산업재해예방
안전보건공단
산업안전보건연구원

국외출장 계획 보고

-제38회 미국독성병리학회 참석-

2019. 4. 16

산업안전보건연구원
산업화학연구실

Ⅰ. 출장 목적

- ❍ 미국독성병리학회(STP, Society of Toxicologic pathology)에서 주최하는 제38회 심포지엄에 참석하여
- ❍ 흡입독성연구센터에서 수행된 연구 성과를 발표하고 참가자들과의 국제교류를 통해 기관 홍보와 정보교환 및 기술교류를 하고자 함
- ❍ 또한, 독성병리분야 실무자의 전문 지식을 함양하여 데이터의 신뢰성 및 전문성을 향상시키려고 함

※ 심포지엄 개요

- 미국독성병리학회 (STP, Society of Toxicologic pathology)는 1971년 설립된 이래 미국과 캐나다를 중심으로 북미권에서 최고 권위를 인정받고 있고 주기적인 교육, 학회 개최 및 학회지 발간을 통해 세계 독성병리학 분야를 이끌어 가고 있음
- 제 38회 심포지엄 주제는 'One Health and Environmental Toxicologic Pathology'로 사람 및 동물을 아우르는 자연 생태계에서 모든 생물의 건강을 위하여 화학 및 물리적 위험 인자에 대한 탐색, 규정, 기전적 이해, 규제 등과 관련된 최신 접근법 등을 다룰 예정이며, 대기오염의 독성과 병리학, 직업 환경인자의 독성병리학, 규제 독성병리학의 독성평가 패러다임, 내분비 교란 및 생식 독성병리학, 모든 생물의 건강을 위한 생태연구에서 병리학, 독성병리학과 빅 데이터 기술의 통합 등 모두 6가지 주제로 진행될 예정임
- 교육 코스(Continuing Education Courses)는 심포지엄과 매년 같이 실시하는 전문가 교육프로그램으로 특정 계통장기 또는 독성병리학의 특정주제에 대한 전문 교육을 실시함

Ⅱ. 출장 개요

- ❍ 출장기간 : 2019. 06. 22(토) ~ 06. 28(금) : 5박 7일
- ❍ 출 장 지 : 미국 노스캐롤라이나주 롤리(롤리 컨벤션센터)
- ❍ 출 장 자 : 병리검사부 이용훈 연구위원 및 차효근 대리 (2인)
- ❍ 주관학회 : 미국독성병리학회(Society of Toxicologic Pathology)

III. 출장 세부 일정

일 정	출장지	수 행 내 용
6. 22(토)	인천공항	○ 이동 (인천 → 미국 롤리)
6. 23(일)	롤리 컨벤션 센터	○ 교육 코스 프로그램(선택2) ■ CE I. Data Interpretation, Visualization, and Statistics for Nonclinical Toxicity Studies - 독성시험분야의 데이터 분석(통계 등)에 영향을 미치는 요인 및 관련 툴 소개 ■ CE II. Medical Device Safety Assessment: The Frontiers of Safety Assessment Pathology - 의료기기 규제와 관련된 특화된 병리학적 기법 등 ■ CE III. Cardiac Effects Commonly Encountered in Drug Development: Mechanisms and Clinical Relevance - 심혈관계에 영향을 미치는 주요 기전과 인실리코 모델을 이용한 심장 독성 예측 적용 ■ CE IV. Otic Toxicologic Pathology - 독성시험에서 이(otic)독성의 판단 기법과 규제관련 고려점
6. 24(월) ~6. 26(수)	롤리 컨벤션 센터	○ 심포지엄 참석 ■ Session 1. Toxicology and Pathology of Air Pollution - 교통, 사업장, 자연 등 실내·외 공기오염에 의한 건강장애(호흡기계, 심혈관계, 대사이상 등)에 대한 최근의 주목할 연구 및 세계적으로 공기오염 감소를 위한 환경 조성 노력 등 ■ Session 2 Toxicologic Pathology of Workplace Agents - 직장 내 환경에 의해 발생할 수 있는 질병의 병리학적 설명 및 직업병의 독성학적 논의, 작업장에서 지속적으로 발생하는 유기 용매 노출(Diketone 등)에 의한 신경 독성기전의 최신 연구 동향, 향료(flavoring) 관련 폐질환, 탄광 광부들의 급속 진행성 진폐증 발생 등에 대한 논의를 통한 직업병의 예측/예방

일 정	출장지	수 행 내 용
6. 24(월) ~6. 26(수)	롤리 컨벤션 센터	■ Session 3 : Toxicity Assessment Paradigms in Regulatory Pathology - 독성전문병리학자들이 참여한 식품 및 화학물질 등의 위험성 평가에서 독성학자와 협업을 통해 법적 규제를 확정한 다양한 예시 소개 및 안전성 평가의 개요 소개와 법적 제도 개선을 위한 유의점 논의 ■ Session 4 : Endocrine Disruption and Reproductive Pathology - 사람, 영장류, 설치류, 어류에서 내분비활성물질의 알려진 또는 잠재적 영향, 에스트로겐 및 안드로겐 경로에 대한 항진제와 길항제의 영향, 내분비 활성물질의 진단 기법과 생식발달에 대한 영향 논의 ■ Session 5 : Pathology in Ecological Research with Implications for One Health - 생태 독성병리학은 인구, 공동체, 생태계에 독성물질과 물리인자의 영향을 연구하기 위한 환경독성병리학의 새로운 분야 임. 미생물, 곤충, 어류 인류 등 모든 생태계를 어울러서 환경 오염물질에 대한 영향을 독성병리학 관점에서 논의 ■ 포스터발표 : 2건
6. 27(목)~ 6. 28일(금)	미국(롤리)	○ 이동 (미국 롤리 → 인천)

※ 현지 사정에 따라 수행 내용은 조정될 수 있음.

IV. 주요 수행 업무

○ 포스터 발표

연번	제 목	발표자
1	Immunohistochemical Characterization of Oxidative Stress in Lung of Rats Exposed to Humidifier Disinfectant, PHMG • HCl	이용훈, 차효근
2	Two-week Toxicity of Humidifier Disinfectant, PHMG • HCl by Whole Body Inhalation Exposure in Rats	이용훈, 차효근

- 가습기 살균제인 PHMG·HCl 관련 연구 결과를 발표함으로써 흡입독성연구센터의 연구 성과와 기술력을 세계 전문가들에게 홍보

○ 교육코스 및 심포지엄 참석 등

- 직업, 환경 및 생태에 관한 독성병리 분야의 연구와 기술의 세계적 추세에 대한 정보 습득
- 국외 독성관련 대학, 연구소 및 기관의 독성 및 병리전문가와 교류를 통한 독성진단에 대한 정보 및 기술 습득

V. 기대효과

○ 직업, 환경, 생태 분야의 유해화학물질에 대한 최신 연구 습득을 통한 화학물질 유해성 판별 전문성 강화와 이를 통한 근로자 건강 장해 예방에 기여

○ 학회에 참석한 전문가들과 정보 교환을 통한 인적 네트워크 형성 및 흡입독성연구센터 연구홍보를 통한 국제적 위상 제고

【덧붙임】 심포지엄 및 교육 프로그램



ONE HEALTH AND ENVIRONMENTAL TOXICOLOGIC PATHOLOGY

STP 38TH ANNUAL SYMPOSIUM

RALEIGH, NORTH CAROLINA • JUNE 22–27, 2019

SATURDAY, JUNE 22

9:00 AM–4:30 PM

NTP Satellite Symposium: Pathology Potpourri

Chair: Susan A. Elmore, MS, DVM, DABT, FIATP, DACVP, *NTP/NIEHS, Research Triangle Park, NC*

The objective of this interactive symposium is to provide continuing education on interpreting pathology slides, to generate lively and productive conversation, and to have a good time. During each talk, the speakers will project a series of images of lesions on one screen with a choice of diagnoses/answers on a separate screen. The members of the audience will then vote using wireless keypads and the results will be displayed on the screen. Time is allowed for discussion after each voting session.

SUNDAY, JUNE 23

Career Development Session (Sunday AM)

8:00 AM–12:00 Noon

Looking Forward: Cutting-Edge Technologies and Skills for Pathologists in the Future

Co-Chairs: Kyathanahalli Janardhan, BVSc, MVSc, PhD, DACVP, *Integrated Laboratory Systems, Research Triangle Park, NC; and* ***Rebecca Kohnken, DVM, PhD, DACVP,*** *AbbVie, North Chicago, IL*

Toxicologic Pathology is one of the most valuable fields contributing to the advancement of animal and human health. With the ever-changing technological and economic environment, the basic skill set pathologists are equipped with may not be sufficient to address the current and future needs. Periodically, pathologists must add relevant, new skills to their toolbox. This session provides a comprehensive review of some of the skills that will be handy for the current time and the near future.

CE1 (Sunday AM)

8:00 AM–12:00 Noon

Data Interpretation, Visualization, and Statistics for Nonclinical Toxicity Studies

Co-Chairs: Michael Logan, DVM, PhD, DACVP, *AbbVie, Highland Park, IL; and* ***Susan G. Emeigh Hart, VMD, PhD, DACVP, DABT, ERT,*** *Boehringer Ingelheim Pharmaceuticals Inc., Ridgefield, CT*

Analysis of anatomic and clinical pathology data is central to the safety assessment of new molecules. Technologic advancement and the push for additional measures for both toxicity and risk prediction have expanded the pathologist's toolbox for data presentation and analysis. This course will explore the application of new data visualization tools and their application to toxicologic pathology with examples that are applicable to both anatomic and clinical pathology. In addition, the more traditional statistical analysis tools for data analysis will be scrutinized. The appropriate (and sometimes inappropriate) use of these techniques will be presented in a user friendly and toxicologic pathology focused manner.

8:00 AM–8:40 AM

Introduction to Data Visualization Technology—Evolution, Functionality, Data Requirements, Pitfalls, and Regulatory Considerations

Sean Troth, DVM, PhD, DACVP, Merck & Co., Inc., West Point, PA

8:40 AM–9:15 AM

Data Visualization; Practical Applications

Brian Knight, DVM, PhD, Boehringer Ingelheim Pharmaceuticals Inc., Ridgefield, CT

9:15 AM–9:45 AM

Data Visualization Strategies and Limitations for Clinical Pathology Endpoints

Bill Siska, DVM, MS, DACVP, Charles River Laboratories, Reno, NV

9:45 AM–10:15 AM

Break

10:15 AM–10:50 AM

Statistical Methods, an Overview of Their Application to Clinical Pathology Data from Toxicologic Pathology Studies

Lila Ramaiah, DVM, PhD, DACVP, Bristol-Myers Squibb, New Brunswick, NJ

10:50 AM–11:25 AM

Practical Limitations of Statistical Analysis of Clinical Pathology Data from Toxicologic Pathology Studies

Kirstin Barnhart, DVM, PhD, DACVP, AbbVie, North Chicago, IL

11:25 AM–12:00 Noon

Statistical Applications in Biomarker Development and How Not to Torture Data

Jacqueline Tarrant, BVSc, PhD, DACVP, Gilead Sciences, Foster City, CA

CE2 (Sunday AM)

8:00 AM–12:00 Noon

Medical Device Safety Assessment: The Frontiers of Safety Assessment Pathology

Co-Chairs: Maureen T. O'Brien, DVM, MS, DACVP, *Charles River Laboratories, Frederick, MD; and* ***Serge D. Rousselle, DVM, DACVP,*** *Alizée Pathology, Thurmont, MD*

Pathology of medical devices poses unique, ever-evolving challenges and considerations that often cannot be answered by employing traditional toxicologic pathology methods. Furthermore, medical device specimens may be limited and/or expensive; therefore, having a structured approach to pathology is particularly essential for study success. Medical device regulation

differs from that of drugs, and knowledge of the regulatory pathways is an asset when providing pathologic evaluation of medical devices. This course provides an introduction to basic medical device pathology, including specialized methods for pathology such as plastic embedding, unique considerations for the pathologic evaluation, topical discussion of pathology, and an overview of the regulatory path to market for medical devices.

8:00 AM–9:00 AM
Basic Techniques in Medical Device Pathology
Nicolette D. Jackson, DVM, DACVP, AccelLab, Boisbriand, Québec, Canada

9:00 AM–9:30 AM
Overview of the Regulatory Approval Process for Medical Devices in the United States
Karen Manhart, VMD, MA, DACVP, US FDA, CDRH, Laurel, MD

9:30 AM–10:00 AM
Break

10:00 AM–10:30 AM
Biocompatibility: Key Concepts for Medical Device Safety Assessment
William C. Stoffregen, DVM, PhD, DACVP, Northstar Preclinical and Pathology Services, LLC, Lake Elmo, MN

10:30 AM–11:00 AM
A Primer of Common Medical Device Biomaterials
Michael N. Helmus, PhD, Consultant, Worcester, MA

11:00 AM–11:30 AM
Medical Device Bioabsorption
Serge D. Rousselle, DVM, DACVP, Alizée Pathology, Thurmont, MD

11:30 AM–12:00 Noon
Hernia Mesh Implants
John H. Keating, DVM, DACVP, CBSET, Inc., Lexington, MA

CE3 (Sunday PM)

1:30 PM–5:30 PM

Cardiac Effects Commonly Encountered in Drug Development: Mechanisms and Clinical Relevance

Sponsored by American College of Toxicology (ACT)

***Co-Chairs: Matthew M. Abernathy, PhD, DSP,** Eli Lilly & Company, Indianapolis, IN; and **Donald N. Jensen, DVM, MS,** US FDA/CDER, Silver Spring, MD*

The cardiovascular system is an intricate meshwork of organ structures regulated by multiple feedback loops to maintain organ perfusion, deliver fuel, and remove cellular waste. Due to the range of CV targets that are dispersed throughout our many tissues, it should be of no surprise that a high percentage of drug attrition falls at the feet of cardiovascular findings both preclinically and clinically. Given the high exposures achieved and techniques used to assess CV safety in preclinical models, the number of preclinical observations of CV effects generally exceeds the prevalence of effects observed clinically. Findings may range from cardiomyopathy to arrhythmia, and not all CV safety signals carry the same weight when deciding to continue to develop a compound. Thus, safety margin and target patient population heavily influence judgment-based development decisions beginning early on in compound discovery. This course will focus on mechanisms for both histological and functional cardiac effects encountered during drug development. Additionally, decision-making strategies for unexpected CV effects and use of *in silico* models to predict the mechanism and translation of cardiac effects to the clinic will be covered in depth.

1:30 PM–2:10 PM
Cardiac Toxicity: Options from a Regulatory Perspective
Donald N. Jensen, DVM, MS, US FDA/CDER, Silver Spring, MD

2:10 PM–2:50 PM
Integrative Cardiovascular Toxicologic Pathology—Building Translational Bridges
Brian Berridge, DVM, PhD, DACVP, NIEHS/NTP, Research Triangle Park, NC

2:50 PM–3:20 PM
Break

3:20 PM–4:00 PM
Measuring, Interpreting, and Decision Making Based on Drug-Induced Hemodynamic Effects, Case Studies in Diabetes and Oncology
Derek J. Leishman, PhD, DSP, Eli Lilly & Company, Indianapolis, IN

4:00 PM–4:40 PM
Safe QTc Prolongation? How the Comprehensive *In Vitro* Proarrhythmia Assessment Will Spare Nontorsadogenic Molecules that Prolong Cardiac Repolarization (QTc Interval)
Wendy Wu, PhD, US FDA/CDER, Silver Spring, MD

4:40 PM–5:20 PM
***In Silico* Modeling in Cardiorenal Safety Assessment**
K. Melissa Hallow, PhD, University of Georgia, Athens, GA

5:20 PM–5:30 PM
Panel Discussion

CE4 (Sunday PM)

1:30 PM–5:30 PM

Otic Toxicologic Pathology

***Co-Chairs: Kenneth A. Schafer, DVM, PhD, DACVP,** Vet Path Services, Inc., Greenfield, IN; and **Bradley L. Njaa, BSc (Hons), DVM, MVSc, DACVP,** Kansas State University, Manhattan, KS*

The ear is infrequently evaluated in toxicologic pathology, and only so when there are very specific drivers to evaluate it. These include known compound classes where otic toxicity may be anticipated or when the intended therapeutic is applied directly to the ear. This session will cover an overview of otic anatomy, otic physiology, techniques in otic toxicology, otic pathology, and regulatory considerations for otic toxicology studies.

1:30 PM–2:15 PM
Comparative Anatomy and Physiology of the External and Middle Ear
Bradley L. Njaa, BSc (Hons), DVM, MVSc, DACVP, Kansas State University, Manhattan, KS

2:15 PM–2:40 PM
Anatomy and Physiology of Hearing and Balance
Teresa Southard, DVM, PhD, DACVP, Cornell University, Ithaca, NY

2:40 PM–3:35 PM
Nonclinical In-Life Study Requirements to Assess Ototoxicity
Rachel Tapp, MS, Charles River Laboratories, Mattawan, MI

3:35 PM–4:05 PM
Break

4:05 PM–4:50 PM
Otic Toxicologic Pathology
Kenneth A. Schafer, DVM, PhD, DACVP, Vet Path Services, Inc., Greenfield, IN

4:50 PM–5:30 PM
Regulatory Considerations for Otic Toxicology Studies
Christopher Toscano, PhD, DABT, US FDA, CDER, Silver Spring, MD

MONDAY, JUNE 24

8:00 AM–8:10 AM

Symposium Welcome

8:10 AM–9:00 AM

Keynote Address

Linda S. Birnbaum, PhD, DABT, ATS, *NTP/NIEHS, Research Triangle Park, NC*

Session 1

9:00 AM–12:00 Noon

Toxicology and Pathology of Air Pollution

Co-Chairs: Jack R. Harkema, DVM, PhD, DACVP, ATSF, *Michigan State University, East Lansing, MI; and* ***Mark Cesta, DVM, PhD, DACVP,*** *NIEHS, Research Triangle Park, NC*

Nine out of ten people in the world live in areas with polluted air according to the World Health Organization. Seven million people each year die as a result of diseases caused by exposures to outdoor or indoor air pollution. Toxicological and pathobiological research has been instrumental in providing biological plausibility and paradigms for the association of adverse health effects and air pollutant exposure identified by environmental epidemiologists. The speakers in this session will provide presentations on cutting-edge research that focuses on the toxicology and pathobiology of air pollutants (e.g., fine particulate matter, ozone) that emanate from various sources ranging from motor vehicle traffic to wildfires. They will present recent discoveries that have uncovered possible ways that short- or long-term exposures to specific toxic components in polluted air may directly or indirectly foster the development of or exacerbate a wide-range of respiratory, cardiovascular, metabolic, autoimmune and neurological diseases. Research to identify why certain sub-populations (e.g., children, the elderly, diabetics) appear more susceptible to the health effects of air pollution, as well as studies to identify effective interventions to prevent or treat air-pollutant-triggered illnesses will also be presented. The session will foster discussions on data gaps and future research that are needed to address this global environmental health problem.

9:00 AM–9:10 AM
Introduction to Topic and Speakers
Mark Cesta, DVM, PhD, DACVP, NIEHS, Research Triangle Park, NC

9:10 AM–9:45 AM
Cardiopulmonary Health Effects of Air Pollution
Kent E. Pinkerton, PhD, University of California Davis, Davis, CA

9:45 AM–10:20 AM
Susceptibility Variations in Air Pollution Health Effects
Urmila P. Kodavanti, PhD, DABT, US EPA, Research Triangle Park, NC

10:20 AM–10:50 AM
Break

10:50 AM–11:25 AM
Exposure to Ambient Ultrafine Particles as a Risk Factor for Neurodevelopmental Disorders
Deborah A. Cory-Slechta, PhD, University of Rochester School of Medicine, Rochester, NY

11:25 AM–12:00 PM
New Onset Asthma, Ozone, and Innate Lymphoid Cells: A New Pathogenesis Paradigm
Jack R. Harkema, DVM, PhD, DACVP, ATSF, Michigan State University, East Lansing, MI

Career Development Lunchtime Series

12:30 PM–1:30 PM

Global Perspective on Careers in Environmental Toxicologic Pathology

Chair: Wanda Haschek-Hock, BVSc, PhD, DACVP, DABT, FIATP, *University of Illinois, Urbana, IL*

A wide range of career options are available globally in the environmental toxicologic pathology (ETP) arena including academia, government, contract research organizations and the agrichemical industry. This small and specialized subset of toxicologic pathologists addresses the effects of contaminants and pollutants on human, animal and ecological health (One Health). Veterinary students and pathology trainees are primarily exposed to diagnostic pathology and often have limited exposure to toxicologic pathology and even less so to the issues and opportunities in environmental toxicology. The speakers will provide a brief overview of global opportunities in their work sector and personal perspectives of their careers in environmental toxicologic pathology. The goal of the panel discussion is to engage the audience and provide an opportunity to explore careers in this specialty.

Session 2

1:30 PM–5:00 PM

Toxicologic Pathology of Workplace Agents

Co-Chairs: Ann Hubbs, DVM, PhD, DACVP, *NIOSH, CDC, Morgantown, WV; and* ***Peter Spencer, PhD, FANA, FRCPath,*** *Oregon Health & Science University, Portland, OR*

The workplace environment often produces a different spectrum of exposures than those received by the general public. This session focuses on the pathology and pathogenesis of diseases associated with workplace environments. The talks emphasize the toxicologic pathology of occupational diseases that challenge workplaces today. Significant organic solvent exposure continues to occur in global workplaces, and the session begins with an update on mechanisms of γ-diketone solvent neurotoxicity. Emerging and re-emerging occupational diseases and associated pathologies are addressed in talks on flavorings-related lung disease and on the ongoing outbreak of rapidly progressive pneumoconiosis in Appalachian coal miners. Lifestyle factors may interact with workplace exposures to influence the pathology of occupational disease, as will be discussed in a talk on the effect of dietary omega-3 fatty acids in silica-exposed lupus-prone NZBWF1 mice. The session will end with a panel discussion addressing a very important question: Can we predict/prevent occupational disease before workers get sick?

1:30 PM–1:35 PM
Introduction to Topic and Speakers
Ann Hubbs, DVM, PhD, DACVP, NIOSH, CDC, Morgantown, WV

1:35 PM–2:10 PM
Organic Solvent Neurotoxicity
Peter Spencer, PhD, FANA, FRCPath, Oregon Health & Science University, Portland, OR

2:10 PM–2:45 PM
Rapidly Progressive Pneumoconiosis in Appalachian Coal Miners: Clinical and Pathology Findings
Robert Cohen, MD, FCCP, University of Illinois Chicago, Chicago, IL

2:45 PM–3:15 PM
Break

3:15 PM–3:50 PM
Silica, Lupus, and Dietary Omega-3 Fatty Acid Interventions
Kathryn Wierenga, BA, Michigan State University, East Lansing, MI

3:50 PM–4:25 PM
Flavorings-Related Lung Disease
Ann Hubbs, DVM, PhD, DACVP, NIOSH, CDC, Morgantown, WV

4:25 PM-5:00 PM
Panel Discussion

Town Hall

5:30 PM–6:30 PM

TUESDAY, JUNE 25

Session 3

8:00 AM–12:00 Noon

Toxicity Assessment Paradigms in Regulatory Pathology

Co-Chairs: Deepa B. Rao, BVSc, MS, PhD, DABT, DACVP, *US FDA, CDER, Silver Spring, MD; and* ***John C. Lipscomb, PhD, DABT, ATS,*** *US EPA, Cincinnati, OH*

Toxicologic pathologists are routinely engaged in the histopathologic evaluation of tissues from toxicology studies. Toxicology studies encompass a wide spectrum of agents that include drugs and biologics, chemicals (industrial, environmental and occupational), food additives, cosmetic ingredients, tobacco products, medical devices, and even physical agents such as radiation and noise. Toxicity assessments differ between such diverse agents depending on exposure settings, target populations, and safety assessment by the appropriate regulatory authorities. The objective of this session is to provide an overview of safety assessments in toxicology studies through examples where the safety decision has hinged on pathology end-points. This session is designed to maximize the cross-talk and collaboration between toxicologists/risk assessors and toxicologic pathologists, so that the differences in toxicity and risk assessments between diverse example agents are highlighted. Each example includes perspectives from a toxicologist and a pathologist; and the examples in this symposium session include a physical agent (cell phone radiation), environmental chemicals (/hydrogen sulfide, acetaldehyde), polymer conjugated biologics (polyethylene glycol), and a food additive (myrcene) to provide an overview of the role of various regulatory agencies in the risk assessment of toxic agents.

8:00 AM–8:05 AM
Introduction
Deepa B. Rao, BVSc, MS, PhD, DABT, DACVP, US FDA, CDER, Silver Spring, MD

8:05 AM–8:30 AM
Purpose-Specific Toxicity and Risk Assessments
John C. Lipscomb, PhD, DABT, ATS, US EPA, Cincinnati, OH

8:30 AM–9:05 AM
Toxicity Assessment of Food Additives: Myrcene, a Synthetic Flavoring Agent
Steve Mog, DVM, DACVP, US FDA, CFSAN, Silver Spring, MD; and Yu Janet Zang, PhD, DABT, US FDA, CFSAN, Silver Spring, MD

9:05 AM–9:35 AM
Cell Phone Radiation: Toxicity Assessment of a Physical Agent
Mark Cesta, DVM, PhD, DACVP, NTP, NIEHS, Research Triangle Park, NC; and Michael Wyde, PhD, NTP, NIEHS, Research Triangle Park, NC

9:35 AM–10:05 AM
Break

10:05 AM–10:20 AM
Student Speaker

10:20 AM–10:55 AM
Hydrogen Sulfide and Acetaldehyde: Toxicity Assessment of Inhaled Chemicals
David C. Dorman, DVM, PhD, DABT, DABVT, ATS, North Carolina State University, Raleigh, NC

10:55 AM–11:30 AM
Polyethylene Glycol (PEG): Neurotoxicity Assessment of PEGylated Biologics
Armando R. Irizarry, DVM, PhD, DACVP, Eli Lilly & Company, Indianapolis, IN; and Deepa B. Rao, BVSc, MS, PhD, DABT, DACVP, US FDA, CDER, Silver Spring, MD

11:30 AM–12:00 PM
Panel Discussion

Afternoon

Free Time

Mystery Slide Session

7:30 PM–9:30 PM

Environmental Toxicologic Histopathology

Co-Chairs: Ron A. Herbert, DVM, PhD, *NIEHS/NTP, Research Triangle Park, NC; and* ***Jerrold M. Ward, DVM, PhD, DACVP,*** *Global Vet Pathology, Montgomery Village, MD*

The Mystery Slide Session is intended to provide STP Annual Symposium attendees with the opportunity to expand their knowledge of environmental pathology through selected histopathology case review of lesions induced by exposure to environmental toxicants. Cases will be shared with STP membership via online whole-slide scans prior to the Symposium in order to stimulate discussion during the face-to-face session in Raleigh, NC. Cases will include induced non-neoplastic and neoplastic disease.

WEDNESDAY, JUNE 26

Session 4

8:00 AM–12:00 Noon

Endocrine Disruption and Reproductive Pathology

Co-Chairs: Jeffrey C. Wolf, DVM, DACVP, *EPL, Inc., Sterling, VA; and* ***Darlene Dixon, DVM, PhD, DACVP,*** *NTP/NIEHS, Research Triangle Park, NC*

During the past twenty years, investigations involving endocrine active substances (EAS) and reproductive toxicity have dominated the landscape of ecotoxicological research. This has occurred in concert with heightened awareness in the scientific community, general public, and governmental entities of the potential consequences of chemical perturbation in humans and wildlife. The exponential growth of experimentation in this field is fueled by our expanding knowledge into the complex nature of endocrine systems and the intricacy of their interactions with xenobiotic agents. Complicating factors include the ever-increasing number of novel receptors and alternate mechanistic pathways that have come to light, effects of chemical mixtures in the environment versus those of single EAS laboratory exposures, the challenge of differentiating endocrine disruption from direct cytotoxicity, and the potential for transgenerational effects. Although initially concerned with EAS effects chiefly in the thyroid glands and reproductive organs, it is now recognized that anthropomorphic substances may also adversely affect the nervous and immune systems via hormonal mechanisms, and play substantial roles in metabolic diseases such as type 2 diabetes and obesity.

The six expert presenters and one highly motivated student in this session will cover a diverse variety of topics that are intended to provide an overview of the field as it currently stands, in addition to the latest cutting-edge research. At minimum, discussions will encompass known and potential effects of EAS in humans, non-human primates, rodents, and fish. Categories of EAS to be discussed will include agonists and antagonists of estrogenic and androgenic pathways, among others. In addition to histomorphology, presentations will demonstrate a variety of diagnostic approaches for investigating EAS effects, and developmental effects of EAS will be highlighted. Regulatory implications for chemicals suspected of having endocrine activity will be mentioned, and controversial aspects of EAS research will be briefly explored. It is hoped that attendees will leave this session with an enhanced understanding and appreciation for endocrine and reproductive toxicity and the associated pathological consequences.

8:00 AM–8:10 AM
Introduction
Jeffrey C. Wolf, DVM, DACVP, EPL, Inc., Sterling, VA

8:10 AM–8:45 AM
Antiandrogen Mixology: Cumulative Effects of Environmental Chemicals on Male Rat Reproductive Tract Development
Justin Conley, PhD, US EPA, Research Triangle Park, NC

8:45 AM–9:20 AM
Reproductive Consequences in Adult Female Mice following Developmental Estrogen Exposure: An ERα-Mediated Estrogen Response
Wendy Jefferson, PhD, NIEHS, Research Triangle Park, NC

9:20 AM–9:45 AM
Assigning Molecular and Physiological Mechanisms to the Pathology of the Endocrine Disrupting Chemical BPA
Scott Belcher, PhD, North Carolina State University, Raleigh, NC

9:45 AM–10:15 AM
Break

10:15 AM–10:45 AM
Combined Exposure to Low Doses of Three Anti-Androgens in Wistar Rats: Investigations and Results
Sibylle Groeters, DVM, BASF SE, Ludwigshafen am Rhein, Germany

10:45 AM–11:15 AM
Endogenous and Exogenous Influences on the Reproductive Tract of Nonhuman Primates
J. Mark Cline, DVM, PhD, DACVP, Wake Forest University School of Medicine, Winston-Salem, NC

11:15 AM–11:45 AM

Update on Intersex and Endocrine-Induced Reproductive Abnormalities in Fish

Mac Law, DVM, PhD, DACVP, North Carolina State College of Veterinary Medicine, Raleigh, NC

11:45 AM–12:00 PM

Student Speaker

IATP/STP Lunchtime Workshop

12:30 PM–1:30 PM

Bridging the Gap between Toxicologic Pathologists and the Medical Device Industry

Co-Chairs: Darlene Dixon, DVM, PhD, DACVP, FIATP, *NTP/NIEHS, Research Triangle Park, NC; and* ***Robert R. Maronpot, DVM, MS, MPH, DABT, FIATP,*** *Maronpot Consulting LLC, Raleigh, NC*

Speaker: JoAnn C. L. Schuh, DVM, PhD, DACVP, DABT, *JCL Schuh PLLC, Bainbridge Island, WA*

This lunchtime workshop will explore the existing gap between the field of toxicologic pathology and the medical device industry and the need for toxicologic pathologists to improve this relationship.

Session 5

1:30 PM–5:00 PM

Pathology in Ecological Research with Implications for One Health

Co-Chairs: Wanda Haschek-Hock, BVSc, PhD, DACVP, DABT, FIATP, *University of Illinois, Urbana, IL; and* ***Mac Law, DVM, PhD, DACVP,*** *North Carolina State College of Veterinary Medicine, Raleigh, NC*

Ecological toxicologic pathology is a relatively new field that builds on the science of environmental toxicologic pathology to study the effects of toxic substances and physical agents, especially pollutants, at the population, community, and ecosystem levels. The objective of this session is to illustrate the wide-ranging aspects of this field and the potential contributions of toxicologic pathology. This session explores the effects of pollutants on One Health beginning at the ecosystem level, including microbes, insects, fish and humans. Presentations will explore the interaction of pesticides, pathogens, phytochemicals and xenobiotic biotransformation in bee colony losses critical for food security (honey bees have been proposed as models for gut microbiota research and recently listed under the 2017 US FDA veterinary feed directive); the role of pathology in identifying the effects of pollutants on fish as sentinels for human health; the effects climate and nutrients on harmful algal blooms and toxin production leading to animal and human disease; the processing of environmental carcinogens by intestinal microbiota; and the clinical pathology of per- and polyfluoroalkyl substances (PFAS) that can persist in the environment and contaminate drinking water.

1:30 PM–1:35 PM

Introduction to Topic and Speakers

Mac Law, DVM, PhD, DACVP, North Carolina State College of Veterinary Medicine, Raleigh, NC

1:35 PM–2:10 PM

Honey Bees and the Four Ps—Pesticides, Pathogens, P-coumaric Acid, and P450s

May R. Berenbaum, PhD, University of Illinois, Urbana, IL

2:10 PM-2:45 PM

Integration of Pathology in the Assessment of Adaptation to PAHs in Atlantic Killifish *(Fundulus heteroclitus)*

David E. Hinton, PhD, Duke University, Durham, NC

2:45 PM–3:10 PM

Biochemical and Hematologic Changes in 28-Day Rat Studies of Seven Per- and Polyfluoroalkyl Substances (PFAS)—Beyond PFOA and PFOS

Michelle Cora, DVM, DACVP, NTP/NIEHS, Research Triangle Park, NC

3:10 PM–3:40 PM

Break

3:40 PM–4:20 PM

The Occurrence and Toxicological Effects of Freshwater Cyanobacterial Toxins

Neil Chernoff, PhD, US EPA, Research Triangle Park, NC; and Gregory S. Travlos, DVM, DACVP, NIEHS, Research Triangle Park, NC

4:20 PM-5:00 PM

Processing of Environmental Carcinogens by the Intestinal Microbiota

Aadra Bhatt, PhD, University of North Carolina at Chapel Hill, Chapel Hill, NC

THURSDAY, JUNE 27

Session 6

8:00 AM–12:00 Noon

Integration of Big Data Technologies with Toxicologic Pathology

Co-Chairs: Charles E. Wood, DVM, PhD, *Boehringer Ingelheim Pharmaceuticals, Inc., Ridgefield, CT; and* ***Matt Martin, PhD,*** *Pfizer, Inc., Groton, CT*

Large-scale bioinformatic tools play an increasingly important role in environmental health, as well as translational and regulatory science. The Thursday morning session will address emerging concepts and drivers related to the integration of these new technologies in current toxicologic pathology practice. Talks will explore how big data analytics can be used to guide nonclinical testing strategies, streamline diagnostics, enhance target discovery, and inform interpretation of pathology outcomes. Topics will range from alternative toxicological models to use of digital pathology and machine learning. Speakers will also discuss issues, challenges, and future directions related to translation and use of molecular information in pathology.

8:00 AM–8:10 AM

Introduction to Topic and Speakers

Matt Martin, PhD, Pfizer, Inc., Groton, CT

8:10 AM–8:45 AM
Use of Alternative Methods/Technologies/Data Types in Hazard Characterization
Warren Casey, PhD, NTP, NIEHS, Durham, NC

8:45 AM–9:20 AM
Diagnostic Applications of Artificial Intelligence and Machine Learning in Pathology
Ilan Wapinski, PhD, PathAI, Boston, MA

9:20 AM–9:45 AM
Bridging the Gap between Data Sciences and Toxicologic Pathology: Chemical Screening and Prioritization
Sean Watford, PhD, US EPA, Durham, NC

9:45 AM–10:15 AM
Break

10:15 AM–10:50 AM
Regulatory Perspective of Whole Slide Imaging and Digital Pathology in Nonclinical Safety Assessment
LuAnn McKinney, DVM, DACVP, US FDA, CDER, Silver Spring, MD

10:50 AM–11:25 AM
Molecular Applications for Target Identification in Archival FFPE Tissue Samples
Charles E. Wood, DVM, PhD, Boehringer Ingelheim Pharmaceuticals, Inc., Ridgefield, CT

11:25 AM–12:00 PM
Panel Discussion

12:00 Noon
Meeting Adjourned