasingly impacts biocides, cosmetics, and food labeling sectors. The recent implementation of the European Cosmetics Regulation 1223/2009 requires cosmetics containing nanomaterials to be thoroughly assessed for safety. Aside from reporting toxicological profiles of nanomaterials, characterization is to include size distribution, as well as physical and chemical properties.

Nonclinical Juvenile Toxicity Testing: Lessons Learned

**Tuesday, March 25, 9:45 AM to 10:45 AM**

**Presented by:**
MPI Research

Approval of drugs currently used in pediatric patients requires a special risk/benefit assessment. In February 2006 the US FDA issued the first guideline in the industry, titled “Guidance for Industry of Nonclinical Safety Evaluation of Pediatric Drug Products.” Since then the industry has gained enormous experience.

Method Development and Validation of Six Bile Acids Using LC-HR/AM MS for Regulated Bioanalysis: Improving Selectivity and Sensitivity

**Tuesday, March 25, 11:00 AM to 12:00 Noon**

**Presented by:**
Tandem Labs

Quantification of bile acids using LC-MS has been challenging on triple quadrupole MS systems due to the absence of a primary fragment ion for unconjugated bile acids. We will discuss a LC-high-resolution/accurate mass MS method for analysis of bile acids (cholic, chenodeoxycholic, taurocholic, deoxycholic, lithocholic, ursodeoxycholic), development, and validation.
Pathology Working Groups (PWGs): Definition, Application in Toxicity and Carcinogenicity Studies, and Case

Tuesday, March 25, 11:00 AM to 12:00 Noon
Presented by:
   EPL, Inc.

A Pathology Working Group (PWG) is a specialized type of panel review composed of a group of expert pathologists convened to answer specific questions regarding study results to provide an independent, unbiased opinion. PWGs are often convened to address equivocal study findings and questions from regulatory agencies.

Practicalities of Juvenile, Inhalation, and Safety Pharmacology Studies in the Minipig

Tuesday, March 25, 11:00 AM to 12:00 Noon
Presented by:
   Ellegaard Göttingen Minipigs

Increasingly the minipig is being used for more diverse and increasingly complicated study designs. This complexity presents unique challenges and considerations that require overcoming to ensure study integrity and easier data interpretation.

Analysis of Failed Pharmaceutical Compounds in the BioMAP Platform of Primary Human Cell Systems

Tuesday, March 25, 12:15 PM to 1:15 PM
Presented by:
   DiscoveRx Corporation, BioSeek Division

This session will bring together various stakeholders (academic, government and industry) to discuss the analysis of a recently released dataset generated on failed pharmaceutical compounds that have been profiled in the BioMAP platform of primary human cell and co-culture assays as a part of the US EPA’s ToxCast program.

Comparative Placental Transfer of Biologicals: Preclinical Alternatives to the Nonhuman Primate?

Tuesday, March 25, 12:15 PM to 1:15 PM
Presented by:
   WIL Research

This session will provide the latest information about Mab transfer, including human IgG1 in the mouse and to compare with other laboratory species, such as the rat and minipig. Discussion will attempt to put in perspective the relevance of the use of these preclinical species for drug candidate development.

From Systematic Review to Assessment Development: Managing Big (and Small) Datasets with DRAGON

Tuesday, March 25, 12:15 PM to 1:15 PM
Presented by:
   ICF International

Systematic literature review of toxicology, epidemiology, and exposure data for risk assessment purposes can require assessment of thousands of references. To inform decisions, data must be collected and evaluated and all decisions transparently documented. This session will describe the DRAGON suite of tools developed by ICF to streamline this process.

Inhalation As a Route for Systemic Drug Delivery

Tuesday, March 25, 1:30 PM to 2:30 PM
Presented by:
   Huntingdon Life Sciences

Inhalation has obvious advantages as the route of administration for pulmonary indications. More recently investigators have begun to recognize and take advantage of the gas exchange region of the lung for systemic delivery of treatments for a variety of nonpulmonary indications.
The Minipig As a Model for Ocular Toxicity Studies

**Tuesday, March 25, 1:30 PM to 2:30 PM**

**Presented by:**
CiToxLAB and Ellegaard Göttingen Minipigs

Minipigs are a commonly used species in biomedical research. The structure and anatomy of the eye resembles that of humans and makes minipigs a suitable model for studies where direct dosing to the ocular structures is required. This session will present detail about the practical aspects of such studies.

The Use of Human HepatoPac™, an *In Vitro* Microliver Platform, for Predictive Toxicology

**Tuesday, March 25, 1:30 PM to 2:30 PM**

**Presented by:**
Hepregen Corporation

Current *in vitro* platforms to assess hepatotoxicity have been poor predictors of *in vivo* performance. HepatoPac™ is a highly predictive *in vitro* microliver platform demonstrated to improve sensitivity. It remains functional for several weeks, making it an ideal platform for “extended-horizon” scenarios, including chronic toxicity and DDIs.

**WEDNESDAY**

Application of Molecular Imaging and Radiochemistry in Drug Development

**Wednesday, March 26, 9:15 AM to 10:15 AM**

**Presented by:**
MPI Research

Contemporary drug development is a lengthy process. Molecular imaging (MI) has become a solution to decrease development time via assessment of specific molecular targets. MI is a multidisciplinary field evaluating biological processes at the molecular and cellular levels *in vivo*. This session focuses on application of molecular imaging drug development.

Regulated Bioanalysis and Diagnostics Using High Resolution LC/MS

**Wednesday, March 26, 9:15 AM to 10:15 AM**

**Presented by:**
Tandem Labs

In this presentation, we will investigate HRAM and a new nanospray source for a challenging bioanalytical method. We will discuss the issues and challenges using triple quadrupole MS, and review several method development cases using bench-top HRAM, UHPLC, and the Easy-Spray/nanoLC system.

Risk Assessment of Postnatal Musculoskeletal Development — Juvenile and Reproductive Toxicology Studies

**Wednesday, March 26, 9:15 AM to 10:15 AM**

**Presented by:**
Charles River

Juvenile toxicology and postnatal studies can include basic measurements of growth to assess risk in developing animals, but when there are concerns of off-target effects, more comprehensive evaluations are required. This presentation will discuss the incorporation of these measurements and specialized endpoints into these studies in a range of species.

Developments in Global Regulations for Crop Protection Products: Meeting the Challenge

**Wednesday, March 26, 10:30 AM to 11:30 AM**

**Presented by:**
Huntingdon Life Sciences

Developments in worldwide regulatory requirements for crop protection products require new approaches to provide data for conducting effective risk assessments for both humans and the environment. These range from new study designs to investigate specific risks to enhancement of existing designs to maximise the usefulness of available data.
3rd Annual

Tox ShowDown
Tuesday evening, March 25, 7:30 PM–9:00 PM, Sheraton Hotel

Calling All Meeting Attendees:
Contestants Still Needed!

Tox ShowDown is a quiz game pitting three teams of toxicologists—The Endocrine Disruptors, The Free Radicals, and The Toxic Metabolites—against each other to see who really knows the most when it comes to toxicological fact and fancy. No ticket is required.

Join the Graduate Student Leadership Committee and your peers for an evening of fun!
If you’d like to be a contestant, contact the GSLC Secretary Alessandro Venosa or Phil Wexler.

Sponsored by: SOT Graduate Student Leadership Committee (GSLC)
www.toxicology.org/al/meet/am2014/socialevents.asp

SOT High School Student and Teacher Workshop

Lotions are Not Potions:
Personal Care Product Safety

Saturday, March 22, 2014 • 8:30 AM – 4:30 PM
Health Science Education Building
University of Arizona, Phoenix Biomedical Campus

Volunteer to Assist
We need your help with this exciting day of presentations, toxicology activities, and opportunities for students and teachers to talk with toxicologists.

Registration for Volunteers, High School Students, and Teachers is accessed via the Education and Outreach Section of the Annual Meeting website.
Can't choose between primary cells and cell lines? ATCC offers a wide variety of primary cells that have been immortalized using the hTERT component of the Telomerase gene. These cells combine the physiology and stable karyotype of primary cell isolates and the indefinite propagation properties of continuous cell lines, while avoiding the replicative senescence of the former and the unstable karyotype of the latter.

Choose ATCC hTERT immortalized Cell Lines and get the best of both worlds!

Go to www.atcc.org to see a complete list.
Enhance Your Annual Meeting Experience

Participate in your Regional Chapter, Special Interest Group, and Specialty Section Meetings and Receptions.

Your component group meetings and receptions offer an excellent opportunity to network at the SOT Annual Meeting. Be sure to attend your Regional Chapter, Special Interest Group, or Specialty Section meeting/reception to connect and engage with your colleagues. It’s a great time to catch up with new and old friends and colleagues!

Interested in joining a Regional Chapter, Special Interest Group, or Specialty Section?

Attend a component group networking meeting/reception at the Annual Meeting. It’s a great way to meet, network and decide on joining a component group. You’ll be glad you did!

Component group meetings/receptions may be found on the SOT mobile event app or event website and in the 53rd Annual Meeting Program.
Deadline for Proposals for SOT 2015 Annual Meeting
Sessions: April 30, 2014

Why Submit a Proposal?
1. To present new developments in toxicology.
2. To provide attendees an opportunity to learn about state-of-the-art technology and how it applies to toxicological research.
3. To provide attendees an opportunity to learn about the emerging fields and how they apply to toxicology.

Session Types

Continuing Education—Emphasis on quality presentations of generally accepted, established knowledge in toxicology.  
*Note: CE Courses will be held on Sunday.*

Symposia—Cutting-edge science: new areas, concepts, or data

Workshops—State-of-the-art knowledge in toxicology

Roundtables—Controversial subjects

Continuing Medical Education—Emphasis on state-of-the-art knowledge to assist medical doctors, health professionals and researchers in life-long learning for providing high quality health care

Historical Highlights—Review of a historical body of science that has impacted toxicology

Informational Sessions—Scientific planning or membership development

Education-Career Development Sessions—Sessions that provide the tools and resources to toxicologists that will enhance their professional and scientific development

Regional Interest—Central topics of relevance that describe public health and/or ecological problems of a particular region

Submit your proposal online at www.toxicology.org
Support Opportunities

are still available for the 2014 Annual Meeting. Your support serves as visible evidence of your organization’s commitment to the science of toxicology. In addition, your support provides an opportunity for you to increase overall awareness of your company to SOT members and more than 6,500 Annual Meeting attendees. As a supporter, your company will be featured in pre- and postmeeting newsletters, the ToxExpo Directory, premeeting publications, on-site meeting registration materials, the mobile event and event website, and the SOT website. In addition, acknowledgement signs will group supporters by levels of giving and will be displayed at many of the SOT functions during the Annual Meeting, as well as in the SOT presentation in all session rooms.

Your support will help the Society sustain low registration rates, which allows scientists at all stages of their career to attend. If you are interested in SOT Support, contact Ray Luca at SOT Headquarters: 703.438.3115 or email: ray@toxicology.org.

The Society of Toxicology Contributions of the

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